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Seagreen Alpha and Seagreen Bravo Offshore Wind Farms

Boulder Clearance Marine Licence Application – Supporting Environmental Information Report

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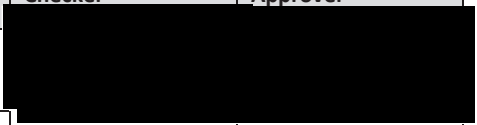
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Glossary

Term	Definition
Inter-array Cable	Cables connecting the Seagreen Alpha and Seagreen Bravo Offshore Wind Farm WTG strings and the OSP
HRA	Habitats Regulations Appraisal
ICES	International Council for the Exploration of the Sea.
LAT	Lowest Astronomical Tide
MBES	Multibeam Echosounder
MS-LOT	Marine Scotland Licensing Operations Team
MSS	Marine Scotland Science
OTA	Offshore Transmission Asset
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
pSPA	proposed Special Protection Area
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WSI	Written Scheme of Investigation
WTG	Wind turbine generator

1. Introduction

Seagreen Wind Energy Ltd (SWL, hereafter Seagreen) is developing the Seagreen Alpha and Seagreen Bravo offshore wind farms off the east coast of Scotland in the outer Firth of Forth and Firth of Tay area (Figure 1.1). The projects received consent under Section 36 of the Electricity Act 1989 from the Scottish Ministers in 2014 (the S.36 Consents) (subsequently varied to remove capacity limits, August 2018). The S36 consent applicable to the Bravo Offshore Wind Farm was assigned to Seagreen Alpha Wind Energy Ltd (SAWEL) on 22nd November 2019. Marine Licences were also awarded by the Scottish Ministers in 2014, one for Seagreen Alpha, one for Seagreen Bravo, and one for the Offshore Transmission Asset (OTA). Together the wind farms Seagreen Alpha and Seagreen Bravo and the OTA collectively comprise 'the Seagreen Project'.

In 2018, following application by Seagreen, the Alpha Marine Licence and Bravo Marine Licence were varied by Scottish Ministers. Subsequently, in 2019, the OTA Marine Licence was also varied by Scottish Ministers. In addition, an additional Marine Licence was granted in 2019, and subsequently varied on 24 February 2020, providing an alternative landfall cable installation method. On 12 December 2019, the Bravo Marine Licence was transferred from the name of Seagreen Bravo Wind Energy Limited (SBWEL) into the name of Seagreen Alpha Wind Energy Limited (SAWEL).

The Onshore Transmission Asset (the onshore export cable from landfall at Carnoustie to a new substation at Tealing) was subject to a separate planning application under the Town and Country Planning (Scotland) Act 1997 and was granted Planning Permission in principle by Angus Council in January 2013. This was extended by Angus Council in December 2016, following re-application by Seagreen.

The existing OWF Marine Licence permits the installation of up to 150 wind turbine generators (WTGs) with associated foundations, inter-array cables, offshore substation platforms (OSPs) and meteorological masts. Offshore installation is due to commence in September 2021 at the first Offshore Substation Platform (OSP) location, with installation of the WTGs also starting at that time. In advance of these works, Seagreen propose to undertake seabed clearance activities given the potential for unexploded ordnance (UXOs), boulders or other debris to be present within the Seagreen OWF site which may cause a safety issue to the construction phase of the project. Seagreen submitted a Marine Licence application in March 2021 for these clearance works within the Seagreen OWF site, which included pre-commencement works to remove approximately 1,900 boulders, based on 2018 site survey data, from around the WTG and OSP locations and from the inter-array cables using an orange-peel grab from a Utility Remotely Controlled Vehicle (UTROV). The Marine Licence was granted by Scottish Ministers on 30th July 2021.

Seagreen has undertaken further geophysical survey of the Seagreen OWF site in advance of construction start which has demonstrated a greater presence of seabed boulders in parts of the site than had previously been estimated. Seagreen is therefore seeking consent for the use of additional seabed clearance methodologies, to supplement the UTROV grab already included in the recent Marine Licence application, for boulder clearance for the inter-array cable routes. It is likely that this additional seabed clearance will overlap with the installation of the OSP and WTG foundations under the main wind farm consents.

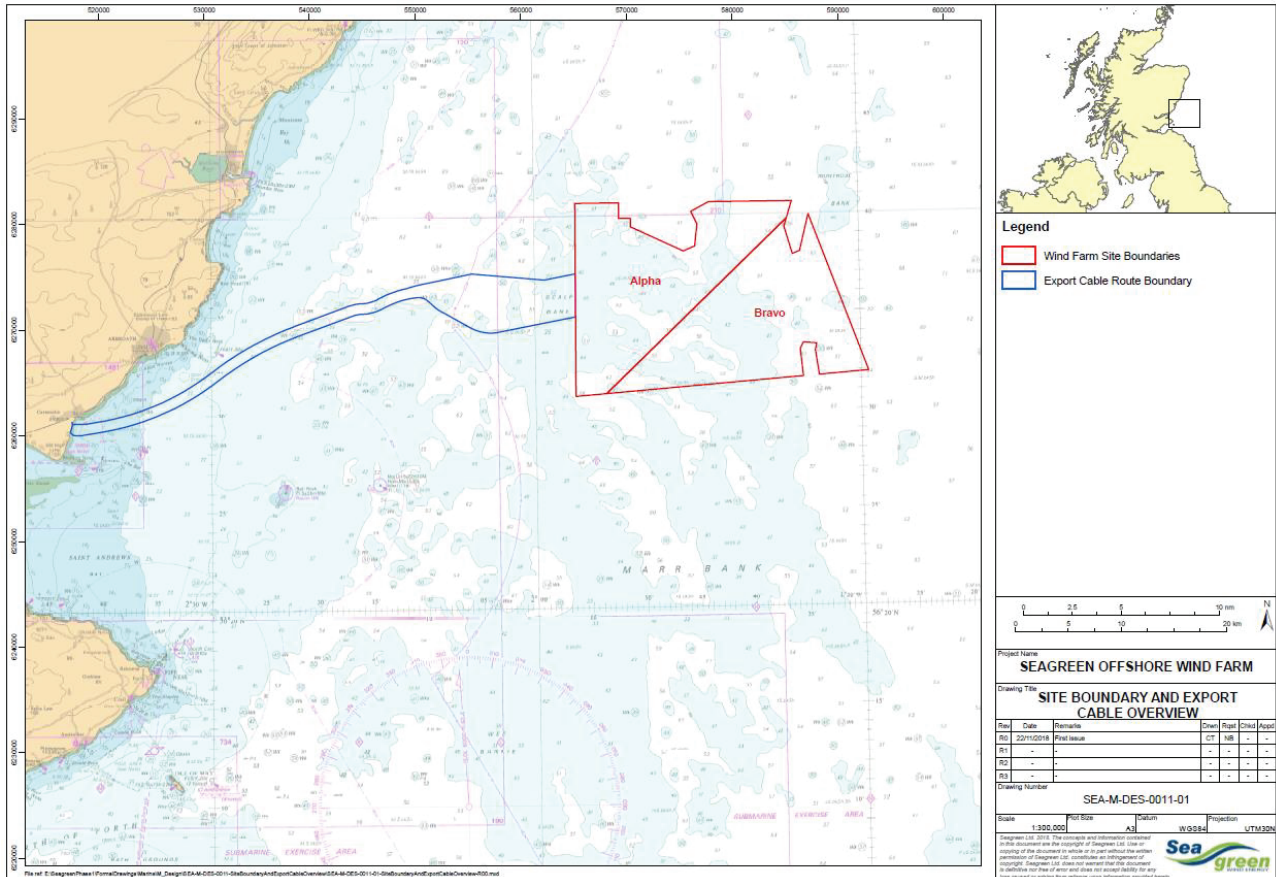


Figure 1.1: Seagreen Alpha and Seagreen Bravo Offshore Wind Farms and the Export Cable Route Corridor.

1.1 Consultation

Seagreen consulted with Marine Scotland via a meeting on 27th July 2021 to discuss the Marine Licence Application for the additional proposed boulder clearance works and methodology. During the consultation meeting, Marine Scotland outlined that the following matters should be considered within the Supporting Environmental Information Report:

- Consideration of whether the additional boulder clearance works and methodologies require an Environmental Impact Assessment (EIA) under the 2017 EIA Regulations (addressed in Section 3);
- Robust justifications for the screening out of certain receptors (addressed in Section 4);
- Impacts to commercial fisheries and shipping and navigation should be considered (addressed in Sections 6.1.5 and 6.1.6 respectively); and
- Discussion of the rationale for the screening of protected sites in the consideration of the potential for Likely Significant Effect (LSE) to arise from the proposed boulder clearance works (addressed in Section 6.1.4).

2. Description of Proposed Works

2.1 Background

The following sections provide an overview of the consented Seagreen Alpha and Seagreen Bravo projects, an outline of the boulder clearance methods included in the July 2021 pre-commencement works Marine Licence and a comparison of the previously submitted methods with the proposed additional boulder clearance method that is the subject of this application.

2.1.1 Seagreen Alpha and Seagreen Bravo Overview

The Seagreen project is described in full in the Design Specification and Layout Plan (LF000009-CST-OF-PLN-0004) approved by Marine Scotland in July 2021 (Rev 03). The consented Seagreen Alpha and Seagreen Bravo offshore wind farms will together comprise 150 WTGs with an additional 27 “spare” locations and inter-array cables connecting to two OSPs. The total length of inter-array cable to be installed is approximately 355 km. The original application provided for the installation of up to 710 km of inter-array cables and a width of temporary disturbance from trenching of up to 10 m and 150 WTGs with a total seabed footprint of up to 1.638 km² (Seagreen, 2012, Chapter 5: Project Description).

2.1.2 Existing Offshore Consent relevant to Boulder Clearance Activities

Seagreen recently received a Marine Licence from Scottish Ministers to undertake seabed preparation and clearance works, involving the clearance of boulders or other debris and clearance (i.e. removal and/or potential detonation) of any potential UXOs. The Supporting Environmental Information (Seagreen, 2021) provided in respect of the application for this licence included the removal of boulders from a total of 137 WTG locations in a bow-tie shaped area around the turbine. The Supporting Environmental Information assumed that the area to be cleared would extend up to 380 m from each WTG location, covering an area of approximately 0.26 km² per WTG location. The bow-tie shape reflects the area that would need to be cleared of obstructions for WTG installation and inter-array cables to be laid from the WTG. It was assumed that boulders (and UXOs) may need to be removed from within a 300 m radius around the OSP location and within a 50 m wide corridor centred around each of the inter-array cables (Figure 2.1).

The methodologies included in the Supporting Environmental Information (Seagreen, 2021) for boulder clearance included an Orange-peel grab or a Utility Remotely Operated Vehicle (UTROV). It was proposed that any obstructing boulders would be relocated outside of the inter-array cable corridor and WTG/OSP boulder free areas.

2.2 Proposed Additional Boulder Clearance Methodologies

As noted in Section 2.1.2, the pre-commencement works Marine Licence is for boulder clearance works undertaken by a UTROV grab. Seagreen wishes to consent an additional boulder clearance approach that will permit the use of SCAR plough for clearance of inter-array cable corridors and an ROV push bar as an additional clearance methodology for WTG and jack up footprint locations. These additional boulder clearance works are required for Stage 1 of the Seagreen OWF comprising one OSP location, 114 WTG locations (plus 23 spare locations) and a total inter-array

cable length of 278 km. Detailed methodologies for these additional clearance methods are provided in Sections 2.2.2 and 2.2.3.

