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Cockenzie Alternative Landfall Cable Installation Method Environmental Appraisal

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1. Introduction

1.1 Background

Seagreen Wind Energy Ltd (SWEL) is a joint venture between SSE Renewables (49%) and Total (51%). SWEL was awarded exclusive development rights in the Firth of Forth Round 3 Offshore Wind Zone (the 'Firth of Forth Zone') by The Crown Estate in 2010. The Firth of Forth Zone lies beyond the 12 nautical mile Scottish territorial waters limit. In 2014, SWEL were awarded the following consents:

1. Seagreen Alpha Marine Licence[1] and Seagreen Alpha S36 Consent[2] for Seagreen Alpha Offshore Wind Farm (OWF);
2. Seagreen Bravo Marine Licence[3] and Seagreen Bravo S36 Consent[4] for Seagreen Bravo OWF; and
3. Seagreen Offshore Transmission Asset (OTA) Marine Licence to Carnoustie[5].

Together these consents comprise 'the Seagreen Project'.

The Seagreen Project is located in the North Sea, in the outer Firth of Forth and Firth of Tay region. It comprises the OWFs (which includes the Wind Turbine Generators (WTGs), their foundations and associated array cabling), together with associated infrastructure of the Offshore Transmission Asset (OTA) (which includes the Offshore Substation Platforms (OSPs) and their foundations and the offshore export cable which will make landfall at Carnoustie and connect to the Tealing substation). The consents described above give permission for the installation and operation of up to 150 WTGs, 5 OSPs and associated electrical infrastructure to export to Carnoustie. As described in the 2020 Construction Programme, 114 of the 150 consented WTGs are currently under construction (beginning in September 2021[6]) and have a grid connection into Tealing, Angus.

To maximise energy generation and facilitate full export capacity from the Seagreen Project, Seagreen 1A Limited obtained consent for an additional export cable corridor (approximately 108 km) from the consented Seagreen Alpha and Seagreen Bravo OWFs to an identified landfall location at Cockenzie[7]. This includes one high voltage export cable to mean high water springs (MHWS), cable landfall and connection to onshore infrastructure and together comprise the 'Seagreen 1A Project 'or 'SG1A Project' (SG1A Project). The SG1A Project is planned to support connection of additional export capacity to accommodate the remaining 36 consented but not constructed WTGs under the Seagreen Project consents. Figure 1.1 presents the location of the Seagreen Alpha and Seagreen Bravo OWFs and SG1A Project.

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[1] Seagreen Alpha Marine Licence

[2] Seagreen Alpha S.36 Consent

[3] Seagreen Bravo Marine Licence

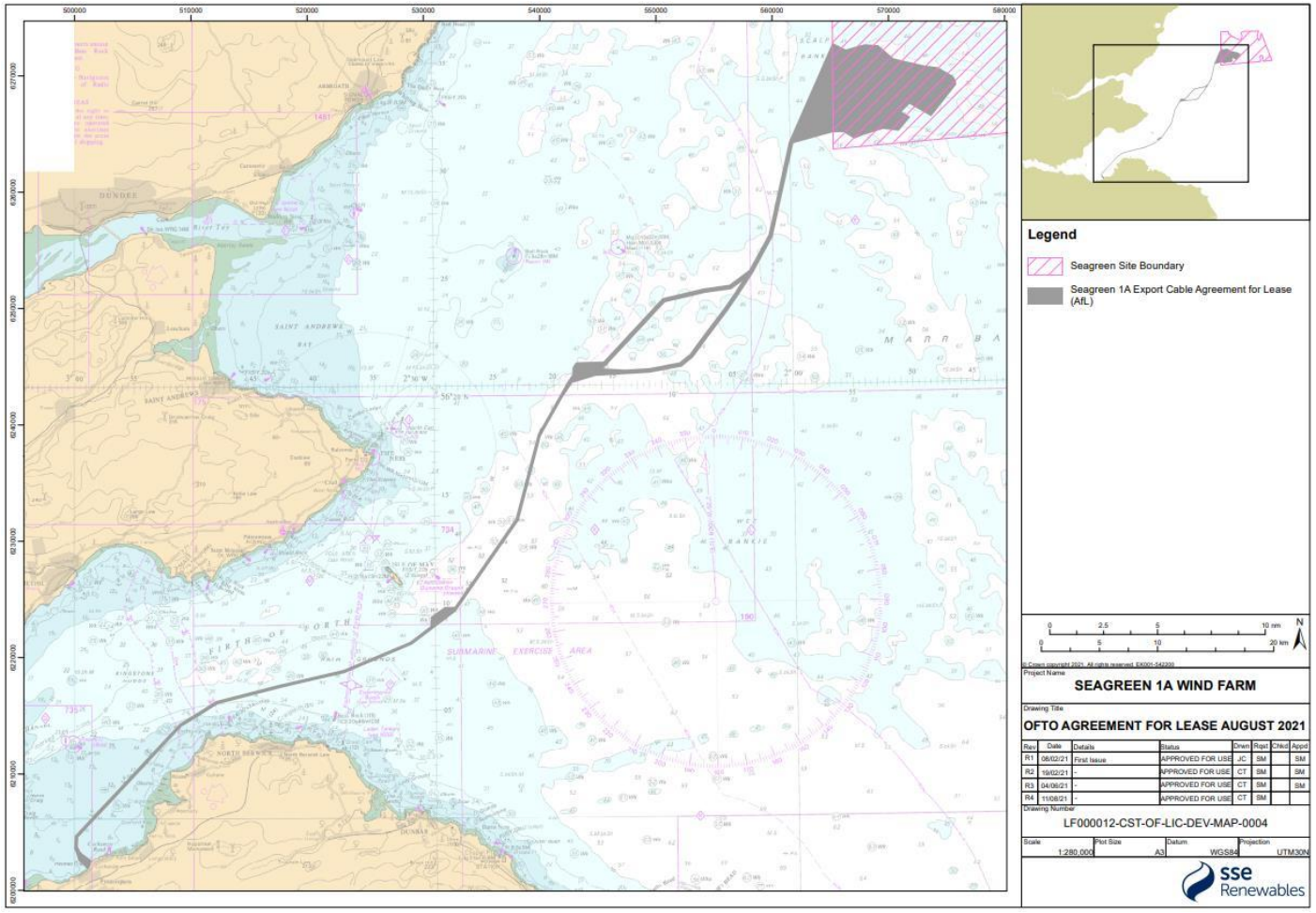
[4] Seagreen Bravo S.36 Consent

[5] Seagreen Offshore Transmission Asset to Carnousite Marine Licence

[6] 2020 Construction Programme

[7] Seagreen 1A Offshore Transmission Asset to Cockenzie Marine Licence

Figure 1.1 SG1A Project Export Cable Route



1.2 Seagreen 1A Alternative Landfall Installation Method

Awarded in December 2021, the existing SG1A Project Marine Licence (Licence Number: MS-00009291) permits the installation of one export cable between the Seagreen Project and the landfall at Cockenzie (the "SG1A Project Marine Licence"). The Licence permits installation of the export cable through the intertidal area using horizontal directional drilling (HDD) under the rip rap sea defence from above MHWS.

SG1A is applying for consent for an alternative landfall cable installation methodology, in addition to the method of HDD already consented under the SG1A Project Marine Licence, although only one installation methodology will be implemented. Since the Seagreen 1A: Offshore Export cable Corridor Environmental Impact Assessment Report ("SG1A Project EIAR") was submitted in March 2021, further geotechnical technical assessment of the ground conditions at and near landfall has shown that HDD installation may pose significant technical challenges.

The alternative method is to allow use of a trenched installation technique (also termed 'open cut' trenching), between the original proposed landward entrance point of the HDD (approximately 10 m above MHWS), across the beach and intertidal zone, down to a depth of 5 m (LAT) (approximately 700 m below charted MLWS) (the "Proposed Works"). The Application boundary is shown in Figure 1.2 below. The use of open cut trenching will alleviate some of the constraints and challenges associated with the site conditions (e.g., morphology, soil types and soil thermal resistivity) at the shore approach and landfall area.

Under the Marine (Scotland) Act 2010, a Marine Licence is required if a person or organisation intends to carry out marine construction works within the Scottish marine area seaward of MHWS and therefore a Marine Licence is required for the alternative landfall cable installation methodology up to the point of MHWS. SG1A's request for a Screening Opinion referred to an application for a new marine licence for the Proposed Works, similar to the approach taken in relation to the Carnoustie Alternative Installation Methodology Marine Licence (ref: MS-000094451), where a new marine licence was awarded that included conditions that referenced the original Seagreen Offshore Transmission Asset (OTA) Marine Licence. However, SG1A also understand from MS-LOT that the application for the Proposed Works could alternatively proceed by way of a variation to the original licence and SG1A would be happy to discuss this route with MS-LOT. Through-out this report the proposal is referred to as the SG1A Alternative Landfall Installation Method application ('the Application').

Separate approval from East Lothian Council is also required and this is being sought under a new onshore planning application.

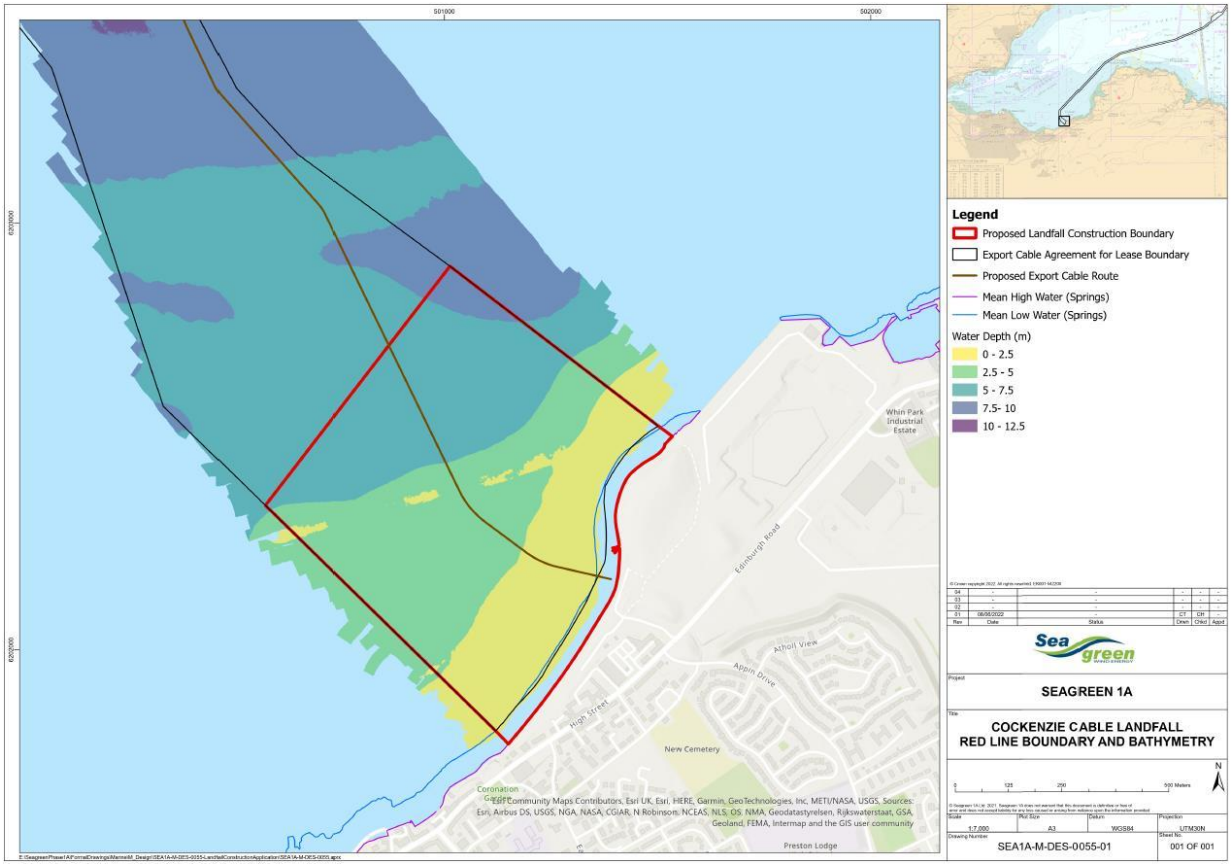


Figure 1.2 The SG1A Alternative Landfall Installation Method Application Boundary

1.3 Consenting Approach

On 07 April 2022, SG1A requested a Screening Opinion under the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (hereafter referred to as the 2017 Regulations) from Scottish Ministers via the Marine Scotland Licensing Operations Team (MS-LOT). The purpose of the request and supporting information was to:

- Provide information required under Regulation 10(2), 10(3) and 10(4) of the 2017 Regulations to allow MS-LOT to determine if the Proposed Works are screened out of being an EIA project;
- Confirm that formal pre-application consultation (PAC) under the Marine Licensing (PAC) (Scotland) Regulations 2013 (the PAC Regulations) is not required for the Proposed Works; and
- Confirm the scope of the proposed Environmental Appraisal to be submitted to MS-LOT the Application.

