The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 6 Alternatives and Design Evolution

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None provided.

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6 Alternatives and Design Evolution

6.1 Introduction

6.1.1 This chapter presents a description of the reasonable alternatives considered by SZC Co. in relation to the main development site. An explanation of the reasonable alternatives studied by the developer is described, including an indication of the main reasons for selecting the chosen option and a comparison of the environmental effects. This approach meets the requirements of Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 6.1) and Schedule 3 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (Ref 6.2) (collectively referred to as the 'EIA Regulations').

6.1.2 This chapter provides details of the supporting studies and assessments that have informed the final location and design choices for the proposed development, taking into account consultation feedback and potential environmental and socio-economic impacts, where relevant.

6.1.3 This chapter provides a description of how the design of the proposed development has evolved, both over the course of the Sizewell C Project development and in relation to Hinkley Point C, and other nuclear power stations operated by EDF Energy Group. The design of the proposed development has evolved based on:

- an understanding of the operational requirements of the various components of the proposed development;
- the experience of designing and constructing the Hinkley Point C power station;
- consideration of the site's context and development constraints;
- the planning policy context;
- the outcomes of the environmental assessment process to avoid likely significant environmental effects where possible and where this is not possible, to mitigate and manage any remaining effects;
- consideration of potential transport impacts; and
- feedback from consultation with public and statutory stakeholders.

6.1.4 The site selection and design evolution process has been undertaken in parallel with the EIA and has taken into account the emerging assessment outcomes and mitigation measures. Reference to the description of 'primary' and 'tertiary' mitigation measures are found within **Volume 1, Chapter 6** of the **ES**. The process has been iterative and informed by consultation with statutory consultees and the public.

6.1.5 Further detail can be found in the **Site Selection Report** at **Appendix A** of the **Planning Statement** (Doc Ref. 8.4) which addresses site selection in a wider context than the requirements of the EIA Regulations.

6.1.6 The following reasonable alternatives are considered to be strategic in nature, rather than site-specific, and so are set out in **Volume 1, Chapter 4** of this **ES**:

- the strategic site selection for the power station and reactor design;
- the consideration of alternative strategies for the accommodation and movement of construction workers and the transportation of freight – which in turn has informed the need for, and strategic siting of, associated development; and
- the principles of design development that have evolved through the pre-application phase of the Sizewell C Project.

6.1.7 The remainder of this chapter is structured geographically within the main development site:

- Main platform: the area that would become the power station itself.
- Sizewell B relocated facilities and National Grid land: the area that certain Sizewell B facilities would be moved to in order to release other land for the proposed development, and land required for the National Grid infrastructure.
- Offshore works area: the area where offshore cooling water infrastructure and other marine works would be located.
- Temporary construction area: the area located primarily to the north and west of the proposed site of special scientific interest (SSSI) crossing, which would be used to support construction activity on the main platform.
- Land to the East of Eastlands Industrial Estate (LEEIE): the area to the north of Sizewell Halt and King George's Avenue, which would be used to support construction on the main platform and temporary construction area.
- Off-site sports facilities at Leiston, which would be used during the construction stage as a shared outdoor sports facility for Alde Valley School, the local community and construction workers.
- Fen meadow compensation sites to the south of Benhall and to the east of Halesworth.

- Marsh harrier habitat improvement area to the west of Westleton (if required).

6.1.8 Locations for the above elements are contained within **Volume 2, Chapter 1** of this **ES**.

6.2 Main platform

a) Alternative sites

6.2.1 The proposed siting of Sizewell C is set out in the Nuclear National Policy Statement (NPS) (EN-6) (Ref. 6.3). Therefore, SZC Co. has not considered any alternative sites in relation to the main platform.

b) Alternative designs and design evolution

i. Reactor type

6.2.2 The United Kingdom European Pressurised Reactor (UK EPR™) is proposed for Sizewell C. This reactor has completed the UK's Generic Design Assessment (GDA) process with the award of a Design Acceptance Confirmation (DAC) from the ONR and a Statement of Design Acceptability (SoDA) from the Environment Agency in December 2012. Therefore, no alternative designs for the nuclear reactor have been considered. The UK EPR™ reactor is the same reactor design as is being constructed at Hinkley Point C.

ii. Finish of the reactor building domes

6.2.3 Following comments raised at Stage 1 consultation, SZC Co. sought to explore the potential for the domes on top of the Sizewell C reactor buildings to match or reflect the design of the Sizewell B dome. However, the shape of the Sizewell C and Sizewell B reactor building domes differ, and there is also a difference in the design philosophy.

6.2.4 The Sizewell B dome has a structural concrete inner shell and an outer shell which acts as a secondary containment. A 2 metre (m) gap between the inner and outer shells allows for inspection of the safety critical elements. As no external inspection is required of the secondary containment, the dome is finished in the vitreous enamel cladding. The Sizewell C dome has an outer structural shell surrounding the inner containment. This outer shell would need to be inspected, and potentially repaired from the outside to ensure the integrity of the structure is maintained over the operational life of the plant. Inspection and potential repair work would therefore require access to the concrete surface.

6.2.5 Analysis was carried out following the Stage 1 consultation to review whether it was possible to redesign the Sizewell C reactor building domes. For example, it was considered whether it was feasible to erect an outer steel screen or cladding structure with an applied finish similar to Sizewell B, thereby still allowing for inspection and maintenance of the concrete. While this type of modification is technically feasible, the reactor buildings would have to support substantial additional loadings. Standardisation of nuclear safety design across a new fleet of power stations is a fundamental safety consideration; a change of this size would lead to project delays as the implications for the GDA would need to be addressed. From a wider perspective, delays could undermine national energy policy objectives by preventing new nuclear coming on stream. As an alternative, consideration was given to the potential for colour pigmentation of the external concrete. However, this was discounted due to the adverse impact upon strength and durability of the material.

iii. Spent fuel storage

6.2.6 SZC Co. reviewed the alternatives that are available for on-site interim storage of spent fuel at the Sizewell C site prior to its disposal within a Geological Disposal Facility. The length of time for which storage would be required is dependent upon the availability of the Geological Disposal Facility, which is yet to be constructed, and the length of time required for the fuel to cool sufficiently before it meets the required conditions for disposal. Both of these issues are subject to some uncertainty, and it is possible that over the operational lifetime of Sizewell C alternative facilities may become available for managing spent fuel that may warrant further consideration.

6.2.7 SZC Co. determined that, for the site-specific circumstances at Sizewell C, interim storage using dry storage technology was the chosen approach, rather than wet storage. The chosen approach is a similar concept to that in use at Sizewell B.

6.2.8 The size of a dry storage building is greater than wet storage in order to maintain efficient cooling. This is because a greater distance between each cask is needed for dry storage compared with wet storage. Dry storage would not, however, need a gaseous discharge stack (i.e. chimney); this would have been approximately 55m tall. Additionally, there would not be a requirement for external heat sink equipment.

6.2.9 Therefore, whilst the size of the building would increase, the form of the building would be simpler, and would contain less visual ‘clutter’. This would eliminate the necessity for the external façades of the building to be constructed of concrete, and so cladding could be applied to suit the context.

There are unlikely to be any changes in the magnitude of environmental effects arising from this design evolution.

iv. Forebays

6.2.10 There would be one forebay for each EPR reactor unit. The forebays receive water from the intake tunnels, and a single cooling water intake would feed directly into each open forebay. The forebay structures are now rectangular in shape rather than semi-circular as shown in the Stage 2 consultation. This is similar to the layout identified in the Stage 1 consultation and is consistent with a change in design agreed for Hinkley Point C, where this shape was found to be more resilient to silt deposits. The forebay structures are not visible from the majority of public viewpoints and there are unlikely to be any changes in the magnitude of environmental effects arising from this design evolution.

v. Main platform height

6.2.11 The main platform height would be set at 7.3m Above Ordnance Datum (AOD), with minor variations as necessary to provide for adequate drainage, compared with a platform height at Sizewell B power station of 6.4m AOD. This finished ground level for Sizewell C is based on a robust assessment of nuclear safety and is the ALARP (As Low as Reasonably Practicable) solution to minimise flood risk. Assessment findings showed that a platform level above 6.4m AOD provides a clear nuclear safety benefit to Sizewell C without disproportionate disbenefits in relation to flood risk off-site.

6.2.12 A height of 7.3m AOD would provide protection for the main platform against extreme static water levels, including a safety margin in excess of the 100,000 year return period extreme water height, plus reasonably foreseeable climate change. Increases in platform height beyond 7.3m AOD would provide insignificant benefits compared to the costs of the proposal.

6.2.13 The coastal defence features would protect the main platform against extreme wave run-up. Should climate change effects on sea level rise be greater than expected then the coastal defence features could be raised to 14m AOD.

vi. Emergency diesel generator stacks

6.2.14 The emergency diesel generator buildings each contain an emissions stack that would be between 34m AOD and 39m AOD in height. In defining these parameters, strong consideration was given to safety as the stacks must be capable of withstanding severe external hazards. The diesel generator buildings are also located underneath overhead power lines and therefore their height must be restricted.

6.2.15 A stack height assessment, including dispersion modelling, was carried for the purposes of environmental permitting and to ensure compliance with Best Available Techniques (BAT). This assessment gave due consideration to minimising ground-level air quality impacts and the increased visual impacts of a taller stack.

6.2.16 The optimum stack height range was identified by determining a BAT curve, which shows the reduction in ground level pollutant concentrations with increasing stack height. The 'elbow' of the curve typically represents the most appropriate stack height that balances impacts with the height of the stack (i.e. it represents BAT for that emission point).

6.2.17 The 'elbow' of the curve was at 40m AOD for the maximum concentrations for the model output for the annual average process contributions, however for the hourly average there is no clear elbow. At receptor locations, the process contribution concentrations showed a steady decrease with increased stack height, however no definitive 'elbow' could be seen. It was therefore considered that the selected height range, which included the tallest stack that can be achieved whilst enabling the clearance required for the overhead lines, represented an acceptable solution. Further details on the consideration of alternatives to the pylons and associated overhead lines are set out later in this chapter.

vii. Nuclear auxiliary stacks

6.2.18 The nuclear auxiliary stacks would discharge gaseous radioactive emissions during the operational phase. SZC Co. has minimised the radiological impact of gaseous emissions through the application of BAT and balanced this against the visual impacts of increasing the stack height, as part of the assessment process undertaken for environmental permitting.

6.2.19 Factors considered in determining the minimum stack heights included:

- On-site and off-site radiological impacts.
- Safety associated with construction and maintenance of the gaseous emission stacks.
- Technical limitations in terms of design and construction of the emission stacks, and the associated cost implication.
- Landscape and visual impacts.

6.2.20 Upon consideration of the above factors, a stack height of between 77m and 79m AOD was determined to provide an optimum balance between environmental, health and safety, planning and technical objectives.

viii. Open water cooling system

6.2.21 Sizewell C would be 'direct' or 'once-through' cooled, which means that it would abstract water from the sea to cool its condensers before returning that water back to sea.

6.2.22 The use of direct cooling is a fundamental part of the nuclear safety case for Sizewell C. In particular, there is considerably more operating experience in the UK for open circuits compared to closed circuit cooling systems, meaning that potential issues associated with operating the plant are well understood and such systems can be run in a way that ensures nuclear safety and minimises environmental impacts.

6.2.23 Direct cooling is the most efficient cooling option, compared with alternatives such as cooling towers or hybrid systems, and is the preferred option for cooling of large combustion plant in coastal locations, provided that the aquatic environment is not adversely impacted (Ref. 6.4).

6.2.24 The Environment Agency (Ref. 6.5) states that direct cooling can be acceptable in coastal locations if three conditions are met:

- extension of heat plume in the surface water leaves passage for fish migration;
- cooling water intake is designed aiming at reduced fish entrainment; and
- heat load does not interfere with other users of receiving surface water.

6.2.25 All three of these criteria have been met by the Sizewell C Project:

- Numerical modelling of the thermal plumes demonstrates that there is no thermal barrier to migratory fish returning to / departing from their natal rivers. Furthermore, numerical modelling has demonstrated that there would be no thermal barrier migrating along shore, as provided in **Volume 2**, **Chapters 21 and 22** of this **ES**.
- The Sizewell C cooling water system has been designed to minimise environmental impacts on fish and other marine biota by means of the siting of the intake and outfalls, the specially designed Low Velocity Side-Entry intake head and the Fish Recovery and Return system.
- Thermal modelling has demonstrated that, although there would be an area where surface temperatures are higher than ambient, the thermal discharge would not affect other users of the Greater Sizewell Bay.

6.2.26 Alternative cooling solutions are less thermodynamically efficient and have their own disadvantages associated with them. Conventional cooling towers, of the size required to cool Sizewell C, would have needed to be extremely large both in terms of area and height. They would have caused unacceptable visual effects on the Suffolk Coast and Heath Area of Outstanding Natural Beauty (AONB) and the site would not have had adequate space to accommodate them without significantly encroaching into sites designated for nature conservation, including the Sizewell Marshes Site of Special Scientific Interest (SSSI). Hybrid cooling towers (which cool using a combination of wet and dry cooling) are typically not as tall as conventional draught towers but would have still required considerably more space on site than the chosen solution. Furthermore, both types of cooling require seawater to be abstracted (albeit at a much smaller rate) that would also have required treatment and, therefore, would have potential impacts the marine environment.

