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2.2 Best Practicable Environmental Option (BPEO) Report for Dredge Disposal

2.3 Dredge Disposal Site Characterisation Report

2.1 Masterplan Summary Report

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Uig Harbour Redevelopment

Masterplan Summary Report

The Highland Council

Project number: 60536743
60536743-DOC-00-0000-C-1019

24 August 2017

Quality information

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Figures

No table of figures entries found.

Tables

1. Introduction

Uig Harbour forms one part of the Uig, Tarbert, Lochmaddy triangle, providing lifeline ferry services to the communities of the Western Isles. Increasing demand and tonnage has led CMAL to commission new, larger ferry vessels for a number of its routes. The Triangle has been identified by CMAL as a priority and the procurement of a new vessel for this route has commenced

The new vessel (802) will be owned by CMAL and operated by CalMac Ferry Limited (CFL). The ferry will be a dual fuel vessel running on Marine Diesel Oil and Liquefied Natural Gas (LNG). As part of the overall programme LNG will be delivered and bunkered at Uig. The design and implementation of the LNG service and infrastructure will be the responsibility of CFL. The details of LNG are currently being developed by the ship owners (CMAL) and CFL.

The present berth for vessels using the Roll On/Roll Off facility is exposed to wind and wave action predominately from the west direction. In certain conditions the berth can become untenable particularly when waves refract around the headland. The present structure and layout of the pier is a result of the following modernisations:

- 1984-1986 - Berthing structure and roundhead were added and Roll On/roll Off facilities provided for Caledonian MacBrayne's MV Hebrides Isles. New fishing berths and landing areas were provided during this modernisation;
- 2000 – Construction of new Inner berthing dolphin and construction of new Outer berthing dolphin.

The provision of a new vessel with increased vehicle and pedestrian capacity will have significant impact on the existing operability of Uig Ferry Terminal. The current Ferry Terminal was constructed in 1986 and it is recognised by THC/ CMAL/CFL that the facility is at its operational limit for the vessel turnaround time and the consequential vehicle throughput for the current vessel.

This report considers the following mitigation options for the following critical infrastructure elements of Uig Ferry Terminal to ensure that for the larger vessel, larger vehicle and passenger carrying capacity, the current operability and vessel turnaround times are not reduced. Refer to Appendix A for current layout 60536743-SKE-00-0000-1120.

1. Berthing Structure.
2. Marshalling Area including new Ticket Office.
3. Approachway Structure.
4. Fisherman's Compound.
5. Dredging.
6. Linkspan.
7. Passenger Access System/Gangway

The six key elements considered in assessing the mitigation measures options are as follows:

- The new vessel will geometrically fit the infrastructure and linkspan orientation but requires dredging works and strengthening of the current berthing facility to maintain the structural integrity. Without dredging the compromised water level will introduce a tidally effected service;
- Maintaining current Ferry Terminal operability for increased vessel vehicle and passenger numbers;
- Infrastructure not suitable for current vessel including footprint requirements for Passenger Access Gangway and LNG footprint requirements on the berthing structure;
- Infrastructure not suitable for additional passengers and vehicle requiring widening of the Approachway, increased footprint of Marshalling area and larger ticket office;
- Health and safety concerns of passengers traversing near mooring bollards on the berthing structure and the current Approachway footway not wide enough to allow passengers to pass without encroaching onto the road.
- Environmental conditions (wave/wind) affecting the berth, which impact on the reliability of the vessel.

The impacts of the 'Do Nothing' option for the larger vessel and larger vehicle and passenger carrying capacity will mean that the current operability and vessel turnaround times will be both reduced, together with the increased impact of the existing environmental conditions on the new vessel, would result in a reduction on a reliability of the existing infrastructure to maintain vessel timetables. The key impacts are detailed below:

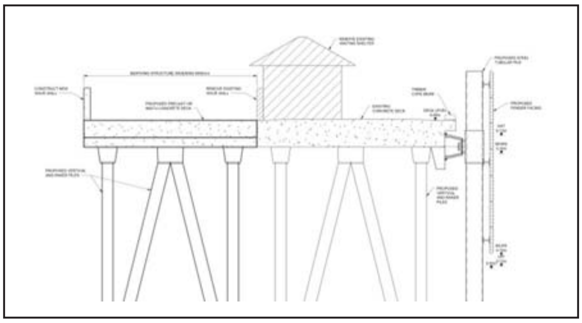
- Geometrical vessel fit will still require berth dredging and fendering strengthening if the structural integrity of the berthing structure and the vessel timetable is to be maintained;
- The increased deadweight/displacement and windage of the new vessel will impact on berthing, bunkering and offloading of passengers, vehicles and freight.
- The impact of not improving pedestrian and vehicle provision and capacity will mean that the vessel may have to operate by limiting its carrying capacity (vehicle and passenger) to the capacity of the existing Ferry Terminal infrastructure including Marshalling Area footprint;
- Reputational risk of bringing into service a larger vessel which cannot run at full capacity because the infrastructure is not suitable and the number of lost days of vessel sailings is increased due to the increased berthing and mooring requirements of the new vessel.

2. Preferred Option

2.1 Summary and Recommendations

The following is a summary of the recommendations and an overall cost estimate contained in this document for the following critical infrastructure for the upgrade of Uig Ferry Terminal. Refer to Appendix A for Block plan sheet no. 60525699-SKE-20-0000-C-1145.

2.1.1 Pier Strengthening Summary



Option 2, Widening of the existing berthing structure by introduction of additional 8m width of new pier does solve the issue of maintaining the structural integrity. The recommendation is that this is the preferred masterplan option because this option does adequately address the following issues which could have affected the operability of Uig Ferry Terminal for the new vessel:

- Berthing structure width increased means that there is no longer a health and safety issue with movement of passengers within the bollard rope snap back zone;
- Berthing structure width increased means it may be possible to introduce in future phases of the work mechanically operated Passenger Access System (PAS);
- The increased pier width means that the sterilised footprint area required for the vessel gangways will not have a detrimental effect on mooring operations and pedestrian access.
- The increased pier width means that LNG bunkering footprint (as yet undefined) required will not have a detrimental effect on berthing and mooring operations and pedestrian access;
- Covered pedestrian access can be introduced along the back face of the widened pier structure further reducing pedestrian exposure to environmental conditions.
- Would allow for the opportunity of a covered walkway to the waiting room and gangway.

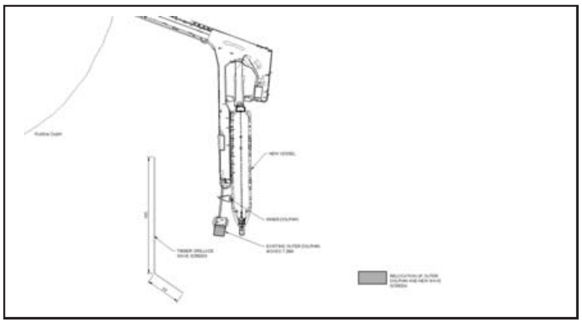
Justification

Alternative Option 1 was considered which included strengthening of the existing berthing structure by introduction of tension anchors into the front face raking piles and does solve the issue of maintaining the structural integrity of the existing berthing structure due to the increased horizontal fender reaction. The recommendation is that this Option was not taken forward as a preferred masterplan option because this option does not address the following issues with the potential to reduce the operability of Uig Ferry Terminal for the new vessel:

- Berthing structure width not increased means the problem still exists with movement of passengers safely to the vessel within the bollard rope snap back zone;
- Berthing structure width not increased means it is not possible to introduce mechanically operated Passenger Access System (PAS) because of restricted space;
- There is a large window for the range of vessels gangways and this will require an area that will sterilise that area of the berthing structure for mooring operations and pedestrian access. Existing waiting shelter will become redundant;
- Will require a larger pier waiting room for the increased number of passengers;
- LNG bunkering footprint (as yet undefined) will be required and this will require a large area on the berthing structure that will sterilise that area of the berthing structure for berthing and mooring operations and pedestrian access.
- Would not allow for the opportunity of a covered walkway to the waiting room and gangway.

2.1.2 Potential Pier Berthing Improvements Work Required after Arrival of New Vessel

Option No.7



Construction of wave screen and repositioning of the outer dolphin.

The recommendation is that Option 7 is not required for the arrival of the new vessel and will not therefore prevent the new vessel from berthing and mooring at Uig Ferry Terminal. It should be noted that CFL believe that without improvements to mitigate the effects of wave, wind and swell at the existing pier, the increase in vessel length and windage is likely to result in a reduced level of service compared to the existing level of service. The following further studies will be required to be carried out to assess the necessity for these additional pier upgrade works.

- Vessel simulation study;
- Wave/coastal modelling study;
- Daily records from the skippers of the new vessel on environmental conditions (wind, wave and current) at the berth;
- Daily records from the skippers on issues encountered during berthing manoeuvres and while moored at the berth.

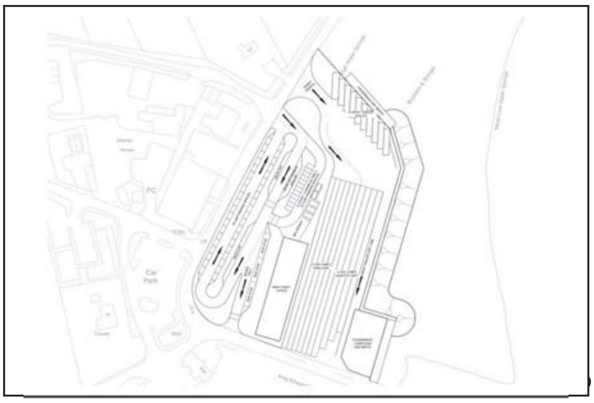
Justification

Alternative Options 3-6 were also considered providing engineered solutions for solid pier extension beyond the existing outer berthing dolphin with the potential to reduce impact on the new vessel due to swell. If the above additional studies conclude that there is the necessity for additional pier upgrade works to maintain the operational requirements of the ferry terminal berth then Option 7 is the preferred option for the reasons detailed below. :

- The wave screen detailed in Option 7 has the potential to provide a greater reduction of wave and swell effects than Options 3-6;
- Option 7 is the most cost effective construction option;
- Option 7 has the potential to limit any potential ferry terminal closure requirements;
- Option 7 has the potential to limit any temporary works and temporary berthing piles.

Consideration was also given to the alternative east/west orientation of the berthing structure. It was noted that the previous modelling study concluded that the proposed orientation in the East/West direction was not considered to be operationally feasible by the prospective users of the berth. CFL were re-consulted on the issue and confirmed that the east/west orientation would provide no improvement to the berthing operations.

2.1.3 Marshalling Area Summary



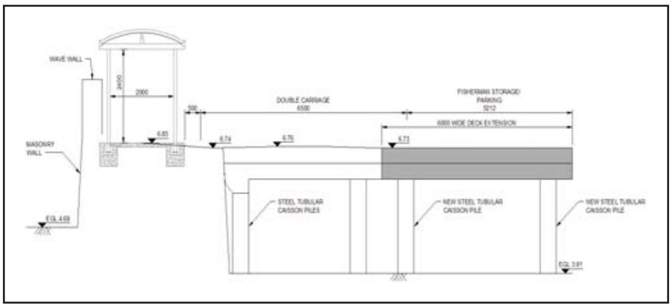
Three options were considered for the layout and structural details for the new marshalling area. All three options provided suitable engineering solutions however Option No. 1 was the preferred option to meet the requirements of THC/CMAL/CFL for the following reasons.

- Marshalling area footprint for new vessel increased lane width will not have a detrimental effect on Uig Ferry Terminal operability.

- Allows a smoother flow of traffic through the marshalling area improving turnaround time.
- Fisherman's compound located closer to the existing fisherman's working area on the approachway structure.
- Provides largest number of additional parking spaces.

2.1.4 Approachway Summary

Option No. 2 extending the approachway structure width by 6.0m is the preferred option for the following reasons.



- Extension of the approachway width will ensure that the vessel turnaround times required for the new vessel will be achieved and the operability of the Ferry Terminal is not reduced with the introduction of the new vessel. The increased width will cater for the potential of LNG and increased traffic and will eliminate issues associated with a vehicle breakdown that could impact on passenger safety and vessel loading/unloading
- Reduces any delays in vessel turnaround times due to broken down vehicles on the approachway;
- The new vessel has increased capacity for pedestrians which are anticipated to grow, this option allows for an enhancement to existing substandard pedestrian access which places pedestrians onto the road and in conflict with vehicular traffic.
- It allows for an enclosed protective walkway from the terminal building for the length of the approachway as a minimum. However this could terminate immediately adjacent to the gangway access point - either into a waiting room or simply to hold passengers inside the walkway itself if pier strengthening option 2 is constructed. This would provide the optimum passenger journey in terms of safety and experience from the terminal building to the vessel and avoids exposing foot passengers to the elements on what can be a significantly exposed pier at times;
- The 2m wide protective walkway allows for two way movement of pedestrians (including prams and wheelchairs). This means that the health and safety risk to passengers is alleviated as passengers can pass each other on the footpath without needing to step onto the roadway;

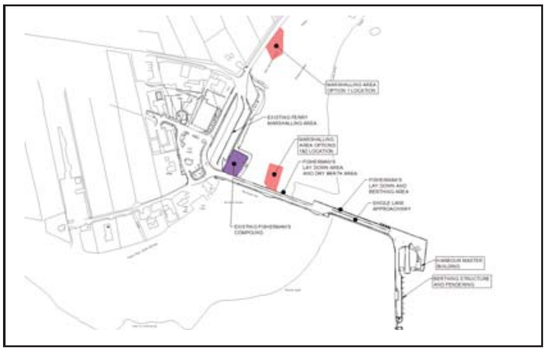
  The 6m berth extension ensures that there is no loss of laydown area/working space on the fisherman's berth.

Justification

Option No.1 for a 3m wide approachway extension was not taken forward as the preferred option because this 3m extension would only allow for the provision of the passenger shelter to meet passenger safe access along the approachway and health and safety requirements while still maintaining single vehicle movement along the approachway. The 3m wide extension does not fully address the potential of LNG and increased traffic and in addition a vehicle breakdown could potentially have a severe impact.

2.1.5 Fisherman's Compound Summary

Three options were considered for the new location of the Fisherman's Compound. All three options provided suitable engineering solutions however Option 1 is the preferred location for the re-establishment of the fisherman's compound which maintains close accessibility for the fishermen and reduces the likelihood of conflicts with other harbour and ferry users.



2.1.6 Linkspan Summary

The existing linkspan at Uig was installed in 1986 and therefore can be considered to be at the end of its serviceable life without major structural overhaul/refurbishment. It is recommended that a replacement single lane linkspan is installed at Uig which will include construction of new bankseat and lifting dolphins.

Option No. 3 New Linkspan is the preferred option for the following reasons:-

- This option proposes to replace the existing linkspan with a new Linkspan replacement that would be procured as part of the project;
- All M&E equipment would be replaced;
- The existing lifting dolphins and bankseat will be likely be replaced;
- The new linkspan would be compliant with PUWER, BS7671, PUWER and current regulation with a CE Mark;
- Commissioned and assessed by qualified body required;
- Alternative load path provided and enhanced safety features;
- Estimate 1-2 month outage;

Justification

Option No. 1 was not recommended. This was the Do Nothing option and had the following disadvantages:

- No improvement;
- Compliance to BS7671 and PUWER needs to be assessed;
- No works to civil structures so life of structures may not provide 30year design life;
- There is no alternative load path and automation;
- Bow in for 802 could be constrained;
- Structure was installed in the mid 1980's so may need major refurbishment or replacement in near future.

Option No. 2 was not recommended. This was the Like for Like replacement option and had the following disadvantages:

- No improvement;
- Compliance to BS7671 and PUWER needs to be understood;
- No works to civil structures so life of structures may be reduced to less than that of the steel;
- There is no alternative load path and automation;
- Bow in for 801/802 could be constrained.

Option No. 4 was not recommended. This was the Double Lane Linkspan option and had the following disadvantages:

- Significant outage of the linkspan;
- No geometrical improvement;

- Requires significant more investment;
- More complex machinery;
- Temporary relocation of harbourmaster office;
- Temporary loss of come fishing berth and ice plant relocation.

2.1.7 Passenger Access Summary

Further detail can be found in the Passenger Access report as appended in appendix D of the masterplan.

Option No. 2 Gangway and Full Covered Walkway is our preferred option;

- Provides a safe and sheltered access from the terminal building 300m away from the vessel;
- Familiarity to operation for staff;
- Can provide a waiting area when required prior to loading of ferry;
- Improves the passenger experience.

Justification

Option No. 1 was not recommended. This was the Do Nothing option and had the following disadvantages:

- Does not meet compliance with regulation and standards;
- Passengers, during busy period will migrate onto the carriageway;
- No improvement;
- Passengers are exposed to the elements approaching the pier,

Option No. 3 was not recommended. This was the full Electro Mechanical Passenger Boarding Bridge option and had the following disadvantages:

- Significant cost;
- Highly complicated system;
- PBB require regular maintenance;
- Significant cost of maintenance;
- Difficult to manage as these are very specialist;
- Breakdowns can cause significant difficulty for the port;
- Operators will have very little time in tying up the vessel and operating the PBB;
- Structure can be an eyesore to the local community;
- PBB would sterilise significant space on the pier

2.1.8 Dredging Summary

Consideration has been given to dredge depths in respect of 802, the Isle of Lewis and the Loch Seaforth.

The capital dredge volume taking account of the dredge depth and vessel manoeuvring areas, as agreed with CFL, equates to some 12,229cu.m.

A dredge cost allowance of £444,500 for 802 has been established. This cost assumes that disposal of dredge arisings will be by incorporation within the land reclamation area or by sea disposal. Should programming requirements dictate dredging in advance of such disposal consent – then disposal will be to an approved sea location or to landfill – these options will add significantly to the cost and will only be considered if the timing of vessel delivery and the impact on service is deemed to justify such additional costs.

2.1.9 Miscellaneous Summary

The upgrade of Uig Ferry terminal will include the following infrastructure improvements;

- Ticket Office

- Survey and Investigations
- Old Ticket Office Demolition
- Harbour Order Revision
- Lighting
- Utilities
- Consenting and Licensing
- EIA
- Power upgrade

2.2 Preferred Option Cost

The total cost for the redevelopment works at Uig Ferry terminal is £26,502,195.

3. Programme and Required Outages

3.1 Programme Key Dates

Stage	Start	Finish
HRO	13/07/2017	26/10/2018
Marine License	13/07/2017	18/07/2018
Detail Design	02/08/2017	23/02/2018
Construction	19/07/2018	04/09/2019

Table 1. Programme Schedule

The construction end date shown above does not allow for construction of option 7's wave screen. This will be determined with monitoring of the new vessel once in service.

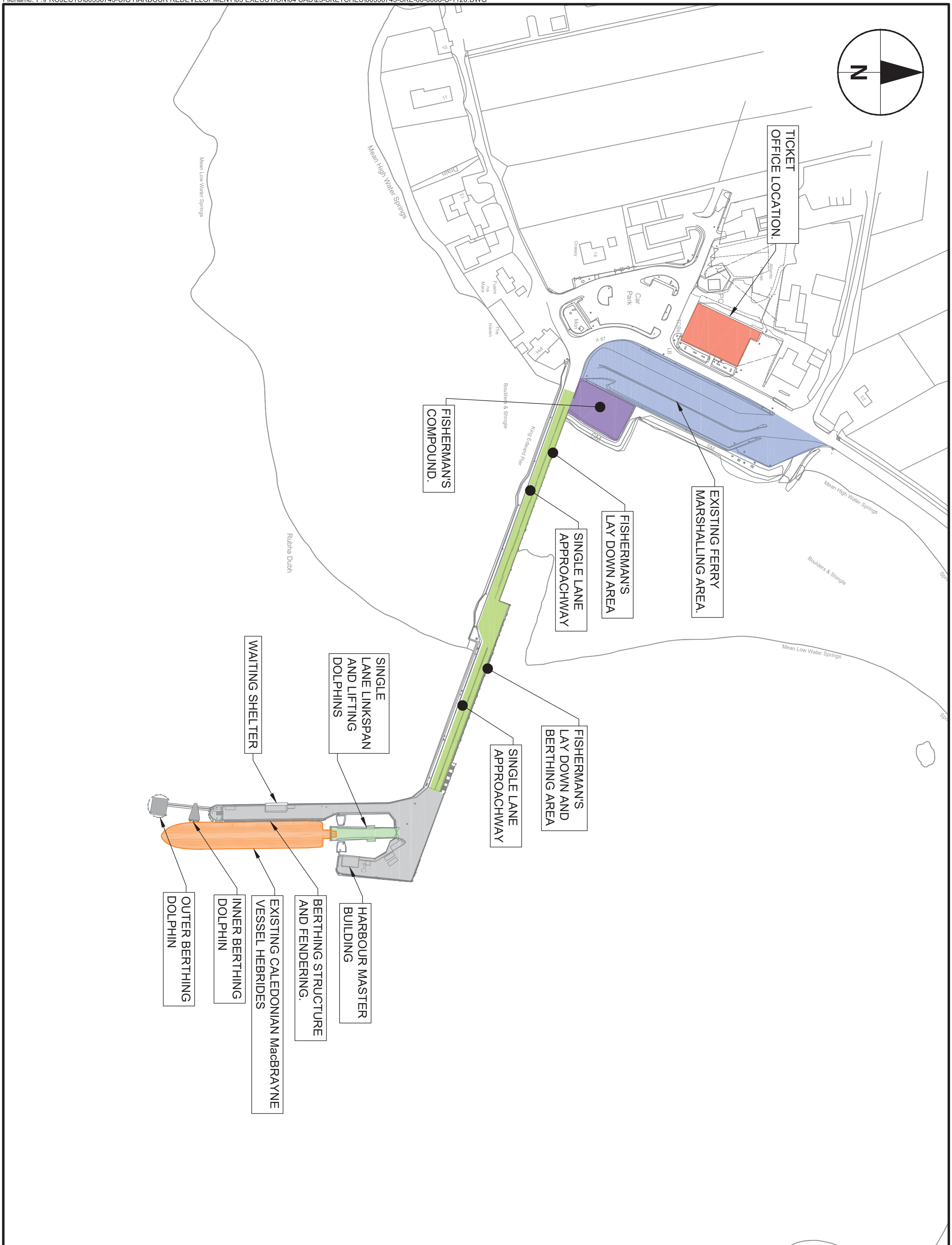
The above programme dates are for guidance. Construction works start date is dependent on consent approval for Marine License, Planning and HRO and no clear timescales are given for consents approval and are likely to be subject to change. The construction start and end date is approximate however these cannot dictate the method that would be used by the contractor.

3.2 Required Outages

Based on the dates provided in the above table, a proposed outage would be required for the delivery of the vehicle linkspan. An estimation of 5 weeks has been allowed.

Appendix A - Masterplan Block Plan Drawings

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ISO A3 297mm x 420mm



Issue Status: FOR INFORMATION

UIG HARBOUR REDEVLOPMENT

CURRENT LAYOUT

THE HIGHLAND COUNCIL, UIG, ISLE OF SKYE
Project No.: 60536743 Date: 27-MAR-2017

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Figure: 60536743-SKE-00-0000-1120

AECOM

PROJECT

UIG HARBOUR REDEVELOPMENT

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NOTES

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED. DO NOT SCALE.
2. ALL LEVELS IN METRES AND REDUCED TO CHART DATUM UNLESS OTHERWISE NOTED.

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B	2017-07-26	FOR INFORMATION
A	2017-06-06	DRAFT

KEY PLAN

PROJECT NUMBER

60536743

SHEET TITLE

PREFERRED OPTION BLOCK PLAN

SHEET NUMBER

60525699-SKE-20-0000-C-1145

Project Management Initials: Designer: ___ Checked: ___ Approved: ___ ISO A1 594mm x 841mm

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2.2 Best Practicable Environmental Option (BPEO) Report for Dredge Disposal

Uig Harbour Redevelopment

Best Practicable Environmental Option (BPEO) Assessment

The Highland Council

Project number: 60536743
UHRD-ACM-ZZ-GE-RP-EN-00011

24 August 2018

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Figures

Tables

1. Introduction

1.1 Introduction to this Report

1.1.1 This report presents the results of the Best Practicable Environmental Option (BPEO) assessment prepared by AECOM on behalf of The Highland Council (hereafter referred to as the 'Applicant') for the dredging and dredge disposal associated with the Uig Harbour Redevelopment (hereafter referred to as the 'Proposed Development'). This report accompanies a marine licence application to Marine Scotland (MS) for capital dredging and opening a new sea disposal site in the vicinity of Uig Bay for the disposal of the dredged material.

1.1.2 The purpose of the BPEO assessment is to identify the disposal option that provides the most environmental benefit or least environmental damage. This assessment considers the alternative options available against a range of criteria including technical feasibility, environmental impact and cost.