2.2.1 Location and Extent of Boulders

Based on survey data from 2018, it was expected that approximately 1,900 boulders are located across the Seagreen OWF site. Figure 2.1 below shows the potential boulder locations within the Seagreen OWF area where they overlap with inter-array cables and WTGs. The current pre-commencement surveys have, however, demonstrated a higher density of boulders generally across these areas. Due to the density of boulders expected to be present within the inter-array cables route corridors, an additional boulder clearance methodology has been considered.

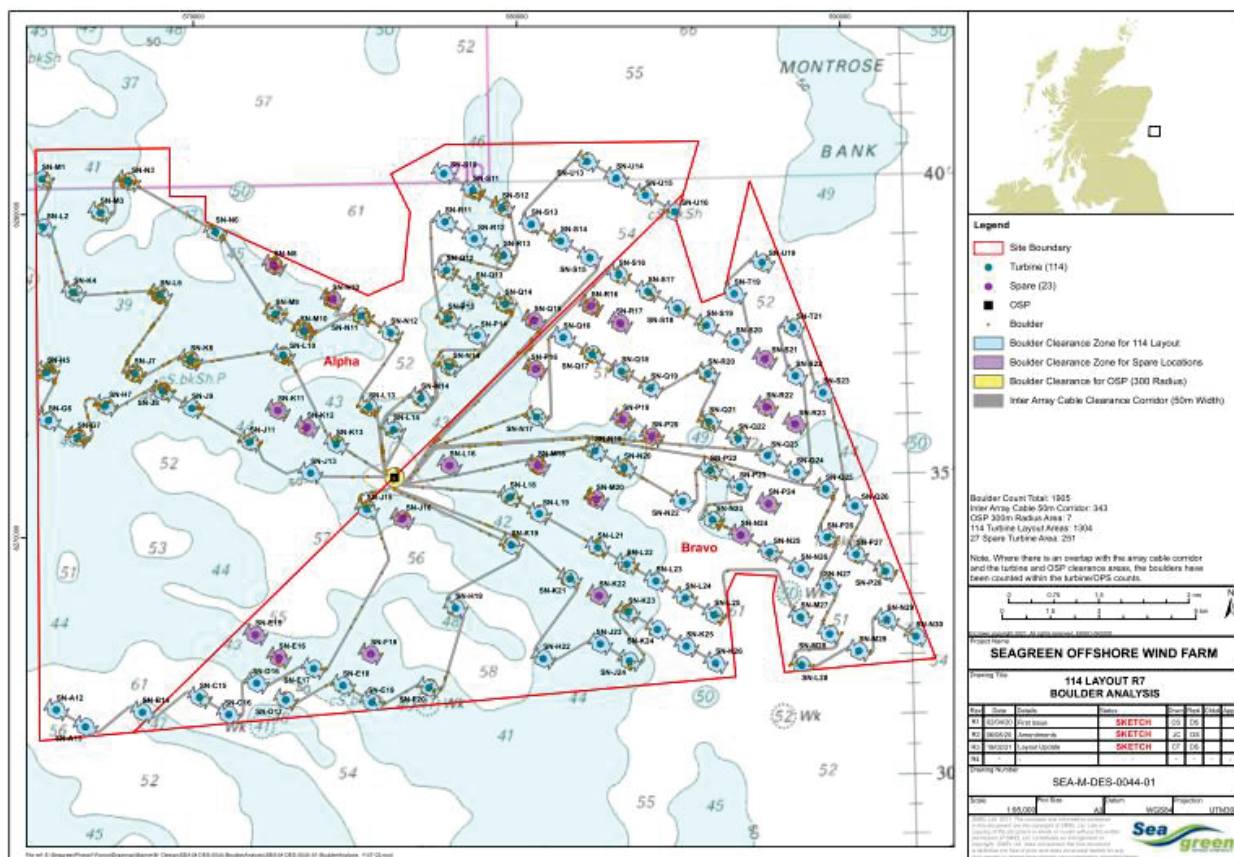


Figure 2.1: Expected boulder locations within the Seagreen OWF area.

Boulder clearance works using the SCAR plough will, as a worst case, be required at up to 40% of the inter-array cable routes. This will be up to approximately 111.2 km of inter-array cable corridor as a maximum design scenario, although the full extent of the individual cable routes will not require clearance in each case. The area of influence would cover a 16 m wide corridor centred around each of the inter-array cables (Figure 2.1). It should be noted that the corridor of disturbance has been substantially reduced from 50 m width included in the pre-commencement works Marine Licence for boulder clearance via UTROV grab.

Boulder clearance works using the ROV push bar may take place at any of the 137 WTG or spare locations, depending on the confirmed presence of boulders. The area requiring clearance at each location has been reduced by 50% to 0.13 km² resulting in a maximum design scenario of 17.81 km². However, the actual clearance area will be considerably less than this. The ROV push bar approach will not be used across the full extent of any locations where it is required and is likely to be targeted at groups of boulders at the periphery of the area, moving them a relatively short distance only.

The maximum design scenario can be seen in

Table 2.1. This represents a very conservative worst case and further work is underway to refine and reduce the area further. It is likely that the additional boulder clearance works will take place in parallel with the OSP and WTG installation under the main wind farm consents during the period November 2021 to May 2022.

Table 2.1: Maximum Design Scenario for Proposed Boulder Clearance Works.

Description	Maximum Design Envelope for Boulder Clearance	Maximum area of seabed affected
Boulder clearance of inter-array cables via SCAR plough	111.2 km	1.78 km ²
Boulder clearance of WTG locations via ROV push bar	137 WTG locations	17.81 km ²

2.2.2 SCAR Plough

The SCAR Seabed System, in its Route Preparation configuration, is designed to remove boulders and other mobile surface obstacles from a pre-defined route corridor. The SCAR plough would be used for inter-array cable route site clearance only. The SCAR plough has a width of up to 16 m and can move boulders in excess of 3 m in diameter. Examples of the SCAR plough are presented in Figure 2.2 and Figure 2.3. The SCAR plough is highly effective and efficient for route corridor preparation and therefore will only require one pass of the target clearance area. Depending on the sediment type, the SCAR plough would penetrate the seabed to a depth of up to 200 mm. The specification parameters of the SCAR plough are outlined in Table 2.2. Once the SCAR plough pass had been completed, a post plough ROV survey would be completed, including a multibeam echosounder (MBES).

A final pass with a boulder grab will remove any of the remaining boulders that the plough was not able to move. This will be done using a UTROV grab, targeting individual boulders and so will not cause further extensive disturbance, but rather localised effects during the re-location of the individual target boulders (Figure 2.4). The specification parameters for the UTROV are provided in Table 2.3.



Figure 2.2: Image of the SCAR plough.

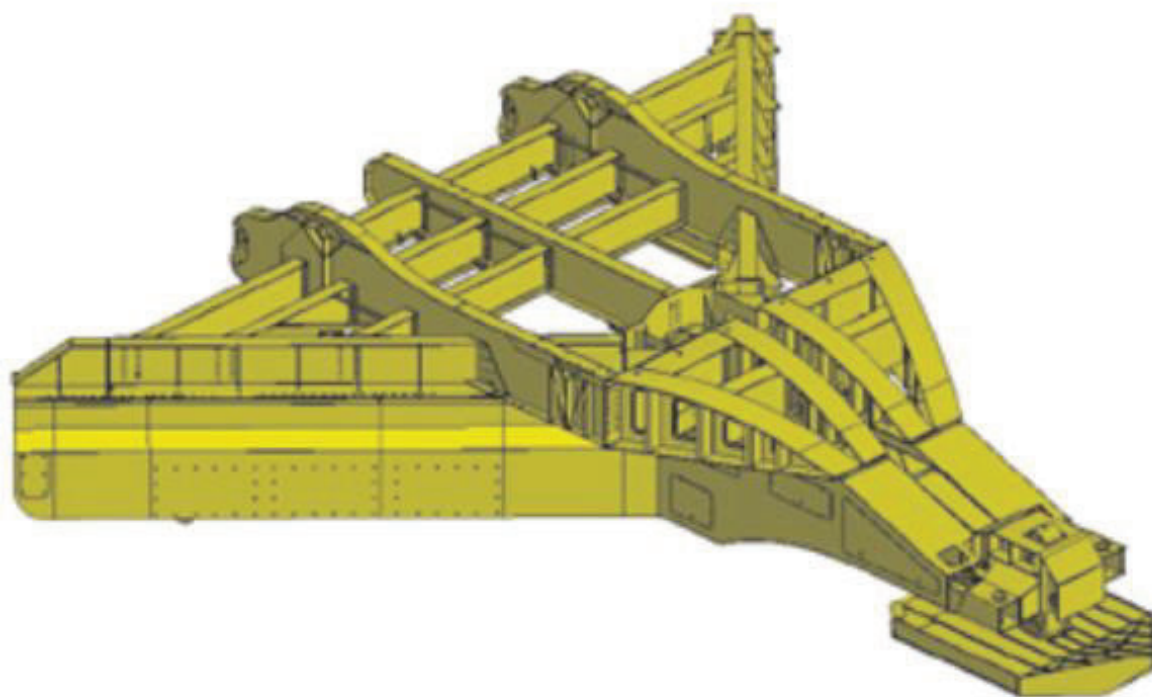


Figure 2.3: Diagram of the SCAR plough.

Table 2.2: Specification parameters of the SCAR plough.

Specification	Value
Max. Operating Depth	3,000 m+
Clearance width (single pass)	16 m

Specification	Value
Speed range	Up to 1000m/hr
Tow force (design load)	75 t
Weight	85 t
Length (assembled)	16 m
Width (assembled)	15.8 m
Height (assembled)	3.6 m



Figure 2.4: UTROV boulder grab.

Table 2.3: Specification parameters of the UTROV.

Specification	Value
Depth Rating	3,000 m
Dimensions	2030 x 2030 x 1780 mm
Weight In Air	4 t

Specification	Value
Weight in Water	3.2 t
Through-Frame Lift	55 t (Including Dynamics)
System Power Requirements	280 kVa, 3-Phase, 380 to 480 VAC, 50/60 Hz

2.2.3 ROV Push Bar

The ROV push bar will be used in a similar way to the SCAR plough to clear surface boulders. Its use will be limited to those WTG locations with greater presence of boulders. The SCAR plough will not be used at these locations and instead, an ROV push bar will be used to target boulder clusters on the extremities of the WTG locations, moving boulders a short distance only. The ROV push bar will have a width of 1.9 m and may be deployed using the same ROV as the UTROV. Figure 2.5 shows the ROV push bar and Table 2.3 gives the specification parameters of the ROV likely to be used.

