The Highland Council

Uig Harbour Redevelopment

Disposal site characterisation report

February 2019





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Non-Technical Summary

Uig Harbour is located in Uig Bay in the northeast of the Isle of Skye. It forms part of the 'Skye Triangle' (along with Tarbert and Lochmaddy), providing lifeline ferry services for communities in the Western Isles. The Pier at Uig Harbour, named King Edward Pier, serves the Caledonian MacBrayne (CalMac) ferry route to the Isles of Harris and North Uist. The Pier is under the control of Highland Harbours which is run by The Highland Council (THC), whilst the ferry service operations are controlled by CalMac Ferries Ltd. Increasing demand and aging tonnage has led the ferry operator to commission new, larger ferry vessels for a number of its routes, including the 'Skye Triangle'. THC is required to undertake redevelopment works (referred to as the 'Proposed Development') to Uig Harbour to accommodate a new vessel commissioned for this route. The Proposed Development includes dredging activity to support the works and to deepen the berth to accommodate the new vessel. Given the requirement to dispose of dredged material, this Disposal Site Characterisation Report has been prepared.

The estimated total capital dredge (and thus disposal) volume for the Proposed Development is 27,992 m^3, split between Dredge Pocket 1 (26,842 m^3) and Dredge Pocket 2 (1,150 m^3). Sediment samples were collected from around Uig Bay and the two Dredge Pockets to characterise the dredge material and surrounding area. The composition of Dredge Pocket 1 was found to be predominantly sand (57%), while relatively increased fine material (silt and clay) was estimated for Dredge Pocket 2 (61%). Sediment quality is poor around Uig Bay, with concentrations of chromium and nickel above Action Level 2 at several locations, including the Dredge Pockets (considered most likely to be naturally occurring). Based on these findings and the requirements of the Proposed Development, a waste hierarchy assessment concluded that the Best Practical Environmental Option for the dredge material would be disposal at sea.

A site selection process was undertaken, including reviewing the potential to dispose of dredged material at an existing marine disposal site. However, given the distance to the nearest existing marine disposal site (approximately 40 km from Uig Harbour) and the high concentrations of chromium and nickel in sediments, use of an existing marine disposal site was not considered viable. Considerations were then made to identify a suitable new disposal site from within an initial disposal site search area in the west of Uig Bay. Marine Scotland agreed that the proposed disposal site search area was sensible, noting that sediments at the final disposal site would need to have similar concentrations of chromium and nickel to the dredged material.

Following the disposal site selection process, a proposed new disposal site has been identified within the disposal site search area (Figure NTS-1). It is located approximately 2 km to the west of Uig Harbour covering an area of approximately 250 m x 500 m (0.125 km^2). This sub-section of the disposal site search area was selected as the most suitable location for the proposed new disposal site for the following key reasons:

- Water depths (approximately 60 m) provide increased retentive properties of deposits which reach the seabed;
- Very low flow speeds throughout Uig Bay, particularly apparent in deeper areas, indicating the proposed new disposal site would provide retentive properties for disposed sediment;
- Distance from the Dredge Pockets at Uig Harbour (approximately 2 km) reduces the potential for any fine sediment plume generated during dredging and disposal operations to combine;
- Distance greater than 1 km from any known White-tailed eagle nest (*Haliaeetus albicilla*; confidential information provided by the Highland Raptor Study Group); and
- Distance greater than 1 km from Uig Bay and Loch Snizort East finfish farms.

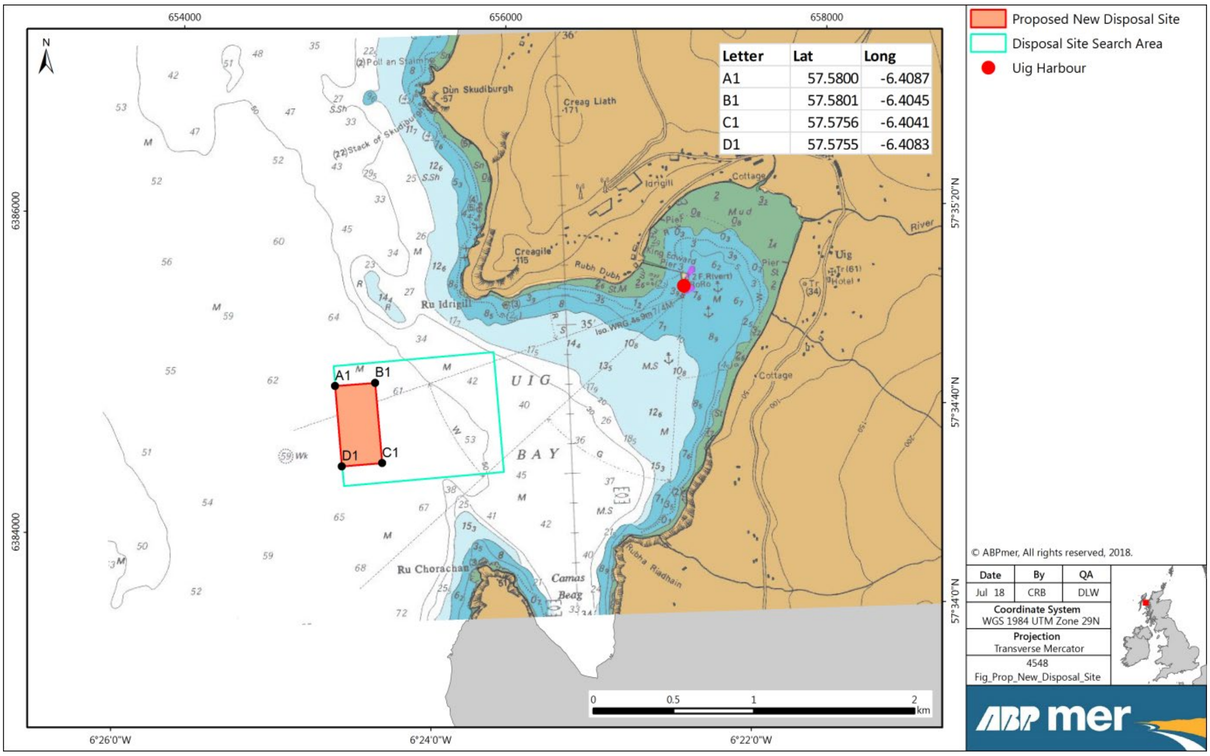

Figure NTS1. Location of the proposed new disposal site including coordinates (WGS84; decimal degrees)

In identifying the proposed new disposal site, a number of key considerations were made regarding potential effects on the physical, chemical, biological and human environment and other sea users/ infrastructure. This was supported by numerical modelling (AECOM, 2018) to determine the fate of the fine material following disposal, including consideration of the nearby finfish farms, and potential changes to the wave regime, flows and sediment transport. This process was undertaken to evaluate the acceptability of a proposed new disposal site to support dredging activity for the Proposed Development.

The designation of the proposed new disposal site in the outer Uig Bay is anticipated to result in minimal effects to the physical, chemical, biological and human environment. While some further project-specific assessment will be required as part of the Proposed Development, such as a Habitats Regulations Assessment (HRA), it is concluded that the proposed new disposal site is a suitable location for the deposit of dredged material from Uig Harbour.

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1 Introduction

1.1 Project background

Uig Harbour is located in Uig Bay in the northeast of the Isle of Skye (Figure 1). It forms part of the 'Skye Triangle' (along with Tarbert and Lochmaddy), providing lifeline ferry services for communities in the Western Isles. The Pier at Uig Harbour, named King Edward Pier, serves the Caledonian MacBrayne (CalMac) ferry route to the Isles of Harris and North Uist. The Pier is under the control of Highland Harbours which is run by The Highland Council (THC), whilst the ferry service operations are controlled by CalMac Ferries Ltd.

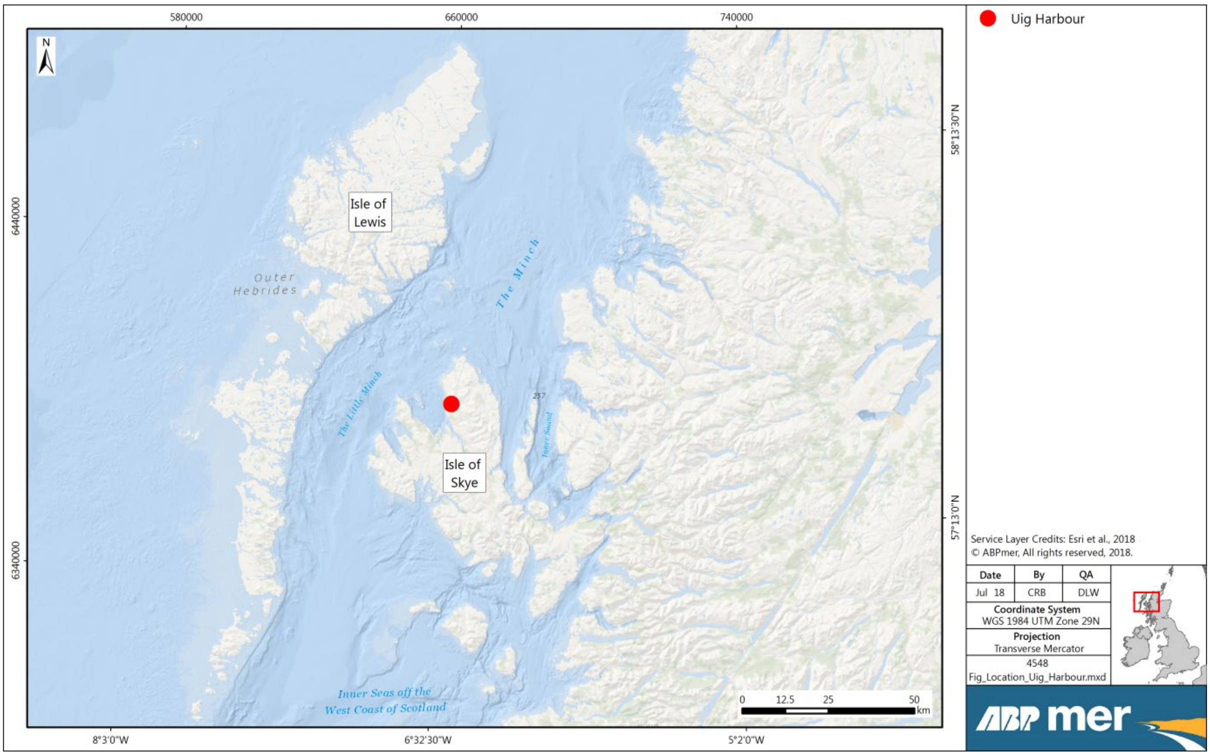


Figure 1. Location of Uig Harbour

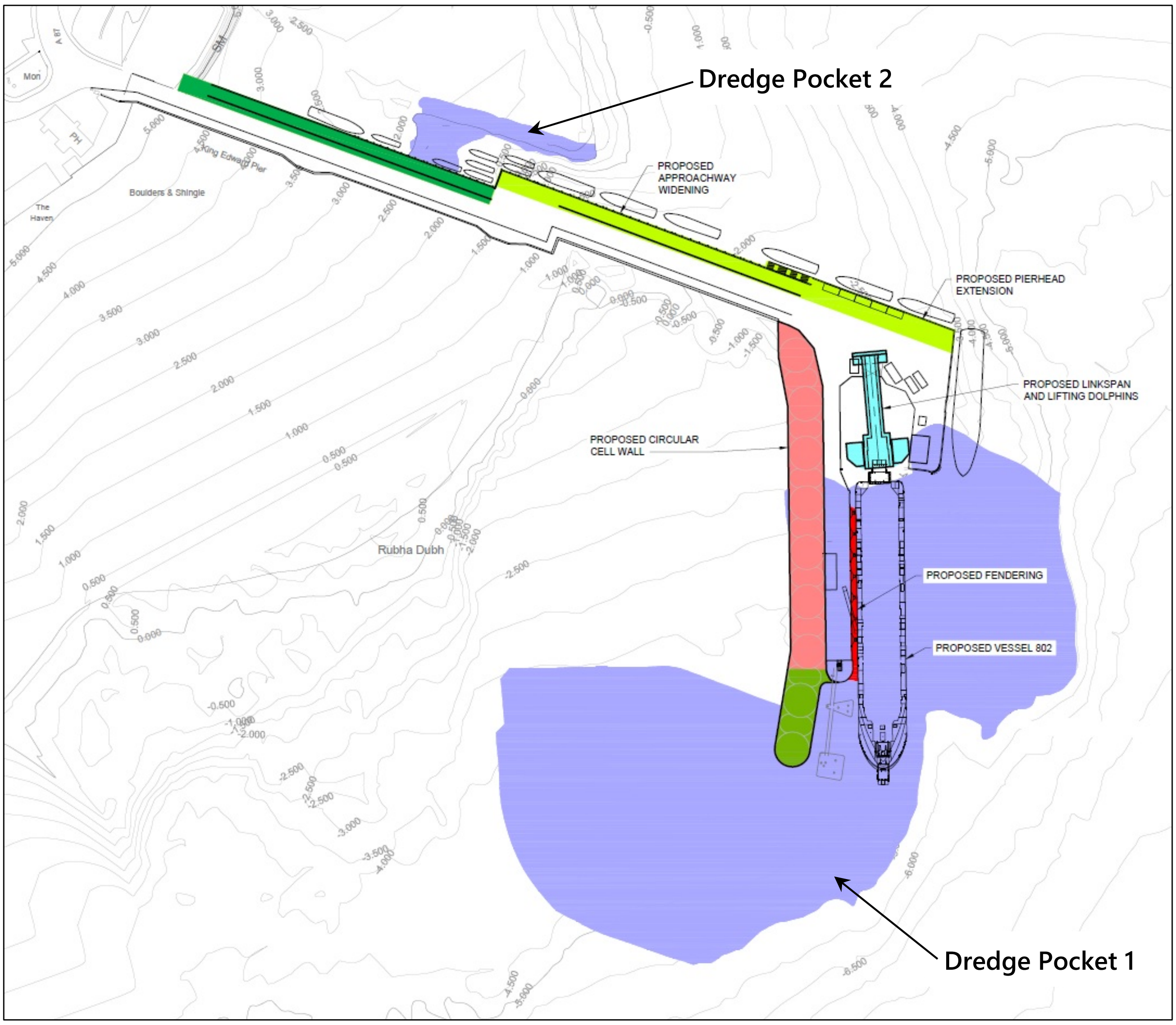
Increasing demand and aging tonnage has led the ferry operator to commission new, larger ferry vessels for a number of its routes. The 'Skye Triangle' has been identified by the operator as a priority and the procurement of a new vessel for this route has commenced. THC (hereafter also referred to as the 'Applicant') is required to undertake redevelopment works (hereafter referred to as the 'Proposed Development') to Uig Harbour to accommodate the new vessel which has been commissioned.

The Proposed Development includes dredging activity and the subsequent disposal of dredged material to support the works and to deepen the berth to accommodate the new vessel. The following two areas of seabed (referred to as 'Dredge Pockets') will need to be dredged to accommodate the new vessel and resulting changes to the pier infrastructure (see Figure 2):

- **Dredge Pocket 1**: The berthing area will be dredged to accommodate the new vessel. A capital dredge will be carried out to -5.9 m above chart datum (ACD) (including 300 mm over dredge) consisting of approximately 26,842 m^3;

- **Dredge Pocket 2**: A section along the approach way in front of the fisherman's compound will be dredged to provide a fisherman's berth to compensate for the loss of berthing space from the widening of the approach way. This area will be dredged to 0.7 m ACD (including 300 mm over dredge) consisting of approximately 1,150 m^3.

Therefore, the estimated total capital dredge volume for the Proposed Development is 27,992 m^3. The dredging method will be confirmed once the dredging contractor has been appointed. However, at this stage and for the purpose of preparing this disposal site characterisation report, it has been assumed that a cutter suction dredger (CSD) will be deployed to undertake the dredging required for the Proposed Development. It is also anticipated that maintenance dredging will be required every 3-5 years to ensure safe operation of the ferry service. Maintenance dredging will likely use backhoe, grab and/or plough methods which have previously been used at Uig Harbour.



Source: AECOM

Figure 2. Proposed Development at Uig Harbour including location of Dredge Pockets

This report has been prepared to characterise a new disposal site to support dredging requirements of the Proposed Development and future maintenance dredging at Uig Harbour. Figure 3 summarises the overall process followed. This includes characterisation of the dredge (waste) material to be disposed, consideration of options against the principles of the waste hierarchy, selection of a new disposal site based on a range of criteria, characterisation of the proposed new disposal site and assessment of potential effects of disposal at this location.

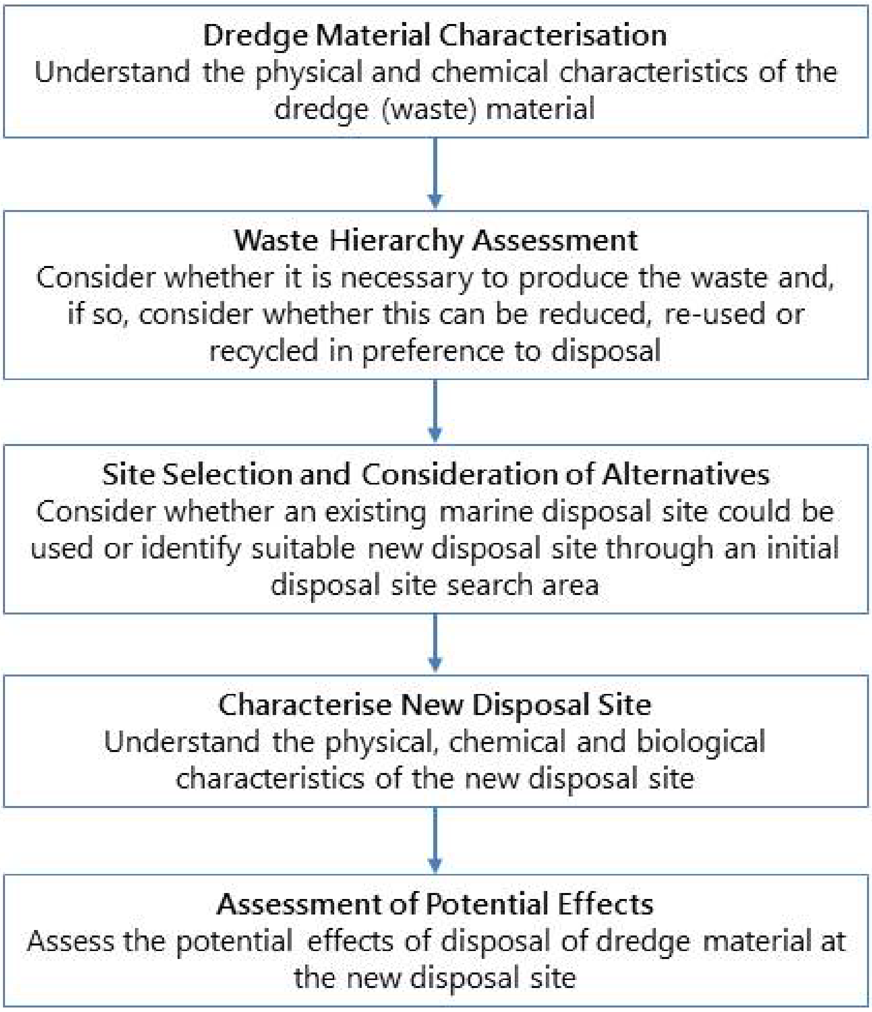


Figure 3. Summary of disposal site characterisation process

1.2 Report structure

This disposal site characterisation report has been structured as follows:

Section 2: **Regulatory Framework** - Reviews the key legislation and policy regarding dredging and disposal activity in the marine environment;

Section 3: **Dredge (Waste) Material Characteristics** - Describes the physical and chemical characteristics of the material to be dredged;

Section 4: **Waste Hierarchy Assessment** - Provides an audit of considerations for the dredged material against the principles of the waste hierarchy;

Section 5: **Site Selection Process and Consideration of Alternatives** - Identifies key criteria for the selection of a suitable disposal site and provides a review of alternatives;

Section 6: **Proposed New Disposal Site** - Describes a proposed new disposal site within Uig Bay, including the key considerations used to determine the location; and

Section 7: **Assessment of Potential Effects** - Evaluates the acceptability of a proposed new disposal site to support dredging activity for the Proposed Development.

2 Regulatory Framework

This section introduces key legislation and policy regarding dredging and disposal activity in the marine environment, how these have been taken into account in preparing this disposal site characterisation report and, specifically, the management of waste material generated.