A Screening Opinion was made by Scottish Ministers on 14 June 2022. Scottish Ministers concluded that an EIA is not required to be carried out in respect of the Proposed Works under the 2017 MW Regulations and are in support of SG1A's proposal to submit an Environmental Appraisal alongside the Application.

1.4 Report Purpose

This Environmental Appraisal has been prepared to support an application to permit an alternative cable installation method (open cut trenching) at landfall for the consented (under the SG1A Project Marine Licence) Seagreen 1A export cable to Cockenzie[7]. The purpose of this Environmental Appraisal is to assess and propose mitigation for any likely significant adverse environmental effects from the Proposed Works.

1.5 Report Structure

The structure of this Environmental Appraisal is as follows:

Section 2, Project Description: this section provides a description of the Proposed Works, the associated licensable marine activities that are the subject of the Application and the proposed programme.

Section 3, Embedded Mitigation: this section sets out mitigation measures embedded into the design of the Proposed Works.

Section 4, Consultation Summary: this section summarises consultation activities undertaken to date.

Section 5, Technical Assessment: this section provides an assessment of the potential environmental impacts and likely significant effects of the Proposed Works including consideration of cumulative and inter-related effects.

Section 6, Summary of Effects: this section summarises the potential significant effects and any mitigation of management measures proposed.

2. Project Description

This section provides a description of the main elements of the design of the Proposed Works and the maximum design scenario used for the technical assessment is presented in Section 2.1.4.

2.1 Proposed Works

The proposed alternative method of installation at landfall is use of a 'trenched installation technique' for the subsea cable (

Figure 2.3).

The Proposed Works can be split in to two main sections with each section potentially requiring different installation techniques:

- Section 1 - The intertidal area (between the rip rap sea defence and MLWS)
- Section 2 – The subtidal area (Between MLWS to 700m offshore)

2.1.1 Section 1 - The intertidal area between the rip rap sea defence and MLWS

Open cut trenching will be used whereby a trench will be excavated using conventional earth moving vehicles such as tracked excavators (Figure 2.2). Following excavation of the trench a high-density polyethylene (HDPE) duct of approximately 780 mm outside diameter will be installed and then the trench will be backfilled and reinstated. The use of a duct enables the trenching activities to be separate to the subsea cable installation process which de-risks the construction programme.

The detailed design of the trench and the depth of the burial of the subsea cable will take account of any expected beach erosion/transport to minimise the risk that the cable becomes exposed during the operational lifetime of the cable. It is anticipated that the trench will be up to 3m deep, with the duct buried at least 1m below the surface.

Although unlikely, there may be a requirement to install temporary sheet piling or a cofferdam in order to provide safe trench side support during excavation. If required, the coffer dam will be a "U shape" cofferdam, with the open end of the "U" facing the land to surround the working area at the rip rap sea defence (

Figure 2.4). The dimensions of the cofferdam are expected to be up to 50 m long by 12 m wide and up to 7m high. The coffer dam would extend through the rip rap sea defence approximately 15 m out onto the beach. The use of a temporary cofferdam would provide a safe and guaranteed working area at all times, including when the tide is in. Once the pipe is installed, the cofferdam would be removed and the affected area would be reinstated.

A section of the subsea cable will have to pass across the existing rip rap sea defence. To facilitate this, a section of the rip rap sea defence will be removed and stockpiled on site. This material will either be stored at the side of the rip rap opening, or alternatively within a storage area adjacent to the landfall/transition joint bay works compound. The opening in the rip rap would be wide enough to accommodate the open cut trench as well as to allow the movement of vehicles to / from the beach. Once the duct is installed, the rip rap sea defence would be temporarily reinstated until the subsea cable is ready to be installed.

For the stretch of beach between the seaward side of the rip rap sea defences and MLWS the cable may be installed as part of the offshore installation campaign by means of direct lay and post lay burial. This would involve floating and lowering the cable to the pipe end at the seaward side of the sea defences following which it would be buried using a jetting machine remotely operated from the vessel (

Figure **2.4**) or trenched using a backhoe excavator (Figure 2.5). This approach may also require the provision of additional cable protection such as the use of cast iron shells, rock dumping and/or concrete flexible mattresses.

2.1.2 Section 2 - Subtidal area (MLWS to 700m offshore)

For the subsea cable installation a winch will be set up on the landward side of the transition joint bay (

Figure **2.6**). A winch bond would be extended through the pipe out onto the beach. The subsea cable will then be floated and winched from the cable laying vessel (Figure 2.7) which delivers the cable to site up the beach, through the pipe and into the transition joint bay. Once the cable is lowered to the seabed the cable will be buried using a jetting machine remotely operated from the vessel (

Figure **2.4**). Where harder substrates are encountered along the offshore section of the cable, mechanical cutting/rock ripping or backhoe excavator (Figure 2.5) may be used to achieve burial. Where burial can't be achieved the cable will be protected by other means (mattresses, cast iron protectors, rock or a combination of).

The offshore burial depth will be sufficient to provide mechanical protection from third party risks and include for any additional risk from long term shallow water sediment erosion. The burial depth will be confirmed prior to installation but is expected to be approximately 1m below the surface of the seabed.

Once the subsea cable is installed into the transition joint bay and all the nearshore works are completed, the rip rap sea defence would then be permanently reinstated.

Figure 2.3 Offshore Cable

Figure 2.4 Cofferdam example

Figure 2.5 Offshore Backhoe Excavator

Figure 2.1 Open Cut Trenching

Figure 2.2 Cable Burial ROV

Figure 2.6 Cable Pull In Winch

Figure 2.7 Cable Lay Vessel

2.1.3 Post-installation Surveys

To ensure the HDPE pipe and/ or cable is buried to the desired depth, a survey will be carried out prior to backfilling of the trenches. Following reinstatement, a topographical survey will be carried out to identify and map the contours of the ground/seabed and to confirm reinstatement to the correct profile.

2.1.4 Maximum Design Parameters

Table 2.1 presents the key maximum design parameters of the Proposed Works.

Table 2.1 Proposed Works Maximum Design Parameters

Parameter	Details
Need for open cut trenching installation method	Following further detailed site investigations and design studies, it has been identified that HDD may pose significant technical challenges due to ground conditions. The alternative method proposed is open cut trenching which is a better technical solution as it alleviates some of the constraints and challenges associated with the site conditions (e.g. morphology, soil types, soil thermal resistivity) at the shore approach and landfall area.
Number of interface joint pits – onshore	One
Number of trenches – onshore *From MHWS to interface joint pits*	One
Number of trenches – intertidal and subtidal *Below MHWS*	One
Dimensions of trenches – onshore (W x D x L) *From MHWS to interface joint pits*	8 m x 2 m x 125 m (trench walls will be sloped at approximately 1:1.5 depending on the ground conditions)
Dimensions of trenches – intertidal and subtidal (W x D x L) *Below MHWS*	25 m x 3 m x 700 m
Length of sheet piling / coffer dam required	50 m long x 12m wide x 7.0m high (from beach to top of sheet piles)

Parameter	Details
Plan area of interface joint pit – onshore	250 m^2
Plan area of trench (onshore)	1,000 m^2
Plan area of trench (intertidal and subtidal)	17,500 m^2
Volume – interface joint pit – onshore	625 m^3
Volume – trenches – onshore	2,000 m^3
Volume – trenches – intertidal and subtidal	52,500 m^3
Working area onshore	125 m x 20 m (2,500 m^2)
Working area below MHWS	700 m x 80 m (56,000 m^2)
Total area temporarily disturbed below MHWS - intertidal and subtidal *Trench area + working area*	56,000 m^2
Storage/laydown/welfare areas and site compounds – onshore *Above MHWS*	Temporary construction compound – 925 m^2 Temporary hardstanding area for subsea cable installation 945 m^2 Two temporary stockpile areas each 150 m^2
Access to works below MHWS	Jack up barge accessed via a crew transfer vessel (CTV) from a local port. The beach area between the joint pit and MLWS may also be accessed by land via the opening in the rip rap sea defences.
Vessels and plant	Plant required to construct the subsea cable may include Jack up 30 m x 30 m /Multicat 26m/80 t tracked excavator/130 t crawler crane. The exact vessels and plant will be confirmed prior to construction.

Indicative duration of works between MHWS and 700m offshore *Includes excavation, installation of cable ducts and or burial of cable and reinstatement*	Open cut trenching in intertidal area and jetting in subtidal out to 700m offshore (without the use of a cofferdam) – 4 months. Open cut trenching with cofferdam (50m seaward from rip rap sea defences) followed by jetting of the cable to 700m below MHWS – 6 months. In the case that the duct is extended from shore to the 700 m mark the cable pull in operation will be undertaken from shore at a later stage, this operation will take approximately 1 day. The construction durations defined above are indicative and will be confirmed prior to installation.
Cable parameters (Typical)	Landfall Cable - (Shallow Water) 2000 mm^2 Copper Core Cable - Outer Diameter 280 mm Weight 135 kg/m. Offshore Cable – 1800 mm^2 Aluminium Core Cable – Outer Diameter 270 mm Weight 127 kg/m.

2.2 Licensable marine activities

The following activities associated with the alternative cable landfall installation are considered to be licensable under the Marine (Scotland) Act 2010 and will be considered within the Environmental Appraisal that supports the Application:

- Temporary removal and storage of material in the intertidal and subtidal zones;
- Creation of working areas in the intertidal zone;
- Open cut trenching and pipe installation in the intertidal and subtidal zones; and
- Backfilling of the trench(es) in the intertidal and subtidal zones.

3. Embedded Mitigation

There are a number of mitigation measures embedded within the design of the proposed alternative cable installation methodology, to reduce potential effects on the environment. In addition, SG1A will require the implementation of a number of industry standard measures during the installation activities, which reduces the potential for certain impacts. These measures are listed in Table 3.1. These embedded mitigation measures have been taken into consideration in the assessment of potential impacts presented in Section 5. Additional topic-specific mitigation and management measures have been specified in the technical assessment in Section 5 where appropriate.

Table 3.1 Embedded mitigation measures

Measure	Description
Selection of appropriate construction plant	Selection of appropriate plant would reduce the potential for over-excavation and reduce delays during construction.
Minimising working and stockpile areas	Working and stockpiling areas would be kept to a minimum size during the construction phase.
Excavation and reinstatement on a 'layer by layer' basis	Excavation of material along each trench would be undertaken in separate sediment layers and material of different grades would be stored separately within temporary stockpile areas where practicable. In intertidal areas, berms will be created to store the material which will be flattened to ensure that the berms do not become too high where practicable.
	Reinstatement in the intertidal zone will be undertaken on a 'layer by layer' basis in reverse order to the excavation sequence. This reduces potential for adverse effects on the sediment structure and profile within the affected area.
Flood Risk	A localised coastal flood warning system will be implemented during construction in consultation with SEPA.
	Where possible, works will not be carried out during a coastal flood or storm event.
Cable burial	A topographic survey will be carried out to identify and map the contours of the seabed, beach and rock revetment prior to construction. Following reinstatement, a repeat topographical survey will be carried out to confirm that the original profiles and bathymetry have been restored.
	The beach and adjoining seabed bathymetry along the line of the proposed cable landfall trench will be regularly surveyed during the lifetime of the project to ensure that there is adequate cover of the HDPE pipe.
	If the HDPE Pipe become exposed, they will be reburied to a suitable depth to maintain adequate cover.
	Weighted collars will be secured on the HDPE pipe to prevent the risk of the HDPE pipe floating up to the surface of the beach due to storm wave induced liquefication of the beach sediments.
Advisory Safety Distances	During cable installation works, working areas in the intertidal zone will be marked off to prevent public access, and advisory safety distances (of up to 500 m radius) will be recommended around the cable installation

Measure	Description
	works in the subtidal zone. Advisory safety distances will be notified via issue of a Notice to Mariners.
Notices to Mariners	Seagreen will issue Notices to Mariners in advance of installation activities to alert vessels and other interests of the timing and location of the works.
Fisheries Liaison	A Fisheries Liaison Officer (FLO) will be appointed for the construction phase. The FLO will maintain dialogue with fishermen prior to all Seagreen construction activities to ensure that fishermen are informed of the activity and are aware of any restricted areas. The fishing community can raise issues regarding the activity with the FLO. Information regarding the works will be provided to the fishing industry through appropriate bulletins, publications and Notices to Mariners.
Environmental Management and Pollution Prevention	An Environmental Management Plan (EMP) and Marine Pollution Contingency Plan (MPCP) will likely form a consent requirement for the alternative cable landfall methodology. These plans will contain proposed measures for the mitigation of construction noise, vibration and dust, and will outline the relevant pollution prevention measures for the works (e.g. bunding and drip catchment for hydraulic oils and fuels).
Waste Management	Wastes will be managed as part of the proposed EMP, which will include waste management measures to minimise, reuse, recycle and dispose of waste streams in compliance with relevant waste legislation.
Archaeological mitigation	An Archaeological Written Scheme of Investigation and Protocol for Archaeological Discoveries will likely form a consent requirement for the alternative cable landfall methodology and will be adhered to throughout the works

4. Consultation Summary

Table 4.1 provides a summary of key points raised during consultation and the responses received to the Screening Request submitted on 07 April 2022. The table details the consultee, date and method of consultation, a summary of the discussion/response received and a response to the consultation with a cross reference to the relevant section of this Environmental Appraisal if applicable.