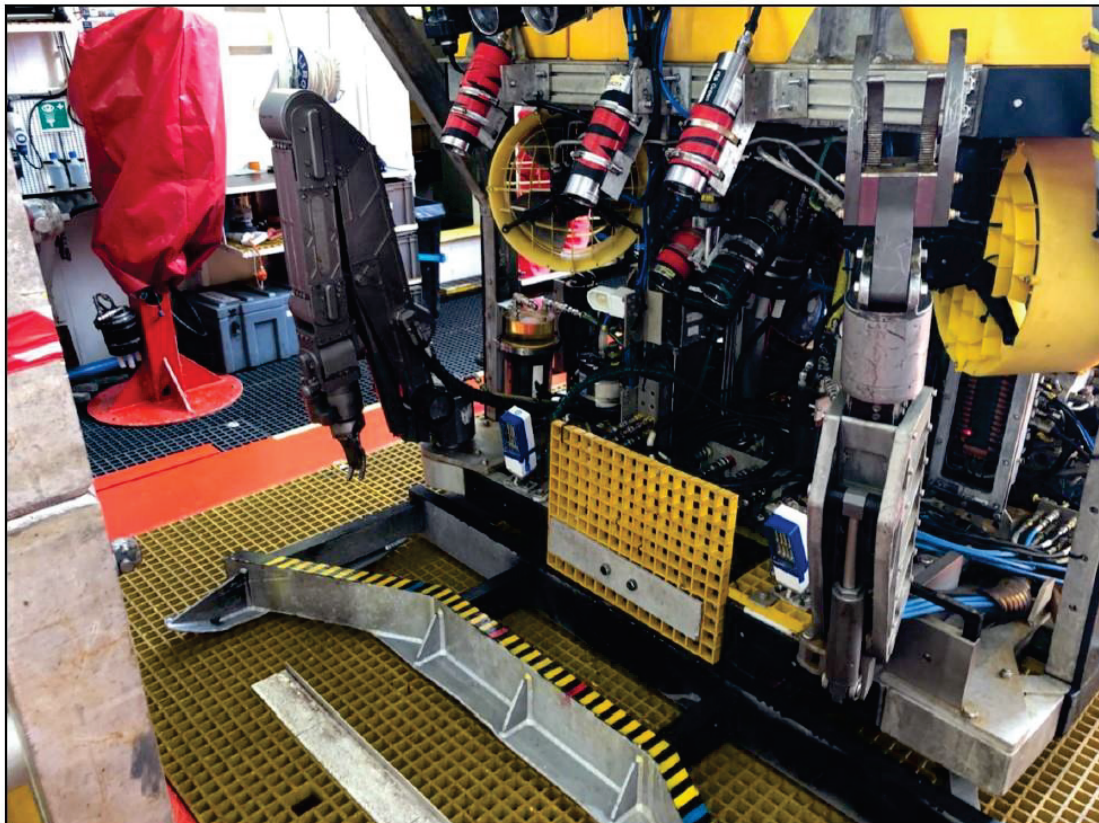


Figure 2.5: ROV push bar.

2.2.4 Vessels

Base case vessels for the SCAR will be an anchor handler (tug) for plough operations and a separate light ROV construction vessel for subsequent boulder grab operations. A light ROV

construction vessel would be used for the push bar. The relevant details and specifications of vessels and equipment will be provided to MS once they have been contracted.

Clearance works using the SCAR plough and ROV push bar are planned to commence from November 2021 with a duration of up to 7 months.

3. Approach to Consent

3.1 Alignment with the National Marine Plan

The Seagreen Alpha and Seagreen Bravo offshore wind farm sites are considered a planned development in Scotland's National Marine Plan. Boulder clearance activities are required, for the wind turbine foundation and inter-array cable installation, to ensure engineering and health and safety risks during construction resulting from the presence of surface boulders are managed. The activities will also support appropriate burial of the inter-array cables to minimise environmental and socio-economic impacts. Boulder clearance is required to facilitate the development of the Seagreen Alpha and Seagreen Bravo offshore wind farms with their associated economic and social benefits (policies GEN 2 and GEN 3). Effective burial of the cables will promote co-existence with other marine users (GEN 4).

The proposed works have also been considered in relation to climate change (GEN 5), natural heritage (GEN 9), engagement (GEN 18) and cumulative impacts (GEN 21). Renewables-specific policies RENEWABLES 4 and RENEWABLES 5 which relate to marine licensing are also considered relevant to the application.

3.2 Consideration of the need for EIA

Seagreen has determined that an EIA under the 2017 EIA Regulations is not required to support the Marine Licence application for the reasons described below.

The proposed works represent a change to an authorised project and therefore are considered to fall under the description of projects provided at Paragraph 13 of Schedule 2 of the 2017 EIA Regulations (i.e. a change to an installation for the harnessing of wind power for energy production (wind farms) where those works are already authorised), whereby an EIA is required where the change may have significant adverse effects on the environment. The 2017 EIA Regulations specify that in making a determination as to whether or not a Schedule 2 project is an EIA project, the relevant criteria set out in Schedule 3 must be considered together with the results of any relevant assessment. These criteria cover the characteristics of the works, the location of the works and the characteristics of the potential impact. Each of these are addressed in turn within the following sections.

3.2.1 Characteristics of the works

The 2017 EIA Regulations specify that the following characteristics must be considered:

- The size and design of the works;
- Cumulation with other existing works and/or approved works;
- The use of natural resources, in particular land, soil, water and biodiversity;

- The production of waste;
- Pollution and nuisances;
- The risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge; and
- The risks to human health (for example due to water contamination or air pollution).

In terms of the **size and design of the works**, the size of the project is relatively small in the context of the overall scale of the consented Seagreen Alpha and Seagreen Bravo projects, with a total project area of 391 km². The proposed works will take place within the existing consented array area of the OWF and the maximum design scenario will cover a total area of 19.58 km². This is a conservative estimate. As set out above, the key differences between the proposed works and the consented works is an additional boulder clearance requirement for site preparation before construction of the OWF begins. The area of the works are within the already consented construction area of the Seagreen OWF and will generate negligible impacts in comparison to the construction of the OWF. No sediment will be removed from the seabed, it will be moved to the side of the array cable routes and WTG locations affected, creating a short-term, non-permanent disturbance only.

In terms of **cumulation with other existing works**, the proposed boulder clearance works are within the previously consented Seagreen OWF array area. The Seagreen Environmental Statement (ES) (Seagreen, 2012) did not identify any significant cumulative effects within the array area. Seabed disturbance resulting from the proposed boulder clearance works will be limited to areas where construction impacts of the OWF would take place (i.e., cable installation) and so there will be a small amount of repeat disturbance in these areas but this is not anticipated to hinder the recovery of the communities. The Seagreen ES (Seagreen, 2012) assessed a maximum area of disturbance resulting from cable disturbance of 7.1 km² (i.e., 710 km of inter array cables and a width of disturbance of 10 m). The ES also assessed a maximum of 150 WTG locations, with a total seabed footprint of up to 1.638 km² (150 locations with an area of influence of 10,923 m² each). The maximum design scenario for the boulder clearance represents a factor of two greater than the GBS and scour assessed in 2012 (Table 3-1), however, it is emphasised that this is temporary disturbance and not permanent habitat loss as would have been the case for GBS installation and therefore not a like for like comparison (Seagreen, 2012; Seagreen 2018). In addition, the maximum design scenario assessed is highly conservative and assumes that boulder clearance will occur at all locations, which is unlikely to be the case.

Table 3.1: The maximum design scenario of the current application compared with the previously assessed maximum design scenario for the Seagreen OWF (Seagreen, 2012).

Description	Maximum Design Scenario	Maximum Design Scenario Assessed for in the Seagreen ES (2012)
Inter-array cable disturbance	1.779 km ²	7.1 km ²

Description	Maximum Design Scenario	Maximum Design Scenario Assessed for in the Seagreen ES (2012)
Temporary disturbance from boulder clearance of WTG locations vis ROV push bar	17.8 km ²	n/a
Permanent disturbance from GBS footprint plus scour protection	n/a	1.638 km ²

In terms of the **use of natural resources**, no sediment will be removed from the seabed during the boulder clearance works. Sediment would be relocated, with boulders being moved to the side of the affected inter-array cable routes, WTG and OSP site locations. Any disturbance caused by the relocation of sediment would be temporary and short-lived. Therefore, no significant adverse effects on the environment through the use of natural resources are anticipated.

Regarding **production of waste and pollution and nuisances**, all wastes will be managed in line with the Environmental Management Plan (EMP), and marine pollution prevention and contingency planning measures set out in the Marine Pollution Contingency Plan (MPCP), for the Seagreen Alpha and Seagreen Bravo OWF Projects. The EMP includes waste management measures to minimise, reuse, recycle and dispose of waste streams in compliance with relevant waste legislation. Due to the measures in place to control and/or manage waste, pollution and nuisance, significant adverse effects on the environment are not predicted.

Regarding **risk of major accidents and/or disasters, including those caused by climate change**, Seagreen will require all contractors and subcontractors to complete adequate risk assessments for all aspects of the installation activities and these requirements will be captured within the contractor's method statement prepared for the works. Seagreen will require compliance with the Construction (Design and Management) Regulations 2015 (CDM Regulations) throughout the completion of the installation process through conditions of contract. Management standards in line with ISO 9001, 14001 and OHSAS 18001 will be applied for the overall Seagreen project management system, and the management systems of all contractors will be required to concur with the same principles.

In relation to **risks to human health**, Seagreen will require compliance with the Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations) through conditions of contract in ensuring that the risk to health from workplace exposure to hazardous substances is appropriately assessed and that exposure is prevented or, where this is not reasonably practicable, adequate controls are implemented and exposure monitored and managed to within acceptable levels, in line with relevant regulations. Health and Safety regulations will be adhered to at all times

and relevant HSE Management tools implemented, to ensure the safety of the workforce and the general public.

In summary, in consideration of the characteristics of the works as set out in the 2017 EIA Regulations, the boulder clearance works is relatively small in the context of the overall scale of the consented Seagreen Alpha and Seagreen Bravo projects, and the proposal is for clearance works that are within the already consented OWF construction site and is not likely to result in cumulative effects with other plans and projects. In terms of use of natural resources, there will be no removal of sediment throughout the works, just a relocation of boulders to the side of construction sites. The works will be short term only and measures will be put in place to control and manage waste, pollution and nuisance, risk of accidents and risk to human health. For the reasons outlined above, it is considered that the characteristics of the project are not likely to result in significant adverse effects on the environment.

3.2.2 Location of the works

The 2017 EIA Regulations specify that the environmental sensitivity of geographical areas likely to be affected by works must be considered having regard to the following:

- The existing and approved land use;
- The relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground;
- The absorption capacity of the natural environment, paying particular attention to the following areas:
 - Wetlands, riparian areas, river mouths;
 - Coastal zones and the marine environment;
 - Mountain and forest areas;
 - Nature reserves and parks;
 - European sites and other areas classified or protected under national legislation;
 - Areas in which there has already been a failure to meet the environmental quality standards, laid down in European Union legislation and relevant to the project, or in which it is considered that there is such a failure;
 - Densely populated areas;
 - Landscapes and sites of historical, cultural or archaeological significance.

The boulder clearance works are located offshore, 31 km away from the nearest coast. The indicative works area overlaps with the Firth of Forth Banks Complex MPA (see Figure 5.1). The boulder clearance works area covers only a very small proportion (0.1%) of the total 2,130 km² area of this MPA (JNCC, 2020). The proposed boulder clearance works will cause negligible impacts to the marine environment and any effects to the MPA will be localised and short-term.