1.2 Background to the Proposed Development

1.2.1 Uig Harbour is located in Uig Bay in the north east 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 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 Applicant, whilst the ferry service operations are controlled by CalMac Ferries Ltd. (CFL).

1.2.2 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. A number of upgrades are required to Uig Harbour to accommodate the new, larger vessel, including a capital dredge at the berth and along the approach way. Maintenance dredges will also be required in the future.

1.3 Environmental Impact Assessment

1.3.1 In view of the nature, size and location of the Proposed Development, an Environmental Impact Assessment (EIA) has been carried out by AECOM to assess the onshore and offshore elements of the Proposed Development. The EIA Report will be submitted as part of the marine licence application together with this BPEO assessment.

1.4 Other Supporting Information

1.4.1 The following supporting information will also accompany the application:

- Site Characterisation Report;
- Environmental Impact Assessment Report
- Pre-Application Consultation Report;

1.5 Structure of the Report

1.5.1 This report has the following structure:

1. Introduction
2. Dredging Requirements
3. Available Disposal Options
4. Assessment of the Disposal Options
5. Identification of the BPEO

2. Dredging Requirements

2.1 Dredging

2.1.1 Uig Harbour was last dredged in 2015. This was classed as a 'maintenance dredge to ensure that the operation of the harbour is maintained'. The volume of dredge was less than 5000m^3 and therefore was deemed acceptable by Marine Scotland for beach nourishment.

2.1.2 The proposed 'Capital Dredge' is required due to the increased draft of the proposed new vessel of 0.5m depth and to increase resilience of the route for use by a range of vessels (up to and including the draft depth of the MV Isle of Lewis). The proposed dredge volume would be 30,792m^3. This volume would provide sufficient depth for the harbour for all intended vessels provided by CFL to serve Uig. Following the Capital Dredge, maintenance dredging will be required to maintain the depth in the navigable areas. The anticipated maintenance dredging will be undertaken at 5 yearly intervals.

2.2 Dredge Sediment characteristics

2.2.1 The material to be dredged was sampled and analysed. This was undertaken during the ground investigation undertaken by Holequest Ltd and included in document No. THC/UHRG1/1117/FACT (attached in Appendix A) and the sampling undertaken by Aspect Surveys (attached in Appendix B). The finding from the ground investigation identified that the material contains elevated levels of some metals as discussed further below.

2.2.2 Geo-chemical testing was undertaken on nine samples from the superficial deposits at three locations in order to determine the suitability for disposal of any dredged material at sea:

- BH DS01 at 0.3m, 1.5m and 3.0m BSBL.
- DS02 (seabed sample) at 0.1m, 0.5m and 0.8m BSBL.
- BH1 at 0.0m, 0.5m and 2.0m BSBL.

2.2.3 The results are compared to the Marine Scotland Action Levels, as published in the Pre-Disposal Sampling Guidance Version 1 (2017). This comparison can be observed in Table 1, reproduced below.

Table 1: Summary of Pre Disposal Sampling Test

Contaminant	Action Level 1 (mg/kg dry weight)	Action Level 2 (mg/kg dry weight)	Maximum recorded concentration (mg/kg)	Number of exceedances (AL1-AL2)
Arsenic	20	70	9	0-0
Cadmium	0.4	4	0.3	0-0
Chromium	50	370	490	9-4
Copper	30	300	97	8-0
Mercury	0.25	1.5	0.35	1-0
Nickel	30	150	260	9-8
Lead	50	400	7.6	0-0
Zinc	130	600	120	0-0
Tributyl tin	0.1	0.5	22	1-1
Polychlorinated Biphenyls	0.02	0.18	0.0092	0-0

2.2.4 The exact location of areas to be dredged remains unconfirmed. The samples taken from the existing pier should therefore be used for a preliminary assessment only, with further sampling required at a future date once the dredge area is defined.

2.2.5 There are recorded concentrations of five substances which exceed the relevant Action Level 1 (AL1) concentrations. Three of these substances also exceed the Action Level 2 (AL2) concentrations. Three Chromium concentrations above the AL2 threshold value were recorded in the 3 samples from the 'Seabed' sampling location (DS02) and the one in the 1.5m BSBL sample at the BH DS1 location. Elevated Nickel concentrations above the AL2 threshold were observed in samples from all three locations. The 1.5m sample from BH DS1 exceed the AL1 concentrations of 8 PAH's, concentrations over double the action level are recorded for Dibenzo(ah)anthracene, Furoanthene and Pyrene. The PAH (total) value for this sample is well below the AL1 concentration.

2.2.6 For the Post glacial Deposits in the Foreshore Area

2.2.6.1 The trial pits encountered very soft / very loose material at the surface, underlain by variable deposits of sands, gravels, silts and clays including shell debris and organic material. Borehole BH07 encountered possibly organic clay, dense to very dense sand and gravel and gravel overlying stiff to very stiff clay. Most of the CPTs were terminated at shallow depth due to obstructions, however they also encountered variable deposits of variable consistencies.

2.2.6.2 Laboratory classification testing of the organic silt indicates that recorded moisture contents range from 24% to 50%. The finer fraction recovered from the more cohesive materials generally classifies as silts (occasionally clays) of high plasticity (plasticity index ranging from 17 to 33, average 23). Particle size distribution analysis indicates the material to be slightly clayey to clayey slightly sandy slightly gravelly silt.

2.2.7 Glacial Till Deposits in the Pier Area

2.2.7.1 The superficial deposits around the existing pier comprised variable deposits of sands, gravels, silts and clays down to depths of between 6.4m and 9.6m below seabed level. Below this were generally stiff to very stiff (locally firm) clay with bands of sand and /or gravel, with cobbles and boulders, proved to a to maximum depth of 36.5m below seabed level (-40.94m CD).

2.2.7.2 Laboratory classification testing indicates that recorded moisture contents range from 10% to 32%. The finer fraction recovered from the more cohesive materials generally classifies as clays of low to intermediate plasticity (plasticity index ranging from 7 to 35, average 18). Particle size distribution analysis indicated the glacial till materials to contain varying proportions of finer and coarser materials but to primarily comprise silty / clayey slightly sandy GRAVEL or slightly sandy slightly gravelly to gravelly CLAY (based also on the classification tests).

3. Available Disposal Options

3.1 Overview

3.1.1 A range of disposal options have been considered in this BPEO assessment including the following and detailed in the following sections:

Option 1 – Land Reclamation on Site

Option 2 – Construction Material Offsite

Option 3 – Beach Recharge

Option 4 – Sea Disposal at Existing Disposal Site

Option 5 – Sea Disposal at New Sea Disposal Site

Option 6 – Landfill

3.2 Option 1 – Land Reclamation on Site

3.2.1 The Proposed Development includes the expansion of the current marshalling area by land reclamation. A proportion of the dredged material could be used as infilling material for the land reclamation, if appropriately prepared to a suitable specification. To reuse the material, further working of the material would be required. The material would first be landed from the dredger. The dredged arisings must then be placed onshore and moved to an appropriate space to be dried and classified, then additional material added to ensure the dredge material is compliant with specification for infill and/or treatment for contamination then relocated to be deposited in the reclaim.

3.2.2 Transportation of the material to a space for drying out would generate an increase in traffic for moving the 30,792m^3 of dredging. If the assumption is they were moved by 40t trucks and is adopted, this would generate circa 1,400 vehicle movements for moving to the processing site and additional 1,400 movements to the reclaim area. This would total approximately 2,800 vehicle movements.

3.3 Option 2 – Construction Material Offsite

3.3.1 Dredged material can be suitable for use as construction material offsite. Given the high content of certain metals identified in the ground investigation and sampling undertaken in 2017 of the sediment in Uig (see section 2.2), the material would require treatment prior to further use as a construction material. The material would have to be landed and transported to an appropriate site for treatment, then transported to a storage site and finally further transported to the site for its specific use. This option is similar to option 1 except it moves the process to a remote site from this locality (potentially - Duisky Landfill Site, Kinlocheil, near Fort William - 137 miles away from Uig by road). The potential triple or quadruple handing of the material and processing would create significant cost.

3.4 Option 3 – Beach Recharge

3.4.1 Should there be a requirement for beach recharge this option considered whether the dredged material could be used for this purpose. This would require Marine Scotland's approval and could only be suitable for small amounts (<5000m^3). The methodology would require; sampling of the proposed recharge area to consider the suitability of the receiving material, and then monitoring of the area identified for disposal and its adjacent parts for sediment transportation and 'drift' for a period before and after recharge of a minimum of 2 years. It is understood that the existing foreshore has a relatively low amenity to the local community and is tidally flooded. A detailed methodology for undertaking this work was not identified at this stage as it was considered that the time required to undertake an assessment and associated monitoring is not compatible with the project programme and costs.

3.5 Option 4 – Sea Disposal at an Existing Disposal Site

3.5.1 There is an existing disposal site at Loch Broom adjacent to Ullapool Harbour as shown in Figure 1. It is understood the site was used for the disposal of dredged material for Ullapool Harbour Redevelopment in 2015. The distance to the site from Uig is approximately 75 nautical miles. This distance would mean that the dredging operation would require additional time as the hopper for the dredger would need to travel to the disposal site. Additional hoppers would be required.

3.5.2 The disposal site at Ullapool would need to be tested and assessed for chemical suitability and compatibility with the known characteristics, including high metal content, of the dredge material expected from Uig Bay. The consideration of cost/programme impact due to the distance and the mobilisation of additional equipment and timescale would extend the programme due to travel time to the disposal site, it is estimated this would add 2-4 weeks to the dredging activity programme. Cost associated with this task would increase by 100-200% when compared to disposal at a new local site to Uig.

3.5.3

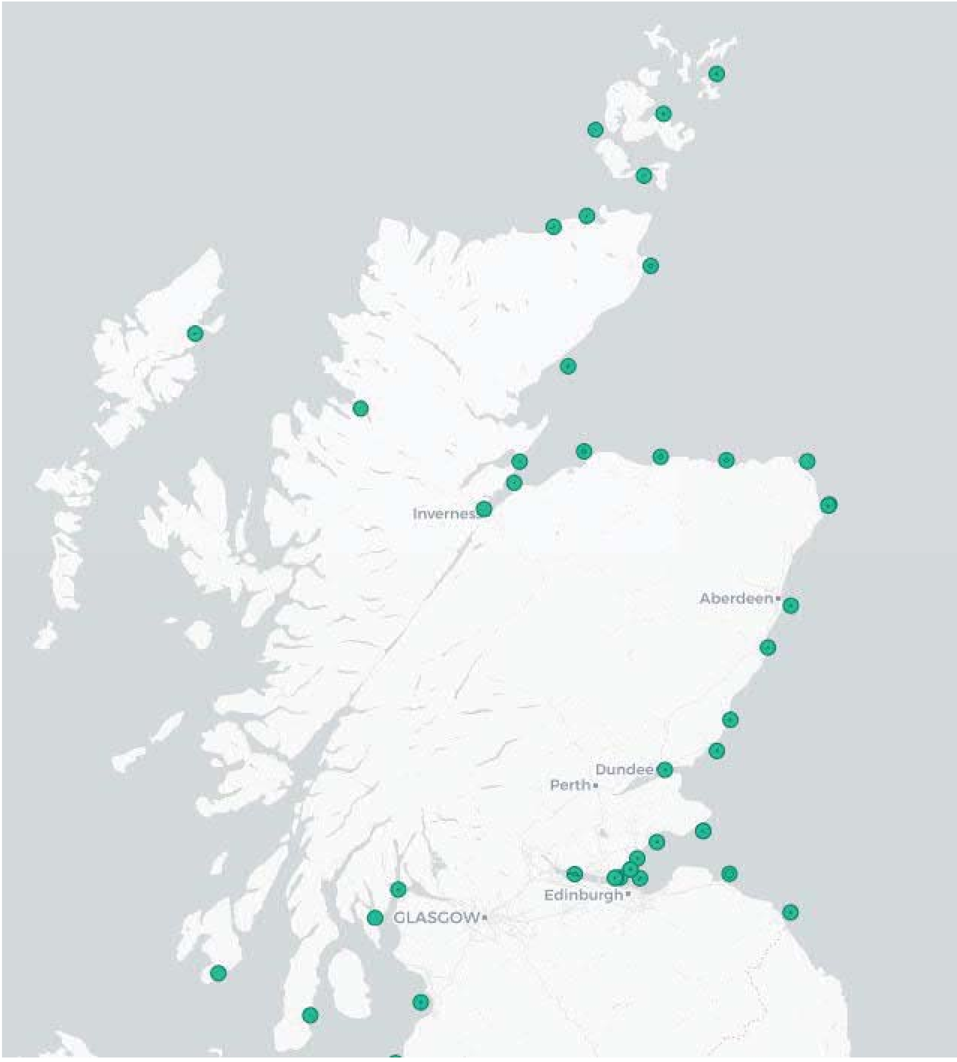

Figure 1. Existing, open, marine disposal sites (source – Extract from Marine Scotland Maps NMPI)

3.6 Option 5 – Sea Disposal at a New Disposal Site

3.6.1 Given the significant distance to existing sea disposal sites, this BPEO assessment also considered the potential of opening a new disposal site within Uig Bay. This option offers an opportunity for efficient materials handling as dredge material will be collected straight into the barge hopper and disposed of without any additional processing.

The high metal content expected within the dredge sediments is likely to be at least partially, as a result of naturally occurring geological process 'BGS, Information on Land Quality in Scotland, R&D Technical Report P293'. These characteristics are therefore likely to be relatively widespread within Uig Bay. Disposing of dredged materials locally, would therefore minimise the risk of distributing contamination to areas which are currently unaffected.

3.6.2 A Site Characterisation Study including a survey programme to identify physical, chemical and biological characteristics of an agreed search area within Uig Bay would be required in order to identify a suitable disposal site. Appropriate disposal licencing would then be required to be agreed with Marine Scotland.

3.7 Option 6 – Landfill

3.7.1 The dredged material would be landed and transported by road to Duisky Landfill Site, Kinlocheil, near Fort William. This site was identified but has not been confirmed to be suitable to accept the waste. The cost associated with road transport of the dredge arisings would be in excess of £2.5m with the considered volume for road transport. Space on land would be required to process the material for road transport. The material would need to be landed and dried prior to transport.

4. Assessment of Disposal Options

4.1 Summary of Available Options

4.1.1 As part of the assessment, an indicative high-level cost of each option along with consideration of the practicalities of physically undertaking of each option was considered in developing the BPEO. The chemical composition of the dredged arising considered is summarised in section 2.2 of this report and is provided from the ground investigation undertaken by Holequest Ltd in document No. THC/UHRG1/1117/FACT. The results of the sampling testing are included in Appendix A with further dredge sampling which was also undertaken by Aspect Surveys and results are included in Appendix B.

4.2 Option 1 – Land Reclamation on Site

Strategic Considerations

4.2.1 The handling of the dredge material onshore will present specific operational challenges, as the material will be saturated, difficult to handle (till dried) and will have an odour issue dependent upon wind direction and amount of organic bed material recovered. The dredged material would need to be; landed, transported, classified, separated, treated/improved, tested and then transported to the reclamation.

4.2.2 As part of the ground investigation, testing was undertaken to find the composition of the samples, the material was found to contain concentrations of certain metals specifically, chromium and nickel which are believed to be naturally occurring. The level of chromium and nickel in some samples exceeded the level 2 actions used by Marine Scotland for Dredged Material Assessment. Liaison with Marine Scotland and the Applicant regarding the possibility of reuse of the material took place. Marine Scotland's Redacted indicated that the observed high levels of metals in the area are likely naturally occurring. This is acknowledged in 'BGS, Information on Land Quality in Scotland, R&D Technical Report P293'

Environmental Considerations

4.2.3 The odour from the dredged material (see below) may cause discomfort to those in proximity of the site compound, which is proposed to be adjacent to the existing terminal building, local businesses and residential property.

The landing of the dredged material could impact on the existing harbour activity which would include the Harbour and ferry operation, as well as the local community. The estimated dredge volume of circa 30,792m^3 would require approximately 1,400 vehicle movements on the pier for tippers to take it to the compound, this additional traffic could be expected to have a detrimental effect on the local community and road, road users, with increase noise, emissions and road safety.

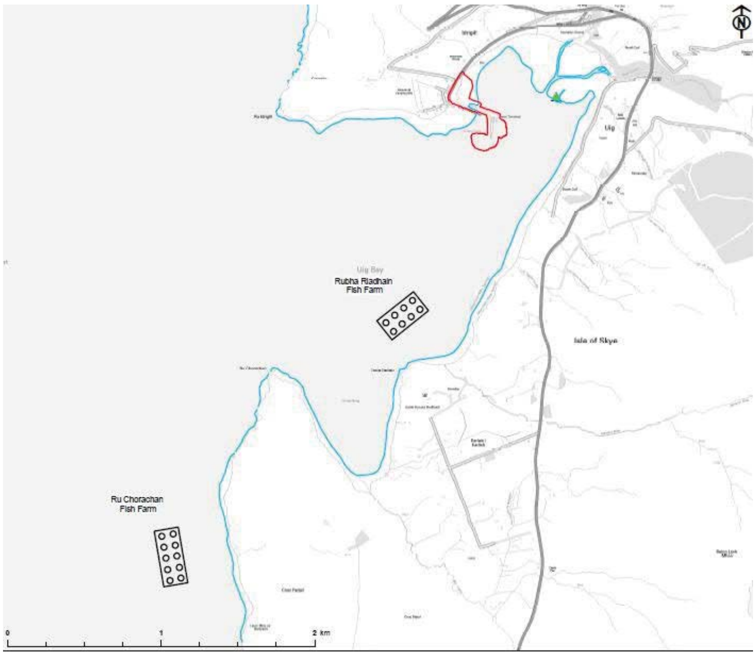

Figure 2. Location of fish farms in relation to proposed development

Aesthetically, the storage of dredged arisings on land, initially in the form of a slurry then once processed, arisings will be in a dried form, would be visually intrusive. In addition arisings may result in potential odour issues particularly when in slurry form. In dried form, dust may also be a problem.

Available mitigation options for the above would be to install hoarding and covers as appropriate. Management of the run-off from the drying process would require additional surface drainage management. Traffic management measures would also be adopted to manage the additional traffic, but limited measures could be used to reduce the impact of this option on odour and handling.

During the drying process airborne dust would require standard dust suppression measures for the arisings.

<u>Cost Considerations</u>

4.2.4 The cost for handling the dredge material, classification, treatment and reuse would be £1.5 this considers that 50% of the material would be unsuitable for the reclaim material and this would need to be transported to landfill and disposed. The cost considerations are for the practical undertaking of the work.

4.3 Option 2 – Construction Material Offsite

Strategic Considerations

4.3.1 As discussed within Option 1, the handling of the dredge material onshore will present specific challenges, as the material will be saturated, difficult to handle until it has been dried and may present an odour issue; dependent upon wind direction and amount of organic bed material recovered. The dredged material would need to be; landed, transported, classified, separated, treated/improved, tested and then transported to the reclamation. The licensing for 'disposal' on land would need acceptance from SEPA.

4.3.2 As part of the ground investigation, testing was undertaken to find the composition of the samples, the material was found to contain naturally occurring high metals. The level of chromium and Nickel in some samples exceeded the level 2 actions levels used by Marine Scotland for Dredged Material Assessment. Treatment of the material would be required to ensure all levels are below Action Level 1. Currently the samples also show elevated levels of copper that exceed the Level 1 actions level used by Marine Scotland for Dredged Material Assessment. Landfill tax and waste management certification would be required to ensure proper processing and disposal.

Environmental Considerations

4.3.3 The handling of the dredged material would increase the risk to health and safety, with the increased traffic cause by the movement of the material, potential dust from drying and processing and also the work of processing the arisings. The material would be transported by road to a site for processing and treat the dredging to remove or reduce the levels of the metals in the soil so it can be used in alternative locations and organic matter, also specific processing for the purpose of the reuse of the material. The risks to the public in this option are reduced when compared to option 1 however, the whole process would occur at the nearest landfill site which, is approximately 137 miles away.

4.3.4 The material once treated could be suitable for a different application but the transportation of the material will again be required to the location where it is required. The distance the material would have to travel and the processing that would be required may be is impractical.

Cost Considerations

4.3.5 The key cost would be the transportation of the sediment. It is estimated from experience and consideration of the transport costs and distance to the landfill site that the cost of this option would be in excess of £2m. The cost considerations are for the practical undertaking of the work.

4.4 Option 3 – Beach Recharge

Strategic Considerations

4.4.1 The dredging could be dispersed from the hopper at high tide on the foreshore using a splitter hopper adjacent to the works to the north and east of the proposed marshalling area. This would minimise any requirement for road transport. At low tide tracked "back actor' excavator could be used to spread the arisings to form the beach nourishment, a deposition depth of of 600mm has been assumed, which would require significant foreshore area to disperse the material.

4.4.2 The potential was identified for sediment movement from beach recharge location(s) back towards the dredge area around the berth as a result of natural coastal processes, which may lead to the requirement for a more frequent maintenance dredging regime.

4.4.3 This option would require beach monitoring pre- and post- disposal in order to understand natural beach recharge rates and existing rates of coastal weathering etc. No monitoring has been undertaken to date. The period of monitoring may vary but would likely include two years of monitoring pre-disposal and 1 year after disposal. These fall outwith the timescales of the project for the pre-disposal surveys.

4.4.4 Dredge disposal licence(s) would be required from Marine Scotland for this option.

4.4.5 Disposal in the beach location would also increase the siltation rate of the fisherman's berth.

Environmental Considerations

4.4.6 Beach recharge was initially considered as a viable option where the dredge volume was <5000m^3. However as the volume of dredge material now expected is significantly more than 5000m^3 following our original consultation with Marine Scotland (5th July 2017) acknowledged concern that should the dredge volume be >5000m^3 they would have difficulty in them accepting the volume. From our discussion large volumes of beach re-charge in this area was not acceptable.

4.4.7 Noise generated as a result of vehicle movements and from sediment handling machinery on the foreshore would impact the local community. It has also been assumed that this option does not offer sufficient capacity for the disposal of the full volume of dredge sediment expected. As a result the remainder of dredge materials would also require disposal through one of the other method options discussed above also therefore incurring additional environmental effects associated with this additional disposal method.

Cost Considerations

4.4.8 The cost associated with this option would be comparable with disposal at a new sea disposal site. It is considered possible that disposal of up to approximately 5000m^3 could be accommodated by this option in Uig Bay. As a result other forms of disposal would be also required.

4.4.9 For this exercise it is assumed that some may be used if suitable in the backfill of the infill are of 50% of the total dredged volume and the remaining is taken to landfill. This is estimated from experience and the above considerations to be £1.2m. The cost considerations are for the practical undertaking of the work.

4.5 Option 4 – Sea Disposal at Existing Disposal Site

Strategic Considerations

4.5.1 The existing disposal site closest to Uig is at Loch Broom at Ullapool. This is approximately 75 nautical miles away from the dredging area. Using a site at this distance from the Proposed Development would increase the cost and time required, meaning additional hoppers, tugs and equipment would likely be required. This option would also require further assessment of the characteristics of the existing disposal site at Ullapool to establish its suitability to accept dredge sediments from Uig. An assessment of the suitability of the site would be required prior to disposal and a licence from Marine Scotland for disposal at the site.

Dredge disposal at the existing site at Ullapool would require significant transit times for the dredge hopper(s) between Uig and Ullapool. As a result the capital dredge programme could be expected to be subject to greater influence by weather conditions than other options under consideration.

Environmental Considerations

4.5.2 The disposal site in Loch Broom at Ullapool lies within the Wester Ross Marine Protected Area (MPA) designated for burrowed mud and circalittoral muddy sand communities. All three species of seapen found in Scottish coastal waters are present within this MPA, including substantial numbers of the nationally scare tall seapen (Marine Scotland et al 2014)[1]. Whilst this disposal site is listed as an open site, It is considered that disposal of the quantity of dredge materials to be generated by the Proposed Development could result in significant effects on the benthic habitats for which this MPA is designated.

4.5.3 The distance between Uig and the disposal site at Ullapool would also result in higher vessel emissions when compared to more local disposal options, with result effects on air quality.

Cost Considerations

4.5.4 The cost associated would be approximately £1m. This is estimated considering the distance the disposal site is from Uig bay, the extended time for dredging required with extra equipment and risk of weather delays is more prominent as the duration of the dredge would possibly extended. The cost considerations are for the practical undertaking of the work.

[1] Marine Scotland, JNCC, SNH and The Scottish Government (2014): Wester Ross Marine Protected Area: Amazing marine biodiversity in a glacial landscape.