Table 4.1 Summary of Consultation Responses

Consultee	Date and Method	Consultation Summary	Response and Cross Reference (if applicable)
Angus Council	Screening Opinion	The proposed development would have no direct impact on Angus. Considering the information provided the scale, location and potential impacts arising from the alternative installation method would be unlikely to have significant effects on the environment. Angus Council is therefore of the opinion that a full Environmental Impact Assessment is not required in this instance as it is considered that any potential impacts can be identified and mitigated without requiring the support of a full EIA.	Noted
Dundee City Council	Screening Opinion	No comment on the proposal	Noted
East Lothian Council	Screening Opinion	There is significant existing and consented electricity infrastructure in this area, namely pylons originally serving the former Cockenzie power station, the Inchcape onshore works and the Seagreen proposal. There are also proposals which could have impacts on similar receptors, including the Musselburgh Flood Protection works, which could also impact on the birds of nearby Special Protection Areas. This will be considered through Habitat Regulation Appraisal. Part of the proposed site is within the 'Greenhills' area. This was formerly the laydown site for the construction of the former Cockenzie Power Station and as such it is thought that it may contain contamination (from waste disposal and storage of construction materials). A Phase I Geo-environmental Assessment (Desk Study) should be carried out, with the subsequent report being submitted prior to the determination of any	Potential cumulative impacts of the onshore works on protected sites is assessed as part of the onshore application. Potential onshore geo-environmental impacts are assessed within the onshore application. The Proposed Works involves an alternative installation technique at landfall for a single offshore export cable. Given the small footprint of the Proposed Works and the air emissions and climate change not requiring assessment in the SG1A Project EIAR (as agreed with MS-LOT and NatureScot), the Proposed Works will not

Consultee	Date and Method	Consultation Summary	Response and Cross Reference (if applicable)
		Planning Application for the site. This will allow for the full characterisation of all the relevant pollutant linkages on the site and enable a suitable Ground Investigation to be designed. It is possible that lighting may be required in construction, though this is not mentioned. If it is needed, effects from this will be temporary, and are unlikely to be significant, though should be considered through Habitat Regulation Appraisal and if necessary appropriate assessment. No information is given about the difference in emissions of the proposed and consented methods of construction. Although it is likely quality standards overall will be exceeded in terms of climate emissions, the contribution of the works proposed are minor and do not warrant consideration through EIA. However, the Council encourages provision of this information in the proposed EA. Taking into account comments from specialist colleagues and proposed mitigation measures, it is the opinion of East Lothian Council as Planning Authority that the proposed development does not constitute 'EIA development' under the terms of the EIA regulations.	generate any emissions that will have any notable impact on climate change. In addition, the wider SG1A Project will facilitate the export of clean renewable energy from the Seagreen OWF and therefore the Proposed Works will contribute to the UK achieving renewable energy and net zero emission targets. Therefore, climate change is not considered as part of the assessments included in this Environmental Appraisal.
Fife Council	Screening Opinion	The alternative cable landfall method is unlikely to significantly impact further on the environment than has already been assessed through the environmental assessments carried out to date	Noted

Consultee	Date and Method	Consultation Summary	Response and Cross Reference (if applicable)
Historic Environment Scotland	Screening Opinion	We consider that that there are unlikely to be impacts on our historic environment interests of a level that would require consideration through the Environmental Impact Assessment (EIA) process. We also note that it is proposed to prepare an Environmental Appraisal, in which our cultural heritage interests will be considered, in support of the marine licence application. On this basis, we confirm that we would be content for the proposed works to be screened out of EIA. We recommend that any Environmental Appraisal undertaken for the works should include an archaeological mitigation scheme to account for potential impacts on undesignated archaeological remains.	Potential impacts to archaeology and cultural heritage are assessed in Section 5.9.
Marine Scotland	Screening Opinion	The Seagreen 1A Project is an Environmental Impact Assessment ("EIA") project therefore the Scottish Ministers consider the Proposed Works to fall under paragraph 13 of schedule 2 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ("the 2017 MW Regulations") on the basis that they constitute a change to schedule 2 works already authorised. Consequently, the Scottish Ministers are obliged to adopt a screening opinion as to whether the Proposed Works are or are not, an EIA project under the 2017 MW Regulations. The Scottish Ministers are of the opinion that an EIA is not required to be carried out in respect of the Proposed Works under the 2017 MW Regulations. The Scottish Ministers support SG1A's proposal to submit an Environmental Appraisal alongside any marine licence application for the Proposed Works	Potential impacts of the Proposed Works have been assessed within this Environmental Appraisal, which was informed by consultation responses received in Appendix 1 of the Screening Opinion.

Consultee	Date and Method	Consultation Summary	Response and Cross Reference (if applicable)
		and refer SG1A to the consultation responses in Appendix 1 for advice on the content of this document.	
NatureScot	Screening Opinion	The indicative application area overlaps or is adjacent to a number of European and nationally designated sites which should be considered further, as follows: • Outer Firth of Forth & St Andrews Bay Complex SPA • Firth of Forth SPA • Firth of Forth SSSI • Forth Islands SPA We highlight that the following information should be presented: • temporary loss of supporting SPA/SSSI habitat and effects on prey species; • assessment of disturbance and displacement of the bird populations; • habitat restoration plan or methodology. Additionally, we advise that comparisons of the zone of influence should be made to the relevant Wetland Bird Survey (WeBS) sector as a meaningful scale to assess impacts.	Potential impacts to designated sites highlighted in NatureScot's response are presented in Section 8.
Scottish Borders Council	Screening Opinion	No comments to offer on the Screening Opinion request and would leave that for yourselves/ELC/Nature Scot.	Noted

Consultee	Date and Method	Consultation Summary	Response and Cross Reference (if applicable)
Scottish Environmental Protection Agency	Screening Opinion	Please note that in relation to the issue of the cable for the Seagreen 1A project we would only comment on issues related to the on-shore part of the project. We have already provided a response to the East Lothian Council (ELC) consultation, which deals with the on-shore element of Seagreen 1A project (19 May 2021 21/00290/PPM, Cockenzie.).	Noted

5. Technical Assessment

5.1 Scope and Approach

The Screening Request proposed what topics would be considered further and justified topics to be screened out of further assessment. Based on the Screening Request, subsequent Screening Opinion from MS-LOT, and given the proposed offshore export cable corridor was selected following a robust cable route selection process which considered environmental constraints, engineering feasibility and other marine users in the region, the following offshore environmental topics have been screened into the assessment:

- Natural Fish and Shellfish Resource.
- Marine Mammals.
- Physical Environment and Water Environment.
- Benthic Ecology and Intertidal Ecology.
- Ornithology.
- Archaeology and Cultural Heritage.
- Nature Conservation Designations and Other Designations.

The following topics have been screened out of the assessment:

- Commercial Fisheries.
- Shipping and Navigation.
- Aviation, Military and Communications.
- Seascape, Landscape and Visual Amenity.
- Air Quality.
- Human Health.
- Flood Risk.
- Other Marine Users and Activities.
- Climate Change.

Each topic section presents a summary of the baseline environment, applicable mitigation and management measures and an assessment of potential impacts based on whether the Proposed Works are likely to result in a negligible, minor, moderate or major effect on a receptor, based on the assessment method discussed below.

Consideration of the potential for Likely Significant Effect (LSE) on Nature Conservation Designations and Other Designations is presented in Section 8.

5.2 Method

For each impact identified, the assessment of impact significance has been made. Impact significance considers the sensitivity of the receptor and the magnitude of the effect. The definitions of these vary depending on the individual receptor or parameter assessed. Defining the sensitivity of a receptor is done by regarding relevant guidance, available knowledge and experienced professional opinion. Where guidance does not exist, the term is generally characterised by the receptors ability to tolerate, adapt to and recover from changes in the environment. Consideration is also given to its importance, for example, protected status, economic value or value to the local community. Magnitude of effect provides an indication of the scale and direction of change in the environment, following a project activity. It refers to the 'size' or 'amount' of a change and is a function of other aspects including extent, duration, frequency, likelihood and reversibility.

Following identification of receptor value and sensitivity and magnitude of effect, it is possible to determine the significance of impact. For the purposes of this report, potential impacts identified as major or moderate are generally considered significant and mitigation may be required, while impacts identified as minor or negligible are generally considered not significant

5.3 Cumulative Effects

This technical assessment considers the potential for cumulative effects arising from the alternative landfall cable installation activities identified in Section 2 alongside other known activities. These other activities are based on those identified in the SG1A Project EIAR (SG1A, 2021) combined with a review of any new activities since. Three projects were identified as having the potential for cumulative impacts, Berwick Bank, Inch Cape, and Neart Na Gaoithe OWF.

The cumulative assessment considers potential cumulative effects with other nearby developments in the following sections.

5.4 Natural Fish and Shellfish Resource

5.4.1 Baseline Environment

Due to their mobile nature and wide ranging habits, the study area considered for fish and shellfish species is much larger than that for other species, in order to understand which species have the potential to be present either as adults, or as juveniles in nursery areas. Therefore, in order to give the baseline context, data from the nearest ICES Rectangles was utilised to understand which species of commercial importance may move through the area or be present in the vicinity of the landfall during construction. ICES Rectangles 40E7 and 41E7 are in the vicinity of the Proposed Works. The general area provides spawning and nursery areas for herring, whiting, Nephrops, cod, sandeel, plaice and lemon sole, as well as nursery areas for spurdog, tope shark, common skate, blue whiting, ling, hake, anglerfish, mackerel, sprat and saithe (Coull et al, 1998; Ellis et al, 2012). King scallop (*Pecten maximus*) and queen scallop (*Aequipecten opercularis*) are also present in the area (Seagreen, 2018a, Chapter 9: Natural Fish and Shellfish Resource). Species more likely to be found in shallower inshore waters include whelk (*Buccinum undatum*); lobster (*Homarus gammarus*); velvet swimming crab (*Necora*

puber); juvenile saithe, spotted ray and edible crab (*Cancer pagurus*); and mature female spurdog and tope shark which migrate inshore to give birth to young.

There are no protected sites which are designated due to presence of qualifying natural fish or shellfish species which overlap with the Proposed Works. The River Teith SAC is a protected site within the Firth of Forth, located ~55km west of the landfall, which is designated for migratory fish species. These species include Atlantic salmon (*Salmon salar)* and Sea Lamprey (*Petromyzon marinus*). This SAC is considered in Section 8.

5.4.2 Potential Impacts

5.4.2.1 Cable installation activities may result in temporary subtidal habitat loss/disturbance

Cable installation activities may result in temporary subtidal habitat loss/disturbance to fish and shellfish communities. Trenching activities in the intertidal / subtidal zone during construction would result in a temporary habitat loss/disturbance of up to 56,000 m^2. Any habitat loss/disturbance will be temporary and will take place over a relatively short duration (up to 6 months).

In general, the nursery and spawning grounds that extend into the nearshore area are extensive and cover large areas within the Outer Firth of Forth and Firth of Tay and the wider North Sea (Ellis et al., 2012; Seagreen, 2012, Chapter 12: Natural Fish and Shellfish Resource, SG1A, 2021, Chapter 7). Therefore, only a small proportion of any spawning grounds which coincide with the Proposed Works are likely to be affected. Figure 5.1 and Figure 5.2 show nursery and spawning ground of key fish species in the vicinity of the Proposed Works.