As such, Seagreen has considered the **environmental sensitivity** of the proposed works in relation to these designations. A review of potential impacts and resultant effects is provided in Section 6.1.4 of this document. This review, having regard to the **existing and approved use**, the **relative abundance, availability, quality and regenerative capacity of natural resources in the area**, and the **absorption capacity of the natural environment (with reference to coastal**

zones and European and nationally designated sites), concluded that, due to the minimal area potentially affected within the Firth of Forth Banks Complex MPA, the lack of any direct overlap with any other designated site, the localised nature of the effects arising from the works, and the short-term and temporary nature of potential effects, there will be no significant adverse effects on the environment.

3.2.3 Characteristics of the potential impact

The 2017 EIA Regulations specify that the likely significant effects of the works on the environment must be considered with regard to the impact of the works taking into account the following:

- The magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected);
- The nature of the impact;
- The transboundary nature of the impact;
- The intensity and complexity of the impact;
- The probability of the impact;
- The expected onset, duration, frequency and reversibility of the impact;
- The cumulation of the impact with the impact of other existing and/or approved works;
- The possibility of effectively reducing the impact.

The potential environmental impacts of the proposed works are presented in Section 6 of this document. Within the impact assessment, Seagreen has considered potential impacts in relation to the **magnitude and spatial extent** of the impact, the **nature** of the impact, the **intensity and complexity** of the impact and the **probability, duration, frequency and reversibility** of the impact, to determine whether or not the impact is likely to have a significant adverse effect on the environment. This review is presented in Section 6 of this document and concludes that none of the potential impacts are likely to result in significant adverse effects.

In terms of the **transboundary nature of the impact**, due to the localised extent of the works and the localised nature of the impacts, it is considered that there will not be any impacts on any other European Economic Area (EEA) state from these works.

In terms of the **cumulation of the impact** with other existing and/or approved works, as noted above in Section 3.2.1 and in Section 7, no significant cumulative effects are anticipated.

In terms of **effectively reducing the impact**, the management measures presented in Section 6 will ensure that any potential effects will be effectively managed. It is also important to note that the proposed works will take place within the existing consented Seagreen OWF site and that that the area of disturbance associated with boulder clearance works along inter array cable corridors and at WTG locations has been substantially reduced from the extent included within the pre-commencement works Marine Licence for boulder clearance via UTROV grab.

3.2.4 Conclusion

In summary, having considered the matters outlined within Schedule 3 of the 2017 EIA Regulations in terms of the characteristics and location of the project and the characteristics of the potential

impacts, Seagreen has determined that the boulder clearance works are not likely to have significant adverse effects on the environment, and therefore an EIA is not required.

4. Scope of Impact Assessment

Table 4.1 sets out the environmental receptors that were scoped in and out of the impact assessment, giving justification for any that are scoped out. The impact considered in the current impact assessment is temporary disturbance to the seabed. The presence of the vessel and underwater noise from the works have been screened out of the assessment. The presence of the vessel will be short term and highly localised, with the impact of its presence being negligible. Underwater noise generated from the works will be of low magnitude, highly localised and short-term, with any impacts arising from the noise generated also being negligible.

Table 4.1: Topics scoped into or out of the impact assessment.

Topic	Scoped In / Out	Justification
Physical Environment	Scoped In	The proposed boulder clearance works have the potential to disturb the seabed and effect habitats within the area of the works. For further details, see Section 6.1.1.
Benthic Ecology	Scoped In	The proposed boulder clearance works have the potential to result in effects from temporary habitat disturbance. For further details, see Section 6.1.2.
Fish and Shellfish	Scoped In	The proposed boulder clearance works have the potential to result in effects from temporary habitat disturbance. For further details, see Section 6.1.3.
Marine Mammals	Scoped Out	The proposed boulder clearance works will not cause underwater noise in magnitudes large enough to adversely affect marine mammals. Any underwater noise generated will be low impact and short-term. Marine mammals will not be affected by the temporary seabed disturbance.
Ornithology	Scoped Out	The proposed boulder works will not have any effect on ornithological receptors due to the works occurring on the seabed, not effecting ornithological receptors, and the presence of the vessel and any noise generated by the works will be small magnitude, localised and short-term.
Protected Sites	Scoped In	The boulder clearance works area overlaps with a small proportion of Firth of Forth Banks Complex Area (MPA).

Topic	Scoped In / Out	Justification
		All European sites are located more than 27 km from the array area. Due to the highly localised and short-term nature of the works, the impacts will not interact with any other protected areas. For further details, see Section 6.1.4.
Shipping and Navigation	Scoped In	The proposed boulder clearance works have the potential to effect shipping and navigation by causing a temporary loss of access to potential shipping routes. For further details, see Section 6.1.5.
Commercial Fisheries	Scoped In	The proposed boulder clearance works have the potential to effect commercial fisheries by causing a temporary loss of access to fishing grounds, and potentially by re-locating boulders from known locations, causing a risk to bottom contacting fishing gear. For further details, see Section 6.1.6.
Marine Archaeology and Cultural Heritage	Scoped In	The proposed boulder clearance works have the potential to affect marine archaeology through direct impact to the seabed or through finds of archaeological interest being identified during the works. For further details, see Section 6.1.5.

5. Existing Environment

5.1 Overview

A detailed description of the baseline environment for each environmental parameter is available from the Seagreen Alpha and Seagreen Bravo OWF Offshore Environmental Statement (ES) (Seagreen, 2012) and 2018 Offshore EIA Report (Seagreen, 2018). The following sections provide an overview of the key receptors that may be potentially affected by the additional boulder clearance method. The key receptors that may be affected are:

- Physical Environment;
- Benthic Ecology;
- Fish and Shellfish;
- Protected Sites
- Commercial Fisheries;

- Shipping and Navigation; and
- Marine Archaeology and Cultural Heritage.

Effects on environmental receptors associated with the clearance works are anticipated to be:

- Temporary seabed disturbance.

The information utilised to provide details of the key receptors that are likely to be affected by these impacts has been drawn from the 2012 Offshore ES (Seagreen, 2012) and 2018 Offshore EIA Report (Seagreen, 2018), other Seagreen project documents such as the APEM Benthic Survey Report (Seagreen, 2021) and other publicly available information.

5.2 Nature Conservation Designations

A number of European protected sites with connectivity to the Seagreen OWF site were considered in the Seagreen EIA (2018). A summary of the designated sites that have been screened into the assessment as having the potential to interact with the licensable activities is provided in Table 5.1 and Figure 5.1.

Table 5.1: Summary of the designated sites and specific features that have been screened in as having the potential to interact with the licensable activities.

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
Firth of Forth Banks Complex (MPA)	0	<ul style="list-style-type: none"> Ocean quahog aggregations (<i>Arctica islandica</i>) Offshore subtidal sands and gravels Shelf Banks and Mounds Moraines representative of the Wee Bankie Key Geodiversity Area 	<p>The conservation objectives for the Firth of Forth Banks Complex MPA are that the protected features:</p> <ul style="list-style-type: none"> so far as already in favourable condition, remain in such condition; and so far as not already in favourable condition, be brought into such condition, and remain in such condition. <p>With respect to the Offshore subtidal sands and gravels, this means that:</p> <ul style="list-style-type: none"> extent is stable or increasing; and structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating; <p>Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. Any alteration to that feature brought about entirely by natural processes is to be disregarded.</p> <p>With respect to the Ocean quahog aggregations, this means that:</p> <ul style="list-style-type: none"> the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. <p>Any temporary reduction of numbers is to be disregarded if the population of ocean quahog aggregations is sufficiently thriving and resilient to enable its</p>

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
			<p>recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.</p> <p>With respect to the Shelf banks and mounds large-scale feature, this means that:</p> <ul style="list-style-type: none"> the extent, distribution and structure is maintained; the function is maintained so as to ensure that it continues to support its characteristic biological communities (which includes a reference to the diversity of any species associated with the large-scale feature) and their use of the site for, but not restricted to, feeding, courtship, spawning, or use as nursery grounds; and the processes supporting that feature are maintained. <p>Any alteration to that feature brought about entirely by natural processes is to be disregarded.</p> <p>With respect to the Wee Bankie key geodiversity area, this means that:</p> <ul style="list-style-type: none"> its extent, component elements and integrity are maintained; its structure and functioning are unimpaired; and its surface remains sufficiently unobscured for the purposes of determining whether the above criteria are satisfied. <p>Any obscuring of that feature entirely by natural processes is to be disregarded.</p> <p>Any alteration to that feature brought about entirely by natural processes is to be disregarded.</p>
Fowlsheugh Special Protected Area (SPA)	27.5	<ul style="list-style-type: none"> Fulmar (<i>Fulmarus glacialis</i>) Kittiwake (<i>Rissa tridactyla</i>) 	<ul style="list-style-type: none"> To avoid deterioration of the habitats of the qualifying species or significant disturbance of the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying interests that the following are maintained in the long term: <ul style="list-style-type: none"> Population of the species as a viable component of the site;

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
		<ul style="list-style-type: none"> Herring gull (<i>Larus argentatus</i>) Guillemot (<i>Uria aalge</i>) Razorbill (<i>Alca torda</i>) 	<ul style="list-style-type: none"> 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.
Outer Firth of Forth and St Andrews Bay Complex SPA	29	<ul style="list-style-type: none"> Overwintering seabirds and other waterbirds, and breeding seabirds 	<ul style="list-style-type: none"> To avoid deterioration of the habitats of the qualifying interest 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 objectives for each of the site's qualifying features: <ul style="list-style-type: none"> (a) 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; (b) To maintain the habitats and food resources of the qualifying features in favourable condition.
Firth of Tay and Eden Estuary Special Area of Conservation (SAC)	47	<ul style="list-style-type: none"> Harbour seal (<i>Phoca vitulina</i>) 	<ul style="list-style-type: none"> 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; and To ensure for the qualifying species that the following are maintained in the long term: <ul style="list-style-type: none"> 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;

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
			<ul style="list-style-type: none"> Structure, function and supporting processes of habitats supporting the species; and No significant disturbance of the species.
Forth Islands SPA	49	<ul style="list-style-type: none"> Kittiwake (<i>Rissa tridactyla</i>) Herring gull (<i>Larus argentatus</i>) Guillemot (<i>Uria aalge</i>) Razorbill (<i>Alca torda</i>) Gannet (<i>Morus bassanus</i>) Puffin (<i>Fratercula arctica</i>) 	<ul style="list-style-type: none"> 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 interests that the following are maintained in the long term: <ul style="list-style-type: none"> 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. 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 interests; and To ensure for the qualifying interests that the following are maintained in the long term: <ul style="list-style-type: none"> 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. Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;
Isle of May SAC	52	<ul style="list-style-type: none"> Grey seal (<i>Halichoerus grypus</i>) 	<ul style="list-style-type: none"> 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 interests; and To ensure for the qualifying interests that the following are maintained in the long term: <ul style="list-style-type: none"> 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. Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;
Berwickshire and North	64.5	<ul style="list-style-type: none"> Grey seal (<i>Halichoerus grypus</i>) 	<ul style="list-style-type: none"> 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 interests; and To ensure for the qualifying interests that the following are maintained in the long term: <ul style="list-style-type: none"> 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. Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
Northumberland Coast SAC			<ul style="list-style-type: none"> ○ The extent and distribution of qualifying natural habitats and habitats of qualifying species; ○ The structure and function (including typical species) of qualifying natural habitats; ○ The structure and function of the habitats of qualifying species; ○ The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely ○ The populations of qualifying species; and the distribution of qualifying species within the site.
St Abb's Head to Fast Castle SPA	66	<ul style="list-style-type: none"> ● Guillemot (<i>Uria aalge</i>) ● Razorbill (<i>Alca torda</i>) ● Kittiwake (<i>Rissa tridactyla</i>) ● Herring gull (<i>Larus argentatus</i>) 	<ul style="list-style-type: none"> ● To avoid deterioration of the habitats of the qualifying interest 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 the qualifying interests. ● To ensure for the qualifying interests that the following are maintained in the long term: <ul style="list-style-type: none"> ○ 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. ● 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 interests that the following are maintained in the long term: <ul style="list-style-type: none"> ○ 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;
Buchan Ness to Collieston Coast SPA	72	<ul style="list-style-type: none"> ● Guillemot (<i>Uria aalge</i>) ● Kittiwake (<i>Rissa tridactyla</i>) ● Herring gull (<i>Larus argentatus</i>) 	<ul style="list-style-type: none"> ● 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 interests that the following are maintained in the long term: <ul style="list-style-type: none"> ○ 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;