2.1 UK Marine Policy Statement

The UK Marine Policy Statement (MPS) (HM Government, 2011) is the framework for preparing Marine Plans and taking decisions affecting the marine environment. It was adopted for the purposes of Section 44 of the Marine and Coastal Access Act 2009 to facilitate and support the formulation of Marine Plans, ensuring the sustainable use of marine resources in line with the following high level marine objectives:

- Promote sustainable economic development;
- Enable the UK's move towards a low-carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapt to their effects;
- Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets; and
- Contribute to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues.

The MPS recognises that most marine dredging and disposal is for the purposes of navigation and existing and future port development, while it can also allow specific construction activities to be taken forward. Appropriately targeted disposal of dredged sediment can have an ancillary benefit in maintaining sedimentary systems and, where the sediment is constituted appropriately, can have social and economic benefit in providing material for alternative uses such as construction, beach nourishment or saltmarsh restoration (HM Government, 2011).

The primary environmental considerations associated with dredging and disposal activity include:

- Potential risk to fish and other marine life from the release of sediments, chemical pollution and morphological changes including burial of seabed flora and fauna;
- Hydrological effects;
- Interference with other marine activities;
- Increases in turbidity;
- Increases in marine noise;
- Possible adverse effects for designated nature conservation areas;
- Potential destruction or destabilisation of known or unknown heritage assets; and
- Potential adverse impacts to the natural sedimentary systems.

The MPS states that applications to dispose of wastes must demonstrate that appropriate consideration has been given to the internationally agreed hierarchy of waste management options for sea disposal. Wastes should not be accepted for disposal where appropriate opportunities exist to re-use, recycle or treat the waste without undue risks to either human health or the environment, or disproportionate costs. The decision maker should give appropriate consideration to alternative uses of the sediment (HM Government, 2011). A waste hierarchy assessment for the Proposed Development at Uig Harbour, considering options for waste management of the associated dredge arisings from King Edward Pier and requirement for a new marine disposal site, is provided in Section 4.

2.2 Scotland's National Marine Plan

In accordance with the Marine and Coastal Access Act 2009 and based on the high level objectives for marine planning outlined in the MPS (HM Government, 2011), Scotland's National Marine Plan was published by the Scottish Government in March 2015. It covers both Scottish inshore waters out to 12 nautical miles and Scottish offshore waters from 12 to 200 nautical miles.

Scotland's National Marine Plan (Scottish Government, 2015a) highlights that safeguarding the viability of routes used by shipping, ensuring safety of navigation and encouraging development of Scottish ports and harbours are essential for the continuation and growth of economic prosperity provided by ports and harbours and the variety of sectors they support. As part of these considerations, dredging is recognised as an essential activity to maintain existing shipping channels, establish safe approaches to new ports or open up routes to old ports. Dredged material may be disposed of at licensed marine disposal sites or used for alternative purposes such as land reclamation or coastal nourishment, if suitable, to minimise seabed disposal. Licensed disposal areas may change, typically as a result of disuse, monitoring information or the need for sites in additional locations. The consideration of both dredged navigation channels and disposal sites in marine planning and decision making is important to support safe access to ports and the disposal of dredged material in appropriate locations (Scottish Government, 2015a).

While Scotland's National Marine Plan highlights the requirements for dredging and disposal to support port development and navigational safety, it also highlights a number of key issues. Dredging to maintain navigation channels can cause loss or damage to habitats and species and exposure of buried archaeological remains. Dredging requirements may increase if ship size increases and deeper and wider navigation channels are required. Dredging, and the disposal of dredged material, may impact on other sea users on a temporary basis, and dredged areas and disposal sites may not be compatible with other specific uses. Dredging is a licensable activity and, therefore, the potential environmental impacts are assessed through licensing procedures (Scottish Government, 2015a).

2.3 London Convention and London Protocol

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, commonly referred to as the London Convention, came into force in 1975 and is one of the first global conventions to protect the marine environment from human activities. Contracting Parties shall individually and collectively promote the effective control of all sources of pollution of the marine environment and take all practicable steps to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea. The term 'dumping' is defined to include any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea.

The 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, commonly referred to as the London Protocol and which entered into force in 2006, was agreed to modernise and supersede the London Convention. Under the London Protocol, the dumping of any wastes or other matter is prohibited, except those referenced in Annex 1 which includes dredged material. Nevertheless, the dumping of wastes or other matter listed in Annex 1 shall require a permit and Contracting Parties shall adopt administrative or legislative measures to ensure that issuance of permits and permit conditions comply with provisions of Annex 2 (e.g. waste prevention audit, consideration of waste management options and monitoring).

2.4 OSPAR Convention

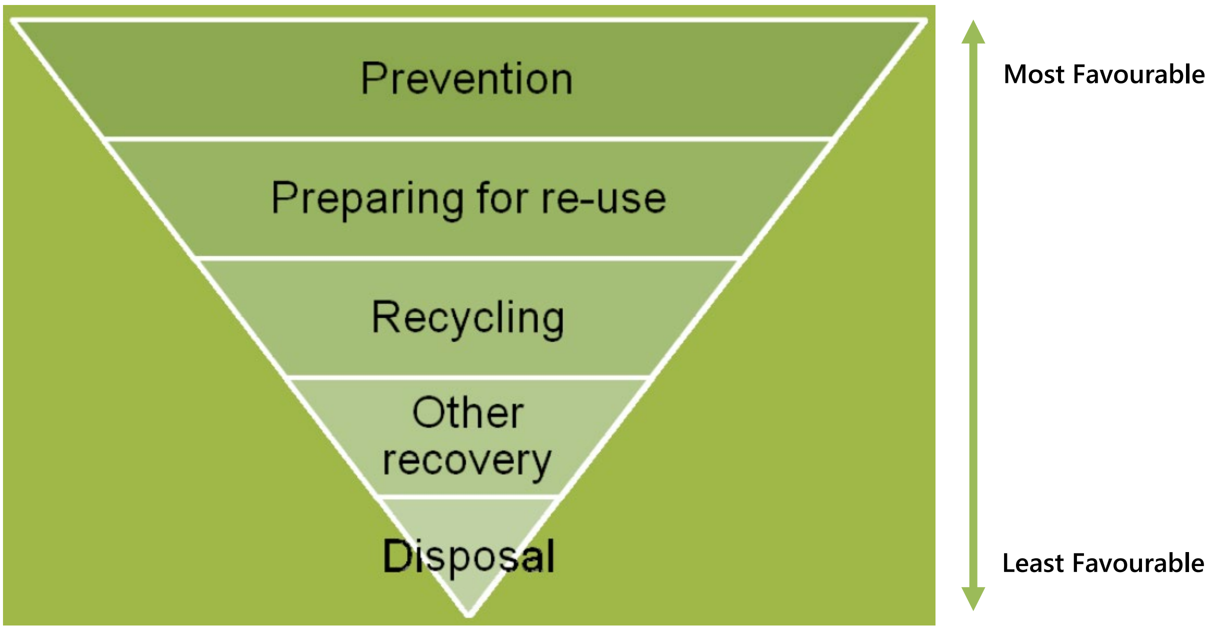
The Convention for the Protection of the Marine Environment of the North-East Atlantic, commonly referred to as the OSPAR Convention, was adopted in 1992 and entered into force in 1998. The OSPAR Convention replaced both the Oslo Convention (adopted in 1972) and the Paris Convention (adopted in 1974), with the intention of providing a comprehensive and simplified approach to addressing all sources of pollution which might affect the maritime area, and all matters relating to the protection of the marine environment.

Similar to the London Protocol, Contracting Parties of the OSPAR Convention shall take, individually and jointly, all possible steps to prevent and eliminate pollution by dumping or incineration of wastes or other matter except for those wastes or other matter listed in Article 3 (paragraphs 2 and 3) of Annex II which includes dredged material. The OSPAR Commission is the forum through which Contracting Parties cooperate, drawing up and adopting criteria, guidelines and procedures relating to the dumping of wastes or other matter listed, with a view to preventing and eliminating pollution.

2.5 Waste Framework Directive

The Waste Framework Directive (75/442/EEC) was originally adopted in 1975, followed by substantial amendment in 1991 (91/156/EEC) and a codified version in 2006 (2006/12/EC). The revised Waste Framework Directive (2008/98/EC) repealed earlier versions, providing a general framework of waste management requirements and sets the basic waste management definitions for the European Union (EU). It lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use. It defines 'waste' as any substance or object which the holder discards or intends or is required to discard.

Article 4 of the revised Waste Framework Directive sets out five steps for dealing with waste, ranked according to environmental impact, commonly referred to as the 'waste hierarchy' (see Figure 4 and Table 1).



Source: Adapted from Department for Environment, Food and Rural Affairs (Defra), 2011

Figure 4. Waste hierarchy

Prevention, which offers the best outcomes for the environment, is at the top of the priority order, followed by preparing for re-use, recycling, other recovery and disposal, in descending order of environmental preference.

Table 1. Stages of the waste hierarchy

Stage	Name (Article 4)	Definition (Article 3)
1	Prevention	Measures taken before a substance, material or product has become waste, that reduce: (a) The quantity of waste, including through the re-use of products or the extension of the life span of products; (b) The adverse impacts of the generated waste on the environment and human health; or (c) The content of harmful substances in materials and products.
2	Preparing for re-use	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
3	Recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.
4	Other recovery (e.g. energy recovery)	Any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations.
5	Disposal	Any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. Annex I sets out a non-exhaustive list of disposal operations.

For any dredging project, the *in situ* characteristics of the material (physical and chemical) and the method and frequency of dredging (and any subsequent processing) determines its characteristics for consent through the waste hierarchy assessment. This understanding is central for consideration of management options for dealing with dredged material with respect to the waste hierarchy assessment. A Marine Licence is required for the use/disposal of dredged material below mean high water springs (MHWS). An applicant must take account of the waste hierarchy and consider alternative means of disposal of dredged material before applying for a licence to dispose of dredged material at sea (HM Government, 2011).

Where prevention of the dredging is not possible, then the volume to be dredged should be minimised, then options for re-use of the material, recycling and other methods of recovery must be considered in the first instance. In the context of re-use and recycling of dredge material this could include, for example:

- Engineering uses, such as:
  - Aggregate for the construction industry;
  - Land creation and improvement;
  - Beach nourishment;
  - Construction of offshore berms;
  - Capping material; and
  - Temporary disposal at sea (e.g. in an aggregate site) for future re-use.

- Agriculture and product uses:
  - Aquaculture; and
  - Construction material.
- Environmental enhancement:
  - Intertidal feeding/creation, e.g. islands for birds, mudflat and saltmarsh creation, fisheries habitat and wetland restoration.
- Post treatment of the dredge material to change its character prior to determining a potential use, for example:
  - Dewatering to create consolidated sediments;
  - Separation basins; to separate sediments into different size classes for different uses;
  - Soil manufacturing; and
  - Physico-chemical treatments of contaminated sediments.

Following such treatments, it might be possible to use the material, for example, as top soil or bricks etc. Should no practical and cost-effective solutions be identified, finally options for the disposal of the dredged material are considered. These include:

- Marine disposal in licenced deposit sites; and
- Land-based disposal in terrestrial landfill.

2.6 Habitats Directive

Article 3 of the Habitats Directive (92/43/EEC, as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SACs) that will contribute to conserving habitat and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). When assessing applications, the Competent Authority will consider if the project is likely to have a significant effect on a designated European site (including SACs). Therefore, consideration must be made as to whether the Proposed Development, which includes dredging and disposal activities, could have a significant impact on the notified features of any directly overlapping or nearby designated European sites.

2.7 Water Framework Directive

The Water Framework Directive (2000/60/EC) establishes a framework for the management and protection of Europe's water resources. The overall objective of the Water Framework Directive is to achieve "good ecological and good chemical status" in all inland and coastal waters. The initial deadline to meet this objective was 2015; however, in cases where it was not possible to do so due to disproportionate expense, natural conditions or technical feasibility, the deadline to achieve "good ecological and good chemical status" has been extended (currently working towards revised objectives for 2021).

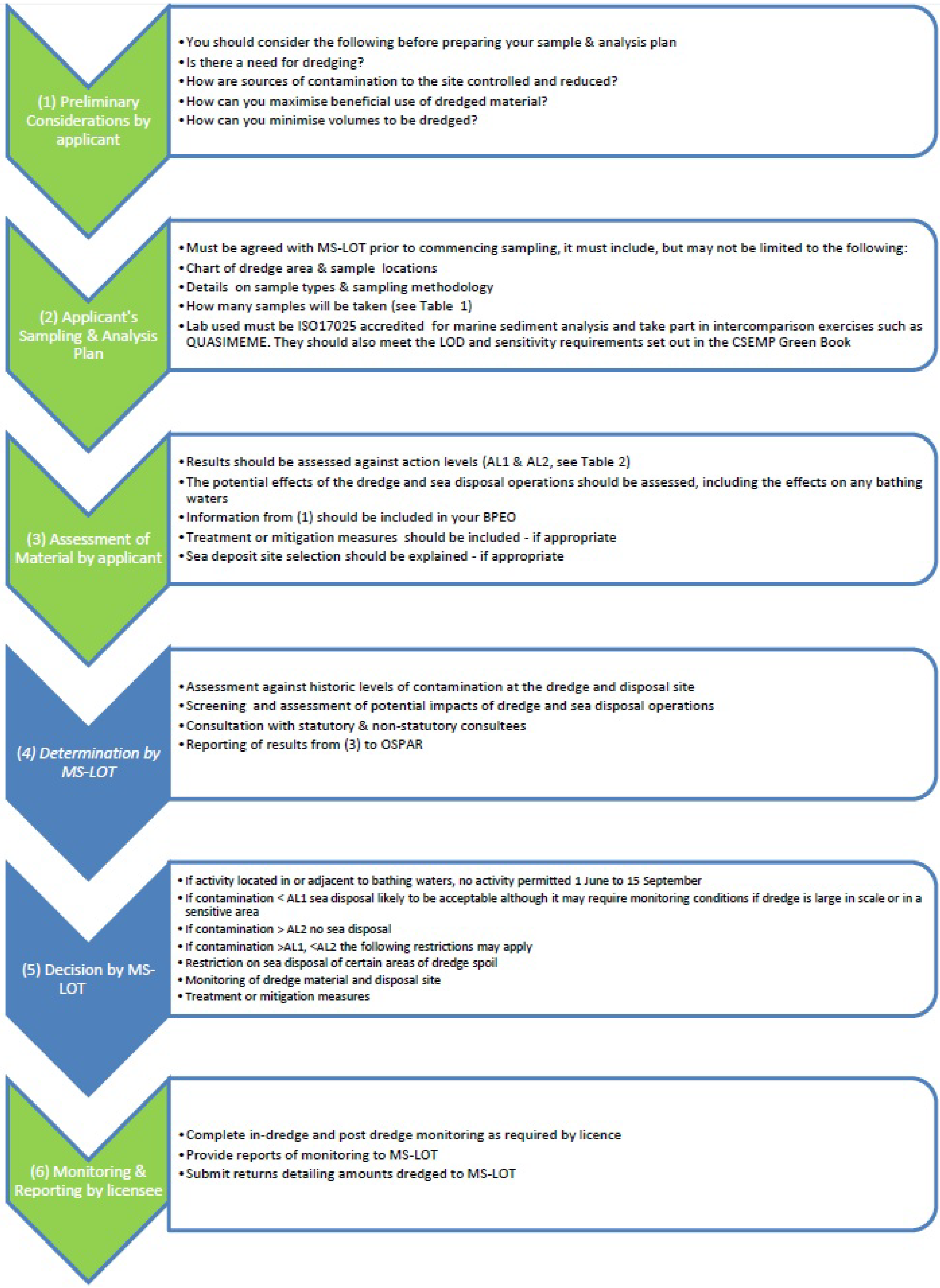
A water body is a discrete unit of water of similar characteristics. Scottish Ministers and the Scottish Environment Protection Agency (SEPA) are the competent authorities for implementation of the Water Framework Directive within the Scotland River Basin District, including transitional (i.e. estuarine) and coastal waters to one nautical mile. Determining if a water body has reached good ecological status requires the consideration of biological, hydromorphological and physico-chemical quality elements, while chemical status is determined against a list of priority (hazardous) substances.

EU Member States must ensure that new schemes, including dredging and disposal activities, do not adversely impact upon the status of aquatic ecosystems, and that historical modifications that are already impacting it are addressed.

2.8 Guidance documents

Guidelines for the management of dredged material at sea have been prepared by the OSPAR Commission (2014). The guidelines are designed to assist Contracting Parties of the OSPAR Convention in the management of dredged material in ways that will prevent and eliminate pollution in accordance with Annex II, and protect marine species and habitats in the OSPAR maritime area in accordance with Annex V. This includes sampling recommendations for dredge material management, including an indication of the number of separate sampling stations required to obtain representative results, and the selection and characterisation of a site for sea deposits.

In addition, pre-disposal sampling guidance has been published by Marine Scotland (2017). It sets out the stages both the applicant and Marine Scotland's Licensing Operations Team (MS-LOT) must go through to determine a marine licence application for sea disposal activities. This includes a process map identifying preliminary considerations regarding the 'need' to dredge and potential beneficial uses, sampling and analysis planning, assessment criteria for sediment quality, the marine licence determination process and subsequent monitoring requirements (see Figure 5).



Source: Marine Scotland, 2017

Figure 5. Process map of pre-disposal sampling stages

3 Dredge (Waste) Material Characteristics

This section describes previous dredging and disposal activity at Uig Harbour, followed by a summary of sample collection and available data to characterise the dredge (waste) material at King Edward Pier.

3.1 Previous dredging and disposal activity

In 2015, a Marine Licence (05459/15/0) was granted by Marine Scotland to THC for the deposit of dredged material from King Edward Pier as part of beach nourishment works in Uig Bay. The Marine Licence was valid between 20 March and 22 June 2015, permitting up to 1,000 m^3 of dredge material to be deposited (bottom dumping) at both South Cuil Beach and Idrigill Beach (thus a total of 2,000 m^3). No additional details regarding historic maintenance dredging works, or disposal activity, at Uig Harbour are available.

3.2 Sample collection and available data

The characteristics of the dredged material from the Proposed Development are required to inform the waste hierarchy assessment and to support identification of a suitable (new) disposal site. It is assumed that CSD will be deployed to undertake the dredging required for the Proposed Development. CSD vessels tend to have a pontoon hull structure without propulsion and are typically anchored (i.e. anchor or spud leg) during dredging operations. The dredged material is drawn up through the cutterhead and suction pipe and discharged in a hopper barge (self-propelled vessel). Overflowing will not be allowed from the hopper barges during proposed dredging operations. It should be noted that dredging of sediment using CSD can result in significant changes to the character of the material, specifically cohesion due to the rotating cutterhead.