6.2.27 Given the three main environmental constraints associated with direct cooling are mitigated by the design and siting of Sizewell C, direct cooling was the chosen option for Sizewell C.

ix. Crossing of the Sizewell Marshes SSSI

6.2.28 As described in **Volume 2, Chapter 3** of the ES, the Sizewell Marshes SSSI separates the main power station platform and the temporary construction area.

6.2.29 SZC Co. established at an early stage of consultation that the main development site would need to be accessed from the north, from a new access road linking the site to the B1122. Access from the south via the Sizewell A decommissioned site and Sizewell B power station was not therefore a feasible alternative.

6.2.30 The new road would be the principal means of bringing workers and materials into the site during construction and would provide the main access during operation. This necessarily means going through the Sizewell Marshes SSSI to get from the temporary construction area to the main power station platform, which would involve direct land take from the SSSI.

6.2.31 Sizewell Marshes SSSI is designated for its large expanse of unimproved wet meadow which supports important assemblages of invertebrates and breeding birds. The area of Sizewell Marshes SSSI that is located within the main development site comprises mainly reed beds, lowland ditches, and wet woodland habitats, with some limited areas of grazing marsh/fen meadow habitat. The wet woodland habitat is not a designated feature of the SSSI.

6.2.32 The principle that the development of Sizewell C would have the potential for some effects on the SSSI - including through the direct loss and fragmentation of habitats - was understood by Government, and recognised as necessary for the delivery of the power station when NPS EN-6 was designated. SZC Co. took care to limit the impacts on the SSSI and developed an option for the crossing of the SSSI that, when considered in its own right, resulted in no significant residual effects on the SSSI.

6.2.33 As a result of the staged process in which the power station would be built, the proposals would require the construction of more than one crossing across the SSSI, which could include:

- a short-term crossing to enable the construction of the cut off wall;
- a temporary crossing during construction to move full material to and from the site; and
- a permanent crossing used during construction by heavy earthmoving plant and to bring in abnormal indivisible loads (AILs) (and to provide operational access).

6.2.34 At Stage 1 consultation, it was proposed that the access would be provided from the north-west of the main power station platform towards the B1122, although the precise form of the access through the SSSI was not identified.

6.2.35 In response to the comments received at Stage 1 consultation, together with an enhanced understanding of the construction programming and sequencing, the crossing points shown in the Stage 1 consultation document were relocated further towards the north-east corner of the main power station platform.

6.2.36 Alternative options for the SSSI crossing were subsequently considered throughout the consultation stages, based on technical work and environmental studies undertaken by SZC Co. in relation to groundwater, surface water, ecology, flooding and landscaping and visual impacts, which informed the identification of alternative options for the SSSI crossing. This included bridge options as initially suggested in the Stage 1 consultation, as well as options involving a causeway over a culvert as an alternative to bridge options. This process led to the identification of four potential options, which were then presented as part of the Stage 2 consultation.

6.2.37 Four different alternatives were identified (resulting in the loss of between 0.19ha to 0.45ha of the Sizewell Marshes SSSI depending on which SSSI crossing was chosen), as set out at **Table 6.1.**

Table 6.1: Comparison of SSSI crossing options presented at Stage 2 consultation

Option	Description of options presented at Stage 2
Option 1: Causeway over culvert	An embankment wide enough for both permanent and temporary road crossings. The initial phase of its construction would involve the establishment of an early lower level causeway, followed by a higher-level permanent arrangement. The crest of the causeway would be up to 42.5m wide and the base would be up to 68.5m wide. The amount of land required during construction would be approximately 10,900m^2. Second highest land take from the SSSI is estimated to be 3975m^2 (0.40ha) assuming a 1:2 slope.
Option 2: Single span bridge with vertical wing walls	In this option the bridging arrangements would be as follows: a short-term bridge (to be used in the early phase of construction) would be erected in the location of the permanent bridge. At the same time a temporary bridge would be erected alongside the short-term bridge. Once the construction of the temporary bridge is complete the short-term bridge would be dismantled, and the permanent bridge (which would also be used during construction) would be erected in its place. On completion of construction the temporary bridge would be removed. The bridge would be up to 35.5m wide, and require approximately 8,385m^2 of land during construction. Second lowest SSSI land take - estimated to be 2175m^2 (0.22ha).
Option 3: Three span bridges	In this option the bridging arrangements would be as follows: a short-term bridge (to be used in the early phase of construction) would be erected in the location of the permanent bridge. At the same time a temporary bridge would be erected alongside the short-term bridge. Once the construction of the temporary bridge is complete the short-term bridge would be dismantled, and the permanent bridge (which would also be used during construction) would be erected in its place. On completion of construction the temporary bridge would be removed. The bridge would be up to 35.5m wide and require approximately 7,750m^2 of land during construction. Lowest SSSI land take -estimated to be 1865m^2 (0.19ha).
Option 4: Causeway over culvert with adjacent short-term bridge	This option is a variant of option 1 but with a narrower causeway of 28 metres (m). During construction, the causeway would accommodate both the permanent and temporary crossings, which would be feasible if supplemented by an adjacent short-term bridge for preliminary works. The crest of the causeway would be up to 28m wide and the base would be up to 54m wide. The amount of land required during construction would be approximately 10,900m^2. Highest SSSI land take estimated to be 4460m^2 (0.45ha) assuming a 1:2 slope.

6.2.38 The Stage 2 consultation material noted that the land lost within the Sizewell Marshes SSSI (as a whole – not solely as a result of the SSSI crossing) would comprise reedbed, wet woodland and fen meadow. The consultation material also introduced SZC Co.'s habitat creation scheme at Aldhurst Farm to compensate for reedbed and ditch habitats, and that work was ongoing to compensate for the loss of fen meadow habitat (although the SSSI crossing would not be a contributing factor for fen meadow loss).

6.2.39 Guided by preliminary assessment at Stage 2, SZC Co. concluded that option 1 was preferable given its speed and ease of construction, taking into account its potential environmental impacts, both negative and positive. This included a recognition that option 1 resulted in a slightly greater land take from Sizewell Marshes SSSI compared to some other options, but that the reedbed and ditch habitats would be compensated for by the Aldhurst Farm habitat creation scheme, and the bridge would not deliver the same benefits to construction and operational flexibility as a causeway option.

6.2.40 A causeway with culvert option identified as the most straightforward option for construction in the SSSI, as it involves a single and time-limited procedure. This includes a temporary bridge within the footprint of the completed causeway to provide early access. However, once the causeway is constructed the surroundings would be left undisturbed as there would be no need to remove temporary structures and re-profile land, as would have been required with the other three options.

6.2.41 The amount of SSSI and associated habitat loss and other environmental factors have also been important in concluding that a variant of option 1 was the most appropriate crossing solution. These factors are considered below:

Ecology

Direct loss of habitat

6.2.42 The habitats lost as a result of the SSSI crossing would be reedbeds, ditch habitat and wet woodland. The SSSI crossing would not result in the loss of any fen meadow habitat.

6.2.43 Measures to create replacement reedbed and ditch habitat (to compensate for the loss of these habitats as a whole, not just the SSSI crossing) have already been implemented at the Aldhurst Farm habitat creation scheme, adjacent to the western edge of Sizewell Marshes SSSI. Further compensatory habitats including wet woodland and reedbeds would be provided in the north of the main development site.

6.2.44 As concluded at **Volume 2, Chapter 14** of the ES, the residual effects of the Sizewell C Project as a whole, as a result of the permanent loss of around

7ha of the Sizewell Marshes SSSI direct land, would be not significant during both construction and operational phases with successful mitigation in place. This conclusion was based on the total amount of land take resulting from the Sizewell C Project including the proposed SSSI crossing. Whilst the quantum of SSSI loss would have been marginally less adopting a bridge option this had no bearing on the overall conclusion of residual effects.

Loss of habitat supporting invertebrate assemblage and fragmentation

6.2.45 The direct loss of around 0.4ha of SSSI for the crossing would directly affect invertebrate assemblages of national importance, and high conservation value by reducing the extent of available breeding, foraging and sheltering habitat. However, the vast majority of the Sizewell Marshes SSSI would remain, and areas of similar habitat would be retained which support the same wetland invertebrate assemblages as the habitat lost, as a result of the SSSI crossing. Although the amount of direct land take would vary between the options, the effect of the direct loss of habitat on invertebrate assemblage was not considered to be significant for any of the four options, as a result of the SSSI crossing alone.

6.2.46 The construction of the SSSI crossing over the Leiston Drain may also result in the fragmentation of wetland habitats between the retained Sizewell Marshes SSSI and Minsmere European site/SSSI. This may cause some localised restriction of invertebrate species moving between the two designated sites. The drain would be unimpeded during construction, and although bankside habitat would be lost through vegetation loss causing some minor discontinuity of vegetation along the Leiston Drain, aquatic invertebrates would still be able to move through the culvert within the water course, and mobile terrestrial invertebrates would be able to travel over the top of the causeway. As confirmed at **Volume 2, Chapter 14** of the **ES,** the impact of habitat fragmentation on invertebrate assemblages that would result from the selected SSSI crossing option constitutes a negligible adverse effect which is not significant.

Loss of habitat supporting water voles and incidental mortality

6.2.47 Project-wide embedded mitigation includes receptor habitat for water voles already created in advance at the Aldhurst Farm habitat creation scheme and a detailed water vole mitigation strategy based on translocating water voles and excluding them from the SSSI footprint. The choice of SSSI crossing has no bearing on the overall conclusion that the effects of the Sizewell C Project as a whole on incidental mortality to water voles and loss of habitat would be not significant.

Ecological connectivity

6.2.48 **Volume 2, Chapter 14** of the **ES** also considers the potential effects of the SSSI crossing on connectivity for various species, including water voles, otters and bats.

6.2.49 Neither a bridge structure nor a culvert option is considered to present a barrier to the passage of water voles, otters, eels or bats.

6.2.50 The dimension of the culvert would be sufficient not to interfere with the geomorphology of the Leiston Drain and would leave the banks of the drain intact at the crossing point. Whilst water voles are unlikely to inhabit culverted structures, animals would disperse through them and move along watercourses thereby demonstrating that long stretches of culvert do not pose a barrier to movement or fragment populations. **Volume 2, Chapter 14** of the **ES** concludes, therefore, that habitat fragmentation as a result of the proposed SSSI crossing would not be significant. There was, therefore, no requirement to consider an alternative bridge option on grounds of water vole movement that would result in comparable (not significant) residual effects.

6.2.51 Primary mitigation also includes the SSSI crossing being designed to allow the passage of otter, with fencing to guide otters to the crossing, as described in the **Otter Method Statement** in **Appendix 14C10** of **Volume 2** of the **ES**. The residual effects would again be not significant.

6.2.52 With regard to bats, a culvert option is likely to be more successful than a bridge in delivering a functional dark “movement corridor” along the Leiston Drain, because it would be easier to avoid disturbance from light and noise. Whilst the cross-sectional area underneath a bridge option would be sufficient for the majority of bats to use (other than certain species which fly at a height where they are unlikely to be constrained by the crossing at all), the noise and lighting environment in the vicinity of bridges, even with mitigation provided by fences, could be such that bats are discouraged from moving along the Leiston Drain.

Changes in hydrology/hydrogeology

6.2.53 None of the four options would result in changes in water levels that would result in any significant effects on ditch and wet woodland habitats, or on any fauna species associated with these habitats. There was, therefore, no material difference between the options in this regard.

Groundwater

6.2.54 SZC Co. has assessed the potential impacts of the four options on the peat groundwater system. This is generally low in value in its own right but supports important assemblage of flora and fauna, and is therefore considered to have a high value and sensitivity, given it supports, or contributes to, designated habitats that support or contribute to designated species of natural, or international importance that are sensitive to significant changes in the groundwater regime.

6.2.55 The assessment of impacts on groundwater has included a) long-term changes to water levels and flows, b) changes to water levels and flows during construction, c) changes to water quality from increased upflow, and d) changes to water quality from embankment materials.

Long-term changes to water levels and flows

6.2.56 The causeway options would result in changes in groundwater levels resulting from the emplacement of sheet pile walls to support the embankment. Similarly, the bridge options would result in change in ground levels from emplacement of the wing wall, and sheet pile walls. The change for all options would comprise a slight rise in groundwater levels to the west of the crossing and decrease to the east. The effect of each option would be minor as the predicted changes from all four options is well within baseline groundwater level variation.

Changes to water levels and flows during construction

6.2.57 Analysis also considered the potential for short-term change during construction resulting from dewatering. During construction, the temporary dewatering would decrease levels by less than 2 centimetres immediately downgradient of the sheet pile wall and approximately 1 centimetre upgradient. Groundwater levels were predicted to return to baseline levels within 90m of the crossing point both up and down gradient.

