AQUIND Limited

AQUIND INTERCONNECTOR

Environmental Statement – Volume 1 – Chapter 2 Consideration of Alternatives

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

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2. CONSIDERATION OF ALTERNATIVES

2.1. INTRODUCTION

2.1.1.1. This chapter provides an overview of the process undertaken to identify electricity grid connection points in England and France, site selection for the UK Landfall, the Cable Corridor (Onshore and Marine) and the location for the Converter Station. This process included the identification, appraisal and selection of options to refine the Proposed Development.

2.1.1.2. Further information is provided regarding the main reasons for the selection of the chosen options for the Proposed Development, including a comparison of the environmental effects pertinent to that option selection. It also provides the rationale for the design approach for the Proposed Development, and explains the decision-making process that has been followed.

2.1.1.3. To do so this chapter describes the methodology and criteria that were employed to evaluate the options for the Proposed Development and the conclusions that were reached.

2.1.1.4. The chapter has been drafted to reflect the chronological order of the optioneering process, which accounts for the inter-relationship between the respective elements of the Proposed Development.

2.1.1.5. The EIA Regulations, at paragraph 2 of Schedule 4 require an ES to include:

> "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.*"

2.1.1.6. The Proposed Development has been refined to a single option where possible, however, some aspects are subject to a degree of flexibility within the Order Limits (see Chapter 3 (Description of the Proposed Development) of the ES Volume 1 (document reference 6.1.3)).

2.1.1.7. Under the Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations') a consideration of alternatives to the Proposed Development is required if it is determined that the Proposed Development is likely to have a significant effect on a European Site, such that it may adversely affect the integrity of the Site. In the event that an Appropriate Assessment ('AA') is required, the Applicant must provide the Secretary of State ('SoS') with such information as may reasonably be required to enable it to conduct the AA. Requirements under the Habitats Regulations are addressed in the Habitat Regulations Assessment Report ('HRA') (document reference 6.8).

2.2. NATIONAL POLICY STATEMENT CONSIDERATIONS

2.2.1.1. Section 4.4 of the National Policy Statement ('NPS') EN-1 (Energy) covers the planning policy requirements with regard to the consideration of alternatives for application where the NPS has effect, as it does in relation to the Proposed Development. Whilst the NPS does not include any general requirement to consider alternatives or establish whether a proposed project represents the best option, paragraph 4.4.2 of the NPS confirms that applicants are obliged, as a matter of fact, to include within their ES information about the main alternatives they have studied, giving an indication of the main reasons for the applicants choice taking into account the environmental, social and economic effects, and where relevant, technical and commercial feasibility.

2.2.1.2. Paragraph 4.4.3 of the NPS provides that where there is a policy or legal requirement to consider alternatives, the applicant should describe the alternatives considered in compliance with those requirements. Paragraph 4.4.3 identifies that "*given the level and urgency of need for new energy infrastructure*", the SoS should, subject to any legal requirements, be guided by the following principles when deciding what weight should be given to alternatives:

- the consideration of alternatives in order to comply with policy should be carried out in a proportionate manner;
- in considering alternative proposals whether there is a realistic prospect of the alternative delivering the same infrastructure capacity (including energy security and climate change benefits) in the same timescale as the proposed development;
- alternatives not among the main alternatives studied by the applicant should only be considered to the extent that the SoS thinks they are both important and relevant to its decision;
- where the SoS must decide an application in accordance with the relevant NPS (subject to the exceptions set out in the Planning Act 2008), if the SoS concludes that a decision to grant consent to a hypothetical alternative proposal would not be in accordance with the policies set out in the relevant NPS, the existence of that alternative is unlikely to be important and relevant to the SoS's decision;
- alternative proposals which mean the necessary development could not proceed, for example because the alternative proposals are not commercially viable or alternative proposals for sites would not be physically suitable, can be excluded on the grounds that they are not important and relevant to the SoS's decision;
- alternative proposals which are vague or inchoate can be excluded on the grounds that they are not important and relevant to the SoS's decision; and

- it is intended that potential alternatives to a proposed development should, wherever possible, be identified before an application is made to the SoS in respect of it (so as to allow appropriate consultation and the development of a suitable evidence base in relation to any alternatives which are particularly relevant). Therefore, where an alternative is first put forward by a third party after an application has been made, the SoS may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the SoS should not necessarily expect the applicant to have assessed it.

2.3. OPTIONEERING PHILOSOPHY AND PROCESS

2.3.1. OPTIONEERING PHILOSOPHY

2.3.1.1. The optioneering philosophy applied has been one of staged filtering to optimise the selection, based on increasing knowledge of individual options and the environment. The initial stages used high level assessments and baseline principles to enable, where possible, comparison, ranking and selection of options.

2.3.1.2. The process of considering the options and their selection has been multidisciplinary, taking into account electrical, cable engineering, geotechnical, environmental, planning, civil engineering, access considerations. It has also taken into account the land affected and the exploration of all reasonable alternatives to acquisition.

2.3.1.3. The consideration of the options for the Proposed Development adopts a holistic approach, using detailed assessments to refine the selection and takes into account the inter-relationships between the grid connection, the Converter Station location, the Onshore Cable Corridor, the Landfall location and the Marine Cable Corridor.

2.3.2. OPTIONEERING PROCESS AND UK SITE SELECTION STEPS

Building on this optioneering philosophy, the consideration of the reasonable alternatives was undertaken through a staged process, some interlinked and overlapping. This overarching stage of the processes is illustrated in Plate 2.1 below, with detail in relation to each step of the process and the extent to which there was concurrent consideration of stages explained within this chapter.

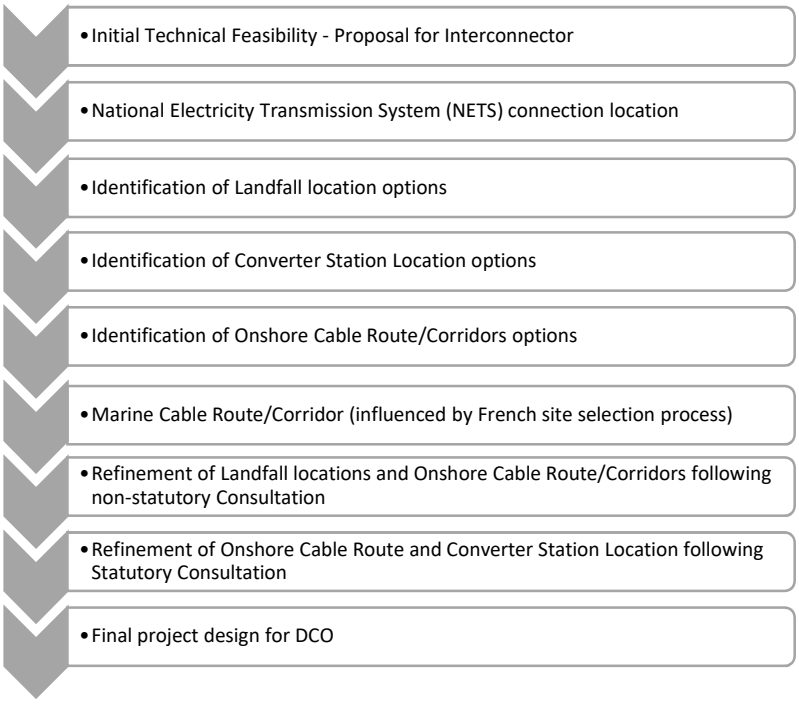


Plate 2.1 – Site Selection Process for Aquind Interconnector

2.4. TECHNICAL STUDIES AND INVESTIGATIONS TO NON-STATUTORY CONSULTATION

2.4.1. INITIAL TECHNICAL FEASIBILITY REPORT – AUGUST 2014

2.4.1.1. In August 2014, a preliminary technical-economical study was undertaken by the Applicant, which identified the potential to develop a bi-directional, high capacity interconnector between the UK and another European Union member state.

2.4.1.2. This study investigated commercial feasibility of an interconnector, reviewed the technologies available on the marketplace to support its delivery and considered the scope/location for the proposal, which included a number of early strategic project considerations in relation to alternatives which fed directly into the optioneering process (detailed in Table 2.1).

Table 2.1 – Strategic Project Alternatives Considered

Alternatives Considered	Decision	Main considerations, including environmental effects
Connection between the UK and another EU Member State.	Connection to France	• Differences between the French and UK wholesale electricity markets generation mix providing the opportunity for environmental benefits via the availability of electricity with reduced carbon emissions; • cost profile differences between the UK and France wholesale electricity markets provide an opportunity to increase competition via an interconnector asset, creating substantial socio-economic welfare benefits; and • France is the UK's nearest neighbour in continental Europe, reducing the likely environmental impacts associated with the shorter marine cable route distance.
General UK location for landfall and connection to GB electricity transmission network.	South coast of the UK (refined to the South East of England)	• Reduced marine cable installation length from the South coast of England to France; • Avoidance of network congestion, associated risks with crossing and limited capacity to transmit electricity due to other interconnectors connected into, or planned to connect into the southern region and Europe (IFA2000, BritNed, ElecLink, NEMO))
Onshore overhead lines or buried cables	Buried Cables	• Burying cables as opposed to building overhead lines ('OHLs') removes the associated visual impacts

Alternatives Considered	Decision	Main considerations, including environmental effects
Onshore: Overall Cross-Country Route or Highway Route	Highway Route Preferred	• Highway installation reduces impacts on ecology, archaeology and associated designations; • Highway installation has a reduced impact on agricultural/open land associated with the weight of the large cable drums, agricultural disruption of laying cables and the potential sterilisation of land above the cables (for maintenance purposes), but will result in temporary traffic disruption during installation (and to a lesser level during maintenance); • Highway installation avoids risk of accidental damage from farming operations; • Reduced impact on future development sites (greenfield) in an area with significant housing need through installation within the existing highway network; • Avoidance of the need to develop greenfield land; and • Ability to use verges alongside major roads, where possible, to reduce potential for lane closures and limit highway impacts associated with construction.
Technology - HVDC and non-HVDC Options	HVDC transmission technology	• No alternative technology available to transmit electricity between France and the UK given the distance and the need to cross water bodies. • Reduced transmission losses with HVDC technology compared to alternatives.

2.4.1.3. The report also considered the process to establish the Marine Cable Corridor using a methodical approach to refine and adjust the Marine Cable Corridor alongside the considerations for a Landfall location.

2.4.1.4. Following the decisions on the strategic alternatives a Connection Agreement was sought to inform the geographic location of the Converter Station and subsequently the Landfall.

2.4.2. NATIONAL GRID ELECTRICITY TRANSMISSION ('NGET') STUDIES – 2014/2015

2.4.2.1. The Applicant requested National Grid Electricity Transmission ('NGET') to perform a feasibility study in December 2014, with the report completed in November 2015. The study sought to identify the available level of entry capacity to the GB transmission network, required reinforcements and potential connection locations in the South Coast of England, taking into account the information provided by the Applicant derived from the initial technical-economic study explained above.

2.4.2.2. Meetings were held between the Applicant and NGET to consider key issues and to determine the potential locations through an efficient, coordinated and economical assessment of the options. The following criteria were identified:

- HVDC technology is widely used to transmit large amounts of power (typically over 500MW) efficiently over long distances;
- For the power levels under consideration, the connection needs to be with the 400kV transmission network;
- An existing 400kV substation must have the thermal capability to handle the power exchange between the interconnector and the GB transmission network via two new electrical connections, one per circuit, or an extension to provide two new connections with sufficient thermal capacity is feasible;
- The import (or export) of power through the connection substation should minimise any adverse consequences on the GB transmission network; and
- The proximity of the substation options to the South Coast, so as to minimise onshore cable length and associated environmental disruption during installation.

2.4.2.3. Taking into account the existing grid network congestion in the South East and South West of England, NGET refined the search area and identified ten substations (see Plate 2.2) on the 400kV transmission network for further studies.

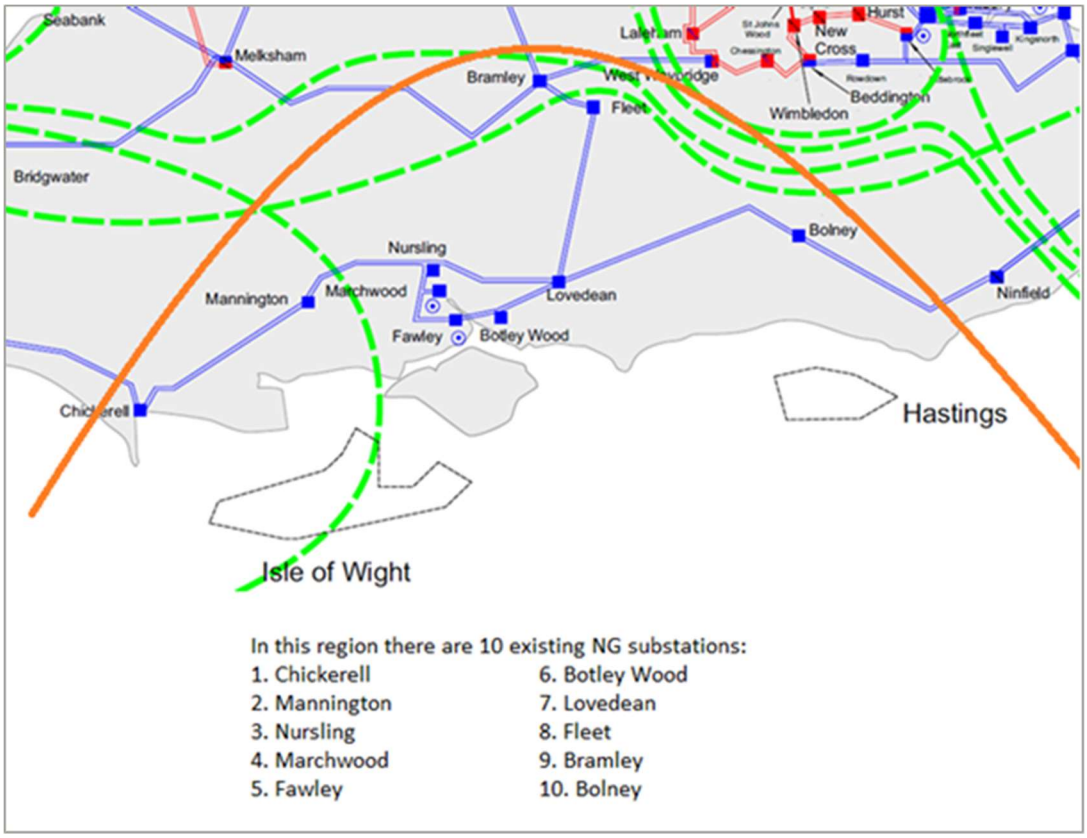


Plate 2.2 - England South Coast Map showing the region and ten connection sites identified

2.4.2.4. Utilising the above outlined criteria for the assessment and selection of the substation connection options, NGET discounted seven of the ten substations. This discounting was based on the limited thermal capacity of substations and/or feasibility to extend them to provide the required thermal capacity, and difficulties with access for the marine cable onto the shore and/or potential onshore cable routes.

2.4.2.5. The three shortlisted substations considered for further analysis were Bramley in Basingstoke and Deane Borough, Chickerell in Dorset (formerly Weymouth and Portland Borough), and Lovedean within East Hampshire District and Winchester City Councils.

2.4.2.6. Technical, geographical and environmental considerations of the shortlisted substation sites are summarised in Table 2.2. To facilitate the study the assessment assumed a UK landfall at East Wittering and French Landfall at Fécamp.

Table 2.2 – Substation Options Constraints and Benefits

Substation Site	Constraints and benefits		
	Technical	**Geographical**	**Environmental**
Chickerell	Lack of thermal capacity, requiring a complete rebuild of the substation Reinforcement works to the wider network would also be required, which would cause associated network disruption	Longest overall cable route (approximately 220km) or additional marine cable length of 40-60 km, depending on the finalisation of landfall points in the UK and France (resulting in potential for associated environmental impacts) Forms part of the green infrastructure network, separating settlements of Chickerell and Southill (resulting in potential impact on reduction of green infrastructure and coalescence of settlements) An alternative landfall would have potential significant impacts on key shipping lanes	Coastlines designated as AONB (Dorset) and World Heritage Sites (Dorset & East Devon Coast) and Heritage Coast (West Dorset), 1.5 km (likely impacts if an alternative landfall be progressed) Substation within Local Plan designation of Land of Local Landscape Importance (potential negative impacts on the landscape from new infrastructure)
Bramley	Less transmission works than Chickerell	Longest onshore cable route (approximately 103km) (potential for resultant impacts on the environment)	The onshore cable route would be required to run through South Downs National Park (potential temporary impact during construction) Within Ancient Woodland (Bramley Frith

Substation Site	Constraints and benefits		
	Technical	Geographical	Environmental
			Wood) (any substation extensions requirements would directly impact designation)
Lovedean	Less transmission works than Chickerell	Shortest connection route length (up to 34.7km depending on a landing location) (potential impacts on the environment, but anticipated to be less given the shorter route)	Adjacent to the South Downs National Park, 450 m (potential impacts on setting of above ground infrastructure) 1 km from LNR (Yeoll's Copse) and 1.2 km from SSSI / LNR (Catherington Down) (no direct impact anticipated) Ancient Woodland adjacent to northeast (Crabdens Row) and southwest (Crabdens Copse) (potential impact subject to design)

2.4.2.7. The Chickerell substation was discounted due to the requirement for a complete rebuild of the substation to improve its thermal capacity and the need for wider network reinforcements to be provided. These works were considered likely to result in significant disruption to the existing network whilst they were carried out and associated disturbance to the local environment, in addition to the development of

the interconnector, taking into account the proximity of the required works to statutory designations (see table 2.2 for detail of the designations).

2.4.2.8. In addition, a connection to the Chickerell substation was considered likely to result in an indicative increase in the marine cable route length by 40 to 60 km (depending on the finalisation of landfall points in the UK and France) based on its westerly location. Also taken into account was the likely resultant difficulties with delivery as a consequence of difficult marine conditions and the impact on large number of coastal environmental designations which include Dorset AONB, Dorset and East Devon Coast World Heritage Site and West Dorset Heritage Coast around the feasible landfall sites in proximity to the substation.

2.4.2.9. Following the discounting of Chickerell for the above reasons, NGET conducted an internal Cost-Benefit Analysis of the Bramley and Lovedean substations, assessing the technology configuration and entry capacities to establish the most economic, efficient and coordinated point of connection (see Appendix 2.1 for the full methodology).