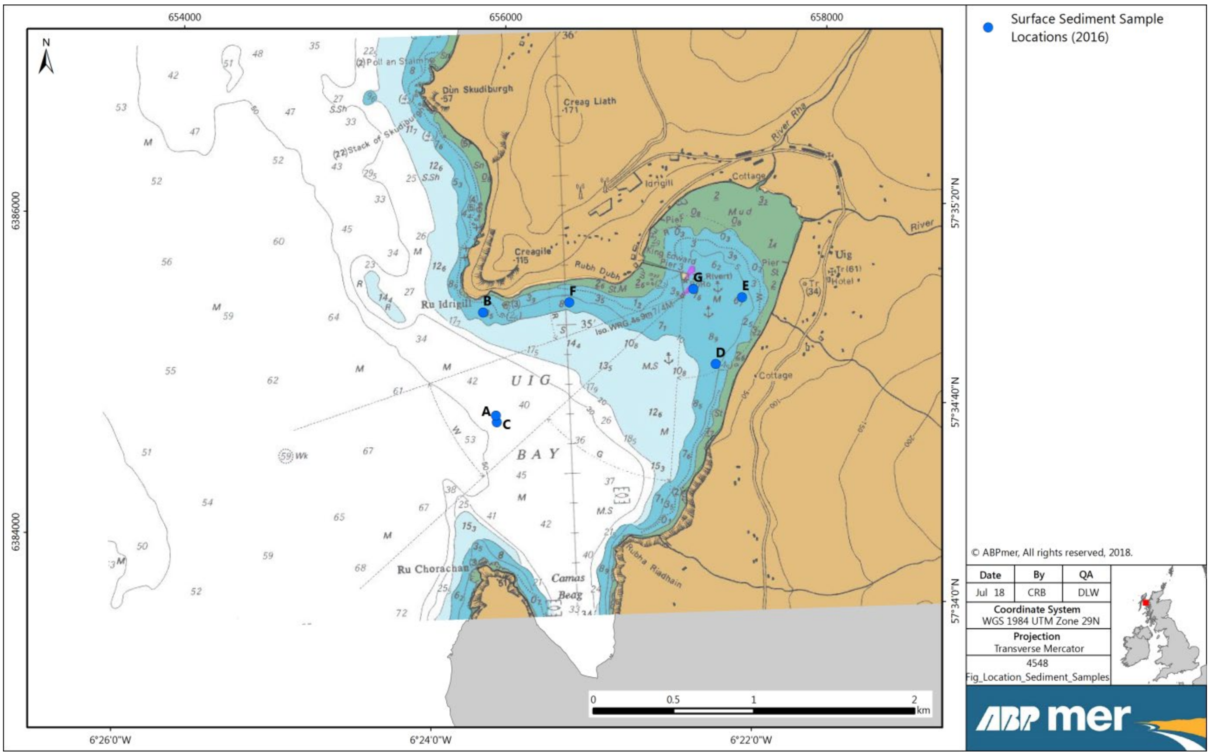
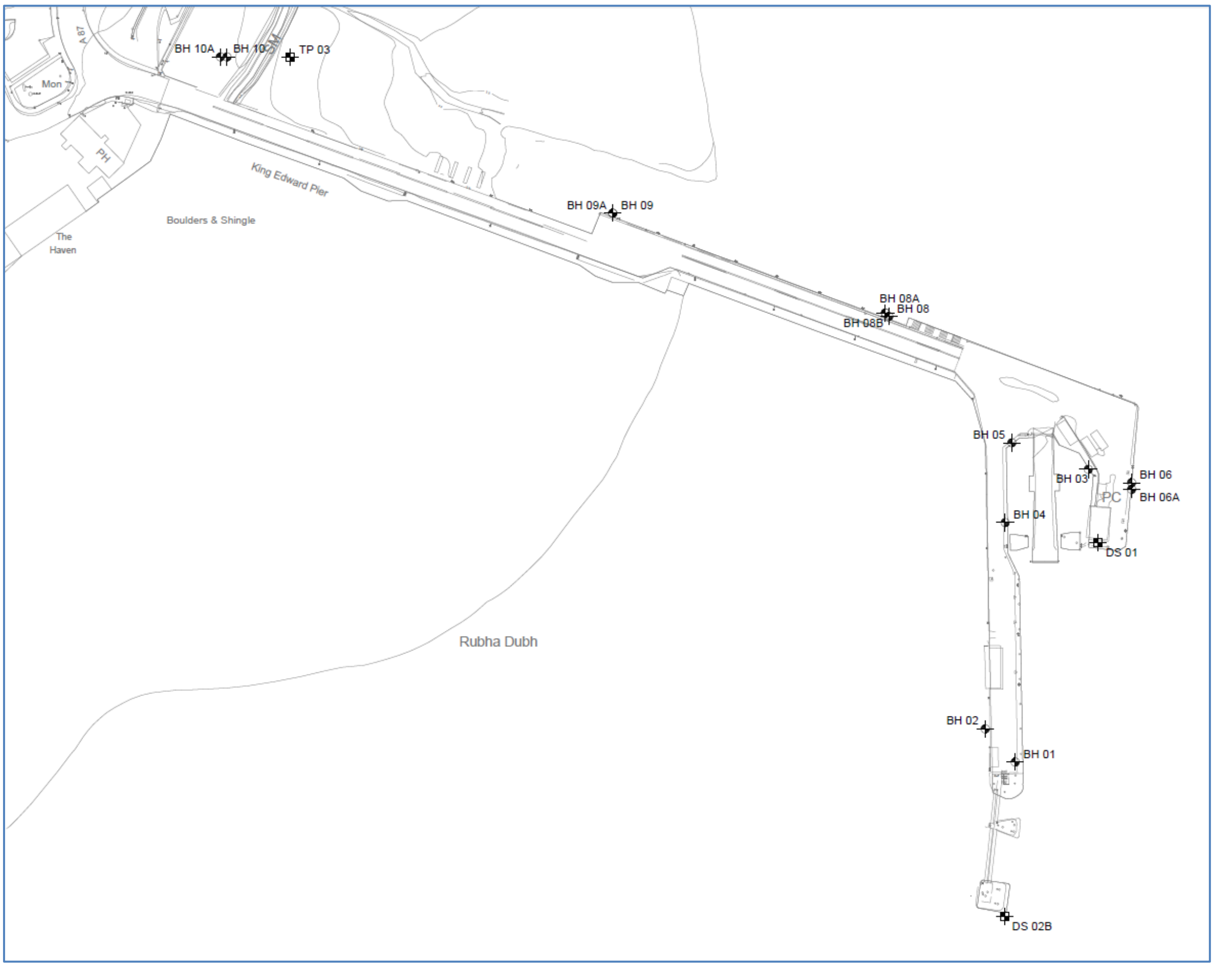


Figure 6. Location of surface sediment samples collected around Uig Bay in 2016

In December 2016, surface sediment samples were collected using a Van Veen grab at seven locations (A-G) around Uig Bay (Figure 6). This included one surface sediment sample from within Dredge Pocket 1 (G; also refer to Section 1.1 and Figure 2 for a summary of the Proposed Development).

Between July and October 2017, sediment samples were collected at depth via rotary boreholes (BH01, BH02, BH06A, BH09 and DS01) located within or immediately adjacent to Dredge Pockets 1 and 2. In July 2017, diver-collected samples were obtained from the southern-most dolphin (DS02) within Dredge Pocket 1, while a trial pit adjacent to Dredge Pocket 2 (TP03) was also sampled (see Figure 7). Based on the analysis of these sediment samples, the physical and chemical characteristics of the material to be dredged are described in the following sections.



Source: AECOM

Figure 7. Location of boreholes, trial pits and diver-collected samples along King Edward Pier

3.2.1 Physical characteristics

The physical characteristics of the dredged material are described from particle size analysis (PSA) of sediment samples, with the exception of the diver-collected samples (DS02) where only a stratum description is provided. Table 2 and Table 3 present PSA results from surface sediment samples around Uig Bay and borehole/trial pit samples, respectively. Results suggest that surficial sediments are predominantly comprised of silt and sand material, particularly in considering Sample G from within Dredge Pocket 1 and samples collected adjacent to Dredge Pocket 2 (BH09 and TP03). However, sediments obtained from below the surface (i.e. boreholes/trial pits) indicate an increased proportion of coarser material (sand and gravel) with reduced contributions from fines, particularly at Dredge Pocket 1.

Table 2. PSA of surface sediment samples collected around Uig Bay

Sample	Particle Size Fraction (%)			Sample Description
	Silt (<63 µm)	Sand (>63 µm-<2 mm)	Gravel (>2 mm)	
A	69	30	1	Grey slightly gravelly very sandy very silty clayey PEAT. Von Post Classification - H9.
B	5	89	6	Grey slightly gravelly slightly clayey slightly silty fine to coarse SAND with shell fragments. Gravel is fine to medium.
C	68	31	1	Brown slightly gravelly very sandy very silty clayey PEAT. Gravel is fine. Von Post Classification - H10
D	11	80	9	Grey slightly silty slightly clayey slightly gravelly fine to coarse SAND. Gravel is fine to coarse.
E	35	64	1	Brown / grey slightly gravelly very sandy very silty slightly clayey PEAT. Gravel is fine. Von Post Classification - H9.
F	41	52	7	Brown slightly gravelly very silty fine to coarse SAND with shell fragments and pockets of organic matter. Gravel is fine.
G	37	63	0	Brown/grey slightly clayey very sandy PEAT. Von Post Classification - H10.
For location of sediment samples, refer to Figure 6.				

Table 3. PSA of boreholes, trial pits and diver collected samples at the dredge site

Sample	Bed Level (m ACD)	Depth of Sample		Particle Size Fraction (%)			GI Report Stratum Description
		Below Bed Level (m)	Relative to Datum (m ACD)	Silt (<63 µm)	Sand (>63 µm-<2 mm)	Gravel (>2 mm)	
BH01	-4.4	1.3	-5.7	9	56	35	Medium dense to dense dark grey to black and white slightly silty very gravelly fine to coarse SAND that includes much shells and shell debris.
		4.3	-8.7	4	49	47	Dense dark grey to black and white silty fine to coarse SAND and fine to coarse rounded to angular GRAVEL with occasional cobbles and boulders that includes much shells and shell debris.
BH02	-3.46	0.5	-3.96	5	61	34	Loose becoming very dense with depth light grey to black and white silty fine to coarse SAND and fine to coarse rounded to subangular GRAVEL that includes varying proportions of shells and shell debris.
		3.5	-6.96	7	38	55	
BH06A	-2.47	0.5	-2.97	6	38	56	Above 0.5 m - Dark grey to black and white slightly silty gravelly fine to coarse organic SAND, 50-75% sand constitutes shells and shelly debris with occasional rusty metallic fragments. Below 0.5 m - Very loose dark grey to black and white silty very sandy fine to coarse rounded to angular GRAVEL that includes many shells and shell debris, occasional cobbles, rusty metallic fragments and rare slate.
		1.5	-3.97	2	28	70	Dense to very dense becoming medium dense towards base dark grey locally speckled white silty very sandy fine to coarse rounded to subangular GRAVEL predominantly of basalt.
		5.4	-7.87	9	32	59	Dense to very dense dark grey to black silty to very silty very sandy fine to coarse rounded to subangular GRAVEL that includes some fine shell debris, occasional cobbles and boulders
DS01	-2.25	1.5-3.0	-5.25	8	69	23	Loose to medium dense grey silty very gravelly fine to coarse SAND with some boulders that includes much shelly debris and possible silt lenses.
		3.0-4.5	-6.75	9	62	29	Dark grey very clayey very gravelly fine to coarse SAND with occasional boulders (possibly slightly organic).
DS02	N/A	0.1	N/A	-	-	-	Dark grey silty slightly gravelly fine to coarse sand. Sand consists of approximately 35% shell debris. Gravel is fine to medium and angular.
		0.5	N/A	-	-	-	Grey silty fine to medium sand. Sand consists of approximately 20% shell debris.
		0.8	N/A	-	-	-	Dark grey silty slightly gravelly fine to coarse sand. Sand consists of approximately 35% shell debris. Gravel is medium to coarse and angular.

Sample	Bed Level (m ACD)	Depth of Sample		Particle Size Fraction (%)			GI Report Stratum Description
		Below Bed Level (m)	Relative to Datum (m ACD)	Silt (<63 µm)	Sand (>63 µm-<2 mm)	Gravel (>2 mm)	
BH09	-1.51	0.9	-2.41	19	74	7	Black silty gravelly fine to medium organic sand that includes shells, wood, metal and plastic. Very loose dark grey to black silty gravelly fine to coarse organic SAND with occasional cobbles and much shell debris.
		7.4	-8.91	84	8	8	Firm to stiff grey and dark grey slightly sandy slightly gravelly silty locally very silty CLAY with lenses (generally <20 mm thick) of silty fine sand and silty partings; with occasional shell fragments between 6.4-10.0 m.
TP03	3.15 m	0.8	2.35	80	19	1	Very loose dark grey mottled black silty to very silty gravelly fine to coarse SAND that includes some shells and shell debris. Firm to stiff locally soft slightly sandy silty CLAY with occasional lenses (<100 mm thick) and pockets (up to approx. 500 mm diameter) of black silty fine to medium Sand, occasional cobbles and boulders and rare fine shell debris. Includes thin beds of very silty clay (generally <250 mm thick). Becoming slightly gravelly at approx. 1.8 m.
		3.0	0.15	96	3	1	

m ACD Metres Above Chart Datum;
N/A Not Available.
For location of sediment samples, refer to Figure 7.

Based on a review of PSA results from sediment samples collected within and immediately adjacent to Dredge Pockets 1 and 2, an estimation of dredged material composition was calculated (Table 4). The composition of Dredge Pocket 1 was assumed to be predominantly sand (57%) and gravel (25%), while relatively increased fine material (silt and clay) was estimated for Dredge Pocket 2 (61%).

Table 4. Dredged composition and settling rates

Parameter	Units	Particle Size Fraction	Dredge Pocket	
			1	2
Dry Density	kg/m^3	-	1,660	1,610
Content	%	Gravel	25	9
		Sand	57	30
		Silt	15	53
		Clay	3	8
	m^3	Gravel	6,711	103
		Sand	15,300	345
		Silt	4,831	702
		Clay	805	92
		Total	26,842	1,150
D_{50}	mm	Gravel	-	-
		Sand	0.50	0.15
		Silt	0.02	0.02
		Clay	0.001	0.001
Settling Velocity	cm/s	Gravel	-	-
		Sand	7.0	1.5
		Silt	0.04	0.04
		Clay	0.0005	0.0005
Note: D_{50} - diameter of the particle that 50% of a sample's mass is smaller than and 50% of a sample's mass is larger than. D_{50} and settling velocity for gravel not reported as this fraction is assumed to fall straight to the bed.				

3.2.2 Chemical characteristics

Sediment samples collected from around Uig Bay (A-G) and within Dredge Pocket 1 (BH01, DS01 and DS02)[1] were analysed for concentrations of the following chemical determinands (dry weight):

- Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
- Tributyltin (TBT);
- Polychlorinated biphenyls (PCBs) (ICES 7 congeners: 028, 052, 101, 118, 153, 138, 180); and
- Polycyclic aromatic hydrocarbons (PAHs) (United States Environmental Protection Agency (USEPA) suite of 16: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(123-cd)pyrene, Dibenzo(ah)anthracene, Benzo(ghi)perylene).

1 It should be noted that PSA results from the two rotary boreholes (i.e. BH01 and DS01) were obtained from samples at different depths compared to chemical analysis. Sediment samples collected from BH02, BH06A, BH09 and TP03 were not analysed for chemical determinands. Samples from around Uig Bay (A-G) were collected from the surface.

Unlike water quality, there are no formal quantitative environmental quality standards (EQS) in the UK for the concentration of chemicals in sediments, although the Water Framework Directive (2000/60/EC) has introduced optional standards for a small number of priority and priority hazardous substances. Marine Scotland (2017) provides a series of Action Levels to assist in the assessment of dredged material (and its suitability for disposal to sea, assuming this is considered appropriate under the waste hierarchy). In general, concentrations of chemicals in dredged material below Action Level 1 (AL1) are likely to be acceptable for disposal at sea, although it may require monitoring conditions if the dredge is large in scale or in a sensitive area. In contrast, dredged material with concentrations above Action Level 2 (AL2) is generally considered unsuitable for disposal at sea. Dredged material with concentrations between AL1 and AL2 requires further consideration before a decision can be made. This could potentially include a restriction on sea disposal of certain areas of dredge spoil, monitoring of the dredge material and disposal site and specific treatment or mitigation measures (Marine Scotland, 2017).

To provide a wider context to sediment quality in the surrounding area, Table 5 provides chemical concentrations in surface sediment samples collected from around Uig Bay (A-G). Metal and TBT concentrations were typically below AL1, with the exception of chromium and nickel which were well above AL1 in all samples and above AL2 in four samples. The highest concentration of chromium (740 mg/kg dry weight) was recorded in Sample E to the east of King Edward Pier, while the highest concentration of nickel (530 mg/kg dry weight) was recorded in Sample B adjacent to Ru Idrigill headland in the northwest of Uig Bay. Copper and zinc concentrations were also found to be above AL1 (but below AL2) in several samples, while the concentration of PCBs and PAHs were consistently below AL1 in all samples. Of particular relevance to Dredge Pocket 1 for the Proposed Development at Uig Harbour, chromium (460 mg/kg dry weight) and nickel (150 mg/kg dry weight) concentrations were above AL2 in Sample G.

Table 6 provides a summary of chemical concentrations in borehole/diver-collected samples from within Dredge Pocket 1 (BH01, DS01 and DS02). The concentration of metals and TBT were below AL1, with the exception of chromium, copper and nickel. As with the surface samples collected around Uig Bay (i.e. samples A-G), chromium and nickel were consistently above AL1, with several samples above AL2. The highest concentrations for chromium and nickel were 490 mg/kg dry weight (DS02; 0.8 m) and 260 mg/kg dry weight (DS01; 1.5 m), respectively. Copper concentrations were typically above AL1, but well below AL2. PCBs and PAHs were below AL1 apart from one sample (DS01; 1.5 m) whereby several PAHs were above AL1 (there are no AL2 values for PAHs). There were no clear spatial trends with regards to sediment quality. Chromium concentrations were slightly lower in BH01 compared to DS01 and DS02, although nickel concentrations were also found to be above AL2 in BH01. There were also no clear trends in chemical concentrations with depth, with elevated concentrations in the relatively surficial samples collected at DS02 (<1 m) and those at greater depths in BH01 and DS01 (up to 3.5 m).

In summary, sediment quality is poor around Uig Bay with concentrations of chromium and nickel above AL2 at several locations, including the dredge site of the Proposed Development at Uig Harbour.

Table 5. Concentration of chemical determinands in surface sediment samples collected around Uig Bay

Determinand	Unit	AL1	AL2	A	B	C	D	E	F	G
Arsenic	mg/kg	20	70	9.2	9.2	8.1	8.6	10	8.5	9.7
Cadmium	mg/kg	0.4	4	0.2	0.1	0.2	0.1	0.3	<0.1	0.3
Chromium	mg/kg	50	370	310	530	250	710	740	110	460
Copper	mg/kg	30	300	230	36	30	32	71	19	53
Lead	mg/kg	50	400	27	7.4	26	11	13	3.7	16
Nickel	mg/kg	30	150	110	530	93	350	230	68	150
Zinc	mg/kg	130	600	200	100	83	91	130	42	99
Mercury	mg/kg	0.25	1.5	0.05	<0.01	0.05	0.02	0.03	<0.01	0.04
Tributyltin (TBT)	µg/kg	100	500	<10	<10	<10	<10	<10	<10	<10
PCB #28	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #52	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #101	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #118	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #153	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #138	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #180	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	µg/kg	100	-	<2	<2	<2	<2	<2	<2	<2
Acenaphthylene	µg/kg	100	-	<2	<2	<2	<2	<2	<2	2
Acenaphthene	µg/kg	100	-	<2	<2	<2	<2	<2	<2	<2
Fluorene	µg/kg	100	-	<2	<2	<2	<2	<2	<2	<2
Phenanthrene	µg/kg	100	-	<2	<2	<2	<2	7	<2	15
Anthracene	µg/kg	100	-	<2	<2	<2	<2	3	<2	4
Fluoranthene	µg/kg	100	-	3	<2	<2	2	28	<2	36
Pyrene	µg/kg	100	-	2	<2	<2	<2	25	<2	32
Benz(a)anthracene	µg/kg	100	-	<2	<2	<2	<2	16	<2	15
Chrysene	µg/kg	100	-	3	<2	<2	<2	13	<2	13
Benzo(b/k)fluoranthene	µg/kg	100	-	6	3	<2	2	27	<2	29
Benzo(a)pyrene	µg/kg	100	-	3	<2	<2	<2	15	<2	17
Indeno(123-cd)pyrene	µg/kg	100	-	3	<2	<2	<2	8	<2	9
Dibenzo(ah)anthracene	µg/kg	10	-	2	<2	<2	<2	3	<2	2
Benzo(ghi)perylene	µg/kg	100	-	4	<2	<2	<2	15	<2	19
Key	Below AL1									
	Above AL1 (Below AL2)									
	Above AL2									
Note: Surface sediment samples. AL1 - Action Level 1; AL2 - Action Level 2.										