Designated site	Distance to Project Area (km)	Relevant Qualifying features	Conservation objectives
			<ul style="list-style-type: none"> Structure, function and supporting processes of habitats supporting the species; and No significant disturbance of the species.
Moray Firth SAC	142	<ul style="list-style-type: none"> Bottlenose dolphin (<i>Tursiops truncatus</i>) 	<ul style="list-style-type: none"> To ensure that the qualifying features of Moray Firth SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. To ensure that the integrity of Moray Firth SAC is maintained or restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature: <ul style="list-style-type: none"> 2a. The population of bottlenose dolphin is a viable component of the site; 2b. The distribution of bottlenose dolphin throughout the site is maintained by avoiding significant disturbance; and 2c. The supporting habitats and processes relevant to bottlenose dolphin and the availability of prey for bottlenose dolphin are maintained.

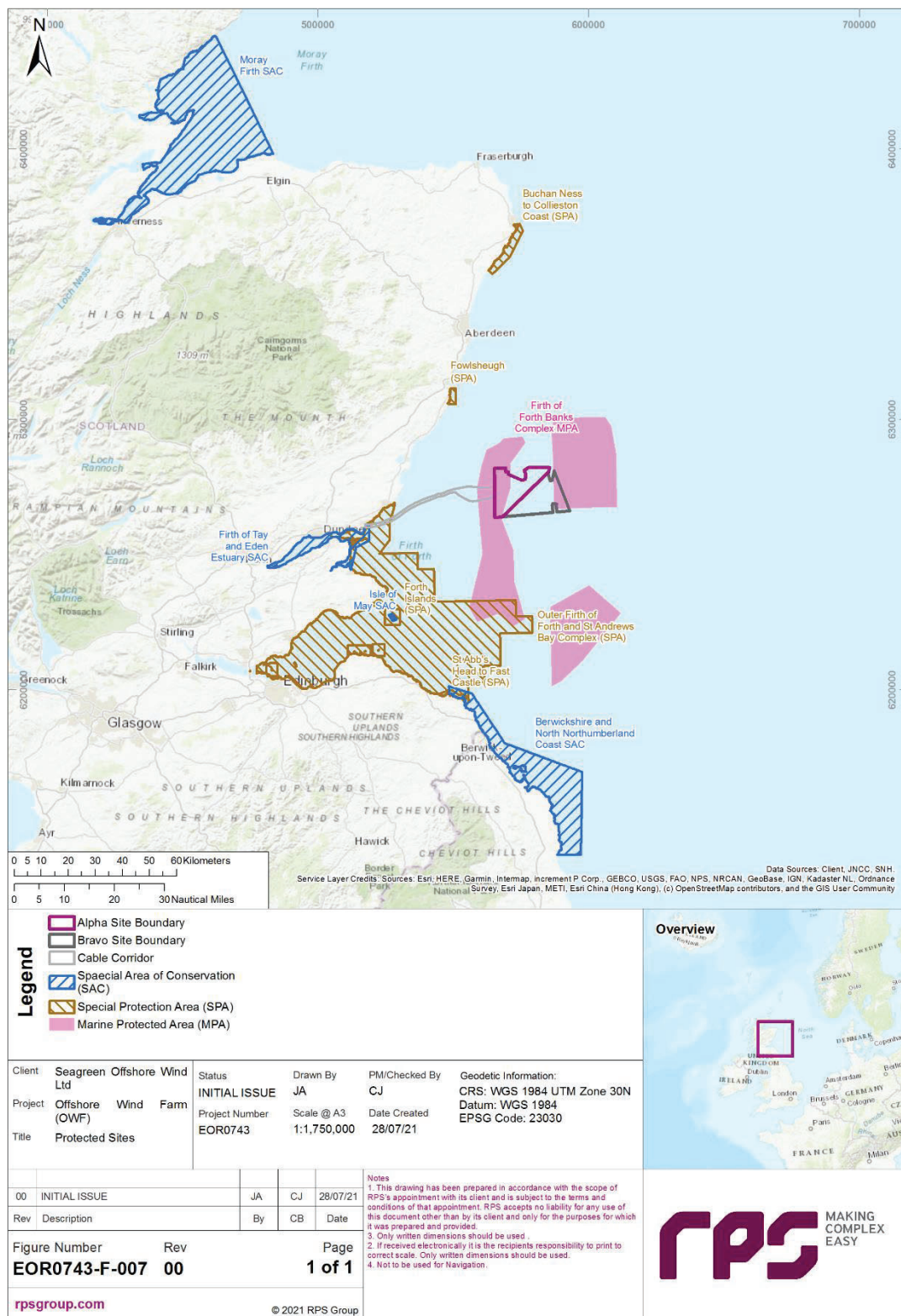


Figure 5.1: Designated sites in relation to the proposed boulder clearance works application boundary.

5.3 Physical Environment

The tidal regime within the Seagreen Alpha and Seagreen Bravo OWF areas is semi-diurnal in nature and characterised by a variable mean spring tidal range (Seagreen, 2012). Tidal patterns within outer Firth of Forth area are governed by a southerly directed flood tide that moves across the eastern coastline of Scotland. Within the Firth of Forth, typical peak flow velocities are 0.4 m/s to 0.7 m/s and on the ebb are 0.7 m/s to 1.1 m/s. Seaward of the estuaries the tidal flows are typically weaker.

Bathymetry across the Seagreen OWF Site ranges from 40-60 metres at the lowest astronomical tide (LAT) across the majority of both Seagreen Alpha and Seagreen Bravo. The majority of the Seagreen Alpha and Seagreen Bravo project areas can be characterised as having a slight gradient (0 to 5 degrees), though in some localised areas, gradients can be as steep as 11.9 degrees.

The geological features of the project areas identified seabed substrate and features including boulders, sandbars, sand waves and megaripples. Megaripples are the predominant feature across the seabed, with isolated sand waves in the Seagreen Alpha area. Megaripples are the predominant feature across the seabed, with isolated sand waves in the Seagreen Alpha area. Boulders are prevalent across the area and are either isolated or as clusters. All of the features are characteristic of various stages of sediment erosion and transportation produced by fluid movement (waves or currents) over sediments. The predominant sediment types within the project areas are predicted to be rippled medium to fine sand with varying amounts of coarse shell, and mixed mosaics of gravel, cobbles and coarse shell lying on or embedded within sand.

5.4 Benthic Ecology

Benthic characterisation surveys, which comprised infaunal grab sampling, beam trawl sampling and drop down video sampling, were carried out for the Seagreen ES (2012). These surveys found that the sediments present across the Seagreen Alpha OWF site ranged from cobbles with sand and gravelly sand in the west to sandy gravel in the east. There was a greater predominance of fine sediments recorded across Seagreen Bravo OWF compared with Seagreen Alpha OWF with sediments ranging from slightly gravelly sand in the west, sandy gravel in the central section and gravelly sand in the east of the Seagreen Bravo OWF.

Polychaetes were the dominant taxa recorded in the infauna, with approximately 60% of the individuals and 36% of the species present in Project Alpha and 62% of individuals and 40% of the species present in Project Bravo. The most abundant species of polychaetes were *Capitella capitata* and *Chone spp.* Molluscs were the next most numerous group, with the bivalve *Moerella pygmaea* being the most abundant species present. Crustaceans were the next most abundant group, with the most abundant species being the amphipod *Atylus vedlomensis*, and the squat lobster *Galathea intermedia*.

The epifauna was dominated by crustaceans, with them accounting for almost 70% and 81% of the individuals for Seagreen Alpha and Seagreen Bravo respectively. The most abundant species

were the shrimp *Crangon allmani* and the hermit crab *Pagurus bernhardus*. Demersal fish were also found as part of the epifauna, including *Limanda*, *Agonus cataphractus* and *Ammodytes spp.*

The habitats recorded across both sites were identified as being typical of the wider study area (defined in the ES as the northern North Sea regional area) and areas of the North Sea that have been subject to fishing with ground contacting gears. The habitats mapped for the EIA characterisation can be divided into the following benthic community classes for each site:

- Seagreen Alpha OWF:
 - Western area: ‘*Sabellaria*’, ‘sparse polychaetes and bivalves’ and ‘faunal turf’; and
 - Central and eastern areas: dominated by the sabellid polychaete classes ‘dense Chone’ and ‘sparse Chone’.
- Seagreen Bravo OWF:
 - Western half: ‘*Sabellaria*’, ‘rich polychaetes and bivalves’ and ‘epifauna with polychaetes’; and
 - Eastern half: ‘dense Chone’ and ‘rich polychaetes’.

In general, the communities present across the Seagreen Alpha and Seagreen Beta OWF areas are typical of the wider North Sea area that have been subject to fishing with ground contacting gears (such as dredges) for a number of years. Whilst there is likely to have been some small degree of natural variability in the benthic communities present within the Seagreen OWF, it is reasonable to assume that the habitats and communities present at the time of construction and the boulder clearance works will be broadly similar to those recorded during the EIA characterisation surveys and described here. As these habitats have already been widely impacted by fishing, they are not considered to be pristine or particularly sensitive to physical impacts.

The most sensitive habitats present were *Sabellaria* (equivalent biotope SBR.PoR.SspiMx) which was located mainly in the western part of the Seagreen Alpha site, and dense *Amphiura/Phoronis* (biotope SS.SMu.CSaMu.AfilMysAnit) which is located in the extreme south west of Seagreen Alpha. It is possible that the colonisation of suitable areas by *Sabellaria* increases the species richness of habitats; however, there was no evidence that this species forms extensive or well-developed aggregations at this site, which would potentially qualify as ‘reefs’ under the Habitats Directive or criteria developed by Gubbay (2007). A Drop-Down Video (DDV) survey was undertaken in October 2020 to verify that there were no biogenic reef habitats present in the Project Area. No evidence of biogenic reefs was identified in either the 2012 ES or 2021 survey (Seagreen, 2012; Seagreen, 2021).