4.6 Option 5 – Sea Disposal at New Sea Disposal Site within Uig Bay.

Strategic Considerations

4.6.1 This option offers the opportunity for efficient materials handling, when compared with other options and could therefore be expected to have the least impact on the receiving environment in terms of operational impact and handling.

4.6.2 A marine disposal licence will need to be obtained. The marine licence application will be required to include an assessment of the proposed site for suitability for the dredge disposal. Licence determination is expected to take up to 16 weeks, although it has been acknowledged in discussion with Marine Scotland that application consideration timescale may be extended as a reflection of the potential complexity of the application.

4.6.3 In obtaining a licence for a new sea disposal site for dredge arisings in close proximity to the Proposed Development, this would streamline and minimise subsequent potential effects as a result of future maintenance dredging.

Environmental Considerations

4.6.4 Consideration of potential for sediment dispersion impacts affecting the two identified fish farms in Uig would need further assessment. This option has minimal impact on public health. The elevated metal content in the samples would need to be assessed with the sampling from the disposal site. It is assumed at this stage the material is suitable when considering the proximity to the dredge site.

A benthic survey and assessment would need to be undertaken to understand the characteristics of existing benthic communities within Uig Bay and to ensure any effects as a result of sediment deposition could be minimised.

Cost Considerations

4.6.5 The cost associated with the dredging and disposal at the new site and disposal at Sea is estimated at £550k. The cost considerations are for the practical undertaking of the work.

4.7 Option 6 – Landfill

Strategic Considerations

4.7.1 The considerations associated with disposing of dredged deposits to landfill are similar to those discussed in Option 1 and 2. The transportation is a key consideration and the cost of landfill tax would be substantial.

4.7.2 Due to the substantial cost associated with this option (as discussed below) and duration of programme required to transport this volume by road and the associated time requirements of having to land the arising and dry the material prior to transport. This option should be dismissed. The landfill site at Lochaber and the one identified above at Duisk are a significant distance by road. The cost associated with moving the dredging and processing at Uig was considered unfeasible.

Environmental Considerations

4.7.3 As discussed above the handing of the dredged arisings and traffic movements, noise, air quality and amenity disturbance would discount this option.

Cost Considerations

4.7.4 The key cost would be the transportation of the sediment and a desktop exercise was undertaken to ascertain the most practicable landfill that could be used to treat, store and re-use the material and concluded it would be the Duisky Landfill Site, Kinlocheil, near Fort William, approximately 137 miles away from the site. This would incur a significant cost, in excess of circa £2.5m more than disposal at a new disposal site. The cost considerations are for the practical undertaking of the work.

5. Waste Hierarchy

1. **Prevention** this is not possible as without dredging the 'lifeline' ferry service to Tarbert and Lochmaddy could not operate regularly.
2. **Re-use** of the material is discussed in this BPEO assessment, but it is not considered feasible as a result of the chemical composition of the sediments, and the required handling and processing of material that will be highly saturated. The high metal content, fine material as the level of preparation of the dredged material would be subject to thorough de-watering makes it unsuitable for re-use.
3. **Recycling** of the dredging has been assessed as part of the BPEO but is not suitable due to the makeup of the dredged material in the geotechnical report and water content. The following options are discussed:
    a. Beach Recharge
    b. Reclaim
    c. Landfill and
    d. Construction Material

    All options were found unsuitable, predominantly due to the characteristics of the dredged material.
4. **Other Recovery** the limited use of the material and the significant cost of processing/remediation would not be viable.
5. **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.

6. Identification of the BPEO

6.1 BPEO Scoring Matrix

6.1.1 In considering the options, the key benefits and disadvantages of each option have been considered and an indicative scoring of Low/Moderate/High impact allocated as described below:

- **Cost** – This is an assessment from the cost estimates associated with each option. The options are compared with each other where high is the highest and the low present the lowest assumed cost.
- **Logistical difficulty** – This considers the handling and the movement of the arisings. The distance and number of times the arising are transferred and handles was considered. High is the most distance and times the material is transferred and handled.
- **Environmental impact** – this is an overall consideration for the natural environment that the option would have for the lifecycle of the options. The greater the impact this would be classed as high, when compared against all the other options.
- **Public Health Risk** – this considers the interaction of the options with human health. High describes the high risk to human public health when compared against the other options.
- **Duration** - is the estimated time to undertake the option. High is for high duration of the options
- **Technical Difficulty** – This considers the practical possibility of delivering these options within the context of the project This looks at the need for space and time to undertake the option and compares them against each other.

Table 2: A summary of the Assessment of the Best Practical Environmental Option

Options	Cost	Logistical Difficulty	Environmental Impact	Public Health risk	Duration	Technical Difficulty
1. Reuse for Land Reclamation	Moderate	Moderate	Low	High	High	High
2. Reuse for Offsite	High	High	Low	Moderate	Moderate	High
3. Beach Recharge	Low	Moderate	Moderate	Low	Moderate	High
4.Sea Disposal at Existing Site	Moderate	Low	High	Low	Low	Moderate
5. Sea disposal at New Site	Low	Low	Moderate	Low	Low	Low
6.Landfill	Very High	Moderate	Low	Low	Moderate	High

6.2 Discussion

6.2.1 The strategic considerations highlighted that the need for handling and transport of the dredged arisings is a key consideration particularly in consideration of onshore disposal options due to the volume of material required to be moved by road transport. The Need to process the arising on land is considered impractical either as a result of the extensive site space that would be required if processed locally, or as a result of the distance for the material to be transported for offsite disposal options. The effort to move the material would increase vehicular traffic increasing the risk to Health and Safety of the local community and road safety.

6.2.2 The assumed dredge method for the capital dredge is cutter suction dredging, which would place the arisings on a hopper. The subsequent landing of this material for processing with significant vehicular movements, as proposed in Option 1 would be both technically impractical and disruptive for the local community. The visual intrusion of storage, odour from drying, noise from moving vehicles, dust from arisings and the need to store this material with limited space mean this was discounted at an early stage. Uig is a small town and its connection made by the Lifeline ferry service to Tarbert and Lochmaddy makes it a tourist and visitor area and the operation to land the arisings would not be advantageous to the local community or visitors/tourists

6.2.3 A similar range of environmental considerations exist for Option 2, with the exception of the significant vehicular movements created as a result of landing the arising. The distance to the Duisk site would also increase the level of vehicle activity and the time required to dispose of dredge materials. .

6.2.4 The high metal content in samples collected limits the reuse of the material away from the locality of the works. Beach nourishment with dredged material has been undertaken in the past but the volume of such previous works was low and this option was considered likely to have a significant impact on the foreshore unsuitable for the volume of dredge arisings to be generated here. The long terms effects of beach recharge are difficult to measure but it is considered likely that the material would increase the siltation rate of the vessel berth area along the approachway used by the fisherman and commercial vessels directly adjacent to the area of disposal.

6.2.5 Beach recharge posed significant challenge with consenting due to the significant volume for the works. The volume of dredging would have meant a significant area of the foreshore would require to be used to spread the arisings to minimise impact. When this proposal was discussed with Marine Scotland it was noted that Marine Scotland would likely object to this approach due to the large volume discussed. Further consideration was the morphological and sedimentation process in the bay would likely increase the need for dredging of the harbour as the material 'drifts' and is transported onto the berths by swell, wave and current.

6.2.6 Due to the location of Uig, transportation both by road and sea to the existing disposal sites (both on and offshore) are significant for a project of this scale, increasing cost of the dredging and disposal part of this project, which would bring to question the viability of the project.

6.2.7 The need to keep the material local and minimise transportation provided the assessment with two meaningful options (3 & 5) Beach Recharge or New Disposal Site.

6.2.8 Option 3: Beach recharge was considered unlikely to offer sufficient capacity to accommodate the volume of dredge materials expected to be generated as a result of the Proposed Development.

6.2.9 The disposal at a new sea disposal site in proximity to Uig Bay would have impact on the sub-tidal habitats within Loch Snizort and Uig Bay which were mapped as part of the 1988 Skye Sealochs Marine Nature Conservation Review (MNCR) (JNCC, 2001). These include the habitats 'Seapens and burrowing mega fauna in circalittoral soft mud' and 'Kelp and red seaweed on sublittoral sediments'. 'Northern seafan and sponge communities' and 'Maerl beds' have also been previously recorded close to the Ascrib Islands. Whilst the burrowing megafauna in this biotope including seapens can tolerate smothering by fine sediments of up to approximately 30 cm depth, the sediment for disposal and quantity and depth of disposal required could be expected to result in localised habitat loss.

6.2.10 Careful consideration would need to be taken in identifying a specific site for a new disposal site, in order to minimise impact on local benthic communities. Notwithstanding this potential effect, it was considered that the particular characteristics of the local geology, including the naturally occurring elevated metal content expected within the dredge materials, should be most compatible for disposal in the local area, where the receiving environment could be expected to be similar. The minimal handling of sea disposal at the new disposal site is a most favourable as the arisings are neither landed or travelled a significant distance for disposal.

6.2.11 Option 5: Sea disposal in a new disposal location within the local area was identified as the BPEO to be taken forward to further investigation.

Appendix A Holequest Ltd Geotechnical Sampling and Testing Extract

4:0 LABORATORY TESTING

A programme of laboratory testing, agreed with AECOM, was undertaken at the UKAS Accredited laboratories of PSL Ltd on behalf of Messrs Holequest Limited. The tests where appropriate were undertaken in accordance with British Standard 1377 "Methods of Tests for Soils for Civil Engineering Purposes" or as indicated otherwise. The various tests undertaken are as follows:-

1) **NATURAL MOISTURE CONTENT**
2) **PARTICLE SIZE DISTRIBUTION BY WET SIEVE**
3) **PARTICLE SIZE DISTRIBUTION BY SEDIMENTATION (PIPETTE)**
4) **LIQUID & PLASTIC LIMITS**
5) **CONSOLIDATED DRAINED SHEARBOX**
6) **CONSOLIDATED UNDRAINED TRIAXIAL WITH MEASUREMENT OF POREWATER PRESSURE (MULTISATGE)**
7) **ONE DIMENSIONAL CONSOLIDATION**

A programme of laboratory testing for contaminants, agreed with AECOM, was undertaken at the UKAS / MCERTS accredited laboratory of Scientific Analysis Laboratories Ltd, on behalf of Messrs Holequest Limited. The soil and water samples were tested for one or more of the following:-

1) **BRE SD1 SUITE**
2) **MARINE SCOTLAND SUITE**
3) **WASTE ACCEPTANCE CRITERIA (UNKNOWN)**
4) **ARSENIC**
5) **BORON (WATER SOLUBLE)**
6) **CADMIUM**
7) **CHROMIUM (TOTAL)**
8) **COPPER**
9) **CYANIDE (TOTAL)**
10) **LEAD**
11) **MERCURY**
12) **NICKEL**
13) **pH**
14) **SELEMIUM**
15) **SULPHATE (ACID SOLUBLE AND 2:1 EXTRACT)**
16) **ZINC**
17) **ORGANIC MATTER CONTENT**
18) **PAH (EPA 16)**
19) **SVOC**
20) **VOC**
21) **TPH (ALIPHATIC / AROMATIC SPLIT)**
22) **ASBESTOS ID**

The Geotechnical and Environmental Laboratory Test Results are summarised in Appendix IV.

Prepared By:-

F. Murray (Assistant Contracts Manager)
for HOLEQUEST LTD **Dated:- November 2017**

Approved By:-

C. Rodger (Technical Manager)
for HOLEQUEST LTD **Dated:- November 2017**
&©ajb

APPENDIX IV

Laboratory Testing

ii) Environmental Testing

CONCEPT LIFE SCIENCES

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

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Report Number: 669675-2

Date of Report: 08-Aug-2017

Customer: Holequest
Winston Road
Galashiels
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Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17155
Customer Site Reference: UIG, Skye
Date Job Received at Concept: 19-Jul-2017
Date Analysis Started: 21-Jul-2017
Date Analysis Completed: 08-Aug-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

Report checked and authorised by :
Ashleigh Cunningham
Customer Service Advisor

Issued by :
Alison Forrester
Project Manager

AForrester

Concept Reference:	669675
Project Site:	UIG, Skye
Customer Reference:	17/035

Sediment Analysed as Sediment

Metals Matrix Spike

				Concept Reference	**669675 005**
				Customer Sample Reference	**Matrix Spike**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
As Recovery	T750	AR	1	%	**100**
Cd Recovery	T750	AR	1	%	**100**
Cr Recovery	T750	AR	1	%	**100**
Cu Recovery	T750	AR	1	%	**90**
Ni Recovery	T750	AR	1	%	**100**
Pb Recovery	T750	AR	1	%	**100**
Zn Recovery	T750	AR	1	%	**100**

Concept Reference: 669675
Project Site: UIG, Skye
Customer Reference: 17/035

Soil Analysed as Soil

PAH Matrix Spike

				Concept Reference	669675 004
				Customer Sample Reference	Matrix Spike
				Date Sampled	20-JUL-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Naphthalene Recovery	T429	AR	1	%	**92**
Acenaphthene Recovery	T429	AR	1	%	**97**
Phenanthrene Recovery	T429	AR	1	%	**93**
Chrysene Recovery	T429	AR	1	%	**95**
Benzo(a)Pyrene Recovery	T429	AR	1	%	**99**

Concept Reference:	669675
Project Site:	UIG, Skye
Customer Reference:	17/035

Soil Analysed as Soil

PCB Matrix Spike

				Concept Reference	**669675 004**
				Customer Sample Reference	**Matrix Spike**
				Date Sampled	**20-JUL-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
PCB BZ#28 Recovery	T434	AR	1	%	**84**
PCB BZ#52 Recovery	T434	AR	1	%	**94**
PCB BZ#101 Recovery	T434	AR	1	%	**86**
PCB BZ#118 Recovery	T434	AR	1	%	**90**
PCB BZ#153 Recovery	T434	AR	1	%	**86**
PCB BZ#138 Recovery	T434	AR	1	%	**92**
PCB BZ#180 Recovery	T434	AR	1	%	**92**

Concept Reference: 669675
Project Site: UIG, Skye
Customer Reference: 17/035

Sediment Analysed as Sediment
Marine Scotland Suite

				Concept Reference	669675 001	669675 002	669675 003
				Customer Sample Reference	Seabed 0.1m	Seabed 0.5m	Seabed 0.8m
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Arsenic	T740	AR	0.5	mg/kg	**7.3**	**9.0**	**6.5**
Cadmium	T740	AR	0.1	mg/kg	**0.3**	**0.3**	**0.3**
Chromium	T740	AR	0.5	mg/kg	**380**	**410**	**490**
Copper	T740	AR	0.5	mg/kg	**41**	**25**	**37**
Lead	T740	AR	0.5	mg/kg	**6.4**	**3.5**	**4.8**
Nickel	T740	AR	0.5	mg/kg	**220**	**190**	**230**
Zinc	T740	AR	1.0	mg/kg	**100**	**77**	**100**
Mercury	T355	AR	0.05	mg/kg	**(13) 0.35**	(13) <0.05	(13) <0.05
Moisture	T2	AR	0.1	%	**20**	**21**	**15**
PCB (Total Tri-Hepta)	T16	AR	0.05	μg/kg	(2) <0.50	<0.05	<0.05
Tributyl tin	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
PCB EC7 (Sum)	T85	AR	0.35	μg/kg	<0.35	<0.35	<0.35

Concept Reference:	669675
Project Site:	UIG, Skye
Customer Reference:	17/035

Sediment Analysed as Sediment

Poly-Chlorinated Biphenyls (ICES 7)

				Concept Reference	**669675 001**	**669675 002**	**669675 003**
				Customer Sample Reference	**Seabed 0.1m**	**Seabed 0.5m**	**Seabed 0.8m**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
PCB BZ#28	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#52	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#101	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#118	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#153	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#138	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#180	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05

Concept Reference: 669675
Project Site: UIG, Skye
Customer Reference: 17/035

Sediment Analysed as Sediment
Total and Speciated USEPA16 PAH

				Concept Reference	669675 001	669675 002	669675 003
				Customer Sample Reference	Seabed 0.1m	Seabed 0.5m	Seabed 0.8m
Determinand	Method	Test Sample	LOD	Units			
Naphthalene	T1	AR	2	µg/kg	**24**	**6**	**11**
Acenaphthylene	T1	AR	2	µg/kg	<2	<2	<2
Acenaphthene	T1	AR	2	µg/kg	**3**	<2	**3**
Fluorene	T1	AR	2	µg/kg	**2**	<2	**2**
Phenanthrene	T1	AR	2	µg/kg	**15**	<2	<2
Anthracene	T1	AR	2	µg/kg	**6**	<2	<2
Fluoranthene	T1	AR	2	µg/kg	**56**	<2	<2
Pyrene	T1	AR	2	µg/kg	**48**	<2	<2
Benzo(a)Anthracene	T1	AR	2	µg/kg	**33**	<2	<2
Chrysene	T1	AR	2	µg/kg	**33**	<2	<2
Benzo(b/k)Fluoranthene	T1	AR	2	µg/kg	**47**	**2**	<2
Benzo(a)Pyrene	T1	AR	2	µg/kg	**22**	<2	<2
Indeno(123-cd)Pyrene	T1	AR	2	µg/kg	**11**	<2	<2
Dibenzo(ah)Anthracene	T1	AR	2	µg/kg	**5**	<2	<2
Benzo(ghi)Perylene	T1	AR	2	µg/kg	**9**	<2	<2
PAH(total)	T1	AR	2	µg/kg	**310**	**8**	**16**

Index to symbols used in 669675-2

Value	Description
AR	As Received
2	LOD Raised Due to Matrix Interference
13	Results have been blank corrected.
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T85	Calc
T740	ICP/MS (HF)
T16	GC/MS
T429	GC/MS (Recovery)
T1	GC/MS (HR)
T355	CVAFS
T750	ICP/MS (Recovery)
T2	Grav
T434	GC/MS (HR) (Recovery)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
PCB BZ#28 Recovery	T434	AR	1	%	N	004
PCB BZ#52 Recovery	T434	AR	1	%	N	004
PCB BZ#101 Recovery	T434	AR	1	%	N	004
PCB BZ#118 Recovery	T434	AR	1	%	N	004
PCB BZ#153 Recovery	T434	AR	1	%	N	004
PCB BZ#138 Recovery	T434	AR	1	%	N	004
PCB BZ#180 Recovery	T434	AR	1	%	N	004
Naphthalene Recovery	T429	AR	1	%	N	004
Acenaphthene Recovery	T429	AR	1	%	N	004
Phenanthrene Recovery	T429	AR	1	%	N	004
Chrysene Recovery	T429	AR	1	%	N	004
Benzo(a)Pyrene Recovery	T429	AR	1	%	N	004
Arsenic	T740	AR	0.5	mg/kg	N	001-003
Cadmium	T740	AR	0.1	mg/kg	N	001-003
Chromium	T740	AR	0.5	mg/kg	N	001-003
Copper	T740	AR	0.5	mg/kg	N	001-003
Lead	T740	AR	0.5	mg/kg	N	001-003
Nickel	T740	AR	0.5	mg/kg	N	001-003
Zinc	T740	AR	1.0	mg/kg	N	001-003
Mercury	T355	AR	0.05	mg/kg	N	001-003
Moisture	T2	AR	0.1	%	N	001-003
PCB (Total Tri-Hepta)	T16	AR	0.05	µg/kg	N	001-003
Tributyl tin	T16	AR	0.01	mg/kg	N	001-003
PCB EC7 (Sum)	T85	AR	0.35	µg/kg	N	001-003
PCB BZ#28	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#52	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#101	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#118	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#153	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#138	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#180	T1	AR	0.05	µg/kg	N	001-003
Naphthalene	T1	AR	2	µg/kg	N	001-003
Acenaphthylene	T1	AR	2	µg/kg	N	001-003
Acenaphthene	T1	AR	2	µg/kg	N	001-003
Fluorene	T1	AR	2	µg/kg	N	001-003
Phenanthrene	T1	AR	2	µg/kg	N	001-003
Anthracene	T1	AR	2	µg/kg	N	001-003
Fluoranthene	T1	AR	2	µg/kg	N	001-003
Pyrene	T1	AR	2	µg/kg	N	001-003

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Benzo(a)Anthracene	T1	AR	2	µg/kg	N	001-003
Chrysene	T1	AR	2	µg/kg	N	001-003
Benzo(b/k)Fluoranthene	T1	AR	2	µg/kg	N	001-003
Benzo(a)Pyrene	T1	AR	2	µg/kg	N	001-003
Indeno(123-cd)Pyrene	T1	AR	2	µg/kg	N	001-003
Dibenzo(ah)Anthracene	T1	AR	2	µg/kg	N	001-003
Benzo(ghi)Perylene	T1	AR	2	µg/kg	N	001-003
PAH(total)	T1	AR	2	µg/kg	N	001-003
As Recovery	T750	AR	1	%	N	005
Cd Recovery	T750	AR	1	%	N	005
Cr Recovery	T750	AR	1	%	N	005
Cu Recovery	T750	AR	1	%	N	005
Ni Recovery	T750	AR	1	%	N	005
Pb Recovery	T750	AR	1	%	N	005
Zn Recovery	T750	AR	1	%	N	005

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
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G75 0YF
Tel : 01355 573340
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Report Number: 675775-1

Date of Report: 23-Aug-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference:
Date Job Received at Concept: 25-Jul-2017
Date Analysis Started: 16-Aug-2017
Date Analysis Completed: 22-Aug-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING 1549

Report checked and authorised by :
Alison Forrester
Project Manager

Issued by :
Alison Forrester
Project Manager

Concept Reference: 675775
Customer Reference:

Soil Analysed as Soil
CWG

				Concept Reference	675775 003	675775 008
				Customer Sample Reference	TP02 0.0M	TP04 0.0M
				Date Sampled	20-JUL-2017	21-JUL-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
TPH (C5-C6 aliphatic)	T54	AR	10	µg/kg	<10	<10
TPH (C6-C8 aliphatic)	T54	AR	10	µg/kg	<10	<10
TPH (C8-C10 aliphatic)	T54	AR	10	µg/kg	<10	<10
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	<1	<1
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	<1	<1
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	<1	<1
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	(13) <1	<1
TPH (C6-C7 aromatic)	T54	AR	10	µg/kg	<10	<10
TPH (C7-C8 aromatic)	T54	AR	10	µg/kg	<10	<10
TPH (C8-C10 aromatic)	T54	AR	10	µg/kg	<10	<10
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	<1	<1
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	<1	<1
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	<1	<1
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	<1	<1

Concept Reference: 675775
Customer Reference:

Soil Analysed as Soil
Suite Requested

					Concept Reference	675775 003	675775 008
					Customer Sample Reference	TP02 0.0M	TP04 0.0M
					Date Sampled	20-JUL-2017	21-JUL-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Arsenic	T82	A40	2	mg/kg		**7**	**8**
Cadmium	T82	A40	1	mg/kg		<1	<1
Chromium	T82	A40	1	mg/kg		**52**	**71**
Copper	T82	A40	1	mg/kg		**55**	**43**
Lead	T82	A40	3	mg/kg		**10**	**19**
Mercury	T82	A40	1	mg/kg		<1	<1
Nickel	T82	A40	1	mg/kg		**140**	**170**
Selenium	T82	A40	3	mg/kg		<3	<3
Zinc	T82	A40	1	mg/kg		**95**	**130**
pH	T7	A40				**8.2**	**7.7**
Asbestos ID	T27	AR				N.D.	N.D.
Organic Matter	T2	A40	0.1	%		**1.9**	**3.8**

Concept Reference: 675775
Customer Reference:

Soil Analysed as Soil

Total and Speciated USEPA16 PAH (EK)

				Concept Reference	675775 003	675775 008
				Customer Sample Reference	TP02 0.0M	TP04 0.0M
				Date Sampled	20-JUL-2017	21-JUL-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Naphthalene	T149	AR	0.01	mg/kg	**0.01**	**0.01**
Acenaphthylene	T149	AR	0.01	mg/kg	**0.01**	<0.01
Acenaphthene	T149	AR	0.01	mg/kg	<0.01	<0.01
Fluorene	T149	AR	0.01	mg/kg	<0.01	<0.01
Phenanthrene	T149	AR	0.01	mg/kg	**0.01**	<0.01
Anthracene	T149	AR	0.01	mg/kg	**0.01**	<0.01
Fluoranthene	T149	AR	0.01	mg/kg	**0.04**	**0.01**
Pyrene	T149	AR	0.01	mg/kg	**0.04**	**0.01**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	(13) **0.02**	(13) <0.01
Chrysene	T149	AR	0.01	mg/kg	**0.02**	**0.01**
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	**0.04**	**0.01**
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	**0.02**	<0.01
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	**0.03**	**0.01**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	**0.02**	**0.01**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	**0.01**	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	**0.03**	**0.01**
PAH(total)	T149	AR	0.01	mg/kg	**0.31**	**0.08**