Table 6. Concentration of chemical determinands in borehole samples collected within Dredge Pocket 1 of the Proposed Development

Determinand	Unit	AL1	AL2	BH01			DS01			DS02		
				0.0 m	0.5-2.0 m	2.0-3.5 m	0.3 m	1.5 m	3.0 m	0.1 m	0.5 m	0.8 m
Arsenic	mg/kg	20	70	7.3	7.2	8.8	8.1	6.4	7	7.3	9	6.5
Cadmium	mg/kg	0.4	4	<0.1	<0.1	<0.1	0.2	0.2	0.2	0.3	0.3	0.3
Chromium	mg/kg	50	370	100	220	120	310	460	330	380	410	490
Copper	mg/kg	30	300	38	42	58	97	43	62	41	25	37
Lead	mg/kg	50	400	3.8	4.6	2.5	7.6	4	3.8	6.4	3.5	4.8
Nickel	mg/kg	30	150	140	240	210	210	260	250	220	190	230
Zinc	mg/kg	130	600	77	96	78	120	100	110	100	77	100
Mercury	mg/kg	0.25	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.35	<0.05	<0.05
Tributyltin (TBT)	µg/kg	100	500	<10	20	<10	<10	<10	<10	<10	<10	<10
PCB #28	µg/kg	20	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #52	µg/kg	20	180	<0.05	<0.05	<0.05	0.39	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #101	µg/kg	20	180	<0.05	<0.05	<0.05	0.91	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #118	µg/kg	20	180	<0.05	<0.05	<0.05	0.74	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #153	µg/kg	20	180	<0.05	<0.05	<0.05	0.54	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #138	µg/kg	20	180	<0.05	<0.05	<0.05	0.73	<0.05	<0.05	<0.05	<0.05	<0.05
PCB #180	µg/kg	20	180	<0.05	<0.05	<0.05	0.22	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	µg/kg	100	-	<2	<2	<2	<2	3	<2	24	6	11
Acenaphthylene	µg/kg	100	-	<2	<2	<2	5	34	4	<2	<2	<2
Acenaphthene	µg/kg	100	-	<2	<2	<2	2	7	<2	3	<2	3
Fluorene	µg/kg	100	-	<2	<2	<2	<2	7	8	2	<2	2
Phenanthrene	µg/kg	100	-	3	2	<2	21	98	28	15	<2	<2
Anthracene	µg/kg	100	-	<2	<2	<2	11	37	8	6	<2	<2
Fluoranthene	µg/kg	100	-	9	6	<2	67	340	25	56	<2	<2
Pyrene	µg/kg	100	-	11	6	<2	62	310	19	48	<2	<2
Benz(a)anthracene	µg/kg	100	-	6	5	<2	32	150	8	33	<2	<2
Chrysene	µg/kg	100	-	5	3	<2	29	130	8	33	<2	<2
Benzo(b/k)fluoranthene	µg/kg	100	-	10	9	<2	65	280	12	47	2	<2
Benzo(a)pyrene	µg/kg	100	-	6	4	6	36	160	7	22	<2	<2
Indeno(123-cd)pyrene	µg/kg	100	-	4	3	<2	22	88	4	11	<2	<2
Dibenzo(ah)anthracene	µg/kg	10	-	<2	<2	<2	6	20	<2	5	<2	<2
Benzo(ghi)perylene	µg/kg	100	-	5	3	<2	26	110	4	9	<2	<2
Key	Below AL1											
	Above AL1 (Below AL2)											
	Above AL2											

Note: Samples depths provided. Bed level for BH01: -4.4 m above chart datum (ACD); DS01: -2.25 m ACD. Bed level for DS02 unknown (diver-collected). AL1 - Action Level 1; AL2 - Action Level 2.

4 Waste Hierarchy Assessment

As described in Section 2.5, the waste hierarchy ranks waste management options according to the best environmental practice. This section discusses the Best Practicable Environmental Option (BPEO) assessment, carried out by AECOM, with respect to the management of dredge arisings from the Proposed Development, documenting the considerations made to ensure the waste hierarchy is adopted where possible.

4.1 Prevention

Prevention is not possible as without dredging the lifeline 'Skye Triangle' ferry service to Tarbert and Lochmaddy could not operate regularly.

4.2 Prepare for re-use

Re-use of the dredge material is not considered feasible due to the chemical composition of the sediment and high water content (percentage of total solids could be less than 50%). This makes it unsuitable for re-use due to the high metal content (particularly chromium and nickel) and fine material, as the level of preparation of the dredged material would be subject to thorough de-watering.

4.3 Recycle

Recycling of the dredge material has been assessed as part of the BPEO assessment, but it is not considered suitable due to the high proportion of fine particles and water content. The following options were considered:

- Beach recharge;
- Reclaim
- Landfill; and
- Construction material.

All of the above options were found unsuitable, predominantly due to the characteristics of the dredged material.

4.4 Other recovery

The limited use of the dredge material and the significant cost of processing/remediation would not be viable with regards to other recovery.

4.5 Disposal

Disposal for both onshore and offshore application have been assessed as part of the BPEO. The distance of the nearest landfill site would not be feasible due to the practical, economic and environmental cost associated with disposal to land. Therefore, sea disposal was identified as the BPEO regarding the waste hierarchy of dredge material from the Proposed Development.

5 Site Selection Process and Consideration of Alternatives

Based on the waste hierarchy assessment as discussed in Section 4, this section describes the site selection process to support the disposal of dredged material as part of the Proposed Development. Firstly, this includes the potential to dispose of dredged material at an existing marine disposal site (Section 5.1), followed by considerations to identify a suitable new disposal site from within an initial disposal site search area (Section 5.2).

5.1 Existing marine disposal sites

There are several existing marine disposal sites in the wider area surrounding the Isle of Skye, as described in Table 7. This includes disposal sites which are open (in use), disused (not used for at least five years) or closed (not used for at least ten years or specifically closed) based on data presented on Marine Scotland's National Marine Plan interactive (NMPi) map[2]. The two nearest existing disposal sites are both closed, namely Loch Maddy (HE030) and Leverburgh (HE033) located approximately 40 km to the west of the Proposed Development. The nearest open disposal sites are located at Stornoway (HE035) and Ullapool (Loch Broom; HE050), approximately 65 km to the north and 80 km to the northeast of the Proposed Development, respectively (see Figure 8).

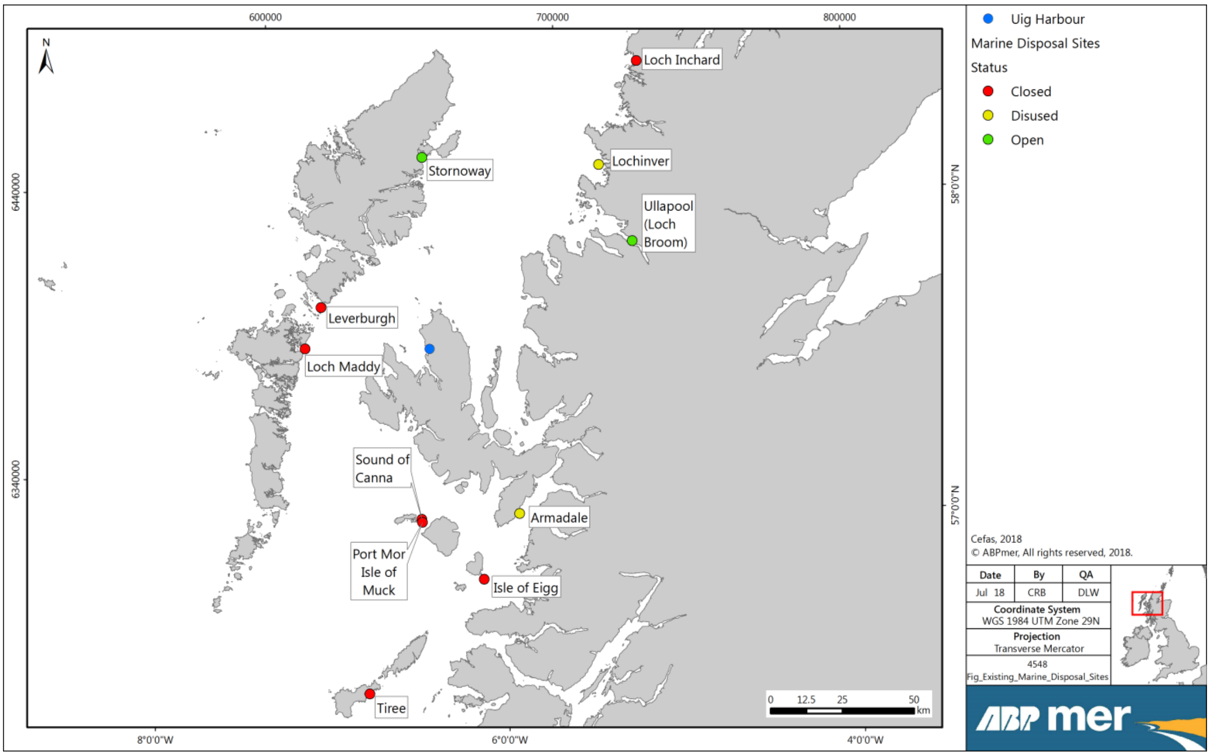


Figure 8. Existing marine disposal sites and current status

The existing disposal sites identified in Table 7 are considered too distant to be economically viable for the disposal of dredged material from the Proposed Development and the two closest disposal sites have not received disposal material in over 20 years.

2 https://marinescotland.atkinsgeospatial.com/nmpi (Accessed June 2018). Data presented from 2015, but Marine Scotland confirmed "there has been no update to the disposal site data" (General enquiry email; 12/06/18).

Table 7. Existing open, closed and disused marine disposal sites in the wider area

Existing Disposal Site			Approximate Distance from Uig Harbour (km)		Year	Volume Disposed		Dredge Type
Name	ID	Status	Straight Line	By Sea		Wet Tonnes	Dry Tonnes	
Loch Maddy	HE030	Closed	40	40	1985	6,483	-	Capital
Leverburgh	HE033	Closed	40	40	1996	2,275	1,820	Capital
					1997	20,755	16,604	Capital
Sound of Canna	HE025	Closed	60	90	2000	21,784	17,427	Capital
					2001	13,466	10,772	Capital
Port Mor Isle of Muck	HE080	Closed	60	90	2003	1,662	831	Maintenance
Stornoway	HE035	Open	65	70	1993	19,714	9,857	Maintenance
					1995	55,305	44,244	Capital
					2002	37,590	18,796	Maintenance
					2003	4,772	2,382	Maintenance
					2012	28,113	22,490	Capital
Armadale	HE070	Disused	65	120	2004	21,151	10,573	Maintenance
Ullapool (Loch Broom)	HE050	Open	80	95	2003	10,115	5,058	Maintenance
					2006	4,130	2,065	Maintenance
					2007	4,130	2,065	Maintenance
					2014	820	410	Capital
Isle of Eigg	HE020	Closed	80	120	2000	12,956	10,365	Capital
					2001	20,170	16,136	Capital
					2003	92,176	46,088	Maintenance
Lochinver	HE040	Disused	85	95	1990	30,000	24,000	Capital
					1991	28,500	22,800	Capital
					2004	385	192	Maintenance
Tiree	MA080	Closed	120	140	1991	5,300	4,240	Capital
Loch Inchard	HE060	Closed	125	130	1987	40,833	38,793	Capital
					1988	81,667	77,587	Capital
					1997	34,314	27,451	Capital

Source: Marine Scotland MAPS NMPi (National Marine Plan interactive) interactive tool; Centre for Environment, Fisheries and Aquaculture Science (Cefas) Disposal at Sea (DAS) database

It is also uncertain whether these existing disposal sites would be suited to accept the dredged material from Uig Harbour based on sediment type, as well as the known concentrations of chromium and nickel within the sediments (see Table 5 and Table 6). Therefore, it is considered impracticable, both economically and environmentally, to pursue the use of an existing disposal site as part of the Proposed Development and a new disposal site is required to be designated.

5.2 Disposal site search area

The site selection process used to identify a proposed new disposal site initially focussed in on a pre-defined search area, as discussed with Marine Scotland during a teleconference on 07 December 2017. The teleconference was used to discuss the reasoning behind the location of the disposal site search area and to agree a sampling plan to characterise the whole area, from which a sub-section would be selected for a proposed new disposal site. Coordinates for the disposal site search area are provided in Table 8, covering an area of approximately 1,000 m x 750 m in the west of Uig Bay (Figure 9).

Table 8. Disposal site search area coordinates

Point	Coordinates (WGS84; Decimal Degrees)	
	Latitude (N)	Longitude (W)
A	57.5811	-6.4088
B	57.5816	-6.3921
C	57.5748	-6.3915
D	57.5744	-6.4082

In summary, the disposal site search area was chosen given the deeper waters (up to 60 m depth) further out in the Bay, to avoid the nearby finfish farms (Uig Bay and Loch Snizort East) and to prevent any suspended sediment plumes from disposal and dredging operations to combine. A further consideration was made with regards to White-tailed eagle (*Haliaeetus albicilla*), specifically pairs breeding/nesting in the vicinity of Uig Bay. The location of the disposal site search area ensures any proposed new disposal site would be greater than 1 km from any known White-tailed eagle nest (confidential information provided by the Highland Raptor Study Group). Conversely, disposal in shallower waters within the inner Uig Bay area would likely result in greater re-distribution of sediment as a result of wave action. Marine Scotland agreed during the teleconference that the proposed disposal site search area was sensible, noting that the final disposal site would need to have similar sediment quality to the dredged areas at Uig Harbour. Given the concentrations reported in sediment samples collected from around Uig Bay in 2016 (see Table 5 and Table 6), this was considered feasible within the disposal site search area.

To characterise the disposal site search area, supplementing data collected from around Uig Bay and at the dredge site, additional surveys were undertaken in February 2018. The disposal site search area was set out in a 3 x 4 grid of 250 m x 250 m boxes (12 in total). The survey design included grab sampling to determine sediment type (i.e. PSA), benthic infauna and concentrations of chemical determinands, as well as the collection of drop-down video (DDV) footage using a remotely operated vehicle (ROV) to characterise epifaunal/infaunal benthic habitats and to establish the presence of any priority marine features (PMF). The sampling locations from these surveys, based on the 12 grid cells, are shown in Figure 10.

The grab sampling involved the collection of 12 randomly selected surface sediment samples within the disposal site search area (one sample per grid; methodology suggested by Marine Scotland during teleconference). Samples were collected with a 0.1 m^2 Day grab sampler, with two samples collected per station to allow for the measurement of physical (PSA and total organic carbon), chemical and biological (faunal analysis) variables. Coordinates for the grab samples are provided in Table 9.

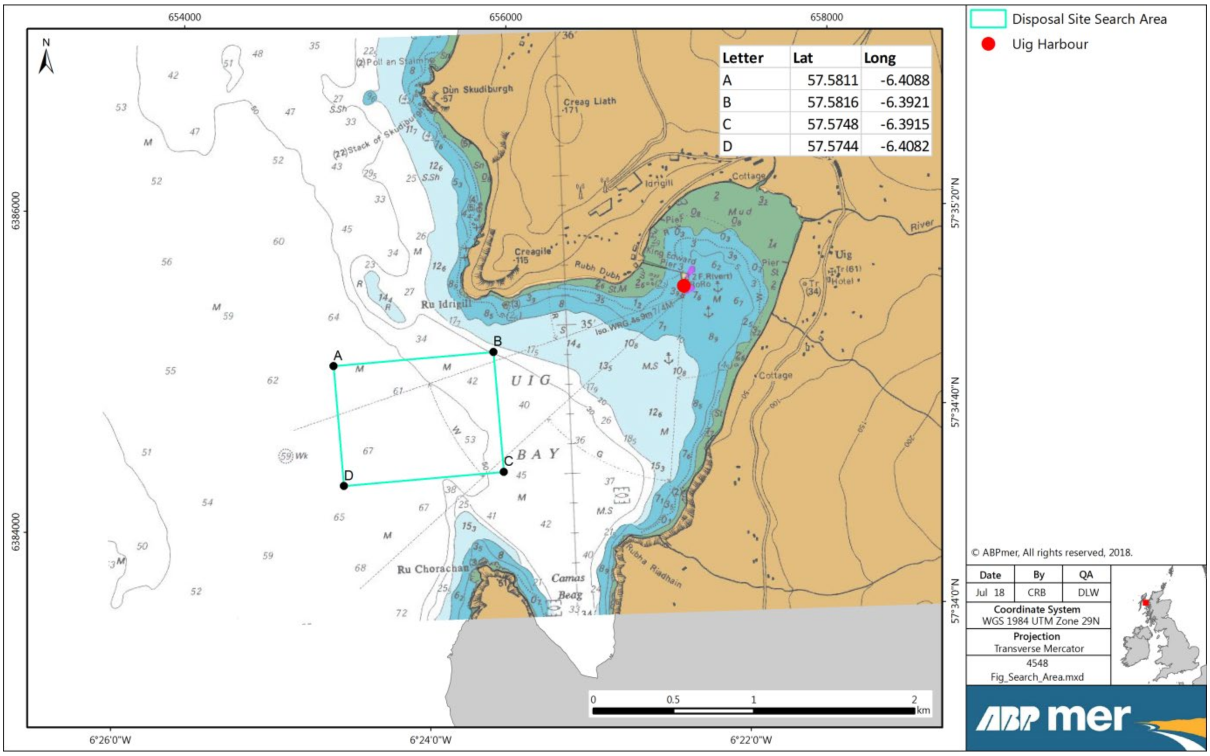


Figure 9. **Location of the disposal site search area**

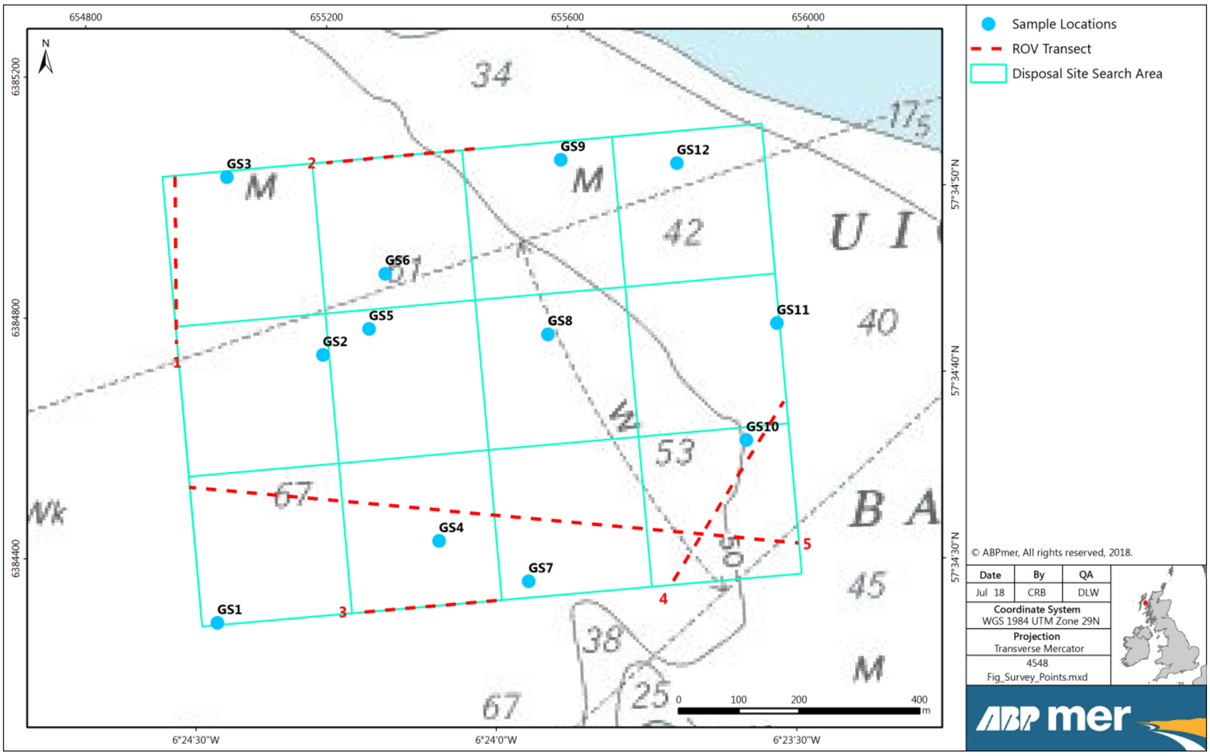


Figure 10. **Location of grab sampling points and ROV transects within the disposal site search area**

Table 9. Grab sample coordinates

Grab Sample	Coordinates (WGS84; Decimal Degrees)	
	Latitude	Longitude
GS1	57.5744	-6.4077
GS2	57.5784	-6.4045
GS3	57.5811	-6.4070
GS4	57.5755	-6.4015
GS5	57.5787	-6.4032
GS6	57.5795	-6.4027
GS7	57.5749	-6.3990
GS8	57.5786	-6.3983
GS9	57.5811	-6.3977
GS10	57.5769	-6.3929
GS11	57.5786	-6.3919
GS12	57.5810	-6.3945

Video footage and stills were collected using an ROV along five seabed transects within the disposal site search area. Whilst the equipment did not enable a time stamp on the resultant footage, still images were taken at regular intervals to provide a series of 'quadrats' along each transect. Additional stills were taken on an *ad hoc* basis to capture features of special interest, particularly seapens and evidence of burrowing megafauna. The data were analysed to record species present and to assign biotopes (UK Marine Habitat Classification/EUNIS). Particular attention was given to the identification of any PMF habitats. This specifically included 'Seapens and burrowing megafauna in circalittoral fine mud' as this has previously been observed within the Bay and wider area, and any evidence of the rare biotope '*Brissopsis lyrifera* and *Amphiura chiajei* in circalittoral mud' which has been observed at the site of the Loch Snizort East finfish farm to the south of the disposal site search area. Start and finish coordinates for the ROV transects are provided in Table 10.