2.4.2.10. A connection to Bramley substation would require a substantially longer onshore cable route of approximately 65 km by comparison to Lovedean substation, and this would be required to pass through sensitive areas, including the South Downs National Park ('SDNP') (or a much longer and in turn less feasible route around the National Park designation). In addition, Bramley substation, and in turn the broad likely location of any converter station, is close to further environmentally designated sites including Sites of Special Scientific Interest ('SSSIs'), Local Nature Reserves ('LNRs'). By comparison, Lovedean Substation was closer to the potential landfall locations, sited adjacent to but outside the SDNP and with significantly fewer environmental designations in close proximity (see Table 2.2 for detail of the environmental designations).

2.4.2.11. Further, the significantly shorter onshore cable route was preferable from a technical, cost and environmental perspective.

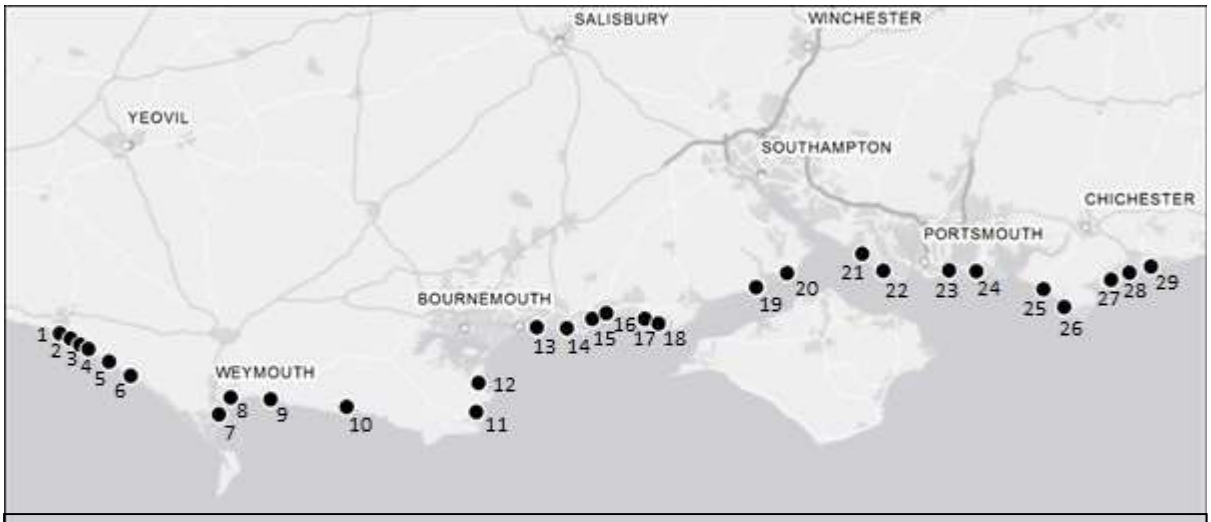
2.4.2.12. The assessment identified a voltage-source converter as the preferred HVDC converter technology over a line-commutated converter due to the advantages delivered in terms of cable specification, independence from the AC network strength, minimal harmonic distortion on the AC system, ability for independent reactive power control, and a smaller footprint. It also identified a 2 x 1000 MW symmetrical monopole configuration being a more suitable technology for the proposed voltage.

2.4.2.13. Whilst the Applicant contributed to NGET's consideration of the substation connection options, the final choice of a connection point was determined by National Grid, who concluded that a connection to Lovedean Substation was the most efficient, coordinated and economical grid connection point.

2.4.3. POTENTIAL LANDFALL LOCATIONS: PRELIMINARY DESKTOP STUDY – 2015/16

2.4.3.1. Concurrent with the NGET studies, in April 2015, a preliminary desk study was undertaken by the Applicant to identify the potential landfall locations in connection with the three substations NGET had (at the time of this preliminary desktop study) taken forward for further consideration at Bramley, Chickerell and Lovedean. The search area extended across the South Coast of England, bounded by West Bay, Dorset in the southwest and Bognor Regis, West Sussex in the southeast.

2.4.3.2. Following a review of data sources, including aerial photos and land mapping, 29 potential landfall sites were identified by the Applicant, which are illustrated in Plate 2.3.



Sites from west to east: 1) West Bay, 2) Freshwater Beach, 3) Hive Beach, 4) Cogden Beach, 5) West Bexington, 6) East Bexington, 7) Weymouth, 8) Overcombe, 9) Ringstead, 10) Worbarrow Bay, 11) Swanage, 12) Studland, 13) Boscombe, 14) Southbourne, 15) Mudeford, 16) Highcliffe, 17) Barton on Sea, 18) Milford on Sea, 19) Solent, 20) Lepe, 21) Lee on the Solent, 22) Browndown, 23) Southsea (now Eastney), 24) Hayling, 25) East Wittering, 26) Selsey, 27) Pagham, 28) Bognor Regis West, 29) Bognor Regis East.

Plate 2.3 - Potential Landfall Sites

2.4.3.3. In the first instance, a ranking exercise was undertaken of each potential landfall site based on engineering parameters, which considered the following:

- Nature of beach (e.g. probable thickness of sediments, rock outcrops, operational space);
- Back of beach topography (e.g. presence of steep gradients, watercourses);
- Marine approach (e.g. presence of skerries (reefs or rocky islands), bathymetry, wrecks in the nearshore); and
- Inland access (e.g. proximity of roads and road condition).

2.4.3.4. The landfall sites were then initially categorised as:

- Category A - limited constraints identified at this stage, most feasible;
- Category B - some constraints, needs further investigation, potentially feasible;
- Category C - less suitable with significant constraints, would require additional investigation, least feasible.

2.4.3.5. The resulting categorisations of the landfall sites are shown in Table 2.3, with further detail on the categorisations included in Appendix 2.2.

Table 2.3 - Potential Landfall Suitability Categorisations

Location	Category	Location	Category
West Bay	A/B	Highcliffe	B/C
Freshwater Beach	A/B	Barton on Sea	B
Hive Beach	A/B	Milford on Sea	B
Cogden Beach	B	Solent	B/C
West Bexington	B	Lepe	B/C
East Bexington	B	Lee on the Solent	A/B
Weymouth	B	Browndown	A/B
Overcombe	B	Southsea (now Eastney)	A/B
Ringstead	B/C	Hayling	A/B
Worbarrow Bay	C	East Wittering	A/B
Swanage	B	Selsey	B
Studland	B	Pagham	B
Boscombe	B/C	Bognor Regis West	B/C
Southbourne	B	Bognor Regis East	A/B
Mudeford	B		

2.4.3.6. Following this ranking exercise, and the confirmation of Lovedean Substation being identified as the grid connection point for the Proposed Development, nine sites that scored well (A/B) or considered to be within a reasonable distance (35 km) were visited and evaluated in more detail. This further narrowed the potential landfall

locations down to six sites through more detailed consideration of the parameters listed in section 2.4.7 and in addition the consideration of the following:

- Nature of the beach (expanded to consider thickness of sediments to confirm available operational space);
- Availability and feasibility of vehicular access to the landfall; and
- Distance of the preferred grid connection point at Lovedean (with a route length of no more than 35 km being preferred, taking into account technical and cost considerations and the general likelihood of increased environmental impacts associated with a longer route).

2.4.3.7. The six sites subject to further consideration were:

- Lee on the Solent;
- Browndown;
- Southsea (now referred to as Eastney, see 2.4.3.8);
- Hayling;
- East Wittering; and
- Selsey.

2.4.3.8. Following a site visit, the eastern beach area at Southsea was considered to be a more appropriate location for a potential landfall, therefore this option was moved further to the east and renamed appropriately to Eastney to reflect the area closer to the potential landfall site. The main reasons that led to the potential landfall site being moved further east from Southsea to Eastney were the avoidance of an outfall pipe and a larger area of undeveloped land available for installation.

2.4.4. FINAL UK GRID CONNECTION LOCATION – 2016

2.4.4.1. After completing a further assessment (Connection and Infrastructure Options Note) based on OFGEM's approved methodology (OFGEM, 2015) (National Grid ESO, 2018), which included the consideration of further technical and environmental constraints, NGET concluded that a single point of connection is preferred (two circuits connected to the same substation).

2.4.4.2. Subsequently, in October 2015, based on the results of NGET's feasibility study (see 2.4.2), the Applicant made a statutory application to NGET for a connection of 2,000 MW at Lovedean Substation.

2.4.4.3. A Connection Offer was issued by NGET in February 2016 and subsequently signed by the Applicant in June 2016, confirming Lovedean Substation as the grid connection point for the Proposed Development.

2.4.5. PRELIMINARY CONVERTER STATION LOCATIONS (APRIL 2016)

2.4.5.1. The Applicant conducted a preliminary Converter Station site identification exercise in April 2016, using the agreed grid connection point of Lovedean Substation as the focus for the optioneering exercise.

2.4.5.2. The following criteria were used in the initial siting exercise:

- The site should be within 2 km (radius) of the existing Lovedean Substation as a greater distance would result in the greater transmission losses along an AC cable;
    - DC cables have a resistance loss, where AC cables have resistance, inductive and capacitive losses, resulting in greater transmission losses;
    - A distance over 2 km is considered appropriate for AC cables as the transmission losses associated with a longer cable would significantly reduce the efficiency of the Interconnector.
    - An AC cable also requires a wide easement (approximately 11 m wide), creating a corridor where no tree or hedge growth is permitted, although the land can be returned to agriculture. As such, a shorter distance for the AC cable route, and thus closer proximity of the Converter Station to Lovedean Substation reduces potential disruption and impact on the local environment in terms of ecology and visual impact. The constriction corridor width for AC cables extends up to 23 m (depending on haul road requirements), and though temporary, maintaining a restricted distance of the AC cable provides an environmental benefit.
- Overall site dimensions of 160 m x 200 m with a permanent access way of at least 6 m wide (note that this area has since increased following engagement with converter station suppliers);
- An additional area nearby of approximately 100 m x 100 m to use as a temporary Laydown Area during the construction period;
- Beside or close to existing roads to minimise new road construction;
- Close to good quality roads (A class or B class) that allow transport of multiple 300 tonne loads using a multi-wheel low-loader trailer;
- Allowance for a turning radius of 30 m for the site entrance;
- Aim to avoid areas of high environmental value or public amenity, such as ridge tops and rare species habitat;
- Aim to minimise close proximity to dwellings, public buildings, and public spaces due to possible audible noise and electromagnetic interference from the Converter Station;

- Areas of high coastal salt or industrial contamination should be avoided;
- Flood plains, rivers or streams should be avoided;
- Marshland which would require piling for foundations should be avoided; and
- Footpaths and historic public rights of way should be avoided, where practicable.

2.4.5.3. Constraints identified within the 2 km study area (identified in Plate 2.4) from Lovedean Substation posed limitations to the potential location of the Converter Station. This included:

- SDNP and its setting (located approximately 500 m to the north, directly east and approximately 700 m west of Lovedean Substation);
- Densely populated/urban areas to the east and south (Waterlooville and Denmead);
- Numerous rural dwellings in close proximity to the Lovedean Substation;
- Listed buildings (1 Grade II* and 9 Grade II listed, further details in section 21.5.2, Chapter 21 (Heritage and Archaeology) of the ES Volume 1 (document reference 6.1.21) in the southwest segment of the search area;
- Existing transmission lines/towers and underground cables entering/exiting the Lovedean Substation.

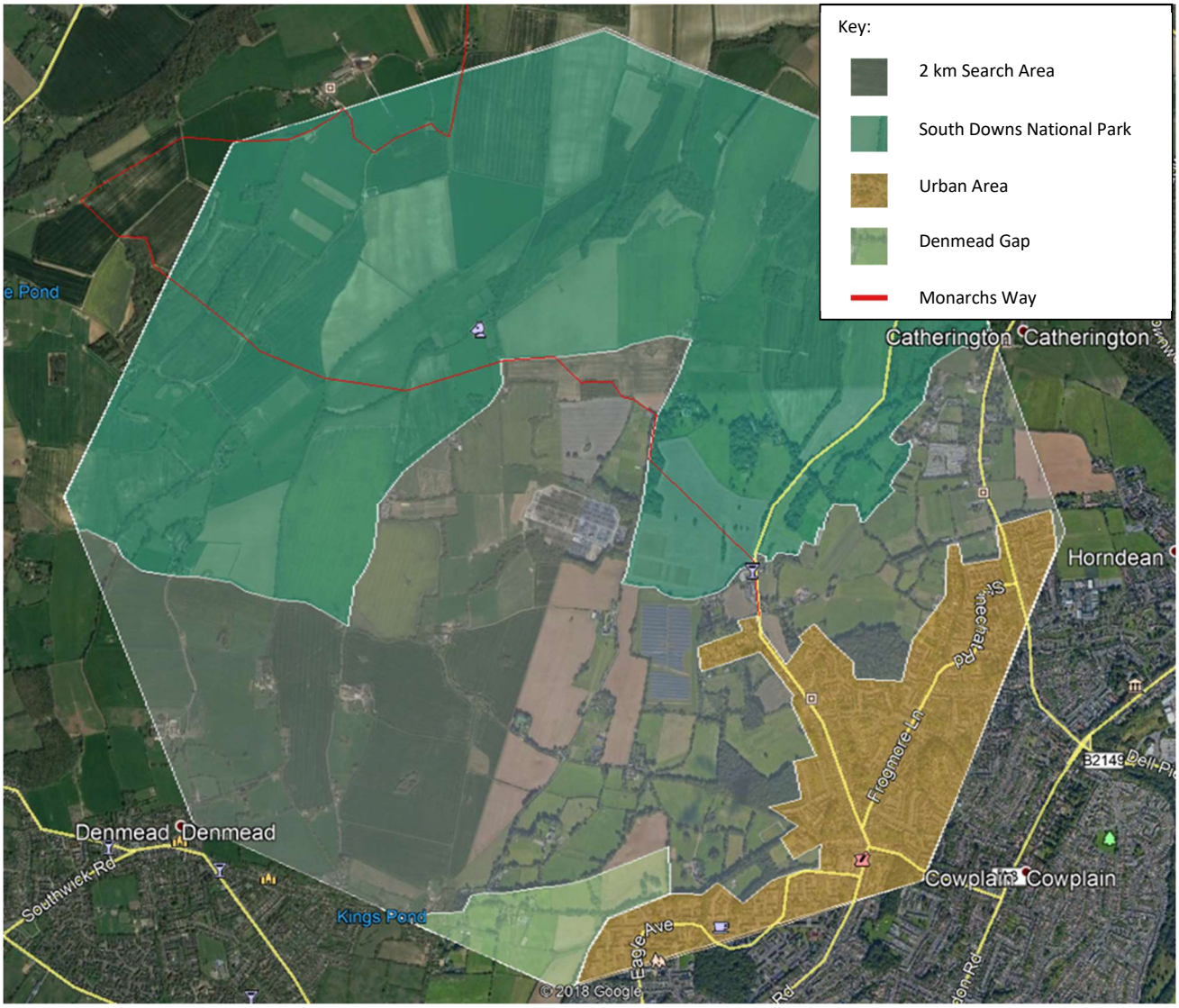


Plate 2.4 - Converter Station Search Area and Initial Constraints

2.4.5.4. Following the mapping of initial constraints, the Applicant initially identified five sites within the 2 km radius as possible locations to develop the Converter Station, these are denoted by the orange areas identified in Plate 2.5.

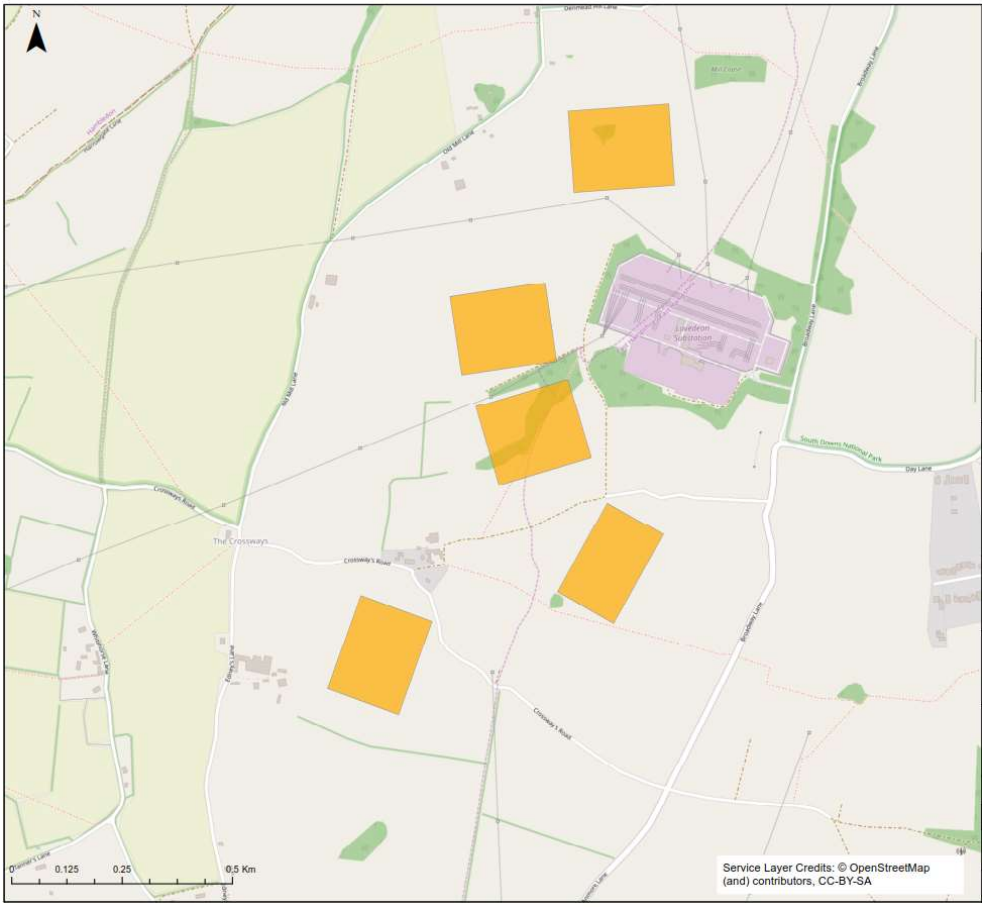


Plate 2.5 - Preliminary Converter Station Investigation Options

2.4.6. ONSHORE ROUTES: DESKTOP STUDY Q2 2016

2.4.6.1. As identified in section 2.4.1, the Applicant made an early strategic decision to underground the cables to avoid the permanent significant adverse landscape and visual impacts associated with OHLs.

2.4.6.2. With the identified grid connection point of Lovedean Substation, and a shortlist of landfalls identified, the anticipated onshore routing, either through densely populated urban areas and/or through more rural areas within open countryside in close proximity to the SDNP, the use of undergrounded cables was maintained.