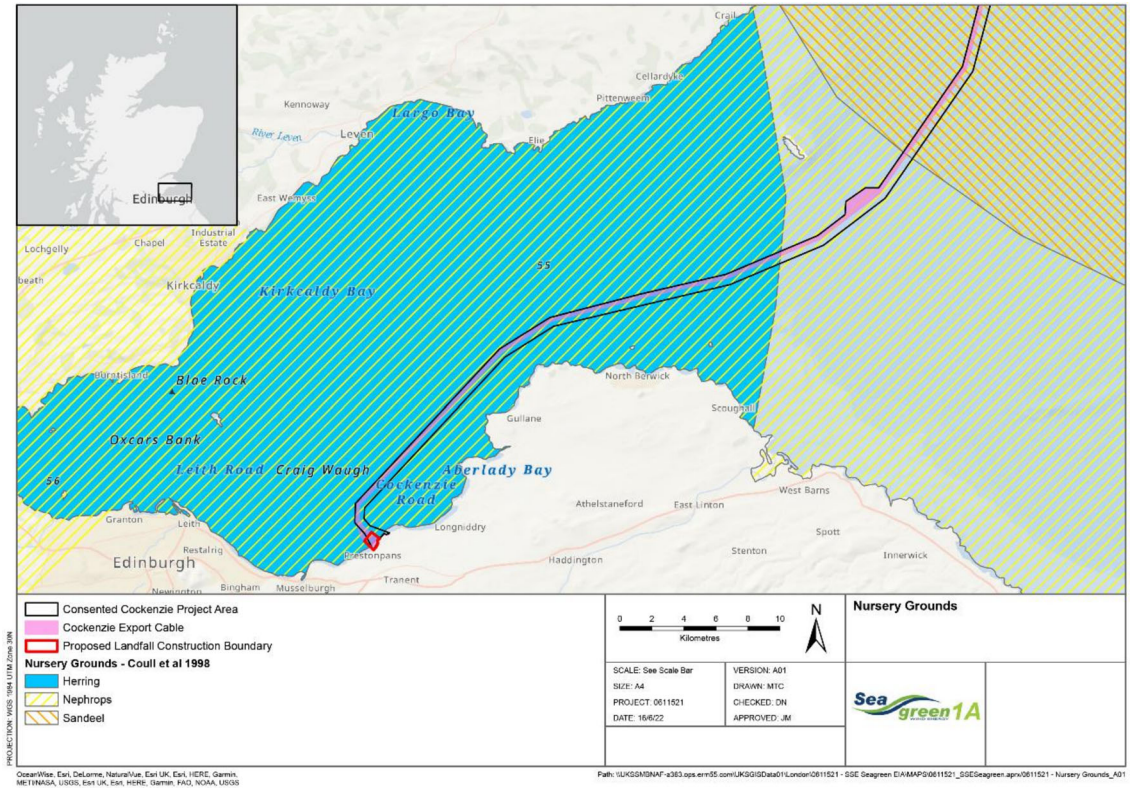


Figure 5.1 Nursey grounds of key fish species in the vicinity of the Proposed Works

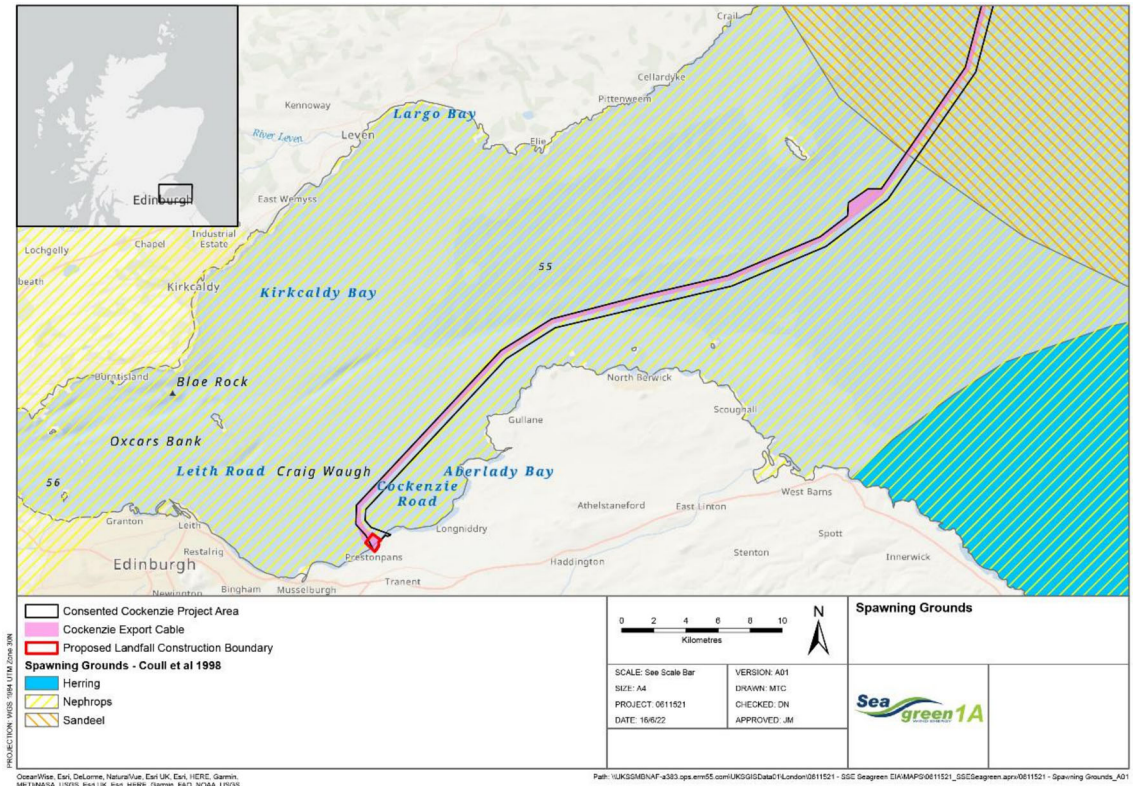


Figure 5.2 Spawning grounds of key fish species in the vicinity of the Proposed Works

The key rivers for migratory salmon are all some distance away from the landfall, the closest being the River Tay, approximately 55 km to the north. While some adults may pass close to the landfall location, recent evidence suggests smolts head directly out to sea on leaving their natal river (Newton et al., 2017) and are unlikely to be in the vicinity of the works in any great numbers, or for any great length of time.

Mobile species will be able to avoid the impacted area and there is unlikely to be any discernible effect due to the availability of similar habitat in the wider area. Sessile shellfish species may be more vulnerable and habitat loss/disturbance could lead to direct loss of individuals in the impacted area. However, the area affected in comparison to the distribution of these species in the wider area is very small. Once installation activities have ceased, habitats will begin to recover and within one or two tidal cycles will return to baseline conditions.

The impact will be of relatively small spatial extent, short term duration, temporary and reversible, therefore the effect of temporary subtidal habitat loss/disturbance on fish and shellfish communities is considered to be **negligible**.

5.4.2.2 Cable installation activities in the subtidal zone may result in temporary increases in suspended-sediment concentration (SSC) and associated sediment deposition

Cable installation activities may result in temporary increases in SSC and associated sediment deposition, affecting fish and shellfish communities. A maximum of 52,500 m^3 of sediment will be removed from the subtidal zone (700 m in length) during trench excavation activities, although the amount of sediment released in any one day will be significantly less than this. Potential increases in SSC will be temporary and will take place over relatively short duration (up to 6 months). Effects will also be reversible, on the basis that levels of SSC will rapidly return to background concentrations following cessation of activities.

Migration of Atlantic salmon takes place throughout the year with smolt downstream migration from rivers (Tay, Forth, Dee, Eden and North and South Esk) occurring between April and May (Malcolm et al., 2015) and adults returning throughout the year with peaks in migration in late summer and early autumn. Mobile fish species will be able to avoid localised areas disturbed by increased SSC.

Deposition of sediment on the seabed may result in smothering of animals, and fish eggs and larvae and shellfish species may be particularly vulnerable due to their lower mobility. In general, the nursery and spawning grounds that extend into the nearshore area are extensive and cover large areas within the Outer Firth of Forth and Firth of Tay and the wider North Sea (Ellis et al., 2012; Seagreen, 2012, Chapter 12: Natural Fish and Shellfish Resource; SG1A, 2021, Chapter 7). Therefore, only a small proportion of any spawning grounds which coincide with the landfall are likely to be affected by increased SSC in the water column and subsequent deposition on the seabed.

The impact will be of relatively small spatial extent, short term duration, temporary and reversible, therefore the effect of increased suspended sediment and associated sediment deposition on fish and shellfish communities is considered to be **negligible**.

5.4.2.3 Cable installation activities may result in underwater noise

Cable installation activities (including cable laying and associated vessel activity) and sheet piling activities have the potential to result in underwater noise, leading to potential effects on fish and shellfish receptors. In relation to cable installation activities, noise modelling undertaken for the Seagreen ES (Subacoustech, 2012) demonstrated that the effect ranges for selected fish species associated with noise generated by cable laying activities, and vessels, will be very small and limited to the immediate vicinity of the area where works are being carried out at a given time. In relation to sheet piling, vibro-piling methods will be used to install sheet piles in the rock revetment and shallow subtidal areas. Modelling of vibro-piling noise undertaken by Subacoustech (2015) for the Beatrice offshore wind farm suggests that noise levels are substantially below injury thresholds for marine mammals (and therefore also fish) and that any lethal effects will only occur within 1 m of the piling activity. Note that it is currently anticipated that installation will be undertaken without the need for sheet piling, however its use has been included as a worst-case scenario.

Adult salmon may be in the vicinity during sheet piling activity, but the magnitude of sound generated will be small scale and significantly smaller than that predicted for foundation piling at the offshore wind farm. Cable trenching noise has been found to be a mixture of broadband noise, tonal machinery noise and transients associated with rock breakage. The level of noise can be highly variable and dependent on the physical properties of the particular area of seabed that is being cut (Nedwell et al., 2003). In general, the power spectral density of cable trenching noise is only some 10 – 15 dB above the level of background noise (Nedwell et al.,2003). Popper *et al*., (2014) suggest that there is a low risk of behavioural effects from noise from hammer piling beyond hundreds of metres for salmon, which is considered to be of medium sensitivity to sound. The nearest salmon river is the River Tay, approximately 55 km to the north. While some adults may pass close to the cable installation works, recent evidence suggests smolts head directly out to sea on leaving their natal river (Newton et al., 2017) and are unlikely to be in the vicinity of the proposed works in any great numbers, or for any great length of time.

Due to the low level, localised, short term and reversible (as fish will start to return to the area once activity has ceased) nature of the impact, and considering the distance of the site to the nearest key spawning habitat, the sensitivity of the receptors (including Atlantic salmon, river and sea lamprey as features of SACs) and the distance from the nearest river designated for key migratory species (55 km to the River Tay SAC), the effect of underwater noise on fish and shellfish receptors is considered to be **negligible**.

5.4.3 Potential Cumulative Impacts and inter-related effects

The potential impacts of the alternative landfall cable installation activities are assessed as being negligible for temporary subtidal habitat loss and disturbance on fish and shellfish communities. The remaining SG1A Project works to the OWF site are likely to result in localised, temporary and reversible effects on fish and shellfish from habitat loss/disturbance, impacts for the SG1A Project were assessed as being minor (SG1A, 2021). The total area affected by both the alternative cable landfall works and the remaining SG1A Project works will represent a small proportion of the total

available spawning and nursery habitat for key species and herring nursery grounds are much further to the north. Migratory species are not likely to be present in any great numbers and will avoid areas where habitat disturbance has occurred. Therefore, cumulative effects are assessed as being **minor**.

The impact of the alternative landfall cable installation activities is assessed as negligible. Effects from the remaining aspects of the SG1A Project will occur further offshore than those from the alternative cable landfall (i.e. beyond 2.5 m LAT) and are unlikely to add to SSC levels in the same area. Cumulative effects on SSC and associated sediment deposition are not anticipated as cable installation will be temporally and spatially sequential along the export cable route. Fish that occur in subtidal areas close to shore are also tolerant of high levels of SSC. Therefore, the cumulative effect of increased SSC and sediment deposition on fish and shellfish communities is considered to be **negligible**.

Impacts on fish and shellfish from underwater noise generated by other SG1A Project construction activities did not require assessment in the SG1A Project EIAR (SG1A, 2021). The impact of underwater noise from the alternative landfall cable installation activities is also assessed as negligible. Any impacts experienced will be short term, localised and reversible with fish returning to the area once activities have ceased. Therefore, the cumulative effect of noise disturbance is considered to be **negligible.**

5.4.4 Conclusion

When considering the effect of the Proposed Works on fish and shellfish receptors, all potential impacts associated with installation activates are localised and deemed to be short-term, temporary and reversible and are therefore considered to be **negligible**. Cumulatively, effects are considered negligible, apart from potential effects due to temporary subtidal habitat loss and disturbance on fish and shellfish communities which is assessed as **minor** based on the SG1A Project EIAR's assessment.

5.5 Marine Mammals

5.5.1 Baseline Environment

Marine mammals have the potential to migrate across large distances and therefore the study area for the purposes of this environmental appraisal is subsequently quite large, encompassing areas within the known foraging ranges of species likely to be present close to the Seagreen landfall.

These species include harbour seal, grey seal, harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale. Scotland supports the greatest numbers of seals in the UK, which provides 80% and 81% of habitats to grey and harbour seals respectively (SCOS, 2019). There are also likely to be Atlantic white-sided dolphin, killer whale, Risso's dolphin, fin whale, long-finned pilot whale, humpback whale and short-beaked common dolphin present within the vicinity of the proposed works, although these species are much less likely to be found in the very shallow, near shore environment of the works location and are, therefore, unlikely to be subject to any impacts from the proposed works.

Within 50 km of the Seagreen Project, there are two SACs designated for the protection of grey seals (i.e. Isle of May SAC and Berwickshire and North Northumberland Coast SAC) and one for the protection of harbour seals (i.e. Firth of Tay and Eden Estuary SAC).

