17 Marine Water and Sediment Quality

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17 Marine Water and Sediment Quality

17.1 Executive Summary

17.1.1 As part of the Proposed Development there is a requirement for a new extended slipway and a new landing jetty to be constructed on the south-east of Faray. This would include works below the Mean High Water Spring (MHWS) line. This chapter provides an assessment of marine water and sediment quality impacts of this requirement for marine works.

17.1.2 The relevant components of the Proposed Development comprise:

- A new extended slipway to replace the existing facility. The existing slipway is c.20 m long by 3.5 m wide, though this was originally longer. This would be upgraded to a maximum 36 m long and 8 m wide. The design of the slipway would be sufficient to enable access by larger vessels with the bow or stern gate and would be built to a standard design for the Orkney Islands to allow access for local vessels. The slipway may require dredging to allow access to a c.600 m^2 area to the south of the slipway as indicated in Figure 17.1.
- A new landing jetty to accommodate abnormal loads. The jetty would comprise a causeway up to 55 m long and 10 m wide, terminating in square structure for docking measuring up to 20 m by 20 m. The square docking structure would likely be constructed on site from sheet piles. The causeway would be in-filled and capped-off with concrete batched onsite. The landing jetty may require dredging to allow access to a c.2400 m^2 area at the seaward end of the docking area as indicated in Figure 17.1.

17.1.3 Dredging to increase the access areas will be required for c. 3,000 m^3 of sediment. The dredge areas are provided in (Figure 17.1) to a maximum dredge depth of 1 m, which will require disposal at sea of dredged sediment. It is anticipated that the dredged material will be disposed of at a licenced disposal site close to the Proposed Development. The likely disposal site will be Stromness A. Dredging is expected to be completed in 1-2 weeks. A marine licence application has been submitted for the dredging works under the Marine (Scotland) Act 2010.

17.1.4 This chapter describes the assessment carried out to assess the potential impact of the Proposed Development on marine water and sediment quality from the proposed dredging activities. The assessments provided within this chapter are supported by a desk study of the dredging required and an estimation of the disturbance, and resettlement of sediments as a result.

17.1.5 This assessment of potential impacts on marine water and sediment quality does not include assessment of disposal on the basis that the disposal is at a site that is already an accepted and regulated activity. However, a Best Practical Environmental Options (BPEO) has been prepared to accompany the dredging marine licence application. This includes an assessment of alternative options, outlining why disposal at sea was determined as the BPEO in this instance. In addition, as requested by the Northern Lighthouse Board (NLB), disposal plans will be included within the Port Management Plan (see Chapter 18 for further details).

17.1.6 A survey to collect sediment samples, which was subsequently subjected to Particle Size Analysis (PSA) and contaminants at an accredited laboratory, show that the material to be dredged is almost entirely sand with a very low content of fine material.

17.1.7 Sand particles released into the water column during the dredging activity will re-deposit onto the bed within a few hundred metres of the dredging. The desk study estimates the distribution of this re-depositing sediment by considering the rate at which these sand particles will fall back onto the bed and the distance moved by the sand particles (under the influence of tidal currents) over that period. The release of sand particles is estimated to be 5% of the material that would be dredged (though this figure will reduce depending on the prevalence of sandstone boulders). This means that

around 150 m^3 of sand will be deposited, a portion of which will redeposit in the dredging areas and be re-dredged.

17.1.8 The estimated depths of sand deposition are in the region of:

- 8-14 mm within 50 m of the slipway and causeway,
- 2-8 mm within 50-150 m of the slipway and causeway; and,
- falling to below 1 mm at a distance of 200 m.

17.1.9 The levels of sediment deposition as a result of the dredging activity is likely to result in a temporary **minor and not significant** effect within 150 m of the dredging activity and will reduce to **negligible and not significant** at distances further than that.

17.1.10 The chemical analysis of the sediment samples collected as part of the planning process, show that sediment in the areas to be dredged contains very low concentrations (or below levels of detection) of heavy metal, organotin, polyaromatic hydrocarbons, polychlorinated biphenyls and pesticides. Where chemicals were found in very low concentrations, all were well below the all available action levels, such as Marine Scotland action levels and the Canadian temporary effect level, in most cases by an order of magnitude lower.

17.1.11 On this basis there is considered to be **no effect** on water quality chemical parameters as a result of the dredging activity and a **negligible and not significant effect** during the limited time period required for the dredging for suspended sediments.

17.2 Introduction

17.2.1 This chapter describes and evaluates impacts from dredging in marine water and sediment quality associated with the construction of the new extended slipway and landing jetty. It documents the baseline conditions, includes an assessment of the likely effects of dredging on marine water and sediment quality and defines mitigation measures where significant effects are predicted.

17.2.2 As part of the Proposed Development there is a requirement for a new extended slipway and a new landing jetty to be constructed on the south-east of Faray, this would include dredging works below the Mean High Water Spring line (MHWS). Under the Marine (Scotland) Act 2010, an application for a marine licence will be submitted to Marine Scotland (MS-LOT) for the dredging works below MHWS. The structures are illustrated in Figure 17.1.

17.2.3 The specific objectives of this chapter are to:

- Describe the marine water and sediment baseline conditions below MHWS.
- Summarise the scope of the marine water and sediment assessment.
- Assess the magnitude of the impacts and significance of effect on marine water and sediment due to the dredging activity. The assessment draws upon a Dredging Desk Study (Appendix 17.2) carried out by HR Wallingford and also includes an assessment of sediment sample analysis.
- Provide additional mitigation measures to address significant effects (if applicable) and assess any residual effects.
- Provide an impact assessment for marine water and sediment receptors, to accompany the marine licence application.

17.2.4 This chapter has been authored by HR Wallingford and ITPEnergised (ITPE) and is supported by the following appendices:

- Appendix 17.1 – Marine Water and Sediment Quality Inception Report.
- Appendix 17.2 – Dredging Desk Study.
- Appendix 17.3 – Sediment Sample Plan and Marine Scotland approval.
- Appendix 17.4 – Sediment Sample Analytical Report.

Statement of Competence

17.2.5 This chapter has been prepared by John Bleach of HR Wallingford and reviewed by Gemma Tait of ITPE.

17.2.6 John Bleach (MSc, BSc) is a Principle Marine Ecologist Consultant at HR Wallingford, with over 17 years' experience in the marine and freshwater field, including EIA, marine monitoring and marine policy.

17.2.7 Gemma Tait (MA, MSc) is a Principal Environmental Consultant at ITPE, an EIA specialist with over 10 years' experience.

Proposed Development

17.2.8 As discussed in Chapters 3 and 12, the following construction works would include works below MHWS.

New Extended Slipway

17.2.9 A new extended slipway would be required to replace the existing facility would need to be replaced regardless of the Proposed Development as the current slipway is badly damaged and access to the island is still required for agricultural purposes. The new extended slipway would be built in the same location as the existing slipway. It would be refurbished and extended to allow for preliminary site works to be undertaken. The design of the slipway would be sufficient to enable access by larger vessels with the bow or stern gate and would be built to a standard design for the Orkney Islands to allow access for local vessels. The extant slipway is c.20 m long by 3.5 m wide, though this was originally longer. This would be upgraded to a maximum 36 m long and 8 m wide.