2.4.6.3. The underground HVDC cables require a recommended easement (trench) of 3 m wide and 1.5 m deep. This assumption was used during the process of considering the available route options.

2.4.6.4. Onshore cable routes were developed on a desktop basis from the six shortlisted potential landfall locations to Lovedean Substation.

2.4.6.5. Preliminary routes were developed within a Geographical Information Systems ('GIS') computer software package. This software determined the shortest route between Lovedean Substation and each potential landfall location, using the following criteria:

- shortest terrestrial routes;
- minimal impacts on landowners/occupiers;
- routes which follow roads, but avoid motorways;
- minimal number of rail/waterway/motorway crossings; and
- avoidance of environmental designations/constraints.

2.4.6.6. The automated GIS cable routing process took a fixed start and end point (nearest road access to the landfall and grid connection), and then used network analysis to identify the shortest road routes, based on guiding parameters listed above.

2.4.6.7. Using the preliminary GIS routes, a high-level multi-disciplinary review was undertaken which considered high level constraints, including environmental designations. A feasibility (engineering) assessment of the route was also undertaken to identify obvious constraints and opportunities for route optimisation.

2.4.7. LANDFALL SITES: SITE VISITS (Q2 2016)

2.4.7.1. Site visits were conducted for the six shortlisted landfall locations in April 2016. In addition to the criteria mentioned in section 2.4.4, the following additional criteria were considered:

- Site area e.g. restrictions, sediment to bury cable through;
- Accessibility to site e.g. places heavy plant can access the site;
- Working Space e.g. sufficient room for pulling the cable into position;
- Special features in vicinity of site e.g. sand waves, fish traps;
- Environment e.g. designations, flooding, erosion;
- Leisure activities e.g. tourist area, pleasure craft;
- Tide e.g. tides at time of visit, any concerns;
- Weather, sea and swell e.g. prevailing direction;
- Fishing activity e.g. evidence of activity near the sites;
- Marine traffic activity e.g. shipping lanes; and
- General facilities e.g. nearest ports, local facilities.

2.4.7.2. During the site visit, two potential landfall locations were identified at Lee on the Solent and subsequently named Lee on the Solent 1 and Lee on the Solent 2. As a consequence the total number of landfall sites under consideration at this stage was increased to seven. The seven sites (see Plate 2.6) were:

- Lee on the Solent 1;
- Lee on the Solent 2;
- Browndown;
- Eastney (previously Southsea);
- Hayling;
- East Wittering; and
- Selsey.

2.4.7.3. Refer to Plate 2.4 for the locations of the initial landfall site options considered, numbered in line with the list in Section 2.4.6.2.

Plate 2.6 - Landfall Location Options

2.4.8. MARINE PRELIMINARY HIGH-LEVEL STUDY – AUGUST 2016

2.4.8.1. A preliminary high-level study was undertaken in August 2016 to establish a study area based on the extremes of the potential landfalls within the UK and France (see Section 2.4.1), but with a further additional western constraint due to the planned IFA2 Interconnector.

2.4.8.2. The following marine constraints were then applied to the study area to select a preferred survey corridor (illustrated in Plate 2.7):

- Dredging areas;
- Aggregate extraction;
- Offshore wind farm locations;
- Transport/shipping activity;
- Cables and pipelines;
- Wrecks, obstructions and foul areas;
- Rock outcrop; and
- Marine Conservation Zones ('MCZs').

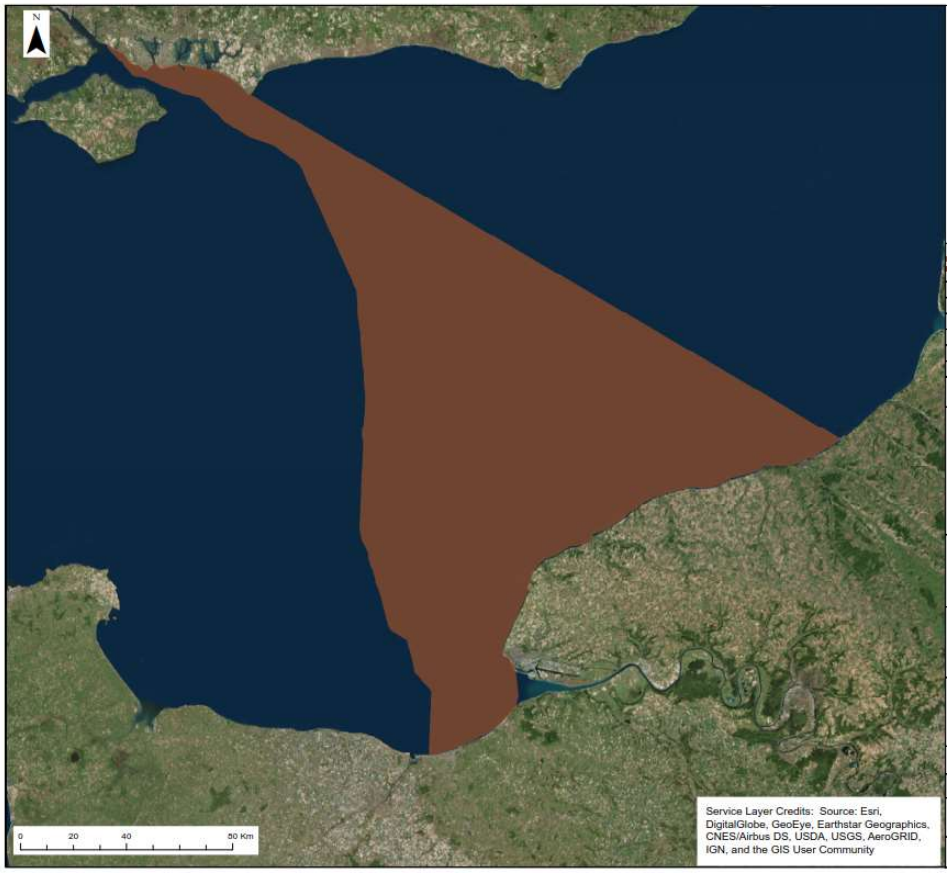


Plate 2.7 - Marine Cable Study Area (area shown in brown)

2.4.9. LANDFALL SITES: CONSTRAINTS WORKSHOP/FEASIBILITY REPORT – MAY 2016

2.4.9.1. A multi-disciplinary landfall constraints workshop was held in May 2016 (disciplines included cable engineering, marine geotechnical engineering, onshore geotechnical engineering, environmental, planning and HVDC/electrical engineering). The purpose of the workshop was for the disciplines to engage in considering the constraints and opportunities provided by the seven shortlisted landfall locations, with the aim of identifying preferred sites for the landfall.

2.4.9.2. As summarised in Appendix 2.3, the workshop considered a matrix of 46 engineering and environmental constraints. This exercise resulted in the following locations being discounted:

- Selsey – this location had insufficient site area to be suitable for onshore construction. The location is also constrained due to rock and hard substrate reef (with shallow rock visible as a result of increased wave activity) and has limited accessibility from the public highway due to narrow roads with numerous listed buildings along their length. This site was therefore not considered further.
- Lee on Solent 1 – this location was discounted due to a preference to progress with Lee on Solent 2 which had a larger and more suitable site to allow for onshore construction. The associated constraints are listed in the paragraph below with regards to Lee on Solent 2.

2.4.9.3. Following a further workshop and more focused review of the marine constraints, Lee on Solent 2 and Browndown were also discounted as potential landfall sites for the following reasons:

- Lee on Solent 2 – discounted due to lack of suitable marine installation space with existing outfalls/pipelines and an anti-submarine barrier resulting in a restricted installation area of just 300 m from IFA2 (with the preferred minimum installation area being 500m). As a result, the marine cable would have to cross the IFA2 cable twice, or be laid in less optimal conditions of shallow water. In addition, the approach was congested due to ramps and groynes within a busy shipping area. There were also concerns regarding the potential to impact on fisheries (shell fish waters and aquaculture, close in proximity to Lee on Solent to Itchen Estuary SSSI (30 m)); and
- Browndown – discounted due to restricted marine installation space and also suffering from a congested approach including outfall pipes, a busy shipping area, a potentially high Unexploded Ordnance ('UXO') risk. There were also concerns over marine archaeology, the close proximity to Browndown SSSI (135 m) at landfall and the proximity to a number of listed buildings and scheduled monuments.

2.4.9.4. Subsequently the preferred landfall locations taken forward following the multi-disciplinary workshops were Eastney, East Wittering and Hayling.

2.4.10. CONVERTER STATION OPTIONEERING STAGE 1 – 2017

2.4.10.1. Having initially identified five potential Converter Station site areas, the Applicant conducted further detailed assessments covering technical viability and environmental constraints to refine the siting of the Converter Station within the wider search area.

2.4.10.2. The key considerations applied during this assessment included:

- Space requirements: finished platform area of between 4-6 ha for the Converter Station site, plus sufficient area for the required temporary laydown area during construction;
- Environmental constraints in proximity to Lovedean Substation e.g. proximity to the SDNP, areas of residential development, heritage assets, presence of Ancient Woodland and SINCs;
- Planning constraints in proximity to Lovedean Substation e.g. committed and proposed developments, landscape designations (the 'Denmead Gap'), both of which are south of Lovedean Substation;
- Existing infrastructure constraints (e.g. power cables, OHLs);
- Surface water and groundwater Source Protection Zone ('SPZ') and flood risk, including the level of the water table;
- Favouring use of previously developed land in the vicinity or, where not feasible, the most sustainable greenfield location (i.e. reduced environmental impacts, opportunities for incorporation of mitigation); and
- Potential for limitation of operational noise impacts.

2.4.10.3. Localised constraints such as the proximity of the SDNP to the northeast and west of the Lovedean Substation meant that Converter Station locations to the north of the Lovedean Substation were considered not viable due to need for avoiding any direct impact on the SDNP (being designated as having the highest status of protection in relation to landscape and scenic beauty), subsequently the northernmost location was discounted.

2.4.10.4. From the sites identified above in Plate 2.5 one of the proposed sites was situated on Ancient Woodland (Stoneacre Copse). This option was relocated further south and the site footprint was elongated to avoid the Ancient Woodland, see Plate 2.8.

2.4.10.5. In addition, due to proximity of residential receptors at the settlements of Denmead and Anmore, the southwestern-most option was also discounted. The result of this exercise identified three potential Converter Station locations to be progressed.

2.4.10.6. Ongoing consultations with Planning Officers from WCC and EHDC resulted in an additional option been introduced at their request, which was perceived to potentially reduce negative landscape and visual amenity effects by virtue of being located further south from residential receptors than the previous southwestern option. The four alternative locations considered further as illustrated in Plate 2.8 were:

- Option A: Southwest of Lovedean Substation;
- Option B: West of Lovedean Substation, between the existing 400 kV OHLs;
- Option C: Located between Stoneacre Copse and the existing 132 kV cable circuits of the existing Lovedean Substation; and
- Option D: Further southwest of Lovedean Substation (by LPA request).

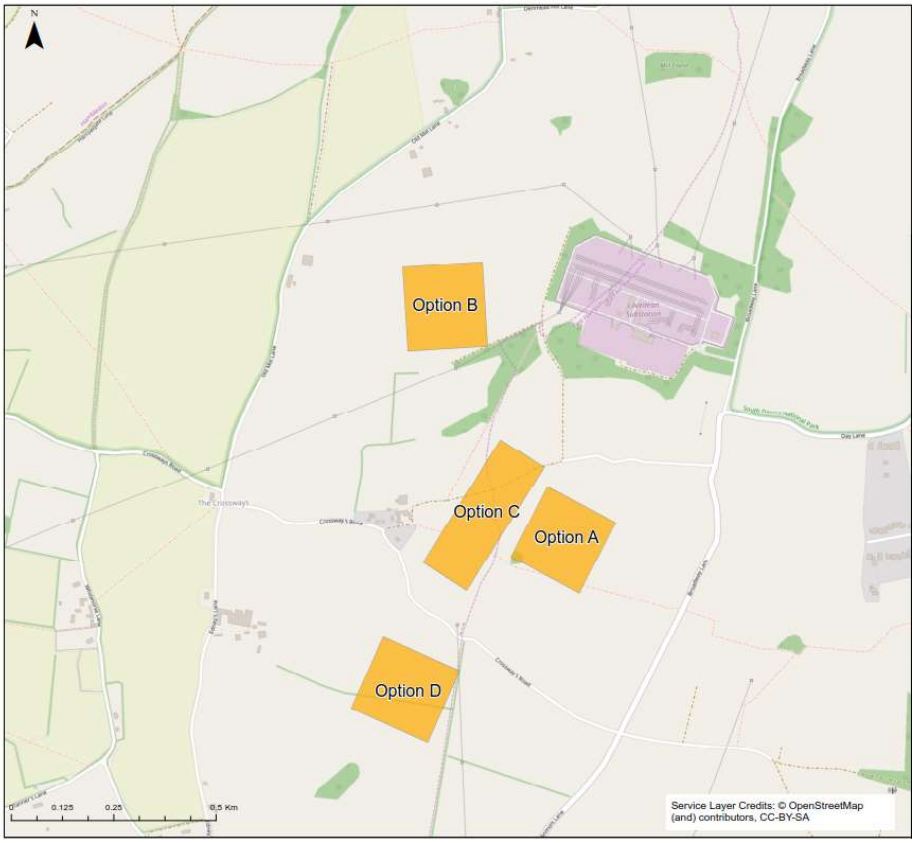


Plate 2.8 – Refined Converter Station Options

2.4.10.7. A comparison of the environmental effects in relation to each option is included in Table 2.4 below.

Table 2.4- Environmental Effects with Converter Station Options A - D

	Option A	Option B	Option C	Option D
Ecology	Low impact on ancient woodland No trees Hedgerow removal (for AC cable) Potential impact on protected species (215 m north and northwest) Agricultural (arable) land, lowest ecological impact	Close proximity to Ancient Woodland Hedgerow trees of moderate quality Hedgerow removal Potential impact on protected species (70 m southeast) including impact of longer access track Agricultural (pastoral) land, close proximity to priority habitat with likely ecological impact	Close proximity to Ancient Woodland 1 low quality tree Potential hedgerow removal, and consequent potential impact on protected species Likely presence of protected species (20 m north and northwest) including impact of longer access track Agricultural (arable) land, limited ecological impact	Low impact on ancient woodland No trees Hedgerow removal – increased AC cable route length (and larger number of cables) Potential impact on protected species (500 m northeast) Agricultural (arable) land, limited ecological impact
Landscape	Prominent in local views, limited screening 70-80 Above Ordnance Datum (AOD), resulting in high visibility from SDNP due to location in open field	Least visual impact, screened from near views 80-90 AOD, resulting in visibility from SDNP, but visible in context of Lovedean Substation and	Prominent in local views, limited screening 70-80 AOD, resulting in high visibility from SDNP due to linear orientation	Prominent in local views, limited screening 55-65 AOD, resulting in visibility from SDNP

	Option A	Option B	Option C	Option D
		existing pylons and power lines due to landform		
PRoW	Direct impact on PRoW, but a revised location 25 m north could avoid a direct impact	No direct impact, but visible from existing PRoWs	Direct impact resulting in permanent diversion	No direct impact, but adjacent to and visible from existing PRoW
Heritage	5 listed buildings (grade II) within 1km radius	6 listed buildings (grade II) within 1km radius	6 listed buildings (grade II) within 1km radius	8 listed buildings (grade II) within 1km radius
Ground Conditions	Potential impact on karst features and SPZ Nitrate vulnerable and groundwater protection zone	Potential impact on karst features and SPZ Nitrate vulnerable and groundwater protection zone	Potential impact on karst features and SPZ Nitrate vulnerable and groundwater protection zone	Potential impact on karst features and SPZ Nitrate vulnerable and groundwater protection zone
Utilities	None identified	Proximity of OHLs	Underground cables	None identified
Amenity (noise, vibration and air quality impact)	Nearest sensitive residential receptors 102 m to the northeast, 8 receptors within 300 m 690 m east of urban area	Nearest sensitive residential receptors 200 m to the north, 3 receptors within 300 m 1 km east of urban area	Nearest sensitive residential receptors 51 m to the west, 7 receptors within 200 m 805 m east of urban area	Nearest sensitive residential receptors 50 m to the north, 5 receptors within 300 m 550 m north of urban area

2.4.10.8. Option C was discounted due its likely significant impacts on nearby Ancient Woodland due to its immediate adjacency to Crabdens Copse, proximity to Little Denmead Farm (51 m) and the greatest concentration of residential receptors (seven within 200 m) resulting in the likelihood of the greatest potential for negative impacts on residential amenity in terms of noise, vibration and visual impact compared to the other options. Further, the location would result in a likely permanent diversion of the existing PRoW from Denmead Farm.

2.4.10.9. A preliminary landscape and visual amenity study also concluded that siting the Converter Station in a north south alignment (as per Option C) in the locality would result in the Converter Station appearing as a prominent feature in local views from within the SDNP, particularly from the northwest, including from Monarch's Way long distance path. As such Option C was considered to have the greatest visual impact of the four options.

2.4.10.10. Analysis of Option D concluded that whilst situated a greater distance from individual dwellings (five within 300 m) than other options, this location would have a more significant visual impact on the settlement of Denmead (as the closest urban area), resulting in a greater number of residents being impacted than Options A and B (and C) due to this more southerly location, with limited established landscape screening.

2.4.10.11. Option D was also in closer proximity to a number of listed buildings than Options A and B (and C), again with limited existing vegetation to screen the proposed Converter Station, and resulting in a detrimental impact on their setting.

2.4.10.12. Further as Option D is sited at the greatest distance from Lovedean Substation, there is a resulting requirement for a longer AC cable route length, and with this distance likely to require the use of a 12 AC cable solution (compared to the typical six AC cable solution deemed achievable for all other Options), due to cable capacity constraints. The additional number of cables would result in a greater environmental impact from the need for a wider construction corridor for the AC cable installation which, due to the distance would sever the greatest number of hedgerow field boundaries.

2.4.10.13. Option A and Option B, having lesser environmental impacts were shortlisted as preferred locations for the Converter Station and subsequently progressed to further assessment (see Section 2.5.7 for the further assessments).

2.4.11. UK CABLE ROUTE DESK STUDY (FEB 2017)

2.4.11.1. As discussed in Section 2.4.11, preliminary onshore cable routes were identified via GIS modelling along the existing road network. These automatically generated routes were further investigated from the three shortlisted landfall locations (Eastney, Hayling Island and East Wittering) to Lovedean Substation. This study assumed that the Converter Station would be located within 2 km of the Lovedean Substation (see section 2.4.5 for further explanation of the rationale for this assumption).