Table 10. ROV transect start and end coordinates

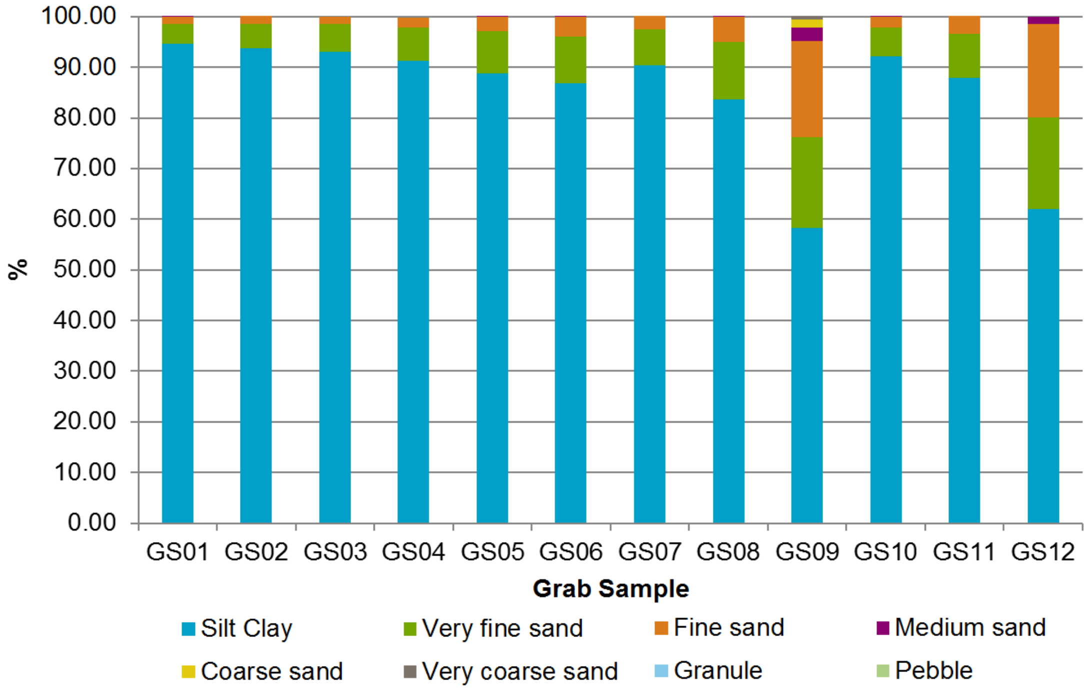
Remotely Operated Vehicle (ROV) Transect	Coordinates (WGS84; Decimal Degrees)			
	Start		Finish	
	Latitude	Longitude	Latitude	Longitude
1	57.578620	-6.4085675	57.58111	-6.40843
2	57.581236	-6.4042131	57.58136	-6.40004
3	57.574512	-6.4038680	57.57462	-6.39981
4	57.574746	-6.3951075	57.57742	-6.39178
5	57.575302	-6.3915252	57.57648	-6.40837

The following sections describe the physical, chemical and biological characteristics of the disposal site search area, as well as known human uses and other sea users of the area, based on available data and the additional surveys undertaken.

5.2.1 Physical characteristics

The bathymetry in the outer sections of Uig Bay indicates water depths of greater than 30 m, with sections within the disposal site search area as deep as 60 m towards the western margin. Such depths suggest any disposed material which reaches the seabed is unlikely to be affected by wave action and, therefore, the disposal site search area is likely to be retentive in nature (i.e. material will remain *in situ* once deposited). It was noted that increased water depths could also result in the sediment plume/finer material being suspended in the water column for extended periods prior to settling. Therefore, dispersion modelling has been carried out to determine the fate of material disposed (see Section 7). Very low flow speeds are observed throughout Uig Bay, particularly apparent in deeper areas, which would suggest selection of a new disposal site throughout the disposal site search area would largely provide retentive properties for disposed sediment.

Dredged material would ideally be disposed of at a site with similar sediment type (i.e. like-for-like) to minimise changes in seabed habitat. The sediment type from Sample G indicated fairly coarse mud material in the surficial layer of Dredge Pocket 1, broadly comparable to Samples A and C located to the east of the disposal site search area as well as other locations around Uig Bay (see Table 2 and Figure 6). However, the sediment types recorded at depth in rotary borehole samples (BH01, BH02, BH06A, BH09 and DS01), diver-collected samples (DS02) and trial pits (TP03), all located within or immediately adjacent to Dredge Pockets 1 and 2 of the Proposed Development, indicated coarser material (sand, gravel and shell debris; see Table 3 and Figure 7). An estimation of dredged material composition is provided in Table 4. A large disposal site search area was selected to maximise the potential for locating an area with sediments that were compatible with the sediments of the dredge pockets. PSA results from sediments collected within the disposal site search area are shown in Figure 11 (Wentworth sediment class) and size fractions are presented in Table 11.



Source: AECOM, 2018a

Figure 11. Particle size distribution (%) of sediments collected from grab samples in the disposal site search area

With the exception of GS9 (41.7% sand) and GS12 (38.0% sand), all samples indicated more than 80% of the sediment was silt/clay. None of the samples included gravel fractions (>2 mm). The difference in the physical nature of the sediments in GS9 and GS12 were also evident in a lower percentage of total organic carbon (1.0 and 1.6% respectively, compared to around 2.0% across all other stations), as would be predicted from the greater average particle size.

In summary, sediment composition in grab samples collected from the disposal site search area (Table 11) were similar to surface samples collected from around Uig Bay in 2016 (Table 2). However, it is noted that coarser material (predominantly sand) is found below the surface at the dredge sites, differing from the muddy sediment type observed at the surface throughout the disposal site search area. It is acknowledged that samples collected from GS9 and GS12 indicated relatively increased sand content compared to the rest of the disposal site search area, although these samples still comprised greater than 58% silt material. While the increased sand fraction at locations GS9 and GS12 (to the northeast of the disposal site search area) are potentially more similar to the dredged material, the surface sediment composition remains fundamentally different and the deposition of dredge material from Uig Harbour at any location within the disposal site search area will effectively result in a change in substrate type (as would be the case throughout Uig Bay). Therefore, surface sediment type around the disposal site search area does not present a key differentiator with regards to physical characteristics.

Table 11. PSA of surface sediment samples collected from grab samples in the disposal site search area

Grab Sample	Particle Size Fraction (%)			Sample Comments (Visual Inspection)	Folk Description
	Silt (<63 µm)	Sand (>63 µm-<2 mm)	Gravel (>2 mm)		
GS1	94.6	5.41	0.0	Colour - Brown; Texture - Wet Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS2	93.7	6.32	0.0	Colour - Brown; Texture - Wet Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS3	93.1	6.86	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS4	91.5	8.53	0.0	Colour - Brown; Texture - Wet Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS5	88.9	11.2	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud
GS6	86.8	13.2	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud
GS7	90.2	9.79	0.0	Colour - Brown; Texture - Very wet Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS8	83.6	16.4	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud
GS9	58.3	41.7	0.0	Colour - Brown; Texture - Very Wet Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud
GS10	92.1	7.88	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Mud
GS11	87.8	12.2	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud
GS12	62.0	38.0	0.0	Colour - Brown; Texture - Sludge; Odour - None; Biota - None; Anthropogenic Inputs - None	Sandy Mud

5.2.2 Chemical characteristics

As described in Table 5 and Table 6, sediments within Uig Bay and at the dredge site indicate high concentrations of certain chemical determinands, particularly chromium and nickel. The Harbours Manager for THC has suggested there is no history of metal works or other similar anthropogenic activities in the Uig Bay area (i.e. human activities which could have caused the high levels of chromium and nickel to occur). Therefore, it is considered most likely that the high chromium and nickel concentrations observed in sediments throughout Uig Bay are naturally occurring, potentially due to the leaching of geological material. This would potentially explain the high concentrations found throughout Uig Bay, including both shallow and deeper water locations.

During the teleconference on 07 December 2017, Marine Scotland noted that concentrations of chromium and nickel in the harbour are high and, therefore, sediments at any proposed new disposal site would need to have similar levels to the dredged areas. It was considered likely that concentrations of chromium and nickel within the disposal site search area would be similar to those reported around Uig Bay and at the dredge site, particularly given Samples A and C were collected within the eastern section of the disposal site search area.

Table 12 provides concentrations of chemical determinands from 12 surface sediment samples collected from the disposal site search area (see Figure 10 for locations). The concentration of metals and TBT were below AL1, with the exception of chromium, copper and nickel. Chromium and nickel concentrations were consistently above AL1, with GS9 and GS12 above AL2. The highest concentrations for chromium (528 mg/kg dry weight) and nickel (189 mg/kg dry weight) were both from GS9. Copper concentrations were typically below AL1, except for GS10 which was marginally above AL1 (32.4 mg/kg dry weight; well below AL2). The concentration of PCBs was consistently below AL1 in all samples collected from the disposal site search area. The concentration of PAHs was also typically below AL1, with the exception of benzo(b+j)fluoranthene (GS3) and dibenz(ah)anthracene (GS1, GS3 and GS12) which were slightly above AL1 (there is currently no AL2 for PAHs).

The concentrations of chemical determinands in grab samples collected from the disposal site search area were similar to samples collected from around Uig Bay in 2016 (Table 5) and the dredge sites at Uig Harbour in 2017 (Table 6). Therefore, based on the range of sites sampled throughout the disposal site search area, it is considered that the entirety of disposal site search area would present a suitable new disposal site with regards to chemical characteristics due to the consistently high concentrations of chromium and nickel.

Table 12. Concentration of chemical determinands in surface sediment samples collected from grab samples in the disposal site search area

Determiand	Unit	AL1	AL2	GS1	GS2	GS3	GS4	GS5	GS6	GS7	GS8	GS9	GS10	GS11	GS12
Arsenic	mg/kg	20	70	8.66	8.1	8.11	7.89	8.08	8.98	9.16	7.92	9.72	10.6	8.69	8.79
Cadmium	mg/kg	0.4	4	0.12	0.13	0.11	0.11	0.11	0.12	0.14	0.13	0.12	0.14	0.1	0.1
Chromium	mg/kg	50	370	117	145	145	139	203	175	172	231	528	287	282	415
Copper	mg/kg	30	300	21	22.7	21.3	22.2	22.2	22.5	22	24.1	25.7	32.4	26.7	26.8
Lead	mg/kg	50	400	32.9	31.1	29.2	29.1	26.9	28	28.3	25.4	19.7	31.5	22.1	20.9
Nickel	mg/kg	30	150	52.9	60.7	59.7	59.5	73.3	68.2	68.6	91	189	106	105	158
Zinc	mg/kg	130	600	109	108	104	107	99.7	104	105	100	94.8	124	93	92.8
Mercury	mg/kg	0.25	1.5	0.08	0.07	0.07	0.08	0.07	0.07	0.07	0.06	0.04	0.06	0.05	0.05
Tributyltin (TBT)	µg/kg	100	500	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PCB #28	µg/kg	20	180	1.4	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
PCB #52	µg/kg	20	180	0.76	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PCB #101	µg/kg	20	180	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB #118	µg/kg	20	180	0.62	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB #153	µg/kg	20	180	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB #138	µg/kg	20	180	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB #180	µg/kg	20	180	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	µg/kg	100	-	17.80	10.2	24.9	6.47	14.60	10.00	15.60	12.80	7.85	12.1	9.44	12.90
Acenaphthylene	µg/kg	100	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acenaphthene	µg/kg	100	-	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7
Fluorene	µg/kg	100	-	7.85	<1.7	9.93	<1.7	5.65	<1.7	5.89	4.47	<1.7	4.50	<1.7	5.48
Phenanthrene	µg/kg	100	-	23.30	9.73	34.20	6.47	15.80	9.78	19.50	13.80	9.34	12.10	9.66	19.80
Anthracene	µg/kg	100	-	4.39	<2.5	5.08	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	5.28
Fluoranthene	µg/kg	100	-	21.20	7.47	33.00	9.35	14.10	8.41	18.80	13.00	8.04	10.80	8.12	27.60
Pyrene	µg/kg	100	-	14.30	5.21	24.20	5.99	10.40	6.14	14.30	10.20	6.91	9.89	7.69	25.60
Benzo(a)anthracene	µg/kg	100	-	11.80	<1.6	18.20	<1.6	6.83	3.87	9.06	6.17	4.67	6.30	<1.6	16.60
Chrysene	µg/kg	100	-	7.97	<1.7	12.00	<1.7	4.71	<1.7	6.34	4.47	3.36	4.05	<1.7	11.00
Benzo(b+j)fluoranthene	µg/kg	100	-	69.5	20.8	130	12.5	46.9	18.6	49.6	43.4	33.4	42.9	18.9	82
Benzo(k)fluoranthene	µg/kg	100	-	28.6	7.7	67.6	5.27	16.7	6.14	17.2	18.7	13.1	18.2	7.47	39.5
Benzo(a)pyrene	µg/kg	100	-	35.6	10.4	66.5	5.51	22.4	8.64	24.9	22.3	16.8	22.3	7.9	41.9
Indeno(123-cd)pyrene	µg/kg	100	-	43.9	11.5	85.2	5.51	24.5	9.55	24.7	23.4	21.1	25.2	11.9	51.5
Dibenz(ah)anthracene	µg/kg	10	-	12.7	<1.6	22.4	<1.6	7.3	<1.6	<1.6	6.6	5.61	6.52	3.73	13.9
Benzo(ghi)perylene	µg/kg	100	-	44.1	12.7	87	6.47	28.7	10.5	28.8	24.3	21.7	27.4	14.1	48.9
Key	Below AL1														
	Above AL1 (Below AL2)														
	Above AL2														
Note: Surface sediment samples. AL1 - Action Level 1; AL2 - Action Level 2.															

5.2.3 Biological characteristics

The Inner Hebrides and the Minches candidate Special Area of Conservation (cSAC) is located immediately adjacent to Uig Bay (boundary between the Ru Idrigill and Ru Chorachan headlands) (Figure 12). Therefore, the majority of the disposal site search area overlaps with this designated site. The site is designated for Harbour porpoise (*Phocoena phocoena*) and considered to be "one of the best areas in the United Kingdom" for this mobile species[3]. However, for context, the size of the disposal site search area (0.75 km^2) is less than 0.01% of the spatial extent of the Inner Hebrides and the Minches cSAC (13,802 km^2).

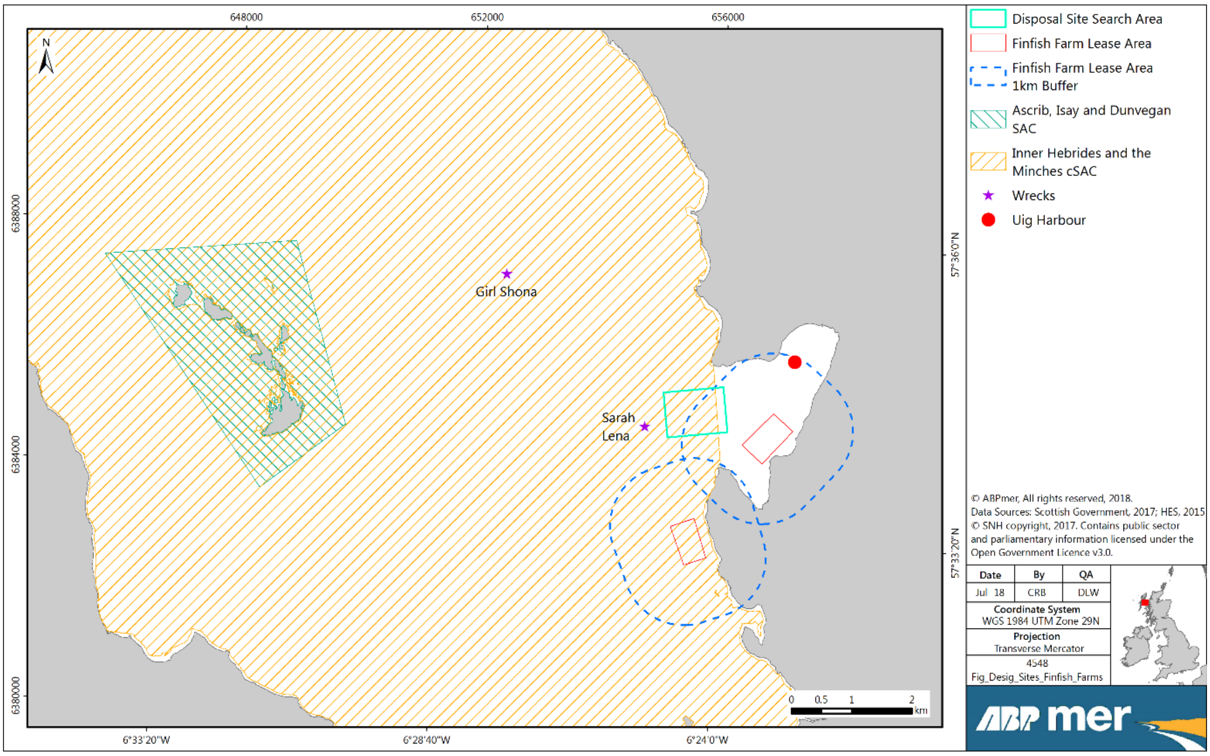


Figure 12. Nature conservation designated sites, finfish farms and known wrecks

The Ascrib Islands component of the Ascrib, Isay and Dunvegan Special Area of Conservation (SAC), designated for Harbour seal (*Phoca vitulina*), is located approximately 5 km to the west of the disposal site search area (Figure 12). This complex of skerries, islets, undisturbed mainland shores and offshore islands in north-west Skye consistently supports a breeding colony of Harbour seals. The site represents one of the larger discrete colonies of common (harbour) seals in the UK, holding around 2% of the UK population. While the disposal site search area does not directly overlap with this designated site, it is likely that this species will migrate and forage within Uig Bay.

The EMODnet MESH Atlantic data records indicate 'Seapens and burrowing megafauna in circalittoral fine mud' (A5.361) within the disposal site search area, while '*Laminaria saccharina* and red seaweeds on infralittoral sediments' (A5.521) has been reported in relatively close proximity; however, the latter biotope would not be expected to occur at the depths within the disposal site search area. As highlighted on Marine Scotland's NMPi, seapens and burrowing megafauna in circalittoral fine mud is extensively distributed throughout the sea lochs of the west coast, Hebrides and voes of Shetland, occurring at depths of between 10-100 m.

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3 http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030393.pdf (Accessed June 2018).

Table 13 presents the mean infauna abundance results from the grab samples collected from the disposal site search area (see Figure 10 for locations). A total of 54 taxa (not all organisms could be identified to species level) were recorded from the 12 grab samples. The average abundance of infauna was 223.9 individuals per m^2. Samples were dominated, both in terms of species and number of animals, by polychaetes with 28 taxa (52% of species) and an average abundance of 145 polychaetes per m^2 (63% of animals). Mollusca were also an important component of the benthic community with 14 species and an average abundance of 66.7 individuals per m^2 found in the disposal site search area. Crustaceans, echinoderms and other groups were also present but in much lower diversity and abundance.