New Landing Jetty

17.2.10 The new landing jetty will accommodate abnormal loads, such as turbine components. The jetty would comprise a causeway up to 55 m long and 10 m wide, terminating in a square structure for docking measuring up to 20 m by 20 m. The square docking structure would likely be constructed on site from sheet piles. The causeway would be in-filled and capped-off with concrete batched onsite.

17.2.11 Localised dredging will be required for the construction of both the slipway and the jetty, in addition there is the potential for dredging to allow for vessel access to the jetty. Locations of dredging required at these two structures are shown in Figure 17.1. An estimated dredging of up to 3,000m^3 of sand will be required, taking 1-2 weeks to complete.

17.3 Legislation, Policy and Guidelines

17.3.1 Relevant legislation, policy and guidance documents have been reviewed and taken into account as part of this assessment. Of particular relevance are:

- Council Directive 2014/89/EU establishing a framework for maritime spatial planning (Marine Spatial Planning Directive);

- Council Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive, MSFD);
- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (Water Framework Directive);
- Council Directive 2006/7/EC monitor and assess bathing waters and inform the public about bathing water quality and beach management (Bathing Waters Directive);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (the Habitats Directive);
- Council Directive 2013/39/EU Priority Substances Directive;
- Marine (Scotland) Act 2010;
- The Marine Strategy Regulations 2010;
- Water Environment and Water Services (WEWS) (Scotland) Act 2003;
- The International Convention for the Prevention of Marine Pollution by Ships 73/78 (IMO) (MARPOL);
- Bathing Waters (Scotland) Amendment Regulations 2012;
- Marine Scotland Action Levels for the disposal of dredged material (Marine Scotland, 2017);
- Scotland's National Marine Plan (NMP) (Scottish Government, 2015);
- The Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (Scottish Government, 2016);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations); and
- The Wildlife and Countryside Act 1981 (as amended) (WCA).

Legislation

Marine Strategy Framework Directive

17.3.2 Under the Marine Strategy Regulations 2010, which ratify the MSFD into UK law, the Secretary of State and devolved authorities must take necessary measures to achieve or maintain "good environmental status". Good environmental status is defined within the regulations as*: "the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations, i.e.Contaminants are at a level not giving rise to pollution effects."*

Marine Licence

17.3.3 Under the Marine (Scotland) Act 2010, two applications for marine licences will be submitted to MS-LOT for the Proposed Development works below the MHWS. Namely one application for construction and a separate application for the dredging works associated with the new extended slipway and new landing jetty.

17.3.4 This chapter details the assessment which will accompany the dredging marine licence application. In line with the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013, a pre-application consultation event was held for the marine licensable activities on 4th March 2021. Comments received have been considered and detailed within a pre-application consultation report which will accompany the marine licence applications.

Water Framework Directive

17.3.5 The Water Framework Directive (WFD) was designed to produce an integrated approach to the protection, improvement and sustainable use of Europe's water bodies, which requires surface water bodies, such as lakes, streams, rivers, estuaries, and coastal waters, and groundwater bodies to be ecologically sound (i.e. achieving Good Ecological Status) by 2015.

17.3.6 In 2003, the WFD was transposed into Scottish law by the Water Environment and Water Services (Scotland) Act 2003 (WEWS Act). The Act created a new River Basin Management Planning (RBMP) process to achieve environmental improvements to protect and improve the water environment in a sustainable way. In addition, it provides a framework of regulations designed to control any activities likely to have an impact on the water environment.

17.3.7 The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (commonly known as CAR), were introduced under the WEWS Act. In Scotland, SEPA regulates activities which impact on the water environment, including activities such as discharges to groundwater, discharges to surface water, abstractions and removal of sediments. Under the WFD, water quality is monitored out to three nautical miles (nm) in coastal waters.

Priority Substances Directive

17.3.8 One of the WFD assessment areas is for chemicals that may be contained within the water. The level of chemicals found within water samples are assessed against a number of Environmental Quality Standards (EQS). The EQSs are under the Priority Substances Directive (PSD) and, where relevant, the limit values originally under the Dangerous Substances Directive (DSD), establish the water quality standards for WFD compliance.

17.3.9 Accordingly, these EQSs are used as reference criteria in the assessments of the Proposed Development's potential impacts on water quality and are identified in Section 17.5 below.

Planning Policy

Scottish NMP

17.3.10 The Scottish NMP sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nm, taking into account various EU Directives on marine management, including those listed above, and the Marine (Scotland) Act 2010. The following General Policies of the NMP are applicable to this assessment (Scottish Government, 2015):

- GEN 9 Natural heritage: *"Development and use of the marine environment must:*

  (a) Comply with legal requirements for protected areas and protected species.

  (b) Not result in significant impact on the national status of Priority Marine Features.

  (c) Protect and, where appropriate, enhance the health of the marine area".

- GEN 12 Water quality and resource: Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply.

- GEN 18 Engagement: *"Early and effective engagement should be undertaken with the general public and all interested stakeholders to facilitate planning and consenting processes".*

- GEN 21 Cumulative impacts: *"Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation".*

Pilot Pentland Firth and Orkney Waters Marine Spatial Plan

17.3.11 To satisfy the requirements of the Scottish NMP, the planning policy for Orkney is covered under the Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (Scottish Government, 2016) developed by a collaboration between Marine Scotland, Orkney Islands Council and Highland Council. This planning policy, referred to hereon as 'the Plan', sets out an integrated planning policy framework to guide marine development, activities and management decisions, whilst ensuring the quality of the marine environment is protected.

17.3.12 Under General Policy 5A (Water Environment) of the Plan, it is a requirement that applications for a marine development or an activity that a project:

- does not cause any water body to deteriorate in status nor prevent the achievement of established objectives set out in the RBMP for the Scotland river basin district;
- where possible, towards objectives improve the ecological status of coastal water bodies and the environmental status of marine waters;
- does not cause deterioration in the standard of waters designated under European Commission Directives and national legislation;
- is accompanied by sufficient information to enable a full assessment of the likely effects, including cumulative effects, on the water environment; and
- has taken into account existing activities in the proposed location for development and undertaken early consultation to ensure that activities that may not be compatible (e.g. development of an incompatible activity near an established legitimate activity, such as a licensed discharge) are not located together.

17.3.13 Currently, all water bodies in the Plan area are at "good ecological status" and any development or use of the marine environment should not cause a deterioration in this status.

Guidance

Marine Scotland Action Levels

17.3.14 Marine Scotland guideline Action Levels (Marine Scotland, 2017) for the disposal of dredged material are not statutory contaminant concentrations for dredged material but are used as part of a weight of evidence approach to decision-making on the disposal of dredged material to sea. These values are used in conjunction with a range of other assessment methods as well as historical data and knowledge regarding the dredging site, the material's physical characteristics, the disposal site characteristics and other relevant data, to make management decisions regarding the fate of dredge material.