2.4.11.2. The onshore cable route desk study was broken down into several stages:

- Desktop route study;
- Utility mapping; and
- Geotechnical study of crossing points (relevant to feasibility of HDD).

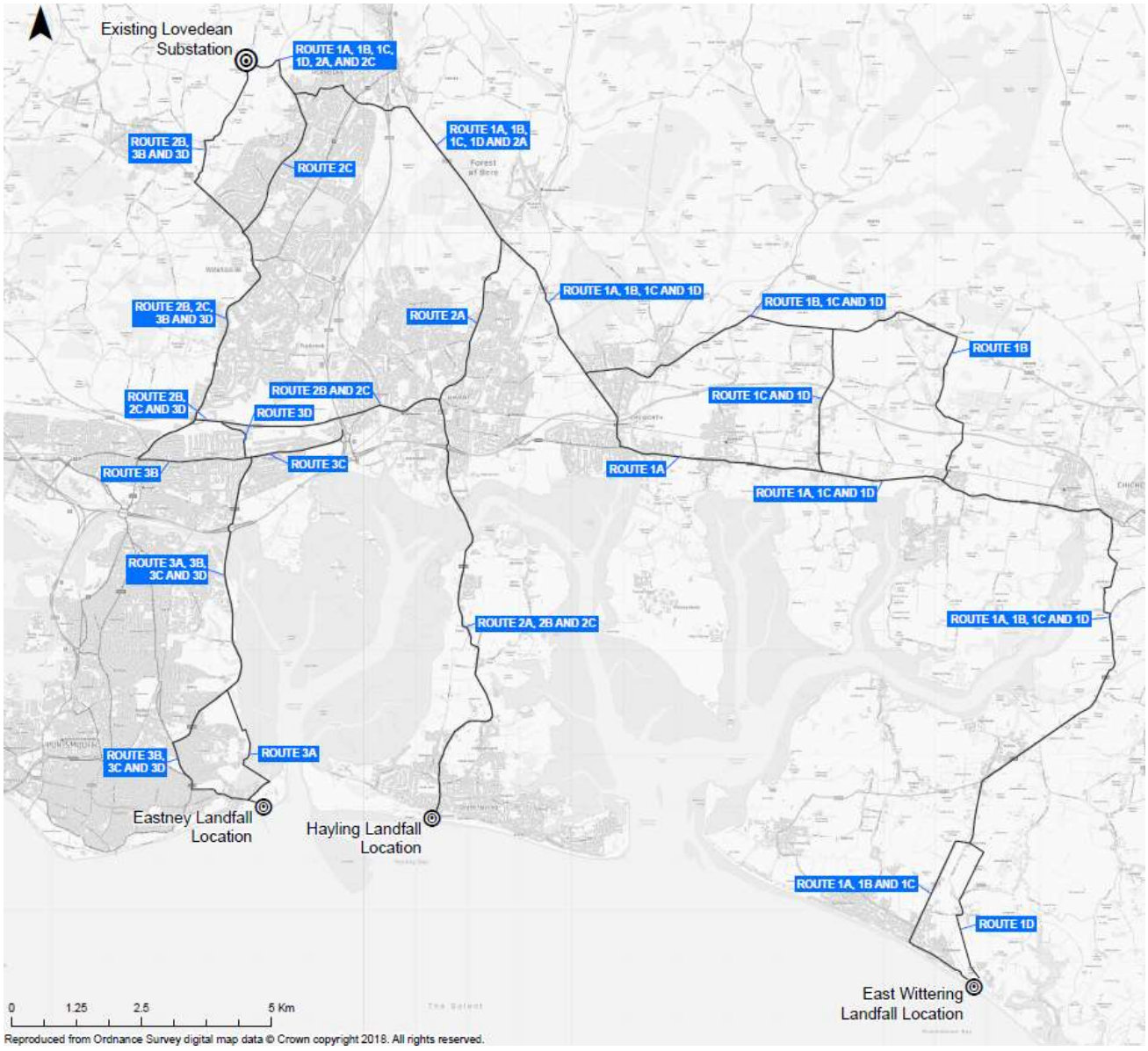


Plate 2.9 - DC Cable Route Options (Feb 2017)

2.4.11.3. Following desk-based analysis, and a site visit/walkover of the routes, four cable routes were identified as potentially constructible: Route 1B, Route 1C, Route 1D and Route 3D (where the number ID represents the landfall site (1 = East Wittering; 2 = Hayling; 3 = Eastney) and letter ID represents the route taken i.e. A = option A, B = option B, etc.). There routes are illustrated on Plate 2.9 above.

2.4.11.4. Along the majority of the cable route, the assumption was made that both pairs of cables would be laid in the same road. At some locations along the route, optionality was included to split the cable route into two separate routes (one for each circuit).

2.4.11.5. In general, the cable routes followed the existing road network (avoiding motorways and dual carriageways), except where deviations off-road for HDD crossings were identified and where the analysis identified a likely need to deviate around constraints that exist within the road. In addition, consideration was also given to shortening certain sections of the routes by crossing fields or open areas that were not otherwise designated or protected under environmental, ecological or heritage legislation. Detail of the three main cable routes and the deviations considered is provided below:

East Wittering

2.4.11.6. Route 1A was discounted as it was considered impractical to cross Slipper Mill Pond, a wildlife nature reserve (Site of Importance for Nature Conservation ('SINC')) without significant disturbance to the surrounding area. The use of HDD techniques were not deemed a suitable alternative due to the land requirements for HDD installation which would still result in significant disturbance to the protected sites.

2.4.11.7. Route 1B was considered incorporating a diversion around Slipper Mill Pond, but required the crossing of the railway line (level crossing) at Bosham. This was found to be unsuitable as a result of no available land for the required crossing (with the land developed with residential properties, gardens and railway infrastructure) and as a result it was discounted.

2.4.11.8. In light of it not being feasible to cross the level crossing at Bosham, Route 1C was developed with an alternative railway crossing at Nutbourne Station. This was deemed to be more suitable for the installation of two circuits due to open land (agricultural) to the east of the level crossing.

2.4.11.9. To avoid the constraints in proximity to the landfall location (river crossing, narrow roads and caravan park), Route 1D was developed through agricultural fields.

2.4.11.10. The East Wittering routes, whilst avoiding the need to cross Langstone Harbour required by the Hayling and Eastney routes (which is designated as Langstone Harbour SSSI, Chichester and Langstone Harbour SPA and Ramsar and Solent Maritime SAC), were the longest of all the cable routes with the largest number of HDD crossings (between six and 11 HDD crossings). Routes 1C and 1D were in a rural setting, and would avoid the engineering constraints associated with urban areas such as existing services and structures. However, they were considered likely

to encounter and adversely impact a greater number of ecological, landscape and other features and therefore had the potential to cause greater impact to the natural environment.

2.4.11.11. Routes 1B, 1C and 1D all passed through Ancient Woodland on the B2149. It was observed that whilst there are narrow road verges at this location, if excavation outside of the carriageway and verge footprint was required this may involve the removal of some trees and increase potential risk of damage to tree roots.

2.4.11.12. Ancient Woodland is irreplaceable, and its loss cannot be mitigated, although compensation measures are possible. Alternative routes through fields would require crossing Chichester Harbour SSSI, Solent Maritime SAC and Chichester and Langstone Harbours SPA and Ramsar sites to reach the A259, which was considered an unsuitable alternative due to the potential negative environmental impacts on crossing these designations.

2.4.11.13. Additionally, the increased length of the East Wittering Routes (between 15 and 17 km longer than Hayling and Eastney routes) would result in a significantly longer construction period than the alternative routes, with resultant highway disruption, including direct impacts on the settlements (and residents) of Chichester (southwest), Fishbourne, Bosham, Funtington, Westbourne, and Horndean.

Hayling Island

2.4.11.14. The study deemed that no cable routes from this landfall site would be technically feasible since it was not possible to identify a suitable crossing from Hayling Island to the mainland. In considering a crossing to the mainland a number of options were considered including:

- Langstone Bridge - no suitable solution was identified to attach the cables to Langstone Bridge or place them within the bridge deck. This would also require closure of the bridge, which provides the only access to the island. The bridge also forms part of the Chichester Harbour Area of Outstanding Natural Beauty ('AONB') and sits directly adjacent to the Langstone Harbour Conservation Area;
- Traditional trenching techniques – the option of excavating the sea bed/mud flats during low tides to install conduits, and requiring subsea-land joints was discounted due to disturbance and other environmental effects on the sensitive estuary which is subject to a large number of designations (SSSI, Ramsar, SPA, SAC, LNR, AONB); and
- Use of HDD – the use of HDD from the north of Hayling Island to the mainland (to avoid disturbance to the estuary) was not achievable due to insufficient land availability outside ecological designations (Southmoor Nature Reserve Local Nature Reserve and SSSI, Chichester Harbour AONB, Solent Maritime SAC, Langstone and Chichester Harbours SPA and Ramsar Sites) to house the compounds either side of the estuary for the HDD construction works, with

alternatives leading to HDD length beyond current technological limits posing a risk to installation. Further constraints existed due to the very steep bathymetry of the Langstone Harbour entrance (around 12-14 m over a relatively short distance) which would need to be crossed. There were also concerns in relation to the regular movement of the coastline evidenced by ongoing beach replacement works, resulting in a medium to high engineering risk.

2.4.11.15. Furthermore, Routes 2B and 2C required routing via Portsdown Hill Road Bridge to cross the A3(M) which proved infeasible due to a lack of available land on either side of the bridge for a HDD crossing, further restricted by its setting in a cutting around 15 to 20 m deep. Other considerations of attaching the cables to the bridge were unsuitable given the bridge deck thickness and existing services.

2.4.11.16. The three routes (2A, 2B and 2C) from Hayling Island were considered to be complex and impractical and ultimately unfeasible, furthered by the additional likely impacts on the environmental constraints listed above, led to all of the Hayling routes being discounted.

Eastney/Portsea Island

2.4.11.17. Four routes were considered from a landfall location at Eastney: Routes 3A, 3B, 3C and 3D. A table summarising the route options and constraints is included in Appendix 2.4.

2.4.11.18. Route 3A was ruled out during initial feasibility stages due to technical challenges associated with crossing of Milton Common, a former landfill site and Local Nature Reserve. Although, this route was initially discounted, further to consultation with Portsmouth City Council and local residents, and additional engineering assessment this section of Route 3A now forms part of the Order Limits, (see section 2.6.6, (Section 8 - Eastern Road (adjacent to Great Salterns Golf Course) to Moorings Way) for further detail).

2.4.11.19. Route 3B was considered but not pursued, following more detailed investigation of an earlier perceived 'pinch-point' in the vicinity of Havant Road on Route 3D. As such, Route 3B was no longer required and could be discounted with Route 3D (see section 2.4.13 for a description of the route) considered further.

2.4.11.20. Route 3C was considered but discounted due to spatial constraints at the major A27/A3(M) roundabout, which meant it was not possible to cross the junction using HDD or trenching.

2.4.11.21. Route 3D, proposed running the onshore cables from Eastney via the A288, A2030, B2177, A3, B2150 and via country roads or fields to the Converter Station location. Whilst comprising a number of high traffic routes, cable routing was considered deliverable with the use of suitable traffic management measures.

2.4.11.22. Three crossing points requiring HDD were identified as moderately difficult but achievable. Options to route the cables along Soake Road were considered but due to this being a narrow lane with existing buried services concerns, were raised that it may be unable to accommodate two cable circuits. Alternatives via the fields from Hambledon Road or through Milton Road (and its verges), Waterlooville were also considered and were found to provide viable alternatives should detailed studies find Soake Road to be unsuitable to cable installation. Route 3D was the shortest of all those investigated at approximately 18.6 km in length and comprised a lower number of HDD crossings.

UK Cable Route Desk Study Conclusions

2.4.11.23. In light of its engineering feasibility and the initial observations that the environmental constraints (i.e. traffic impact) would via the implementation of carefully planned traffic management measures be able to be mitigated, Route 3D was recommended to be progressed to a further detailed assessment. To manage the risk of Route 3D being found to be not deliverable following further assessment, a backup route was also taken forward to the detailed assessment, with Route 1D selected for this purpose.

2.4.12. PORTSMOUTH CITY COUNCIL ('PCC') FEEDBACK – APRIL 2017

2.4.12.1. In April 2017, PCC requested that the Applicant explore the option of landing further east along Eastney beach (south-east of Fort Cumberland site) or whether the marine cable corridor approach could extend into the estuary and land at Eastney Ferry Terminal before continuing along the onshore cable route. These options suggested by PCC were subsequently considered by the Applicant, but were found to not be a feasible for the following reasons:

- The alternative landfall location further east along Eastney beach would be located between two outfall pipes at the entrance to Langstone Harbour;
- The channel width (reducing to 250 m at its narrowest point) and shallow water depths (of between 5 and 14 m) at this location would be likely to be unsuitable for vessel access during construction works, and too narrow for a barge, which would be required for construction;
- The narrow channel entrance would limit the access to this location to allow for direct pull-in operations and the cable routing on the approach to the landfall would be very challenging;
- The alternative landfall locations are also subject to statutory environmental designations including Chichester and Langstone Harbours SPA, Ramsar, and Langstone Harbour SSSI site designations in addition to the Solent Maritime SAC which is also applicable to the proposed landfall;

- A more eastern landfall from Eastney beach would also have the potential to impact on the setting of Fort Cumberland Scheduled Ancient Monument and the coastal flood defences due to their proximity to any available land for a landfall in the vicinity of the estuary and Eastney Ferry Terminal.

2.4.12.2. The alternatives of a more easterly landfall location at Eastney beach or a landfall further within the estuary in proximity to Eastney Ferry Terminal were therefore discounted.

2.4.13. UK CABLE ROUTES – DETAILED DESK STUDIES OF ROUTE 1D AND 3D (JUNE 2017)

2.4.13.1. Detailed desk studies were undertaken in June 2017 to assess the two shortlisted Routes 3D (Eastney landfall to Lovedean Substation) and 1D (East Wittering landfall to Lovedean Substation) (illustrated in Plate 2.10) and included:

- Detailed utilities searches to identify potential pinch points;
- Review of third party land ownership;
- Detailed consideration of identified crossings/HDDs;
- Review of geotechnical, historical and environmental constraints and sensitivities; and
- Design of a preliminary ground investigation, based on the identified geotechnical risks and constraints, to inform the cable design.

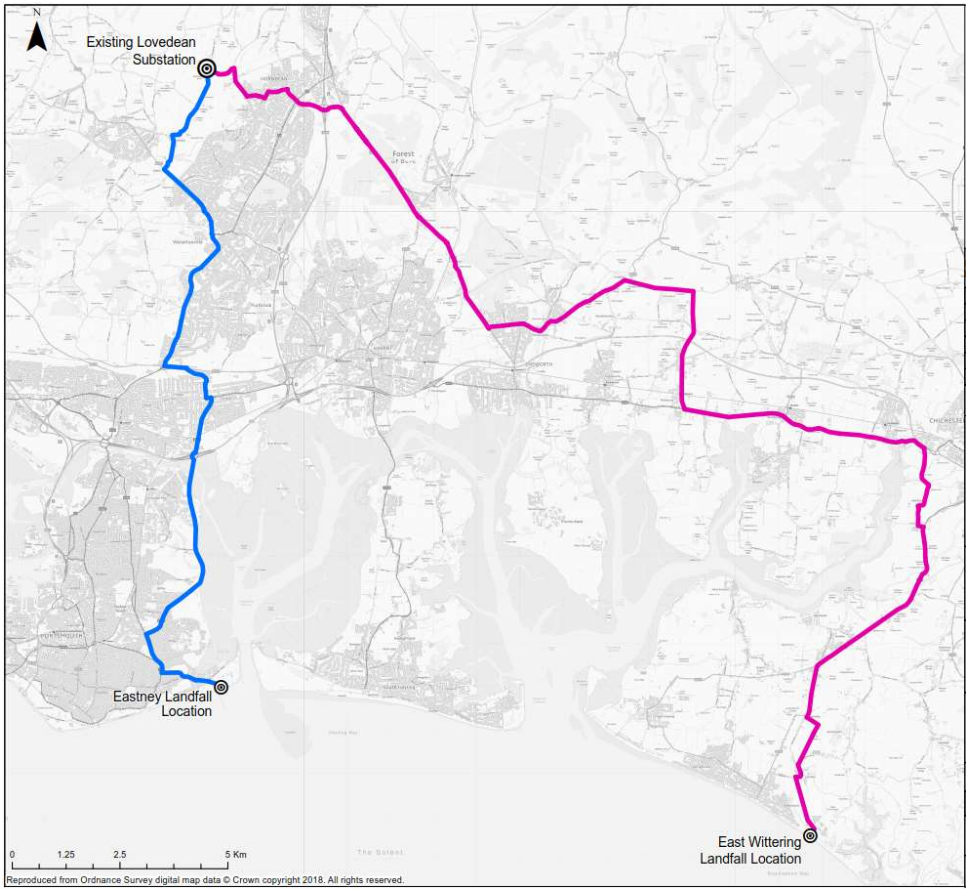


Plate 2.10 - Cable Route 3D (blue) and Cable Route 1D (pink)

3D Route (Eastney landfall to Lovedean) Summary of Key Challenges

2.4.13.2. Cable Route 3D is the shorter of the two shortlisted routes at 18.6 km, with the least number of HDD crossings. The route was concluded to be viable, although the following aspects were identified as requiring careful consideration to allow for the cable installation:

- Environmental designations associated with the crossing of Langstone Harbour (Ramsar wetland of international importance, SPA, SSSI and SAC) at the Eastern Road Bridge, using HDD crossing techniques to avoid disturbing the estuary and surrounding protected areas with restrictions on the final HDD design due to the environmental protection, including timing of surveys and construction, HRA requirements alongside and restricted land access;
- The route between Soake Road and Anmore Lane to the proposed Converter Station location being too narrow for cable installation (recommending routing in the fields to the west);
- Concentration of utilities within the existing highway and verges (notably within the urban area of Portsmouth);

- Construction constraints associated with a crossing of the railway line;
- Requirements for preliminary ground investigation to determine ground and groundwater conditions;
- Negotiation with third party land owners for investigations and main construction works;
- Potential for UXO;
- Potential impact on Land West of Fort Cumberland, Milton Common, Great Salterns Lake, Golf Course North of Burrfields Road, Land East and West of Gillman Road, Meadow West of Farlington Avenue, London Road Fen, Kings Pond Meadow and Crabdens Copse SINCs associated with trenching works for cable installation, with potential routing considerations to avoid direct impacts and potential for mitigation where route adjustment is not possible;
- Identification of protected species in the study area, bats (6 records), hazel dormice (18 records), water vole (5 records), [redacted] (4 records) and GCNs (4 records); and
- Timing of construction works with regards to sensitivities including wintering bird and breeding bird seasons, peak tourist seasons and agricultural harvesting seasons.