Concept Reference: 675775
Customer Reference:

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)(EK)

				Concept Reference	**675775 003**	**675775 008**	**675775 011**
				Customer Sample Reference	**TP02 0.0M**	**TP04 0.0M**	**SVOC BLANK**
				Date Sampled	**20-JUL-2017**	**21-JUL-2017**	**15-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Phenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Bis (2-chloroethyl) ether	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-Chlorophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Bis (2-chloroisopropyl) ether	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-methyl phenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
3/4-Methylphenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Hexachloroethane	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Nitrobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Isophorone	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,4-Dimethylphenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Bis (2-chloroethoxy) methane	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,4-Dichlorophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Naphthalene	T16	AR	0.1	mg/kg	**0.2**	<0.1	<0.1
4-Chloroaniline	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Hexachlorobutadiene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
4-Chloro-3-methylphenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-Methylnaphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Hexachlorocyclopentadiene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,4,6-Trichlorophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,4,5-Trichlorophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-Chloronaphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-Nitroaniline	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Dimethyl phthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,6-Dinitrotoluene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	**0.2**	<0.1	<0.1
3-Nitroaniline	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Dibenzofuran	T16	AR	0.1	mg/kg	**0.1**	<0.1	<0.1
2,4-Dinitrotoluene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2,4-Dinitrophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
2-Nitrophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Diethyl phthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Fluorene	T16	AR	0.1	mg/kg	**0.2**	<0.1	<0.1
4-Chlorophenyl phenylether	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
4-Nitroaniline	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Azobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
4-Bromophenyl phenylether	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Hexachlorobenzene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Pentachlorophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	**0.9**	**0.1**	<0.1
Anthracene	T16	AR	0.1	mg/kg	**0.3**	<0.1	<0.1
Carbazole	T16	AR	0.1	mg/kg	**0.3**	<0.1	<0.1
Di-n-butylphthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	**1.1**	**0.2**	<0.1
Pyrene	T16	AR	0.1	mg/kg	**0.9**	**0.2**	<0.1
Butyl benzylphthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	**0.5**	<0.1	<0.1
4-Nitrophenol	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Chrysene	T16	AR	0.1	mg/kg	**0.5**	<0.1	<0.1
Bis (2-ethylhexyl)phthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Di-n-octylphthalate	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	**0.8**	**0.1**	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	**0.5**	<0.1	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	**0.2**	<0.1	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	**0.3**	<0.1	<0.1

Concept Reference: 675775
Customer Reference:

Soil Analysed as Soil
Volatile Organic Compounds (USEPA 624)

				Concept Reference	675775 003	675775 008
				Customer Sample Reference	TP02 0.0M	TP04 0.0M
				Date Sampled	20-JUL-2017	21-JUL-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Dichlorodifluoromethane	T54	AR	5	µg/kg	<5	<5
Chloromethane	T54	AR	5	µg/kg	<5	<5
Vinyl chloride	T54	AR	5	µg/kg	<5	<5
Bromomethane	T54	AR	5	µg/kg	<5	<5
Chloroethane	T54	AR	5	µg/kg	<5	<5
Trichlorofluoromethane	T54	AR	5	µg/kg	<5	<5
1,1-Dichloroethylene	T54	AR	5	µg/kg	<5	<5
Dichloromethane	T54	AR	50	µg/kg	<50	<50
Trans-1,2-Dichloroethene	T54	AR	5	µg/kg	<5	<5
1,1-Dichloroethane	T54	AR	5	µg/kg	<5	<5
Cis-1,2-Dichloroethylene	T54	AR	5	µg/kg	<5	<5
2,2-Dichloropropane	T54	AR	5	µg/kg	<5	<5
Chloroform	T54	AR	5	µg/kg	<5	<5
Bromochloromethane	T54	AR	5	µg/kg	<5	<5
1,1,1-Trichloroethane	T54	AR	5	µg/kg	<5	<5
1,1-Dichloropropene	T54	AR	5	µg/kg	<5	<5
Carbon tetrachloride	T54	AR	5	µg/kg	<5	<5
1,2-Dichloroethane	T54	AR	5	µg/kg	<5	<5
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1
1,2-Dichloropropane	T54	AR	5	µg/kg	<5	<5
1,1,2-Trichloroethylene	T54	AR	5	µg/kg	<5	<5
Bromodichloromethane	T54	AR	5	µg/kg	<5	<5
Dibromomethane	T54	AR	5	µg/kg	<5	<5
Cis-1,3-Dichloropropene	T54	AR	5	µg/kg	<5	<5
Toluene	T54	AR	1	µg/kg	<1	<1
Trans-1,3-Dichloropropene	T54	AR	5	µg/kg	<5	<5
1,1,2-Trichloroethane	T54	AR	5	µg/kg	<5	<5
1,3-Dichloropropane	T54	AR	5	µg/kg	<5	<5
Tetrachloroethene	T54	AR	5	µg/kg	<5	<5
Chlorodibromomethane	T54	AR	5	µg/kg	<5	<5
1,2-dibromoethane	T54	AR	5	µg/kg	<5	<5
Chlorobenzene	T54	AR	5	µg/kg	<5	<5
1,1,1,2-Tetrachloroethane	T54	AR	5	µg/kg	<5	<5
EthylBenzene	T54	AR	1	µg/kg	<1	<1
M/P Xylene	T54	AR	1	µg/kg	<1	<1
O Xylene	T54	AR	1	µg/kg	<1	<1
Styrene	T54	AR	5	µg/kg	<5	<5
Bromoform	T54	AR	5	µg/kg	<5	<5
Isopropyl benzene	T54	AR	5	µg/kg	<5	<5
1,1,2,2-Tetrachloroethane	T54	AR	5	µg/kg	<5	<5
1,2,3-Trichloropropane	T54	AR	5	µg/kg	<5	<5
n-Propylbenzene	T54	AR	5	µg/kg	<5	<5
Bromobenzene	T54	AR	5	µg/kg	<5	<5
1,3,5-Trimethylbenzene	T54	AR	5	µg/kg	<5	<5
T-Butylbenzene	T54	AR	5	µg/kg	<5	<5
1,2,4-Trimethylbenzene	T54	AR	5	µg/kg	<5	<5
S-Butylbenzene	T54	AR	5	µg/kg	<5	<5
p-Isopropyltoluene	T54	AR	5	µg/kg	<5	<5
2-Chlorotoluene	T54	AR	5	µg/kg	<5	<5
4-Chlorotoluene	T54	AR	5	µg/kg	<5	<5
1,3-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5
1,4-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5
1,2-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5

Index to symbols used in 675775-1

Value	Description
AR	As Received
A40	Assisted dried < 40C
N.D.	Not Detected
13	Results have been blank corrected.
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

SVOC, PAH and VOC - These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T7	Probe
T8	GC/FID
T149	GC/MS (SIR)
T27	PLM
T54	GC/MS (Headspace)
T2	Grav
T82	ICP/OES (Sim)
T16	GC/MS

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Phenol	T16	AR	0.1	mg/kg	U	003,008,011
Bis (2-chloroethyl) ether	T16	AR	0.1	mg/kg	U	003,008,011
2-Chlorophenol	T16	AR	0.1	mg/kg	U	003,008,011
1,3-Dichlorobenzene	T16	AR	0.1	mg/kg	U	003,008,011
1,4-Dichlorobenzene	T16	AR	0.1	mg/kg	U	003,008,011
1,2-Dichlorobenzene	T16	AR	0.1	mg/kg	U	003,008,011
Bis (2-chloroisopropyl) ether	T16	AR	0.1	mg/kg	U	003,008,011
2-methyl phenol	T16	AR	0.1	mg/kg	U	003,008,011
3/4-Methylphenol	T16	AR	0.1	mg/kg	U	003,008,011
Hexachloroethane	T16	AR	0.1	mg/kg	U	003,008,011
Nitrobenzene	T16	AR	0.1	mg/kg	U	003,008,011
Isophorone	T16	AR	0.1	mg/kg	U	003,008,011
2,4-Dimethylphenol	T16	AR	0.1	mg/kg	U	003,008,011
Bis (2-chloroethoxy) methane	T16	AR	0.1	mg/kg	U	003,008,011
2,4-Dichlorophenol	T16	AR	0.1	mg/kg	U	003,008,011
1,2,4-Trichlorobenzene	T16	AR	0.1	mg/kg	U	003,008,011
Naphthalene	T16	AR	0.1	mg/kg	U	003,008,011
4-Chloroaniline	T16	AR	0.1	mg/kg	U	003,008,011
Hexachlorobutadiene	T16	AR	0.1	mg/kg	U	003,008,011
4-Chloro-3-methylphenol	T16	AR	0.1	mg/kg	U	003,008,011
2-Methylnaphthalene	T16	AR	0.1	mg/kg	U	003,008,011
Hexachlorocyclopentadiene	T16	AR	0.1	mg/kg	U	003,008,011
2,4,6-Trichlorophenol	T16	AR	0.1	mg/kg	U	003,008,011
2,4,5-Trichlorophenol	T16	AR	0.1	mg/kg	U	003,008,011
2-Chloronaphthalene	T16	AR	0.1	mg/kg	U	003,008,011
2-Nitroaniline	T16	AR	0.1	mg/kg	U	003,008,011
Dimethyl phthalate	T16	AR	0.1	mg/kg	U	003,008,011
2,6-Dinitrotoluene	T16	AR	0.1	mg/kg	U	003,008,011
Acenaphthylene	T16	AR	0.1	mg/kg	U	003,008,011
Acenaphthene	T16	AR	0.1	mg/kg	U	003,008,011
3-Nitroaniline	T16	AR	0.1	mg/kg	U	003,008,011
Dibenzofuran	T16	AR	0.1	mg/kg	U	003,008,011
2,4-Dinitrophenol	T16	AR	0.1	mg/kg	N	003,008,011
2,4-Dinitrotoluene	T16	AR	0.1	mg/kg	U	003,008,011
2-Nitrophenol	T16	AR	0.1	mg/kg	U	003,008,011
Diethyl phthalate	T16	AR	0.1	mg/kg	U	003,008,011
Fluorene	T16	AR	0.1	mg/kg	U	003,008,011

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
4-Chlorophenyl phenylether	T16	AR	0.1	mg/kg	U	003,008,011
4-Nitroaniline	T16	AR	0.1	mg/kg	U	003,008,011
Azobenzene	T16	AR	0.1	mg/kg	U	003,008,011
4-Bromophenyl phenylether	T16	AR	0.1	mg/kg	U	003,008,011
Hexachlorobenzene	T16	AR	0.1	mg/kg	U	003,008,011
Pentachlorophenol	T16	AR	0.1	mg/kg	U	003,008,011
Phenanthrene	T16	AR	0.1	mg/kg	U	003,008,011
Anthracene	T16	AR	0.1	mg/kg	U	003,008,011
Carbazole	T16	AR	0.1	mg/kg	U	003,008,011
Di-n-butylphthalate	T16	AR	0.1	mg/kg	U	003,008,011
Fluoranthene	T16	AR	0.1	mg/kg	U	003,008,011
Pyrene	T16	AR	0.1	mg/kg	U	003,008,011
Butyl benzylphthalate	T16	AR	0.1	mg/kg	U	003,008,011
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	U	003,008,011
4-Nitrophenol	T16	AR	0.1	mg/kg	N	003,008,011
Chrysene	T16	AR	0.1	mg/kg	U	003,008,011
Bis (2-ethylhexyl)phthalate	T16	AR	0.1	mg/kg	U	003,008,011
Di-n-octylphthalate	T16	AR	0.1	mg/kg	U	003,008,011
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	U	003,008,011
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	U	003,008,011
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	U	003,008,011
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	U	003,008,011
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	U	003,008,011
TPH (C5-C6 aliphatic)	T54	AR	10	μg/kg	N	003,008
TPH (C6-C8 aliphatic)	T54	AR	10	μg/kg	N	003,008
TPH (C8-C10 aliphatic)	T54	AR	10	μg/kg	N	003,008
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	N	003,008
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	N	003,008
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	N	003,008
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	N	003,008
TPH (C6-C7 aromatic)	T54	AR	10	μg/kg	N	003,008
TPH (C7-C8 aromatic)	T54	AR	10	μg/kg	N	003,008
TPH (C8-C10 aromatic)	T54	AR	10	μg/kg	N	003,008
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	N	003,008
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	N	003,008
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	N	003,008
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	N	003,008
Naphthalene	T149	AR	0.01	mg/kg	U	003,008
Acenaphthylene	T149	AR	0.01	mg/kg	U	003,008
Acenaphthene	T149	AR	0.01	mg/kg	U	003,008
Fluorene	T149	AR	0.01	mg/kg	U	003,008
Phenanthrene	T149	AR	0.01	mg/kg	U	003,008
Anthracene	T149	AR	0.01	mg/kg	U	003,008
Fluoranthene	T149	AR	0.01	mg/kg	U	003,008
Pyrene	T149	AR	0.01	mg/kg	U	003,008
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	003,008
Chrysene	T149	AR	0.01	mg/kg	U	003,008
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	U	003,008
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	U	003,008
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	003,008
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	003,008
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	003,008
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	003,008
PAH(total)	T149	AR	0.01	mg/kg	U	003,008
Arsenic	T82	A40	2	mg/kg	U	003,008
Cadmium	T82	A40	1	mg/kg	U	003,008
Chromium	T82	A40	1	mg/kg	U	003,008
Copper	T82	A40	1	mg/kg	U	003,008
Lead	T82	A40	3	mg/kg	U	003,008
Mercury	T82	A40	1	mg/kg	U	003,008
Nickel	T82	A40	1	mg/kg	U	003,008
Selenium	T82	A40	3	mg/kg	U	003,008
Zinc	T82	A40	1	mg/kg	U	003,008
pH	T7	A40			U	003,008
Asbestos ID	T27	AR			SU	003,008
Organic Matter	T2	A40	0.1	%	N	003,008
Dichlorodifluoromethane	T54	AR	5	μg/kg	U	003,008
Chloromethane	T54	AR	5	μg/kg	U	003,008
Vinyl chloride	T54	AR	5	μg/kg	U	003,008
Bromomethane	T54	AR	5	μg/kg	U	003,008

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Chloroethane	T54	AR	5	µg/kg	U	003,008
Trichlorofluoromethane	T54	AR	5	µg/kg	U	003,008
1,1-Dichloroethylene	T54	AR	5	µg/kg	U	003,008
Dichloromethane	T54	AR	50	µg/kg	N	003,008
Trans-1,2-Dichloroethene	T54	AR	5	µg/kg	U	003,008
1,1-Dichloroethane	T54	AR	5	µg/kg	U	003,008
Cis-1,2-Dichloroethylene	T54	AR	5	µg/kg	U	003,008
2,2-Dichloropropane	T54	AR	5	µg/kg	U	003,008
Chloroform	T54	AR	5	µg/kg	U	003,008
Bromochloromethane	T54	AR	5	µg/kg	U	003,008
1,1,1-Trichloroethane	T54	AR	5	µg/kg	U	003,008
1,1-Dichloropropene	T54	AR	5	µg/kg	U	003,008
Carbon tetrachloride	T54	AR	5	µg/kg	U	003,008
1,2-Dichloroethane	T54	AR	5	µg/kg	U	003,008
Benzene	T54	AR	1	µg/kg	U	003,008
1,2-Dichloropropane	T54	AR	5	µg/kg	U	003,008
1,1,2-Trichloroethylene	T54	AR	5	µg/kg	U	003,008
Bromodichloromethane	T54	AR	5	µg/kg	U	003,008
Dibromomethane	T54	AR	5	µg/kg	U	003,008
Cis-1,3-Dichloropropene	T54	AR	5	µg/kg	U	003,008
Toluene	T54	AR	1	µg/kg	U	003,008
Trans-1,3-Dichloropropene	T54	AR	5	µg/kg	U	003,008
1,1,2-Trichloroethane	T54	AR	5	µg/kg	U	003,008
1,3-Dichloropropane	T54	AR	5	µg/kg	U	003,008
Tetrachloroethene	T54	AR	5	µg/kg	U	003,008
Chlorodibromomethane	T54	AR	5	µg/kg	U	003,008
1,2-dibromoethane	T54	AR	5	µg/kg	U	003,008
Chlorobenzene	T54	AR	5	µg/kg	U	003,008
1,1,1,2-Tetrachloroethane	T54	AR	5	µg/kg	U	003,008
EthylBenzene	T54	AR	1	µg/kg	U	003,008
M/P Xylene	T54	AR	1	µg/kg	U	003,008
O Xylene	T54	AR	1	µg/kg	U	003,008
Styrene	T54	AR	5	µg/kg	U	003,008
Bromoform	T54	AR	5	µg/kg	U	003,008
Isopropyl benzene	T54	AR	5	µg/kg	U	003,008
1,1,2,2-Tetrachloroethane	T54	AR	5	µg/kg	U	003,008
1,2,3-Trichloropropane	T54	AR	5	µg/kg	U	003,008
n-Propylbenzene	T54	AR	5	µg/kg	U	003,008
Bromobenzene	T54	AR	5	µg/kg	U	003,008
1,3,5-Trimethylbenzene	T54	AR	5	µg/kg	U	003,008
T-Butylbenzene	T54	AR	5	µg/kg	U	003,008
1,2,4-Trimethylbenzene	T54	AR	5	µg/kg	U	003,008
S-Butylbenzene	T54	AR	5	µg/kg	U	003,008
p-Isopropyltoluene	T54	AR	5	µg/kg	U	003,008
2-Chlorotoluene	T54	AR	5	µg/kg	U	003,008
4-Chlorotoluene	T54	AR	5	µg/kg	U	003,008
1,3-Dichlorobenzene	T54	AR	5	µg/kg	U	003,008
1,4-Dichlorobenzene	T54	AR	5	µg/kg	U	003,008
1,2-Dichlorobenzene	T54	AR	5	µg/kg	U	003,008

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

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Report Number: 675785-1

Date of Report: 23-Aug-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference:
Date Job Received at Concept: 25-Jul-2017
Date Analysis Started: 16-Aug-2017
Date Analysis Completed: 22-Aug-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING 1549

Report checked and authorised by :
Alison Forrester
Project Manager

Issued by :
Alison Forrester
Project Manager

Waste Acceptance Criteria

Customer Sample Reference : TP01 0.0M
SAL Sample Reference : 675785 001
Test Portion Mass (g) : 175
Date Sampled : Deviating

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
TPH C10-C40 (sum)	Calc	1	mg/kg	N	(100) <10	500.0		
BTEX (Sum)	Calc	0.0040	mg/kg	U	(13) <0.0040	6.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.030	1.0		
Total Organic Carbon	OX/IR	0.1	%	N	1.7	3.0	5.0	6.0
pH	Probe			U	8.2		>6.0	
Loss on Ignition	Grav	0.1	%	N	6.2			10.0

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.024	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0021	mg/kg	N	0.21	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.54	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.04	1.0	5.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	2.0	50.0	100.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0031	mg/kg	N	<0.0031	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.0021	mg/kg	N	<0.0021	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.052	mg/kg	N	0.48	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.045	0.4	10.0	40.0
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0052	mg/kg	N	0.0056	0.1	0.5	7.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.021	mg/kg	N	0.14	4.0	50.0	200.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	23000	800.0	**15000.0**	25000.0
Fluoride	Calc / Discrete Analyser	0.52	mg/kg	N	9.1	10.0	150.0	500.0
Sulphate	Calc / Discrete Analyser	5.2	mg/kg	N	1400	**1000.0**	20000.0	50000.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	290	500.0	800.0	1000.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Total Dissolved Solids	Calc	100	mg/kg	N	46000	**4000.0**	60000.0	100000.0

From: Criteria set by European Council Decision 2003/33/EC(2) pursuant to Directive 1999/31/EC(3) and implemented in Scotland by The Landfill (Scotland) Regulations 2003 The 2:1 moisture extract was not produced because the moisture content of the sample was greater than 200%. Therefore, the exact application of the two-step leaching test is precluded on technical grounds (ref: Section 5.2.4 BS EN 12457-3:2002). Results are derived from a single step leaching at L/S 10/1 as prescribed by the EA guidance. (Ref Section C4.1.1 Guidance on Sampling and Testing of Wastes to meet Landfill Waste Acceptance Procedures Version 1 April 2005, Environment Agency)
Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Waste Acceptance Criteria

Customer Sample Reference : TP03 1.0M
SAL Sample Reference : 675785 002
Test Portion Mass (g) : 175
Date Sampled : Deviating

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
TPH C10-C40 (sum)	Calc	1	mg/kg	N	<1	500.0		
BTEX (Sum)	Calc	0.0040	mg/kg	U	(13) 0.020	6.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.030	1.0		
Total Organic Carbon	OX/IR	0.1	%	N	1.5	3.0	5.0	6.0
pH	Probe			U	8.8		>6.0	
Loss on Ignition	Grav	0.1	%	N	3.0			10.0

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.043	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.11	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.04	1.0	5.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	2.0	50.0	100.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	<0.0020	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.050	mg/kg	N	<0.050	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.020	0.1	0.5	7.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	<0.020	4.0	50.0	200.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	25	800.0	15000.0	25000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	0.50	10.0	150.0	500.0
Sulphate	Calc / Discrete Analyser	5.0	mg/kg	N	180	1000.0	20000.0	50000.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	16	500.0	800.0	1000.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Total Dissolved Solids	Calc	100	mg/kg	N	880	4000.0	60000.0	100000.0

From: Criteria set by European Council Decision 2003/33/EC(2) pursuant to Directive 1999/31/EC(3) and implemented in Scotland by The Landfill (Scotland) Regulations 2003
Note:- Sample failed to produce sufficient eluate within the specified time after vacuum filtration for 1 hour and centrifugation for 30 minutes. Therefore, the exact application of the two-step leaching test is precluded on technical grounds. (ref: Section 5.2.4 BS EN 12457-3:2002) Results are derived from a single step leaching at L/S 10/1 as prescribed by the EA guidance. (Ref Section C4.1.1 Guidance on Sampling and Testing of Wastes to meet Landfill Waste Acceptance Procedures Version 1 April 2005, Environment Agency)
Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Index to symbols used in 675785-1

Value	Description
AR	As Received
2:1	Leachate to BS EN 12457-3 (2:1)
8:1	Leachate to BS EN 12457-3 (8:1)
A40	Assisted dried < 40C
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

GC/MS Headspace - LOD raised as samples diluted due to poor internal standard recovery.
PAH soil - These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.
The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
Kelvin South Business Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 676021-1

Date of Report: 24-Aug-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Site Reference: UIG Harbour Redevelopment
Date Job Received at Concept: 15-Aug-2017
Date Analysis Started: 16-Aug-2017
Date Analysis Completed: 22-Aug-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Ashleigh Cunningham
Customer Service Advisor

Issued by :
Alison Forrester
Project Manager

Concept Reference: 676021
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Miscellaneous

					Concept Reference	676021 009	676021 010
					Customer Sample Reference	BH6A 0.00M	BH6A 0.50M
					Date Sampled	Deviating	Deviating
Determinand	Method	Test Sample	LOD	Units			
Organic Matter	T2	A40	0.1	%		**3.0**	**3.2**

Concept Reference: 676021
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Soil Suite

				Concept Reference	**676021 001**	**676021 002**	**676021 003**	**676021 004**	**676021 005**
				Customer Sample Reference	**BH1 0.00M**	**BH1 5.80M**	**BH1 10.30M**	**BH8A 1.00M**	**BH8A 5.30M**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Leach Prep (2:1)	T2	AR			Extracted	Extracted	Extracted	Extracted	Extracted
pH	T7	A40			**8.9**	**9.0**	**8.6**	**9.1**	**8.1**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.16**	**0.14**	**0.26**	**0.16**	**0.53**
Sulphur (total)	T6	A40	0.01	%	**0.09**	**0.19**	**0.34**	**0.14**	**1.7**

Concept Reference: 676021
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Soil Suite

				Concept Reference	**676021 006**	**676021 007**	**676021 008**	**676021 009**
				Customer Sample Reference	**BH9 0.90M**	**BH9 3.80M**	**BH9 9.10M**	**BH6A 0.00M**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**				
Leach Prep (2:1)	T2	AR			Extracted	Extracted	Extracted	Extracted
pH	T7	A40			**8.9**	**7.9**	**8.1**	**9.3**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.17**	**0.76**	**0.37**	**0.35**
Sulphur (total)	T6	A40	0.01	%	**0.18**	**1.7**	**0.48**	**0.77**

Concept Reference: 676021
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Leachate 2:1 Analysed as Water
Suite A