17.3.15 The Action Levels are therefore not 'pass/fail' criteria but triggers for further assessment. In general, contaminant levels in dredged material below Action Level 1 are of no concern and are unlikely to influence the licensing decision. However, dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for sea disposal. Dredged material with contaminant levels between Action Levels 1 and 2 requires further consideration and testing before a decision can be made.

Canadian Sediment Quality Guidelines (CSQGs)

17.3.16 The CSQGs were developed by the Canadian Council of Ministers of the Environment (CCME) as broadly protective tools to support the functioning of healthy aquatic ecosystems (CCME, 2001). The CSQGs have been derived from an extensive database containing direct measurements of the toxicity of contaminated sediments to a range of aquatic organisms exposed in laboratory tests and under field conditions (CCME, 2001). As a result, the CSQGs provide an indication of likely toxicity of sediments to aquatic organisms.

17.3.17 Although this chapter of the EIA Report does not consider the potential impacts on biological receptors (see Chapter 16), the CSQGs are useful reference criteria for establishing baseline sediment quality conditions and for indicating the potential for the Proposed Development to have impacts on marine sediment and water quality during activities; albeit noting that the CSQGs were designed specifically for use in Canada and are based on the protection of unmodified environments.

17.4 Consultation

Summary of Consultation

17.4.1 A summary of consultation undertaken to date is provided in Table 17.1, full details are provided in Appendix 4.4.

Table 17.1 – Consultation Relevant to the Marine Assessment

Consultee	Summary of consultation	Key consultee comments	Applicant action
MS-LOT	Communication following submission of the sediment plan to MS-LOT, replied on 4 March 2021.	Sediment sampling plan (which is required to assess impacts from dredging) approved.	Results from sediment sampling survey are included in this Chapter (Chapter 17: Marine Water and Sediment Quality) which assesses the impacts associated with dredging.
NatureScot	Methodology of assessment of impacts to marine water and sediment quality shared with NatureScot on the 26th of March 2021 for comment.	NatureScot advised that the scope seemed reasonable, but that SEPA/Marine Scotland would usually provide comment on this.	No action required as scope was also shared with Marine Scotland and due to SEPA's ongoing issues following their cyberattack in December 2020 they are not contactable and advise to follow available guidance.
MS-LOT	Methodology of assessment of impacts to marine water and sediment quality shared with MS-LOT on the 26th of March 2021 for comment.	MS-LOT advised that the methodology and assessment appears to be proportionate to the level of the dredge and assumptions made about potential for contamination and sediment movement. However, MS-LOT noted that this is not an official scoping response and that the methodology has not been consulted upon with	Coastal processes are discussed in Chapter 18: Other Issues.

Consultee	Summary of consultation	Key consultee comments	Applicant action
		other stakeholders or Marine Scotland science. The inclusion of coastal processes was also queried, with MS-LOT stating that the EIA should provide information on the scoping out of this topic.	

17.5 Assessment Methodology and Significance Criteria

Introduction

17.5.1 A number of statutory standards and non-statutory guidelines have been used as quantifiable criteria to assist in the assessment of potential impacts of the Proposed Development on marine sediment and water quality. The statutory standards are related to water quality (e.g. EQSs), whereas the non-statutory guidelines are related to sediment quality (e.g. Marine Scotland Action Levels (ALs)). They are identified in Table 17.2 and are described in more detail in the following paragraphs.

Table 17.2 - Directives and Industry Guidance Used as Impact Assessment Criteria for Marine Sediment and Water Quality

Forecasting methodology	Relevance to the impact assessment
Dangerous Substances Directive (DSD)	Water Quality: Compliance with these standards forms the basis of good surface water chemical status under the WFD
Priority Substances Directive (PSD)	Water Quality: Compliance with these standards forms the basis of good surface water chemical status under the WFD
Marine Scotland Action Levels (ALs)	Sediment Quality: To inform the baseline sediment quality survey, and to assess the level of contamination in marine sediments
Canadian Sediment Quality Guidelines (CSQGs) for the Protection of Aquatic Life (CCME, 2001)	Sediment Quality: To assess the level of contamination in marine sediments

Environmental Quality Standards

17.5.2 The EQSs under the PSD and, where relevant, the limit vales under the DSD establish the water quality standards for WFD compliance, both within freshwater and seawater. Accordingly, these EQSs are used as reference criteria in the assessments of the Proposed Development's potential impacts on marine water quality and are identified below.

17.5.3 The EQSs under the PSD and DSD for selected List I substances (substances for which uniform emission standards are stipulated) are shown in the Table 17.3.

Table 17.3 - Selected List I Dangerous Substances (Annual Averaged EQS Type)

Substance	EQS under PSD (µg/l)	EQS under DSD (µg/l)
Mercury (dissolved)	0.05	0.3
Cadmium (dissolved)	0.2	0.25
HCH (Lindane)	0.002	0.02
Total DDT	0.025	0.025
ppDDT	0.01	0.01
Pentachorophenol	0.4	2
Aldrin	0.005	0.01
Dieldrin	0.005	0.01
Endrin	0.005	0.005
Isodrin	0.005	0.005
Totaal 'Drins'	-	0.03
Hexachlorobenzene	0.01	0.03
Hexachlorobutadiene	0.1	0.1
Carbon tetrachloride	12	12
Chloroform	-	12
1,2-dichloroethane	10	10
Trichloroethyleme	10	10
Perchloroethylene	-	10
Trichlorobenzene	0.4	0.4

17.5.4 The EQSs for selected List II substances (substances for which member states have determined EQSs) are shown in Table 17.4 below. The table also includes relevant EQSs under the PSD (where they exist).

Table 17.4 - Selected List II Dangerous Substances

Substance	EQS type	EQS under PSD (µg/l)	EQS under DSD (µg/l)
Arsenic (dissolved)	Annual average	-	25
Chromium (dissolved)	Annual average	-	15
Copper (dissolved)	Annual average	-	5
Lead (dissolved)	Annual average	7.2	25
Nickel (dissolved)	Annual average	20	30
Tributyl tin (TBT)	Maximum concentration	0.0002	0.002
Zinc (total)	Annual average	-	40

Marine Scotland Action Levels (ALs)

17.5.5 The ALs are, in effect, quantified sediment quality guidelines (i.e. not statutory standards) that are used to assess the suitability of dredged material for disposal at sea in relation to marine licensing within Scottish waters (Marine Scotland, 2017).

17.5.6 It is likely that the Proposed Development will require the disposal of dredged sediments. The assessment of potential impacts on marine water and sediment quality provided within this chapter does not include assessment of disposal on the basis that the disposal is at a site that is already an accepted and regulated activity. However, the ALs provide useful reference criteria for establishing baseline sediment quality conditions and for indicating the potential for the Proposed Development to have impacts on marine sediment and water quality in the vicinity of the dredging to be conducted.