1D Route (East Wittering landfall to Lovedean) Summary of Key Challenges

2.4.13.3. Cable Route 1D was the longest of the two shortlisted routes at approximately 35.2 km, and included the greatest number of HDD crossings. This route avoids the sensitive Langstone Harbour estuary crossings and designated sites associated with Route 3D and the congested urban area through Portsmouth's Portsea island. The route was concluded to be viable from an engineering perspective, although the following aspects were identified as requiring careful consideration to allow for the cable installation:

- A route through Earnley being too narrow for cable installation;
- Potential need for several small diversions around villages or sensitive infrastructure/utilities through fields, resulting in potential for disturbance of ecological features;
- Routing through multiple small towns and villages where it is noted to be congested with utilities;
- Construction constraints associated with the railway line (two crossings);
- Requirements for preliminary ground investigation to determine ground and groundwater conditions;

- Negotiation with third party land owners for investigations and main construction works;
- Potential for UXO;
- Potential for adverse impacts Chichester and Langstone Harbours SPA;
- Potential impact on Southleigh Forest, Barton's Copse & The Slip, Oaklands Meadows, Havant Thicket, Idsworth Common, Rowlands Castle Golf Course, The Holt, Pyle Farm Meadow, Hazelton Common, Dell Piece West and Crabdens Copse SINCs, Chichester Canal, River Lavant Marsh, Fishbourne Meadows, and River Ems & Meadows LWS, though potential for routing to avoid impacts and opportunities for mitigation where route adjustment not possible;
- Identification of protected species in the study area, bats (290 records), hazel dormice (10 records), water vole (205 records), [redacted] (2 records) and Great Crested Newts (2 records), thus considered to be more environmentally sensitive than Route 3D;
- Presence of Bechstein's bat maternity roost in the vicinity of Bere Forest situated adjacent to the cable route (significant due to the population size given the limited overall population) and the potential impacts of construction within the roads through the forest on foraging and commuting;
- Timing of construction with regards to constraints associated with ecology, tourism, and agricultural harvesting seasons; and
- Ancient Woodland adjacent to the B2149, with diversionary routes only available through Chichester Harbour AONB.

2.4.14. UK TERRESTRIAL ROUTES AND LANDFALL WORKSHOP (JUNE 2017)

2.4.14.1. The two shortlisted potential landfall locations of Eastney and East Wittering and their associated onshore cable routes to Lovedean Substation (as per sections 2.4.11 and 2.4.13) were considered at a multi-disciplinary workshop against the following factors to determine the preferred UK landfall and associated cable route to be taken forward:

- The available tidal range data;
- Constraints at landfall and within the seabed (technical and environmental);
- The potential landfall installation methods of a Cable Lay Vessel (CLV) or Dynamic Positioning (DP) cable installation vessel, open trenching and transition ducts (either HDD or direct pipe); and
- The findings of the detailed desk studies of Cable Routes 1D and 3D.

2.4.14.2. This workshop concluded that Route 3D was preferable to Route 1D for the following reasons:

- Technical/engineering – shortest cable length and least number of crossings (HDD); and
- Environmental - fewer potential environmental impacts associated with known environmental constraints and designations.

2.4.14.3. In considering the feasibility of construction at the landfall, the main relevant factor is the available water depth on the approach to landfall. Whilst East Wittering was found to provide the least limitations for installation due to the seabed profile, it was also subject to a greater number of environmental designations and risk of associated impacts. The landfall at Eastney was also deliverable, but presented some additional technical challenges to facilitate installation. Consequently, it was agreed that feedback would be sought from HDD and cable installation contractors to give a greater level of confidence in the feasibility of the two landfall locations.

2.4.14.4. The HDD contractors and cable installation contractors concluded that Eastney and East Wittering were similar from a marine installation perspective. Therefore, the deciding factor for the preferred landfall and onshore cable route was an assessment of the associated constraints and potential for environmental effects of East Wittering and Route 1D, and Eastney and Route 3D.

2.4.14.5. A comparison of the key environmental constraints and effects for the landfall and onshore cable route constraints is provided in Table 2.5.

Table 2.5- Comparison of Landfall Locations and Associated Cable Routes (1D and 3D)

	East Wittering and Route 1D	Eastney and Route 3D
LANDFALL		
Environmental Designations	SPA designation (Solent & Dorset Coast), within; SSSI designation (Bracklesham Bay), within; Marine Conservation Zone (Selsey Bill & the Hounds) 1.4km southeast; and Protected Wreck (The Hazardous) 960m west.	SAC designation (Solent Maritime), within; SSSI (Langstone Harbour) 550 m (Sinah Common) 970 m east; SPA 550m east (Solent and Dorset Coast); SPA 550 m east (Chichester & Langstone Harbours); RAMSAR (Chichester and Langstone Harbours) 550 m east; and Fort Cumberland SAM 150 m east.
Environmental Considerations	SSSI, potential indirect impacts including disturbance and habitat degradation subject to construction method and mitigation	
Technical / Geographical	High currents indicate that the pull-in distance for cables may be limited to 1km or less, providing less flexibility; Such a limitation to a distance beyond 1km (due to shallow water depths), would require access by a barge or by a DP vessel which could ground out. DP vessel access restricted by tides, potential requirement for works across two spring tides to allow access and egress, extending the construction programme;	Unsuitable for DP vessel due to shallow water depth (to 7 km from landfall) for a direct pull. A barge may reach a suitable location but may result in an additional offshore joint; Near shore pull-in will be very tidally restricted (1.9 m neap, and 3.9 m spring tidal range) and could result in a risk to the cable installation schedule; Cable burial/protection between the beach and the closest

	East Wittering and Route 1D	Eastney and Route 3D
	Unsuitable for cable installation with a DP vessel due to shallow water depth (5 m at 1 km) preventing a direct float-in; Preferable to pull-in at neap tides (which are shallower) to avoid high currents, again limiting the installation methods and when construction activities can be undertaken; Ducts will likely be required to bypass the SSSI zone, requiring diving operations at the duct exit to float the cable in; Sandwave occurrences with potential to alter geometry with resultant uncertainty on cable impact; and Anchorages for port approach with potential risk of cable strike.	approach point will require a specific shallow water burial; Constrained by existing outfall, sand spit and IFA2, but considered to allow suitable area for installation; Sandwave occurrences with potential to alter geometry with resultant uncertainty on cable impact; Anchorages for port approach in vicinity of Nab Tower, with potential risk of cable strike; and Vessel traffic to Langstone Harbour requiring consideration with regards impacts of cable installation.
CABLE ROUTE		
Environmental Designations	Chichester & Langstone Harbours SPA, SAC; Chichester Harbour AONB; Impacts on SINCS and LWS along the route; Fishbourne Roman Site SAM; Ancient Woodland on route (either side of highway); and Protected Species (5 species, 509 records).	Crossing of Langstone Harbour (and SPA, SSSI, SAC); Farlington Marshes (crossing or avoidance); Fort Cumberland SAM; Protected Species (5 species, 36 records); and Proximity to SINCs.
Environmental Considerations	The greater length of the route results in a potentially greater impact on statutory and non-	The shorter length of the route results in a potentially lesser impact on statutory and non-

	East Wittering and Route 1D	Eastney and Route 3D
	statutory environmental designations than route 3D, including ancient woodland through which the cable route is identified within existing rural highway. A substantially greater number of protected species records have also been identified (associated with the longer route length) and could potentially be impacted by the proposed development. As a predominantly rural area the route is anticipated to have a greater impact on the natural environment and ecology, however, in contrast a lower impact on residents is expected. A greater potential to impact on archaeological deposits due to length of route, undisturbed land and proximity to Fishbourne Roman Site SAM (not directly impacted).	statutory environmental designations than route 1D. The cable route runs in close proximity to a number of ancient woodlands, however it is anticipated that these can be avoided. A significantly lower number of protected species records have also been identified (associated with the shorter route length and urban location) which could potentially be impacted by the proposed development. As a predominantly urban area the route is anticipated to have a lesser impact on the natural environment and ecology, however, in contrast a much greater but temporary impact on a larger number of residents is expected. Lower potential to impact on archaeological deposits due to shorter route, comprising a larger extent of disturbed land (more substantial highway construction and urban development impacts). The proximity to Fort Cumberland SAM would need to be further assessed.
Technical / Geographical	Route length 35.2 km; Routing through multiple settlements, including Earnley, Fishbourne and Horndean; 10 likely HDD crossings; Railway line crossings (two);	Route length 18.6 km; Urban area of Portsmouth and Waterlooville; Crossing Langstone Harbour (Portsea Island to the mainland); 3 likely HDD crossings;

	East Wittering and Route 1D	Eastney and Route 3D
	Utility concentrations within settlements; and Narrow highways at Earnley.	Utility concentrations in the urban area; Railway line crossing (one); and Narrow highway at Soake Road.
SUMMARY		
Summary Comparison of Environmental Effects	More challenging, but deliverable landfall installation, with potential to impact a greater number of environmental designations Longer cable route, with associated increased construction period and environmental disturbance Predominantly rural environment, with lower impact on local residents Greater number of utility pinch points, however more land available for alternative routes Archaeological risk (Fishbourne Roman Palace) Potential impacts on Ancient Woodland due to routes through and adjacent to designations Lower UXO risk Greater number of HDDs required to avoid statutory designations and constraints, with resultant additional land area needed for associated compounds.	Less challenging, but deliverable landfall installation, with potential to impact on fewer environmental designations Shorter cable route with a reduced construction period and reduced environmental disturbance Predominantly urban environment, and associated greater impact on local residents Lesser number of utility pinch points, however less land available for alternative routes Lower archaeological risk Lower impact on ancient woodland due to lower number of and remoteness of the route from designations Higher UXO risk Lower number of HDDs needed to avoid designations and constraints, but challenges associated with HDD length (at upper end of) to cross Langstone Harbour

2.4.14.6. Both landfall locations were identified as being deliverable from a cable installation perspective, with neither resulting in significantly different environmental effects given available mitigation, however, the greater designations at the East Wittering landfall result in a marginally greater risk. The onshore cable route was considered alongside the landfall locations to holistically confirm the preferred site/route.

2.4.14.7. Route 1D was found to have a significantly greater potential for environmental impacts, partly associated with the longer route. This route included routing through Chichester Harbour AONB, Chichester and Langstone Harbour SPA and SAC, with 509 protected species identified within the search area (compared to 38 with Eastney and Route 3D), with an associated increase in timescales for installation and disruption to the environment and highway, including local residents.

2.4.14.8. As such, Eastney and Route 3D was selected as the preferred landfall and onshore cable route to Lovedean Substation, whilst potentially having a greater temporary impact on local residents by virtue of traffic disruption, when balanced against the significantly lower number of potential permanent environmental impacts (associated with the shorter route and construction programme).

2.4.15. DETAILED MARINE CABLE ROUTE DESKTOP STUDY (2017)

2.4.15.1. Following the identification of Eastney as the preferred UK landfall site, a more detailed marine cable route study to refine the marine cable route options was undertaken to build on the marine preliminary high-level study discussed in section 2.4.8. This considered a wide range of parameters, including other sea users (e.g. fishing, shipping), geological/seabed conditions, environmental/heritage constraints, and other seabed uses/constraints (in service and out of service cables, outfalls, UXOs, etc.) alongside discussions with the stakeholders and site visits to the landfall.

2.4.15.2. Preliminary criteria were developed to define a preliminary survey corridor and preliminary route position list. These included:

- Minimum cable bend radius of 500 m;
- Minimum distance of 50 m from any outfall pipe;
- Minimum distance of 500 m from the IFA2 Interconnector cables (western limit);
- Straight for at least 1,000 m from UK landfall location heading towards deeper water;
- Cannot pass through anchorages, offshore wind farm sites or dredging areas;
- Cross other service cables at 90 degrees (for 500 m either side);
- Cross shipping channels/lanes at 90 degrees where possible;
- Where possible, keep bathymetry consistent;
- Where possible, keep within sandy areas (rather than gravel or rock);

- Where possible, avoid environmental designations; and
- Avoidance of wrecks.

2.4.15.3. These criteria were then used to identify a number of alternative options to shorten the marine cable route, evolving from the original route (see orange line in Plate 2.11) which was aligned to avoid the central Channel dredging areas and cross the main shipping corridors at approximately 90 degrees (to reduce the potential for disruption to shipping corridors during installation).

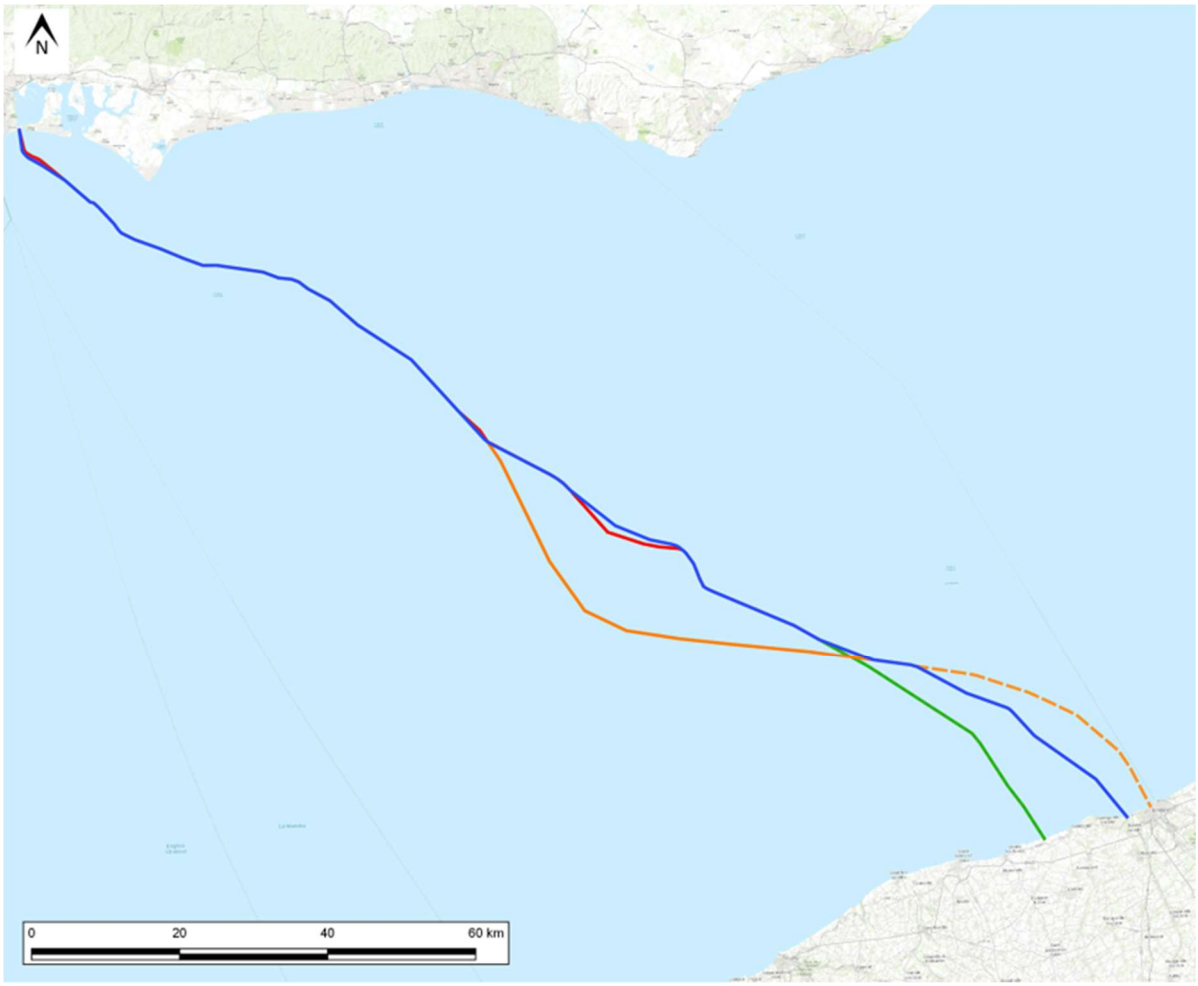


Plate 2.11 - Marine Cable Route Options

2.4.15.4. A number or revisions were developed and are illustrated by the green, blue and red routes (Plate 2.11 which in part also related to alternative French landfall locations (three being under consideration at the time of the route revisions), and are outside the Proposed Development and not discussed further within this chapter.

2.4.15.5. The red route was identified to pass through a gap in the dredging areas, however it crossed the shipping corridors at an angle less than 90 degree and has not been progressed due to the potential impact on shipping.

2.4.15.6. The blue route was selected as the preferred Marine Cable Corridor, being significantly shorter, and thereby reducing environmental impacts, seabed occupation, and time taken during construction (with reduced health and safety risks and reduced operational impacts on other sea users). It also included route optimisation closer to shore following discussions with The Crown Estate, the dredging industry and fishermen, subsequently avoiding as far as possible the former Horsetail dredging area, and routed to avoid rocky seabed/fishing grounds and minimise 'sterilisation' of the seabed. However, in doing so brought the proposed Marine Cable Corridor closer to IFA2.

2.4.16. MARINE SURVEYS (NOVEMBER 2017 TO AUGUST 2018)

2.4.16.1. The Marine Geophysics Survey was undertaken from November 2017 to March 2018, with the Geotechnical Survey from May to August 2018, outputs of which are detailed in paragraph 6.5.6.3 and Plate 6.12 of Chapter 6 (Physical Processes) of the ES Volume 1 (document reference 6.1.6). The results of the surveys have been used to further inform route development and corridor refinement by seeking to increase cable burial and reduce the need for external cable protection. It is envisaged that the appointed contractor will undertake pre-installation surveys and route engineering to determine the final Marine Cable Route within the Marine Cable Corridor.

2.4.17. CONVERTER STATION OPTIONEERING STAGE 2 – 2017/2018

2.4.17.1. In Quarter 3 and 4 of 2017, the Applicant conducted a desktop study to identify the environmental constraints for the siting of the Converter Station Options A and B (see section 2.4.10), alongside consultation with the LPAs. As the AC cable route is closely related to the location of the Converter Station site, the AC cable route was investigated in parallel with the Converter Station optioneering.