				Concept Reference	676021 001	676021 002	676021 003	676021 004	676021 005
				Customer Sample Reference	BH1 0.00M	BH1 5.80M	BH1 10.30M	BH8A 1.00M	BH8A 5.30M
				Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
Determinand	Method	Test Sample	LOD	Units					
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	<0.05	<0.05	0.43	<0.05	1.5
Chloride	T686	2:1	1	mg/l	920	1100	2400	1300	2200
Magnesium	T82	2:1	1	mg/l	24	35	210	28	170
Nitrate	T686	2:1	0.5	mg/l	<0.5	<0.5	<0.5	<0.5	1.7
Dissolved SO4(Total)	T285	2:1	10	mg/l	491	379	844	374	1397

Concept Reference: 676021
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Leachate 2:1 Analysed as Water
Suite A

				Concept Reference	676021 006	676021 007	676021 008	676021 009
				Customer Sample Reference	BH9 0.90M	BH9 3.80M	BH9 9.10M	BH6A 0.00M
				Date Sampled	Deviating	Deviating	Deviating	Deviating
Determinand	Method	Test Sample	LOD	Units				
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	<0.05	3.2	2.2	2.1
Chloride	T686	2:1	1	mg/l	2100	1900	570	2300
Magnesium	T82	2:1	1	mg/l	44	160	220	5
Nitrate	T686	2:1	0.5	mg/l	<0.5	<0.5	<0.5	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l	646	1900	1199	381

Index to symbols used in 676021-1

Value	Description
AR	As Received
2:1	Leachate 2:1
A40	Assisted dried < 40C
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T7	Probe
T2	Grav
T686	Discrete Analyser
T6	ICP/OES
T82	ICP/OES (Sim)
T192	HCl Extraction/ICP/OES (TRL 447 T2)
T285	ICP/OES (SIM) (Filtered)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Organic Matter	T2	A40	0.1	%	N	009-010
Leach Prep (2:1)	T2	AR			N	001-009
pH	T7	A40			U	001-009
(Acid Soluble) SO4	T192	AR	0.01	%	N	001-009
Sulphur (total)	T6	A40	0.01	%	N	001-009
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	U	001-009
Chloride	T686	2:1	1	mg/l	U	001-009
Magnesium	T82	2:1	1	mg/l	N	001-009
Nitrate	T686	2:1	0.5	mg/l	U	001-009
Dissolved SO4(Total)	T285	2:1	10	mg/l	N	001-009

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Wales (No 2514788)

16 Langlands Place
Kelvin South Business
Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: Supplement to previous report number 677646-2

Date of Report: 18-Apr-2018

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17244
Customer Site Reference: UIG Harbour Redevelopment, Skye
Date Job Received at Concept: 22-Aug-2017
Date Analysis Started: 24-Aug-2017
Date Analysis Completed: 05-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

Report checked
and authorised by :
Mr Alan Porteous
Site Manager

Issued by :
Ashleigh Cunningham
Customer Service Advisor

A. Cunningham

Concept Reference:	677646
Project Site:	UIG Harbour Redevelopment, Skye
Customer Reference:	17/035

Sediment Analysed as Sediment

Metals Matrix Spike

				Concept Reference	**677646 001**	**677646 002**	**677646 003**
				Customer Sample Reference	**BH1 0.00M**	**BH1 0.50-2.00M**	**BH1 2.00-3.50M**
				Date Sampled	**18-AUG-2017**	**18-AUG-2017**	**18-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
As Recovery	T750	AR	1	%	**100**	**100**	**100**
Cd Recovery	T750	AR	1	%	**100**	**100**	**100**
Cr Recovery	T750	AR	1	%	**100**	**100**	**100**
Cu Recovery	T750	AR	1	%	**100**	**100**	**100**
Ni Recovery	T750	AR	1	%	**100**	**100**	**100**
Pb Recovery	T750	AR	1	%	**100**	**100**	**100**
Zn Recovery	T750	AR	1	%	**100**	**100**	**100**

Concept Reference: 677646
Project Site: UIG Harbour Redevelopment, Skye
Customer Reference: 17/035

Soil Analysed as Soil
PAH Matrix Spike

				Concept Reference	**677646 005**
				Customer Sample Reference	**Matrix Spikes**
				Date Sampled	**18-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Naphthalene Recovery	T429	AR	1	%	**100**
Acenaphthene Recovery	T429	AR	1	%	**100**
Phenanthrene Recovery	T429	AR	1	%	**100**
Chrysene Recovery	T429	AR	1	%	**99**
Benzo(a)Pyrene Recovery	T429	AR	1	%	**90**

Concept Reference: 677646
Project Site: UIG Harbour Redevelopment, Skye
Customer Reference: 17/035

Soil Analysed as Soil
PCB Matrix Spike

				Concept Reference	**677646 005**
				Customer Sample Reference	**Matrix Spikes**
				Date Sampled	**18-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
PCB BZ#28 Recovery	T434	AR	1	%	**98**
PCB BZ#52 Recovery	T434	AR	1	%	**98**
PCB BZ#101 Recovery	T434	AR	1	%	**92**
PCB BZ#118 Recovery	T434	AR	1	%	**94**
PCB BZ#153 Recovery	T434	AR	1	%	**100**
PCB BZ#138 Recovery	T434	AR	1	%	**96**
PCB BZ#180 Recovery	T434	AR	1	%	**100**

Concept Reference:	677646
Project Site:	UIG Harbour Redevelopment, Skye
Customer Reference:	17/035

Sediment Analysed as Sediment

Marine Scotland Suite

Determinand	Method	Test Sample	LOD	Units	677646 001	677646 002	677646 003
				Concept Reference	**677646 001**	**677646 002**	**677646 003**
				Customer Sample Reference	**BH1 0.00M**	**BH1 0.50-2.00M**	**BH1 2.00-3.50M**
				Date Sampled	**18-AUG-2017**	**18-AUG-2017**	**18-AUG-2017**
Arsenic	T740	AR	0.5	mg/kg	**7.3**	**7.2**	**8.8**
Cadmium	T740	AR	0.1	mg/kg	<0.1	<0.1	<0.1
Chromium	T740	AR	0.5	mg/kg	**100**	**220**	**120**
Copper	T740	AR	0.5	mg/kg	**38**	**42**	**58**
Lead	T740	AR	0.5	mg/kg	**3.8**	**4.6**	**2.5**
Mercury	T355	AR	0.05	mg/kg	(13) <0.05	(13) <0.05	(13) <0.05
Moisture	T2	AR	0.1	%	**26**	**17**	**6.9**
Nickel	T740	AR	0.5	mg/kg	**140**	**240**	**210**
PCB EC7 (Sum)	T85	AR	0.35	μg/kg	<0.35	<0.35	<0.35
PCB (Total Tri-Hepta)	T16	AR	0.05	μg/kg	<0.05	<0.05	<0.05
Tributyl tin	T16	AR	0.01	mg/kg	<0.01	**0.02**	<0.01
Zinc	T740	AR	1.0	mg/kg	**77**	**96**	**78**

Concept Reference: 677646
Project Site: UIG Harbour Redevelopment, Skye
Customer Reference: 17/035

Sediment Analysed as Sediment
Poly-Chlorinated Biphenyls (ICES 7)

				Concept Reference	677646 001	677646 002	677646 003
				Customer Sample Reference	BH1 0.00M	BH1 0.50-2.00M	BH1 2.00-3.50M
				Date Sampled	18-AUG-2017	18-AUG-2017	18-AUG-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
PCB BZ#28	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#52	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#101	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#118	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#153	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#138	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#180	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05

Concept Reference: 677646
Project Site: UIG Harbour Redevelopment, Skye
Customer Reference: 17/035

Sediment Analysed as Sediment
Total and Speciated USEPA16 PAH

				Concept Reference	677646 001	677646 002	677646 003
				Customer Sample Reference	BH1 0.00M	BH1 0.50-2.00M	BH1 2.00-3.50M
				Date Sampled	18-AUG-2017	18-AUG-2017	18-AUG-2017
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Naphthalene	T1	AR	2	μg/kg	(13) <2	(13) <2	(13) <2
Acenaphthylene	T1	AR	2	μg/kg	<2	<2	<2
Acenaphthene	T1	AR	2	μg/kg	<2	<2	<2
Fluorene	T1	AR	2	μg/kg	<2	<2	<2
Phenanthrene	T1	AR	2	μg/kg	**(13) 3**	**(13) 2**	(13) <2
Anthracene	T1	AR	2	μg/kg	<2	<2	<2
Fluoranthene	T1	AR	2	μg/kg	**(13) 9**	**(13) 6**	(13) <2
Pyrene	T1	AR	2	μg/kg	**(13) 11**	**(13) 6**	(13) <2
Benzo(a)Anthracene	T1	AR	2	μg/kg	**(13) 6**	**(13) 5**	(13) <2
Chrysene	T1	AR	2	μg/kg	**(13) 5**	**(13) 3**	(13) <2
Benzo(b/k)Fluoranthene	T1	AR	2	μg/kg	**10**	**9**	<2
Benzo(a)Pyrene	T1	AR	2	μg/kg	**6**	**4**	**6**
Indeno(123-cd)Pyrene	T1	AR	2	μg/kg	**4**	**3**	<2
Dibenzo(ah)Anthracene	T1	AR	2	μg/kg	<2	<2	<2
Benzo(ghi)Perylene	T1	AR	2	μg/kg	**5**	**3**	<2
PAH(total)	T1	AR	2	μg/kg	**59**	**41**	**6**

Index to symbols used in Supplement to previous report number 677646-2

Value	Description
AR	As Received
13	Results have been blank corrected.
N	Analysis is not UKAS accredited

Notes

Supplemental report issued in order to amend sample 002 Tributyl tin result due to laboratory transcription error.

Method Index

Value	Description
T434	GC/MS (HR) (Recovery)
T1	GC/MS (HR)
T429	GC/MS (Recovery)
T16	GC/MS
T355	CVAFS
T2	Grav
T740	ICP/MS (HF)
T750	ICP/MS (Recovery)
T85	Calc

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
As Recovery	T750	AR	1	%	N	001-003
Cd Recovery	T750	AR	1	%	N	001-003
Cr Recovery	T750	AR	1	%	N	001-003
Cu Recovery	T750	AR	1	%	N	001-003
Ni Recovery	T750	AR	1	%	N	001-003
Pb Recovery	T750	AR	1	%	N	001-003
Zn Recovery	T750	AR	1	%	N	001-003
Naphthalene Recovery	T429	AR	1	%	N	005
Acenaphthene Recovery	T429	AR	1	%	N	005
Phenanthrene Recovery	T429	AR	1	%	N	005
Chrysene Recovery	T429	AR	1	%	N	005
Benzo(a)Pyrene Recovery	T429	AR	1	%	N	005
PCB BZ#28 Recovery	T434	AR	1	%	N	005
PCB BZ#52 Recovery	T434	AR	1	%	N	005
PCB BZ#101 Recovery	T434	AR	1	%	N	005
PCB BZ#118 Recovery	T434	AR	1	%	N	005
PCB BZ#153 Recovery	T434	AR	1	%	N	005
PCB BZ#138 Recovery	T434	AR	1	%	N	005
PCB BZ#180 Recovery	T434	AR	1	%	N	005
Arsenic	T740	AR	0.5	mg/kg	N	001-003
Cadmium	T740	AR	0.1	mg/kg	N	001-003
Chromium	T740	AR	0.5	mg/kg	N	001-003
Copper	T740	AR	0.5	mg/kg	N	001-003
Lead	T740	AR	0.5	mg/kg	N	001-003
Mercury	T355	AR	0.05	mg/kg	N	001-003
Moisture	T2	AR	0.1	%	N	001-003
Nickel	T740	AR	0.5	mg/kg	N	001-003
PCB EC7 (Sum)	T85	AR	0.35	µg/kg	N	001-003
PCB (Total Tri-Hepta)	T16	AR	0.05	µg/kg	N	001-003
Tributyl tin	T16	AR	0.01	mg/kg	N	001-003
Zinc	T740	AR	1.0	mg/kg	N	001-003
PCB BZ#28	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#52	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#101	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#118	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#153	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#138	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#180	T1	AR	0.05	µg/kg	N	001-003
Naphthalene	T1	AR	2	µg/kg	N	001-003
Acenaphthylene	T1	AR	2	µg/kg	N	001-003

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Acenaphthene	T1	AR	2	µg/kg	N	001-003
Fluorene	T1	AR	2	µg/kg	N	001-003
Phenanthrene	T1	AR	2	µg/kg	N	001-003
Anthracene	T1	AR	2	µg/kg	N	001-003
Fluoranthene	T1	AR	2	µg/kg	N	001-003
Pyrene	T1	AR	2	µg/kg	N	001-003
Benzo(a)Anthracene	T1	AR	2	µg/kg	N	001-003
Chrysene	T1	AR	2	µg/kg	N	001-003
Benzo(b/k)Fluoranthene	T1	AR	2	µg/kg	N	001-003
Benzo(a)Pyrene	T1	AR	2	µg/kg	N	001-003
Indeno(123-cd)Pyrene	T1	AR	2	µg/kg	N	001-003
Dibenzo(ah)Anthracene	T1	AR	2	µg/kg	N	001-003
Benzo(ghi)Perylene	T1	AR	2	µg/kg	N	001-003
PAH(total)	T1	AR	2	µg/kg	N	001-003

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
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G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 681125-2

Date of Report: 20-Sep-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17257
Customer Site Reference: UIG Harbour Redevelopment
Date Job Received at Concept: 07-Sep-2017
Date Analysis Started: 08-Sep-2017
Date Analysis Completed: 20-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Ashleigh Cunningham
Customer Service Advisor

Issued by :
Ashleigh Cunningham
Customer Service Advisor

A. Cunningham

Concept Reference:	681125	
Project Site:	UIG Harbour Redevelopment	
Customer Reference:	17/035	

Soil Analysed as Soil
Soil Suite

				Concept Reference	**681125 001**
				Customer Sample Reference	**BH2 @0.0**
				Date Sampled	**18-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Leach Prep (2:1)	T2	AR			Extracted
pH	T7	A40			**8.1**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.17**
Sulphur (total)	T6	A40	0.01	%	**0.18**

Concept Reference:	681125	
Project Site:	UIG Harbour Redevelopment	
Customer Reference:	17/035	

Leachate 2:1 Analysed as Water
Suite A

				Concept Reference	**681125 001**
				Customer Sample Reference	**BH2 @0.0**
				Date Sampled	**18-AUG-2017**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	**1.2**
Chloride	T686	2:1	1	mg/l	**2300**
Magnesium	T82	2:1	1	mg/l	**68**
Nitrate	T686	2:1	0.5	mg/l	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l	**494**

Index to symbols used in 681125-2

Value	Description
A40	Assisted dried < 40C
2:1	Leachate 2:1
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T7	Probe
T2	Grav
T82	ICP/OES (Sim)
T686	Discrete Analyser
T192	HCl Extraction/ICP/OES (TRL 447 T2)
T6	ICP/OES
T285	ICP/OES (SIM) (Filtered)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Leach Prep (2:1)	T2	AR			N	001
pH	T7	A40			U	001
(Acid Soluble) SO4	T192	AR	0.01	%	N	001
Sulphur (total)	T6	A40	0.01	%	N	001
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	U	001
Chloride	T686	2:1	1	mg/l	U	001
Magnesium	T82	2:1	1	mg/l	N	001
Nitrate	T686	2:1	0.5	mg/l	U	001
Dissolved SO4(Total)	T285	2:1	10	mg/l	N	001

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
Kelvin South Business Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 681797-1

Date of Report: 20-Sep-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17266
Customer Site Reference: Uig Harbour, Redevelopment
Date Job Received at Concept: 11-Sep-2017
Date Analysis Started: 12-Sep-2017
Date Analysis Completed: 20-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING 1549

Report checked and authorised by :
Brian Neil
Project Manager

Issued by :
Brian Neil
Project Manager

Concept Reference:	681797					
Project Site:	Uig Harbour, Redevelopment					
Customer Reference:	17/035					
Soil	Analysed as Soil					
Soil Suite						

				Concept Reference	**681797 001**	**681797 002**
				Customer Sample Reference	**BH6A 7.50m**	**BH2 6.50m**
				Date Sampled	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Leach Prep (2:1)	T2	AR			Extracted	Extracted
pH	T7	A40			**8.5**	**9.0**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.25**	**0.17**
Sulphur (total)	T6	A40	0.01	%	**0.55**	**0.54**

Concept Reference:	681797					
Project Site:	Uig Harbour, Redevelopment					
Customer Reference:	17/035					
Leachate 2:1	Analysed as Water					
Suite A						

				Concept Reference	**681797 001**	**681797 002**
				Customer Sample Reference	**BH6A 7.50m**	**BH2 6.50m**
				Date Sampled	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	**0.16**	**0.46**
Chloride	T686	2:1	1	mg/l	**1900**	**1700**
Magnesium	T82	2:1	1	mg/l	**49**	**32**
Nitrate	T686	2:1	0.5	mg/l	<0.5	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l	**549**	**436**

Index to symbols used in 681797-1

Value	Description
A40	Assisted dried < 40C
2:1	Leachate 2:1
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T2	Grav
T192	HCl Extraction/ICP/OES (TRL 447 T2)
T7	Probe
T6	ICP/OES
T285	ICP/OES (SIM) (Filtered)
T82	ICP/OES (Sim)
T686	Discrete Analyser

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Leach Prep (2:1)	T2	AR			N	001-002
pH	T7	A40			U	001-002
(Acid Soluble) SO4	T192	AR	0.01	%	N	001-002
Sulphur (total)	T6	A40	0.01	%	N	001-002
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	U	001-002

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Chloride	T686	2:1	1	mg/l	U	001-002
Magnesium	T82	2:1	1	mg/l	N	001-002
Nitrate	T686	2:1	0.5	mg/l	U	001-002
Dissolved SO4(Total)	T285	2:1	10	mg/l	N	001-002

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
Kelvin South Business Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 683576-1

Date of Report: 28-Sep-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17285
Customer Site Reference: UIG Harbour Redevelopment
Date Job Received at Concept: 19-Sep-2017
Date Analysis Started: 20-Sep-2017
Date Analysis Completed: 28-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Ashleigh Cunningham
Customer Service Advisor

Issued by :
Ashleigh Cunningham
Customer Service Advisor

A. Cunningham

Concept Reference:	683576
Project Site:	UIG Harbour Redevelopment
Customer Reference:	17/035
Soil	Analysed as Soil
Miscellaneous	

					Concept Reference	683576 001	683576 004	683576 005
					Customer Sample Reference	**BH3 4.50m**	**BH4 5.0m**	**BH5 4.5m**
					Date Sampled	**Deviating**	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**				
Organic Matter	T2	A40	0.1	%		**2.6**	**5.0**	**7.6**

Concept Reference:	683576
Project Site:	UIG Harbour Redevelopment
Customer Reference:	17/035
Soil	Analysed as Soil
Soil Suite	

					Concept Reference	683576 002	683576 003
					Customer Sample Reference	**BH3 7.50m**	**BH4 0.0m**
					Date Sampled	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Leach Prep (2:1)	T2	AR				Extracted	Extracted
pH	T7	A40				**9.9**	**9.2**
(Acid Soluble) SO4	T192	AR	0.01	%		**0.06**	**0.12**
Sulphur (total)	T6	A40	0.01	%		**1.0**	**0.27**

Concept Reference:	683576
Project Site:	UIG Harbour Redevelopment
Customer Reference:	17/035
Leachate 2:1	Analysed as Water
Suite A	

					Concept Reference	683576 002	683576 003
					Customer Sample Reference	**BH3 7.50m**	**BH4 0.0m**
					Date Sampled	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Ammonia expressed as NH4	T686	2:1	0.05	mg/l		**0.23**	<0.05
Chloride	T686	2:1	1	mg/l		**180**	**580**
Magnesium	T82	2:1	1	mg/l		<1	**4**
Nitrate	T686	2:1	0.5	mg/l		<0.5	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l		**159**	**245**

Index to symbols used in 683576-1

Value	Description
A40	Assisted dried < 40C
AR	As Received
2:1	Leachate 2:1
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T7	Probe
T285	ICP/OES (SIM) (Filtered)
T686	Discrete Analyser

T192	HCl Extraction/ICP/OES (TRL 447 T2)
T82	ICP/OES (Sim)
T2	Grav
T6	ICP/OES

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Organic Matter	T2	A40	0.1	%	N	001,004-005
Leach Prep (2:1)	T2	AR			N	002-003
pH	T7	A40			U	002-003
(Acid Soluble) SO4	T192	AR	0.01	%	N	002-003
Sulphur (total)	T6	A40	0.01	%	N	002-003
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	U	002-003
Chloride	T686	2:1	1	mg/l	U	002-003
Magnesium	T82	2:1	1	mg/l	N	002-003
Nitrate	T686	2:1	0.5	mg/l	U	002-003
Dissolved SO4(Total)	T285	2:1	10	mg/l	N	002-003

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
Kelvin South Business
Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 687648-2

Date of Report: 20-Oct-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17336
Customer Site Reference: UIG Harbour Redevelopment
Date Job Received at Concept: 06-Oct-2017
Date Analysis Started: 06-Oct-2017
Date Analysis Completed: 20-Oct-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

Report checked
and authorised by :
Brian Neil
Project Manager

Issued by :
Brian Neil
Project Manager

Concept Reference: 687648
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Sediment Analysed as Sediment
Marine Scotland Suite

Determinand	Method	Test Sample	LOD	Units	687648 001 (BH DS1 0.3m)	687648 002 (BH DS1 1.50m)	687648 003 (BH DS1 3.0m)
Arsenic	T740	AR	0.5	mg/kg	**8.1**	**6.4**	**7.0**
Cadmium	T740	AR	0.1	mg/kg	**0.2**	**0.2**	**0.2**
Chromium	T740	AR	0.5	mg/kg	**310**	**460**	**330**
Copper	T740	AR	0.5	mg/kg	**97**	**43**	**62**
Lead	T740	AR	0.5	mg/kg	**7.6**	**4.0**	**3.8**
Nickel	T740	AR	0.5	mg/kg	**210**	**260**	**250**
Zinc	T740	AR	1.0	mg/kg	**120**	**100**	**110**
Mercury	T355	AR	0.05	mg/kg	[13] <0.05	[13] <0.05	[13] <0.05
Moisture	T2	AR	0.1	%	**14**	**12**	**11**
PCB EC7 (Sum)	T85	AR	0.35	μg/kg	**3.53**	<0.35	<0.35
PCB (Total Tri-Hepta)	T16	AR	0.05	μg/kg	**9.2**	<0.05	<0.05
Tributyl tin	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01

Concept Reference: 687648
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Sediment Analysed as Sediment
Poly-Chlorinated Biphenyls (ICES 7)

Determinand	Method	Test Sample	LOD	Units	687648 001 (BH DS1 0.3m)	687648 002 (BH DS1 1.50m)	687648 003 (BH DS1 3.0m)
PCB BZ#28	T1	AR	0.05	μg/kg	<0.05	<0.05	<0.05
PCB BZ#52	T1	AR	0.05	μg/kg	**0.39**	<0.05	<0.05
PCB BZ#101	T1	AR	0.05	μg/kg	**0.91**	<0.05	<0.05
PCB BZ#118	T1	AR	0.05	μg/kg	**0.74**	<0.05	<0.05
PCB BZ#153	T1	AR	0.05	μg/kg	**0.54**	<0.05	<0.05
PCB BZ#138	T1	AR	0.05	μg/kg	**0.73**	<0.05	<0.05
PCB BZ#180	T1	AR	0.05	μg/kg	**0.22**	<0.05	<0.05

Concept Reference: 687648
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Sediment Analysed as Sediment
Total and Speciated USEPA16 PAH

Determinand	Method	Test Sample	LOD	Units	687648 001 (BH DS1 0.3m)	687648 002 (BH DS1 1.50m)	687648 003 (BH DS1 3.0m)
Naphthalene	T1	AR	2	μg/kg	[13] <2	**[13] 3**	[13] <2
Acenaphthylene	T1	AR	2	μg/kg	**5**	**34**	**4**
Acenaphthene	T1	AR	2	μg/kg	**2**	**7**	<2
Fluorene	T1	AR	2	μg/kg	<2	**7**	**8**
Phenanthrene	T1	AR	2	μg/kg	**[13] 21**	**[13] 98**	**[13] 28**
Anthracene	T1	AR	2	μg/kg	**11**	**37**	**8**
Fluoranthene	T1	AR	2	μg/kg	**67**	**340**	**25**
Pyrene	T1	AR	2	μg/kg	**62**	**310**	**19**
Benzo(a)Anthracene	T1	AR	2	μg/kg	**[13] 32**	**[13] 150**	**[13] 8**
Chrysene	T1	AR	2	μg/kg	**29**	**130**	**8**
Benzo(b/k)Fluoranthene	T1	AR	2	μg/kg	**65**	**280**	**12**
Benzo(a)Pyrene	T1	AR	2	μg/kg	**36**	**160**	**7**
Indeno(123-cd)Pyrene	T1	AR	2	μg/kg	**22**	**88**	**4**
Dibenzo(ah)Anthracene	T1	AR	2	μg/kg	**6**	**20**	<2
Benzo(ghi)Perylene	T1	AR	2	μg/kg	**26**	**110**	**4**
PAH(total)	T1	AR	2	μg/kg	**380**	**1800**	**140**