17.5.7 The ALs comprise two action levels (AL1 and AL2; Table 17.5) that are used to identify the following decision-making responses with regard to the suitability of dredged material for disposal at sea in relation to the receiving marine environment (Marine Scotland, 2017):

- Below AL1 - contaminants in the sediment/dredged material are generally of no concern and are unlikely to influence a decision about disposal at sea (i.e. the sediment is generally uncontaminated);
- Between AL1 and AL2 - contaminants in the sediment/dredged material require further consideration and testing before a decision can be made about sea disposal (i.e. the sediment is contaminated, and may potentially be significantly contaminated); and,
- Above AL2 - contaminants in the sediment/dredged material are generally considered unsuitable for sea disposal (i.e. significantly contaminated).

Table 17.5 - Marine Scotland ALs (Marine Scotland, 2017)

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Arsenic (As)	20	70
Cadmium (Cd)	0.4	4
Chromium (Cr)	50	370
Copper (Cu)	30	300
Mercury (Hg)	0.25	1.5
Nickel (Ni)	30	150
Lead (Pb)	50	400
Zinc (Zn)	130	600
Tributyltin	0.1	0.5
Polychlorinated Biphenyls	0.02	0.18
Polyaromatic Hydrocarbons		
Acenaphthene	0.1	
Acenaphthylene	0.1	
Anthracene	0.1	
Fluorene	0.1	
Naphthalene	0.1	
Phenanthrene	0.1	
Benzo[a]anthracene	0.1	
Benzo[b]fluoranthene	0.1	
Benzo[k]fluoranthene	0.1	
Benzo[a]pyrene	0.1	
Benzo[g,h,i]perylene	0.1	
Dibenzo[a,h]anthracene	0.01	

Contaminant	Revised AL1 mg/kg dry weight (ppm)	Revised AL2 mg/kg dry weight (ppm)
Chrysene	0.1	
Fluoranthene	0.1	
Pyrene	0.1	
Indeno (1,2,3cd) pyrene	0.1	
Total hydrocarbons	100	

Canadian Sediment Quality Guidelines (CSQGs)

17.5.8 The CSQGs comprise two effects levels (i.e. threshold effect levels (TELs) and probable effect levels ((PELs); Table 17.6) that are used to identify the following three ranges of chemical concentrations in sediments with regard to biological effects (CCME, 2001):

- Below the TEL - the minimal effect range within which adverse effects rarely occur;
- Between the TEL and PEL - the possible effect range within which adverse effects occasionally occur;
- Above the PEL - the probable effect range within which adverse effects frequently occur.

17.5.9 The CSQG TEL are a useful assessment tool as they provide some additional considerations to the more standard set of criteria set out in the ALs. For example there is a more refined list of PAH levels when compared to the blanket AL1 of 0.1 mg/kg for all PAHs (except Dibenzo[a,h]anthracene which has an AL1 of 0.01 mg/kg). They also provide a second level as well, the PEL as there is no associated AL2 for PAHs.

Table 17.6 - Selected CSQG Values (CCME, 2001)

Substance	Units	ISQG/TEL	PEL
Metals			
Arsenic	mg/kg	7.24	41.6
Cadmium	mg/kg	0.7	4.2
Chromium	mg/kg	52.3	160
Copper	mg/kg	18.7	108
Lead	mg/kg	30.2	112
Mercury	mg/kg	0.13	0.7
Zinc	mg/kg	124	271

Substance	Units	ISQG/TEL	PEL
Polychlorinated biphenyls (PCBs)			
PCBs: total PCBs	mg/kg	21.5	189
Polyaromatic hydrocarbons (PAHs)			
Acenaphthene	µg/kg	6.71	88.9
Acenaphthylene	µg/kg	5.87	128
Anthracene	µg/kg	46.9	245
Benz(a)anthracene	µg/kg	74.8	693
Benzo(a)pyrene	µg/kg	88.8	763
Chrysene	µg/kg	108	846
Dibenzo(a,h)anthracene	µg/kg	6.22	135
Fluoranthene	µg/kg	113	1494
Fluorene	µg/kg	21.2	144
2-Methylnaphthalene	µg/kg	20.2	201
Naphthalene	µg/kg	34.6	391
Phenanthrene	µg/kg	86.7	544
Pyrene	µg/kg	153	1398

Scope of Assessment

17.5.10 The scope of the assessments required for this marine water and sediment quality chapter, is provided in more detail within a supplementary report: Marine Water and Sediment Quality – Inception Report (HR Wallingford, 2021) (provided in Appendix 17.1). The inception report was shared with NatureScot and Marine Scotland on 26 March 2021 as part of the consultation process. Feedback from both regulators confirmed they were generally satisfied with the scope of the assessment as provided in the Inception Report.

17.5.11 The relevant receptors that are considered are:

- Marine water quality; and
- Marine sediment quality.

17.5.12 The assessment of potential impacts on these two receptors includes consideration of potential for increases in suspended sediment concentration and the potential for resuspension of chemicals that may be associated with the sediments to be dredged, within the vicinity of the Proposed Development.

17.5.13 In addition, this chapter also considers the potential impacts of accidental spills and leaks on marine water and sediment quality.

17.5.14 The approach to assessing impacts is guided by the use of an Impact Assessment Matrix (IAM) that establishes a consistent framework for determining impact significances by considering the sensitivity and value of a receptor along with the magnitude of the effect to which the receptor is exposed. The approach to assessing impacts takes into account the likelihood (i.e. probability) that a receptor will be exposed to the effect.

17.5.15 It should be noted that this assessment will not consider secondary effects upon other human or ecological receptors, as these are addressed elsewhere in the EIA Report, as required.

17.5.16 Construction will require local capital dredging at the Proposed Development site, likely to be conducted by a backhoe dredger, supported by a barge, which have the potential to have local and temporary effects upon marine water and sediment quality. This will be mainly by sediment disturbance from dredging activity and this is the focus of this assessment.

17.5.17 In terms of timing, frequency and duration of the impact, it is estimated that it will take between one to two weeks for the entire dredging activity to be completed, with dredging occurring during daylight hours only. Because of the limited duration of the works the impact of the works the resultant effects are likely to be temporary. Therefore, the construction stage is the main focus of this assessment.

17.5.18 The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the effects would be less than that of construction as dredging would not be required for decommissioning. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan. This is discussed in this assessment.

Study Area

17.5.19 The new slipway and landing jetty will be situated on the south-east end of the island of Faray. As discussed in Chapter 8, the Proposed Development site partially overlaps with the Faray and Holm of Faray SAC and SSSI, shown in Figure 8.1. The area considered for the assessment of marine water and sediment quality is the area over which sediment, disturbed by the proposed dredging, has the potential to travel and settle. A study area of 2 km is considered sufficient for this assessment.

Assessment of Effects

17.5.20 Significance of effects has been determined using the methods outlined in Chapter 4. To summarise, as shown in Table 4.1, the magnitude of the impact and sensitivity of receptor are considered in order to determine if the effects are of major, moderate, minor or negligible significance. Table 4.1 has been repeated in Table 17.7 for reference.