Table 13. Number of species and average abundance of macrofaunal phyla in grab samples from the disposal site search area

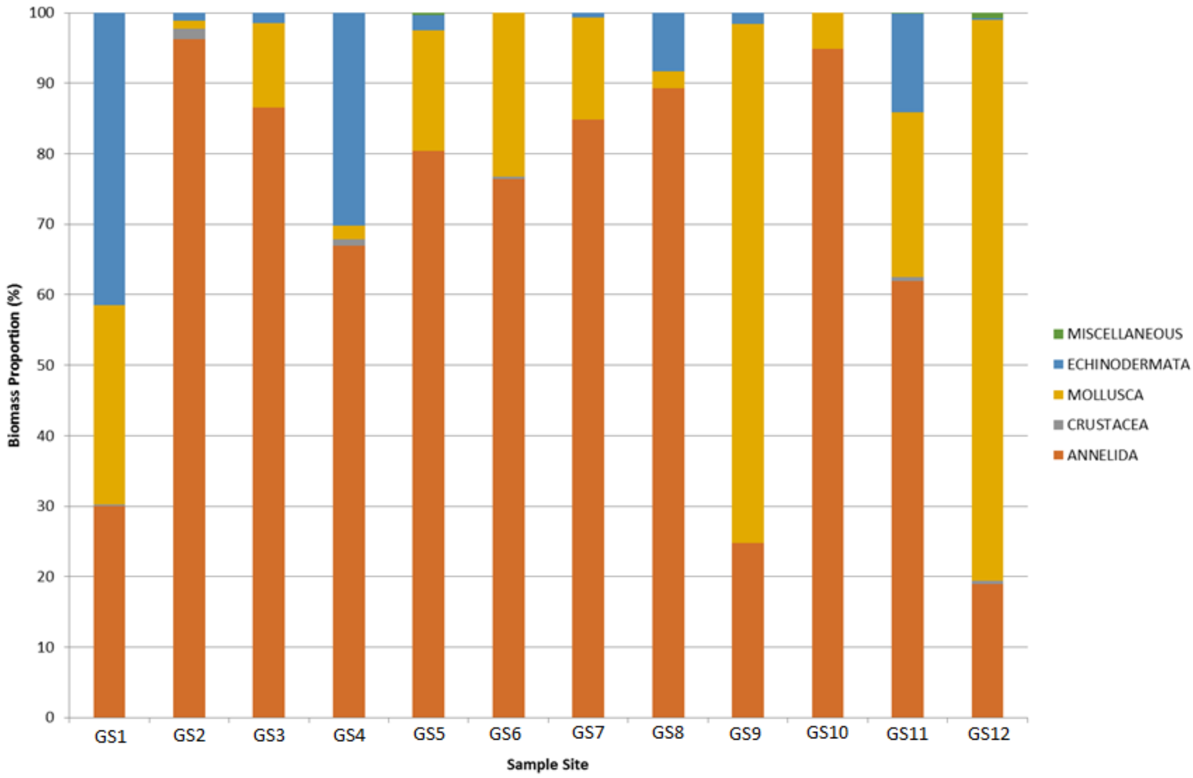
Taxon Group	Number of Species	Mean Abundance (Individuals/m^2)
Polychaeta	28	145
Crustacea	4	4.2
Mollusca	14	66.7
Echinodermata	4	10
Nemertea	1	0.8
Phoronida	1	1.7
Sipuncula	1	0.8
Cnidaria	1	0.1
Total	**54**	**223.9**

The polychaetes were dominated by the catworm, *Nephtys incisa*, which accounted for almost half of all worms present. This was also the only infaunal species found in all grab samples. Bivalves were the most important component of the mollusca diversity, with eight bivalve species recorded. Abundance, however, was split between bivalves and gastropods, predominantly the bivalve genera *Abra* and *Nucula* and the gastropod snail *Cylichna cylindracea*. This small gastropod snail was the only other species that was found to be widespread (recorded in 10 of the 12 grab samples). Only eight species were recorded in 50% or more of the grab samples; the polychaetes *Abyssoninoe hibernica*, *Magelona minuta* and *Nephtys incisa*; the bivalves *Abra nitida*, *Nucula nitidosa* and *Chaetoderma nitidulum*; the gastropod snail *Cylichna cylindracea*; and the brittle star *Amphiura chiajei*.

With the exception of GS1, GS9 and GS12, polychaetes accounted for the highest proportion of faunal biomass (>60%; Figure 13) in grab samples. For GS1, biomass was dominated by echinoderms (a relatively low number of large bodied individuals) and for GS9 and GS12 molluscs accounted for the majority of the biomass (>70%).

Sediments dominated by mud (silt/clay) were widely observed along the ROV transects with fine mud and many burrow holes recorded. The dominance of infaunal polychaete worms and bivalve molluscs in the grab samples is typical of the fauna found in muddy sediments in marine waters. The dominant fauna, as identified by both the infaunal grab sampling and the epifaunal ROV footage, were polychaete worms, bivalves and gastropod molluscs with burrowing megafauna such as *Nephrops norvegicus*, the burrowing shrimp *Maera loveni* and two species of seapen.

The benthic habitat in the disposal site search area is dominated by burrowed muds, including the biotope 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg). There were very regular sightings of two species of seapen (*Virgularia* mirabilis and *Pennatula phosphorea*), highly abundant burrows and mounds on the seabed and the positive identification of several individuals of *Nephrops norvegicus*. This biotope is a PMF in Scottish waters, though it is recognised as having a common and widespread distribution. Therefore, the consistent burrowed muds habitat type throughout the disposal site search area does not present a key differentiator with regards to biological characteristics in selecting a suitable new disposal site.



Source: AECOM, 2018a

Figure 13. Proportion of benthic biomass by major faunal groups in grab samples from the disposal site search area

5.2.4 Human environment and other sea users

The disposal site search area is located within the Loch Snizort Shellfish Water Protected Area. However, there are currently no classified shellfish production areas in the vicinity of the Proposed Development or within the wider Loch Snizort Shellfish Water Protected Area. The Loch Snizort Beag (Kensaleyre and Tote) production area for Common cockles (*Cerastroderma edule*) was declassified in 2011.

The Loch Snizort East finfish farm is an active site operated by Grieg Seafood located between Ru Chorachan, the headland which forms the south side of the entrance to Uig Bay, and Poll na h-Eelaidh, the small inlet which lies 2 km to the south. A Controlled Activities Regulations (CAR) Licence has also been granted to Sgeir Mhor (Salmon) Ltd for a finfish farm along the southern margin of Uig Bay, a site previously used for salmon farming albeit has not been operational since 2004.

The lease area for the Loch Snizort East finfish farm is approximately 1.3 km from the boundary of the disposal site search area, while the lease area for the finfish farm in Uig Bay is largely within 1 km of the southeast section of the disposal site search area (see Figure 12). It was requested by Grieg Seafood to avoid placement of a new disposal site within 1 km of the finfish farms where possible. Given sections to the east of the disposal site search area are within 1 km of the Uig Bay finfish farm lease area, locating the new disposal site in the west of the disposal site search area would support the request from Grieg Seafood to maintain a distance of at least 1 km from the nearby finfish farms.

There is a known wreck to the west of Uig Bay, located immediately west of the disposal site search area boundary ("*Sarah Lena*"; motor fishing vessel), while another wreck is situated further northwest of the disposal site search area ("*Girl Shona*"; motor fishing vessel) (Figure 12). No other marine archaeological features or marine infrastructure, such as cables or pipelines, have been identified within the disposal site search area or immediate vicinity.

The identification of a proposed new disposal site within the disposal site search area is considered unlikely to present a significant constriction to vessel movements. It is also understood that there is relatively limited fishing activity within Uig Bay which would be influenced by disposal of dredge material within the disposal site search area, although Uig Harbour is an important landing port.

In summary, the key differentiator with regards to the human environment and other sea users would suggest locating the new disposal site in the west of the disposal site search area to maintain a requested distance of at least 1 km from the Uig Bay and Loch Snizort East finfish farms.

6 Proposed New Disposal Site

Following the disposal site selection process and consideration of existing marine disposal sites as described in Section 5, a new disposal site is proposed within the disposal site search area (Figure 14). It is located approximately 2 km to the west of Uig Harbour centred on Grid Reference NG 36686 62746, with extent coordinates provided in Table 14. The area is approximately 250 m x 500 m (0.125 km^2), completely overlapping grid 2 and partially overlapping grids 1 and 3 of the disposal site search area. The size of the proposed new disposal site in the outer Uig Bay is consistent with existing disposal site dimensions in the vicinity of the Isle of Skye and wider area, as identified in Table 7.

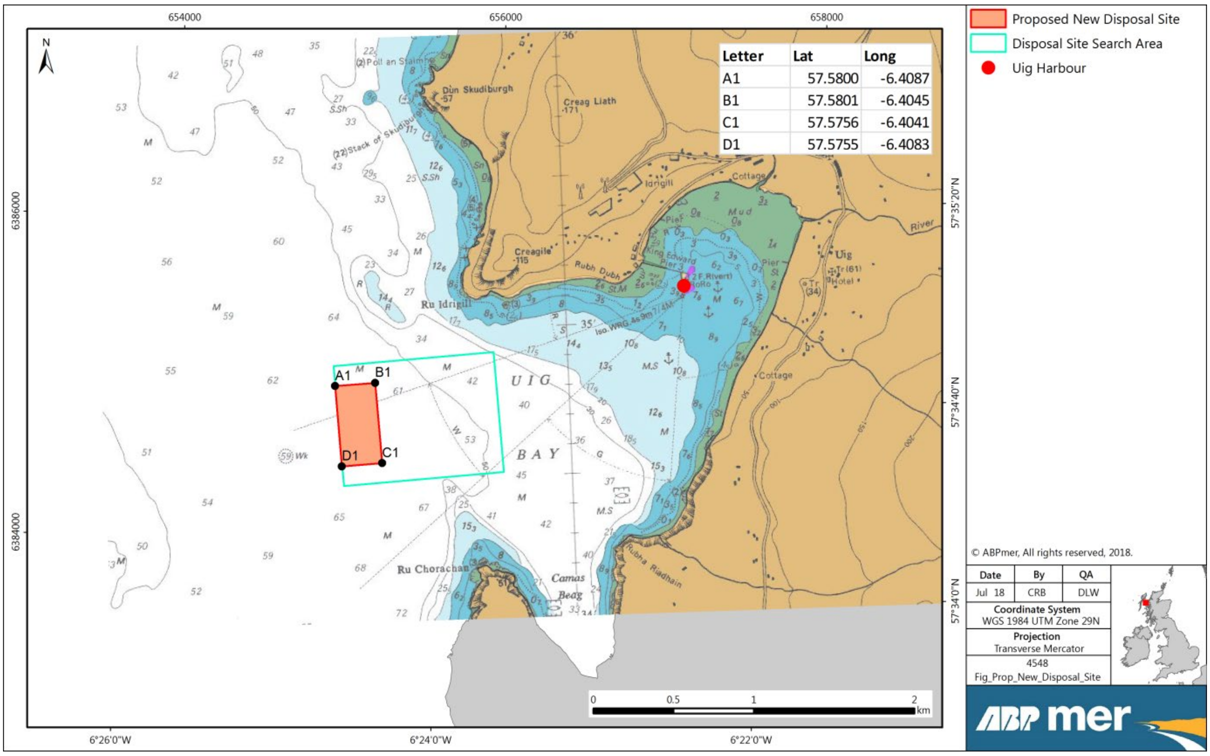


Figure 14. Location of the proposed new disposal site

This sub-section of the disposal site search area has been selected as the most suitable location for the proposed new disposal site for the following key reasons:

- Water depths (approximately 60 m) provide increased retentive properties of deposits which reach the seabed;
- Very low flow speeds throughout Uig Bay, particularly apparent in deeper areas, indicating the proposed new disposal site would provide retentive properties for disposed sediment;
- Distance from the dredge sites at Uig Harbour (approximately 2 km) reduces the potential for any fine sediment plumes generated during dredging and disposal operations to combine;
- Distance greater than 1 km from any known White-tailed eagle nest (*Haliaeetus albicilla*; confidential information provided by the Highland Raptor Study Group); and
- Distance greater than 1 km from Uig Bay and Loch Snizort finfish farms as requested by Grieg Seafood.

Table 14. Proposed new disposal site coordinates

Point	Coordinates (WGS84; Decimal Degrees)	
	Latitude (N)	Longitude (W)
A1	57.5800	-6.4087
B1	57.5801	-6.4045
C1	57.5756	-6.4041
D1	57.5755	-6.4083

Other site selection factors discussed in Section 5.2, whereby no apparent differentiator was identified around the disposal site search area, remain applicable to the proposed new disposal site. This includes the following reasons:

- The surface sediment composition is fundamentally different to the dredged material throughout the disposal site search area (as is the case in surface sediments throughout Uig Bay) and, therefore, the deposition of dredge material from Uig Harbour at any location within the disposal site search area will effectively result in a change in substrate type;
- Similarly, the benthic habitat in the disposal site search area is dominated by burrowed muds, including the PMF biotope 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg) and thus disturbance/smothering of this habitat is unavoidable;
- The concentration of chemical determinands in sediments, particularly chromium and nickel, were consistently high throughout the disposal site search area, including the proposed new disposal site;
- While a small section in the east of disposal site search area does not overlap the Inner Hebrides and the Minches cSAC (Figure 12), it is designated for Harbour porpoise (*Phocoena phocoena*) and thus does not realistically present an opportunity to avoid potential effects given this is a mobile feature which will likely migrate and forage within Uig Bay;
- Equally, the Ascrib Islands component of the Ascrib, Isay and Dunvegan SAC, designated for Harbour seal (*Phoca vitulina*), is located around 5 km to the west of the proposed new disposal site, but this mobile feature will likely migrate and forage within Uig Bay;
- The nearest known wreck is located immediately west of the disposal site search area boundary ("*Sarah Lena*"; motor fishing vessel) and thus the proposed new disposal site does not overlap this feature (Figure 12);
- No other marine archaeological features or marine infrastructure, such as cables or pipelines, have been identified within the disposal site search area or immediate vicinity; and
- The location is considered unlikely to present a significant constriction to vessel movements, while there is relatively limited fishing activity within Uig Bay.

An assessment of potential effects of disposal activity at the proposed new disposal site is provided in Section 7.

7 Assessment of Potential Effects

In identifying the proposed new disposal site (Figure 14), a number of key considerations were made regarding potential effects on the environment and other sea users/infrastructure. Such considerations were similar but more refined compared to the initial identification of the disposal site search area. Table 15 describes the potential effects on the physical, chemical, biological and human environment, providing rationales regarding the need for further assessment. Those effects which were considered to require further assessment are discussed in the following sections.

Table 15. Potential effects as a result of disposal at the proposed new disposal site

Group	Potential Effect	Requires Assessment?	Rationale
Physical Environment	Increases in suspended sediment concentration (SSCs)	Yes	The disposal of fine (silt/mud) material could lead to increased SSCs in the vicinity of the proposed new disposal site. Therefore, numerical modelling has been undertaken to determine the fate of the fine material following disposal.
	Changes to coastal processes	Yes	The disposal of material to the seabed and dispersion of fine material could influence the nearby coastal processes. Therefore, further consideration is required regarding potential changes to the wave regime, flows and sediment transport.
Chemical Environment	Changes to water and sediment quality	Yes	The introduction of sediment-bound chemicals from the dredge sites could lead to a reduction in water and sediment quality at the proposed new disposal site.
	Deterioration in water body status under the Water Framework Directive	Yes	Activities in the marine environment which could have an effect on a water body should be considered against the objectives of the Water Framework Directive.
	Changes in water quality through accidental chemical/fuel spillages	No	Accidental spillages are a risk for all activities involving vessels and equipment/machinery in the marine environment. However, it is assumed that good practice will be followed to minimise the risk of accidents occurring. Disposal activity at the proposed new disposal site will only include the release of dredge material; it will not involve purposeful releases of chemicals or fuel.
Biological Environment	Change in benthic habitat type and extent including Priority Marine Features (PMFs) and smothering	Yes	Given the anticipated change in sediment type at the surface (from soft mud to coarse material) and the identification of PMF habitat at the proposed new disposal site, further consideration is required regarding the change in habitat and impact to species assemblage.

Group	Potential Effect	Requires Assessment?	Rationale
	Disturbance to features of nature conservation designated sites	Yes	The proposed new disposal site overlaps the Inner Hebrides and the Minches cSAC. Therefore, further consideration is required regarding potential impacts to designated features.
	Disturbance to nesting White-tailed eagles and other terrestrial ecology receptors	No	The location of the proposed new disposal site is greater than 1 km from any known White-tailed eagle nest (confidential information provided by the Highland Raptor Study Group). Therefore, further assessment to consider the potential impacts on this species is not required. No other terrestrial ecology receptors are likely to be disturbed by disposal (activity) at the proposed new disposal site.
	Introduction of invasive non-native species (INNS)	No	The origin of the dredge material is relatively local to the proposed new disposal site (i.e. Uig Harbour). While the change in sediment type will alter the seabed habitat type, it is considered unlikely that disposal of this material will result in the introduction of INNS.
Human Environment	Impacts to finfish farms and through changes in water quality	Yes	As described above, there is a potential for increased SSCs through the introduction of fine material at the proposed new disposal site. This could have a significant impact on the operation of nearby finfish farms should the material be transported towards them.
	Loss of commercial and recreational fishing grounds	No	While it is acknowledged that Uig Harbour is an important landing port, it is understood that there is relatively limited fishing activity within Uig Bay and the proposed new disposal site. Therefore, it anticipated that there would be minimal impact to commercial and recreational fisheries from disposal of dredge material at the proposed new disposal site.
	Impacts to Shellfish Water Protected Areas through changes in water quality	No	The proposed new disposal site is located within the Loch Snizort Shellfish Water Protected Area. However, there are currently no classified shellfish production areas in the vicinity of the Proposed Development or within the wider Loch Snizort Shellfish Water Protected Area.
	Disturbance to known marine archaeological features or existing infrastructure	No	There is a known wreck to the west of Uig Bay, located immediately west of the proposed new disposal site ("*Sarah Lena*"; motor fishing vessel). The disposal of dredged material at this site is considered unlikely to significantly impact this wreck, or another wreck situated further northwest of the proposed new disposal site ("*Girl Shona*"; motor fishing vessel).

Group	Potential Effect	Requires Assessment?	Rationale
			No other marine archaeological features or marine infrastructure, such as cables or pipelines, have been identified in the immediate vicinity of the proposed new disposal site.
	Potential increased risk of vessel collision	No	There is sufficient navigable water available in Uig Bay for vessels to use alternative approaches to the harbour during disposal operations. Furthermore, the proposed disposal operations are short-term and unlikely to have any significant impact on navigation assuming local notices to mariners are published by the Harbour Authority and made available to all vessels. Coordination of planned dredging and disposal activities with ferry operations would also help to minimise disruption to services. Following cessation of disposal activity, the proposed new disposal site will not present a hazard to navigation given the location and depth of water. It is also noted that provision of a new disposal site is essential to support the Proposed Development at Uig Harbour, providing improved transport links to the area. An assessment of potential impacts to commercial and recreational navigation will be prepared to support the Proposed Development, considering both the dredging activity and disposal to the proposed new disposal site.

7.1 Physical environment

7.1.1 Increases in suspended sediment concentration (SSC)

Following on from the identification of the proposed new disposal site (as discussed in the preceding Sections of this report), a series of numerical modelling scenarios were undertaken to assess the potential effects of the planned disposal of material and verify the selection of this location. In addition to informing this site characterisation study, the modelling undertaken forms part of the wider environmental impact assessment (EIA) process, in support of the Proposed Development at Uig Harbour. Full details of the modelling approach/inputs, including the rationale for modelling the selected scenarios, are provided in AECOM (2018b). The wider modelling tasks include assessment of effects from the Harbour redevelopment (e.g. installation of new infrastructure, dredging works etc.); for the purposes of the present report, the following sections summarise the modelling undertaken in relation to the disposal of material at the identified disposal site.

Model approach

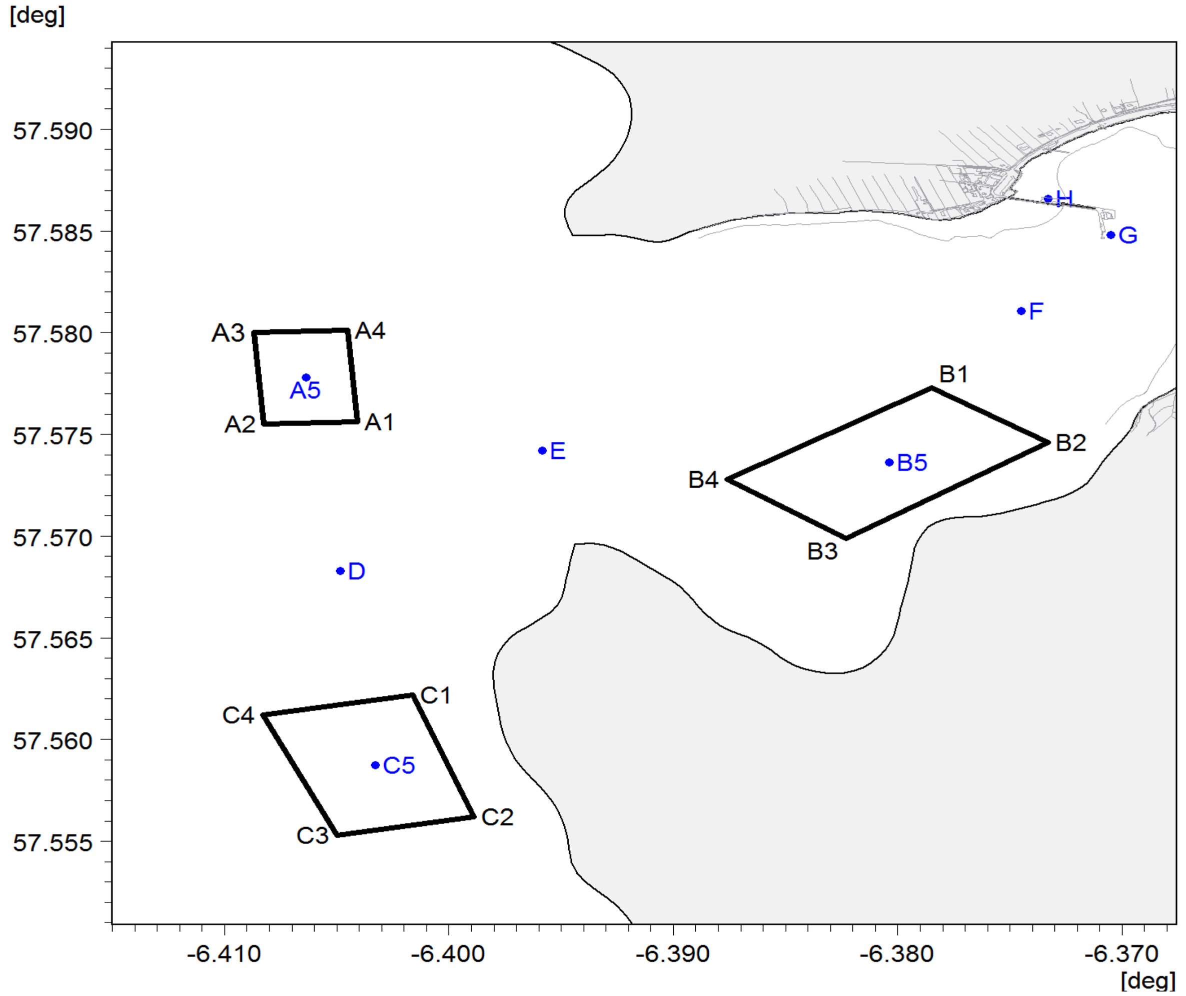
Sediment dispersion modelling was undertaken using the DHI MIKE21 PT (Particle Tracking) module, to simulate the fate of dredged sediment suspended through the disposal process. The calibrated hydrodynamic model (set up for the Uig Harbour EIA studies; AECOM, 2018b) was used to drive the PT module with a description of water levels and flow speeds across the study area. The flow regime was seeded with particles with defined characteristics (e.g. size, density, settling velocity etc.), which were then tracked as they became entrained within the water column.