Index to symbols used in 687648-2

Value	Description
AR	As Received
13	Results have been blank corrected.
N	Analysis is not UKAS accredited

Notes

PCB and ICP/MS analysis was carried out at Concept Life Sciences Manchester.
The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T16	GC/MS
T85	Calc
T355	CVAFS
T2	Grav
T1	GC/MS (HR)
T740	ICP/MS (HF)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T740	AR	0.5	mg/kg	N	001-003
Cadmium	T740	AR	0.1	mg/kg	N	001-003
Chromium	T740	AR	0.5	mg/kg	N	001-003
Copper	T740	AR	0.5	mg/kg	N	001-003
Lead	T740	AR	0.5	mg/kg	N	001-003
Nickel	T740	AR	0.5	mg/kg	N	001-003
Zinc	T740	AR	1.0	mg/kg	N	001-003
Mercury	T355	AR	0.05	mg/kg	N	001-003
Moisture	T2	AR	0.1	%	N	001-003
PCB EC7 (Sum)	T85	AR	0.35	µg/kg	N	001-003
PCB (Total Tri-Hepta)	T16	AR	0.05	µg/kg	N	001-003
Tributyl tin	T16	AR	0.01	mg/kg	N	001-003
PCB BZ#28	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#52	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#101	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#118	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#153	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#138	T1	AR	0.05	µg/kg	N	001-003
PCB BZ#180	T1	AR	0.05	µg/kg	N	001-003
Naphthalene	T1	AR	2	µg/kg	N	001-003
Acenaphthylene	T1	AR	2	µg/kg	N	001-003
Acenaphthene	T1	AR	2	µg/kg	N	001-003
Fluorene	T1	AR	2	µg/kg	N	001-003
Phenanthrene	T1	AR	2	µg/kg	N	001-003
Anthracene	T1	AR	2	µg/kg	N	001-003
Fluoranthene	T1	AR	2	µg/kg	N	001-003
Pyrene	T1	AR	2	µg/kg	N	001-003
Benzo(a)Anthracene	T1	AR	2	µg/kg	N	001-003
Chrysene	T1	AR	2	µg/kg	N	001-003
Benzo(b/k)Fluoranthene	T1	AR	2	µg/kg	N	001-003
Benzo(a)Pyrene	T1	AR	2	µg/kg	N	001-003
Indeno(123-cd)Pyrene	T1	AR	2	µg/kg	N	001-003
Dibenzo(ah)Anthracene	T1	AR	2	µg/kg	N	001-003
Benzo(ghi)Perylene	T1	AR	2	µg/kg	N	001-003
PAH(total)	T1	AR	2	µg/kg	N	001-003

CONCEPT LIFE SCIENCES

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Concept Life Sciences

Certificate of Analysis

16 Langlands Place
Kelvin South Business Park
East Kilbride
G75 0YF
Tel : 01355 573340
Fax : 01355 573341

Report Number: 689661-1

Date of Report: 23-Oct-2017

Customer: Holequest
Winston Road
Galashiels
TD1 2DA

Customer Contact: Redacted

Customer Job Reference: 17/035
Customer Purchase Order: 17354
Customer Site Reference: UIG Harbour Redevelopment
Date Job Received at Concept: 14-Oct-2017
Date Analysis Started: 17-Oct-2017
Date Analysis Completed: 23-Oct-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING 1549

Report checked and authorised by :
Ashleigh Cunningham
Customer Service Advisor

Issued by :
Ashleigh Cunningham
Customer Service Advisor

A. Cunningham

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Miscellaneous

				Concept Reference	689661 001	689661 002	689661 005	689661 006	689661 008
				Customer Sample Reference	BH DS1 0.00-1.50M	BH DS1 4.50-6.00M	BH7 0.00-1.00M	BH7 1.00-2.50M	TP3 0.80M
				Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
Determinand	Method	Test Sample	LOD	Units					
Organic Matter	T2	A40	0.1	%	**1.4**	**3.7**	**3.1**	**2.6**	**3.1**

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Miscellaneous

				Concept Reference	689661 009
				Customer Sample Reference	TP3 3.00M
				Date Sampled	Deviating
Determinand	Method	Test Sample	LOD	Units	
Organic Matter	T2	A40	0.1	%	**3.0**

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Soil Suite

				Concept Reference	689661 001	689661 002	689661 003	689661 004	689661 005
				Customer Sample Reference	BH DS1 0.00-1.50M	BH DS1 4.50-6.00M	BH DS1 6.00-7.50M	BH DS1 7.50-9.00M	BH7 0.00-1.00M
				Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
Determinand	Method	Test Sample	LOD	Units					
pH	T7	A40			**9.2**	**8.4**	**9.5**	**8.9**	**8.3**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.11**	**0.33**	**0.07**	**0.17**	**0.43**
Sulphur (total)	T6	A40	0.01	%	**0.08**	**1.2**	**0.11**	**0.31**	**0.81**

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Soil Analysed as Soil
Soil Suite

				Concept Reference	689661 007
				Customer Sample Reference	BH7 8.50-10.00M
				Date Sampled	Deviating
Determinand	Method	Test Sample	LOD	Units	
pH	T7	A40			**9.6**
(Acid Soluble) SO4	T192	AR	0.01	%	**0.13**
Sulphur (total)	T6	A40	0.01	%	**0.91**

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Leachate 2:1 Analysed as Water
Suite A

				Concept Reference	**689661 001**	**689661 002**	**689661 003**	**689661 004**	**689661 005**
				Customer Sample Reference	**BH DS1 0.00-1.50M**	**BH DS1 4.50-6.00M**	**BH DS1 6.00-7.50M**	**BH DS1 7.50-9.00M**	**BH7 0.00-1.00M**
				Date Sampled	**Deviating**	**Deviating**	**Deviating**	**Deviating**	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	<0.05	**0.10**	**0.54**	**1.0**	<0.05
Chloride	T686	2:1	1	mg/l	**580**	**1700**	**340**	**1100**	**120**
Magnesium	T82	2:1	1	mg/l	**10**	**81**	**2**	**29**	**86**
Nitrate	T686	2:1	0.5	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l	**305**	**1964**	**280**	**505**	**1922**

Concept Reference: 689661
Project Site: UIG Harbour Redevelopment
Customer Reference: 17/035

Leachate 2:1 Analysed as Water
Suite A

				Concept Reference	**689661 007**
				Customer Sample Reference	**BH7 8.50-10.00M**
				Date Sampled	**Deviating**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	<0.05
Chloride	T686	2:1	1	mg/l	**29**
Magnesium	T82	2:1	1	mg/l	<1
Nitrate	T686	2:1	0.5	mg/l	<0.5
Dissolved SO4(Total)	T285	2:1	10	mg/l	**547**

Index to symbols used in 689661-1

Value	Description
A40	Assisted dried < 40C
2:1	Leachate 2:1
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T2	Grav
T192	HCl Extraction/ICP/OES (TRL 447 T2)
T7	Probe
T686	Discrete Analyser
T6	ICP/OES
T285	ICP/OES (SIM) (Filtered)
T82	ICP/OES (Sim)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Organic Matter	T2	A40	0.1	%	N	001-002,005-006,008-009
pH	T7	A40			U	001-005,007
(Acid Soluble) SO4	T192	AR	0.01	%	N	001-005,007
Sulphur (total)	T6	A40	0.01	%	N	001-005,007

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Ammonia expressed as NH4	T686	2:1	0.05	mg/l	U	001-005,007
Chloride	T686	2:1	1	mg/l	U	001-005,007
Magnesium	T82	2:1	1	mg/l	N	001-005,007
Nitrate	T686	2:1	0.5	mg/l	U	001-005,007
Dissolved SO4(Total)	T285	2:1	10	mg/l	N	001-005,007

Appendix B Aspect Survey Vibro-Core Sampling and Testing Extract

5. CONDUCT OF VIBROCORE SAMPLING

The vibrocore apparatus used was a lightweight SDI Vibecore 4D system with 76mm aluminium extruded pipe being used to recover the core. The system does not rely on overall mass but the vibrational frequency of the equipment and liquefaction of surrounding sediments to enable effective penetration. It is therefore reliant on the moisture content in the sediment.

The portability and simplicity of this equipment facilitates rapid deployment at an alternate location should the previous location provide a poor return.

The aim was to collect 3 cores in total across the site, of up to 3m in length, from sample points indicated on Figure 1.

The vessel was manoeuvred to each of the locations in turn and secured to the existing pier in order to avoid swinging during the sampling operation.

All vibrocore locations were sampled on 2nd & 3rd April 2018 at the following locations:

VIBROCORE POINT	SAMPLED EASTING	SAMPLED NORTHING	CORE LENGTH
VB3_3	138657.3	863558.7	2.1m
VB4_1	138778.8	863341.6	1.0m
VB5_2	138711.6	863549.2	1.4m

6. EQUIPMENT USED FOR SAMPLING

A Speciality Devices Incorporated D-4 vibrocorer was used for all samples. A 76mm diameter, 3m long core was fitted for all sample attempts and each core tube was constructed of aluminium.

The sediment was pushed out of the core tube prior to sampling the cores and then sampled with care being taken not to sample material that had come into contact with the sample tube wall.

FIGURE 2 - SDI D-4 VIBROCORER AND CORE ON DECK OF JOHANNA G

7. SAMPLE ANALYSIS

The laboratory analysis was carried out by SOCOTEC. The intention was that all vibrocore samples would be sub sampled at 0.5m intervals at the top middle and bottom of the length of the core and each sub sample analysed for Particle Size, Metals, WAC and Booster Biocides. The lab reporting is rendered with this report under separate cover:

A6542_Uig_Pre-disposal Sampling Results Form_MAR00025.xlsx

TEST REPORT

1252

Report No. EFS/184704 (Ver. 1)

SOCOTEC UK Limited Bretby (Marine)
Derwent House
Bretby Business Park
Ashby Road
Burton Upon Trent
Staffordshire
DE15 0YZ

Site: MAR00025

The 11 samples described in this report were registered for analysis by SOCOTEC UK Limited on 11-Apr-2018. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 30-Apr-2018

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The following tables are contained in this report:

On behalf of
SOCOTEC UK Limited
Tim Barnes Operations Director
Energy & Waste Services

Date of Issue: 30-Apr-2018

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
SOCOTEC UK Limited accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

		Units :	Mol/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
		Method Codes :	ANC	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	LOI(%MM)	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS
		Method Reporting Limits :	0.04	10	10	20	20	10	10	30	0.2	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		UKAS Accredited :	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date	Acid Neut. Capacity	Benzene	Ethyl Benzene	m/p Xylenes	MTBE	o Xylene	Toluene	Xylenes	L.O.I. % @ 450C	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene
1900261	A6542 - 4_1_1	02-Apr-18	10.32	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	3.7	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900262	A6542 - 4_1_2	02-Apr-18	6.16	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	3.9	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900263	A6542 - 4_1_3	02-Apr-18	2.44	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	3.6	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900264	A6542 - 3_3_1	03-Apr-18	1.76	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	11.0	< 0.08 §	< 0.08 §	< 0.08 §	0.15 §	0.17 §	0.18 §	0.10 §
1900265	A6542 - 3_3_2	03-Apr-18	1.24	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	8.1	< 0.08 §	< 0.08 §	0.12 §	0.36 §	0.37 §	0.39 §	0.19 §
1900266	A6542 - 3_3_3	03-Apr-18	4.68	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	3.3	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900267	A6542 - 5_2_1	03-Apr-18	4.32	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	9.1	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900268	A6542 - 5_2_2	03-Apr-18	4.00	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	7.3	< 0.08 §	< 0.08 §	< 0.08 §	0.85 §	0.87 §	1.28 §	0.36 §
1900269	A6542 - 5_2_3	03-Apr-18	4.00	< 10.0 §	< 10.0* §	< 20.0* §	< 20.0 §	< 10.0 §	< 10.0 §	<30 §	4.0	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900271	QC Blank		<0.04	<10 §	<10 §	<20 §	<20 §	<10 §	<10 §	<30 §		< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §
1900272	Reference Material (% Recovery)		97	95 §	88 §	88 §	98 §	90 §	87 §	89 §	102	98 §	100 §	94 §	95 §	96 §	88 §	77 §

SOCOTEC

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Burton-on-Trent, Staffordshire, DE15 0YZ
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Client Name	SOCOTEC UK Limited Bretby (Marine)
Contact	Jane Colbourne

MAR00025

Sample Analysis

Date Printed	27-Apr-2018
Report Number	EFS/184704
Table Number	1

Where individual results are flagged see report notes for status.

		Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
		Method Codes :	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PCBECD	PCBECD	PCBECD	PCBECD	PCBECD
		Method Reporting Limits :	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	1.28	5	5	5	5	5
		UKAS Accredited :	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**Benzo(k)fluoranthene**	**Chrysene**	**Coronene**	**Dibenzo(ah)anthracene**	**Fluoranthene**	**Fluorene**	**Indeno(123-cd)pyrene**	**Naphthalene**	**Phenanthrene**	**Pyrene**	**Total PAH (Sum of USEPA 16)**	**PCB 101**	**PCB 118**	**PCB 138**	**PCB 153**	**PCB 180**
1900261	A6542 - 4_1_1	02-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900262	A6542 - 4_1_2	02-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900263	A6542 - 4_1_3	02-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900264	A6542 - 3_3_1	03-Apr-18	< 0.08 §	0.13 §	< 0.08	< 0.08 §	0.27 §	< 0.08 §	< 0.08 §	< 0.08 §	0.15 §	0.42 §	2.22 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900265	A6542 - 3_3_2	03-Apr-18	0.18 §	0.29 §	< 0.08	< 0.08 §	0.62 §	< 0.08 §	0.20 §	< 0.08 §	0.29 §	0.59 §	4 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900266	A6542 - 3_3_3	03-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900267	A6542 - 5_2_1	03-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900268	A6542 - 5_2_2	03-Apr-18	0.60 §	1.54 §	0.09	0.08 §	0.97 §	< 0.08 §	0.39 §	< 0.08 §	0.11 §	1.00 §	8.45 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900269	A6542 - 5_2_3	03-Apr-18	< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	1.28 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §	< 5.00 §
1900271	QC Blank		< 0.08 §	< 0.08 §	< 0.08	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 0.08 §	< 1.28 §	<5.00 §	<5.00 §	<5.00 §	<5.00 §	<5.00 §
1900272	Reference Material (% Recovery)		86 §	97 §	89	81 §	92 §	91 §	87 §	99 §	93 §	93 §	91 §	89 §	92 §	88 §	92 §	79 §

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Client Name	**SOCOTEC UK Limited Bretby (Marine)**
Contact	Jane Colbourne

MAR00025

Sample Analysis

Date Printed	**27-Apr-2018**
Report Number	**EFS/184704**
Table Number	**1**

Where individual results are flagged see report notes for status.

		Units :	µg/kg	µg/kg	pH Units	%	mg/kg	mg/kg	% M/M
		Method Codes :	PCBECD	PCBECD	PHSOIL	TMSS	TPHFIDUS	TPHFIDUS	WSLM59
		Method Reporting Limits :	5	5		0.1	10	10	0.02
		UKAS Accredited :	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LAB ID Number CL/	Client Sample Description	Sample Date	PCB 28	PCB 52	pH units (AR)	Tot.Moisture @ 105C	TPH Band (>C10-C40)	TPH by GCFID (AR)	Total Organic Carbon
1900261	A6542 - 4_1_1	02-Apr-18	< 5.00 §	< 5.00 §	8.6 §	25.3 §	21.3 §	22.5 §	0.54 §
1900262	A6542 - 4_1_2	02-Apr-18	< 5.00 §	< 5.00 §	8.6 §	24.5 §	10.6 §	12.0 §	0.42 §
1900263	A6542 - 4_1_3	02-Apr-18	< 5.00 §	< 5.00 §	8.9 §	19.8 §	< 10.0 §	< 10.0 §	0.30 §
1900264	A6542 - 3_3_1	03-Apr-18	< 5.00 §	< 5.00 §	7.9 §	57.5 §	1510 §	1510 §	3.53 §
1900265	A6542 - 3_3_2	03-Apr-18	< 5.00 §	< 5.00 §	8.4 §	51.5 §	629 §	630 §	2.61 §
1900266	A6542 - 3_3_3	03-Apr-18	< 5.00 §	< 5.00 §	9 §	22.0 §	13.4 §	14.6 §	0.39 §
1900267	A6542 - 5_2_1	03-Apr-18	65.1 §	< 5.00 §	8.4 §	40.6 §	126 §	127 §	2.11 §
1900268	A6542 - 5_2_2	03-Apr-18	< 5.00 §	< 5.00 §	8.2 §	34.8 §	174 §	175 §	1.63 §
1900269	A6542 - 5_2_3	03-Apr-18	< 5.00 §	< 5.00 §	8.8 §	29.6 §	10.6 §	12.0 §	0.74 §
1900271	QC Blank		<5.00 §	<5.00 §			<10 §	<10 §	<0.02 §
1900272	Reference Material (% Recovery)		82 §	93 §	98 §		93 §	93 §	112 §

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Client Name	SOCOTEC UK Limited Bretby (Marine)
Contact	Jane Colbourne

MAR00025

Sample Analysis

Date Printed	27-Apr-2018
Report Number	EFS/184704
Table Number	1

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

					Leaching Data	
Client	SOCOTEC UK Limited Bretby (Marine)				Weight of sample (kg)	0.292
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	25.3
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.383
					Fraction of sample above 4 mm %	
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	
A6542 - 4_1_1		s18_4704	CL/1900261	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.542§	3	5	6
N	LOI450	Loss on Ignition (%)	3.7			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0802	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	28.51§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.82	100		
N	PHSOIL	pH (pH units)	8.6 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	10.36		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.5	8.9	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	9590	2650					
U	ICPMSW	Arsenic	0.008	0.003	0.016	0.04	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.002	<0.002	<0.02	0.5	10	70
U	ICPMSW	Copper	0.003	0.002	0.006	0.02	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.101	0.163	0.202	1.55	0.5	10	30
U	ICPMSW	Nickel	0.002	0.001	0.004	0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.003	0.003	0.006	0.03	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.003	<0.002	<0.03	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	2910	661	5820	9609	800	15000	25000
U	ISEF	Fluoride	1	1.3	2	13	10	150	500
U	ICPWATVAR	Sulphate as SO4	590	183	1180	2373	1000	20000	50000
N	WSLM27	Total Dissolved Solids	7480	2060	14960	27827	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	8.6	16	17.2	150	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				Leaching Data	
					Weight of sample (kg)	0.341
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	24.5
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.334
					Fraction of sample above 4 mm %	
Sample Description		Report No	Sample No	Issue Date	Fraction of non-crushable material %	
A6542 - 4_1_2		s18_4704	CL/1900262	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.426§	3	5	6
N	LOI450	Loss on Ignition (%)	4			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0796	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	14.04§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.80	100		
N	PHSOIL	pH (pH units)	8.6 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	6.25		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.6	7.8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	11400	1330					
U	ICPMSW	Arsenic	0.009	0.019	0.018	0.18	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	<0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.274	0.038	0.548	0.69	0.5	10	30
U	ICPMSW	Nickel	0.003	<0.001	0.006	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.005	0.003	0.01	0.03	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	0.005	<0.002	0.01	<0.02	4	50	200
U	KONENS	Chloride	3660	308	7320	7549	800	15000	25000
U	ISEF	Fluoride	1.1	0.7	2.2	8	10	150	500
U	ICPWATVAR	Sulphate as SO4	691	109	1382	1866	1000	20000	50000
N	WSLM27	Total Dissolved Solids	8900	1040	17800	20880	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	7.1	2.7	14.2	33	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

					Leaching Data	
Client	SOCOTEC UK Limited Bretby (Marine)				Weight of sample (kg)	0.271
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	19.8
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.404
					Fraction of sample above 4 mm %	
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	
A6542 - 4_1_3		s18_4704	CL/1900263	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.301§	3	5	6
N	LOI450	Loss on Ignition (%)	3.6			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0745	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.042	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	<12.47§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.70	100		
N	PHSOIL	pH (pH units)	8.9 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.45		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.1	8.7	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	7620	992					
U	ICPMSW	Arsenic	0.022	0.031	0.044	0.3	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.039	0.01	0.078	0.14	0.5	10	30
U	ICPMSW	Nickel	0.003	0.001	0.006	0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.005	0.004	0.01	0.04	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	2320	217	4640	4974	800	15000	25000
U	ISEF	Fluoride	1.1	0.6	2.2	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	394	127	788	1626	1000	20000	50000
N	WSLM27	Total Dissolved Solids	5940	774	11880	14628	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	3.9	1.9	7.8	22	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				Leaching Data	
					Weight of sample (kg)	0.417
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	57.5
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.258
					Fraction of sample above 4 mm %	
Sample Description		Report No	Sample No	Issue Date	Fraction of non-crushable material %	
A6542 - 3_3_1		s18_4704	CL/1900264	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.745§	3	5	6
N	LOI450	Loss on Ignition (%)	11.7			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1415	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.084	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	3550§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<5.4	100		
N	PHSOIL	pH (pH units)	7.9 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	1.87		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.7	8.6	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	7270	2970					
U	ICPMSW	Arsenic	0.081	0.004	0.162	0.14	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.138	0.059	0.276	0.7	0.5	10	30
U	ICPMSW	Nickel	0.008	<0.001	0.016	<0.02	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.009	0.003	0.018	0.04	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.003	<0.002	<0.03	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	2300	774	4600	9775	800	15000	25000
U	ISEF	Fluoride	1.8	1.4	3.6	15	10	150	500
U	ICPWATVAR	Sulphate as SO4	926	134	1852	2396	1000	20000	50000
N	WSLM27	Total Dissolved Solids	5670	2310	11340	27580	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	6.8	16	13.6	148	500	800	1000

Template Ver. 1 Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				Leaching Data	
					Weight of sample (kg)	0.278
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	51.5
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.397
					Fraction of sample above 4 mm %	
Sample Description		Report No	Sample No	Issue Date	Fraction of non-crushable material %	
A6542 - 3_3_2		s18_4704	CL/1900265	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.263§	3	5	6
N	LOI450	Loss on Ignition (%)	10.1			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1238	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.07	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	1300§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<8.41	100		
N	PHSOIL	pH (pH units)	8.4 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	1.55		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.4	9.2	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	9040	1530					
U	ICPMSW	Arsenic	0.004	0.005	0.008	0.05	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.004	<0.002	<0.04	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.18	0.08	0.36	0.93	0.5	10	30
U	ICPMSW	Nickel	<0.001	0.003	<0.002	<0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.004	0.004	0.008	0.04	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	0.003	<0.004	<0.03	4	50	200
U	KONENS	Chloride	2880	363	5760	6986	800	15000	25000
U	ISEF	Fluoride	1.4	0.8	2.8	9	10	150	500
U	ICPWATVAR	Sulphate as SO4	242	352	484	3373	1000	20000	50000
N	WSLM27	Total Dissolved Solids	7050	1200	14100	19800	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	0.06	<0.1	<0.6	1		
N	WSLM13	Dissolved Organic Carbon	15	4.3	30	57	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.288
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	22.0
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.387
					Fraction of sample above 4 mm %	
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	
A6542 - 3_3_3		s18_4704	CL/1900266	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.400§	3	5	6
N	LOI450	Loss on Ignition (%)	3.4			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0764	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.042	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	17.18§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.74	100		
N	PHSOIL	pH (pH units)	9 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.81		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8	9.4	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	22300	1200					
U	ICPMSW	Arsenic	0.018	0.155	0.036	1.37	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.064	0.036	0.128	0.4	0.5	10	30
U	ICPMSW	Nickel	<0.001	0.011	<0.002	<0.1	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	<0.001	0.004	<0.002	<0.04	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.002	<0.002	<0.02	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	8150	249	16300	13025	800	15000	25000
U	ISEF	Fluoride	1.1	1	2.2	10	10	150	500
U	ICPWATVAR	Sulphate as SO4	528	246	1056	2836	1000	20000	50000
N	WSLM27	Total Dissolved Solids	17400	935	34800	31303	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	11	5.4	22	61	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)
Contact	Jane Colbourne
Site	MAR00025

Sample Description	Report No	Sample No	Issue Date
A6542 - 5_2_1	s18_4704	CL/1900267	30-Apr-18