2.4.17.2. The desk study considered:

- Construction stage laydown and site establishment access;
- Access route options;
- Preliminary site stability assessment (desk based, and subject to ground investigations);
- Flood risk areas;

- Local footpaths/PRoWs;
- Existing utilities;
- Land availability;
- Local residents;
- Local air quality & noise;
- Landscape and visual amenity; and
- Biodiversity.

2.4.17.3. Further assessments were then undertaken to more fully consider the two preferred sites in greater depth. The following environmental, social and economic topics were considered:

- Landscape and visual amenity;
- Ecology and biodiversity;
- Arboriculture and Ancient Woodland considerations;
- Ground conditions;
- Noise and vibration;
- Transport and access (existing roads);
- Soils and agricultural land use;
- Archaeology and cultural heritage;
- Water resource and flood risk;
- Waste and materials;
- Air quality;
- Socio-economics; and
- Human health.

2.4.17.4. Additional engineering and design considerations included:

- Earthworks requirements;
- Access road route;
- Temporary construction Laydown Area;
- AC cable route location;
- DC cable route location;
- Auxiliary supplies and power management; and

- Drainage management and water supply.

2.4.17.5. The consideration was ongoing during the non-statutory consultation, with the overall considerations identified in section 2.5.7.

2.5. FEEDBACK AND SCHEME CHANGES FROM NON-STATUTORY CONSULTATION (JANUARY 2018)

2.5.1.1. This section includes a summary of alternatives considered following the non-statutory consultation which, was progressed following the completion of the optioneering studies identified in the above sections. Plate 2.12 illustrates the changes to the Proposed Development between the non-statutory consultation through statutory consultation to submission.

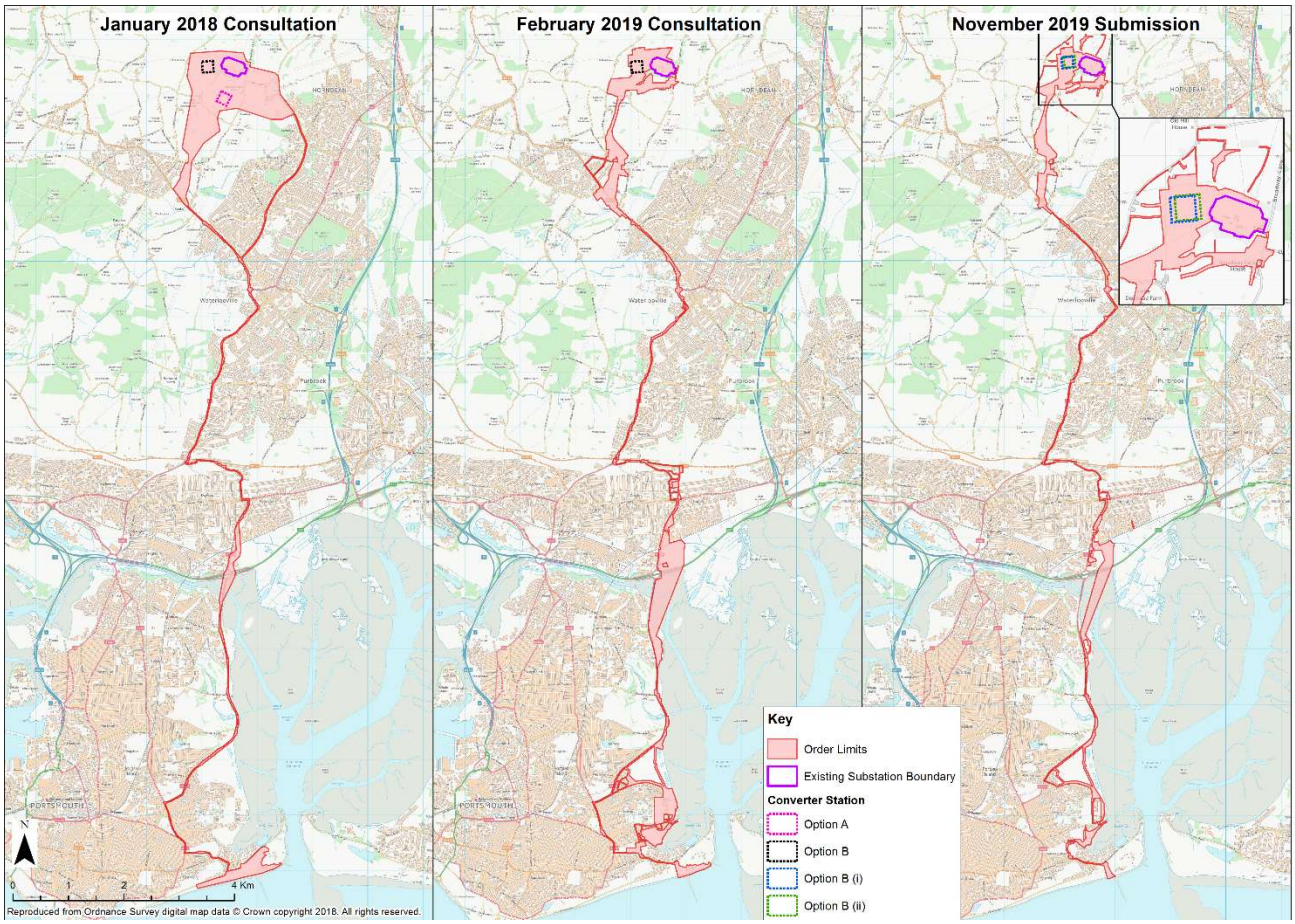


Plate 2.12 - Refinement of the Proposed Development through the pre-application process

2.5.1.2. The main alternatives taken forward for non-statutory consultation presented a Marine Cable Corridor from the UK/France EEZ to a proposed landfall area at Eastney and an onshore cable route from Eastney to two potential Converter Station locations at Lovedean Substation. The onshore cable corridor as presented at the non-statuary consultation followed Route 3D with the exception of Soake Road which further studies had found to be too narrow for the installation of two cable circuits, and included options to route via Milton Road, Horndean and the fields west of Soake Road, Denmead.

2.5.1.3. A detailed summary of the consultation responses is included in the Consultation Report (document ref.: 5.1). A summary of the key issues raised, and the alternatives subsequently considered are set out below.

2.5.2. ONSHORE CABLE ROUTES: TRAFFIC DISRUPTION

2.5.2.1. Concerns associated with traffic disruption were raised in relation to the onshore cable corridor, particularly in relation to the areas of Milton Road and Eastern Road in Portsmouth. In considering these concerns, the philosophy for the onshore cable corridor evolved from the aim of routing within the existing road network, to primarily staying in highway boundary, or public land, but seeking to avoid the vehicular carriageway to minimise disruption.

2.5.2.2. As a result, the Applicant identified two alternative routes which sought to reduce traffic disruption:

- **Milton Common (avoiding Eastern Road):** this area of land was initially considered unlikely to be feasible to accommodate the Onshore Cable Corridor due to its former landfill use (see section 2.6.6). In progressing discussions with PCC on reducing the impacts on Milton and Eastern Roads in Portsmouth, an initial phase of Ground Investigation ('GI') works were undertaken to assess the feasibility of trenching and confirm the risks of, and the potential for mitigation in relation to, likely contamination. The GI allowed the alternative route through Milton Common to be refined, discounting the central area due to the unacceptably high contamination risk, but retaining options to route cables to the south and west, and to the east (adjacent to the coastal defence bunds). Milton Common is also a SINC and LNR, which would be negatively impacted by the cable installation, however, on balance, and following subsequent consultation with PCC, the route options were refined and progressed to the statutory consultation (see section 2.6); and
- **Bransbury Park and Milton Allotments (avoiding Milton Road and Eastern Road):** a number of route options were considered by the Applicant to route the Onshore Cable Corridor through Bransbury Park and the allotment gardens located south of Locksway Road. Comprising areas of open land, and

acknowledging the potential disruption in terms of accessibility by local residents, both trenched and HDD installation techniques were considered. As a number of alternative construction methods to these areas were found to be deliverable and likely to reduce disruption on vehicular traffic, these options were further developed and progressed to the statutory consultation.

- In addition, HDD installation between Kingsley Road/Milton Allotments and Milton Common was considered. This option sought to provide an opportunity to remove a significant length of cable route within the highway, but this was ultimately discounted due to the complexities of HDD needing to pass beneath a large number of private residential dwellings.

2.5.2.3. Therefore, in order to reduce potential traffic impacts the alternative route options through Milton Common and Bransbury Park and Milton Allotments were subject to further consideration and progressed to the statutory consultation (with detail of the considerations included within the PEIR).

2.5.3. LANDFALL: LANGSTONE HARBOUR

2.5.3.1. A number of responses queried the opportunity for Langstone Harbour (and the associated coastline) to be used as an alternative Landfall, thus avoiding the need for the onshore cable to route through the built-up areas of Portsmouth. As had previously been identified throughout this chapter, Langstone Harbour was constrained by the high potential for impacts on internationally designated sites, including the Chichester and Langstone Harbours SPA and Ramsar Site and Solent Maritime SAC and part of Solent and Isle of Wight Lagoons SAC, all of which are internationally protected sites (Natura 2000 sites). Langstone Harbour is also designated as a SSSI.

2.5.3.2. Other nationally important sites that surround Langstone Harbour include Milton Common LNR (and SINC), Farlington Marshes LNR, West Hayling LNR, Hayling Billy LNR and the Kench, Hayling Island LNR. There are also some surrounding sites of local importance including Farlington Marshes SINC. Taking into account the importance of the sites and the statutory requirements in relation to their conservation the option of Langstone Harbour was not considered to be feasible.

2.5.3.3. Further, the vessels typically used to lay the undersea cables cannot operate in the Harbour entrance due to its limited width, while the Harbour's limited depth and sedimentary composition renders it too unstable for the use of onshore cable installation technologies and machinery.

2.5.3.4. The alternative cable installation option of trenching through the extensive tidal mudflats, whilst technically feasible, would be likely to have significant environmental impacts on protected areas and increase the construction period, prolonging the disturbance to those designated environments and thus options for alternative landfall locations on land adjacent to Langstone Harbour were discounted.

2.5.4. ONSHORE CABLE ROUTE: KINGS POND AREA

2.5.4.1. Non-statutory consultation responses raised concerns on the potential routing of the onshore cable through Kings Pond SSSI. As a result, and given the previous discounting of Soake Road, and concerns on traffic impacts on the route along Milton Road, Waterlooville to Lovedean (see section 2.5.5) an assessment of alternative options, including the use of HDD installation within the vicinity of Kings Pond SSSI to avoid direct impacts on the designation were considered. Further consideration (see Chapter 19 (Groundwater) of the ES Volume 1 (document reference 6.1.19)) identified risks associated with the linking of aquifers which further refined this option. Consideration was also given to the cable installation within the highway through Denmead (Mill Road, Martin Avenue and an additional length of Anmore Road) should the HDD or trenching techniques through the area King's Pond prove impracticable, with this alternative considered to reduce the number of residential receptors than the earlier Milton Road option. The HDD, trenching and highway alternatives were progressed to the statutory consultation.

2.5.5. ONSHORE CABLE ROUTE: MILTON ROAD, WATERLOOVILLE TO LOVEDEAN

2.5.5.1. Concerns were raised regarding the impact of the proposed onshore cable corridor on traffic and associated impacts on residents along, and in the vicinity of Milton Road in Waterlooville. In response to that the alternative routes further west (see 2.5.4) have been considered and it was concluded that this alternative should not be progressed further due to the suitable alternatives identified in 2.5.4.

2.5.6. PORTSEA ISLAND CROSSING

An alternative option raised within the consultation responses was whether the existing A2030 Eastern Road bridge structure could be used to cross from Portsea Island to the mainland as an alternative to other crossing methods (trenching and HDD). The bridge provides one of the main routes to Portsea Island and the installation of cables would require the bridge to be closed. As a result, the associated impact on the local highway network was considered too significant for this to be taken forward.

2.5.7. PREFERRED CONVERTER STATION LOCATION

2.5.7.1. Based on the analysis and assessment undertaken for both Converter Station options, Option B was identified as the preferred option. The preference for Option B was strongly related to its more positive environmental assessment from a noise, ecology and visual perspective. In addition, this option also performed best from a technical and engineering perspectives.

2.5.7.2. It was considered that Landscape and Visual Effects were one of the most important distinguishing factors between the sites due to the relative sensitivity of the location, including but not exclusive to their proximity to sensitive features such as SDNP.

2.5.7.3. Option B benefited from existing topography and vegetation, which provide natural screening of the Converter Station site (and better screened from key receptors including the urban area, public highway and PRoWs), however the associated access route would be of greater visibility in the landscape due to the routes' longer length. Overall, it was assessed that Option B had the potential to result in a less significant visual impact.

2.5.7.4. With regard to ground investigations, both options were similar, however clay depth (impacting foundation design) and a lower risk for karstic features (potential causes of ground instability) were more favourable for Option B.

2.5.7.5. From a technical and engineering perspective, the AC and DC cable entry and exit points into Lovedean Substation were preferable for Option B. In addition, Option B would necessitate a shorter AC cable route whilst also avoiding the need to cross existing transmission cables.

2.5.7.6. Option B was also affecting a lower number of Noise Sensitive Receptors.

2.5.7.7. Option B did raise the potential of a greater loss of existing established habitats than Option A, including the loss of established trees and hedgerows to the west which would require appropriate mitigation (the loss of this landscaping has subsequently been considered further, see Section 2.6.5).

2.5.7.8. Both options were deliverable from an environmental and technical perspective. However, when weighing the environmental considerations relevant to each of the options, Option B was considered to present the least level of impact within the existing environmental constraints.

2.5.7.9. A comparison of the environmental effects was carried out in the Stage 2 Optioneering and the results are summarised in Appendix 2.5.

2.5.7.10. Alternative crossing options were investigated and HDDs were considered feasible from either the Interchange Park industrial estate (south of the estuary/east of Eastern Road) or from Anchorage Park (south of the estuary/west of Eastney Road) to Farlington playing fields. These alternatives also included the potential to investigate and seek an alternative to an uncertain road depth at the inlet to Great Salterns Lake and were progressed to statutory consultation.

2.5.7.11. The alternatives considered following the non-statutory consultation resulted in the revised Order Limits for the statutory consultation, illustrated in plate 2.12.

2.6. STATUTORY CONSULTATION (FEBRUARY TO APRIL 2019)

2.6.1.1. The onshore cable corridor identified for the statutory consultation included the majority of the "non-statutory consultation route" (as presented to the public in January 2018), with additional options presented along the route, including those referenced in section 2.5 above, that were subject to ongoing studies at the time of consultation. Numerous assessments/investigations further informed the refinement of the onshore cable corridor, including desktop studies; utility information; highway boundary information; ground investigation results; HDD feasibility studies; environmental surveys and public engagement feedback, including ongoing assessments and considerations during the statutory pre-application process.

2.6.2. FEEDBACK FROM STATUTORY CONSULTATION

2.6.2.1. A detailed commentary and review of the statutory consultation feedback is provided in the Consultation Report (document reference 5.1) supporting the DCO Application.

2.6.2.2. The key matters raised predominantly related to the impact on highways and traffic flows, and associated impacts in terms of noise and air quality, and the consideration of the options presented along the onshore cable corridor. A large number of responses also related to the proposed Converter Station. These aspects are considered further in Section 2.6.5.

2.6.3. WEST WATERLOOVILLE ALTERNATIVE ROUTE

2.6.3.1. Hampshire County Council ('HCC') and Havant Borough Council ('HBC') requested consideration of the routing of the onshore cables through the West Waterlooville Major Development Area ('MDA'), which will eventually provide a continuous highway route through the MDA between Ladybridge Roundabout and Hambledon Road.

2.6.3.2. The Applicant has liaised with the developer who has prepared an updated delivery programme and masterplan associated with the MDA. This confirmed that there is no definitive date for the completion of the highway elements within the site although they are anticipated to commence implementation of the Ladybridge Roundabout works in 2020. Winchester City Council ('WCC') have indicated that they anticipate the full extent of highway works will be completed within five years.

2.6.3.3. Further meetings and discussions with the developer have resulted in advice that due to the long-term nature of the construction associated with the development, comprising 14 phases, they would not be able to support any infrastructure unrelated to their development that could complicate their programme, cause construction delays and also introduce uncertainty to potential buyers/occupiers of the development. The uncertainty of the phasing could subsequently impact on the delivery of the Proposed Development.

2.6.3.4. Due to the proposed timing of construction of the Proposed Development, and the delivery programme for the West Waterlooville MDA, being a strategic housing and

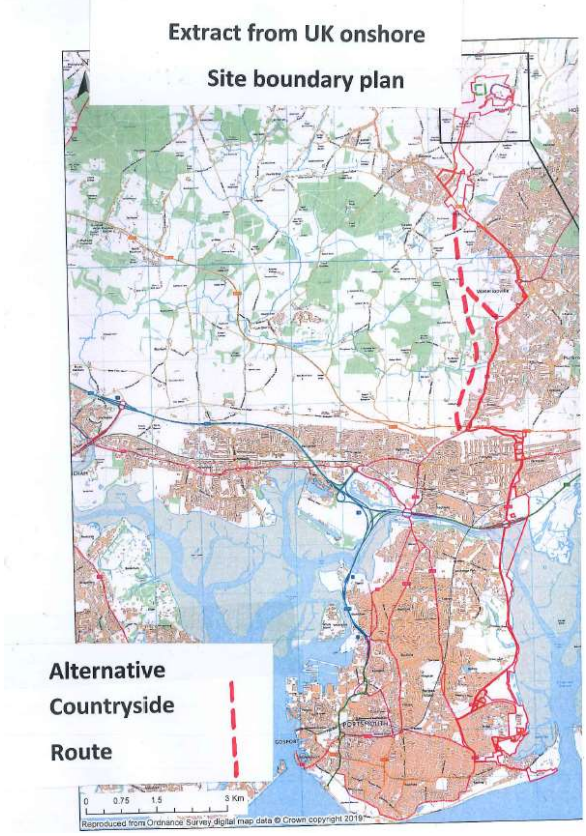
employment allocation, routing through this area was not considered a feasible alternative to the proposed highway route. This alternative was therefore not considered in further detail.

2.6.4. WCC/HBC ALTERNATIVE COUNTRYSIDE ROUTE

2.6.4.1. HBC and WCC jointly raised concerns on the need to consider alternative options for the onshore cable route and to assess them against the chosen route. The main concerns raised related to the suggested need to consider an alternative other than routing along the A3 from the junction with the B2177 (Portsdown Hill Road) which, in the view of the Councils, could remove (or ease) potential traffic impact. Specific concerns raised in respect of the A3 highway route were:

- Disruption to residents and businesses;
- Delays to road users;
- Pollution caused by stationary traffic/congestion;
- Presence of the cables hinders road infrastructure improvements; and
- Slower installation speed.