Ocean quahog *Arctica islandica* was also identified in the Project Area. *Arctica islandica* was recorded at 22 sites within the Project Area, however, only juveniles were found, with a maximum of four individuals per 0.1 m² grab sample. The presence only of juveniles suggests that more mature animals may have been removed by external disturbance mechanisms over a period of many years. The main activity causing seabed disturbance within the site is commercial fishing, in particular with seabed contacting mobile gear such as scallop dredges (Seagreen, 2012).

A pre-construction DDV survey of the Seagreen Alpha and Seagreen Bravo OWF areas was carried out in 2020 to determine whether any Annex I biogenic or geogenic reef was present at any of the 15 Annex I target locations identified from a predictive modelling exercise (Seagreen Wind Energy, 2019a) within the project boundary (Seagreen, 2021). No biogenic reefs were recorded within the array area, with only small numbers of *Mytilus edulis* and *Sabellaria spinulosa* (as isolated tubes) being present at survey locations. There were several sites that had boulder and cobble formations that had a low resemblance to a stony reef, and three sites in the array area had areas of medium resemblance stony reef (Seagreen 2021; Irving 2009). The majority (12) of the 15 target locations did not meet the criteria for resemblance to Annex I stony reef. Three sites (ST04, ST05 and ST07) had areas of seabed that were considered to meet all four of the criteria for medium resemblance stony reef and were considered to be likely to represent Annex I reef habitat. These three sites had substrate comprising more than 40% cobbles and boulders supporting a biota dominated by epifauna that dense aggregations of the brittlestars *Ophiura fragilis* and *Ophiura nigra* over larger cobbles and boulders. Of these sites, only Site ST07 was located within the array area and is of relevance to this report. At ST07 the medium resemblance reef made up an area of approximately 67 m² along the north-south transect (ST07a) and 73 m² along the west-east transect, but was not present at further deployments 91 m to the south or 88 m to the east of these transects. The site locations are shown in Figure 5.2.

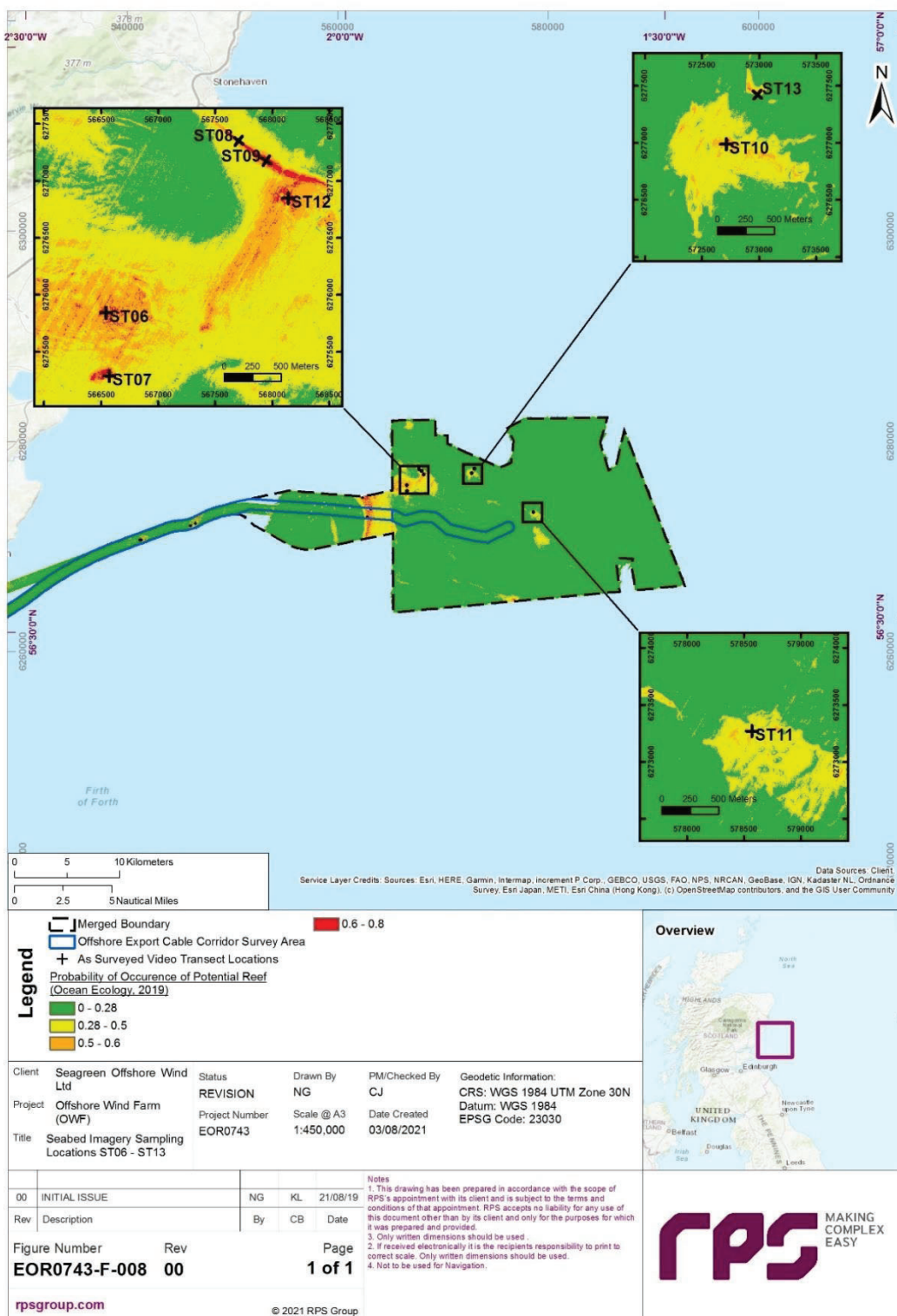


Figure 5.2. Location of the APEM benthic survey sites within the Seagreen OWF array area.

5.5 Fish and Shellfish

A wide range of demersal and pelagic fish species were present within the Project Area. Benthic trawl surveys found 34 species. A number of the fish and shellfish species present use part of or all of the area for spawning and nursery grounds (Ellis *et al.*, 2012). Species that use the Project Area for spawning and/or as a nursery ground are herring (*Clupea harengus*), cod (*Gadus morhua*), sandeel (*Ammodytidae spp.*), sprat (*Sprattus sprattus*), whiting (*Merlangius merlangus*), mackerel (*Scomber scombrus*), plaice (*Pleuronectes platessa*), saithe (*Pollachius virens*), lemon sole (*Microstomus kitt*), spurdog (*Squalus acanthias*), nephrops (*Nephrops norvegicus*), scallops (*Argopecten irradians*), edible crab (*Cancer pagurus*), lobster (*Nephropidae sp.*) and squid (*Loligo vulgaris*).

Migratory, or diadromous, fish are also present. Marine Scotland highlighted the presence and migration of Atlantic salmon (*Salmo salar*) smolts during consultations. During site-specific surveys, no Atlantic salmon were recorded, however, due to the distance from coast, this was expected. Salmon are known to spawn in a number of rivers in the east coast of Scotland. The species is present as a feature for a number of protected areas within the vicinity of the Seagreen OWF Area including as a primary feature of the River Tay SAC, River Dee SAC and River South Esk SAC, and present as a qualifying feature of the River Teith SAC. Most fish leave rivers around mid-April to end of May, and there is a chance that individuals will travel through the Seagreen OWF Area. Other migratory species may also pass through this area including sea trout, European eel (*Anguilla anguilla*), sea lamprey (*Petromyzon marinus*) and river lamprey (*Lampetra fluviatilis*).

5.6 Shipping and Navigation

Commercial and recreational shipping may use the project area for a number of reasons including transport of cargo and commercial fishing.

AIS data taken from 2017 reported that within the Seagreen OWF site, there is an average of 18 unique vessels per day in winter and 20 vessels per day in summer. The main types of vessels consisted of cargo vessels (27%), tankers (20%) and fishing vessels (14%). A total of seven recreational vessels were recorded in summer, but no recreational vessels were recorded during winter.

There are no military training areas within the project boundary and there are no restrictions on anchoring, no chartered spoil grounds and no marine aggregate dredging areas within or adjacent to the Seagreen OWF Site.

The consented Inch Cape Offshore Wind Farm and Neart na Gaoithe Offshore Wind Farm are both located to the south-west of the Seagreen OWF Site at a minimum distance of 4.6 nm. The closest Oil and Gas infrastructure is the Buzzard platform located approximately 71 nm north-west. Vessels used in these projects may travel through or adjacent to the Seagreen OWF area.

5.7 Commercial Fisheries

Commercial fisheries operate within the project area which lies within International Council for the Exploration of the Sea (ICES) rectangle 42E8. The data used for commercial fisheries is based on

the information and data used to inform the Seagreen EIA (2018). ICES rectangle 42E8 reports landing values that are of moderate to low importance on a national scale and of moderate importance on a regional scale. The scallop fishery is the predominant fishing activity within the Seagreen Alpha and Seagreen Bravo array area, with other smaller fisheries targeting squid (*Loligo sp.*) and creelers targeting lobster (*Homarus gammarus*) and crabs (*Cancer pagurus* and *Necora puber*). *Nephrops* are also an important species for the regional area, however, they are not fished for in ICES Rectangle 42E8 and therefore, the Seagreen Alpha and Seagreen Bravo array area. The average monthly value of landings for each species can be seen in Figure 5.3. The vast majority of vessels are over 15 m in length, with vessels in the 10 -15 m category. Vessels in the under 10 m category account for a very small proportion of overall landings.

Scallops are principally targeted by boat dredges which typically penetrate the seabed by 20 cm. The majority of scallop dredging vessels are over 15 m in length, with fishing activity in the regional area being predominantly carried out by larger category scallop vessels (over 20 m in length). These vessels are capable of fishing continuously for several days at a time and working in difficult weather conditions. They are nomadic with a wide operational range, targeting grounds around the UK including the North Sea, Irish Sea and English Channel. Scallop dredging occurs throughout the year and is generally cyclical, with grounds being intensively targeted before being left to recover. Vessel number within the Seagreen Alpha and Seagreen Bravo array area will therefore vary annually.

Squid are targeted by bottom otter trawlers, with the majority of vessels being over 15 m. Squid are more often found in inshore waters, with comparatively lower landing values of squid in ICES Rectangle 42E8 compared to other ICES Rectangles in the region. Squid landings fluctuate annually, with fishing activity occurring further offshore as the season progresses. Vessel numbers will therefore vary depending on the time of year and between years. Over the 2000 to 2016 period, relatively high landings values have been recorded in rectangle 42E8 in 2010, 2011 and 2015, with the remaining years recording comparatively lower values.

The lobster and crab fishery are predominantly targeted by full time static gear vessels which set pots/creels. Once again, landings from ICES Rectangle 42E8 are comparatively lower than further inshore areas, however, landings of these species have been made (Figure 5.3). Creeling in the area occurs all year round, although activity peaks in the summer months.