6.2.58 This was similar for each of the four options and the predicted changes were well within the baseline ground water level variation.

Changes to water quality from increased upflow

6.2.59 The SSSI crossing could potentially result in increased upward flow due to the creation of a preferential pathway where sheet piling penetrates the Peat. Similarly, the piling required for the bridge options to support the bridge piers may create a preferential pathway. The creation of preferential pathways for upward flow of Crag groundwater around piles, and sheet piling for all four options was not considered likely to significantly alter the Peat water chemistry. The predicted effect for all four options were minor.

Changes to water quality from embankment materials

6.2.60 The potential impact for all four options would be the emplacement of material with different chemical composition leading to the introduction of chemically different recharge to the Peat groundwater system. The predicated significance of effect for each option was minor.

Surface water

6.2.61 SZC Co. assessed the potential impacts of the four options on surface water hydrology, geomorphology, and water quality.

6.2.62 The only surface water receptor that could be potentially affected by the proposed SSSI crossing options is the Leiston Drain, which has been subject to extensive modification with limited geomorphological variability. Flows are generally low although increase rapidly in response to rainfall. Water quality is generally good.

6.2.63 Although the surface water system is generally of low value in its own right, it supports an important assemblage of aquatic flora and fauna (as considered above) which partly account for the designation of the Sizewell Marshes SSSI. It therefore has a high value and sensitivity, as it supports or contributes to designated habitats, or species of national, or international importance that are sensitive to changes in surface hydrology, geomorphology, or water quality.

6.2.64 The assessment of impacts on Leiston Drain has included analysis of a) direct loss of natural geomorphology in the crossing footprint, b) changes to geomorphology upstream and downstream of crossing c) changes to geomorphology resulting from changes to water level and flow and d) changes to surface water chemistry resulting from changes to groundwater.

Direct loss of natural geomorphology in the crossing footprint

6.2.65 It is not considered that there would be any significant difference between any of the bridge options (options 2 and 3); they would not result in any direct geomorphological changes in the development footprint, the direct loss of natural channel habitat from options 1 and 4 would be small, and they would not have the potential to affect the wider geomorphological functionality of the Leiston Drain.

Changes to geomorphology upstream and downstream of crossing

6.2.66 With regard to upstream and downstream changes, whilst increased water levels and decreased energy upstream of a culvert could increase sedimentation, and increased flow velocities through a culvert could increase scour these potential impacts can be readily mitigated.

Changes to geomorphology resulting from changes to water level and flow

6.2.67 The changes to water levels as a result of any of the four options are not considered to be sufficient to result in geomorphological changes.

Changes to surface water chemistry resulting from changes to groundwater

6.2.68 Some increase in exchange between groundwater and surface water would be expected for any of the four options, though the effect for each option would be minor.

Flood risk

6.2.69 There would not be any significant differences between the four options in the extent of flooding in the event of coastal inundation or a breach of coastal defences. The SSSI crossing restricts flow between the Minsmere Levels and the Sizewell Belts when the whole system is significantly inundated, with water depth increase occurring in the Minsmere Levels, and a slight reduction in Sizewell Belts. However, the effect is not significant in terms of depth, duration or extent.

6.2.70 Construction of the SSSI crossing would provide safe access and egress from the temporary construction area to the main platform without any significant wave overtopping during the construction phase. The road would also be safe in the unlikely event of a breach of the coastal defences north of the main platform. During operation the risk of overtopping remains low.

6.2.71 The culvert size requirements are based on width of current watercourse, flood levels, ecological connectivity, plus safe access for inspection and maintenance. The combination of these factors results in a culvert that is much larger than just dictated by flood flow capacity. The culvert would accommodate more than the fluvial 1 in 100 annual probability plus climate change flows without a significant throttling effect.

6.2.72 The surface water from both sides of the crossing would be drained to the north into a swale in the temporary construction area before infiltrating to the ground. The drainage system on the permanent crossing would remain in place after the construction phase. The chosen SSSI crossing also provides the capability to increase its crest height to up to 10.5mAOD to meet the Nuclear Site Licence requirement of responding to much more stringent levels of flood risk than required by the planning process. Further details are set out in **Chapter 2, Volume 2** of the **Environmental Statement** (Doc. Ref.

6.3) and the **Main Development Site Flood Risk Assessment** (Doc. Ref 5.2).

Landscaping

6.2.73 The dimensions for each of the crossing options are broadly similar, so the extent of visibility would be generally the same for each option. As such, the potential effects on visual amenity and landscape character are likely to be broadly the same for each option.

6.2.74 The causeway options, however, have the greatest potential to support mitigation planting which would help to soften the engineered appearance, whilst also providing some screening of close views, and allowing for the establishment of vegetation along its eastern edge that would be retained into the operational phase.

6.2.75 The bridge options had a broadly comparable effect on visual amenity and landscape character, but with less scope to support mitigation planting.

Conclusion

6.2.76 Care was taken to limit impacts on the SSSI and, although resulting in a greater land take than a bridge option, the preferred causeway option, in its own right, resulted in not significant residual effects on the SSSI – whilst also delivering significant benefits to the Sizewell C Project through construction and operational flexibility.

6.2.77 Further analysis, including benefits of the preferred option for construction and operational flexibility, is provided at Appendix A of the **Planning Statement** (Doc Ref. 8.4).

x. Electrical connection to the National Grid substation

6.2.78 It is necessary to provide an electrical connection between Sizewell C and a National Grid substation to export the net electrical output from Sizewell C of approximately 3,340 megawatts.

6.2.79 In the Stage 2 consultation SZC Co. said that electrical connections from Sizewell C would be made via underground cables to a new National Grid 400 kilovolts (kV) substation, which would be located adjacent to the existing Sizewell B substation. It also said that additional overhead cabling near to Sizewell C was unlikely.

6.2.80 However, design work carried out since Stage 2, and further development of plans for the construction of the main platform, has highlighted that there are significant safety and programme risks with constructing and operating an underground cable option:

- Additional underground galleries would be required to contain the power export cables. Due to the large number of galleries and underground infrastructure already planned for the site, the options available to introduce additional galleries are extremely limited.
- Potential routes to Unit 1 were considered, but none were found to be feasible within the constraints of the site. Deep excavation and dewatering would be required in part of the site where these activities are not permissible, due to the close proximity to the existing Sizewell B site and lack of sufficient space for construction activities.
- Potential routes to Unit 2 were considered separately, but to create space to construct an additional gallery through the site would significantly delay the construction programme due to the impact on site logistics and would require enlargement of the main platform to the north, leading to further loss of land within the Sizewell Marshes SSSI and leaving only a relatively narrow corridor of wetland habitat between the northern edge of the platform and the Goose Hill area to the north.
- The selection of an underground cable in place of an overhead line does not present an option where nuclear safety risks are ALARP.
- In addition to the above, an overhead connection is significantly more reliable, and cost-effective proposal, that would ultimately deliver better value to customers.

6.2.81 At Stage 3 consultation, SZC Co. therefore proposed four pylons (each 65m in height) to export electricity via overhead power lines to the National Grid substation.

6.2.82 In response to feedback from consultees at Stage 3, SZC Co. sought to reduce the visual impact of the pylons, and amended the option shown at Stage 3 by refining the location of pylons, and finding opportunities that would allow three of the four pylons to be reduced in height by around 25%. The accompanying preliminary environmental information was based on the reduction in height of only two pylons to ensure a robust worst case was assessed.

6.2.83 The consultation also introduced an alternative option at Stage 4, for a five-pylon option which would facilitate the reduction in height of all of the pylons by approximately 25% - enabled through the introduction of the additional pylon. The additional pylon would be introduced in the vicinity of the SSSI crossing within the main power station platform, which would allow the overhead line to go around the emergency diesel generator building rather than over it. The accompanying preliminary environmental information was based on the reduction in height of only four pylons to ensure a robust worst case was assessed.

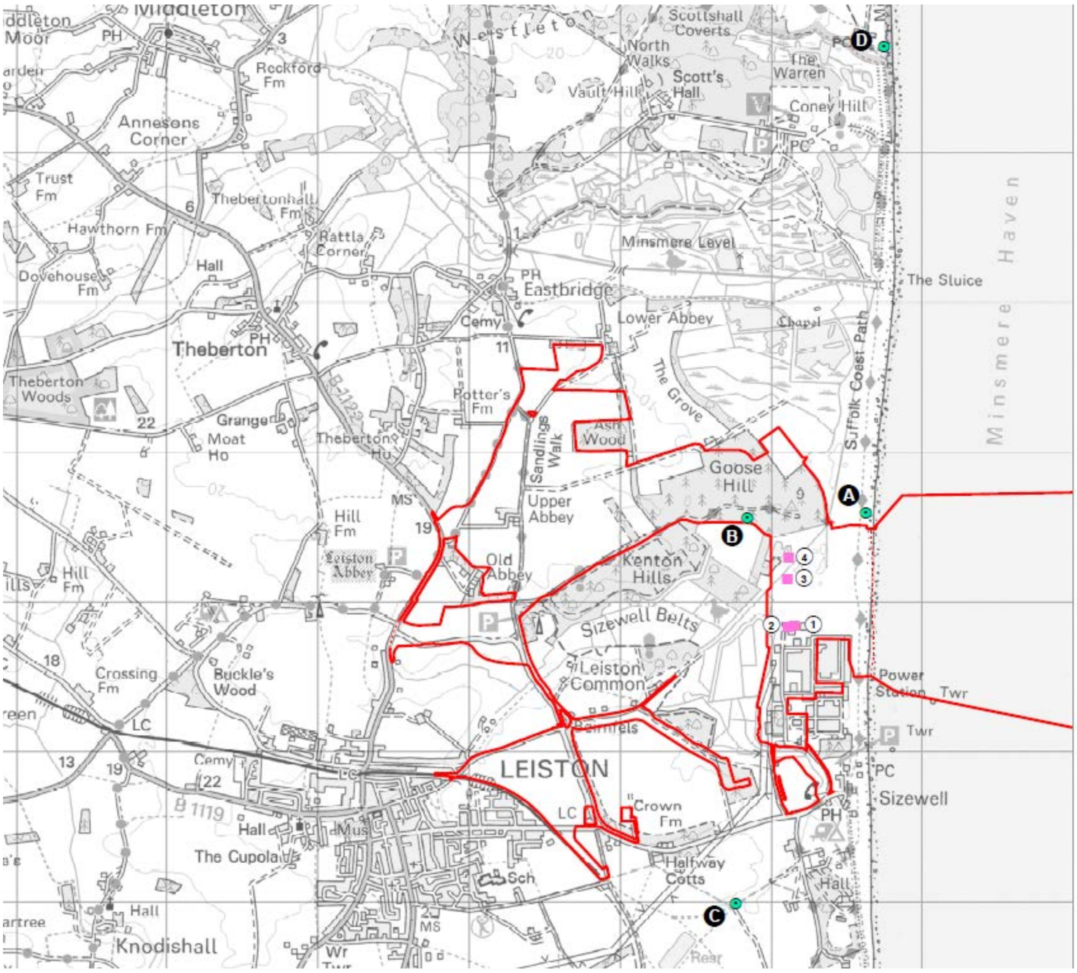
6.2.84 SZC Co. also noted a preference from consultees for the undergrounding of the connection, to remove the need for overhead lines. The consultation confirmed that SZC Co. would continue to assess the practicability of this, and the implications for the Sizewell C Project – although noting that these implications were likely to be significant.

6.2.85 SZC Co. therefore consulted on, or made a commitment to considering further, three possible alternatives at Stage 4, as set out in **Table 6.2**.