2.6.4.2. Both HBC and WCC proposed an alternative “countryside route” running northward through land to the west of the built-up area of Widley and Purbrook. The alternative countryside route proposed by the Councils covers land in the jurisdictions of both PCC and WCC, but is closely associated with land within HBC. The countryside route generally runs to the south of, and west around the West Waterlooville MDA and its associated landscaping (see Plate 2.13 for the location of the countryside route as proposed by WCC and HBC).



Indicative 'Countryside' Route provided by WCC

Indicative 'Countryside' Route provided by HBC

Plate 2.13 – Alternative Countryside Routes (as proposed by WCC and HBC)

2.6.4.3. The proposed countryside routes have been considered by the Applicant as a wide corridor to allow further flexibility to this alternative. There are a number of constraints identified within the suggested countryside route options illustrated in Plate 2.13 above and summarised in Table 2.6 below.

Table 2.6 – Alternative Countryside Routes Comparison

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
Development	Avoidance of minor development sites along A3 London Road	Potential impact on build-out of approved planning application for West

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
		Waterlooville MDA (and its associated landscaping); Future restrictions on longer term urban development due to easements associated with the Proposed Development preventing a build-out on top of the cables (build-out to the west of A3 considered by the Applicant to be the preferred direction of growth noting the existing constraints to the south, east and north/northwest of the urban area)
Engineering	Installation within the open countryside would be approximately 50 metres per day compared to 15-30 metres within the highway resulting in a shorter construction timescale; Less likely to encounter buried utility constraints	Routing further west along Portsdown Hill Road would result in negative highway impacts to this key east-west route; Existing Portsdown Hill Road bridge is unsuitable for cable installation, and alternatives via the slip road would result in additional cable bends resulting in a more challenging installation; Routing north of Portsdown Hill Road is constrained by an existing reservoir, historic chalk pit, trees and ecological designations; Likely be a requirement for additional HDD crossings to avoid watercourses (and potentially areas of Ancient Woodland) which would each require a minimum compound of 14 m by 20 m for installation at either end; Narrow rural roads discounted due to their narrow width (typically three

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
		metres) being unsuitable for the installation of two circuits
Highways	No (or reduced, depending on potential options) traffic impact on A3 London Road, a key north-south route Potential to utilise rural roads to avoid key environmental designations (however, see negative aspect associated with full closure)	Requirement for extended works along the B2177 Portsdown Hill Road for a distance of at least 200 metres, with limited option other than to install within the carriageway; Route would also need to cross Purbrook Heath Road and Closewood Road requiring associated traffic management and potential closures; Route would require the installation of a haul road to facilitate the construction in open countryside, with appropriate access points from the existing highway network; Route would cross a number of PRoWs along the route (a minimum of 5) requiring temporary closure or diversion; Routing within rural roads will likely require full road closure, with narrow widths likely resulting in a single circuit per highway, which would lead to additional highway closures to install two circuits; Potential impact on, or adjacent to, private residential land.
Ecology	Limited, possibility to avoid designations	Route could cross predominantly arable land and areas of improved grassland, including areas of woodland, hedgerows and watercourses, each likely to provide

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
		habitats and connectivity for flora and fauna; Likely impacts on protected species (MDA surveys found evidence of protected species including bats, dormice, alongside reptiles and otters) within the vicinity of the route; Hedgerow removal would introduce temporary reduction in habitat connectivity (introducing severance); Route is adjacent to Portsdown SSSI (400 m at its greatest distance) with the works being located within the impact zone and being of an operation identified as posing a risk to this 'unfavourable recovering' site; Large number of SINCs along the route comprising areas of woodland and meadow habitats
Arboriculture	Limited, possibility to avoid trees	Required working width of up to 23 m in open land and would require clearance of hedgerows (and hedgerow trees) to facilitate installation; Wooded areas, with a significant number designated as Ancient Woodland (and as SINCs) exist in the corridor and would require an appropriate off-set/cable diversion; Number of woodland areas also subject to area tree preservation orders, with a large concentration in the vicinity of Purbrook.

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
Heritage and Archaeology	No conservation areas; Avoidance of above ground heritage assets	46 heritage records within the suggested countryside corridor covering the Neolithic, Iron Age, Roman, Medieval and post-Medieval periods, including an area of late Iron Age/Roman archaeology; Archaeological potential within the countryside corridor is considered to be high.
Landscape and Visual Amenity	Likely reduced temporary impact on receptors using the A3 London Road	Installation would result in a temporary landscape impact during construction, being reinstated following completion; Longer term impacts associated with tree/hedgerow clearance, with replacement planting taking time to re-establish; Route is traversed by a large number of PRoWs, and people using these routes would be subject to temporary visual impact from construction and hedgerow removal.
Minerals and Waste	Limited, avoidance of Mineral Consultation Areas	Whilst low, the route is covered by a number of Mineral Consultation Areas with works resulting in potential sterilisation.
Water Resources / Flood Risk	Predominantly Flood Zone 1	Crossing of several watercourses (including a significant crossing at the River Wallington), preference would be to cross the watercourses by HDD; Bespoke designs may have to be considered, likely comprising duct blocks installed by trenching, with

	Environmental Effects of Alternative Countryside Routes compared to proposed Highway (A3) Route	
	Positive	**Negative**
		temporary diversion (via pipes) of the watercourses; The route comprises a number of areas of Floodzone 2/3 category land; Route is within Special Protection Zone 1 and a Nitrate Vulnerability Zone; Large number of rural/agricultural drains would also need to be crossed and may require temporary diversion during construction.
Other	Reduced impacts on residential amenity for a larger population; Reduced impacts on businesses due to avoidance of A3 London Road.	Known utility crossing of two gas pipelines; National Grid OHLs in the locality would need to be considered which take a similar north-south route, reducing the available area for the cable installation; Route includes a known radon zone, although this would be unlikely to constrain route selection.

2.6.4.4. It was concluded that whilst a countryside route is feasible from an engineering installation perspective, and would result in a reduced traffic impact on the A3 compared to the proposed Onshore Cable Corridor, it has a number of constraints as identified above, which include potentially significant impacts on environmental designations and protected species associated with the cable installation within the open countryside.

2.6.4.5. These likely impacts associated with the cable installation and compounds for HDD will both require clearance of a greater length of well-established hedgerows, trees and other vegetation than the highway route. Whilst replacement planting could be provided, it will take time for it to be established. Accordingly, it is considered that impact associated with the country-side route outweigh temporary short-term impact on traffic, and the countryside route options suggested by WCC and HBC are not considered to be reasonable alternative to the highway route proposed during the statutory consultation and thus not taken forward.

2.6.5. REFINEMENT OF CONVERTER STATION FOLLOWING STATUTORY CONSULTATION FEEDBACK

2.6.5.1. The preferred Converter Station location (Option B) was presented at the statutory consultation with an indicative layout within a wider Converter Station Area (see Plate 2.14). Following this, consideration has been given to the consultation feedback alongside further investigations completed on, and in the vicinity of the Converter Station Area to inform the final siting options.

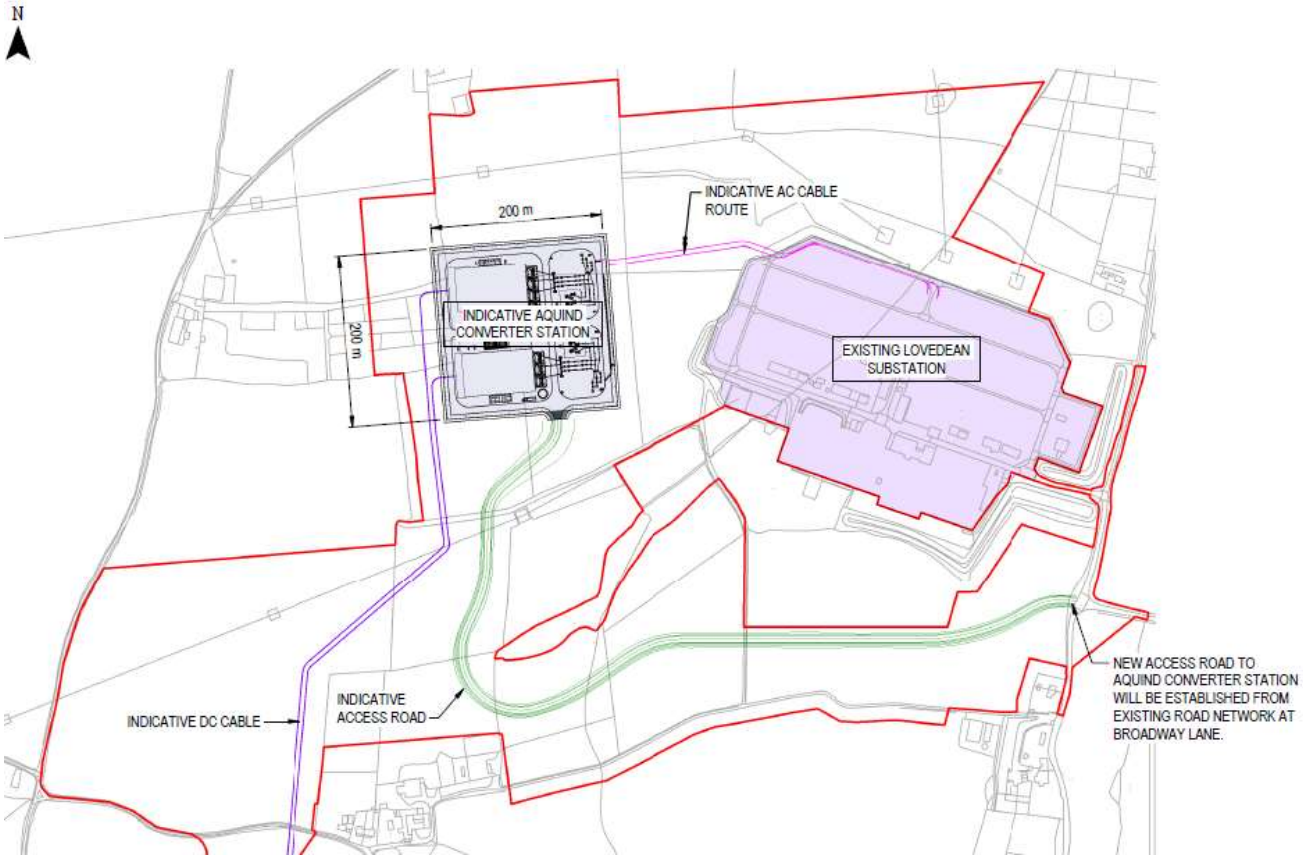


Plate 2.14 - Indicative Converter Station Layout presented at Statutory Consultation

2.6.5.2. Consultation feedback raised concerns regarding the visual impact of the Converter Station, with some additional comments on the associated impact on the ecology, trees and hedgerows in the immediate vicinity.

Micrositing

2.6.5.3. Following the selection of Option B, the Applicant carried out further ecological and arboricultural surveys. These surveys confirmed the absence of dormice, but identified a number of [redacted] setts within close proximity to the indicative Converter Station site (referred to as Option B(i)), to which the hedgerow retention would also secure an appropriate buffer.

2.6.5.4. As a result, the Applicant looked at refining the Converter Station location to avoid or reduce these impacts, and in doing so identified a potential to microsite (the repositioning of the Converter Station in the immediate vicinity of the original location) the Converter Station to the east (approximately 40 m east and 11 m north) (referred to as Option B(ii)).

2.6.5.5. This brought part of the Converter Station into land owned by National Grid, which forms part of their operational land in connection with Lovedean Substation.

2.6.5.6. Due to a number of sensitivities within the Converter Station Area (see section 2.4.10) the microsited option was assessed with regard to the impacts of cut-and-fill (due to the sloping topography of the site), and impact on the known karst features. The impacts on both were found to be acceptable in terms of constructability and the ecology. Further arboricultural survey and ecological results (see ES Chapter 16 (Onshore Ecology) of the ES Volume 1 (document reference 6.1.16) and Appendix 16.2 (Arboriculture Report) of the ES Volume 3 (document reference 6.3.16.3)) further found that the microsited option would allow the retention of the hedgerow and trees, reducing the negative effects on ecology, arboriculture and visual impact (through improved screening) than the original Converter Station location.

2.6.5.7. Both options B(i) and B(ii) are included within the Application, and illustrated on the Converter Station and Telecommunications Buildings Parameter Plans (document reference 2.6). Further detail on the Converter Station Options B(i) and B(ii) are included in section 3.6 of Chapter 3 (Description of the Proposed Development) (document reference 6.1.3).

Access Road

2.6.5.8. Concerns were raised during the consultation over the length and visual impact of the proposed Access Road and the lack of mitigation, and questions were raised as to whether a shared access could be developed through the Lovedean Substation or the proposed battery storage site (which was under consideration at the time of the non-statutory consultation, but to which the planning permission has now been revoked).

2.6.5.9. With regard to sharing the Access Road with the battery storage site, there is currently no extant or pending planning application so this option has not been considered further.

2.6.5.10. In considering a shared access with the Lovedean Substation, this was discussed in consultation with National Grid, but discounted due to concerns regarding security issues to the substation. This option would also have likely required an exit from the substation to the Converter Station that would have resulted in a negative impact on existing woodland and planting due to the location and relationship of substation and Converter Station.

2.6.5.11. The Applicant has also considered alternative access routes from Old Mill Lane to the north-west and further south from Broadway Lane to the south-east. Old Mill Lane was discounted as it is unsuitable for the size of vehicles required for construction and (occasional) replacement of equipment.

2.6.5.12. As the layout of the Access Road has been refined to reduce its visual impact, further landscape mitigation has also been included through the introduction of new hedgerows and hedgerow trees. Additional scrub and tree planting in the wider Converter Station Area will result in improved screening from public vantage points in the locality.

2.6.5.13. The choice of materials for the construction of the Access Road is still under consideration, but alternative options to a tarmacadam surface that meet the technical requirements in terms of loading are being considered to further reduce the impact of this feature within the landscape.

Attenuation Pond(s)

2.6.5.14. Feedback received from SDNP was that the balancing pond indicated at consultation was out of character in its setting in terms of its large size, and should be refined to a number of ponds. The opportunity for the introduction of benefits to biodiversity was also raised in this regard.

2.6.5.15. As a result, the attenuation pond has been reviewed and two ponds are now provided with marginal planting as part of the wider indicative landscape mitigation plan to provide environmental benefits and improve the setting of the ponds in the wider landscape.

Cut and Fill

2.6.5.16. SDNP and WCC raised concerns about the visual impact of the Converter Station in the wider landscape. In seeking to address these concerns, consideration was given to whether, given the need for a level platform for the Converter Station, it could be cut into the slope. A series of cut and fill calculations have been carried out, and identified that this is deliverable, and with the associated environmental benefits in terms of a reduced visual impact, this has subsequently been included as part of the

Proposed Development (document reference 5.5, Design and Access Statement for further detail).

Landscape Mitigation Plan

2.6.5.17. As briefly covered in the consideration of the attenuation ponds (paragraphs 26.5.14 and 15) indicative landscape mitigation plan has been developed to reduce the visual impact of the Converter Station (Option B(i)) with new planting, and strengthening of existing woodland and hedgerows maintaining the rural and agricultural character and enhancing biodiversity. Whilst indicative, should Option B(ii) be progressed an updated landscaping mitigation plan will be required to account for the retained planting to the west of the Converter Station site. The principles for landscape mitigation have been developed with and subsequently agreed with the LPAs and SDNPA.

2.6.6. REFINEMENT OF ONSHORE CABLE CORRIDOR FOLLOWING STATUTORY CONSULTATION

2.6.6.1. In considering the statutory consultation responses, the outcome of further survey work and review of specific alternatives proposed during the statutory consultation, a number of options (and alternatives) have been considered and either incorporated or discounted within the final Order Limits. A summary of the alternative options and reasons for their inclusion or discounting with regards to a comparison of environmental effects is included below.

Section 1 – Lovedean (Converter Station Area)

2.6.6.2. The revised cable route options considered in the vicinity of the Converter Station Area are covered in Section 2.6.5. In summary, these relate to an option to microsite the Converter Station to the east within the Order Limits, and the addition of offsite landscaping to screen the Converter Station in the wider landscape, and have a direct impact on the Onshore Cable Route within this section.

Section 2 – Anmore

2.6.6.3. Whilst no alternatives were proposed during the statutory consultation, discussions with landowners and further ecological survey work identified an alternative option, within the same agricultural field, but routed further east. A comparison of the environmental effects of each alternative is included in Table 2.7.

Table 2.7– Alternatives Considered in Section 2

Alternatives Considered	Environmental Considerations
Section 2 – route presented at statutory consultation	The Onshore Cable Corridor runs south through agricultural fields, in arable use, to north of Anmore Road, where the cable could then route to the southwest (west of Kings Cottage), or southeast (through Shafters Farm/Hillcrest Children's Home). The southwestern area comprises paddock land with three well established hedgerows and hedgerow trees, with the southeastern area comprising two well established hedgerows, one containing a wide access to Anmore Road. Additionally, the southeastern area has been subject to recent development comprising the construction of a new building to provide the Children's Home, with a grade II listed barn to the east retained restricting the potential area for cable installation. The southeastern access was considered to have the least environmental impact when compared to the southwestern access, with a reduced impact (removal) of hedgerows and trees and potential for minor impact on the setting of the listed barn during construction only.
Section 2 alternative route (east)	Following refinement of the access to Anmore Road (to the southeast) a revised onshore cable corridor was considered to reduce the cable length and the associated impacts with regards to a reduced area of land, and shorter construction period. Ecological studies supported an offset from the existing woodland copse within the field. This alternative was considered to have minor environmental benefits.

2.6.6.4. As a result of there being no preferred option from an environmental perspective, a combination of the options above has been included within the DCO application. In order to provide flexibility to the contractor, the corridor width has been refined to include the south-eastern access to Anmore Road through Hillcrest Children's Home whilst widening the Order Limits within the agricultural field. This allows for a potentially more direct cable installation, reducing the impact on arable land.

Section 3 – Denmead/Kings Pond Meadow

2.6.6.5. Five alternatives were proposed at the statutory consultation. A summary of the environmental effects associated with each of the alternatives within Section 3 are included in Table 2.8.