Table 17.7 - Guide to the Inter-Relationship between Magnitude of Impact and Sensitivity of Receptor

		Sensitivity of Receptor / Receiving Environment to Change			
		High	**Medium**	**Low**	**Negligible**
Magnitude of Impact/Change	**High**	major	moderate to major	minor to moderate	negligible
	Medium	moderate to major	moderate	minor	negligible
	Low	minor to moderate	minor	negligible to minor	negligible
	Negligible	negligible	negligible	negligible	negligible

Magnitude of Impact

17.5.21 The magnitude of a potential impact is defined by the extent of environmental change caused by the development. The extent of change can be defined by the area over which the impact occurs (i.e. the spatial dimension of the impact), the duration over which the impact occurs (i.e. the temporal dimension of the impact), and the reversibility of an impact (i.e. whether the impact is reversible (e.g. due to natural recovery, or intervention to mitigate the impact), or is irreversible).

17.5.22 Table 17.8 identifies the guideline descriptions for the range of impact magnitudes used in this Chapter. Impact magnitude has been categorised with reference to the definitions in Table 17.8, this is based on the methods used in Chapter 4.

Table 17.8 – Impact Magnitude

Magnitude of impact	Definition
Negligible	Noticeable but very small scale change or barely discernible changes to a marine physical process receptor over a small part of the development area and potentially beyond. A temporary effect on water or sediment quality standards whose magnitude may be detectable but would not cross threshold levels. Indicatively, those effects potentially extending <0.5 km from the Proposed Development.
Low	Noticeable but small scale changes to a marine physical process receptor over part of the development area and potentially beyond. A temporary effect on water or sediment quality standards whose magnitude are detectable but would not risk exceedance of threshold levels. Indicatively, those effects potentially extending 0.5-1 km from the Proposed Development.

Magnitude of impact	Definition
Medium	Medium scale changes to a marine physical process receptor over the majority of the development area and potentially beyond. A temporary effect on quality standards that may cross water or sediment threshold levels. Indicatively, those effects potentially extending 1-3 km from the Proposed Development.
High	Large scale changes to a marine physical process receptor over the whole development area and potentially beyond. A permanent effect on quality standards or potential risk of downgrades to water body status. Indicatively, those effects potentially extending over >3 km from the Proposed Development.

Sensitivity and Value

17.5.23 The sensitivity and value of receptors in relation to marine sediment and water quality is shown in Table 17.9. Unlike some other environmental receptors, there are not generally attributable values for seawater quality receptors. Nonetheless, in order to provide as transparent an assessment as possible, receptor values have been identified in Table 17.9. These values are often related to other topic receptors.

Table 17.9 - Receptor Value and Sensitivity for Marine Water and Sediment Quality

Value and sensitivity	Example receptor value and sensitivity
High	**Value:** The presence of designated sites for water quality (e.g. designated bathing waters, shellfish waters) or coastal geological interest. The presence of other protected sites that are reliant on water or sediment quality (SACs, SPAs etc). Many pathways for environmental change exist between the project activities and receptors. Critical social or economic uses, e.g. water supply. WFD classification of 'high'. **Sensitivity:** No available headroom within EQS for a particular chemical or group of chemicals.
Medium	**Value:** Supports aquatic species that are protected by national or international law. Few pathways for environmental change exist between the project activities and receptors. Receptor is close to threshold levels and does not show wide natural variability. Important social or economic uses, e.g. water supply. WFD classification of 'good'. **Sensitivity:** Low available headroom within EQS for a particular chemical or group of chemicals.
Low	**Value:** Receptor is not protected by specific water quality designations but is protected by wider water quality legislation. Limited or no pathways from between the project and receptors. Receptor is well

Value and sensitivity	Example receptor value and sensitivity
	within threshold levels and/ or is subject to wide natural variability. WFD classification of 'moderate' **Sensitivity:** Medium available headroom within EQS for a particular chemical or group of chemicals.
Negligible	**Value:** The receptor is tolerant of any changes which may occur and has no legislative thresholds controlling it. No pathways exist under which the receptor could be exposed to the project's activities under consideration. WFD classification of 'fail'. **Sensitivity:** Almost all available headroom within EQS for a particular chemical or group of chemicals.

17.5.24 To note, the sensitivity criteria provided above is not necessarily linked to the overall WFD water body status. For example, a waterbody may be at 'high' status, however have very little headroom for a number of chemical EQSs (headroom denotes how close to the EQS level the waterbody is for a particular chemical), and as such is highly sensitive. However, it may also be at 'high' status and have a lot of available headroom for a number of chemical EQSs, and therefore have much lower sensitivity to change.

Requirements for Mitigation

17.5.25 If significant likely effects are identified appropriate mitigation will be implemented to remove and reduce the significance of the effects where possible.

Assessment of Residual Impact Significance

17.5.26 Where the potential for a moderate to major effect was identified, further investigation of effects using appropriate additional mitigation measures, was undertaken and the residual impact identified. Residual impacts are assessed following a similar methodology as the likely effects but taking into consideration the identified mitigation.

Limitations to Assessment

17.5.27 There are a number of limitations to the data availability and uncertainties over the construction method, which mean that a relatively conservative approach has been adopted to the assessment. These limitations are:

- Sediment releases from dredging during the construction activities have been assessed via a desk study on sediment dispersion and settling rates, based on the low-risk nature of the dredging associated with the slipway and jetty. The desk assessment can be seen in Appendix 17.2 - Dredging Desk Study.
- The detailed specifics of the dredging method will be dependent on future procurement of contractors and are not known at the time of writing (May 2021), therefore appropriate professional judgement has been used to estimate a likely and suitable dredger to complete the works (Appendix 17.2 - Dredging Desk Study).

17.6 Baseline Conditions

Overview

17.6.1 The site comprises the island of Faray, an uninhabited island to the north and west of Eday and south-east of Westray in the Orkney Islands. A smaller uninhabited island Holm of Faray is immediately to the north and can be reached from Faray on foot at low tide. Faray is approximately 17 km north-east of the Mainland of Orkney, and approximately 25 km from Kirkwall. The island extends to approximately 168 hectares (ha) and is centred on British National Grid (BNG) 353112, 1036752 (refer to Figure 1.1).

WFD Waterbody Classification

17.6.2 The Proposed Development is located within the Westray Firth which is a coastal water body (ID: 200243) in the Scotland river basin district. It is 378.5 square kilometres in area. The waterbody has an overall status of 'good', with an overall ecology status of 'good', a hydromorphology status of 'good' and chemical status of 'high' (SEPA, 2018). As reported by SEPA (2018), the water body is expected to maintain this status in 2021 and 2027. Full classification details of this waterbody are provided in Table 17.10.

Table 17.10 - Classification Status of Westray Firth Coastal Water Body (ID: 200243) in 2018

WFD Parameter	Status
Overall status	Good
Overall ecology	Good
Physio-Chem	High
Dissolved Oxygen	High
Dissolves inorganic nitrogen	High
Biological elements	Good
Invertebrate animals	Good
Benthic invertebrates (IQI)	Good
Macroalgae	High
Phytoplankton	High
Specific pollutants	Pass
Unionised ammonia	Pass
Hydromorphology	High
Morphology	High

Bathing Waters

17.6.3 The Proposed Development is not located near any bathing waters. There are no classified bathing waters in Orkney (Orkney Island Council, 2020).