Density estimates from the most recent SCANS-III surveys indicated harbour porpoise are the most abundant species within the vicinity of the offshore Seagreen Project, with an estimated density of between 0.5–0.6 animals/km^2 (Hammond et al., 2017), much higher in comparison to density estimates of bottlenose and white-beaked dolphin, and minke whales.

Biogeographic populations are used to characterise each species as they naturally occur without artificial anthropogenic boundaries (i.e. territorial marine jurisdictions). These are referred to as management units (MUs) (IAMMWG, 2015). The harbour porpoise MU covers the entire North Sea, while the white-beaked dolphin and minke whale MUs cover the Celtic and greater North Seas (IAMMWG, 2015). However, the bottlenose dolphin MU relevant to the offshore SG1A Project, known as the Coastal East Scotland MU (IAMMWG, 2015), has a much smaller, coastal distribution which is predominantly limited to the 20 m depth contour (SG1A, 2021).

There are no protected sites immediately adjacent to the offshore Seagreen Project designated for cetaceans. The closest is the Southern Trench NCMPA, located 91.7 km north of the offshore SG1A Project, which is proposed for the protection of minke whales and the 'Southern Trench', which is a large-scale submarine feature that supports cetacean summer feeding activities (NatureScot, 2019).

Additionally, the Moray Firth SAC is located 147.7 km northeast of the offshore SG1A Project and is designated for supporting the only known resident population of bottlenose dolphins in the North Sea (JNCC, 2020b), which are affiliated with the Coastal East Scotland MU (IAMMWG, 2015). It is recognised that small sub-groups of bottlenose dolphins from the Moray Firth SAC may transit along the coastline to the Firth of Forth, though they predominantly utilise the more accessible sheltered waters of the Firth of Tay and Eden Estuary. The offshore SG1A Project is located within the southernmost extent of the Greater North Sea MU's range for bottlenose dolphins and, given their affiliation with very shallow waters, is not considered to form important habitat to this species.

Harbour seals are affiliated with the East Scotland seal management unit, which is a small and declining biogeographic population which has been historically concentrated within the Firth of Tay and Eden Estuary (Thompson et al., 2019). Furthermore, Grey seals affiliated the East Scotland seal management unit specific to that species (Russell et al., 2019; Thomas et al., 2019). The population sizes associated with these seal management units are 343 harbour seals and 3,683 grey seals, based on the most recent count data (i.e. 2016–2019; Thompson et al., 2019; Thomas et al., 2019). Within 20 km of the offshore Seagreen Project, there is one SAC designated for the protection of grey seals (i.e. Isle of May SAC) and within 50 km one for the protection of harbour seals (i.e. Firth of Tay and Eden Estuary SAC). The harbour seal population within the Firth of Tay and Eden Estuary SAC has undergone unexplained catastrophic declines in the past two decades and now supports approximately 15% of the original population the site was designated to protect (i.e. approximately 40 individuals; Russell et al., 2019). Whereas the Isle of May SAC is the fourth-largest breeding colony of grey seals in the UK

and regularly supports approximately 5,900 animals during the breeding season (between September to December each year; JNCC, 2015; NatureScot, 2015).

Harbour seals are found in the Firth of Tay and Eden Estuary SAC. The 2019 harbour seal count for this SAC was 41 (SCOS, 2020). The most recent count of harbour seal (2016-2019) for the whole of the East Scotland Management Unit (MU) was 343 (SCOS, 2020). Grey seals (Halichoerus grypus) are also found in the vicinity of the proposed work area. The most recent East Coast Scotland MU grey seal complete count was 3,683 (SCOS, 2020).

5.5.2 Mitigation and Management Measures

Embedded mitigation measures part of the offshore Seagreen Project with reference to marine mammals are as follows:

- All vessels will be compliant with the Scottish Marine Wildlife Watching Code (NatureScot, 2017).
- A marine mammal observer (MMO) will be on the geophysical survey vessel to carry out the proposed mitigation.
- The MMO will conduct a pre-shooting search of a 500 m radius mitigation zone. If a marine mammal is observed, survey commencement will be delayed until 20 minutes after the marine mammal has left the mitigation zone or was last observed.
- Soft start procedures will be implemented by seismic survey equipment, where practical, through the uniform ramping up o power. It is acknowledged that this is not possible for some SBP equipment (i.e. It is either on or off) and such instances will be ascertained by the appointed survey contractor; and
- For SBP, in relation to line change procedures, it is interpreted here that equipment should be turned off in line changed (or other pauses) are expected to be longer than 40 minutes, and also where practical if line changes/pauses are less than 40 minutes, with the above pre-shooting search and soft start procedures applying in both cases.

5.5.3 Potential Impacts

5.5.3.1 Cable installation activities may result in noise disturbance

Cable installation activities may result in noise disturbance to marine mammal receptors. The magnitude and spatial extent of the impact from excavation activities is considered to be small, on the basis that the works will be restricted to shallow, nearshore waters (i.e. 2.5 m LAT) where marine mammals are less likely to be relative to deeper waters. In addition, noise modelling (Seagreen, 2012) has demonstrated that the modelled ranges for disturbance associated with cable installation activities (e.g. vessel activity and trenching for cable laying) are highly localised and limited to the immediate vicinity of the area where works are being carried out (up to a maximum of 16 m for vessel noise and 40 m for cable laying (Seagreen, 2012)).

The magnitude and characteristics of vessel noise varies depending on ship type, ship size, mode of propulsion, operational factors and speed. Vessels of varying size produce different frequencies,

generally becoming lower frequency with increasing size. Although it has yet to be determined whether plant will include barge mounted backhoe excavators and whether any rock will be transported to the site, vessels will largely be stationary during much of the installation activities. Where backhoe trenching is used noise from engines or hydraulic power units radiating through the hull of the barge into the water will increase underwater noise. Noise levels are expected to be similar to a small vessel and below the noise levels produced by larger vessels underway which frequently transit past the area out of the Tay. Therefore, noise from backhoe trenching activities is not considered to be a significant contributor to overall underwater noise levels.

The magnitude and spatial extent of the impact from vibro-piling to install sheet piles in the rock revetment and shallow subtidal areas may be greater than that from vessels and trenching/cable laying activities detailed above. However, modelling of vibro-piling noise undertaken by Subacoustech (2015) for the Beatrice offshore wind farm suggests that noise levels generated by vibro-piling are substantially below injury thresholds for marine mammals. Further, modelling by Subacoustech (2015) suggests that behavioural effects may only potentially occur out to a few hundred metres for marine mammals, with behavioural avoidance potentially occurring up to 410 m for minke whales, 100 m for harbour porpoises, 43 m for bottlenose dolphins and 46 m for harbour and grey seals. Only bottlenose dolphins showed a measurable (but weak) behavioural response to both impact and vibration piling, with a small reduction in the amount of time that they spent around the construction works during piling.

Seals and cetaceans may avoid the immediate vicinity of the proposed works area due to the presence of plant (including barges and jack up vessels), and noise generated from cable laying and vibro-piling activity. However, due to the highly mobile nature of all marine mammal species and the small scale of the affected area, this disturbance is not expected to have a significant effect on any individual marine mammals.

Elevations in underwater noise will be localised, temporary and intermittent and will take place over a short duration (up to six months). Effects will also be reversible, with normal activity likely to rapidly resume following cessation of the works and in the gaps between noisy activities during the six month period of the overall programme. Based on the low density of both harbour and grey seals and bottlenose dolphin in the area, their high mobility, and the short duration of vibro-piling activity, it is considered that effects on marine mammals as a result of underwater noise generated during the works will be **negligible**.

5.5.4 Potential Cumulative Impacts and inter-related effects

SG1A Project construction activities will result in short term, localised disturbance to marine mammals from underwater noise. Effects from the SG1A Project were considered to be minor (SG1A, 2021). As underwater noise generating activities at other sites will also be working within the bounds of the Habitats Regulations, including ensuring the mitigation of injury and minimisation of disturbance to marine mammals, there will not be any important impacts generated by activities taking place in combination with other projects. For this reason, it was considered highly unlikely that the installation,

operation or decommissioning of the SG1A Project presented any potential for significant cumulative impacts on marine mammal receptors therefore cumulative effects were considered to be minor.

Given underwater noise generated by the Proposed Works are considered to cause negligible impacts to marine mammals the cumulative effect of underwater noise on marine mammals remains as **minor**.

5.5.5 Conclusion

When considering the effect of cable installation on marine mammal receptors, all potential impacts associated with installation activities conclude that based on the low density of marine mammals in the area, their high mobility, and the short duration of activities, the alternative landfall cable installation activities are considered to be **negligible**. When considered cumulatively, effects of underwater noise are considered to be **minor**.

5.6 Physical Environment and Water Environment

5.6.1 Baseline Environment

The mean spring tidal range across the Firth of Forth is in the order of 4 m, increasing from outer areas towards the inner firth and Estuary, due to the funnelling effect of the coastline (Inch Cape, 2011; 2018). The mean spring current speeds along the SG1A Project range between 0.25–1.0 m/s, increasing across the entrance of the Firth of Forth, between Wormiston and Auldhame (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; c; e; f; h).

Waves across the SG1A Project have an approach from the east to northeast associated with long-period swell waves and from the southwest associated with fetch limited locally generated wind waves. Modelling completed for the Inch Cape ECR indicated the dominant direction along much of the SG1A Project is from the northeast. Where the characteristic wave properties generally reduce towards the coast, due to depth limited influence of the seabed and the sheltering afforded by the coastline. Therefore, the most common significant wave heights associated with winter conditions can vary between less than 0.75 m on approach to the landfall to up to 2 m, with isolated events of up to 5 m (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; c; e). Significant wave heights associated with summer conditions are considerably lower, with maximum heights of 1 m at the offshore extent.

There are several bedrock lithologies along the SG1A Project. The Firth of Forth is underlain by Carboniferous rocks which characterise the bedrock geology (Barne, et al., 1997). Elsewhere, the pre-Coal Measures (Namurian) sandstones and mudstones are largely of deltaic and fluvial origin, including oil-shales and thin limestones. Notably, some of these geological features are unconformably exposed at the coast, which resulted in the designations associated with the Firth of Forth Site of Special Scientific Interest (SSSI).

The seabed bathymetry slopes relatively smoothly from the coast to around 50 m on the Wee Bankie. Across the outer firth and towards the Seagreen Project, there are a number of bedforms and deeps ranging in depth between 40 m and 80 m. Tidally dominated seabed bedforms from mega-ripples to

sandbanks are present along the SG1A Project (Repsol Nuevas Energias UK Limited and EDP Renewables , 2013a; b; e).

The seabed sediment across much of the Firth of Forth predominantly comprises Holocene deposits of unconsolidated sand and gravel, particularly in the outer firth, with increasing silt and mud content towards the inner firth (BGS, 2020). In the outer firth, fine sediment supplied to the estuary by rivers is deposited by strong tidal currents. These currents also scour some parts of the estuary floor, particularly close to the coastline, resulting in large areas of exposed rock on the seabed along the margins of the outer firth. Along the SG1A Project, the seabed sediment follows the general pattern described for the Firth of Forth, with coarser sands and gravels at the offshore extent, transforming to mud-rich sands and mud/silt towards the landfall (BGS, 2020).

Average suspended particulate matter (SPM) across the Firth of Forth is relatively low compared with elsewhere in Scotland and the UK (Cefas 2016). Average measurements of 1–2 mg/l were assessed for the period between 1998 and 2015, increasing to about 3–5 mg/l closer to the coast. Sediment concentrations along the SG1A Project over the winter months are around 2–3 mg/l increasing to 5 mg/l at the coast, while during the summer months, the SPM are generally around 0–1 mg/l everywhere (Cefas, 2016). Site observations at Neart na Gaoithe, in proximity to the SG1A Project in the summer of 2010, identified concentrations ranging between 3–8 mg/l (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; e; f; I; j; k). These lower concentrations were estimated to be associated with calm weather conditions at an offshore location, whereas concentration of around 20 mg/l were more characteristic of the outer firth area, increasing to much higher concentrations at the coast.

The SG1A Project intersects two conservation sites which are designated for geodiversity features, the sites as well as the qualifying interest features are as follows:

- Firth of Forth Banks Complex NCMPA
  - Offshore subtidal sand and gravels;
  - Quaternary of Scotland;
  - Moraines (geodiversity feature); and
  - Shelf banks and mounds.
- Firth of Forth SSSI
  - Coastal geomorphology of Scotland;
  - Carboniferous – Permian Igneous;
  - Maritime Cliff;
  - Mineralogy of Scotland;
  - Mudflats;
  - Lower Carboniferous (Dinantian – Namurian (part));
  - Quaternary of Scotland;
  - Saltmarsh;
  - Sand dunes; and

- Upper Carboniferous (Namurian (part) – Westphalian).

The temperature of surface waters in the outer Firth of Forth is relatively uniform, averaging 5.5 – 6.0°C in winter and 13°C in summer, suggesting efficient mixing of fluvial outputs into the marine environment. The salinity of the seawater in the region is generally only very slightly below that of oceanic water (35 g/kg) and is fairly homogenous across the Firth of Forth (Dyke, 1987).