Table 6.2: Description of options presented at Stage 4 consultation

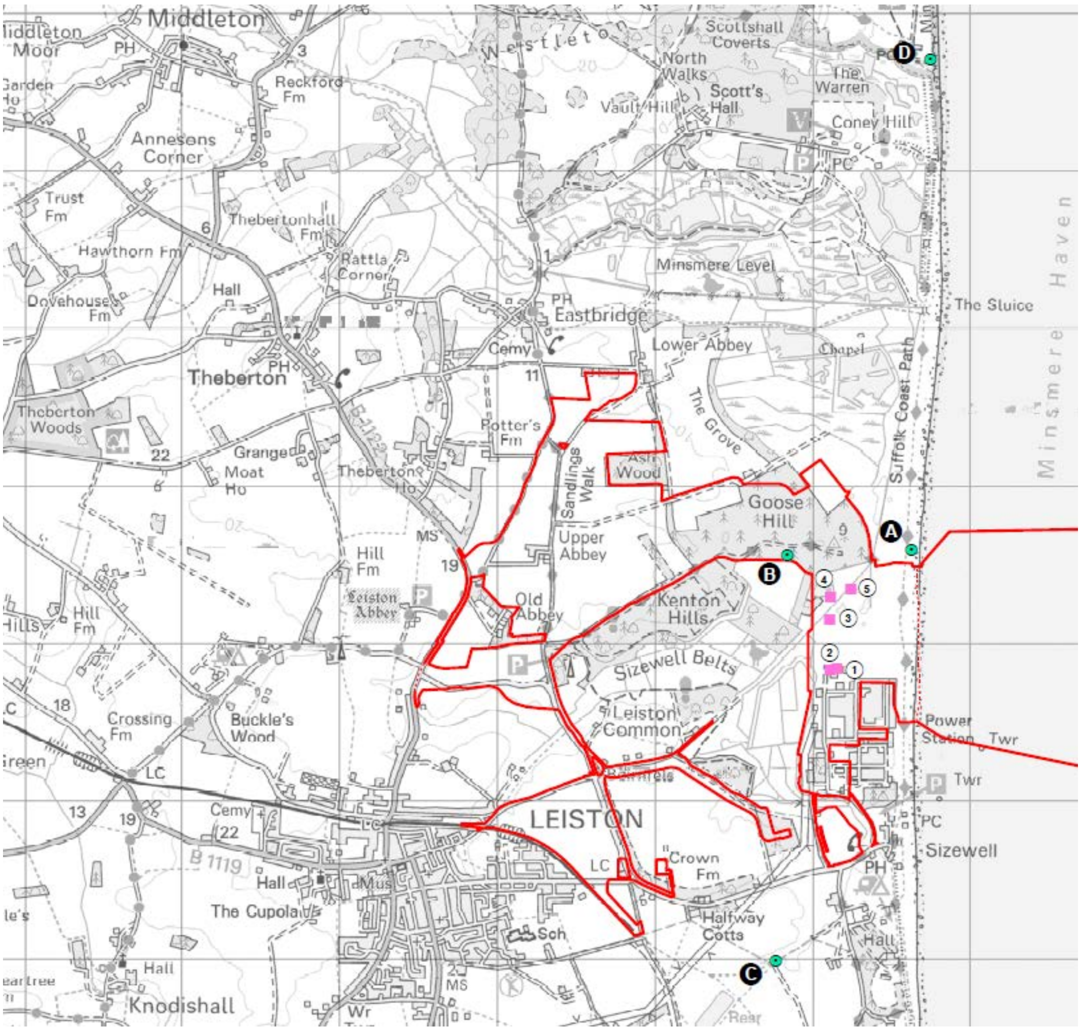
	Description
Pylon Option 1.	A four-pylon scheme, two (pylons 2 and 3) at circa 48m in height and two (1 and 4) at circa 65m in height. The indicative location of the pylons is shown at **Plate 6.1**.
Pylon Option 2.	A five-pylon scheme, four at 48m (pylons 2-5) and one at 65m (pylon 1). The indicative location of the pylons is shown at **Plate 6.2.**
Undergrounding	SZC Co. committed to exploring further the potential for undergrounding, though did not propose an option at Stage 4 consultation.

Plate 6.1: Option 1 Four pylon scheme[1]



[1] Note, this plate identifies the development site boundary at Stage 2 consultation, which has since been updated.

Plate 6.2: Option 2 Five pylon scheme[2]



6.2.86 SZC Co. subsequently undertook further detailed analysis of the overhead options, to ensure that visual effects would be minimised as far as possible, and also with regard to the feasibility of undergrounding. Further assessment with regard to undergrounding is provided at **Appendix A** of the **Planning Statement** (Doc Ref. 8.4). This supports the conclusions reached following Stage 2 Consultation that undergrounding would represent significant safety and programme risks and would also involve further encroachment into the Sizewell Marshes SSSI and further habitat loss.

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2 Note, this plate identifies the development site boundary at Stage 2 consultation, which has since been updated.

6.2.87 Following this analysis, SZC Co. concluded that the reduction in height of four pylons (to 48m) that would be achieved by introducing the fifth pylon at 65m would not be sufficient to justify the additional pylon. Further work also confirmed that an undergrounding option would not be practicable in terms of constructability, safety, and additional harmful effect on the Sizewell Marshes SSSI and that the electrical connection from the main platform would need to be made via overhead lines.

6.2.88 SZC Co. undertook further analysis of options 1 and 2 presented at Stage 4 consultation, from four appraisal viewpoints, set out at **Table 6.2**.

6.2.89 **Table 6.3** then provides a comparative analysis of options 1 and 2 for each of these viewpoints.

Table 6.3: Appraisal viewpoints

Viewpoint	Location	Visual receptors	Current view
A. Beach east of Goose Hill.	On/adjacent to Suffolk Coast Path. Within Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB). Within Suffolk Heritage Coast.	Footpath users. Visitors to Sizewell Beach.	The view south along Sizewell beach includes the principal structures at Sizewell A and Sizewell B. The sea defences/Northern Mound screen low lying structures and activity (such as vehicle movements etc.). Visible power station structures are relatively simple and benign geometric blocks with few scalable features/detailing. There is limited associated infrastructure within the view. Lighting columns adjacent to Sizewell A are visible and glimpsed views towards offshore intake / outfall structures (outside of photograph) are possible. No pylons are visible in views south along Sizewell Beach.
B. Sandlings walk at Goose Hill.	On/adjacent to Sandlings Walk. Within Suffolk Coast and Heaths AONB. Within Suffolk Heritage Coast.	Footpath users.	The view south-east across low lying marshes and tree belts includes the upper portions of the principal structures at Sizewell A and Sizewell B. Tree belts screen views to lower lying structures and activity (such as vehicle movements etc.) and the visible elements of the power station structures are relatively simple and benign geometric blocks with few scalable features/detailing. Several pylons are visible to the west of Sizewell A. These are of relatively limited visual intrusion due to their distribution in the view, and visual

Viewpoint	Location	Visual receptors	Current view
			relationship to the existing tree belts (which screen views to the majority of the pylons and power cables between the pylons). There is no other infrastructure visible. The remaining views from this location are to woodland/forest and wetlands.
C. Junction of Footpaths, The Walks.	At junction of footpaths south-east of Halfway Cottages. Within Suffolk Coast and Heaths AONB.	Footpath users.	The view north-east includes the principal structures at Sizewell A and Sizewell B. Vegetation/tree belts and woodland screen the majority of lower lying structures and activity (such as vehicle movements etc). However, glimpsed views are possible to office buildings south of the main Sizewell A structures. The main power station structures of are relatively simple geometric blocks with few scalable features/detailing. Pylons are relatively prominent element in the view. Approximately eight pylons and power cables are visible to the west of Sizewell B. Beyond the existing Sizewell A and Sizewell B power stations and pylons, there is no other infrastructure visible in views from this location. The remaining views from this location are to woodland/farmland.
D. National Trust Dunwich Coastguard Cottages Car Park.	Adjacent to car park/within seating/picnic area. Within Suffolk Coast and Heaths AONB. Within Suffolk Heritage Coast.	Visitors to Dunwich Coastguard Cottages. Footpath users.	The view south across Sizewell Beach, and the Minsmere Level, includes the principal structures at Sizewell A and Sizewell B. The Northern Mound, and areas of woodland/forest (including Goose Hill/Kenton Hills), screen low lying structures and activity. Visible power station structures are relatively simple geometric blocks above a 'datum' line formed by vegetation. In addition to the main structures of Sizewell A and Sizewell B, ancillary Sizewell B buildings are visible to the west of the main reactor building. Offshore intake/outfall structures are also visible, but not prominent. Overhead pylons are visible in the view. Approximately eight pylons are visible as a group to the west of

Viewpoint	Location	Visual receptors	Current view
			Sizewell B. Further west, pylons are relatively evenly distributed above the wooded 'datum' (formed by Goose Hill/Kenton Hills). These are visible as closely spaced pair of pylons. Despite the viewing distance cables between upper pylons are visible above the tree-line.

6.2.90 The findings of this analysis are set out in **Table 6.4** below.

Table 6.4: Viewpoint analysis findings

Viewpoint	Option 1	Option 2
A. Beach east of Goose Hill.	A single pylon (pylon 4) is visible from this location. Power cables are visible linking pylon 4 and pylon 3 (which is screened from view from this specific location), and to the mono-poles which are located north of the northernmost Turbine Hall.	Two pylons (pylons 4 and 5) are visible from this location. Power cables are visible linking pylons 4 and 5, and are also visible linking to pylon 3 (which is screened from view from this specific location), and to the mono-poles which are located north of the northernmost Turbine Hall.
B. Sandlings walk at Goose Hill.	All four of the proposed pylons are visible from this location. Pylons 3 and 4 are visible in the foreground of the Reactor Buildings. Power cables are also visible linking to the mono-poles, which are partially screened by intervening vegetation and proposed buildings and running between pylons 4, 3, 2 and 1. The upper portions of pylons 1 and 2 are visible above the Spent Fuel Building which screens their lower portions. Pylons 4 and 3, are visible in the immediate context of Sizewell C. Pylons 1 and 2 are less visually prominent, and are viewed in the context of the existing pylons, albeit in closer proximity and of a different design.	Four of the five pylons are visible from this location (pylon 5 is screened by vegetation). Pylons 3 and 4 are visible in the foreground of the Reactor Buildings. Power cables are visible linking to pylon 5. Power cables are also visible running between pylons 4, 3, 2 and 1. On the basis that pylon 5 is not visible from this location, the effects arising from visible pylons are similar to option 1. However, the effects are marginally reduced by pylon 4 being shorter (48m tall) in Option 2 (in contrast to 65m tall in Option 1). Should pylon 5 be visible (i.e. resulting from the loss of the trees that screen it from view), it was judged on balance that the effects of option 2 would be greater than option 1.

Viewpoint	Option 1	Option 2
C. Junction of Footpaths, The Walks.	All four of the pylons are visible in the view, with lowest portions screened by landform/ vegetation.	Four of the five pylons are visible in the view, with lowest portions screened by landform/vegetation. Pylon 5 is screened by proposed power station structures. The layout and difference in pylon heights between options 1 and 2 make a marginal difference to the effects arising from this viewpoint.
D. National Trust Dunwich Coastguard Cottages Car Park.	All four of the pylons are visible, with lowest portions screened by landform/vegetation.	All five pylons are visible in the view, with lowest portions screened by landform/vegetation. Pylon 1 is predominantly screened by proposed structures. The layout and difference in pylon heights between options 1 and 2 make a marginal difference to the effects arising from this viewpoint.

6.2.91 Of the viewpoints considered in the appraisal, Sizewell beach is closest to the proposed development, and currently comprises views south along the beach that are not influenced by overhead power lines.

6.2.92 It was judged that option 2 generates greater adverse effects in views from Sizewell beach than option 1. Option 2 would have resulted in a greater amount of visual 'clutter' extending out from the existing, and proposed power station structures into what is an otherwise relatively simple coastal landscape. As such particular consideration should be given to visual receptors in this location, their sensitivity and susceptibility to change.

6.2.93 Whilst adverse effects are anticipated on visual receptors along Sizewell Beach during construction and operation arising from the power station structures/sea defences, the choice of an option that would reduce the visibility of pylons from Sizewell beach was preferable. The difference in pylon heights between options 1 and 2 makes a marginal difference to the effects arising from the remaining viewpoints assessed. On balance reducing the visibility of pylons from Sizewell beach was considered to be more important and so the four-pylon option (option 1) was chosen.

xi. Hard coastal defence feature

6.2.94 The hard coastal defence feature would be in the form of a landscaped primary embankment built seaward of the outer security fence boundary. No reasonable alternatives to a defence feature in this location exist and the design has evolved in collaboration with stakeholder feedback. The height of the sea defences has been designed to satisfy the requirements of the Office for Nuclear Regulation, and the reasonably foreseeable climate change scenario. The baseline crest height of 10m AOD was derived from flood risk assessments incorporating an allowance for climate change extending out to 2110. Adaptation has been factored into the design that would allow the crest height to be raised to 14m AOD later in the station's life should the monitoring of trends in sea level rise, and nearshore waves suggest that this is necessary.

6.2.95 A landscape scheme for the sea defences was developed, taking into account the findings from preliminary landscape, biodiversity and recreational assessments. Ecological surveys found that the existing vegetation and invertebrate populations within the area are of high value and the landscape scheme has taken this into account as far as possible. In order to create a semi-natural and less engineered appearance, the height of the embankment would vary along its length between 10-12m AOD.

6.2.96 Coastal protection elements, in the form of rock armour, would also be embedded into the landscape of the sea defences to provide the required level of protection against extreme events. Likewise, the positioning and design of the marine delivery infrastructure and its approach road has been designed to reflect the long-term coastal protection needs.

xii. Beach Landing Facility

6.2.97 In the Stage 2 consultation, SZC Co. consulted on three options for the delivery of certain construction materials by sea during the construction stage as well as during the operational stage:

- Option 1 (wide jetty) was designed for the marine-maximised scenario. It comprised a temporary wide jetty for the delivery of bulk materials and AILs by sea during the construction phase. It would need to be approximately 800m in length, with two berths on the north side, and one on the south. The jetty would be constructed with piling into the seabed and would allow vessels to berth offshore.
- Option 2 (narrow jetty) was designed for the rail-maximised scenario. It comprised a temporary narrow jetty for the delivery of AILs only during the construction phase. It would only have berths on the south side. The jetty's simplified structure and reduced functionality allow it to be narrower in width. The jetty would also have been constructed with piles into the seabed and would have allowed vessels to berth offshore.
- Option 3 (Beach Landing Facility (BLF), the final choice) was designed at Stage 2 for the delivery of AILs during the operational phase and

potentially the construction phase. The strategy from Stage 3 onwards was for the BLF to be used in both the construction and operational phases. It would be used to receive large deliveries into Sizewell C by barge. The barge would be loaded with large deliveries at a transhipment port, towed to the shore, moored in position and the barge beached. Large deliveries would then be transported to site along the BLF access road. To support the overall construction schedule, the BLF would need to be constructed and in operation early for the delivery of large deliveries to enable construction of the initial sea defence.