Shellfish Waters

17.6.4 The Proposed Development is not located near any shellfish waters. There are no classified shellfish waters in Orkney (Orkney Island Council, 2020).

Designated Nature Conservation Sites

17.6.5 The Proposed Development partially overlaps the Faray and Holm of Faray SAC and SSSI (JNCC, 2020), which is designated for grey seals. The site is of particular importance to breeding seals, supporting the second-largest breeding colony in the UK and is one of the most important breeding and haul out sites for grey seal in Orkney (Figure 8.1).

17.6.6 There are no other designated nature conservation sites within 2 km.

Suspended Sediment Concentrations

17.6.7 Measurements of background suspended sediments in the Orkney area are limited but satellite-based measurements of sea surface suspended sediment concentrations are available (Marine Scotland, 2020). These show that sediment concentrations at the surface at Orkney are generally in the region of 1 mg/l but increase up to 3 mg/l at times.

Sediment Quality

17.6.8 A diver sediment collection survey was completed by Leask Marine Limited on 24 March 2021 to obtain surface sediment samples to determine the particle size of sediments present at the Proposed Development site and to determine if there are any contaminants present within the material to be dredged.

17.6.9 A sediment sampling plan was shared with MS-LOT (see Table 17.1 and Appendix 17.3) and was approved as being suitable and sufficient for the Proposed Development. Locations of the sampling can be seen on Figure 17.1.

17.6.10 A geotechnical site investigation survey was subsequently undertaken in April 2021. Using handheld cores, sediment cores within the footprint of the dredge area were collected (Figure 17.1). Sediment samples were then sent to a certified laboratory (James Hutton Limited) for chemical and physical analysis.

17.6.11 The results of the chemical and physical analysis can be seen in the Appendix (Appendix 17.4 - Sediment sample analytical report). A summary of the results is provided below for ease.

Particle Size Analysis (PSA)

17.6.12 The PSA show that the sediment present are almost entirely made up of sands, which range from very fine sand up to very coarse sand, but in general mostly fine-medium sand. There are very low amounts of fine material (silts and clays) within the sediment samples.

Heavy Metals and Organotins

17.6.13 Concentrations of heavy metals were found to be low at all four sample locations. The average concentration of each metal and organotin (averaged from the four samples taken) is shown in Table 17.11 and an assessment made against each AL or CSQG criteria. In the case of CSQG criteria, the temporary effect level (TEL) is used as levels are very low and would not require assessment against the permanent effect level (PEL).

Table 17.11 - Average Metals and Organotin Concentrations and Assessment Against ALs and CSQG

Contaminant	Average sediment concentration (mg/kg)	Assessment against criteria (AL and CSQG given in brackets in mg/kg)
Arsenic (As)	1.63	Below AL1 (20) and below TEL (7.24)
Cadmium (Cd)	0.045	Below AL1 (0.4) and below TEL (0.7)
Chromium (Cr)	5.45	Below AL1 (50) and below TEL (52.3)
Copper (Cu)	0.833	Below AL1 (30) and below TEL (18.7)
Mercury (Hg)	<LOD	Below AL1 (0.25) and below TEL (0.13)
Nickel (Ni)	2.82	Below AL1 (30). There is no TEL for Nickel
Lead (Pb)	0.92	Below AL1 (50) and below TEL (30.2)
Zinc (Zn)	3.98	Below AL1 (130) and below TEL (124)
Tributyltin	<LOD	Below AL1 (0.1)

17.6.14 Levels of heavy metals and organotins contaminants were very low, or below the levels of detection (for mercury and tributyltin) and are therefore not of concern.

Polyaromatic Hydrocarbons

17.6.15 Levels of polyaromatic hydrocarbons (PAH) were generally found to be below the level of detection (LOD) for all analysed PAHs, except for naphthalene (average of two samples of 6.5 µg/kg) and phenanthrene (one sample of 5 µg/kg), which were present just over the LOD.

17.6.16 The AL1 for PAHs is 100 µg/kg. As such the levels detected for the two chemicals identified above are an order of magnitude lower than the AL1. The corresponding CSQG TEL is 34.6 µg/kg (naphthalene) and 86.7 (phenanthrene), for the two chemicals that were detected above the LOD.

17.6.17 Levels of PAH contaminants were very low, or below the levels of detection and are therefore not of concern.

Polychlorinated Biphenyls

17.6.18 Levels of polychlorinated biphenyls (PCB) were all found to be below the level of detection and are therefore not of concern.

Organochlorine/Organophosphorus Pesticide

17.6.19 Overall, samples were not found to contain detectable pesticides. One sample (Location 1) did contain detectable levels of tributylamine. This compound is reported to be used as an insecticide besides having other uses. Overall, the levels of pesticides are therefore not of concern.

17.7 Receptors Brought Forward for Assessment

17.7.1 The assessment focuses on the two receptors of marine water quality and sediment quality. The sensitivity and value for these two receptors are provided below.

Marine Water Quality

17.7.2 The sensitivity and value for the marine water quality receptor are:

- Medium value – as there are no designations that rely on water quality, however there are aquatic species present that are listed as Priority Marine Features (PMFs), which are species and habitats identified as being of conservation importance in Scotland, specifically, seagrass (see Chapter 18 for further details);
- Low sensitivity – as the WFD classification for the area is generally high or good and chemical concentrations are generally not close to their EQS level.

Marine Sediment Quality

17.7.3 The sensitivity and value for the sediment quality receptor are:

- Medium value – as there are no designations that rely on sediment quality, however there are PMFs present (seagrass – see Chapter 18);
- Low sensitivity – as there are very low levels of chemicals within the sediments present and as such they are very far from any levels of concern.

17.7.4 The impacts brought forward for the assessment of the Proposed Development on marine water and sediment quality are:

- Impact of dredging during construction on marine water quality – suspended sediment parameters;
- Impact of dredging during construction on marine water quality – chemical parameters;
- Impact of dredging during construction on marine sediment quality – chemical parameters and deposition parameter; and
- Impacts of accidental spills and leaks during construction on marine water and sediment quality.

Consideration is given to the above construction impacts and also to the potential impacts during operation and decomissioning of the Proposed Development in the sections below.

Future Baseline

17.7.5 It is important to recognise that the baseline physical environment does not remain static and may exhibit considerable variability due to cycles of natural change. This can include short-term effects from storms and surges and the longer-term effects of sea-level rise associated with global climate change. Climate change may alter rainfall patterns and bring heavier downpours. Coupled with the increased risk of storm level surges the frequency of flooding events within coastal areas is expected to increase in the future.

17.7.6 However, it is not anticipated that this would result in a significant change in the current marine water and sediment quality environment at the Proposed Development in Faray.

17.8 Standard Mitigation

17.8.1 In terms of marine construction, all vessels will be MARPOL compliant to manage emissions to air and water and have Shipboard Oil Pollution Emergency Plan (SOPEPs) in place.