The SG1A Project crosses a number of designated coastal water bodies within Scotland river basin district and are as follows:

- Firth of Forth Outer – Offshore;
- Eyebroughty to North Berwick;
- Port Seton to Eyebroughty; and
- Leith Docks to Port Seton.

Each of the coastal water bodies are assessed as having a Good water quality status, based on recent available information obtained from the SEPA water environment hub. However, the overall condition is Good for all the water bodies except Leith Docks to Port Seton, which is Poor, primarily due to the physical condition in relation to modification to the seabed, banks and shores (SEPA, 2020).

The designated bathing water in proximity to the cable landfall location is Seton Sands at approximately 1 km from the landfall and is at a Good status (SEPA, 2020). The other bathing water approximately 2 km from the SG1A Project is Gullane, with an Excellent status. All other bathing waters are over 2 km from the cable corridor or landfall location and are therefore not applicable to the SG1A Project. There are no designated shellfish waters within the Firth of Forth or in proximity to the SG1A Project (SG1A, 2021).

Sediment contaminant samples were collected and analysed from locations within the Inch Cape development area, with two samples within the Inch Cape export cable corridor (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013l). For the samples located within the Inch Cape export cable corridor contaminant levels were below CEFAS Action Level 1 (AL1) for the majority of contaminants (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013l). However, occurrences of Chromium, Copper and Nickel, did have contamination above AL1, but the levels were only just over the threshold and were not necessarily repeated in both samples taken at each location, indicating the contamination is most likely localised. There were no occurrences of contaminants above Cefas AL1 associated with Poly-Aromatic Hydrocarbons (PAH), Poly-Chlorinated Biphenyls (PCB) and Organotins or any occurrences of contaminants above Cefas AL2 (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013l).

5.6.2 Potential Impacts

5.6.2.1 Cable installation activities may disturb geomorphological features designated as part of the Firth of Forth SSSI, Ramsar and SPA

Cable installation activities have the potential to disturb the designated geomorphological features of the Firth of Forth SSSI, Ramsar and SPA sites which includes embryonic shifting dunes and fixed coastal

dunes. The proposed location for the trench is within the boundary of the Firth of Forth sites and therefore will directly disturb these sites, however the magnitude of the direct disturbance is considered to be negligible given the overlap with the protected areas being less than 0.001%. SG1A Project comprising of a single export cable, and the works being short-term and temporary in nature, any impacts to the SSSI are expected to be less than those defined for Inch Cape (Inch Cape, 2011; 2018) due to Inch Cape's project design including two export cables requiring a larger trenched area. Any increases in SSC in relation to the SG1A Project will also be highly localised and temporary. For these reasons, it is considered that any effects on the geomorphological features of the Firth of Forth SSSI, Ramsar and SPA sites will be **negligible**.

5.6.2.2 Cable installation activities may affect sediment transport processes

The temporary presence of the trench, trench boxes and sheet piling have the potential to affect sediment transport processes by interrupting longshore sediment transport. Cable installation activities will involve the excavation of either one open trench across the intertidal and subtidal zones with the potential for sheet piling in subtidal areas (and the rock revetment) and trench boxes in areas of dry ground. Effects will be temporary, short term and reversible and would not be enough to disrupt or alter the regional wave and tidal processes or the associated sediment transport in this area of the Firth of Forth and will be reinstated naturally within a few tidal cycles following completion of the works. For these reasons it is considered that any effects on sediment transport processes will be **negligible**.

5.6.2.3 Cable installation activities in the intertidal and subtidal zones may increase Suspended Sediment Concentrations (SSC) within the water column and deposit material on the seabed

Cable installation activities may increase SSC in the water column and lead to subsequent deposition of material on the seabed. Increases in SSC are likely to be localised, with deposition occurring within a short distance either side of the trench. Increases in SSC will be temporary and occur over a relatively short duration of trenching and backfilling activity, occurring over one installation event. Effects will also be reversible, with SSC likely to return to baseline levels relatively quickly following completion of works (SG1A, 2021).

The designated bathing waters surrounding Cockenzie are generally classified as 'good' or 'sufficient' status, with the Seaton Sands being the closest at approximately 1 km north-east of the Proposed Works. While the works are close to the bathing waters, it is considered unlikely that sediment disturbed during the works would affect the bathing waters. While the generated SSC sediments has the potential to affect the bathing waters sediments are expected to quickly settle out within tens to a few hundreds of metres and over a period of seconds to minutes (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; e; f). For the finest sediment, although these may persist in the water column for longer, these would also settle out within hours of disturbance at a maximum dispersion distance of less than 3 km (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; e; f). The resulting sediment deposition thickness over the sediment plume footprints, would be

indiscernible at the greatest distance to only a few centimetres beyond the export cable corridor (Repsol Nuevas Energias UK Limited and EDP Renewables, 2013a; b; e; f).

Due to the short-term, localised and temporary nature of the potential impact, the effect of cable installation activities on increased SSC within the water column and associated deposition is considered to be **negligible**.

5.6.3 Potential Cumulative Impacts and inter-related effects

The remaining SG1A Project installation works (i.e. the installation of the export cable from the point at which the alternative cable landfall works are completed (2.5 m LAT) to the OWF) will take place in the subtidal zone. As a result, these works are only likely to interact with the subtidal aspects of the alternative cable landfall works. Increases in SSC and deposition will be limited in spatial extent to the length of the trench, and for deposition, a short distance either side. Any potential effects will be of short duration. Cumulative effects on SSC and associated sediment deposition are not anticipated as cable installation will be temporally and spatially sequential along the export cable route. Effects from the subtidal elements of the remaining Seagreen Project installation works are expected to be negligible (SG1A, 2021) and will occur further offshore than those from the alternative cable landfall (i.e. beyond 2.5 m LAT). As a result, any cumulative effects are expected to be **negligible**.

There is considered to be no potential for cumulative effects to the Firth of Forth SSSI, Ramsar and SPA as other Seagreen project activities to install the export cable in subtidal areas (e.g. jetting and ploughing activity) will not disturb these features.

Effects on other marine users and activities from the SG1A project were screened out of requiring assessment (SG1A, 2021). Therefore, it is considered that any effects to the bathing waters will remain **negligible**.

There is considered to be no potential for cumulative effects in relation to flood risk as other Seagreen project activities to install the export cable in subtidal areas (e.g. jetting and ploughing activity) will not disturb these features. There is considered to be no potential for cumulative effects in relation to beach drawdown and cable exposure as other Seagreen project activities to install the export cable in subtidal areas (e.g. jetting and ploughing activity) are unlikely to affect the processes that determine the beach profile.

5.6.4 Conclusion

When considering the effect of cable installation on the physical and water environment receptors, most potential impacts and cumulative impacts associated with installation activates are localised and deemed to be short-term, temporary and reversible and are therefore considered to be **negligible**. However, due to a potential for cable to become exposed the potential effect due to beach lowering is considered **minor**, however, any impacts is considered to be short term and localised and will be removed once the HDPE pipe are reburied.

5.7 Benthic Ecology and Intertidal Ecology

5.7.1 Baseline Environment

The intertidal area in the vicinity of the proposed cable installation works and application boundary at the Cockenzie landfall is described within the SG1A ES as ranging from sandy gravel on the upper to mid shore, to sandy gravel and cobbles on the mid to lower shore. Algal growth on mid to lower shore with biotopes 'Barnacles and Littorina spp. On unstable eulittoral mixed substrata (LR.FLR.Eph.BLitX). Down to shore, *Fucus spiralis* on full salinity upper eulittoral mixed substrata (LR.LLR.F.Fspi.X) are more prevalent. Subtidal surveys close to the intertidal show sediments classified as more heterogeneous infralittoral mixed (IMx) and circalittoral mixed (CMx) derived biotopes. The application boundary overlaps with the Firth of Forth SSSI, SPA and Ramsar Site and Outer Firth of Forth and St Andrews Bay Complex SPA.

5.7.2 Potential Impacts

5.7.2.1 Cable installation activities may result in temporary intertidal and subtidal habitat loss/disturbance

Cable installation activities may result in temporary benthic habitat loss or disturbance. A total area of temporary habitat loss/disturbance resulting from trenching activities and associated working areas within the intertidal and subtidal zones is up to 56,000 m^2. This figure is considered to be relatively small in the context of the presence of similar habitats in the wider area (i.e. Firth of Forth).

Recolonisation is likely to occur via recruitment from adjacent populations, and therefore recovery potential is considered to be high (Tilling and Budd, 2016).

Habitat loss/disturbance will be temporary and will take place over a relatively short duration (up to six months). Effects will also be reversible, with trenches in the intertidal zone being backfilled on completion of the works and trenches in the subtidal zone allowed to backfill naturally.

The impact will be of relatively small spatial extent, short term duration, temporary and reversible, and considering the nature of the benthic environment at this location and the potential for recoverability, the effect of temporary habitat loss/disturbance is considered to be **negligible**.

5.7.2.2 Cable installation activities in the subtidal zone may result in temporary increases in SSC and associated sediment deposition

Cable installation activities may result in temporary increases in SSC and associated sediment deposition, leading to smothering of subtidal benthic communities. Up to 52,500 m^3 of sediment will be removed from the 700 m long subtidal zone during trench excavation activities. However, as the excavation will occur over a number of days the amount released into the subtidal zone will be substantially less than this volume each day and is unlikely to result in significant additional SSC in the water column.

Increases in SSC will be temporary and intermittent and will take place over a relatively short duration of trenching and backfilling activity, occurring over one installation. Effects will also be reversible, on

the basis that levels of SSC are likely to rapidly return to background concentrations following cessation of the activity.

The impact will be of relatively small spatial extent, short term duration, temporary and reversible, and considering the nature of the benthic environment at this location, the effect of increased suspended sediment and associated sediment deposition is considered to be **negligible**.

5.7.3 Potential Cumulative Impacts and inter-related effects

Potential impacts from the SG1A Project to benthic and intertidal ecology receptors, such as habitat loss/disturbance in the subtidal and intertidal zone, were scoped out of requiring assessment (SG1A, 2021). The impact of the alternative landfall cable installation is assessed as being negligible. Therefore, cumulative effects of the Proposed Works are considered to be **negligible**.

Cumulative effects on SSC and associated sediment deposition are not anticipated as cable installation will be temporally and spatially sequential along the export cable route. Therefore, the cumulative effect of increased SSC and sediment deposition on subtidal benthic communities is considered to be **negligible**.

5.7.4 Conclusion

When considering the effect of cable installation on benthic ecology and intertidal ecology receptors, all potential impacts associated with installation activates are localised and deemed to be short-term, temporary and reversible and are therefore considered to be **negligible**.

5.8 Ornithology

5.8.1 Baseline Environment

The cable laying process has the potential to disturb and displace birds using shoreline, nearshore and marine habitats. However, risk of disturbance and displacement is considered to be highly localised so the baseline environment relevant to this assessment covers only a small coastal and beach corridor.

Consideration has therefore been given to this baseline data and whether there were any large concentrations of birds recorded on or in proximity to the cable route corridor.

The construction activity would take place in within the Firth of Forth SPA, and Outer Firth of Forth and St Andrews Bay Complex SPA. The sites are designated for a variety of bird populations of European importance including Arctic tern, Atlantic puffin, common tern, Manx shearwater, northern gannet, black-headed gull, common eider, common goldeneye, common gull, common scoter, little gull, long-tailed duck, razorbill, red-breasted merganser, red-throated diver, Slavonian grebe, velvet scoter, guillemot, European shag, herring gull and kittiwake (SNH, 2016).

Site specific intertidal and nearshore bird surveys that supported the SG1A Project showed the inshore waters of the Firth of Forth provide foraging for breeding seabirds in particular shag, gull and tern species. They also provide important foraging and resting habitat for wintering red-throated diver, grebe and seaduck species (SG1A, 2021).

During an intertidal survey carried out between 2015 and 2016 (Seagreen, 2016b) a total of 41 different bird species were recorded, 14 of which were species associated with the Outer Firth of Forth and St Andrews Bay Complex SPA. The most common species were observed to be a mixed assemblage of seagulls, waders, ducks and divers occurring across the intertidal area of the landfall. For all species recorded, the distribution across the survey area was generally even with no distinct clusters of activity. However, across the intertidal area these species were recorded as being evenly distributed. Birds are also regularly disturbed by other activities such as shooting at the Barry Sands firing range and by dog walkers (Seagreen, 2016b).

5.8.2 Potential Impacts

5.8.2.1 Cable installation activities may result in temporary disturbance or displacement of birds

The combination of visual and noise disturbance from construction activity has the potential to cause displacement and disturbance to birds. This result is that the impacted birds behave differently from the behaviour they would be reasonably expected to exhibit without the presence of that activity (Gill, 2007). Disturbance can manifest in a number of forms of varying severity depending on the nature, duration and intensity of the disturbance source:

- Birds looking up or heads raised, temporarily stopping feeding or roosting.
- Birds moving away from the cause of the disturbance by swimming before resuming previous activity.
- Birds taking flight and landing somewhere in the same feeding area.
- Birds taking flight and leaving the survey area completely (i.e. displacement).