6.2.98 SZC Co. has chosen not to proceed with the two jetty options for the following principal reasons, which are informed by design development and environmental work since Stage 2 and SZC Co.'s experiences from the construction of Hinkley Point C:

- Both jetty options would result in severe underwater noise during construction, as a result of the nature of the construction works and the significant amount of time required to construct the jetty. This noise would likely extend to a radius of several kilometres. This would cause significant adverse effects on marine ecology and fisheries, which could only be limited (but not removed) by extensive seasonal controls on construction activity and would thereby unacceptably extend the construction programme and the commencement of operation of the power station.
- The jetty options would result in greater habitat loss associated with the footprint of the piles. The BLF also requires piling but to a substantially reduced extent and only in shallow waters which greatly attenuates the radius of underwater noise.
- The BLF is predicted to have a more limited impact on shipping and navigation activities compared with either of the jetty options. This is largely due to additional disruption caused during the jetty construction and decommissioning periods caused by the jetty options. This would not apply to the BLF, as it would be retained for use during the operation of the power station.
- Whilst the jetty options would not cause any permanent change to the shoreline alignment, they would likely have caused greater temporary effects such as a reduced wave height at the shore and associated short-term changes to the alignment of the shoreline.

6.2.99 A key lesson learned from Hinkley Point C is the benefit of locating the BLF in close proximity to the main platform. Deliveries can then be made directly to the construction site, thereby avoiding the need to make the final journey to the main development site under escort via local roads and increasing the likelihood of traffic congestion.

6.2.100 The choice of facility was also influenced by the freight management strategy and further details on the alternatives considered in this regard are set out in **Volume 1, Chapter 4** of this **ES**.

6.3 Sizewell B relocated facilities works

a) Implementation of Sizewell B relocated facilities works

6.3.1 A hybrid planning application for the relocation, demolition and replacement of a number of existing Sizewell B facilities (known as the Sizewell B relocated facilities works) was submitted to East Suffolk Council (ESC) in April 2019 (application ref. DC/19/1637/FUL) and planning permission for these works was granted on 13 November 2019. The ES submitted with that application is provided in full in **Volume 1, Appendix 2A** of this ES.

6.3.2 As the Sizewell B relocated facilities works are critical elements to facilitate the construction of Sizewell C, the proposals for these facilities are also included in the application for development consent and have been considered to form part of the Sizewell C Project in this ES.

6.3.3 Chapter 4 of Sizewell B relocated facilities ES (included in **Volume 1, Appendix 2A**) provides a description of alternative sites, options and design evolution for these works. A summary of these considerations is provided below.

6.3.4 The Sizewell B relocated facilities works included within the DCO are the same as consented by ESC under the Town and Country Planning Act 1990. However, since the preparation of the Sizewell B relocated facilities ES, two changes to the design proposals have been made and are included within the DCO, as these formed planning conditions to the permission granted by ESC:

- A footpath between the proposed outage car park at Pillbox Field and Coronation Wood development area has been removed from the design to prevent loss of land within the Sizewell Marshes SSSI, which would have been required for the construction of the footpath.
- An alternative junction arrangement for outage car park access and Sizewell Gap road has been developed to minimise effects on road safety.

6.3.5 Sizewell B relocated facilities works are proposed to start pursuant to the permission granted by ESC in advance of the commencement of works under the DCO. The programme assumptions are described within **Chapter 3** of this volume. However, as all of the Sizewell B relocated facilities works and relevant mitigation would be consented in full by the DCO, it is also possible that the entirety of the Sizewell B relocated facilities works could be carried out under the DCO. An environmental assessment of this alternative implementation scenario is provided in **Appendix 6A** of this volume.

a) Alternative designs and design evolution

6.3.6 The location of Sizewell B relocated facilities is largely determined by the location of the Sizewell B power station with which the facilities to be relocated are associated. The facilities to be relocated are required to be in relatively close proximity to the existing Sizewell B station to ensure safe, secure and efficient working practices.

6.3.7 A sequential approach was applied to the siting of the facilities (given the limitation of available land) which sought to:

- rationalise the facilities by co-locating or combining compatible uses into new facilities, wherever possible;
- relocate facilities to within the existing Sizewell B station perimeter, as far as practicable;
- locate facilities in close proximity to Sizewell B within the Sizewell power station complex utilising the most suitable land, including exploring the potential re-use of Sizewell A land without conflicting with the Sizewell A decommissioning activities, such as using land used previously for Sizewell A reservoirs or Sizewell A car parks; and
- locate remaining facilities away from the Sizewell power station complex but only where the level of interaction with the Sizewell complex is less intensive and suitable land can be identified.

i. Facilities within the Sizewell B station perimeter

6.3.8 Two development areas within the existing Sizewell B station perimeter have been selected to accommodate the Sizewell B relocated facilities works.

6.3.9 The proposed locations provide an optimum location for maximising the use of existing built area within the Sizewell B station perimeter, whilst minimising interactions with critical site equipment. Hence, these locations were considered to best balance the requirements of Sizewell B relocated facilities, including safety, operational, environmental and programme considerations.

ii. Facilities outside the Sizewell B station perimeter

6.3.10 Facilities for the relocation of parking for cars, coaches, contractor vehicles, cycles and motorcycles are required. The parking areas to be relocated include parking for normal operation as well as outage conditions when demand is higher.

6.3.11 Four options were developed which would meet the required number of spaces and which were considered to be technically achievable. The options were:

- Option 1: the existing operational at-grade Sizewell B western car park would have been retained and provided with a deck to form a multi-storey parking area (two levels including ground level) for the sole use of Sizewell B. It would have provided 640 operational spaces. The existing Sizewell A at-grade car park would also have been modified to accommodate a multi-storey car park (five levels including ground level), providing 988 operational and outage spaces and the existing Sizewell A at-grade overflow car park would have been modified to accommodate a multi-storey car park (3 levels including ground level), providing 178 operational and outage spaces;
- Option 2: the existing operational at-grade western car park would have been retained providing 409 operational spaces and a new multi-storey car park (four levels including ground level) would have been provided at the current location of Coronation Wood, providing 1,037 operational and outage spaces;
- Option 3: the existing operational western car park would have been retained and would have provided an elevated deck to form a multi-storey parking area (two levels including ground level) for sole use of Sizewell B, providing 640 operational spaces. A new at-grade parking area would have been provided at the former site of the disused Sizewell A reservoirs, providing 230 operational spaces as well as a new at-grade outage parking area within Pillbox Field, providing 576 outage spaces.
- Option 4 (chosen option): provision of a car park during normal operation at the current location of Coronation Wood, requiring clearance of the existing trees, and a car park on Pillbox Field for use during outages only.

6.3.12 Option 4 would provide a new at-grade replacement car park at Coronation Wood and provide the opportunity to locate the training and visitor centre adjacent to the Sizewell B power station. Whilst this option requires the clearance of Coronation Wood, the existing tree stock within this area is considered to be of low ecological value. An at-grade car park on this site would not be able to provide sufficient car parking spaces to meet the requirement during outages. Therefore, the outage car park would be provided on Pillbox Field. The proposed replacement and outage car parks would provide a similar number of spaces as the existing facilities (with 12 additional spaces to meet current standards). Furthermore, the use of the outage car park in Pillbox Field would be infrequent in nature and avoids the need for a multi-storey car park which would have been more visually intrusive.

6.3.13 The use of Sizewell A car parks proposed in Option 1 was discounted as the facilities would be unavailable to meet demand due to the decommissioning programme for Sizewell A, as well as constraints on engineering activities due to underground utilities. Option 2 was discounted as it would be significantly more expensive than Option 4, and provide a greater number of spaces above the existing provision, which is unnecessary. Option 3 was discounted as it would not be feasible to construct an over-deck on the existing Sizewell B operational car park (Western Car Park) due to the 400kV overhead power lines

6.3.14 There was also early consideration of an offsite park and ride as an alternative to Pillbox Field for the outage car park only. However, this option was discounted due to the increased logistics and costs that would be incurred around the critical outage periods.

6.3.15 Overall, the proposed Option 4 was considered to best match the balanced requirements of the project, including environmental and safety considerations, operational, cost, and programme considerations.

6.4 National Grid land

6.4.1 An extension to the existing National Grid 400kV substation would be required to accommodate the additional generation output of Sizewell C. The overhead lines that currently terminate at the existing National Grid 400kV substation would be diverted into a new substation building built alongside and interconnected with the existing substation building, so that the electricity generated by both the existing Sizewell B and new Sizewell C power stations can be exported to the National Electricity Transmission System. As the substation needs to be interconnected no reasonable alternatives exist. Further details on the wider electrical connections to and from the power station are set out in **section 6.2(b)** of this chapter.

6.5 Offshore works area

a) Alternative sites

i. Intake and outfall heads locations

6.5.1 As detailed in **Volume 2, Chapter 2** of the **ES**, Sizewell C would require the installation of sea water intake and outfall structures on the seabed to ensure the safe and efficient operation of the station. Aside from engineering practicability, there are two primary considerations for the appropriate positioning of cooling water intake and outfall structures – the need for safe and efficient operation of the cooling water infrastructure itself and the need to consider environmental sensitivities.

6.5.2 When deciding on the location of the intake and outfall, a detailed understanding of the physics and ecology of the local marine environment was required, together with that of the dynamic processes that would govern the behaviour of the resultant cooling water plume. The location of the cooling water infrastructure has taken due regard of the Environment Agency evidence report (Ref. 6.6).

6.5.3 A key tool within this process was the use of predictive numerical hydrodynamic models. Two models were used to model the discharge plumes for Sizewell C. Ensemble modelling (use of two or more different models) is preferred as it reduces the bias or weaknesses of any particular single approach (Ref. 6.7). The models provided an understanding of the dispersion of a cooling water plume in the marine environment, and its spatial extent relative to the locations of sensitive environmental receptors. In addition, the models enabled the interaction between cooling water intake and outfall locations to be determined both with respect to the proposed Sizewell C infrastructure, and the existing Sizewell B infrastructure. Avoidance of recirculation of discharged cooling water is a fundamental requirement to ensure that the efficiency of the cooling water circuits for the existing Sizewell B and proposed Sizewell C power stations is maintained.

6.5.4 Design work concluded that the Sizewell C intake and outfall heads would be situated east of the sea-bed feature known as the Sizewell-Dunwich Bank, at around 3km from the shore, at depths of approximately 13-15m below Ordnance Datum. The Sizewell bank is gradually moving towards the coast together with localised infilling to the west so placing the intake and outfall structures to the east ensures that they are not at risk of being smothered by the advancing bank. The deeper water to the east of the sandbank increases clearance above the heads thereby reducing navigational risks and ensuring sufficient water levels overlying the structures for uninterrupted cooling water supply. In addition, the deeper water at the location of the outfall allows stratification so that the warm water discharged rises rapidly to the water surface (due to lower density) and loses heat efficiently to the atmosphere.

6.5.5 The selection of an outfall location beyond the Sizewell Bank would also greatly reduce the Sizewell C plume adding to and reinforcing the presence of the existing Sizewell B plume (which is located inside of the Sizewell Bank). The water inside of the Sizewell Bank is constrained somewhat by the sandbank and significant increases in temperature would occur, if both stations discharged their thermal loads in that area; avoiding this greatly reduces potential effects on marine water quality and ecology.

6.5.6 Intake head locations considered the potential impacts of entrapment of marine biota and in particular avoid fish spawning grounds, fish migratory pathways and sensitive benthic habitats (Ref 6.4), which the proposed offshore locations achieve.

6.5.7 Further details on the determination and assessment of intake and outfall locations are presented in **Chapters 20, 21** and **22** of this volume.

6.5.8 The location of the intake and outfall heads were also influenced by the siting of the main platform, which is considered earlier in this chapter.

ii. Fish recovery and return outfall heads locations

6.5.9 The location of the fish recovery and return (FRR) outfall heads is dictated by the need to ensure the head is submerged at all times of even the lowest tide (Lowest Astronomical Tide; LAT), which allows continuous return of fish and other biota to sea. Other constraints are then considered to optimise the location including reducing the time required to return fish to sea and the potential fate of fish and biota once they have been released – essentially a shorter tunnel is preferred to reduce transit time of fish through the tunnel, but the precise discharge location must ensure that the returned fish are (a) not at risk of being drawn into the Sizewell B cooling water intake and (b) discharged at sufficient distance offshore that they do not become immediately caught in the surf and washed ashore (important also for consideration of dead and moribund animals being washed ashore).