Construction Environmental Management Plan (CEMP)

17.8.2 As part of the construction contract, the Applicant will produce, and adhere to, a CEMP. The CEMP shall be developed in accordance with the joint Scottish Renewables, SNH, SEPA, Forestry Commission Scotland and Historic Environment Scotland guidance on Good Practice During Windfarm Construction (2019). This includes guidance and references that are applicable to the Proposed Development works.

17.8.3 The CEMP (as described in more detail in Chapter 3) shall describe how the Applicant will ensure suitable management of project activities. In relation to marine water and sediment quality this will include details on the dredging operation and, although not assessed within this Chapter, subsequent disposal of dredge material. The CEMP will also include details of pollution incident response for the marine environment.

Operational Environmental Management Plan (OEMP)

17.8.4 To ensure the risks of accidental spills and leaks during the operational phase which will include some maintenance boats visiting the island, it is expected that an OEMP is produced in the same way as the CEMP to mitigate the potential risks associated with the operational activities.

17.9 Likely Effects

17.9.1 An assessment is provided below for likely effects of the Proposed Development on marine sediment and water quality. These are provided for construction, operational and decommissioning stages.

Impact of Dredging on Marine Water Quality During Construction – Suspended Sediments

Introduction

17.9.2 The marine construction works associated with the Proposed Development, notably the capital dredging of the two dredge areas (Figure 17.1) could impact a number of different water quality parameters. This principally comprises suspended sediment.

17.9.3 Capital dredging will release sediment into the water column where there is disturbance during the removal by backhoe activity and can also include sediment that is lost during the retrieval process.

17.9.4 The sediment released by dredging will disperse in the receiving water and will cause an increase in suspended sediment concentrations (i.e. increases over background concentrations) known as a sediment plume. This may negatively impact marine water quality, until the sediment drops out of suspension and deposits onto the seabed, which could negatively impact sediment quality (see impact sections below).

17.9.5 This impact assessment is informed by a desk study of the likely disturbance of sediments that is predicted to arise from capital dredging (Appendix 17.2 – Dredging Desk Study).

Impact Assessment

17.9.6 The results of the Dredging Desk Study indicate that:

- within 50 m of the dredging the predicted increase in suspended sediment concentration over background concentrations will be around 16 mg/l on neap and 11 mg/l on spring tides;

- within 100 m of the dredging the predicted increase in suspended sediment concentration over background concentrations will be around 3 mg/l on neap and 6 mg/l on spring tides; and,
- within 200 m of the dredging the corresponding concentration increases will be 1 mg/l or less.

17.9.7 Note that as the released particles are sand-sized (rather than silt/clay-sized) there will be a much reduced effect on turbidity (compared to a similar concentration increase composed of silt/clay particles).

17.9.8 Measurements of background sediments suspended in the Orkney area from satellite-based measurements of sea surface suspended sediment concentrations (Marine Scotland, 2020) show that sediment concentrations at the surface around Orkney are generally in the region of 1 mg/l but increase up to 3 mg/l at times. Therefore, within around 200 m of the dredging area, the dredging plume is likely to have reduced to levels which lie within this range of natural variability.

17.9.9 In practice the range of natural concentrations will be higher due to storms which the episodic satellite measurements will not take into consideration, and therefore the impact of the proposed dredging will be even smaller compared to the natural range of conditions.

17.9.10 Dredging is estimated to last up to two weeks. The sediment plume from dredging will persist for the period of the dredging operation but is not likely to be detectable within a few days (at most) from the cessation of dredging operations.

17.9.11 Overall, the effects of the increases in suspended sediment as a result of the dredging activity are considered to be **negligible and not significant** for marine water quality.

Mitigation

17.9.12 No additional mitigation is required to reduce the effect significance.

Monitoring

17.9.13 No monitoring of water quality is recommended.

Residual effects

17.9.14 As no additional mitigation is required, the residual effect is also considered to be **negligible and not significant** for marine water quality.

Impact of Dredging on Marine Water Quality During Construction – Chemical Parameters

Introduction

17.9.15 The marine construction works associated with the Proposed Development – notably the capital dredging, could also impact a number of different chemical water quality parameters including chemical parameters such as metals, organo-metals, PAHs, PCBs and pesticides.

17.9.16 The principal mechanism for an impact related to chemical parameters in the water body is the disturbance of contaminant-laden sediment (if present), by the dredging activity.

17.9.17 Chemical parameters may be present in the water column where they are either attached to the surfaces of suspended sediment (including inorganic particles and organic matter) in adsorbed and precipitated forms (particularly metal parameters), or attached to the surfaces of dissolved organic matter in adsorbed or complexed forms (particularly organic parameters), or dissolved in the surrounding water in free forms (both metal and organic parameters).

Impact Assessment

17.9.18 As described in Section 17.6, a survey of the sediment in the areas to be dredged found that the sediment contains very low concentrations, or below levels of detection of heavy metal, organotin PAH, PCB, and pesticides. Where chemicals were found in very low concentrations, all were well below the ALs and Canadian TEL, in most cases by an order or magnitude lower.

17.9.19 As there are no or very low concentrations of contaminants present within the sediment disturbed by dredging, there is likely to be **no effect** on water quality chemical parameter as a result of the dredging activity.

Mitigation

17.9.20 No additional mitigation is required to reduce the effect significance.

Monitoring

17.9.21 No monitoring of water quality is recommended.

Residual effects

17.9.22 As no additional mitigation is required, the residual impact is also considered to be **no effect** on water quality chemical parameter.

Impact of Dredging on Marine Sediment Quality During Construction – Chemical Parameter and Deposition Parameter

Introduction

17.9.23 The marine construction works associated with the Proposed Development – notably the capital dredging, could impact sediment quality.

17.9.24 The principal mechanism for an impact relates to the release of sediment into the water column in the vicinity of the Proposed Development. This release may manifest as a plume of suspended sediment in the water column that disperses and dilutes within the water column, and then deposits on the seabed and thereby alters the seabed sediment properties.

Impact Assessment

17.9.25 As described in Section 17.6, a survey of the sediment in the areas to be dredged found that the sediment contains very low concentrations, or below levels of detection of heavy metal, organotin PAH, PCB, and pesticides. Where chemicals were found in very low concentrations, all were well below the ALs and Canadian TEL, in most cases by an order or magnitude lower.

17.9.26 On that basis there is expected to be no effect on the sediment quality chemical parameter as a result of the contaminant levels that may be transported to new locations as a result of the sediment settling out of the water column associated with the dredging activity.

17.9.27 However, the amount of sediment that is deposited, although unlikely to affect sediment quality chemical parameters, will increase the depth of sandy sediment locally to the dredging operation and has the potential to impact the PMF seagrass identified within the area (see Chapter 18).

17.9.28 The sand particles released into the water column will be likely to re-deposit onto the bed within a few hundred metres of the dredging. It is possible to estimate the distribution of this re-depositing sediment by considering the rate at which these sand particles will fall back onto the bed and the distance moved by the sand particle (under the influence of tidal currents) over that period.