The resulting impacts of disturbance from construction activities for seabirds birds are variable (Cutts et al., 2013). In general, each subsequent level of severity will result in a greater reduction in feeding time, and greater energy expenditure. Flushing (moving away in response to disturbance) is an energetic implication that, in severe and prolonged cases, can result in decreases in the overall fitness of a population, which in turn can lead to reduced breeding success and increased mortality. Birds that are more tolerant than other individuals and remain in an area affected by disturbance may not forage efficiently, and if there are additional pressures on the birds (for example cold weather), then this may impact upon the survival of individual birds or their ability to breed later in the year.

For birds on the sea, behavioural responses to the presence of vessels also involve flushing, either into flight or by diving in the case of species such as divers and auks. This reduces feeding time and increases energy expenditure, with knock on impacts to breeding success and mortality possible.

Birds in a coastal setting, including qualifying and assemblage species of the SPA, have large foraging ranges, and are adapted to move to find food, notably in response to the tidal cycles and moving distribution of prey. Considering this ability, the widespread availability of alternative roosting and foraging habitat, a degree of existing habituation to disturbance (given recreational and other beach and coastal activities), the temporary and reversible nature of this effect, the effect of this disturbance/displacement is considered to be **negligible**.

5.8.2.2 Cable laying activities may result in lighting impacts on nocturnal species

The vulnerability of species to the effects of bright lights is informed by the studies by Merkel (2010) and Syposz *et al*. (2018) and information on the tendency for a species to be nocturnally active (Furness *et al*., 2012). It is concluded that bird species in the vicinity are not typically vulnerable to vessel lighting, with the exception of Manx shearwater. As there will only be a maximum of two construction vessels required, there will be low levels of light produced from the project activities compared with the typical levels of light emitted from vessels which are present in the wider area. Taking the above into account, along with the temporary short-term nature of any night time construction works, the potential effect of lighting on nocturnal species is **negligible**.

5.8.3 Potential Cumulative Impacts and inter-related effects

There is potential for cumulative disturbance/displacement of coastal birds during any temporal overlap between the alternative cable landfall installation works and installation of the remaining SG1A Project. It should be noted that birds in a coastal setting, including qualifying and assemblage species of the SPA, have large foraging ranges, and are adapted to move to find food, notably in response to the tidal cycles and moving distribution of prey. Potential impacts, including potential cumulative effects, of the SG1A Project to ornithology receptors were scoped out of requiring assessment. As potential disturbance/displacement impacts coastal birds is assessed as negligible, cumulative effects are also assessed as **negligible**.

There is the potential that that the remaining SG1A Project will act cumulatively with the alternative landfall cable installation works on birds present in both intertidal and terrestrial environments. Birds in the intertidal area are likely to be disturbed by noise generated by plant and machinery. However, it is unlikely that noise generated by the machinery and plant operating onshore will add to this disturbance, due to the distance between the activities. Therefore, it is considered that cumulative effects of temporary disturbance or displacement are unlikely to occur and if they did, they would be **negligible**.

5.8.4 Conclusion

When considering the effect of cable installation on ornithological receptors, all potential impacts associated with installation activates are localised and deemed to be short-term, temporary and reversible and are therefore considered to be **negligible**.

5.9 Archaeology and Cultural Heritage

5.9.1 Baseline Environment

The nearest recorded wreck location to the proposed cable installation works is approximately 20 km to the north east inside of the export cable route corridor, identified as possibly the FV Malta. The FV Malta was of a vessel type and with a cargo of no significant heritage value, so considered to be of low importance. There are no Designated Wrecks or other cultural heritage assets with legal designations within the export cable route corridor. Five ‘Live’ wrecks were identified within the export cable route corridor (SG1A, 2021).

There are a number of recorded maritime and aircraft losses within the study area considered in the ES, a number of which have known positions, and which have been confirmed in the archaeological assessment of geophysical data (SG1A, 2021). A significant number of maritime loss events, both vessels and aircraft have been identified in the wider outer Forth and North Sea basin in proximity to the Seagreen Alpha and Seagreen Bravo project areas. Further, there are a large number of maritime losses listed with arbitrary or tentative locations recorded within the region. With embedded mitigation measures, impacts on the marine historic environment were assessed as minor adverse and not significant in EIA terms (SG1A, 2021).

5.9.2 Mitigation and Management Measures

Embedded mitigation measures part of the offshore Seagreen Project with reference to Archaeology and Cultural Heritage are as follows:

- The avoidance of known assets and identified geophysical anomalies that are likely to be anthropogenic will be the primary mitigation, embedded in the design of offshore SG1A Project export cable corridor;
- Undertake marine geophysical surveys (sidescan sonar, magnetometry, multi-beam echosounding) to recognised standards sufficient for archaeological review (reconnaissance level in Plets et al 2013) to identify objects on the seabed (or just buried at the surface) that are 1–2 m in size, in order to capture the presence/absence of anchors, cannon and aircraft engines that could indicate assets of moderate or high importance;
- A project-specific marine archaeological Written Scheme of Investigation (WSI) and a Protocol for the Accidental Discovery (PAD) of items of archaeological interest will be produced in consultation with the statutory authorities to manage potential impacts. The WSI and the PAD will be based on The Crown Estate's 2010 Model Clauses for Written Schemes of Investigation: Offshore Renewables Projects. This document is in the process of revision, and the latest version will be used if issued in time where the WSI will:
  - Set out the roles and respective responsibilities of the Project Team, including Contractors, and Archaeological Contractors and formal lines of communication between the parties and with Archaeological Curator(s);
  - Outline the agreed mitigation and archaeological actions that are to take place in various circumstances to avoid impact on the known and potential marine historic environment assets;
  - Provide detailed methodologies for these archaeological actions.
  - Establish the position and extent of Archaeological Exclusion Zones, and methodologies for their monitoring, modification and/or removal;
  - Ensure that any further geophysical, geotechnical, ROV, diver, or obstruction investigations associated with the project are subject to archaeological input and review of data, recording and sampling; and
  - Establish the reporting, publication, conservation and archiving requirements for the archaeological works undertaken in the course of the scheme.

- The marine PAD will set out a system for reporting unexpected finds of archaeological interest during route clearance, installation and as-built survey activities, thus reducing any adverse effects of the offshore Project on the marine historic environment by enabling people working on the Project to report archaeological discoveries as part of their work. The PAD will include an archaeological finds management plan for proper recording and analysis of any unexpected finds. The PAD will also cover site inductions and toolbox talks, so that personnel are made aware of the potential for unknown remains, and the procedures for reporting them

5.9.3 Potential Impacts

5.9.3.1 Cable installation activities may affect marine archaeology

Cable installation activities have the potential to affect marine archaeology through direct and indirect impact to the seabed. It is also possible that finds of archaeologist interest may be identified as a result of trenching activities.

The nearest recorded wreck location to the landfall is approximately 7 km to the north east of the cable installation works. While there is still potential for new finds and material to be discovered, mitigation will be secured through a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD), which will include the establishment and avoidance of Archaeological Exclusion Zones (AEZs) and the means of reporting any potential discoveries to the project archaeologist during the works.

The spatial extent of the impact will be limited to a short section of the intertidal and subtidal cable route. Any impact on marine archaeology would be permanent and irreversible, however, as noted above mitigation will ensure direct impact is avoided. The period over which there is potential for impact to occur is of short-term duration (up to six months).

Seabed disturbance may cause secondary physical effects to marine archaeology assets through settlement of SSC out of the water column, however the increases in SSC from the cable installation activities are anticipated to be short term and localised, with associated sediment deposition also predicted to be localised.

Due to the implementation of a WSI and PAD, and due to the short term and localised nature of increased SSC and associated sediment deposition, the effects of cable installation activities on marine archaeology are considered to be **negligible**.

5.9.4 Potential Cumulative Impacts and inter-related effects

Other Seagreen construction activities have the potential to affect archaeological assets, particularly the trenching works for the remainder of the cable route to the Seagreen OWF. Given that the alternative landfall cable installation works and the remaining installation works will be subject to an agreed WSI and PAD, it is considered that any cumulative effects will be effectively managed and therefore **negligible**.

5.9.5 Conclusion

When considering the effect of cable installation on archaeological receptors, all potential impacts associated with installation activates with the implementation of a WSI and PAD are localised and deemed to be short-term, temporary and reversible and are therefore considered to be **negligible**.

6. Cumulative Effects

The Seagreen Project lies in the vicinity of other projects which have the potential to affect receptors in a cumulative fashion, namely Inch Cape OWF, Neart Na Gaoithe OWF and Berwick Bank OWF. Based on assessments completed in the Seagreen Cockenzie Screening Report and this Environmental Appraisal it is concluded that as the Proposed Works will not cause any further significant effects compared to the consented Project, an update to cumulative effects would not be necessary as it will not change cumulative effects assessments undertaken by more recent developments.

7. Inter-related Effects

This section examines the potential for inter-related effects to occur during the alternative cable landfall installation project. These are considered to be:

- Project lifetime effects: Assessment of the potential for effects that occur throughout more than one phase of the project (e.g. installation, operation and maintenance, decommissioning), to interact to potentially create a more significant effect on a receptor than when assessed in isolation; and
- Receptor led effects: Assessment of the potential for effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, effects on Benthic Ecology and Intertidal Ecology receptors may interact to produce a different or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

7.1 Project Lifetime Effects

The greatest potential for project lifetime effects to occur with respect to the alternative cable landfall are associated only with installation activities. There are unlikely to be any impacts during operation and maintenance (due to the cable being buried under the rock revetment and intertidal and subtidal areas). Further, any effects that may occur as a result of decommissioning are likely to be of a similar or lesser scale to those experienced during construction. In addition, the effects will be separated in time (25 years) and will be localised, temporary and of short term duration.

Therefore, across the project lifetime, effects are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

7.2 Receptor-led Effects

It is considered that the greatest potential for receptor led effects across the lifetime of the alternative cable installation project is in relation to potential effects on the Physical Environment and Water Environment, Benthic Ecology and Intertidal Ecology and, Natural Fish and Shellfish Resources. These effects were assessed as negligible in isolation, and although potential combined effects may arise (i.e. spatial and temporal overlap of effects), it is predicted that this will not be any more significant than the individual effects in isolation. This is due to the effects being localised, temporary and short lived over a short timescale. In addition, designed-in measures will also serve to ensure effects remain negligible. Therefore, any potential receptor led effect interactions are predicted to be no greater than the individual effects assessed in isolation.

8. Consideration of Capability of Affect or Likely Significant Effects on Protected Sites

8.1 Initial site identification

Within the SG1A Project Marine Licence, the scoping of Protected Sites was informed by advice from NatureScot. Designated sites with marine components which are located along or in the vicinity of the export cable corridor and landfall alongside sites which are protected for their coastal and marine features of nature conservation importance within the Firth of Forth were included.

The identification of designated sites was undertaken with reference to the qualifying interests or features were in line with:

- Identifying the range of impacts that the offshore SG1A Project could have on qualifying feature(s) of a site (impact pathways); and
- Determining connectivity with the sites.

The following criteria, based on the above, was used to identify the designated sites that would require further consideration:

- SPAs and NCMPAs (including proposed and candidate sites) with breeding seabird qualifying features with Mean Maximum foraging ranges (as identified by Woodward et al., (2019)), that overlap with the offshore SG1A Project export cable corridor.
- SACs (including proposed and candidate sites) with harbour seal interests within 50 km of the offshore SG1A Project export cable corridor and breeding grey seal within 20 km of the offshore SG1A Project export cable corridor.
- Designated seal haul outs that overlap with or are located within 500 m of the offshore SG1A Project export cable corridor.
- SACs (including proposed and candidate sites) with otter interests that overlap with or are located within 500 m of the offshore SG1A Project export cable corridor.
- SACs and NCMPAs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the offshore SG1A Project export cable corridor, or where the qualifying features of a designated site are known to be present within the vicinity of the works.

- SACs with Atlantic salmon and freshwater pearl mussel (which prey on salmonids) who's migrating smolts or adult salmon are likely to cross the offshore SG1A Project export cable corridor).
- SACs and NCMPAs (including proposed and candidate sites) with seabed/benthic protected features that overlap with or are located within 2 km of the offshore SG1A Project export cable corridor.
- SSSIs within the marine environment (to MLWS) that overlap with or are located within 2 km of the offshore SG1A Project export cable corridor.

The first stage of both HRA and NCMPA assessment is for the Competent Authority to conduct a screening exercise which identifies whether there is potential pathway for an effect where a Likely Significant effect (LSE) (for SPAs/pSPAs/SACs/cSACs, and Ramsar Sites) or if the area is Capable of Affect (CoA) (for NCMPAs).