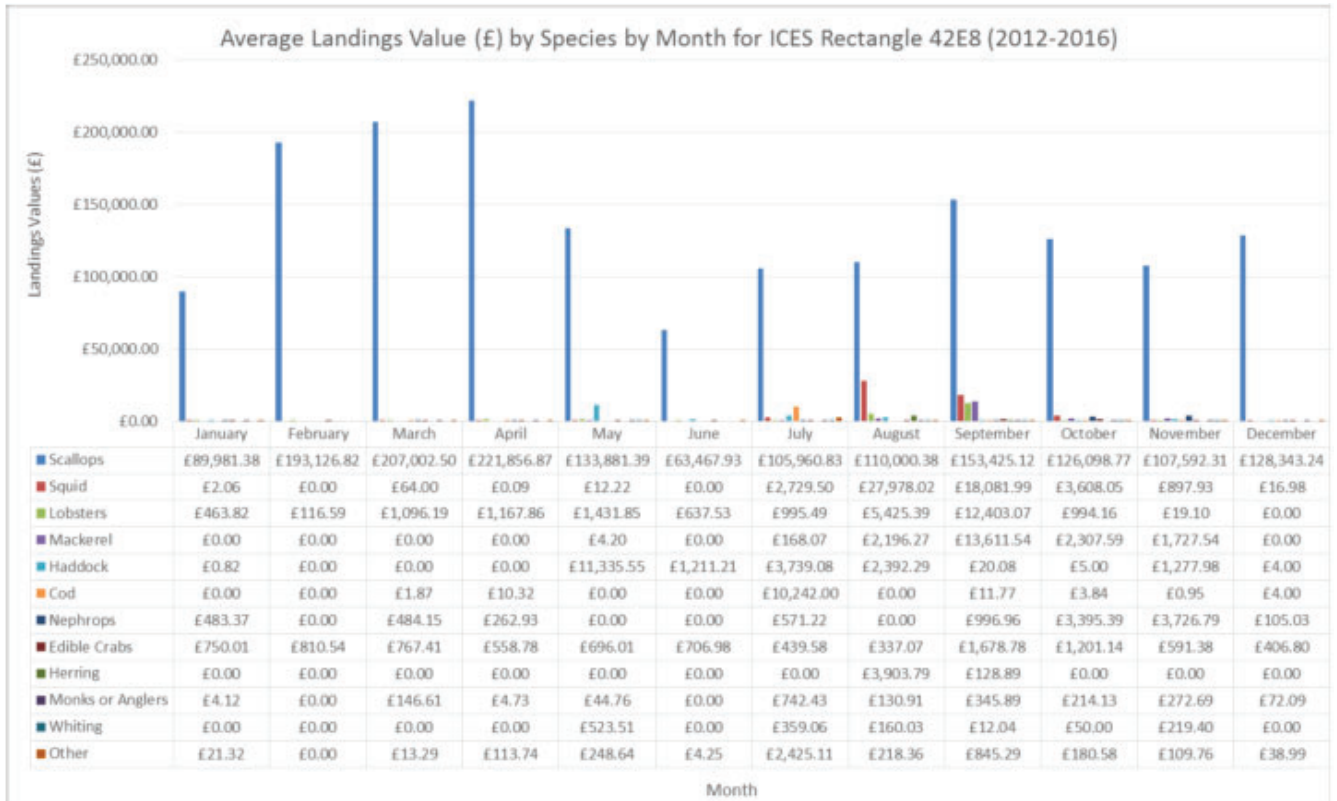


Figure 5.3: Average landings value (£) by species by month in ICES Rectangle 42E8 (2012-2016) (Seagreen, 2018).

5.8 Marine Archaeology and Cultural Heritage

There are no designated wrecks within the boundaries of the OWF site. Marine geophysical surveys were conducted for the Seagreen ES (2012) which identified 55 maritime receptors of high or medium archaeological potential, some of which correspond with the known wrecks verified by the UKHO data. These were given individual Archaeological Exclusion Zones (AEZs) of either 50 m or 100 m depending on the potential of the archaeological feature. In accordance with the Original ES, a consolidated total of 33 AEZs were proposed in the Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) (LF000009-CST-OF-PLN-0002; Seagreen, 2019b). Potential archaeological features have been also identified during the ongoing UXO identifications surveys and AEZs have been proposed for these in line with the WSI and PAD.

6. Assessment of Effects

The following sections provide an assessment of the potential environmental impacts of the boulder clearance works in relation to the following environmental topics:

- Physical Environment
- Benthic Ecology;
- Fish and Shellfish;

- Protected Sites;
- Shipping and Navigation;
- Commercial Fisheries; and
- Marine Archaeology.

The following environmental topics have been screened out of the assessment, as presented to MS-LOT during the meeting held on the 28th July 2021 (see Section 1.1):

- Marine Mammals; and
- Ornithology.

The proposed boulder clearance works have the potential to create a range of 'impacts' and 'effects' with regard to the physical and biological environment. The definitions of impact and effect used in this assessment are drawn from the Design Manual for Roads and Bridges (DMRB) (Highways Agency *et al.*, 2008).

The term 'impact' is used to define a change that is caused by an action. For example, installation of sheet piles (action) results in increased levels of subsea noise (impact). The term 'effect' is used to express the consequence of an impact. For example, in the offshore environment the installation of sheet piles (activity) results in increased levels of subsea noise (impact), with the potential to disturb marine mammals (effect). Each assessment concludes whether the additional boulder clearance methodologies are likely to result in a negligible, minor, moderate or major effect on the receptor. The level of effect is based upon professional judgement and the available evidence to support the conclusions made.

Consideration of the potential for Likely Significant Effect (LSE) on European sites, as a result of the additional boulder clearance methodologies, is presented in Section 8.

6.1 Temporary Disturbance to Seabed

6.1.1 Physical Environment

The physical environment is likely to be affected by the proposed works due to physical disturbance of the seabed and habitat redistribution. A small increase in suspended sediment is also likely to occur, but this will be a negligible amount, particularly as only one SCAR plough pass will be required. Displacement of substrate has the potential to damage or destroy rock formations on the seabed. As there will be no removal of any substrate, it is likely that these formations can reform in a near location after their displacement. The boulder clearance works will result in the redistribution of boulders along the edges of the inter array cable routes affected. There is the potential for this to result in the creation of small berms either side of the corridor. It is however considered likely that these areas of boulders will be rapidly reworked by the action of currents and will potentially be redistributed further during the subsequent cable installation works. Whilst it is not possible to determine where the sediment will be redistributed to, it is reasonable to assume that some of the material will be moved back into the areas which were cleared, thus partially restoring to topography of the area. The movement of boulders is therefore not predicted to create permanent berm features and will therefore not affected local sediment transport pathways.

Overall, due to the small spatial and temporal extent of the works, the nature of the works, and the fact that permanent berms will not be created, any effects on the physical environment will be negligible.

6.1.2 Benthic Ecology

Potential effects of the clearance works on benthic ecology receptors may occur from the physical disturbance of the seabed and habitat redistribution. The maximum design scenario of the works are shown in

Table 2.1. Overall, the area of seabed affected by temporary disturbance associated with the boulder clearance works may be up to 19.58 km². This is a conservative estimate of the area of effect, with any effects of the works being highly localised and involve only the redistribution of sediment to either side of the inter-array cable route corridor (16 m width) or beyond the periphery of those WTG locations cleared in this way. No sediment will be removed during these works.

As outlined in the Seagreen ES (Seagreen, 2012), the majority of species and biotopes present within the array area and which may therefore be impacted by the clearance works, exhibit good potential to recover following physical disturbance. Due to the localised effects and short-term nature of the proposed works, and the widespread nature of these habitats within the wider area, it is expected that the benthic communities would be able to fully recover to pre-impact levels following subsequent spawning and recruitment periods.

As discussed in the Seagreen ES (Seagreen, 2012), post construction monitoring at other OWFs also supports this prediction. At the Kentish Flats OWF and Egmond aan Zee OWF, post-construction benthic monitoring showed that any changes in the benthic communities were indistinguishable from what would be expected from natural variability (Vattenfall, 2008; Daan *et al.*, 2009).

A post-construction survey was also undertaken at the Humber Gateway offshore wind farm which investigated the effects of export cable and array cable installation. The surveys demonstrated that in areas where the seabed comprised relatively flat seabed with mixed, coarse sediments there was little variation in the surface of the seabed or evidence of cable installation (PMSL, 2016). This was supported by DDV sampling in these areas, which showed the presence of pebbles and muddy sandy gravel (i.e. reflecting the pre-construction baseline) in areas where cables had been installed approximately one year previously.

Given the existing patchiness of the distribution of cobbles and boulders in offshore environment this is considered unlikely to represent a significant shift in the baseline situation. Furthermore, since there will be no sediment removal, no loss of habitat will occur, and this will therefore not act as a barrier to the recovery of any epifaunal communities impacted during the process.

The most sensitive biotopes identified within the site boundary are SS.SBR.PoR.SspiMx (non-reef forming) and SS.SMu.CSaMu.AfilMysAnit. Both of these biotopes display a low resistance, medium resilience and overall medium sensitivity to disturbance of the substratum or seabed (Tillin *et al.*, 2020; De-Bastos and Hill, 2016). However, full recovery is expected within approximately two years.

Overall, any effects on benthic ecology receptors would be short-term, temporary and highly localised, with full recovery of all communities expected within two years of the clearance works and subsequent cable installation. The effects of the seabed disturbance due to the boulder clearance on benthic receptors is therefore considered to be negligible.

6.1.3 Fish and Shellfish

Potential effects of the clearance works on fish and shellfish receptors may occur from the physical disturbance of the seabed and habitat redistribution. In particular, the clearance works may result in the temporary loss of habitat, spawning substrate and reduce the prey available within the local area. Shellfish species which are bottom dwellers have limited mobility, such as scallops, will be directly affected by the works and could be damaged during the boulder relocation process. As a result, there may be an increase in scavenging species of fish and crustacea attracted to the area of disturbance. Few pelagic species will be directly affected by the seabed disturbance as they have the ability to move away during the works. Indirect effects such as loss of prey may have some impact on pelagic species, however, due to the localised effects and short temporal scales of the works, this is expected to be negligible.

Some fish species are likely to spawn within the vicinity of the works and may temporarily lose the affected areas to spawn in (Ellis *et al.*, 2012). The proposed works are expected to take place between November 2021 and May 2022 which overlaps with several species spawning periods such as cod and sandeels. However, as the works are short-term with highly localised effects, the effects on spawning are likely to be limited. Furthermore, the works are simply redistributing the habitat into a nearby location, so the substrate will still be present for spawning. Sessile shellfish species (e.g. mussels) may be more adversely affected by the direct effects of the works, however, communities are likely to recover quickly on the redistributed habitats. Overall, the works will have a negligible effect on fish and shellfish receptors.

6.1.4 Protected Sites

The proposed boulder clearance works have the potential to affect some of the qualifying features of the protected sites outlined in Table 5.1. European sites (i.e. SPAs and SACs) are fully considered in Section 8 and this section focuses on the impacts to non-European sites (e.g. MPAs).

The Firth of Forth Banks Complex MPA partially overlaps with the Seagreen OWF. As outlined in Table 5.1, the MPA is designated for ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines representative of the Wee Bankie Key Geodiversity Area.