17.9.29 Approximate transport distances for the average particle sizes (Appendix 17.2 – Dredging Desk Study) were estimated using settling velocities calculated using the method of Soulsby (1997). Fine sands (d_{10} (µm)) are estimated to travel up to 234 m before settling to the seabed, medium sand particles (d_{50} (µm)) up to around 83 m. The larger and heavier sand particles will not travel as far and are likely to settle out within approximately 35 m of the dredging activity.

17.9.30 The release of sand particles is estimated to be 5% of the material that would be dredged (though this figure will reduce depending on the prevalence of sandstone boulders). This means that around 150 m^3 of sand will be deposited, a portion of which will redeposit in the dredging areas and be re-dredged (Appendix 17.2 – Dredging Desk Study).

17.9.31 The Dredge Desk Study (Appendix 17.2) provides an estimation of the distribution of sand depositing from the plume released during the dredging activity for the Proposed Development.

17.9.32 The distribution of sediment disturbed as a result of the dredging activity is provided in Appendix 17.2 – Dredging Desk Study and summarised below. The deposition is estimated to be in the region of:

- 8-14 mm within 50 m of the slipway and landing jetty;
- 2-8 mm within 50-150 m of the slipway and landing jetty; and,
- to fall below 1 mm at a distance of 200 m.

17.9.33 The levels of sediment deposition as a result of the dredging activity is considered to result in a temporary **minor and not significant** effect within 150 m of the dredging activity, including potential sediment deposition on the PMF seagrass within the area, and will reduce to **negligible and not significant** at distances further than that.

Mitigation

17.9.34 No additional mitigation is required to reduce the effect significance.

Monitoring

17.9.35 No monitoring of water quality is not recommended.

Residual effects

17.9.36 As no additional mitigation is required, the residual effect is **negligible** for chemical parameters and of **minor significance** for increases in sediment depth within 150 m of the dredging activity.

Construction: Impact of Accidental Spills and Leaks on Marine Water and Sediment Quality

Impact Assessment

17.9.37 Construction works have the potential to release a range of potentially polluting materials in and around the Proposed Development. Spills and leaks of potentially polluting substances are not planned as part of the Proposed Development, but there is a risk that they may occur due to accidents and incidents.

17.9.38 Potentially polluting materials may be spilled and leaked directly into water in the vicinity of the Proposed Development where they could affect the quality of the marine water and/or sediment. In addition, potentially polluting materials may be spilled and leaked directly onto the land and infiltrate into underlying ground where they may affect the quality of the groundwater and, potentially, any hydrologically connected surface water.

17.9.39 Given the scope of construction materials and equipment that will be used during the construction works, it is possible that unplanned accidental or incidental spills and leaks will occur. Generally, spills and leaks are likely to be small in scale (both in terms of volume of polluting materials released into the environment, and the spatial extent of the affected environment), but larger spills and leaks cannot be ruled out.

17.9.40 The potentially polluting materials associated with the construction works, spills and leaks have the potential to affect water and sediment quality. However, embedded mitigation measures will be in place to reduce the risk of a spill or leak causing a pollution event. These measures will include obligations in relation to the environmental performance of the construction works. Many of the measures, including measures relating to hazardous materials, will be implemented and monitored by the Contractor through a CEMP. Notably, the CEMP will include provisions for pollution incident preparedness such that emergency plans and procedures will in place to respond to any environmental incidents, including incidents involving hazardous materials.

17.9.41 The embedded mitigation measures will reduce the risk of spills and leaks of potentially polluting materials to a level considered to be as low as reasonably practicable (ALARP) and will necessitate emergency response and clean-up measures should a spill or leak occur. With these measures in

place, the potential effects of spills and leaks will be avoided or reduced, such that the magnitude of effects is considered to be low, small in scale and temporary in duration.

17.9.42 On the basis that embedded mitigation measures will be successfully implemented and the risk will be ALARP, spills and leaks of potentially polluting materials associated with the construction of the Proposed Development are considered to be a **negligible and not significant** effect on water and sediment quality.

Operational Impacts

17.9.43 Operational impacts to marine water and sediment quality will be limited to occasional vessel movements during maintenance visits, which bring about the associated potential for accidental spills and leaks and very local sediment disturbance. The measures outlined in the section above for potential constructional effects of accidental spills and leaks are expected to remain during the operational phase.

17.9.44 As above, with embedded mitigation measures during maintenance activities will be implemented and the risk will be ALARP, spills and leaks of potentially polluting materials associated with the operation of the Proposed Development are considered to have a **negligible and not significant** effect on water and sediment quality.

Decommissioning Impacts

17.9.45 The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the effects would be less than that of construction as it is unlikely that dredging would be conducted and there would likely be a lower number of vessels required. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan, are considered to have a **negligible and not significant** effect on water and sediment quality.

17.10 Additional Mitigation and Enhancement

17.10.1 The levels of effect identified above are negligible for all receptors, apart from sediment depth in the vicinity (<150 m) of the dredging operations. The latter is assessed to be temporary, minor and not significant. Therefore, it is not necessary to provide additional mitigation or enhancement for the Proposed Development.

17.11 Residual Effects

17.11.1 There is no change to the identified impacts as there is no requirement for additional mitigation or enhancement.

17.12 Cumulative Assessment

17.12.1 There are no other planned developments in the area that may intersect with the impacts discussed in this chapter. Therefore, there are considered to be no cumulative effects.

17.13 Summary

17.13.1 An assessment was carried out of the potential impacts on marine water and sediment quality as a result of the dredging required for construction and vessels required during construction, operation and decommissioning required for the Proposed Development. A summary of the effects are provided in Table 17.12 and Table 17.13 below.

Table 17.12 - Summary of Effects

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Impact of dredging on marine water quality – suspended sediments	Negligible and not significant	Adverse	None required	Negligible and not significant	Adverse
Impact of dredging on marine water quality – chemical parameters	Negligible and not significant	Adverse	None required	Negligible and not significant	Adverse
Impact of dredging on sediment quality – chemical parameter and deposition parameter	Minor and not significant	Adverse	None required	Minor and not significant	Adverse
Impact of accidental spills and leaks on marine water and sediment quality	Negligible and not significant	Adverse	CEMP	Negligible and not significant	Adverse
Operation					
Impact of accidental spills and leaks on marine water and sediment quality by vessels required during maintenance visits	Negligible and not significant	Adverse	OEMP	Negligible and not significant	Adverse
Decommissioning					
The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the levels of effect would be less as it is unlikely that dredging would be required for removal. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan.					

Table 17.13 - Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	Significance of Cumulative Effect	
			Significance	Beneficial/ Adverse
Marine water and sediment quality	Effects on suspended sediments, and chemical parameters	None in the area	No effect	N/A

17.14 References

Canadian Council of Ministers of the Environment (CCME) Freshwater sediment quality guidelines (2001), available at: https://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/. Accessed 10 May 2021.

Council Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive, MSFD). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0056 Accessed on: 05 May 2021.

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