A summary of the designated sites that were been screened into the assessment as having the potential to interact with the licensable marine activities is provided in Table 8.1. Furthermore, the consideration of the potential for LSE and CoA on these sites is also discussed below.

Table 8.1 Protected sites assessed

Designated Site	Site description	Features	LSE or CoA
Forth Islands SPA	The Forth Islands SPA is located on the east coast of Scotland. It covers an area of approximately 98 km^2 and comprises of islands in the Firth of Forth supporting seabird colonies, including Inchmickery, Isle of May, Fidra, The Lamb, Craigleith, Bass Rock and Long Craig. The SPA includes marine extensions up to approximately 3 km around the islands. The SPA regularly supports in excess of 20,000 individual seabirds in the breeding season including several species that occur in internationally important numbers (NatureScot, 2009). Conservation objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: - Population of the species as a viable component of the site - Distribution of the species within site - Distribution and extent of habitats supporting the species - Structure, function and supporting processes of habitats supporting the species	Qualifying Species: Breeding: - Arctic tern (Sterna paradisaea); - Common tern (Sterna hirundo); - Cormorant (Phalacrocorax carbo); - Gannet (Morus bassanus); - Common guillemot (Uria aalge); - Herring gull (Larus argentatus); - Kittiwake (Rissa tridactyla); - Lesser black-backed gull (Larus fuscus); - Atlantic Puffin (Fratercula arctica); - Razorbill (Alca torda); - Sandwich tern (Sterna sandvicensis); and - European shag.	The SG1A Project Marine Licence determined that the Seagreen Project has no LSEs when considering disturbance /displacement due to vessel presence (including noise and lighting), displacement due to increased water turbidity, indirect effects due to changes in distribution of prey items, and accidental pollution events during all phases either alone or in-combination with other plans or projects. The Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore, will not lead to an adverse effect on the integrity of any feature of the European Site either when considered alone or in combination with other plans and projects and therefore, **no LSE is predicted**.

Designated Site	Site description	Features	LSE or CoA
	- No significant disturbance of the species.		
Outer Firth of Forth and St Andrews Bay Complex SPA	The Outer Firth of Forth and St Andrews Bay Complex SPA is located off the southeast coast of Scotland. It covers an area of c. 2,721 km^2 including the Firth of Forth, the outer Firth of Tay and St Andrews Bay. The Outer Firth of Forth and St Andrews Bay Complex SPA supports a large and diverse marine bird assemblage and is designated for the protection of 21 seabird and waterbird species (JNCC, 2020). The Outer Firth of Forth and St Andrews Bay Complex SPA provides protection for feeding, moulting and roosting habitat for various non-breeding inshore waterfowl qualifying species (red-throated diver, Slavonian grebe, common eider, long-tailed duck, common scoter, velvet scoter, common goldeneye and red-breasted merganser). The SPA also protects foraging habitat for various non-breeding (wintering or passage) seabird species (common guillemot, razorbill, shag, kittiwake, black-headed gull, common gull, herring gull and little gull). The SPA supports more than 35% of the common eider and over 23% of the velvet scoter British wintering populations, along with the largest Scottish concentrations of wintering redthroated diver and passage little gull (JNCC, 2020). During the breeding season, the Outer Firth of Forth and St Andrews Bay Complex SPA provides feeding grounds for an assemblage of over 100,000 seabirds. To a large extent these are same species and individuals that breed on the Forth Islands SPA. The qualifying breeding seabird species are: Arctic tern, common tern, European shag, northern gannet, Atlantic puffin, black-legged kittiwake, Manx shearwater, common guillemot and herring gull. The SPA hosts the largest concentration of breeding common terns in Scotland (JNCC, 2020). Conservation objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long-term and it continues to make an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species. This contribution would be achieved through delivering the following	Qualifying interests: Breeding: - Arctic tern - Atlantic puffin (Fratercula arctica) - Common guillemot (Uria aalge) - Common tern - European shag - Herring gull - Kittiwake - Manshearwater (Puffinus puffinus) - Northern gannet Non-breeding: - Black-headed gull (Chroicocephalus - ridibundus) - Common eider (Somateria mollissima) - Common goldeneye (Bucephala clangula) - Common guillemot - Common gull (Larus canus) - Common scoter (Melanitta nigra) - European shag - Herring gull - Kittiwake - Little gull (Hydrocoloeus minutus) - Long-tailed duck (Clangula hyemalis) - Razorbill - Red-breasted merganser (Mergus - serrator) - Red-throated diver (Gavia stellata) - Slavonian grebe (Podiceps auratus) - Velvet scoter (Melanitta fusca) - Waterfowl assemblage	The SG1A Project Marine Licence determined that the Seagreen Project has no LSEs when considering disturbance /displacement due to vessel presence (including noise and lighting), displacement due to increased water turbidity, indirect effects due to changes in distribution of prey items, and accidental pollution events during all phases either alone or in-combination with other plans or projects. The Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore, will not lead to an adverse effect on the integrity of any feature of the European Site either when considered alone or in combination with other plans and projects and therefore, **no LSE is predicted**.

Designated Site	Site description	Features	LSE or CoA
	objectives for each of the site's qualifying features: - Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term; and - To maintain the habitats and food resources of the qualifying features in favourable condition.		
Firth of Forth SPA	The Firth of Forth SPA is a complex of estuarine and coastal habitats extending to the MLWS tide level and covering an area of c.63 km^2 in southeast Scotland stretching from Alloa to the coasts of Fife and East Lothian. The site includes extensive invertebrate-rich intertidal flats and rocky shores, areas of saltmarsh, lagoons and sand dune (NatureScot, 2001). The Firth of Forth SPA supports populations of waterfowl species consistent with that of the Outer Firth of Forth and St Andrews Bay Complex SPA. Conservation objective: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained. To ensure for the qualifying species that the following are maintained in the long term: - Population of the species as a viable component of the site; - Distribution of the species within site; - Distribution and extent of habitats supporting the species; - Structure, function and supporting processes of habitats supporting the species; and - No significant disturbance of the species.	Non-breeding: - Bar-tailed godwit (Limosa lapponica) - Common scoter - Cormorant - Curlew (Numenius arquata) - Dunlin (Calidris alpina alpina) - Common eider - Golden plover (Pluvialis apricaria) - Common goldeneye (- Great-crested grebe (Podiceps cristatus) - Grey plover (Pluvialis squatarola) - Knot (Calidris canutus) - Lapwing (Vanellus vanellus) - Long-tailed duck - Mallard (Anas platyrhnchos) - Oystercatcher (Haematopus ostralegus) - Pink-footed goose (Anser - brachyrhynchus) - Red-breasted merganser - Common redshank (Tringa totanus) - Red-throated diver - Ringed plover (Charadrius hiaticula) - Sandwich tern - Scaup (Aythya marila) - Shelduck (Tadorna tadorna) - Slavonian grebe - Turnstone (Arenaria interpres) - Velvet scoter - Wigeon (Anas penelope) - Waterfowl assemblage	The SG1A Project Marine Licence determined that the Seagreen Project has no LSEs when considering disturbance /displacement due to vessel presence (including noise and lighting), displacement due to increased water turbidity, indirect effects due to changes in distribution of prey items, and accidental pollution events during all phases either alone or in-combination with other plans or projects. The Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore, will not lead to an adverse effect on the integrity of any feature of the European Site either when considered alone or in combination with other plans and projects and therefore, **no LSE is predicted**.

Designated Site	Site description	Features	LSE or CoA
Firth of Forth SSSI	The Firth of Forth Site of Special Scientific Interest (SSSI) is an extensive coastal area located on the east coast of Scotland. It stretches from Alloa to Crail on the north shore and to Dunbar on the south shore. It includes the estuary upriver from the Forth bridges and the firth east of the bridges. It is of importance for a variety of geological and geomorphological features, coastal and terrestrial habitats, vascular plants, invertebrates, breeding, passage and wintering birds.	Various geological features, habitats, plant, insect and bird species.[8]	The SG1A Project Marine Licence determined no connectivity with the intertidal and terrestrial features of this SSSI. All bird species which are protected are considered as part of the First of Forth SPA assessment of LSE. The proposed trench does pass within the site boundary leading to direct disturbance. However, the magnitude of direct disturbance is considered to be negligible given an overlap of less than 0.001% of the protected area. Any increases in SSC in relation to the Proposed Works will also be highly localised and temporary. As impacts are considered to be short-term, temporary in nature and reversible, the Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore**, will not lead to an adverse effect** on the integrity of any feature of the protected site either when considered alone or in combination with other plans and projects.
Isle of May SAC	The Isle of May, located 3.9 km from the offshore SG1A Project at the entrance to the Firth of Forth on the east coast of Scotland, supports a breeding colony of grey seals. The Isle of May SAC is occupied annually by the largest breeding colony of grey seals in the east coast of Scotland and the fourth-largest breeding colony in the UK, contributing approximately 4.5% of the annual UK pup production of this species. Conservation objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features. To ensure for the qualifying species that the following are maintained in the long term: - Population of the species as a viable component of the site;	Grey Seals	The SG1A Project Marine Licence determined that the Seagreen Project has no LSEs when considering the injury, temporary disturbance or displacement from underwater noise, collision risk from vessel activities, increased turbidity affecting habitat use, and accidental pollution events during all phases either alone or in-combination with other plans or projects. The Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore, will not lead to an adverse effect on the integrity of any feature of the European Site either when considered alone or in combination with other plans and projects and therefore, **no LSE is predicted**.

[8] Full list of classified features located here SSSI_Citation_8163.pdf

Designated Site	Site description	Features	LSE or CoA
	- Distribution of the species within site; Distribution and extent of habitats supporting the species; - Structure, function and supporting processes of habitats supporting the specie; and - No significant disturbance of the species.		
Firth of Tay and Eden Estuary SAC	The Firth of Tay and Eden Estuary SAC is located approximately 30 km from the offshore SG1A Project off the Angus and north Fife coastlines on the east coast of Scotland. The site supports harbour porpoise, bottlenose dolphins, grey seals and harbour seals; however, the latter of these is the only marine mammal qualifying feature which forms a primary reason for site selection due to their regular occurrence there. The Firth of Tay and Eden Estuary supports a nationally important breeding colony comprising roughly 600 individuals, which constitutes approximately 2% of the UK harbour seal population. Conservation objectives: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features. To ensure for the qualifying species that the following are maintained in the long term: - Population of the species as a viable component of the site; - Distribution of the species within site; - Distribution and extent of habitats supporting the species; - Structure, function and supporting processes of habitats supporting the species; and - No significant disturbance of the species.	Harbour Seals	The SG1A Project Marine Licence determined that the Seagreen Project has no LSEs when considering the injury, temporary disturbance or displacement from underwater noise, collision risk from vessel activities, increased turbidity affecting habitat use, and accidental pollution events during all phases either alone or in-combination with other plans or projects. The Proposed Works will not cause any material increase to impacts identified in the SG1A Project Marine Licence and, therefore, will not lead to an adverse effect on the integrity of any feature of the European Site either when considered alone or in combination with other plans and projects and therefore, **no LSE is predicted**.

9. Summary

This Environmental Appraisal has been prepared to support an application to permit an alternative cable installation method (open cut trenching) at landfall for the consented SG1A export cable to Cockenzie. Based on the technical assessments completed in Section 5 to 8, the Proposed Works will not give rise to any likely significant adverse environmental effects, alone or in combination with other projects. Table 9.1 presents a summary of the assessment undertaken for the Proposed Works.

Table 9.1 Summary of Effects

Topic	Potential Impact of Proposed Works	Assessment of Potential Effect
Natural Fish and Shellfish Resource	Cable installation activities may result in temporary subtidal habitat loss/disturbance	Negligible
	Cable installation activities in the subtidal zone may result in temporary increases in SSC and associated sediment deposition	Negligible
	Cable installation activities may result in underwater noise	Negligible
Marine Mammals	Cable installation activities may result in noise disturbance	Negligible
Physical Environment and Water Environment	Cable installation activities may disturb geomorphological features designated as part of the Firth of Forth SSSI, Ramsar and SPA	Negligible
	Cable installation activities may affect sediment transport processes	Negligible
	Cable installation activities in the intertidal and subtidal zones may increase Suspended Sediment Concentrations (SSC)	Negligible

Topic	Potential Impact of Proposed Works	Assessment of Potential Effect
	within the water column and deposit material on the seabed	
Benthic Ecology and Intertidal Ecology	Cable installation activities may result in temporary intertidal and subtidal habitat loss/disturbance	Negligible
	Cable installation activities in the subtidal zone may result in temporary increases in SSC and associated sediment deposition	Negligible
Ornithology	Cable installation activities may result in temporary disturbance or displacement of birds	Negligible
	Cable laying activities may result in lighting impacts on nocturnal species	Negligible
Archaeology and Cultural Heritage	Cable installation activities may affect marine archaeology	Negligible
Consideration of Capability of Affect or Likely Significant Effects on Protected Sites	Potential effects arising from the alternative landfall cable installation activities on Protected Sites	Not CoA and No LSEs

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