Leaching Data	
Weight of sample (kg)	0.441
Moisture content @ 105°C (% of Wet Weight)	40.6
Equivalent Weight based on drying at 105°C (kg)	0.225
Volume of water required to carry out 2:1 stage (litres)	0.234
Fraction of sample above 4 mm %	
Fraction of non-crushable material %	
Volume to undertake analysis (2:1 Stage) (litres)	0.300
Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.182§	3	5	6
N	LOI450	Loss on Ignition (%)	9.4			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1014	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.1576	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	212§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<2.29	100		
N	PHSOIL	pH (pH units)	8.4 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.47		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.1	8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	22200	1230					
U	ICPMSW	Arsenic	0.011	0.013	0.022	0.13	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.003	<0.002	<0.03	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.359	0.015	0.718	0.61	0.5	10	30
U	ICPMSW	Nickel	<0.001	<0.001	<0.002	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.001	0.002	0.002	0.02	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.001	<0.002	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	8350	274	16700	13508	800	15000	25000
U	ISEF	Fluoride	0.9	0.7	1.8	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	499	89	998	1437	1000	20000	50000
N	WSLM27	Total Dissolved Solids	17300	959	34600	31378	4000	60000	100000
U	SFAPI	Phenol Index	0.16	<0.05	0.32	<0.6	1		
N	WSLM13	Dissolved Organic Carbon	17	3.5	34	53	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				Leaching Data	
					Weight of sample (kg)	0.381
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	34.8
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.294
					Fraction of sample above 4 mm %	
Sample Description		Report No	Sample No	Issue Date	Fraction of non-crushable material %	
A6542 - 5_2_2		s18_4704	CL/1900268	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	1.648§	3	5	6
N	LOI450	Loss on Ignition (%)	7.4			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0919	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.056	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	267§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	13.1	100		
N	PHSOIL	pH (pH units)	8.2 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.04		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.9	8.7	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	17300	2380					
U	ICPMSW	Arsenic	0.018	0.007	0.036	0.08	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	<0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.206	0.106	0.412	1.19	0.5	10	30
U	ICPMSW	Nickel	<0.001	0.003	<0.002	<0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.004	0.005	0.008	0.05	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.002	<0.002	<0.02	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	6150	602	12300	13417	800	15000	25000
U	ISEF	Fluoride	1.1	1.4	2.2	14	10	150	500
U	ICPWATVAR	Sulphate as SO4	815	320	1630	3860	1000	20000	50000
N	WSLM27	Total Dissolved Solids	13500	1860	27000	34120	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	8	9.9	16	96	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

					Leaching Data	
Client	SOCOTEC UK Limited Bretby (Marine)				Weight of sample (kg)	0.317
Contact	Jane Colbourne				Moisture content @ 105°C (% of Wet Weight)	29.6
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00025				Volume of water required to carry out 2:1 stage (litres)	0.358
					Fraction of sample above 4 mm %	
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	
A6542 - 5_2_3		s18_4704	CL/1900269	30-Apr-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values: Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.755§	3	5	6
N	LOI450	Loss on Ignition (%)	4.1			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0856	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	15.06§	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.93	100		
N	PHSOIL	pH (pH units)	8.8 §		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.08		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8.6	9.1	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	11100	1630					
U	ICPMSW	Arsenic	0.181	0.174	0.362	1.75	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	0.003	<0.002	<0.03	0.5	10	70
U	ICPMSW	Copper	<0.001	0.006	<0.002	<0.05	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.522	0.183	1.044	2.28	0.5	10	30
U	ICPMSW	Nickel	0.006	0.027	0.012	0.24	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.045	0.018	0.09	0.22	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	0.005	<0.002	<0.04	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.002	<0.004	<0.02	4	50	200
U	KONENS	Chloride	3540	378	7080	7996	800	15000	25000
U	ISEF	Fluoride	0.8	0.7	1.6	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	724	916	1448	8904	1000	20000	50000
N	WSLM27	Total Dissolved Solids	8640	1270	17280	22527	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	12	12	24	120	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

SOCOTEC UK Ltd Environmental Chemistry
Analytical and Deviating Sample Overview

Customer SOCOTEC UK Limited Bretby (Marine)
Site MAR00025
Report No S184704

Consignment No S73786
Date Logged 11-Apr-2018
In-House Report Due 25-Apr-2018

Please note the results for any subcontracted analysis (identified with a '^') is likely to take up to an additional five working days.

ID Number	Description	Sampled	Acid Neut. Capacity	BTEX-HSA + MTBE analysis	MTBE (µg/kg)	CEN Leac(P)1	CEN Leac(P)2	Report B >63 µm	Copper (MS) Sediment	Arsenic (MS) Sediments	Cadmium (MS) Sediments	Chromium (MS) Sediments	Lead (MS) Sediments	Mercury (MS) Low Level Sediments	Nickel (MS) Sediments	Zinc (MS) Sediments	L.O.I. % @ 450C	PAH (17) by GCMS	PCB-7 Congeners Analysis	pH units (AR)	Tot.Moisture @ 105C	TPH Band (>C10-C40)	TPH by GCFID (AR)	Total Organic Carbon
		MethodID	ANC	BTEXHSA		CEN Leachate		CustServ	ICPMSS								LOI(%MM)	PAHMSUS	PCBECD	PHSOIL	TMSS	TPHFIDUS		WSLM59
				✓	✓				✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
CL/1900261	A6542 - 4_1_1	02/04/18																						
CL/1900262	A6542 - 4_1_2	02/04/18																						
CL/1900263	A6542 - 4_1_3	02/04/18																						
CL/1900264	A6542 - 3_3_1	03/04/18																						
CL/1900265	A6542 - 3_3_2	03/04/18																						
CL/1900266	A6542 - 3_3_3	03/04/18																						
CL/1900267	A6542 - 5_2_1	03/04/18																						
CL/1900268	A6542 - 5_2_2	03/04/18																						
CL/1900269	A6542 - 5_2_3	03/04/18																						
CL/1900271	QC Blank																							
CL/1900272	Reference Material (% Recovery)																							

Note: We will endeavour to prioritise samples to complete analysis within holding time; however any delay could result in samples becoming deviant whilst being processed in the laboratory.

If sampling dates are missing or matrices unclassified then results will not be ISO 17025 accredited. Please contact us as soon as possible to provide missing information in order to reinstate accreditation.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time
Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
BTEXHSA	CL1900261 TO CL1900269	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation from the affected analytes (Ethylbenzene, M/P xylenes) . These circumstances should be taken into consideration when utilising the data”

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ANC	Oven Dried @ < 35°C	Quantitative digestion with Hydrochloric Acid back titration with 1M Sodium Hydroxide to pH 7
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in Marine Sediments and Soil samples by aqua regia digestion followed by ICPMS detection
Soil	LOI(%MM)	Oven Dried @ < 35°C	Determination of loss on ignition for soil samples at specified temperature by gravimetry
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBECD	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis (% based upon wet weight)
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and non-dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis
Unless stated otherwise results are expressed as mg/l
Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^oC

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
TR Denotes Tremolite
AC Denotes Actinolite
AN Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.
This may have resulted in deterioration of the sample(s) during transit to the laboratory.
Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : SOCOTEC UK Limited Bretby (Marine)

Site : MAR00025

Report Number : S18_4704

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1900261	A6542 - 4_1_1	MARINE SEDIMENTS
CL/1900262	A6542 - 4_1_2	MARINE SEDIMENTS
CL/1900263	A6542 - 4_1_3	MARINE SEDIMENTS
CL/1900264	A6542 - 3_3_1	MARINE SEDIMENTS
CL/1900265	A6542 - 3_3_2	MARINE SEDIMENTS
CL/1900266	A6542 - 3_3_3	MARINE SEDIMENTS
CL/1900267	A6542 - 5_2_1	MARINE SEDIMENTS
CL/1900268	A6542 - 5_2_2	MARINE SEDIMENTS
CL/1900269	A6542 - 5_2_3	MARINE SEDIMENTS
CL/1900271	QC Blank	QUALITY CONTROL SAMPLE
CL/1900272	Reference Material (% Recovery)	QUALITY CONTROL SAMPLE

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2.3 Dredge Disposal Site Characterisation Report

The Highland Council

Uig Harbour Redevelopment

Disposal site characterisation report

February 2019





Innovative Thinking - Sustainable Solutions

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Uig Harbour Redevelopment

Disposal site characterisation report

February 2019

Source: AECOM

Document Information

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Prepared (PM)	Approved (QM)	Authorised (PD)
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Contributing Authors

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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.

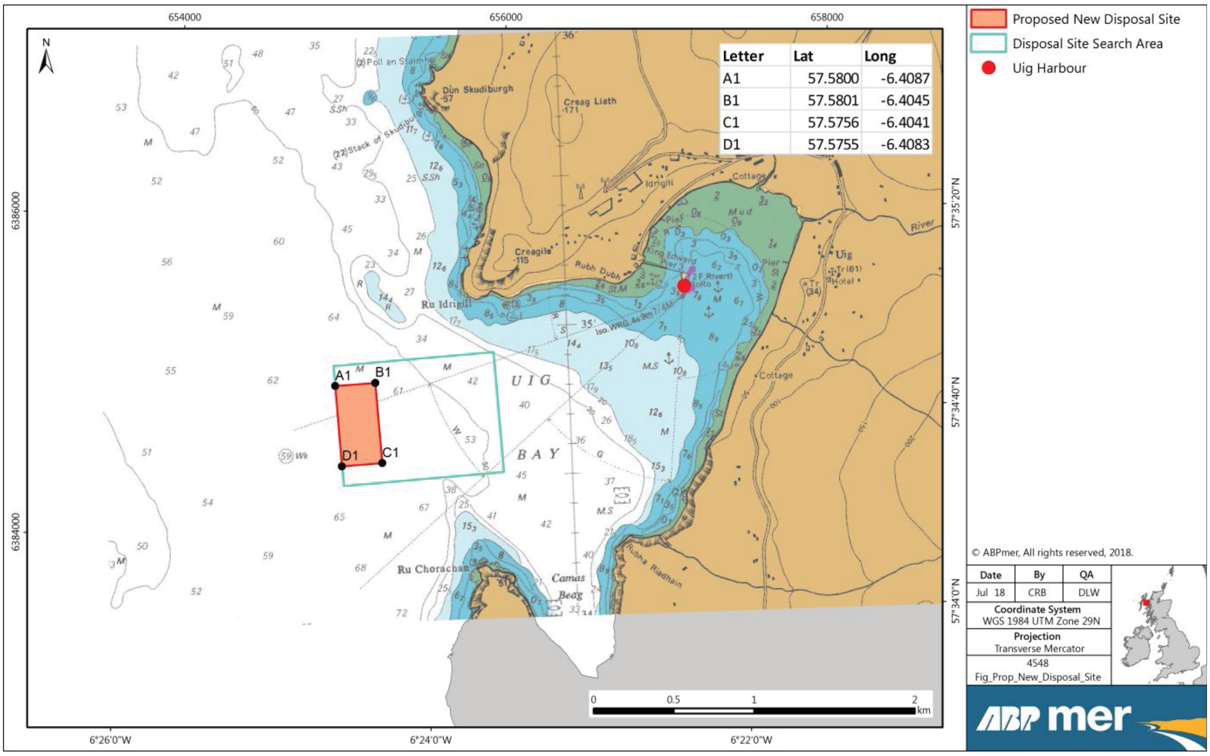


Figure NTS1. Location of the proposed new disposal site including coordinates (WGS84; decimal degrees)

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.

Contents

Tables

Figures

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.

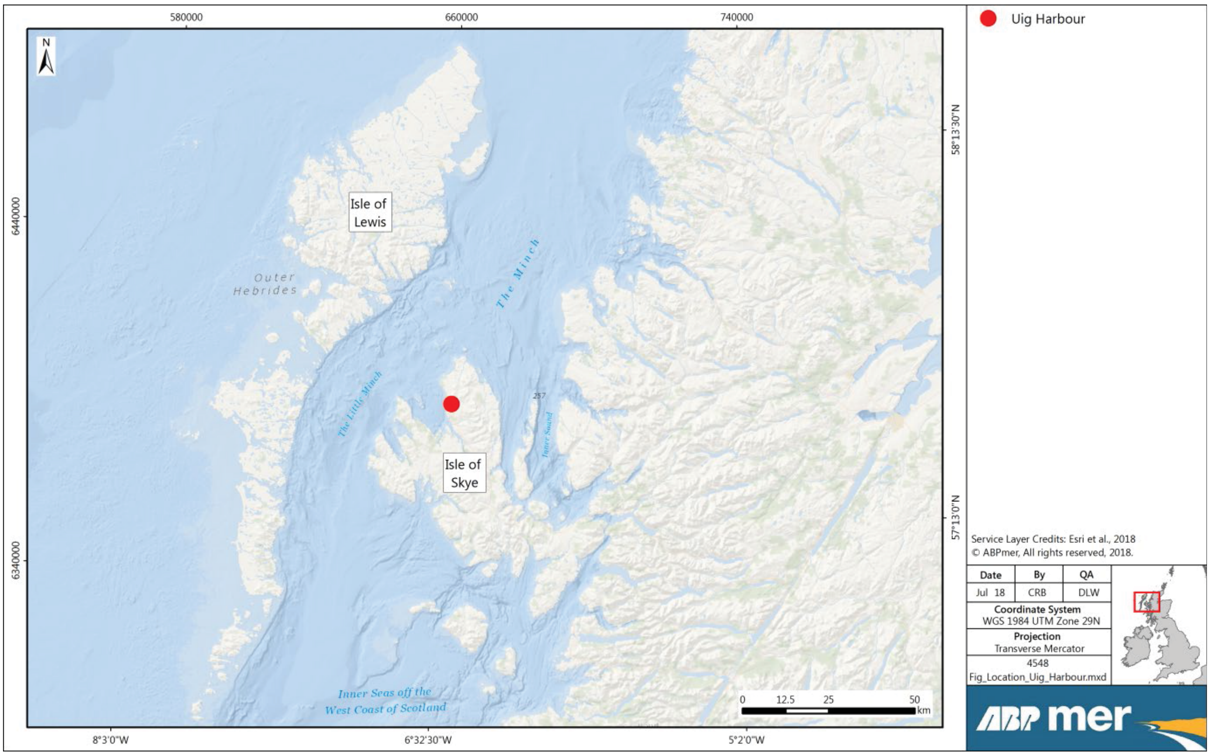


Figure 1. Location of Uig Harbour

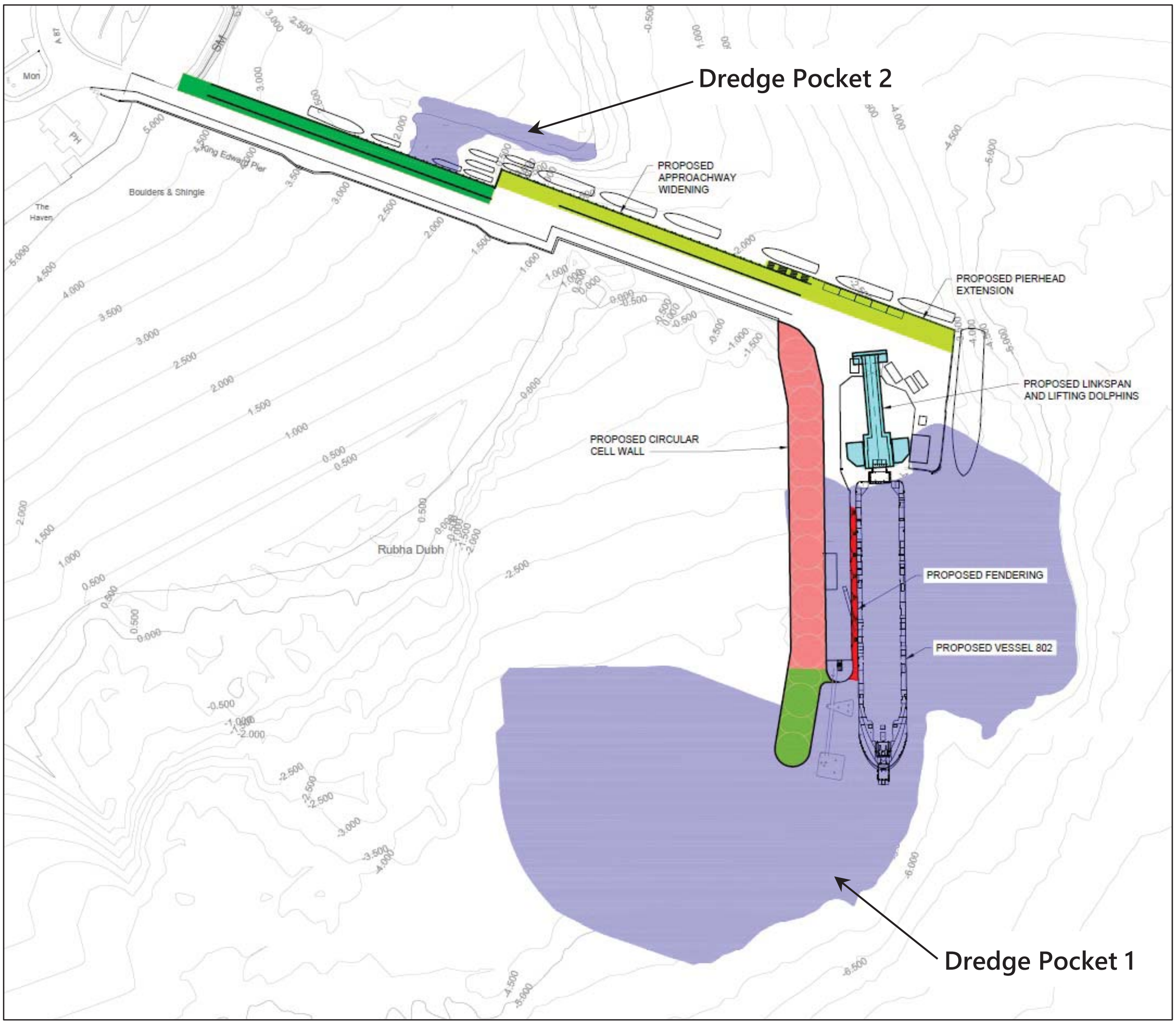
Increasing demand and aging tonnage has led the ferry operator to commission new, larger ferry vessels for a number of its routes. The 'Skye Triangle' has been identified by the operator as a priority and the procurement of a new vessel for this route has commenced. THC (hereafter also referred to as 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.

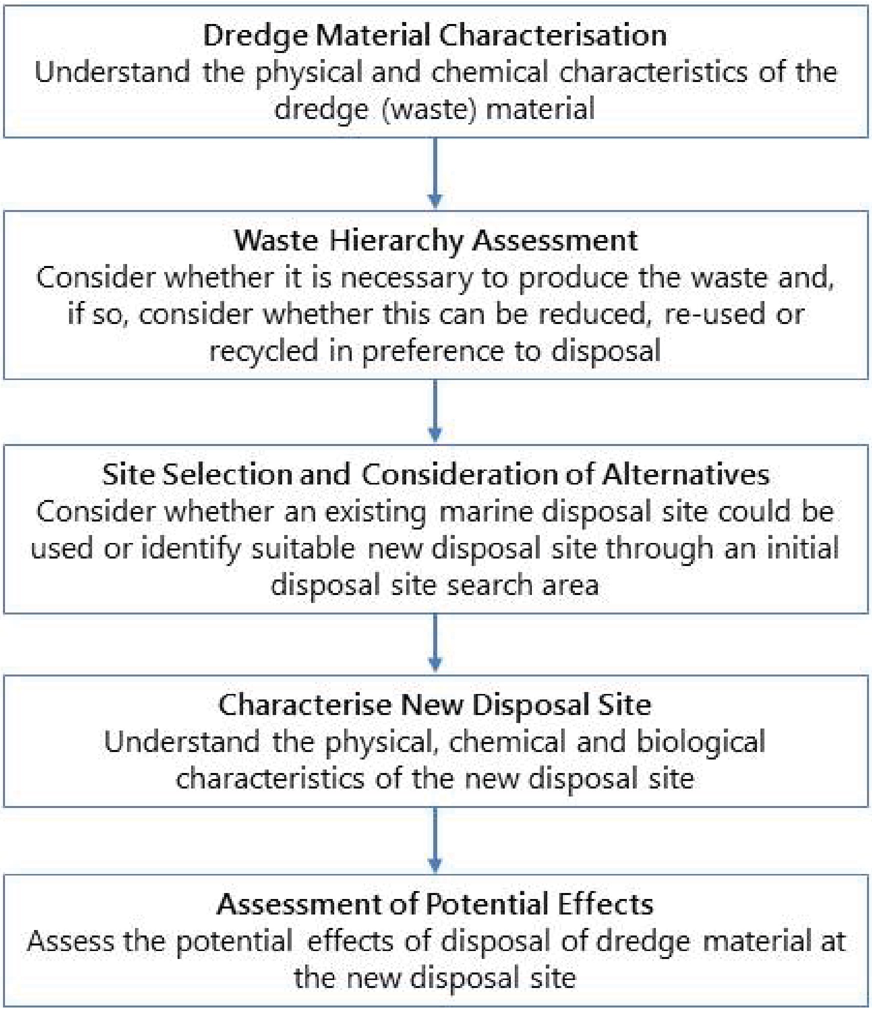


Figure 3. Summary of disposal site characterisation process

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

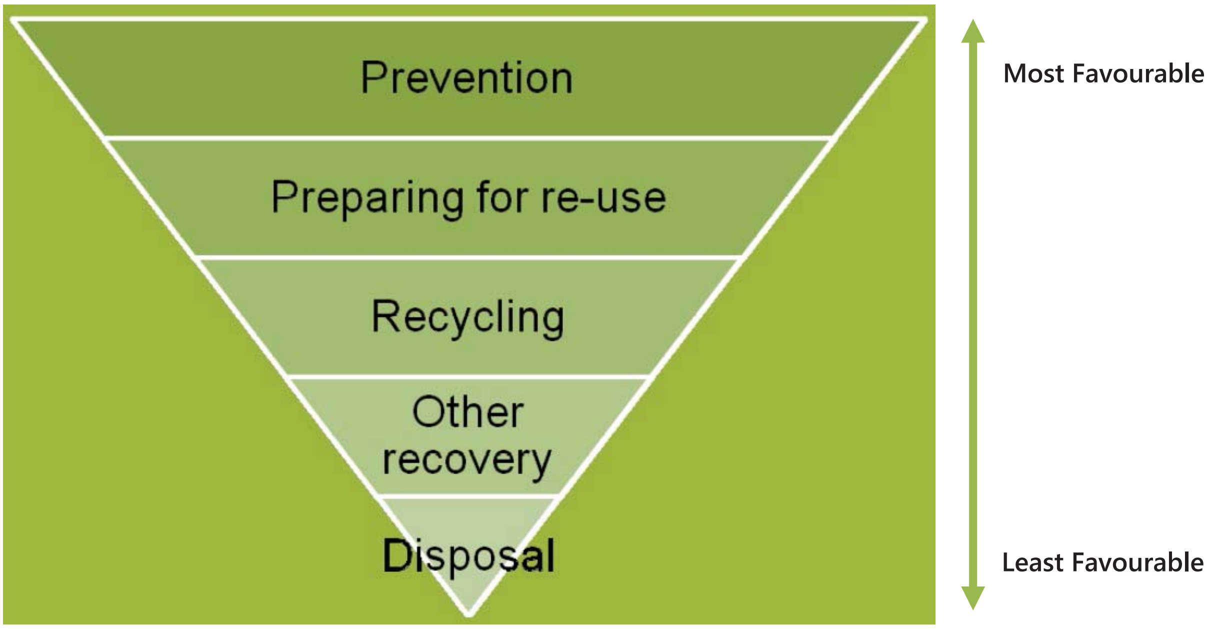
The Convention for the Protection of the Marine Environment of the North-East Atlantic, commonly referred to as the OSPAR Convention, was adopted in 1992 and entered into force in 1998. The OSPAR Convention replaced both the Oslo Convention (adopted in 1972) and the Paris Convention (adopted in 1974), 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).