Table 2.8 – Alternatives Considered in Section 3

Alternatives Considered	Environmental Considerations
Option 3A(i) HDD under Anmore Road	This option proposed two lengths of HDD, with a small trenched section in between to avoid a single HDD drill which could otherwise risk connecting the two aquifers in this location and the associated risk to the SPZ1 protected aquifer. The HDD compounds and trenched areas were designed to avoid Kings Pond Meadow SINC.
Option 3A(ii) Trenching north of Anmore Road to Kings Pond Meadow then HDD to field north of Hambledon Road	This option considered a full-length drill through Kings Pond Meadows SINC. The option was discounted following groundwater investigations which confirmed the risk of impacts on the two aquifers in the locality. The removal of this option was supported by Portsmouth Water and the Environment Agency.
Option 3B Anmore Road	This option proposed a single HDD to the field south of Kings Pond Meadow SINC (avoiding the designation), with trenching north beyond. The single HDD avoided the risk of impacts on the two aquifers in this location and the associated risk to the SPZ1 protected aquifer.
Option 3C Highways Route	Significant objection was received from local residents, the Parish Councils, and WCC on the impact of this proposed highway route on local residents due to traffic impacts and general disruption, including the likely requirement for full closures.
NE – revised HDD location	Following discussions with NE, and subsequent additional further survey work to assess the potential impacts of the HDD compounds on the land within and around Kings Pond Meadows, NE requested consideration of the southern HDD compound being relocated south of Hambledon Road to avoid an area considered to be high value grassland.

2.6.6.6. Option 3B (Anmore Road) was considered to be the option with the lowest environmental risks, and the principles accepted by the Environment Agency ('EA') and NE. Further consideration has been given to the concerns raised by NE on relocating the southern HDD compound to the south of Hambledon Road to avoid the area of higher value grassland, but concerns associated with groundwater impacts cannot be suitably addressed with an ongoing risk remaining. In addition, a relocation

of the compound to the south would have an impact on a number of hedgerows and trees (including trees subject to a Tree Protection Order) which are considered to be of particular value in the locality. Mitigation measures to reduce the impact on the high value grassland north of Hambledon Road have been identified, including a reduced compound area, ground protection and reinstatement, have been included in the Proposed Development. As such Option 3B, with a trench directly north through Anmore Road has been identified as the preferred option and included within the DCO application. However, an option to locate HDD compound to the south of Hambledon Road is also included in the Proposed Development.

Section 4 – Hambledon Road to Farlington Avenue

2.6.6.7. The Onshore Cable Corridor remains predominantly as per the statutory consultation, comprising the full extent of the highway boundary. Small changes have been made which include the removal of highway land at Forest End, the removal of Boundary Way and the inclusion of additional land in the vicinity of Ladybridge Roundabout to accommodate land proposed for highway adoption associated with ongoing highway improvements to facilitate future phases of the West Waterlooville MDA.

2.6.6.8. Flexibility is maintained within the Order Limits by including the full extent of highway land, with an ongoing assessment of constraints (underground utilities) underway to seek to route the cable within highway verges or bus lanes where practicable to avoid direct impact on the operational highway.

Section 5 - Farlington

2.6.6.9. A number of alternatives have been considered for this section of the cable route following the initial concerns raised with the potential impacts on the highway (Farlington Avenue) and are summarised in Table 2.9.

Table 2.9 – Alternatives Considered in Section 5

Alternatives Considered	Environmental Considerations
Option 5A Farlington Avenue	The highways route was of significant concern to PCC with regard to the potential impacts on highways, and the associated delays and considerations regarding potentially negative air quality impacts. Whilst a number of alternative routes have been considered by the Applicant (as detailed below), only one alternative (Option 5B(iv) was found to be technically feasible. Whilst the impact on the highway is noted, it is considered that appropriate traffic mitigation measures can be delivered to mitigate the impact of the proposed cable installation works.

Alternatives Considered	Environmental Considerations
Option 5B(i) via Burnham Road and Ainsdale Road	This alternative considered the use of open land up to the junction with Ainsdale Road, before routing along the highway to reduce the majority of the impact on Farlington Avenue. This option has been discounted due to the presence of underground utilities within Portsmouth Water land which resulted in a lack of available space for cable installation (see Option 5B(v)).
Option 5B(ii) via Blake Road	This sub-option was identified to reduce the impact on Farlington Avenue, joining the road at a junction further south. This option has been discounted due to the utilities within Portsmouth Water land (see Option 5B(v)).
Option 5B(iii) via Recreation Ground	This further sub-option again sought to reduce the impact on Farlington Avenue and any side roads. This option has been discounted due to the utilities within Portsmouth Water land (see Option 5B(v)).
Option 5B(iv) via Evelegh Road	This option sought to avoid the impact at the Havant Road / Farlington Avenue junction, routing along Evelegh Road before routing along Farlington Avenue. This option has been retained as it is considered that a feasible route through Scoutlands can be achieved. The retention of this option also provides flexibility alongside Option 5A should it not be possible to route both circuits within Farlington Avenue.
Option 5B(v) Portsdown Hill Road	This option sought to reduce the impact on Farlington Avenue completely, using the Portsmouth Water land to route north – south from Havant Road to Portsdown Hill Road. Further investigations identified a significant number of utility constraints. A number of route options within this land were considered in seeking to avoid the existing utilities, including a potential short HDD, however, due to the number and extent of the utilities and associated easements, none were considered to be deliverable other than through the section of land known as Scoutlands (between Havant Road and Evelegh Road).

2.6.6.10. Due to the engineering constraints associated with existing utilities, and acknowledging the environmental impacts in terms potential traffic congestion and air quality, options 5A and 5B(iv) are retained in this section. Appropriate traffic management measures, including increased flexibility in terms of construction hours,

are being considered to seek to reduce the impact on Farlington Avenue and the associated highway network.

Section 6 – Zetland Field & Sainsburys

2.6.6.11. Two options were considered within Section 6 in the vicinity of Zetland Field, summarised in Table 2.10 below.

Table 2.10 – Alternatives Considered in Section 6

Alternatives Considered	Environmental Considerations
Option 6A Highway Route	This option proposed a trenched installation along Eastern Road, from the junction with Fitzherbert Road. The statutory consultation identified concerns from residents and PCC associated with the impact on highway, a main route onto Portsea Island.
Option 6B Zetland Field	This alternative was identified to reduce the extent of cable to be installed in Eastern Road, reducing the highway and associated potential air quality impacts. Following assessment of potential access points and surveys of the trees within Zetland Field, a refined area has been identified, to the western edge offset from the existing treed boundary. There will be a temporary impact on the availability of the open space during construction only.

2.6.6.12. A refined Onshore Cable Corridor has been identified within Section 6, routing the cable through the western edge of Zetland Field to avoid this length of Eastern Road, whilst ensuring an appropriate distance is maintained from the existing trees.

2.6.6.13. A specific addition has been made to the Order Limits, namely the inclusion of a section of an open-air storage area (and access track) associated with an existing industrial unit to Fitzherbert Road. This area is included to provide a laydown area to support the cable installation works. The proposed laydown use is not considered to have any detrimental impact on residential amenity or the local highway network given the existing industrial nature of the site.

Section 7 – Farlington Junction to Airport Service Road

2.6.6.14. Whilst there were no distinct variations to the Onshore Cable Corridor presented during the statutory consultation, there has been some refinement to this section of the Onshore Cable Corridor following further survey work and consideration of the engineering feasibility.

2.6.6.15. Section 7 requires the crossing of the existing railway, and initial considerations included an option to cross under the railway line through an existing cattle creep (underpass). This was discounted prior to the statutory consultation due to it already

being used by existing services, and associated difficulties in achieving the required protective cover for the cables rendering it unsuitable for installation. As a result, alternative crossing options were considered with micro-tunnelling being deemed the most suitable option. Following this, an application for Approval in Principle has been submitted to Network Rail.

2.6.6.16. Two options were considered in the vicinity of Kendalls Wharf around the location of the proposed HDD across Langstone Harbour to the mainland. Both alternatives, one routing to the west of Baffins Milton Rovers football ground and the other along the existing service road, are retained within the Order Limits, although the extent of land included north within Farlington Playing Fields has been refined to a smaller footprint (reducing the impact in terms of temporary loss of open space, and availability of pitches) following further information received from the engineering team on the proposed HDD works.

Section 8 – Eastern Avenue (adjacent to Great Salterns Golf Course) to Moorings Way

2.6.6.17. Following concerns raised in the non-statutory consultation on the impact of cable installation within Eastern Road, alternative options incorporating residential roads and Milton Common were presented at the statutory consultation. These alternatives are summarised in Table 2.11.

Table 2.11 – Alternatives Considered in Section 8

Alternatives Considered	Environmental Considerations
Option 8A Eastern Road to Milton Road	The option to route the cables within Eastern Road has the potential to affect traffic congestion in the locality, and on the wider highway network. On an already well trafficked route this could have potential associated impacts on air quality.
Option 8B Eastern Avenue	This alternative option removed the southernmost section of Eastern Road (and Velder Avenue) using one, or a combination of residential roads around Eastern Avenue. The proposal was considered to reduce the highway impact by removing approximately 250 m of Eastern Road. There would however be an associated temporary impact on residential amenity on any of the residential roads used. Subsequently, following further investigation, Shore Avenue, and Salterns Avenue were discounted for cable installation and the option refined to comprise Eastern Road and Eastern Avenue.

Alternatives Considered	Environmental Considerations
Option 8C(i) via Sea Defence Footpath	It was initially proposed to consider routing within the recently installed sea defences, but discussions with East Coast Solent Partnership identified that this was not a suitable option due to their construction. Ongoing discussions have identified that a cable route alongside the defences would be acceptable. The option would however require the removal of contaminated land, to which it has been accepted in principle (with PC and the EA), that subject to appropriate mitigation measures, there is no significant risk. The option would remove all impact on Eastern Road regarding traffic and air quality.
Option 8C(ii) via western edge of Milton Common	A proposed route to the southern and western edge of Milton Common was also proposed, whilst the depth of contaminated ground was found to be shallower than the central areas of the common, similar mitigation measures would be required. The option would remove all impact on Eastern Road regarding traffic and air quality.

2.6.6.18. It has not been possible to fully refine the Order Limits in this location due to the additional investigation to the works and mitigation associated with the contaminated land and it will not be able to do so until further ground investigation works have taken place by the appointed contractor. In light of this, Options 8B (as refined), 8C(i) and 8C(ii) are all retained within the Order Limits to provide optionality following the grant of the Order. This optionality is discussed further in Chapter 3 (Description of the Proposed Development).

Section 9 – Moorings Way to Bransbury Road

2.6.6.19. As identified above in Section 8, the statutory consultation raised concerns from PCC and local residents in respect of the impact from lane closures and shuttle working along the key route of Eastern Road and Milton Road. Alternatives were reviewed further to reduce the highway impact and avoid these important highways and these are summarised in Table 2.12.

Table 2.12 – Alternatives Considered in Section 9

Alternatives Considered	Environmental Considerations
Option 9A Highways Route	This option would result in lane closures and shuttle working to a key highway route into Portsmouth, with potential impacts for congestion on the highway network and associated impacts on air quality.
Option 9B(i) HDD under Allotments	The option has been confirmed as deliverable, and would have significantly lower impacts on the main highway network (and air quality) whilst also avoiding any direct impact on the allotments.
Option 9B(ii) Trenching through Allotments	The option of trenching through the allotments was considered feasible, and removed the impact on the main highway network (and air quality). However, impacts on allotment holders due to disruption in trenching through the paths can be avoided with the HDD alternative that was confirmed deliverable.
Option 9C(i) via footpath opposite south of Ironbridge Lane	These options removed the impacts on the main highway network, but introduced closures to local and residential roads (varying between sub-option), resulting in direct impacts on number of local residents.
Option 9C(ii) via Ironbridge Lane, Redlands Grove and Tideway Gardens into Bransbury Park via footpath	
Option 9C(iii) Ironbridge Lane via Redlands Grove, Tideway Gardens, Kingsley Road and Yeo Court	

2.6.6.20. Option 9B(i) has been identified as having the least environmental impacts, and is included within the Order Limits for the Proposed Development. To the south of the HDD, the Order Limits have been further refined through Bransbury Park, with the Onshore Cable Corridor avoiding the existing pavilion and skate park, retaining these assets, whilst also reducing the area impacted by cable installation. The route also avoids the tree lined boulevard, retaining these important trees (and associated ecological value) within the landscape.

2.6.6.21. To the north of the allotments, two options have been retained in the Order Limits within the vicinity of the Portsmouth University Langstone Campus. One option utilises Furze Lane, this option would however result in the closure of Furze Lane, a bus only route connecting Moorings Way and Locksway Road requiring a diversionary route to be developed for the period of construction. The trees either side of the highway are also subject to a Tree Protection Order. The other option is to route east, along the edge of the campus, with due consideration of the impact on the University of Portsmouth playing fields.

Section 10 – Eastney (Landfall)

2.6.6.22. Ongoing engineering reviews have confirmed Fort Cumberland Road Car Park as the suitable location for Landfall, resulting in the refinement of the Order Limits by removing the majority of the Fraser Range site and the wider (eastern) extent of Eastney Beach.

2.6.6.23. Further consultation with PCC post the statutory consultation, confirmed the Applicants proposal to site the Optical Regeneration Station ('ORS') buildings within the Landfall site (Fort Cumberland Road Car Park). The initial scope presented at the statutory consultation was for the ORS to be located within 1 km of Landfall. Having received confirmation from a specialist engineer (who assessed a series of parameters above the minimum available performance values/standards and below the maximum available performance specifications), it was confirmed that amplification of the fibre optic cables was required.

2.6.6.24. Following confirmation of the need for the ORS buildings, the Applicant considered the alternative locations available for their siting (within a compound up to 450 sqm) within 1 km of the Landfall. Discounted alternatives include:

- the open space to the east of the car park (with the area immediately adjacent forming Flood Zone 2), designated as a SINC, and in immediate proximity to, and including part of the scheduled ancient monument ('SAM') of Fort Cumberland. The loss of an area of protected open land, also available for public use, and likely negative impact on the setting of the SAM was considered to result in an overall negative environmental effect;

- Southsea Marina, Eastney Cruising Association and the Eastney - Hayling terminal further east along Fort Cumberland Road and Ferry Road were found to have no suitable open space to meet the land area requirements;
- Fraser Range, whilst having available land, is subject to a pending planning application for residential development, as a major development site providing up to 134 dwellings and associated works, was not considered available, and had the potential to impact on the setting of Fort Cumberland SAM;
- the open areas of amenity space in the locality of the Lumsden Road residential estate were not considered suitable, being considered to have a negative impact on residential amenity (noise) due to the proximity of dwellings and general residential amenity in terms of the loss of open space, further the area comprises a mix of Flood Zones 1 and 2; and
- other alternatives comprised areas of open land to the west and northwest of the Landfall (Bransbury Park, the Royal Marines playing fields north of Driftwood Gardens, land around Eastney Swimming Pool, and Kingsley Road open space) but were considered to have a negative environmental impact in terms of the permanent loss of publicly accessible open space and recreation facilities.

2.6.6.25. The car park, providing an area of existing compacted ground for car parking, with no formal open space use, directly adjacent to the proposed Landfall and HVDC Cables and Transition Joint Bays (which cannot be built above) was considered to provide the most appropriate location in terms of the least environmental impact. The location was not considered to have any impact on open space, residential amenity, or the setting of the SAM given the distance over 200 m, with opportunities for landscape screening to be provided to reduce the visual impact of the above ground elements and has subsequently been included within the DCO submission.

Ongoing consultation with Portsmouth City Council

2.6.6.26. As part of the ongoing consultation with PCC following the statutory consultation a Member of the Council questioned whether a landfall at Thorney Island had been considered. The whole area along the south coast (see section 2.4.3), where a potential landfall could be feasibly located was subject to an environmental constraints mapping exercise which identified Thorney Island as part of Chichester Harbour AONB, with the harbour itself being designated as a SAC (Solent Maritime), RAMSAR site (Chichester and Langstone Harbours), SSSI (Chichester Harbour), SPA (Chichester and Langstone Harbours), which provide a greater level of constraint to those considered with regards to an alternative landfall within Langstone Harbour. In addition, the entrance to the harbour is also designated as an SPA (Solent and Dorset Coast), and the northern extent of Thorney Island a Local Nature Reserve (Eames Farm) which provide further environmental constraints. As such, the

use of Thorney Island for landfall is not considered to be a viable alternative due to the likely negative impacts on these environmental designations.

2.6.6.27. The routing of the Onshore Cable Corridor through Great Salterns Golf Course was also suggested. This alternative discounted with the area north of Burrfields Road, and the southern area around Great Salterns Lake designated as a Site of Importance for Nature Conservation, with both areas also subject to positive records for Solent Waders and Brent Geese. Additionally, Great Salterns Lake provides for flood attenuation associated with surface water collection from the urban area of Portsmouth, with pumping out into Langstone Harbour. To overcome these restrictions a Trenchless solution would be required, which would still result in negative environmental impacts due to the need for the associated construction compounds. On balance, the proposed Onshore Cable Corridor with appropriate mitigation measured as identified in this Application was considered preferable from an environmental impact perspective.

2.6.6.28. A third alternative proposed by PCC comprised a new pedestrian/cycle bridge crossing in Section 7 of the Onshore Cable Route where a Trenchless HDD crossing is proposed under Langstone Harbour. The area has a number of internationally important habitats (Chichester and Langstone Harbour Ramsar Site and SAC, Langstone Harbour SSSI and Solent Maritime SAC), to which the Proposed Development avoids potential impacts through the use of HDD to cross Langstone Harbour. The suggested bridge was considered to increase the possible impacts on key bird species, marine habitats and water quality associated with the designations when compared the current proposal. Additional costs for the planning, design, construction and the future maintenance of a bridge would add a large and substantial cost to the Proposed Development while being unnecessary in engineering or planning terms for the Proposed Development and is considered to result in greater environmental effects. This it was not considered to constitute a reasonable alternative.

2.7. CONCLUSIONS

2.7.1.1. The studies undertaken in relation to the assessment and selection of options through the development of the Proposed Development to the DCO submission have taken place in parallel with each other, with all aspects of the Proposed Development considered holistically

2.7.1.2. In accordance with paragraph 2 of Schedule 4 EIA Regulations, the multi-disciplinary assessment and consideration of reasonable alternatives has taken into account the specific characteristics of the Proposed Development, including *inter alia* electrical, cable engineering, geotechnical, environmental, planning, civil engineering, access and land considerations. The main reasons for selecting the chosen option have been explained in detail above alongside a comparison of the environmental effects.

2.7.1.3. The Proposed Development, which is described in detail at Chapter 3 (Description of the Proposed Development), has evolved through the consideration of the reasonable alternatives explained in this chapter and is considered by the Applicant to be the most suitable and appropriate form of development to realise the delivery of needed infrastructure of national significance.