6.5.10 Numerical modelling (particle tracking) has been used to assess the potential for fish released from the FRR outfalls to be entrapped in the Sizewell B cooling water intake. The outputs of this modelling have been used to inform how far offshore the outfalls should be.

6.5.11 The FRR outfall head location for Unit 2 is optimised to lie due east its respective filtering debris recovery building debris, thus providing the shortest distance to return to sea. However, the FRR outfall for Unit 1 would lie to the south east of its respective filtering debris recovery building debris - this is a compromise to ensure both a short transit time and maintain sufficient distance from the Sizewell B intake while also maintaining sufficient distance from the combined drainage outfall (CDO) to the north so that potential impacts of commissioning discharges on returned fish and biota minimised.

6.5.12 As with the cooling water infrastructure, the siting of the FRR outfalls takes due regard of Environment Agency evidence (Ref 6.4) and further details on the determination and assessment of intake and outfall locations are presented in **Chapters 20, 21** and **22** of this volume.

6.5.13 The locations of the fish recovery and return outfall heads were also influenced by the siting of the main platform, which is considered earlier in this chapter.

iii. Combined drainage outfall head location

6.5.14 The location of the CDO head is a compromise between engineering and environmental constraints. The CDO tunnel and outfall would be:

- close to shore to reduce tunnel length, thereby simplifying the engineering and amount of spoil arisings;
- towards the north of the site to allow routing of construction and commissioning discharges to the CDO tunnel; and,
- located in a north-south alignment that (a) reduces potential impacts of the discharge plume on both the fish returned from Unit 1 (which would become operational while commissioning and construction discharges are still being made via the CDO) and (b) mitigates the potential incursion of CDO discharges into Minsmere via the sluice to the north of the proposed development.

6.5.15 Further details on the determination and assessment of CDO outfall location is presented in **Chapters 20, 21** and **22** of this volume.

6.5.16 The location of the combined drainage outfall head was also influenced by the siting of the main platform, which is considered earlier in this chapter.

b) Alternative designs and design evolution

i. Intake and outfall heads design

6.5.17 In accordance with general cooling water design processes, the cooling water infrastructure for Sizewell C has been optimised based on specific physical, chemical and biological constraints at the site.

6.5.18 The intake head design has been evolved to optimise mitigation of the entrapment of marine life whilst being resistant to environmental conditions that could affect station efficiency and/or safety. To mitigate entrapment of marine life, a low velocity, side entry (LVSE) intake head is preferred (Refs. 6.4 and 6.5). A LVSE intake provides several benefits to reduce the potential of fish being sucked into the cooling water system:

- it has an elongated shape that abstracts water only along its sides and by being placed orthogonal to the tidal flow it removes tidal currents from forcing fish into the intake;
- by having a large size and abstracting water only along the long side reduces the velocity at which water enters the intake - a nominal intake flow of 30cm/s is suggested as broadly acceptable although other velocities may be acceptable depending on the species assessed (Ref 6.4);
- by being capped and only abstracting water from the side it reduces the potential for fish to be sucked in via vertical flows as fish are less able to swim away from these.

6.5.19 It is worth noting that the benefits of a LVSE design while seemingly reasonable are only hypothetical at present because there are no operational intake heads of this type – the LVSE design approved at Hinkley Point C would be the first in its kind.

6.5.20 For the proposed development, a variation of the LVSE would be used that would take advantage of as many perceived benefits as it can from the design while recognising environmental constraints specific to Sizewell, namely the risk of bio-fouling.

6.5.21 Sizewell is categorised to be a high-risk site in respect of potential fouling by marine organisms (e.g. mussels, tube worm, anemones etc) and low velocities act to enable settlement of the planktonic larvae of these organisms (which then grow into adults and their presence can restrict water flow and potentially block the cooling water system). Consequently, very low flow velocities are not suitable for the Sizewell C intake design. However, a design that is side entry and placed orthogonal to the tidal flow does not affect biofouling risk and so these elements have been retained to mitigate entrapment of marine animals.

6.5.22 The proposed Sizewell C intake head design would be a rectangular, side entry head, similar to that designed for Hinkley Point. However, it would be shorter in length than the Hinkley Point C design to maintain sufficient intake velocities to mitigate biofouling, and would have a ramped nose at each end to reduce its hydrodynamic profile and ensure that intake flows along its length are as uniform as possible. The ramped noses mitigate the removal of flow ‘baffles’ that are used in the Hinkley Point C design to improve flow uniformity – all internal baffles and supports that are not integral to structural strength have been removed from the Sizewell C design to further reduce fouling potential (by reducing the surface area for settlement).

6.5.23 The Sizewell C outfall head would be a simple riser that discharges the cooling water flow horizontally. The design would be a direct replica of the

Hinkley Point C (and Flamanville 3) outfall head design. This type of design allows the discharge to form a thermally buoyant plume for loss of heat to the atmosphere.

ii. Biota exclusion technology

6.5.24 Several different techniques are used, with variable success, to reduce the number of marine animals (fish, shrimp etc.) being abstracted with the seawater and impinged on the drum or band screens. These include auditory and visual deterrents (e.g. acoustic fish deterrents and strobe lights; respectively) and physical barriers (such as wedge-wire screens, bubble curtains, etc). However, while such techniques have been used at onshore or very nearshore abstraction points, or rivers, none have been used at long-offshore locations.

- Wedge-wire screens that are commonly used to exclude fish from small, riverine abstraction points utilise wires placed at uniform intervals very close together and can be effective in excluding fish and other biota from the abstraction point but because of the very small gaps between wires they are also to prone to becoming blocked by seaweed, litter etc. A constant supply of cooling water is a critical component of nuclear safety and wedge-wire screens, as approved at Hinkley Point C are compatible with the safety requirements of Sizewell C.
- The use of a bubble curtain, whereby air is released along a section of seabed to create a ‘curtain’ of bubbles rising to the surface which creates a barrier to fish, is a potentially useful exclusion technique in still or slow-moving waters but is not suitable for waters where tidal currents ebb and flow at >1m/s and breakdown the curtain of bubbles.
- Lights, typically strobe lighting, can be used to deter some fish (for example eels), however, their effectiveness in turbid coastal waters is unproven (turbidity relates to the amount of material; suspected in the water and thus restricting visibility). The seawater at Sizewell is classified as “intermediate turbidity” and experiences increased levels of turbidity autumn to early spring when storms and increased wave action stirs up sediment; this would reduce the penetration of light through the water and significantly reduce the efficacy of strobe lighting deterrents.
- An electric fish barrier is a non-physical barrier that prevents fish passage from one location to another or induces fish movement from one area to another within a body of water using an electric current. Electric barriers pass an electrical current through the water, thus creating an electric field. As fish enter the electric field, they become part of the electrical circuit and experience electric current flowing through their body. As the fish approaches the anode, the electric field

intensifies, which causes the fish to generally turn around and swim away from the electric barrier. The set-up of an electric barrier requires a series of electrodes, alternating anodes and cathodes to span across a body of water. However, electric barriers are affected by water conductivity and are unsuitable for marine or brackish water environments (Ref. 6.6), therefore, the use of an electric fish barrier is considered not to be feasible for the offshore Sizewell C intakes.

- Acoustic fish deterrents (AFDs) have been reported to show very good efficacy at deterring fish from intakes by creating continuous pulses of sound energy; but again all installations of AFDs are either on shore or very close to shore. There are no AFD systems operating in environments several kilometres offshore (Ref. 6.7) . The issue with installation of AFDs in offshore environments in particular is the large number of electrical components required at each intake, the supply of electrical power and control telemetry to the individual 'speakers', the required proximity of the speakers to the intake heads themselves (without affecting the hydrodynamic performance or structural integrity of the head) proximity and the longevity of those components in the offshore environment. The issue of longevity is a particular constraint as the AFD units would need to be serviced every 12-18 months. The logistical and safety considerations preclude the use of AFDs at Sizewell C.

6.5.25 Wedge-wire screens and electric fish barriers are considered unsuitable for the Sizewell C intake heads. Bubble curtains and strobe lighting are expected to have limited benefit in the waters offshore Sizewell (as well as requiring electrical supply and frequent servicing). AFD systems have not been used in offshore environments and the quantity of units required, electrical supply, mounting and servicing issues mean that they are considered unsuitable for use at Sizewell C. The environmental assessment for effects of Sizewell C, with the modified intake head and FRR system installed, shows that impacts on fish are not significant, as provided in **Chapter 22,** of this volume. Therefore additional offshore biota exclusion techniques have been excluded from the design.

6.5.26 Further contextual information on individual biota exclusion technologies considered are set out at **Appendix 22I**, **Chapter 22** of **Volume 2** of the ES (Doc. Ref. 6.3).

iii. Chlorination strategy

6.5.27 As described above, Sizewell is considered a high-risk site for the potential for bio-fouling. Sizewell B injects chlorine into its cooling water tunnels all year round to prevent biofouling of the tunnels themselves and additional dosing occurs at the drum screens to protect the screens and downstream plant. Sizewell C, in accordance with EDF Energy Group's policy on chlorination, would be required to chlorinate the cooling water system due to the high site-specific risk of biofouling. As with other parts of the cooling water system, the chlorination strategy needs to recognise the risk to the safe and efficient operation of the station and the environmental risks of chlorination.

6.5.28 In contrast to the Sizewell B strategy, chlorine would not be added to the system upstream of the Sizewell C drum and band screens. The difference in the chlorination strategy for Sizewell C compared with Sizewell B is due to differences in the size and design of Sizewell C:

- the long lengths of the intake tunnels are prohibitive in maintaining a manageable and accurate dosing system and dosing at the intake itself would potentially lead to discharge of chlorine at that point as well, due to minor imperfections in the intake head hydrodynamics;
- the intake tunnels for Sizewell C are very large (6m internal diameter) and are assessed to be capable of incurring some fouling without having a significant effect on flow rates (fouls occur on the walls of cooling water systems but the depth of material that can attach and survive there is finite; the large diameter of the intakes can accommodate a degree of fouling);
- in addition to the large diameter, flow rates in the intake tunnels are in excess of 2m/s and at such speeds settlement of fouling organisms is very unlikely;
- at the drum and band screens, Sizewell C would have washwater sprayed at a higher pressure;
- chlorination of the intake heads, tunnels or drum/band screens would expose entrapped marine animals (fish etc.) to unacceptable, and for many species lethal, concentrations of chlorine. In line with best practice (Ref. 6.6), Sizewell C would not add chlorine to any part of the cooling system where fish are present.

6.5.29 Sizewell C would chlorinate all parts of the cooling water system that are downstream (i.e. after) of the drum and band screens in the cooling water pump house when the incoming seawater temperature is 10°C or higher. This corresponds to the time when the planktonic larvae of most fouling organisms are most abundant. By 2030, close to commencement of operation of the proposed development, seasonal dosing would typically occur from the beginning of May until the start of December. Outside of this seasonal period of routine chlorination, additional targeted chlorination of specific parts of critical plant may occur.

6.5.30 Anti-biofouling measures are critical to the safe operation of coastal power stations and requires the prevention of settlement and growth as opposed to killing settled organisms. EDF Energy Group maintains a fleet wide policy on the choice of anti-biofouling measures and has periodically examined alternative products and approaches but has not found any that offer an improved risk profile than chlorination. There is no Operational Experience (OPEX) for the use of alternative chemicals on nuclear power stations. Historically, some power stations have used thermal shock as an antibiofouling approach. However, thermal shock involves killing fouling organisms that have already settled and established in the cooling water system which once they are dislodged could cause blockage to the downstream cooling water pipes, for example the condensers. Instead, SZC Co. policy is to deter settlement and growth by low level chlorination which is considered BAT. Determent by use of anti-fouling paints or coatings is not practical as a long-term solution and the impacts of such coatings on non-target species and the wider environment are not acceptable.

6.6 Temporary construction area

a) Alternative sites

6.6.1 As set out in earlier in this chapter, the proposed location of the Sizewell C power station is set out in NPS EN-6 and, therefore, no alternative sites were considered. A significant proportion of the temporary construction area was included in the nominated site boundary set out in NPS EN-6.

6.6.2 The Strategic Siting Assessment (SSA) which sits behind NPS EN-6 (Ref. 6.8) was designed to identify sites in England and Wales that are potentially suitable for the deployment of new nuclear power stations, and nominated areas were defined for each of those sites. However, as stated in paragraph 2.3.3 of EN-6, it was not anticipated that the nominated site would include all of the land required for construction of that power station:

> *"The boundary of the nominated area may, however, vary from the site boundary that is proposed for development consent. It was not considered reasonable to expect nominators to have established, at the time of requesting nominations, detailed lay-outs for the whole of their proposed developments, including for example any additional land needed for construction or decommissioning."*

6.6.3 Paragraph 2.3.4 goes on to say that:

> *"The SSA has therefore been carried out on the basis that applications for development consent may also include land additional to the boundary of the listed site for other elements of the power station, such as car parks, access*

roads or marine landing facilities, or for the construction and/or decommissioning of the nuclear power station.