Model input parameters were defined, relating to:

- Dredge/disposal programme - method of dredging, the dredge volume, the hopper capacity and the transit time from the dredge pocket(s) to the disposal site;
- Sediment characteristics - as informed by the analysis of grab samples and boreholes collected over the proposed dredge pockets; and
- Environmental forcing conditions - applying a range of tidal and wind input conditions (informed by hindcast wind data provided by the Met Office) to provide a representative set of forcing conditions, covering a six-month period and including stormy winter conditions and calmer summer conditions.

Model results

A series of 12 representative forcing conditions were used to define the suite of modelled scenarios. These included a range of wind speeds and directions, and spring and neap tidal conditions. Construction operations for the Uig Harbour redevelopment, including both dredge and disposal activities, were then modelled to assess the subsequent effect on the fate of suspended material. The modelled increase in SSC was extracted, for each model scenario, and for a series of locations across the study area (Figure 15).



Source: AECOM, 2018b

Figure 15. Extraction points from particle tracking (PT) module

The defined extraction locations were chosen to provide information on predicted SSC increases at specific areas of interest. These points included Dredge Pocket 1 (Point G), Dredge Pocket 2 (Point H), the proposed new disposal site (Points A1-A5) and the two finfish farms within the study area (Points B1-B5 and C1-C5), along with selected locations across the inner and outer regions of Uig Bay (Points D, E and F).

The maximum predicted increase in SSC, at each of these points, and from any of the 12 model scenarios, is presented in Table 16.

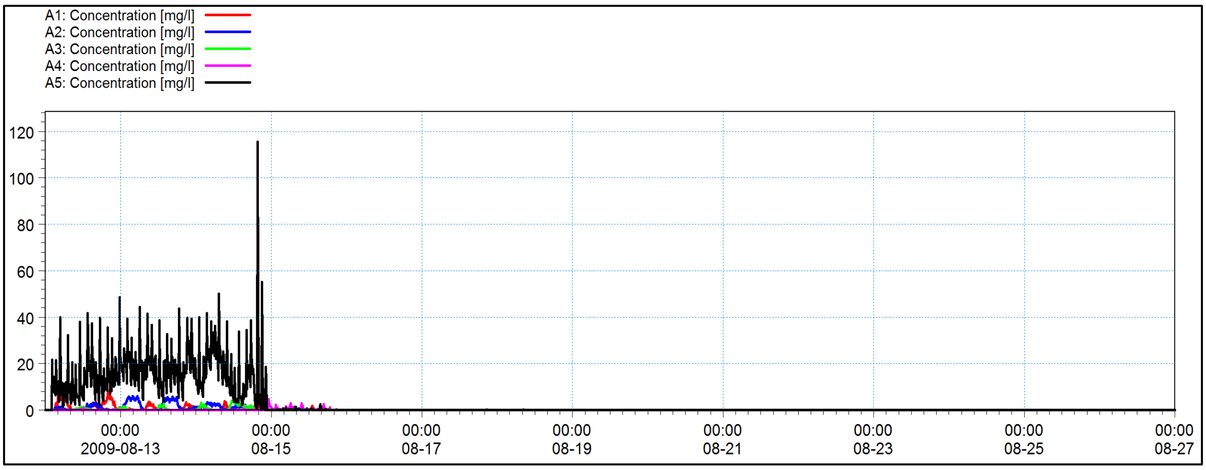
Table 16. Maximum increase in SSC for all 12 model scenarios

Point	Increase in Suspended Sediment Concentration (SSC) (mg/l)		
	Surface	Bed	Depth-averaged
A1	32.7	5.3	6.6
A2	39.7	31.4	24.1
A3	24.0	12.4	10.8
A4	19.4	10.0	10.4
A5	191.0	1,239.0	212.0
B1	2.5	51.6	6.2
B2	1.8	0.8	0.9
B3	6.1	2.7	1.3
B4	3.9	3.9	1.3
B5	2.0	1.7	0.8
C1	4.9	0.3	1.1
C2	3.6	3.2	1.4
C3	1.9	0.3	0.1
C4	1.1	0.6	0.1
C5	3.9	0.2	0.5
D	9.0	16.8	9.3
E	90.0	1,971.0	414.0
F	8.3	7.3	3.0
G	1,347.0	18,920.0	5,030.0
H	62,707.0	62,634.0	7,634.0

As noted above, the results of the model scenarios include the full set of dredge and disposal operations associated with the proposed Uig Harbour redevelopment. As a consequence, the results presented in Table 16 include effects from both the dredge and the disposal of material. In this way, the high SSC values predicted at Points G and H will be as a result of the dredging, as will extraction Points F, B1 and B2 (in the vicinity of the dredge). Meanwhile, the SSC values at the proposed new disposal site (Points A1-A5), the Loch Snizort East finfish farm (Points C1-C5) and sites in between (Points D and E) are considered to result from the disposal operations. For the remaining points (B3, B4 and B5), modelled SSC values are likely to be a combination of the dredge and/or the disposal operations, depending on the forcing conditions applied, and the resultant effect on the fate of suspended material.

The results of the modelling tasks showed high concentrations of material at the dredge sites, and also at the proposed new disposal site (particularly near the bed, as deposited material settles through the water column). At other locations where the disposal activity exerts an influence, only Point E shows evidence of notably elevated SSCs (maximum depth-averaged concentration of 414 mg/l). However, these elevated SSCs are likely to be short-lived, returning to background levels around 1 day following cessation of dredging and disposal activity.

The results presented in Table 16 show the maximum predicted SSC over the full set of model scenarios. Each model scenario covers approximately a 15-day period, and the values presented in Table 16 do not indicate how long these concentrations persist for. To assess this, timeseries of SSC for the extraction points have been plotted. Figure 16 shows an example timeseries output for the various points around the proposed new disposal site. The plot shows the results from model Scenario 12 (covering a relatively calm time period over summer months), although it is noted that maximum SSC values at the disposal site do not exhibit much variation across model scenarios.



Source: AECOM, 2018b

Figure 16. Timeseries of SSC increase at the proposed new disposal site for model scenario 12

The timeseries plot shows that the modelled surface SSC at the proposed new disposal site is elevated for the duration of the disposal operations, but then, following cessation of disposal (19:40 on 14/08/09; Figure 16), very small increases are predicted for up to a further 1-day period, before SSC values return to their baseline levels (i.e. no further increase is predicted). This might be expected, since the large depths and low tidal flows over the disposal site, limit the ability of the forcing conditions to disturb material deposited on the bed.

The temporal development of the disposal plume has also been extracted, with Figure 17 showing an example output for model Scenario 12. The plume development shows increases in surface SSC of up to approximately 30-40 mg/l during disposals within the proposed new disposal site (central panes in Figure 17). Shortly after the modelled disposals (lower left pane), the SSC plume is shown extending up to approximately 700 m to the northeast from the disposal location, with concentrations of up to 10-20 mg/l. A similar pattern is predicted to continue for the duration of the disposal activity (in the modelled scenario, the disposal period lasts just over 2.5 days), following which increases in SSC are predicted to drop quickly (within a day) to negligible levels (e.g. Figure 16; lower right pane of Figure 17).

The direction of the plume development is shown to be influenced by the meteorological forcing applied to the model (as the currents across the study area are controlled by a combination of tidal and wind forcing). Figure 17 shows the maximum predicted increase in depth-averaged SSC, throughout each of the 12 model scenarios. It should be noted here that these plots show maximum SSC, irrespective of timestep (i.e. maximum values in one location will not necessarily coincide with the timing of maximum concentrations in another). In this way, these plots do not show a single snapshot of predicted SSC, rather they refer to an aggregated maximum concentration over the full 15-day period covered by each model scenario. It is further noted that these plots also include the effects of the Uig Harbour redevelopment dredge, alongside the associated disposal activity. In each case, the boundary between the effects of the dredge and those of the disposal are generally well defined.

The maximum predicted SSC plots in Figure 18 reveal the variation in predicted plume dispersion under the representative range of meteorological forcing conditions. For each scenario, the greatest increases in SSC are constrained to the extent of the proposed new disposal site. Increases in depth-averaged SSC of up to 400 mg/l are predicted at the point of disposal, with increases up to 50 mg/l predicted to be constrained to within approximately 250 m of the disposal location. Outside of the proposed new disposal site, increases in SSC of less than 10 mg/l are predicted to extend up to approximately 800 m from the disposal location (model Scenario 2), with lower increases of less than 5 mg/l predicted to extend up to approximately 4.5 km (model Scenario 12).

With specific regard to the identified finfish farm receptors, only model Scenario 3 shows any resultant effect on depth-averaged SSC, with increases of up to 2 mg/l predicted to reach the southwestern edge of the finfish farm inside Uig Bay. By contrast, depth-averaged SSC at the outer finfish farm (within Loch Snizort East), is not predicted to be affected by the disposal at the proposed new site.

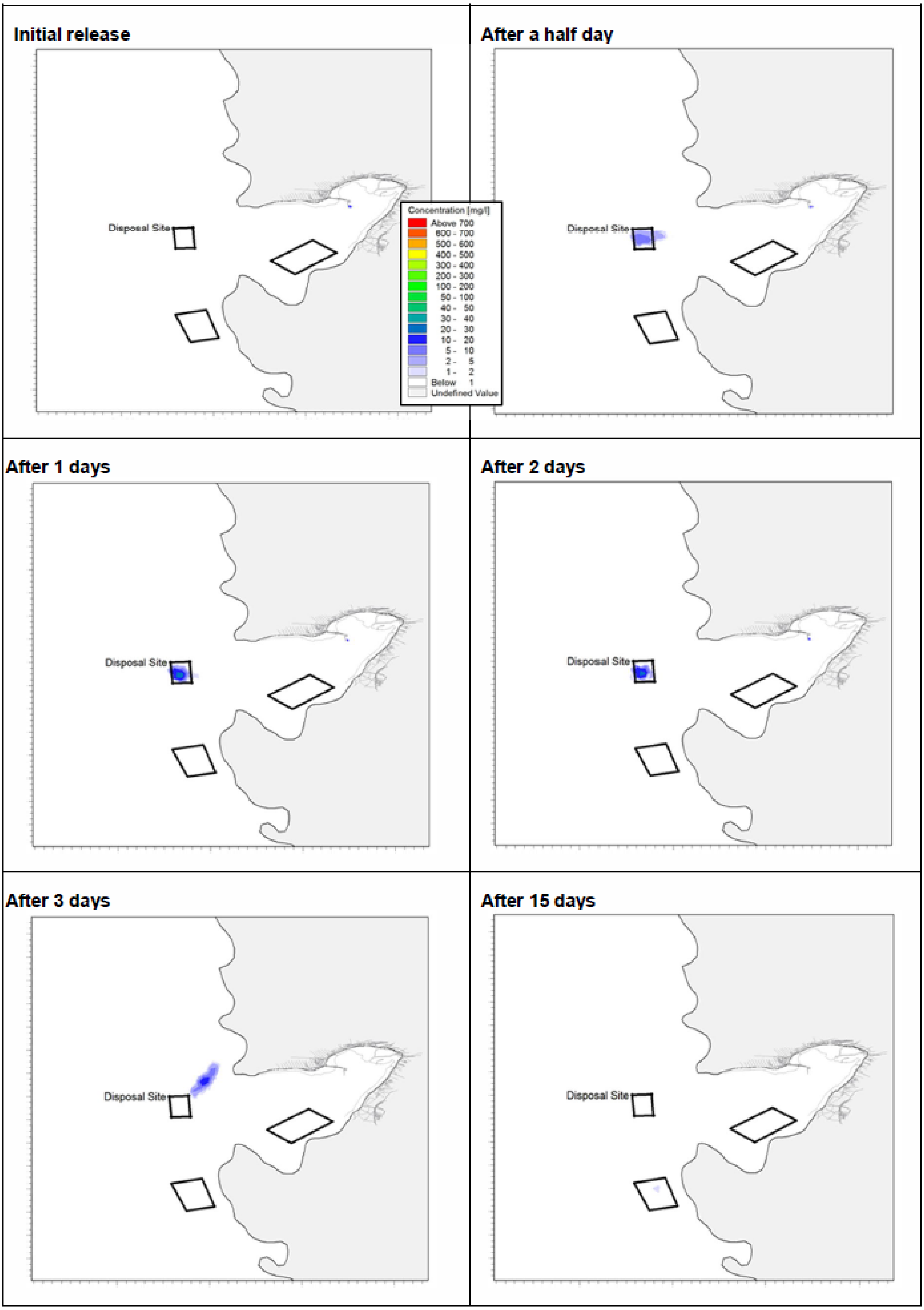
Summary

The potential effects of the proposed new disposal site within the approaches to Uig Bay, on SSC, have been assessed using numerical modelling. A total of 12 model scenarios were undertaken, covering a range of representative meteorological forcing conditions across the study area. The results show predicted increases to SSC above background levels, showing maximum magnitude and extent of effect from the disposal activity associated with the proposed Uig Harbour redevelopment.

The results of this study, in relation to the disposal activity, are summarised below:

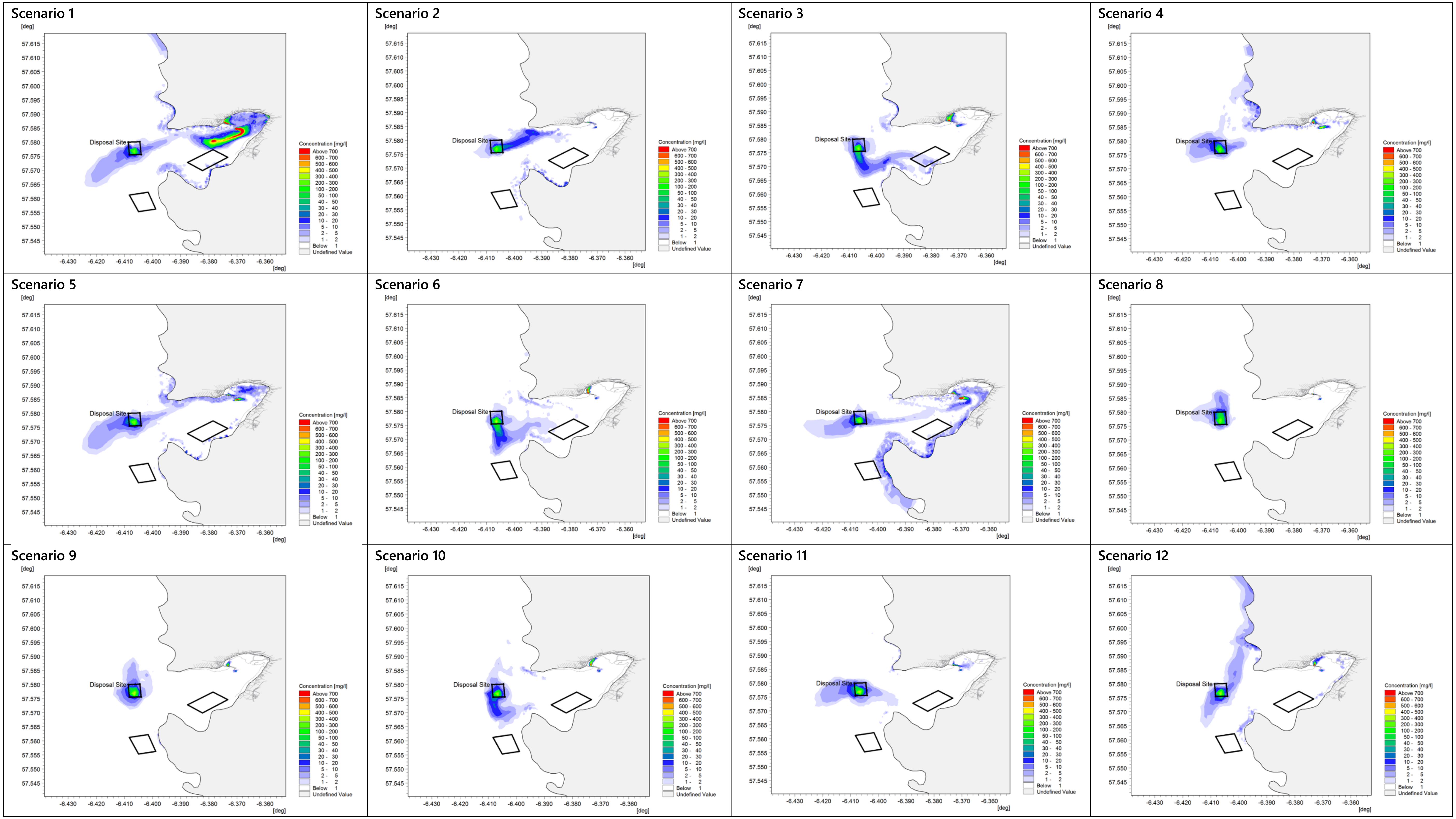
- Increases in depth averaged SSC of up to 212 mg/l are predicted (Table 16) at the proposed new disposal site, for the duration of the disposal activity;
- Following cessation of disposal operations, predicted increases in SSC rapidly reduce such that after 1-day following the final disposal, concentrations across the proposed new disposal site will have returned to background levels (Figure 16);
- In general, the increases in SSC associated with the disposal activity, and those associated with the proposed dredge for the Uig Harbour redevelopment, remain separate, showing little evidence of significant cumulative effects;
- Increases in SSC, from the disposal of between 50 and 400 mg/l are constrained to within approximately 250 m of the proposed new disposal site boundary. Increases of up to 10 mg/l are predicted to extend up to 800 m from the proposed new disposal site, whilst increases of up to 5 mg/l can extend up to 4.5 km from the site (dependent on meteorological forcing conditions) (Figure 18);
- The disposal operation can result in slight increases in SSC extending to the finfish farm within Uig Bay, but the predicted increases are relatively small (less than 2 mg/l), are expected to last for a short period of time (less than a day) and are only predicted for one of the 12 model scenarios; and
- Depth-averaged SSC at the Loch Snizort East finfish farm is not predicted to be increased as a result of the assessed disposal operations.

Overall, while the disposal activity will result in an initial large increase in SSC at the proposed new disposal site, concentrations will return to background levels within 1-day following the final release. There will also be small increases in SSC as indicated in model outputs from points around Uig Bay and, once again, these increases will be short term.