The Firth of Forth Banks MPA overlaps with the site location by 123.8 km². This equates to approximately 5.8% of the total area of the MPA. Whilst the proposed boulder clearance works may overlap with some of the features of the MPA, as discussed in section 6.1.2, the anticipated extent of the proposed works will be relatively small (19.58 km²) and only a small proportion of this may occur within the boundary of the MPA. The works will also be short term in nature and temporary, with any effects being highly localised around the area of impact. As was concluded in

the MPA Assessment for the Seagreen OWF (Marine Scotland, 2014) the shelf bank and mound large-scale features and the Moraines key geomorphological feature are considered unlikely to be adversely affected by the proposed works due to the very small scale of the impact footprints in relation to these large scale features. With respect to the subtidal sands and gravels and ocean quahog features, the impact will be small in extent. For example, if all the proposed boulder clearance along inter array cables was to occur within the MPA (i.e. an over-precautionary and unrealistic scenario) this would equate to 0.9% of the total area of the MPA. In reality, the area impacted within the MPA will be substantially less than this. Furthermore, as described in Section 6.1.2, any effects on benthic receptors are likely to be small, with a fast recovery following any disturbance. There is therefore no significant risk of the proposed boulder clearance works hindering the conservation objectives of the Firth of Forth Banks Complex MPA.

Overall, the proposed works will have a negligible effect on protected sites.

6.1.5 Shipping and Navigation

The proposed boulder clearance works have the potential to affect shipping and navigation within the site boundary. Specifically, vessels may have to route around the proposed works while they are undertaken. The proposed boulder works will overlap with the start of offshore construction within the array area. Therefore, whilst it is unlikely that the works will result in an impact shipping and navigation within the area, the construction area will also be marked off such that non-works traffic will avoid the area. A relatively small number of vessels pass through the Seagreen OWF area, and within that, the proposed works will be highly localised and easily avoidable. At the time of the proposed boulder clearance works (assuming it coincides with the start of offshore construction) the Marine Coordination Centre (MCC) will also be in operation, which will monitor vessel traffic in the area and control works vessels within the site. The works will also be short-term, causing a temporary impact. Overall, the impact of the proposed works on shipping and navigation will be negligible.

6.1.6 Commercial Fisheries

The proposed boulder clearance works have the potential to affect commercial fisheries. During the works, the presence of the vessel may temporarily restrict access to the area of the works. The main fishery likely to be affected is scallop dredging, with this being the most active mobile fishery within the area. However, due to the short-term nature of the works and localised effects during the works, any impact on commercial scallop dredging is not expected to have a large effect, with any restrictions or loss of fishing grounds only lasting for a short duration. As described above, the construction area will also be marked off such that non-works traffic, including fishing vessels, are expected to avoid the area.

There is a potential for the SCAR plough to snag static fishing gear within the Seagreen OWF Site which could lead to safety and manoeuvrability issues and to loss of the gear. Seagreen has established Cooperation Agreements with the static gear fishermen working in the project site for the removal of their gear during the construction works. Other fishing vessels using mobile gear will be required to remain clear of the vessels engaged in clearance works under the Convention on

the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs). This will be monitored by any guard vessels present and by the MCC.

Some fishing techniques such as dredging may be affected by the redistribution of boulders alongside the inter-array cable corridors. Deployment of static gear will be less affected. However, no additional sediment will have been added to the seabed, and boulders will naturally re-distribute across the seabed. Furthermore, fishing techniques such as dredging are expected to redistribute sediment and boulders in a similar manner to the proposed SCAR plough. It is also the case that the dredgers will be targeting the habitat with more sandy, gravelly substrate than dense boulder fields, which may be more suited to the target species of the static gear fishery. The impact on either fishery is expected to be limited in nature and short term.

Seagreen will engage and communicate with the fisheries sector locally and through the Forth and Tay Commercial Fisheries Working Group to ensure that they are aware of the timings of the works. The Seagreen Project has also developed a Fisheries Management and Mitigation Strategy (FMMS) which details Seagreen's approach to fisheries liaison and mitigation and includes proposed measures to facilitate co-existence between the Seagreen Project and commercial fishing and to minimise potential impacts. All Seagreen Contractors (including their Sub-Contractors) involved in the Seagreen Project are required to comply with the FMMS through conditions of contract. Overall, due to the localised and short-term effects of the works, the impact on commercial fisheries is expected to be negligible.

6.1.7 Marine Archaeology and Cultural Heritage

The proposed boulder clearance works have the potential to affect marine archaeology within the site boundary. The WTG locations and inter-array cable routes do not overlap with any AEZs (Seagreen, 2012), therefore, no effects on marine archaeological receptors are likely to arise.

There is the potential for previously unknown archaeological sites or material to be encountered during the works as occurred during the potential UXO target investigations. If this occurs, measures will be taken to reduce the level of impact as outlined in the Seagreen WSI and PAD (LF000009-CST-OF-PLN-0002), specifically the Protocol for Archaeological Discoveries: Offshore Renewables Project (ORPAD). Any items of interest that are identified during the pre-construction surveys will be considered and appropriate action will be taken accordingly such that these locations are avoided, or items are relocated or recovered.

Due to the planned avoidance of AEZs and embedded mitigation measures, as well as the localised extent of any effects caused by the works, there will likely be a negligible impact on marine archaeology throughout the works.

7. Cumulative Effects

This section considers the potential for cumulative effects arising from the boulder clearance works identified in Section 2 alongside other known activities. Given the limited number of other developments present within the Firth of Forth, it is unlikely that cumulative effects will have a large impact on receptors.

Seabed disturbance caused by the proposed boulder clearance works will be limited to areas where construction impacts of the OWF would subsequently take place (i.e. WTG and inter array cable installation). As outlined in section 3.2.1, the total area of seabed affected as a result of boulder clearance will be subject to temporary disturbance as opposed to permanent habitat loss, as would have been the case for GBS installation and is considered to be highly conservative (Seagreen, 2012; Seagreen 2018). With respect to permanent habitat loss for the GBS scenario the Seagreen ES (2012) and EIA (Seagreen, 2018) both concluded no significant adverse cumulative impacts predicted with other plans or projects during construction. Therefore, conclusions from these reports are still considered appropriate for this assessment in support of the Marine Licence application for boulder clearance activities, which is a temporary disturbance.

Due to the relatively small area of repeat seabed disturbance predicted during the proposed boulder clearance works, and the localised and short-term nature of the effects, negligible cumulative effects will occur.

8. Consideration of Likely Significant Effects on European Sites

The location of the proposed boulder clearance works in relation to the European sites identified in Section 5.2 is shown in Figure 5.1. Consideration of the potential for Likely Significant Effects (LSE) on these sites is discussed below.

8.1.1 Fowlsheugh SPA

The Fowlsheugh SPA is designated for a number of breeding marine bird species. Due to the distance of the site from the proposed works (27.5 km), and the fact that the works are not predicted to have any interaction with seabird species, there is no LSE on qualifying interests of the Fowlsheugh SPA from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.2 Outer Firth of Forth and St Andrews Bay Complex SPA

The Outer first of Forth and St Andrews Bay Complex SPA is designated for overwintering seabirds and other waterbirds, and breeding seabirds. Due to the distance of the site from the proposed works (29 km), and the fact that the works are not predicted to have any interaction with seabird species, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.3 Firth of Tay and Eden Estuary SAC

The Firth of Tay and Eden Estuary SAC is designated *inter alia* for harbour seal. At its closest point, the SAC is 47 km away from the Seagreen Alpha and Seagreen Bravo array area, therefore, it is unlikely that harbour seals from the site would forage in this area. Furthermore, due to the small magnitude of any underwater noise, as well as the effects being highly localised and short-term, marine mammal species will not be affected. Therefore, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.4 Forth Islands SPA

The Forth Islands SPA is designated for a number of breeding marine bird species. Due to the distance of the from the proposed works (49 km), and the fact that the works are not predicted to have any interaction with seabird species, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.5 Isle of May SAC

The Isle of May SAC is designated for *inter alia* grey seal. At its closest point, the SAC is 52 km from the Seagreen Alpha and Seagreen Bravo array area, therefore, whilst there is the potential for grey seals from the site to forage in this area, due to the small magnitude of any underwater noise, as well as the effects being highly localised and short-term, marine mammal species will not be affected. Therefore, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.6 Berwickshire and North Northumberland Coast SAC

The Berwickshire and North Northumberland Coast SAC is designated *inter alia* for grey seal. At its closest point, the SAC is 64.5 km from the Seagreen Alpha and Seagreen Bravo array area, therefore, whilst there is the potential for grey seals from the site to forage in this area, due to the small magnitude of any underwater noise, as well as the effects being highly localised and short-term, marine mammal species will not be affected. Therefore, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.7 St Abb's Head to Fast Castle SPA

The St Abb's Head to Fast Castle SPA is designated for a number of breeding marine bird species. Due to the distance of the site from the proposed works (66 km), and the fact that the works are not predicted to have any interaction with seabird species, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.8 Buchan Ness to Collieston Coast SPA

The Buchan Ness to Collieston Coast SPA is designated for a number of breeding marine bird species. Due to the distance of the site from the proposed works (72 km), and the fact that the works are not predicted to have any interaction with seabird species, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

8.1.9 Moray Firth SAC

The Moray Firth SAC is designated for the bottlenose dolphin and is situated 142 km away from the proposed boulder clearance works. Marine mammal species are unlikely to be affected by the works due to the small magnitude of any underwater noise, as well as the effects being highly

localised and short-term.. Bottlenose dolphin is mainly encountered in inshore areas and are therefore unlikely to be affected by the localised boulder clearance works offshore in the array area. Therefore, there is no LSE from any of the impacts identified in this assessment either alone or in-combination with any other projects or aspects of the Seagreen project.

9. Summary

Seagreen wishes to apply for consent for an additional boulder clearance methodology to be implemented for the WTG locations and inter-array cable route corridors, to be undertaken as part of the construction of the Seagreen Alpha and Seagreen Bravo OWF Projects. Some of the boulder clearance works may fall within the Firth of Forth Banks Complex MPA.

This Environmental Report has been prepared in support of a Marine Licence application for the use of a SCAR plough for boulder clearance and has provided an assessment of the potential environmental impacts of the licensable activities. A summary of the environmental effects is presented in Table 9.1 below.

The key potential impacts from the cable installation activities are in relation to seabed disturbance from the use of the SCAR plough or ROV push bar. However, due to the short-term nature and highly localised effects of the works, as well as no sediment being removed from the seabed, only negligible impacts are expected to occur to any receptors.

It is considered that there is no significant risk of the proposed boulder clearance works hindering the conservation objectives of the Firth of Forth Banks Complex MPA. As all European sites are located more than 27 km from the proposed works, no population level effects from the boulder clearance works activities and therefore no LSE on qualifying features of the follow key designations:

- Fowlsheugh SPA;
- Outer Firth of Forth and St Andrews Bay Complex SPA;
- Firth of Tay and Eden Estuary SAC;
- Forth Islands SPA;
- Isle of May SAC;
- Berwickshire and North Northumberland Coast SAC;
- St Abb's Head to Fast Castle SAC;
- Buchan Ness to Collieston Coast SPA; and
- Moray Firth SAC.

Table 9.1: Summary of environmental effects.

Receptor	Potential Impact	Assessment of Effect
Physical Environment	Seabed disturbance	Negligible
Benthic Ecology	Seabed disturbance	Negligible
Fish and Shellfish	Seabed disturbance	Negligible
Protected Sites	Seabed disturbance	Negligible
Shipping and Navigation	Seabed disturbance	Negligible
Commercial Fisheries	Seabed disturbance	Negligible
Marine Archaeology and Cultural Heritage	Seabed disturbance	Negligible

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