6.6.4 On this basis, SZC Co. has chosen to site the temporary construction area in close proximity to the main construction area in order to maximise both efficiency and safety during construction. Siting the temporary construction area in a location remote from the main construction area would not be feasible given the large quantities of construction material required and the size of components involved.

6.6.5 The proposed location of the temporary construction area and related infrastructure was driven by the need to strike a balance between project efficiency and programme, whilst recognising the sensitive nature of the site and its surrounds. The following factors were considerations in the siting of the temporary construction area:

- to locate construction activities with the potential to cause disturbance away from where people live, as far as practicable;
- to minimise land take from within Sizewell Marshes SSSI;
- to avoid the most sensitive landscapes within the Area of Outstanding Natural Beauty (AONB);
- to limit disturbance to deciduous woodlands, significant hedgerows and tree belts;
- to avoid the non-essential use of land along the foreshore (i.e. in front of the Sizewell C power station) that forms part of the AONB and Suffolk Heritage Coast;
- to be as close as possible to the main platform construction area, to minimise the logistical and safety challenges of moving workers and construction materials, storing and backfilling spoil material and supporting construction activity;
- to locate construction areas near to the proposed new access road and avoid using the existing access to the Sizewell B and Sizewell A power stations, where practicable;
- to use flat and well-drained land, where practicable, to avoid substantial re-grading;
- to limit disturbance of retained and newly created habitats;
- to minimise disturbance to European designated habitats, especially the Minsmere to Walberswick Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar to the north of the site, and the Outer Thames SPA to the east where cooling water infrastructure is proposed to be located;

- where practicable, to maintain access to recreation and amenity areas including public and permissive rights of way; and
- to have regard to the setting of key heritage assets.

6.6.6 Another factor in the siting of the temporary construction area was to use land within EDF Energy estate, where possible. It was considered that using land that is owned and managed by SZC Co. would reduce disturbance to surrounding landowners and landownership arrangements, and would be more cost-effective than purchasing land.

6.6.7 Given these considerations, the temporary construction area connects directly to the nominated site and seeks to minimise adverse environmental effects, in the context of the requirements of construction, and particularly in relation to the receptors identified above.

b) Accommodation campus location

6.6.8 As set out in **Volume 1, Chapter 4** of this **ES,** the strategic decision was taken to progress a single accommodation campus in close proximity to the main development site.

6.6.9 SZC Co. presented three options for an accommodation campus at Stage 1 consultation:

- a development site campus next to the main development site entrance (which was stated as the preferred option);
- a Sizewell Gap campus located to the south of Sandy Lane and north of Sizewell Gap, approximately 2.4 kilometres (km) from the main development site entrance; and
- a Leiston East campus located in fields to the south of the Sizewell Sports and Social Club, approximately 2.7km from the main development site entrance.

6.6.10 Following the review of responses to that consultation and evidence from contractors at Hinkley Point C, along with experience on Hinkley Point B and Sizewell B, SZC Co. concluded that it was preferable to have as many workers accommodated on-site as practicable. The on-site accommodation campus was therefore progressed.

6.6.11 The on-site accommodation campus offers a number of benefits, notably: reduced number of journeys on local roads and travelling time to and from the construction site; increased productivity and reduced health and safety risks associated with long travel and work times; and flexibility in terms of the out of hours working that may be necessary to respond to emerging site needs and maintain construction productivity and progress.

6.6.12 The chosen option is the only site located wholly outside of the Suffolk Coast and Heaths AONB.

6.6.13 Details on the design evolution of the accommodation campus is set out later in this chapter.

c) Alternative designs and design evolution

i. Size and layout

6.6.14 The area of land required for construction has been defined by the construction strategy. Given the scale of the Sizewell C Project, a substantial volume of materials, machinery and other specialist equipment would need to be brought to, stored at, processed and removed from the main development site during the construction phase. This phase, therefore, requires careful planning, including the identification of dedicated construction areas for specific activities.

6.6.15 The common user facilities area, which would include concrete production and the prefabrication facilities for essential components which are too large to be delivered from remote locations, would need to be located as near to the main construction area as possible in order to maximise logistical efficiency. For a similar reason the contractors' compounds would need to be located near to the common user facilities, yet the accommodation campus would preferably be sited a suitable distance from the construction worksites to minimise impacts on the residential workforce.

6.6.16 In addition to maximising logistical efficiency, environmental constraints and opportunities were a consideration in the siting of the components within the main development site. The majority of the temporary construction area would be at a lower elevation than the adjacent land to the west and north, which assists in providing some natural screening from the more sensitive areas further north, including the Minsmere Nature Reserve. The construction footprint is also located away from settlements in the vicinity including Eastbridge and Theberton.

6.6.17 A number of options have been considered for the siting of particular components within the main development site, including the accommodation campus, borrow pits and site entrance. These are considered elsewhere in this chapter.

6.6.18 The site boundary for the main development site has evolved as the understanding of the design of the power station and construction requirements have developed. Whilst the majority of the land identified as being required at Stage 1 consultation is included in the proposed development, some amends have been identified following further consultation and design development, examples of which include:

- Water management zones (WMZ): as the drainage strategy for the main development site progressed it was identified that additional land was required for WMZ during the construction phase to help ensure they can adequately attenuate and, if required, treat surface water run-off prior to discharge to either watercourses or to the ground. Additional land is provided adjacent to Lower Abbey Farm; north of Goose Hill; and, north of Aldhurst Farm habitat creation scheme.
- Land west of Eastbridge Road: the accommodation campus design has evolved to only be located east of Eastbridge Road, in order to reduce impacts on heritage features and reduce landscape and visual impacts on the approach to Eastbridge compared with the options presented at the Stage 2 consultation.
- Land north of Sizewell Gap: land was added in this area to provide for an electricity cable and associated trench for use during the construction and operation phases.
- Additional woodland at Goose Hill: retained woodland at Goose Hill was included to allow for active management of this area.
- Land north of Kenton Hills and south of Goose Hill: additional land has been included to help ensure construction ground levels can tie in with levels in the surrounding area.
- Junction of Lover's Lane and Abbey Road: further work on the requirements for Lover's Lane has led to some changes in the land required since the Stage 1 consultation.
- Land north of Ash Wood: additional land has been included to provide for a water resource storage area and additional wet woodland habitat to minimise adverse effects on the local water supply and provide additional compensation for lost habitat at Sizewell Marshes SSSI.

6.6.19 The design of boundary treatments has evolved, in discussion with stakeholders and informed by consultation feedback, with the aim of minimising adverse landscape, visual and noise effects. Indicative designs for boundary treatments at the main development site are set out at **Appendix 3C, Volume 2** of this **ES**.

ii. Accommodation campus design evolution

6.6.20 As set out in **Volume 1, Chapter 4** of this **ES** the strategic decision was taken to progress a single accommodation campus in close proximity to the main development site.

6.6.21 Details on the location of the accommodation campus in close proximity to the main development site are set out earlier in this chapter.

6.6.22 At Stage 2 consultation two design options were presented for an on-site accommodation campus next to the main development site entrance:

- Option 1: built development east and west of Eastbridge Road, comprising three and four storey accommodation blocks. This option required a realignment of Eastbridge Road.
- Option 2: built development on the east side of Eastbridge Road, comprising three, four and five storey accommodation blocks, with sub-options for the siting of the sports pitches:
- sports facilities to the west of Eastbridge Road; or
- sports facilities located remotely, with respondents asked to suggest possible locations.

6.6.23 These options were influenced by the following design considerations:

- accommodate the required bed space numbers, amenity hub, infrastructure and associated parking required;
- provide an attractive and practical environment for the workforce;
- accommodate the realigned Bridleway 19 and retain its rural character as far as possible;
- be sympathetic to the relationship and compatibility with adjoining land uses (existing and proposed);
- consider the design of the proposals in relation to the proximity to the AONB; impact on key viewpoints e.g. Whin Hill and impact on the setting of important buildings e.g. Leiston Abbey;
- take into account the character of the existing natural environment and built environment e.g. Upper Abbey Farm;
- retain existing landscape features within the site where possible and provide a bat corridor along the eastern edge; and
- ensure safe pedestrian and vehicular movement.

6.6.24 Option 2 was proposed at the Stage 3 consultation and is indicatively included in the proposed development. This layout locates the built form of the accommodation campus on the east side of Eastbridge Road only to reduce the visual prominence of new buildings and structures from locations to the west, including in the vicinity of Leiston Abbey and from elevated locations to the north. This has been achieved through more efficient planning for the car parking, and the re-configuration of the campus amenity and entrance hub facilities. Up to two storey car parking is proposed and the accommodation buildings may now be up to four storeys in height. Under this arrangement the three storey buildings would be located nearest to Eastbridge Road, and the four storey buildings near to Bridleway 19. There would be a separation distance between habitable rooms of typically 17 metres (m) between blocks north and south, and 9m between blocks east and west.

6.6.25 Details on the strategic siting of the accommodation campus is set out earlier in this chapter.

iii. Layout of the borrow pits

6.6.26 SZC Co. has evaluated the potential for on-site borrow pits to provide a source of sands and gravel for use as backfill material for the main construction. Once the borrow pit material has been excavated, the ground would then be reinstated by filling the pit with other excavated materials from across the site that are unsuitable for re-use in construction (principally peat materials).

6.6.27 Use of on-site borrow pits reduces the need to import aggregate from off-site locations, whether by road, rail or sea, and was preferred as it would be a more sustainable and cost-effective spoil management option, and in accordance with the Waste Framework Directive. It also reduces the need to export material excavated from across the site, as this excavated material can be filled into the borrow pits.

6.6.28 At Stage 2 consultation four fields, totalling 40ha, within the north-west of the main development site were considered as potential locations for borrow pits. It was estimated at that time that approximately 15ha of land would be required but, due to each of the fields measuring less than 15ha and the practicalities of the borrow pit operation, three combinations of pairs of fields were considered. Those were fields one and two (east and west of Eastbridge Road), fields two and three (east of Eastbridge Road and north of Ash Wood), or fields three and four (north and west of Ash Wood). The sites were chosen because they contained the necessary geology to provide suitable engineering fill material; the groundwater table was sufficiently deep to enable excavation; and a haul road connection could be provided to and from main platform that minimised effects on nearby sensitive receptors.

6.6.29 An alternative option was consulted upon at Stage 2 to ship excavated material to the Royal Society for the Protection of Birds Wallasea Island Wild Coast Project in Essex, where material would have been used to contribute to the ongoing habitat creation scheme, was also included at Stage 2 consultation. Following further consideration, SZC Co. was satisfied that it would be able to sensitively incorporate material in the borrow pits and on-site as part of the land restoration works and that this approach would be more sustainable than shipping that material off-site.

6.6.30 Field one was discounted as it would have been the most visually exposed of the four fields. It would be visible from the north including from the Public Rights of Way south of Eastbridge, and has intermittent views from Eastbridge Road. Potters Farm, Eastbridge Farm and Leiston Abbey are also nearby, and are likely to have had direct views of this borrow pit if it was progressed. Field one would also have required large construction vehicles to cross Eastbridge Road. Whilst it is the only borrow pit option that is not in the AONB, for the above reasons SZC Co. considered that use of this field was the least appropriate solution for borrow pit construction works.

6.6.31 Whilst the options that were presented at Stage 2 identified two borrow pit fields are likely to be required, further consideration led to the conclusion that the remaining three borrow pit fields should be included in the application for development consent.

6.6.32 It is estimated that approximately 1.1 million m^3 of peat and alluvium would be excavated from the main construction area. Material must meet specific qualities to be suitable for backfilling for the main construction and the inclusion of three borrow pit fields significantly increases the amount of backfill material that is likely to be sourced on-site. It also creates additional capacity to sensitively place the material excavated from the main construction area on the site.

6.6.33 The borrow pits were sited to balance operational requirements with environmental considerations and through consultation and design evolution the most visually exposed borrow pit has been discounted. The proposed solution contains heavy earthmoving equipment east of Eastbridge Road, meaning no interaction with the public highway is necessary in this regard.

iv. Location of the main development site entrance

6.6.34 It is proposed that the main access to Sizewell C, serving both the construction and operational phases, would be provided by a new junction with the B1122 in the west of the main development site.

6.6.35 The existing Sizewell power station complex access road was not considered as a feasible option for the primary route to Sizewell C. This is because it would not be able to provide the regular capacity required during both the construction and operational phases, due to its routing past Sizewell B. In addition, the space constraints around the platform for Sizewell C would limit the opportunity to provide operational car parking adjacent to a southern entrance to the station. However, there is a regulatory requirement for two separate accesses to the operational power station and the existing Sizewell power station complex access road would provide the secondary access.