Source: AECOM, 2018b

Figure 17. Development of sediment plume for model scenario 12



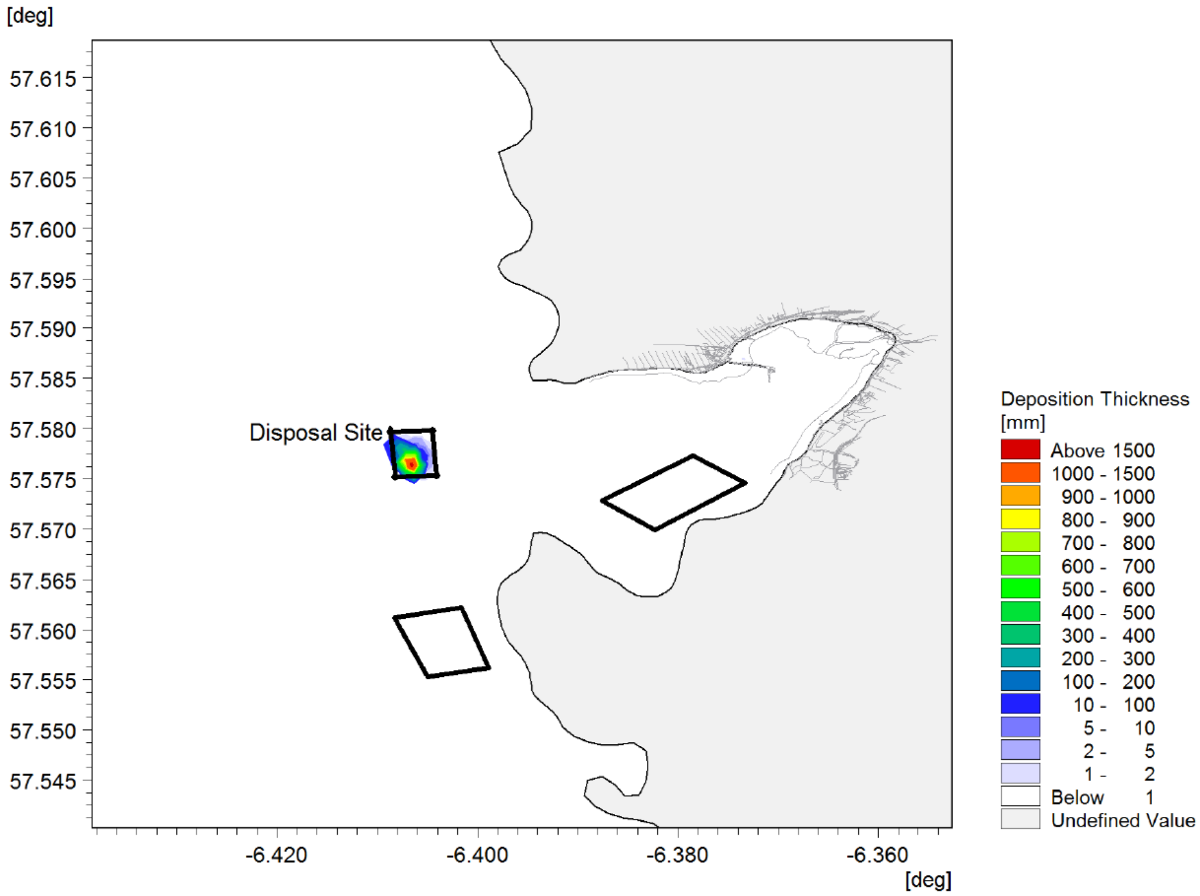
Source: AECOM, 2018b

Figure 18. Maximum depth-averaged SSC increase for all model scenarios (1 to 12)

7.1.2 Changes to coastal processes

The selection of the proposed new disposal site in the west of the disposal site search area means water depths as great as 60 m have been incorporated. Such depths suggest any material which reaches the bed will not be affected by wave action at the surface and, coupled with low flow speeds across the region, therefore, supports retentive properties of the site (i.e. once the material reaches the bed, it is expected to remain in this location).

As described in Table 4, the composition of dredge arisings to support the Proposed Development at Uig Harbour is predominantly sand (15,645 m^3) and gravel (6,814 m^3), equating to approximately 80% of the total volume across Dredge Pockets 1 and 2, combined. It is anticipated that this coarse material will settle to the bed relatively quickly (in a matter of minutes) and in close proximity to the release point from the barge. Model outputs suggest the maximum deposition thickness at the proposed new disposal site will be up to 2.0 m above the bed. This has been estimated based on all dredge material being disposed from the same point at the centre of the proposed new disposal site (see Figure 19; AECOM, 2018b). However, this is considered a relatively conservative assumption, with disposal operations likely to distribute the material equally across the proposed new disposal site. Furthermore, seabed deposition within the model remained unconsolidated and, in reality, recent sediment accretions will tend to compress into thinner layers, de-watering the sediment, increasing the sediment density and reducing the deposition thickness. Therefore, it is likely that the maximum deposition thickness at the proposed disposal site will be much less than 2.0 m above the bed.



Source: AECOM, 2018b

Figure 19. Area of accretion and deposition thickness at the proposed new disposal site

Flow speeds are low around Uig Bay, with peak depth averaged flows less than 0.1 m/s throughout the disposal site search area (model data covering a mean spring tide, with a 1-in-1 year wind condition applied from the west). It is anticipated that small-scale, highly localised changes in flow patterns will occur at the bed in the immediate vicinity of the newly deposited material within the proposed new disposal site. However, as a result of the large water depths at the site, once this material reaches the bed, it will not have a significant influence on coastal processes through changes in wave regime or flows at the surface and around the wider Uig Bay, even assuming the conservative worst case deposition thickness described above.

A comparatively small quantity of fine material will be released at the disposal site, some of which will remain in suspension before slowly settling to the bed. It is noted that water depths at the proposed new disposal site, and around Uig Bay, are likely to extend the duration the fine material remains in suspension (as it will take longer to settle over greater depths; estimated settling rates for different sediment types are described in Table 4). However, this material will be locally sourced (i.e. Dredge Pockets 1 and 2) and, therefore, ensures the material stays within the same sediment cell/budget. Given the total volume of silt/clay to be disposed (5,533 m^3), this quantity is unlikely to have a significant influence on coastal processes through accretion around the Bay. As shown from the model outputs described in Section 7.1.1, SSCs will be reduced to background levels within 1-day following cessation of dredging/disposal activity. It is considered unlikely that disposal operations will result in significant levels of accretion at particular locations around Uig Bay, and would be no different to natural sediment disturbance through storm events.

In summary, any effect on coastal processes as a result of disposal to the proposed new disposal site is likely to be highly localised and small scale. In considering the wider disposal site search area, the proposed new disposal site incorporates the area furthest from the coast in the deepest section of water and, therefore, minimises the potential for interactions with coastal processes.

7.2 Chemical environment

7.2.1 Changes to water and sediment quality

Sediment quality at the proposed new disposal site is relatively similar compared to the dredge site at Uig Harbour and around Uig Bay (see Table 5, Table 6 and Table 12). It is acknowledged that concentrations in the northeast of the disposal site search area were higher for chromium and nickel (above AL2), while concentrations were consistently above AL1 within the proposed new disposal site for these metals. However, given the consistently elevated concentrations of nickel and chromium in sediments around Uig Bay (considered most likely to be naturally occurring; see Section 5.2.2), depositing dredge arising from Uig Harbour at the proposed new disposal site is not analogous to the introduction of contaminated material to a pristine environment. It is therefore considered prudent to dispose of the dredged material within the Uig Bay area rather than transfer the material elsewhere (e.g. an existing marine disposal site). Selection of the proposed new disposal site also considered the location of the Uig Bay finfish farm (potentially sensitive to high concentrations of chromium and nickel in the water column) which would be within 1 km if situated to the northeast of the disposal site search area.

As described in Section 7.1.1, increased SSCs will be observed in the immediate vicinity of the proposed new disposal site and are expected to return to background levels within 1-day of disposal operations ceasing. It is unlikely that the proposed disposal activity will result in significant reductions in dissolved oxygen levels which are naturally high in the area. There is potential for increased concentrations of chromium and nickel to be observed in the water column during disposal operations (i.e. change/partition from sediment-bound to dissolved). However, given the short-term nature of increased SSCs and quantity of water in the receiving environment (large dilution), changes to water quality are anticipated to be minimal and dissolved concentrations of chromium and nickel would quickly return to background levels.

The closest designated bathing waters to the proposed new disposal site are Sand Beach and Gairloch Beach, located approximately 40 km to the east on the Scottish mainland. Similarly, there are no surface water nitrate vulnerable zones (NVZs) within 50 km of the proposed new disposal site, or nearby sensitive areas designated under the Urban Waste Water Treatment Directive (91/271/EEC; Department for Environment, Food and Rural Affairs (Defra), 2012).

Overall, any changes to water and sediment quality through disposal of dredge material from Uig Harbour at the proposed new disposal site are anticipated to be minimal and short term.

7.2.2 Deterioration in water body status under the Water Framework Directive

The proposed new disposal site is located within the Loch Snizort coastal water body (Figure 20) in the Scotland river basin district which is reported in the Scotland River Basin Management Plan (RBMP; Scottish Government, 2015b).

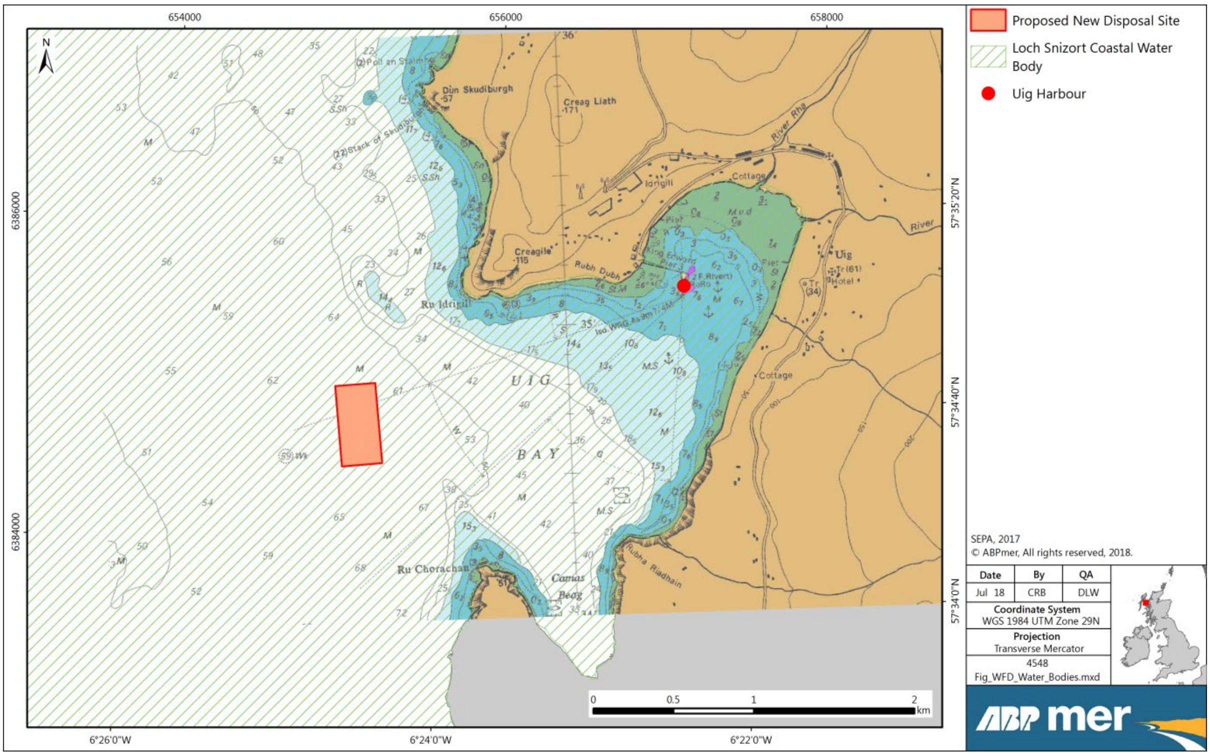


Figure 20. Water Framework Directive water bodies in the vicinity of the proposed new disposal site

Table 17 provides a summary of the Loch Snizort coastal water body (ID: 200141), including current water body status (overall, ecological and chemical). The Loch Snizort coastal water body is currently classified as being at overall good status, based on good ecological status (chemical status not assessed). The overall, ecological and chemical status is determined by the "one-out, all-out" principle, whereby the poorest individual parameter's classification defines the assessment level. Therefore, if any parameter is assessed as less than good (e.g. moderate), then the status for that water body is reported at that level. An overall good status confirms that each individual parameter measured within this coastal water body is currently achieving (at least) the standard required to report good status.

Table 17. Loch Snizort coastal water body summary

Parameter	Description
Water Body Name	Loch Snizort
Water Body ID	200141
Water Body Type	Coastal
Water Body Area	120.3 km^2
Hydromorphological Designation	None
Protected Area Designations	Shellfish Water Protected Area, Natura 2000 (Habitats and/or Birds Directive)
Overall Status (2016)	Good
Ecological Status (2016)	Good
Chemical Status (2016)	Not assessed

There will be no discernible changes in hydromorphology through the disposal of material at the proposed new disposal site (see Section 7.1.2), chemical concentrations in dredged sediments to be disposed are similar to those found at the proposed new disposal site and any changes in water quality are anticipated to be minimal and short-term in nature (see Section 7.2.1). There will be a change in benthic habitat type at the proposed new disposal site through the placement of coarser material (currently burrowed muds; discussed further in Section 7.3.1); however, this is considered minimal in the scale of such habitat available in the wider area. The benthic habitat in the disposal site search area is dominated by burrowed muds, including the PMF biotope 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg) and thus disturbance/smothering of this habitat is unavoidable. As noted in Section 5.2.3, this PMF is extensively distributed throughout the sea lochs of the west coast, Hebrides and voes of Shetland, occurring at depths of between 10-100 m. Given the location of the proposed new disposal site, it is considered unlikely to result in a barrier to fish movement or significantly disturb mobile features of overlapping/nearby nature conservation designated sites (see Figure 12; discussed further in Section 7.3.2).

In summary, the introduction of the proposed new disposal site in the outer Uig Bay is considered unlikely to result in a deterioration in status, or prevent further improvements, of the Loch Snizort coastal water body (already at good status). Nevertheless, a Water Framework Directive compliance assessment will be required to support the Proposed Development at Uig Harbour, including consideration of both dredging and disposal activities.

7.3 Biological environment

7.3.1 Change in benthic habitat type and extent including Priority Marine Features (PMFs)

The benthic habitat was classified following analysis of both ROV footage and grab sample data (fauna and particle size). The identified seabed habitat throughout the disposal site search area, including the proposed new disposal site, was muddy sediment assigned to the PMF biotope 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg). Introduction of coarse sediment from the dredge site at Uig Harbour will lead to a change in seabed habitat type from soft muds to coarse gravels and sands.

Smothering of existing seabed habitats is inevitable, although the location of any new disposal site would ideally avoid PMF habitats and provide like-for-like sediment type to minimise changes in benthic habitat. However, it is considered improbable that like-for-like coarse sediment habitats would be located in a suitable location near to the Proposed Development. This is based on a range of samples collected around Uig Bay in 2016 (see Table 2) and the consistent burrowed mud habitat recorded within the disposal site search area.

As noted in Section 7.1.2, model outputs suggest the maximum deposition thickness within the proposed new disposal site will be up to 2.0 m above the bed. Such changes would result in mortality of seapens and, therefore, lead to a change in habitat. However, it should be noted that this presents a worst-case scenario should all dredged material be released from the same location (centre of the proposed new disposal site). It is likely that material will be deposited evenly around the proposed new disposal site, reducing the deposition thickness and smothering to levels which seapens may be more tolerant. Furthermore, while the PMF habitat will be sensitive to the introduction of dredged material, it is assumed to be widespread in the area as demonstrated throughout the disposal site search area and northwest coast of Scotland[4]. The spatial extent of the proposed new disposal site has been determined based on the requirements of the Proposed Development, while minimising the area of seabed disturbance through disposal activity.

7.3.2 Disturbance to features of Nature Conservation Designated Sites

The proposed new disposal site directly overlaps the Inner Hebrides and the Minches cSAC (Figure 12), designated for the mobile feature Harbour porpoise (*Phocoena phocoena*). Also, the Ascrib Islands component of the Ascrib, Isay and Dunvegan SAC, designated for Harbour seal (*Phoca vitulina*), is located approximately 5 km to the west of the proposed new disposal site (Figure 12).

It is unlikely that Harbour porpoise or Harbour seals would be significantly affected by disposal of dredge material due to the short-term duration of the activity, the mobile nature of these features to avoid the temporary disturbance and the size of the proposed new disposal site (0.125 km^2) compared to the designated sites. The spatial extent of the Inner Hebrides and the Minches cSAC is 13,802 km^2, with the proposed new disposal site overlapping less than 0.001% of this area. While the Ascrib, Isay and Dunvegan SAC is only 25.8 km^2 split over three components, it is more distant from the proposed new disposal site (i.e. no direct overlap) and still only equates to less than 0.5% of this total area. Noise levels are unlikely to present a significant barrier to movement for these species given the current level of vessel movements in the area. Also, loss of available foraging areas is considered to be minimal. Nevertheless, a Habitats Regulations Assessment (HRA) will be required to assess the potential impacts of the Proposed Development at Uig Harbour, including consideration of both dredging and disposal activities on these designated sites.

7.4 Human environment

7.4.1 Impacts to finfish farms and through changes in water quality

Flow directions are typically orientated north-south in the west sections of Uig Bay, and east-west within the Bay. Therefore, placement of the proposed new disposal site towards the west of the disposal site search area means increased SSCs will be directed (primarily) away from sensitive finfish farms in the area. As described in Section 7.1.1, increased SSCs will occur as a result of disposal operations, but these will be short term in nature and largely confined to the proposed new disposal site. Only model Scenario 3 showed any resultant effect on depth-averaged SSC, with increases of up to 2 mg/l predicted to reach the southwestern edge of the finfish farm inside Uig Bay. By contrast, depth-averaged SSC at the outer finfish farm (within Loch Snizort East) is not predicted to be affected by disposal activity at the proposed new site.

[4] http://jncc.defra.gov.uk/marine/biotopes/biotope.aspx?biotope=JNCCMNCR00001218 (Accessed August 2018).

Therefore, in summary, with regards to impacts on nearby finfish farms through changes in water quality, disposal at the proposed new disposal site will potentially result in slight increases in SSC at the finfish farm within Uig Bay. However, the predicted increases are small and are expected to be short-term (less than 1-day). Depth-averaged SSC at the Loch Snizort East finfish farm (outside of Uig Bay) is not predicted to be increased as a result of the assessed disposal operations.

7.5 Conclusion

The designation of a proposed new disposal site in the outer Uig Bay, required to support a Proposed Development at Uig Harbour, is anticipated to result in minimal effects to the physical, chemical, biological and human environment. In conclusion, while some further project-specific assessment will be required as part of the Proposed Development (e.g. HRA and Water Framework Directive compliance assessment), it is considered a suitable location for the disposal of material from Uig Harbour.

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9 Abbreviations

ACD	Above Chart Datum
AL1	Action Level 1
AL2	Action Level 2
BPEO	Best Practicable Environmental Option
CalMac	Caledonian MacBrayne
CAR	Controlled Activities Regulations
Cefas	Centre for Environment, Fisheries and Aquaculture Science
cSAC	candidate Special Area of Conservation
CSD	Cutter Suction Dredger
CSEMP	Clean Safe Seas Environmental Monitoring Programme
D_{50}	Diameter value of particles (an intercept 50% of the cumulative mass)
DAS	Disposal at Sea
DDV	Drop-Down Video
Defra	Department for Environment, Food and Rural Affairs
DHI	Danish Hydraulic Institute
EC	European Commission
EEC	European Economic Community
EIA	Environmental Impact Assessment
EMODnet	European marine Observation and Data Network
EQS	Environmental Quality Standards
EU	European Union
EUNIS	European Nature Information System
HM	Her Majesty's
HRA	Habitats Regulations Assessment
ICES 7	International Council for the Exploration of the Sea - Determination of PCBs (CB28, 52, 101, 118, 138, 153, and 180) in sediment and biota
ID	Identity
JNCC	Joint Nature Conservation Committee
MESH Atlantic	Mapping European Seabed Habitats - Atlantic Area (Northern Component)
MHWS	Mean High Water Springs
MPS	Marine Policy Statement
MS-LOT	Marine Scotland Licensing Operations Team
N/A	Not Applicable
NMPi	National Marine Plan interactive
NVZ	Nitrate Vulnerable Zones
OSPAR	Convention for the Protection of the Marine Environment of the NE Atlantic (Oslo/Paris)
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PMF	Priority Marine Features
PSA	Particle Size Analysis
PT	Particle Tracking
RBMP	River Basin Management Plan
ROV	Remotely Operated Vehicle
SAC	Special Areas of Conservation
SEPA	Scottish Environment Protection Agency
SSC	Suspended Sediment Concentrations
TBT	Tributyltin
THC	The Highland Council

UK	United Kingdom
USEPA	United States Environmental Protection Agency
WGS84	World Geodetic System 1984

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

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