6.6.36 At Stage 1 consultation, it was proposed that the main access road would be routed in a westerly direction from the power station to adjoin the B1122 to the south of the existing Eastbridge Road junction. By Stage 2 consultation the design of the junction had progressed, and a roundabout was proposed, which would be located in the southern part of the field between the existing Eastbridge Road and Greenhouse Plantation. The roundabout would, therefore, be located slightly eastwards of the existing alignment of the B1122. Two options were proposed for the roundabout arrangement, which were driven by the layout options proposed for the accommodation campus (for details see earlier section of this chapter):

6.6.37 Option 1 would involve a permanent diversion of the Eastbridge Road to form a new independent access off the B1122 near to Greenhouse Plantation. Under this arrangement the roundabout would have four arms: the B1122 north towards Theberton; Sizewell C construction workers' entrance; Sizewell C freight entrance; and the B1122 south towards Leiston (running clockwise from north-west).

6.6.38 Option 2 would involve a short section of Eastbridge Road being diverted in order to tie into the new roundabout. Provision of a dedicated arm at this junction would allow vehicles to access the village directly. This arrangement would result in the existing Eastbridge Road being closed to the east of Abbey Cottages, allowing access from the B1122. Under this arrangement the proposed roundabout would have five arms: the B1122 north towards Theberton; a realigned Eastbridge Road; Sizewell C construction workers' entrance; Sizewell C freight entrance; and the B1122 south towards Leiston (running clockwise from north-west).

6.6.39 The chosen solution is closely related to the accommodation campus strategy, which is proceeding on land to the east of Eastbridge Road as set out earlier in this chapter. A permanent diversion of Eastbridge is therefore no longer required. Option 2 was the chosen solution, as it reduced the extent of diversion works needed and allows direct access to the village from the roundabout.

6.7 Land east of Eastlands Industrial Estate

a) Alternative designs and design evolution

6.7.1 At Stage 1 consultation, it was proposed that the land to the East of Eastlands Industrial Estate (LEEIE) (or 'the area north of King George's Avenue' as it was referred to at the time) could be used for a new rail terminal and freight laydown area to support the construction programme. This was presented as one of the four options for the delivery of freight by rail alongside the green, red and blue routes for extending the rail line into the construction site, see **Volume 9, Chapter 3** of the **ES**. The red and blue routes were dropped following Stage 1 consultation because of environmental and logistical reasons.

6.7.2 Following Stage 1 consultation and the identification of Sizewell Halt as a viable facility for the delivery of material by rail, it was considered that the LEEIE could play an important role in the construction of Sizewell C for the delivery and storage of materials. This would particularly be the case in the early phase of the Sizewell C Project when space at the main construction area would be limited. Therefore, the green rail route and LEEIE were presented as options at Stage 2 consultation, with the latter being proposed as either:

- a new rail terminal with additional construction and accommodation campus purposes; or
- for construction and caravan accommodation purposes only.

6.7.3 Following Stage 2 consultation, SZC Co. decided to proceed with the green rail route extension because it would allow for rail freight to be delivered directly into the main development site. The LEEIE would be used to support the main construction area, by providing space for material stockpiling, construction laydown, and the installation of caravan accommodation for construction workers.

6.7.4 For both of the LEEIE options, Sizewell Halt was identified at the Stage 2 consultation as playing a particularly important role during the early years of construction, by taking rail deliveries prior to the completion of alternative infrastructure.

6.7.5 At the Stage 3 consultation, SZC Co. proceeded with a revised approach to temporary development within this area that was strongly driven by the freight management strategy. As explained in **Volume 1, Chapter 4** of the **ES**, SZC Co. discounted the marine-maximised scenario and consulted on a road-led strategy and a rail-led strategy. Rail works required under each strategy are shown in **Table 6.5**:

Table 6.5: Rail works required by freight management strategy

Rail Works Required for a Rail-Led Strategy.	Rail Works Required for a Road-Led Strategy.
Two alternative options which would be used in the early years of construction (prior to completion of the green rail route)	Two alternative options which would be used throughout the construction period for up to two freight deliveries per day (four movements):

Rail Works Required for a Rail-Led Strategy.	Rail Works Required for a Road-Led Strategy.
for up to two freight deliveries per day (four movements): **Option 1: Sizewell Halt** Use of the existing Sizewell Halt rail terminal located south of King George's Avenue. Reconfiguration of the existing railhead in order to accommodate longer trains. An overhead conveyor to transfer freight material back into the LEEIE. OR **Option 2: New rail siding** Construction of a new rail siding adjacent to the existing branch line on the LEEIE.	**Option 1: Sizewell Halt** Use of the existing Sizewell Halt rail terminal located south of King George's Avenue. Reconfiguration of the existing railhead in order to accommodate longer trains. An overhead conveyor to transfer freight material back into the LEEIE. OR **Option 2: New rail siding** Construction of a new rail siding adjacent to the existing branch line on the LEEIE.

6.7.6 Under the rail-led strategy, the green rail route would be constructed, which would take bulk deliveries directly into the temporary construction area once operational. Once constructed, this new rail extension off the existing Saxmundham to Leiston branch line would be used to support up to five freight deliveries per day (ten movements).

6.7.7 In the Stage 4 consultation, an additional option was introduced for a new rail spur located more centrally within the LEEIE. This option refined the option set out in Stages 1-3 with a straighter rail alignment, thereby allowing longer trains to be used, and more freight to be delivered per train.

6.7.8 The rail spur consulted upon at Stage 4 was chosen as this provides equal ability to mitigate potential adverse effects, whilst allowing longer trains to be delivered into LEEIE.

6.8 Marsh harrier habitat improvement area

a) Alternative sites

6.8.1 The conclusion of the **Shadow Habitats Regulation Assessment Report** (Doc Ref. 5.10) and the **Shadow Habitats Regulation Assessment Volume 4 – Compensatory Measures Report** is that the permanent habitat improvement area of 47.8ha that has been established, but is being further improved, at the northern edge of the EDF Energy Estate (UK grid reference: TM 46318 65222) would provide sufficient foraging to be regarded as appropriate compensation for the predicted 'loss of foraging' over the Sizewell Marshes SSSI, arising as a result of a barrier effect created by the temporary construction area. This effect is assessed within **Chapter 14** of this volume and also in the DCO Shadow Habitats Regulation Assessment Report.

6.8.2 However, if it is determined by the Secretary of State that additional marsh harrier foraging habitats are required, then the marsh harrier habitat improvement area (Westleton) would be temporarily used to provide this. Further details on alternative sites to the Westleton site that were considered are set out below.

6.8.3 Based upon the calculated potential loss of the wetland foraging resource on the Sizewell Marshes SSSI, it is estimated that the permanent marsh harrier habitat improvement area at the northern edge of the EDF Energy estate would need to provide a total foraging resource (indexed in terms of flight activity) of approximately 19 m/hr/ha (representing an approximate four-fold increase in the existing flight activity).

6.8.4 At a Habitats Regulations Assessment (HRA) workshop in November 2018, stakeholders suggested that the approach for calculating the 'lost' foraging resource should include arable as well as wetland habitat. The position of the HRA assessment has been to consider that compensatory habitat is required only in relation to wetland habitats, because these provide the key existing foraging areas, whilst arable is a widely available habitat of low foraging value, and marsh harriers would compensate for 'loss' of arable foraging areas through behavioural changes. This was considered a robust position, and is assumed for the basis of the HRA assessment.

6.8.5 However, it is recognised that there is an alternative view, and that if 'lost' arable is included in the calculations of the 'lost' foraging resource, the on-site mitigation land would need to provide a total of c.35 m/hr/ha of foraging resource to fully offset the 'lost' resource. This approximates to a seven-fold increase in the estimated existing flight activity on the on-site habitat improvement land. It is unrealistic to expect the existing habitat improvement area, even when fully optimised, to deliver such a high foraging resource. This leads to a potential requirement to identify additional off-site marsh harrier habitat improvement land, if it was eventually determined that it was appropriate to include for 'lost' arable.

6.8.6 A key consideration in identifying additional land for foraging marsh harriers is the proximity of any new habitat improvement area to the nesting area in the Minsmere reedbeds. The usage of land by marsh harriers for foraging drops substantially with distance from the nesting areas (see ref), and so a distance of 4km from the western side of the Minsmere reed-beds was set as an appropriate search area for identifying potentially suitable land parcels.

6.8.7 A search for land parcels was undertaken using satellite imagery, in accordance with the following criteria:

- a target land parcel of approximately 30-50ha;
- to exclude the SZC Co. estate (no unaccounted-for land available), the Royal Society for the Protection of Birds (RSPB) Minsmere reserve, and any area with a statutory nature conservation designation;
- excluding woodland areas within the target quantum;
- a strong preference for selecting intensively farmed arable areas, which when appropriately managed, would provide the greatest possible habitat gains for marsh harriers;
- land with appropriate access to enable the land to be managed for marsh harriers; and
- a preference for areas with no, or few Public Rights of Way (PRoW), which could act to reduce the potential for use by foraging marsh harriers (irrespective of the habitat management undertaken).

6.8.8 A total of three sites were identified within the Stage 4 consultation which fulfilled the criteria outlined above. These were:

- Site 1, which is 54.26ha and is located to the west of Westleton. The site includes predominantly arable land. The southern boundary is Yoxford Road and the eastern boundary is Darsham Road. The properties to the west of Darsham Road and Wash Lane are not included in the site.
- Site 2, which is 46.21ha and is located to the south of Westleton. This site includes land either side of Reckford Road with residential properties along that road and in Westleton excluded. Black Slough Road is along the south-eastern boundary of the site.
- Site 3, which is 61.52ha and is located to the south of Eastbridge, east of Theberton and to the north of the proposed accommodation campus. The site is comprised of four separate parcels of land that are predominantly arable land. There is land included both north and south of Onner's Lane, in between Potter's Street, Baker's Hill and Eastbridge Road and east of Eastbridge Road

6.8.9 It was explained at Stage 4 that it would be unlikely for all of the three sites to be required in DCO submission. Site 1 has been chosen because, if deemed to be required, it would best meet the criteria, including the existing land use and the ability of the land to be improved for foraging marsh harriers.

6.9 Fen meadow compensation lands

a) Alternative sites

6.9.1 Approximately 0.7ha of fen meadow is being lost from the Sizewell Marshes SSSI in the main development site to provide the western edge of the Sizewell C platform. Fen meadow compensation areas have now therefore been identified to facilitate the creation of new areas of fen meadow habitats.

6.9.2 A study was undertaken to identify potential sites for provision of fen meadow habitat based on the following criteria:

- Site size: the site has to be of sufficient size to provide adequate compensation for any unavoidable fen meadow habitat lost at Sizewell Marshes SSSI taking account of requirements for conservation management and the need to be sustainable (e.g. resilient to potential effects of climate change such as sea level rise).
- Site status: not currently under conservation management, existing habitats should not be classified as existing fen meadow and should offer significant potential for creation of fen meadow habitats.
- Environmental setting: appropriate hydrology, hydrogeology; hydrochemistry and substrate.
- Connectivity: proximity to existing areas of fen meadow/rush pasture or grazing marsh habitat under appropriate conservation management.
- Accessibility: must be readily accessible for any initial capital works and ongoing conservation management.

6.9.3 Further details on the site selection process are set out in **Appendix 14C4** of **Volume 2** of the **ES.**

6.9.4 Two sites were consulted upon at Stage 4:

- Site 1 is comprised of 12.68ha and is located to the south of Benhall. The A1094 runs along the southern boundary of the site and is predominantly improved pasture.
- Site 2 is comprised of 4.26ha and is located to the east of Halesworth. The south-west boundary is the A144 and Blyth Road marks the north-west boundary. The site is predominantly improved pasture.

6.9.5 The two sites have been identified as suitable because of their location within river valleys and proximity to other fen meadow sites. There were no environmental considerations that distinguished the sites from each other and both sites have been included in the DCO submission for the compensatory habitat. Two sites are included to maximise the likelihood of successful fen meadow establishment.

6.10 Leiston off-site sports facilities

6.10.1 The proposed off-site sports facilities at Leiston would be located adjacent to Alde Valley Academy and Leiston Leisure Centre. They would comprise enhancements to an existing facility and would leave a positive legacy benefit for the local community.

6.10.2 The decision to locate facilities at Leiston, rather than directly adjacent to the accommodation campus, was also taken to help minimise the footprint of the temporary construction area and minimise adverse landscape and visual effects in close proximity to the Suffolk Coast and Heaths AONB. Further details on siting options relating to the accommodation campus are set out earlier in this chapter.

References

6.1 Parliament of the United Kingdom, The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended), (London, 2017).

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6.3 Department of Energy and Climate Change, Overarching National Policy Statement for Energy (EN-1) (London: The Stationery Office, 2011).

6.4 European Commission, Integrated Pollution Prevention and Control (IPPC), Reference Document on the application of Best Available Techniques to Industrial Cooling Systems, (2001).

6.5 Environment Agency, Cooling Water Options for the New Generation of Nuclear Power Stations in the UK, (2010).

6.6 Environment Agency, Screening for Intake and Outfalls: a best practice guide, (2005).

6.7 Environment Agency, Nuclear power station cooling waters: evidence on 3 aspects, (2019).

6.8 Department of Energy and Climate Change, National Policy Statement for Nuclear Power Generation (EN-6). (London: The Stationery Office, 2011).