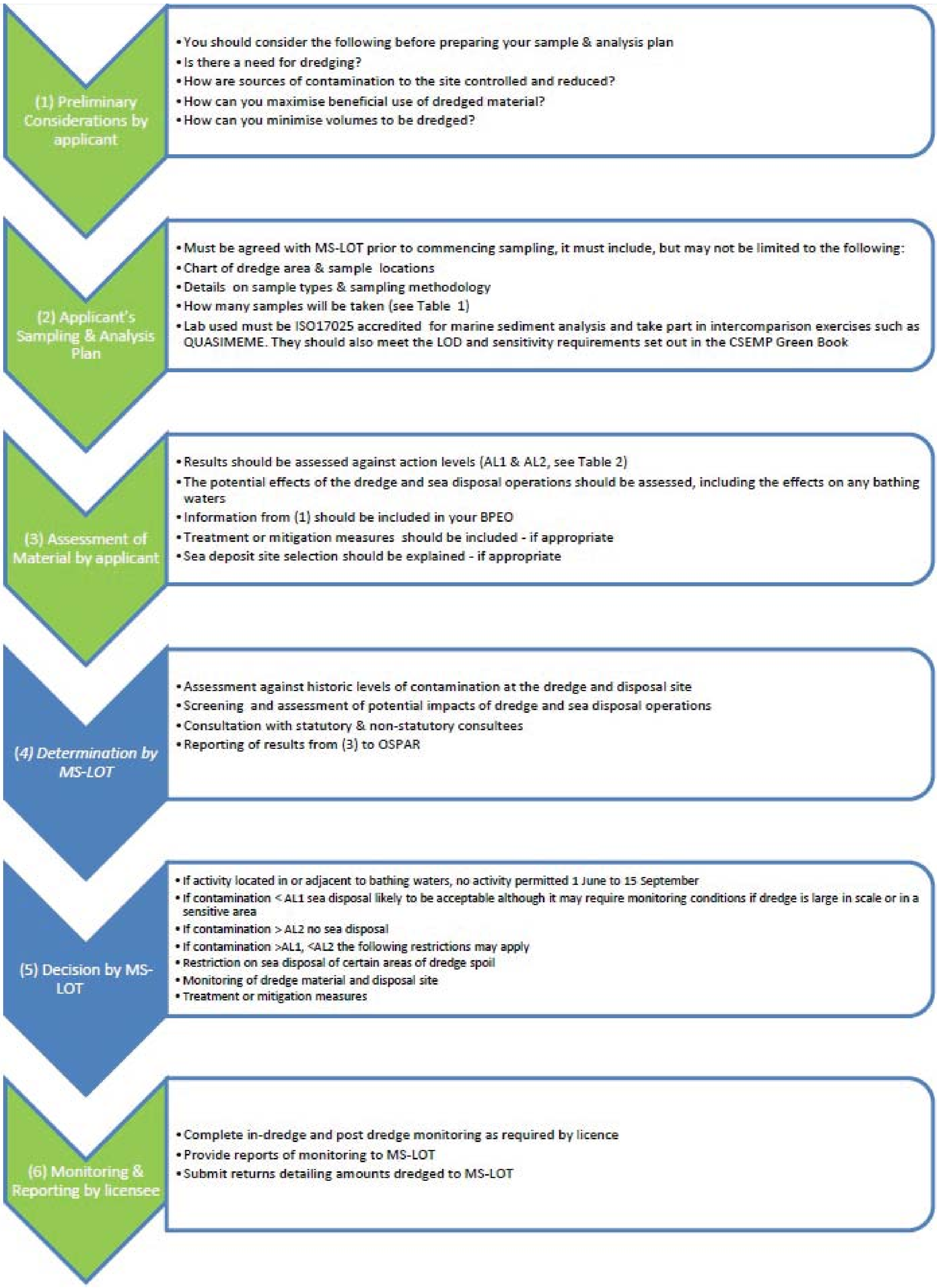
A water body is a discrete unit of water of similar characteristics. Scottish Ministers and the Scottish Environment Protection Agency (SEPA) are the competent authorities for implementation of the Water Framework Directive within the Scotland River Basin District, including transitional (i.e. estuarine) 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.

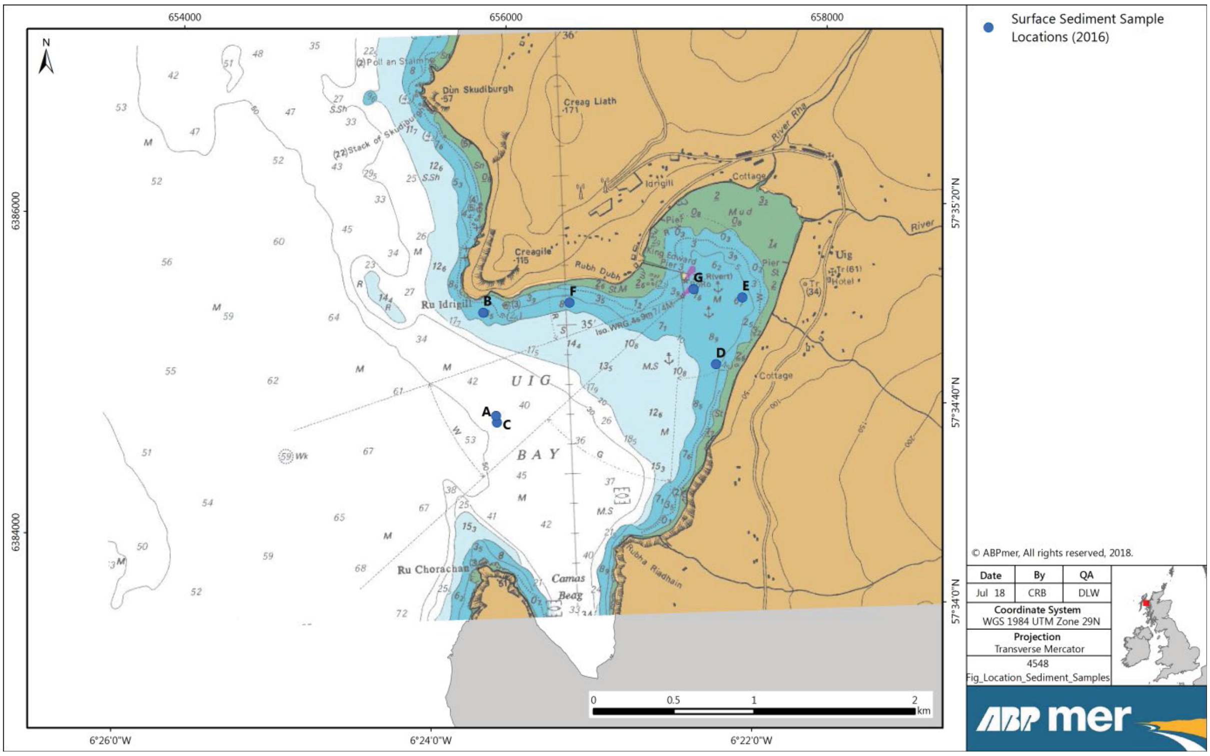
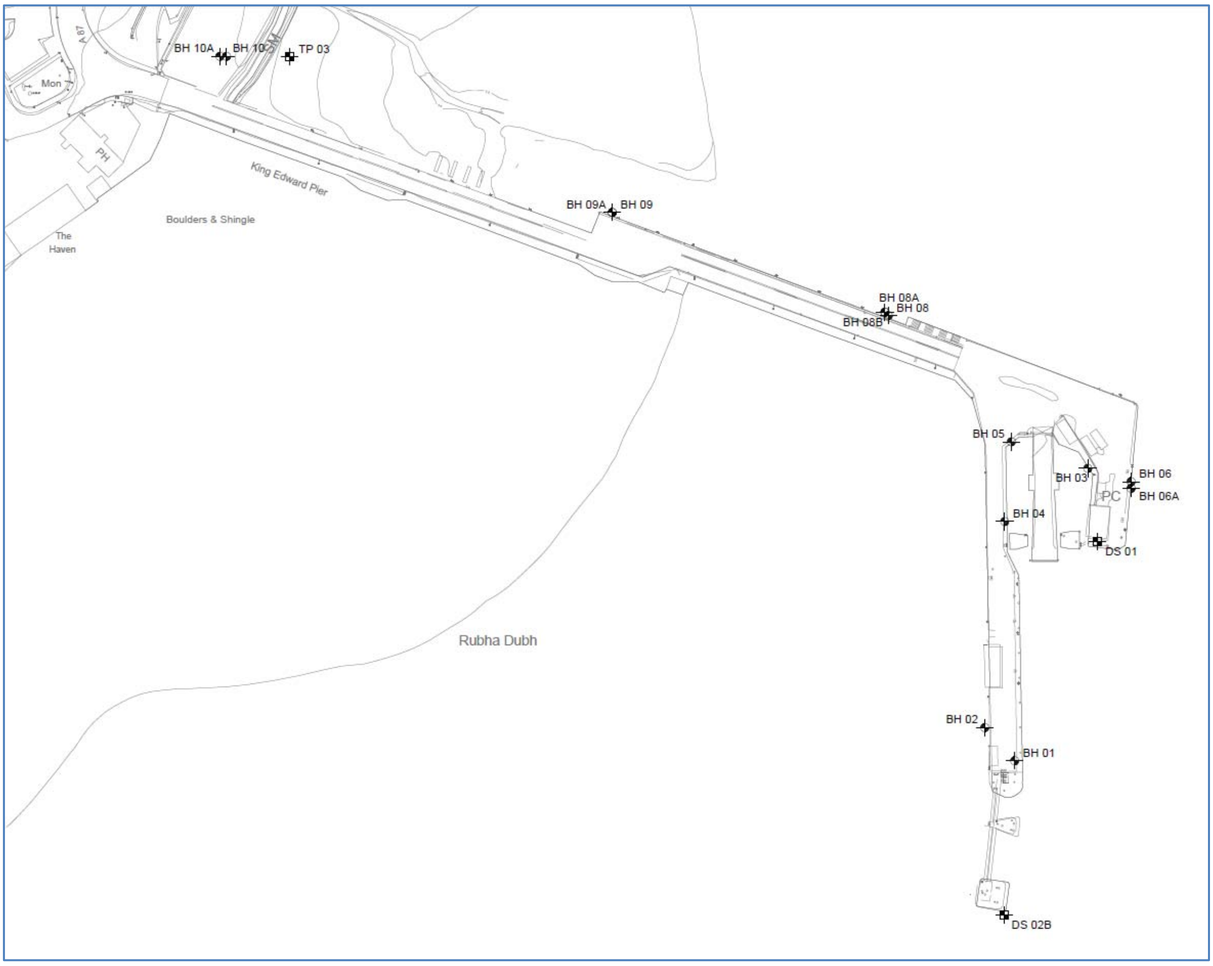


Figure 6. **Location of surface sediment samples collected around Uig Bay in 2016**

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	Dredge Pocket 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).

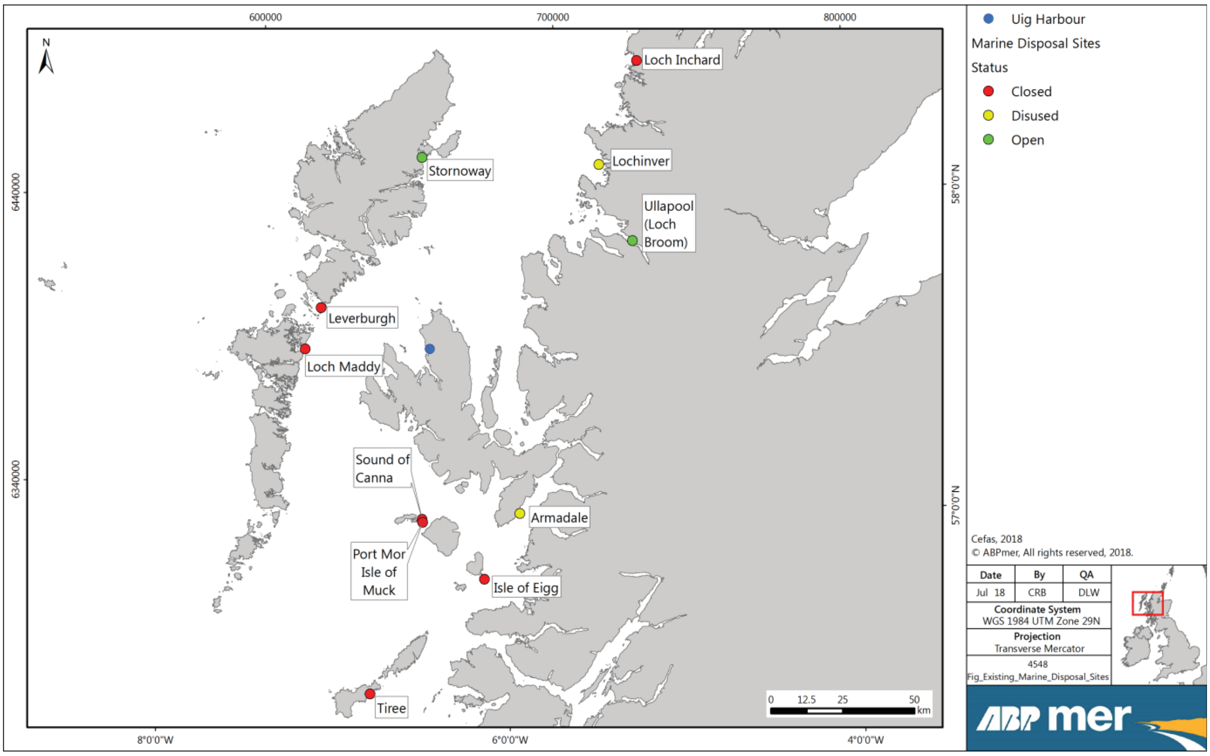


Figure 8. Existing marine disposal sites and current status

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.

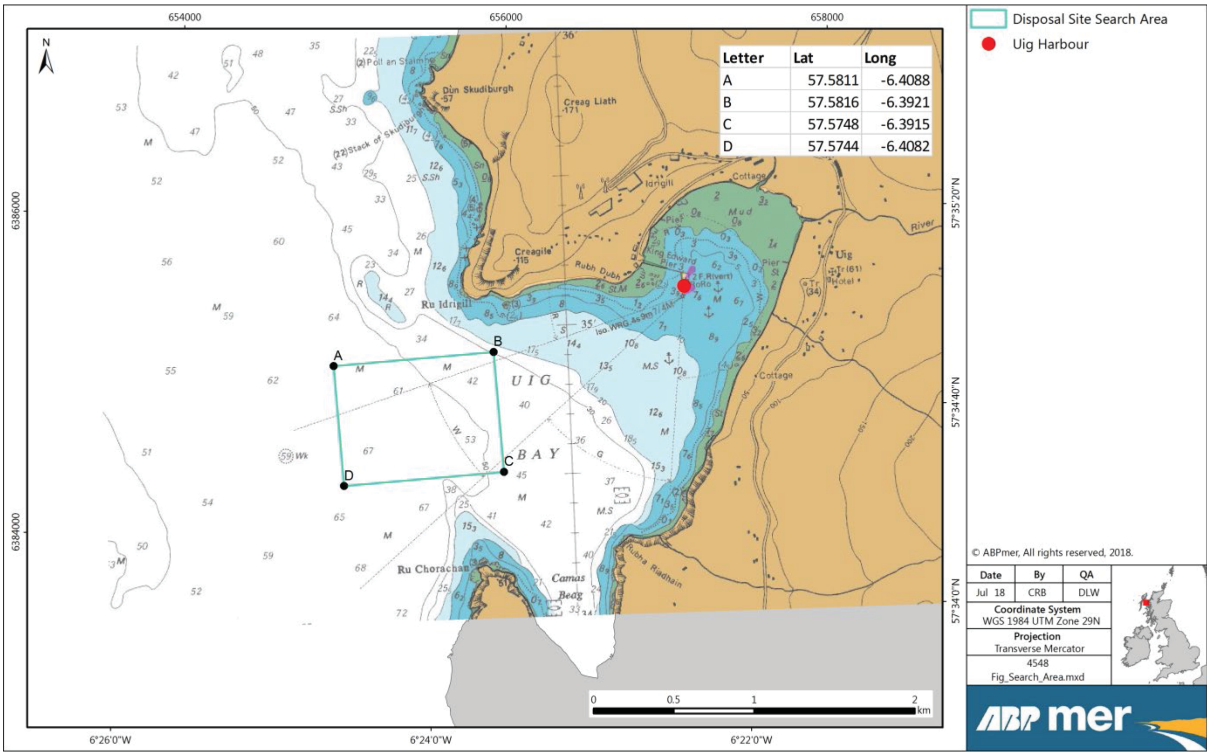


Figure 9. Location of the disposal site search area

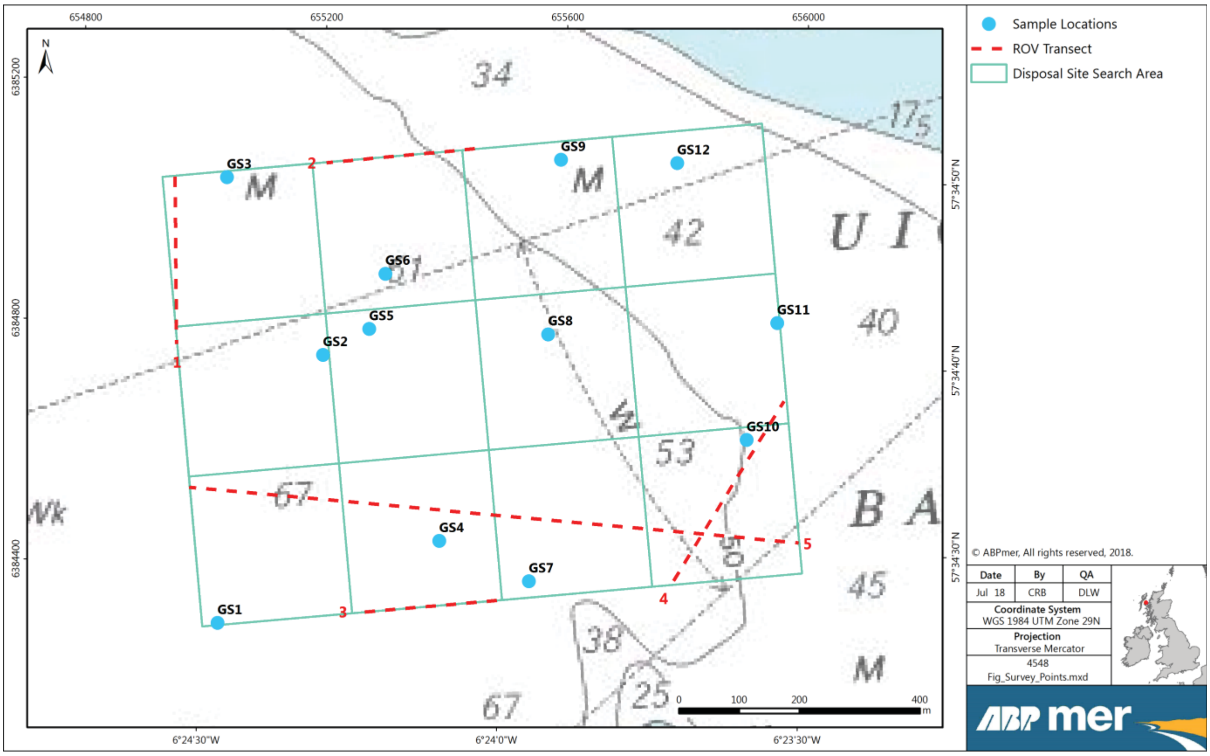


Figure 10. Location of grab sampling points and ROV transects within the disposal site search area

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

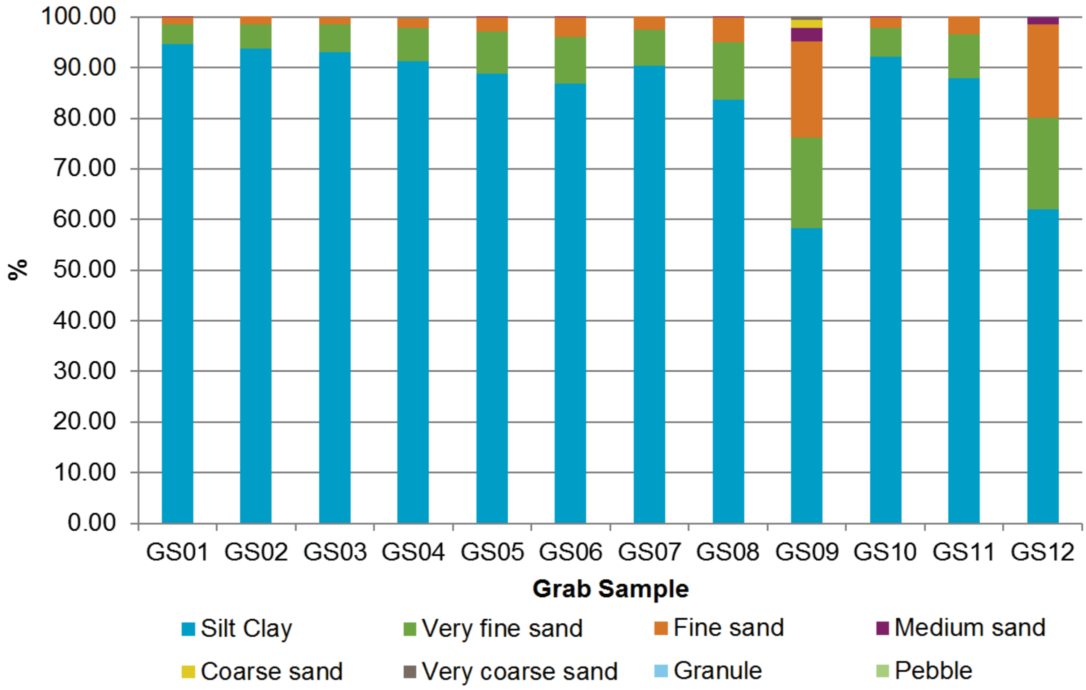
Remotely Operated Vehicle (ROV) Transect	Coordinates (WGS84; Decimal Degrees)			
	Start		Finish	
	Latitude	Longitude	Latitude	Longitude
1	57.578620	-6.4085675	57.58111	-6.40843
2	57.581236	-6.4042131	57.58136	-6.40004
3	57.574512	-6.4038680	57.57462	-6.39981
4	57.574746	-6.3951075	57.57742	-6.39178
5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

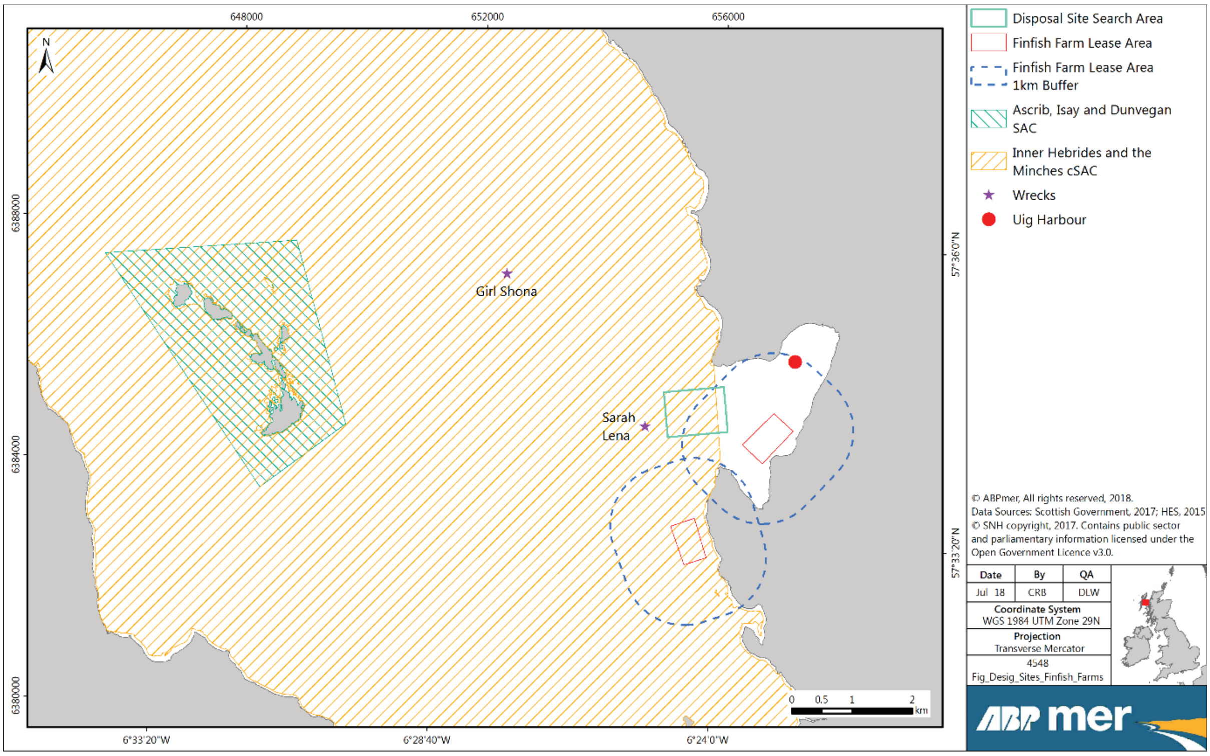


Figure 12. Nature conservation designated sites, finfish farms and known wrecks

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.

[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

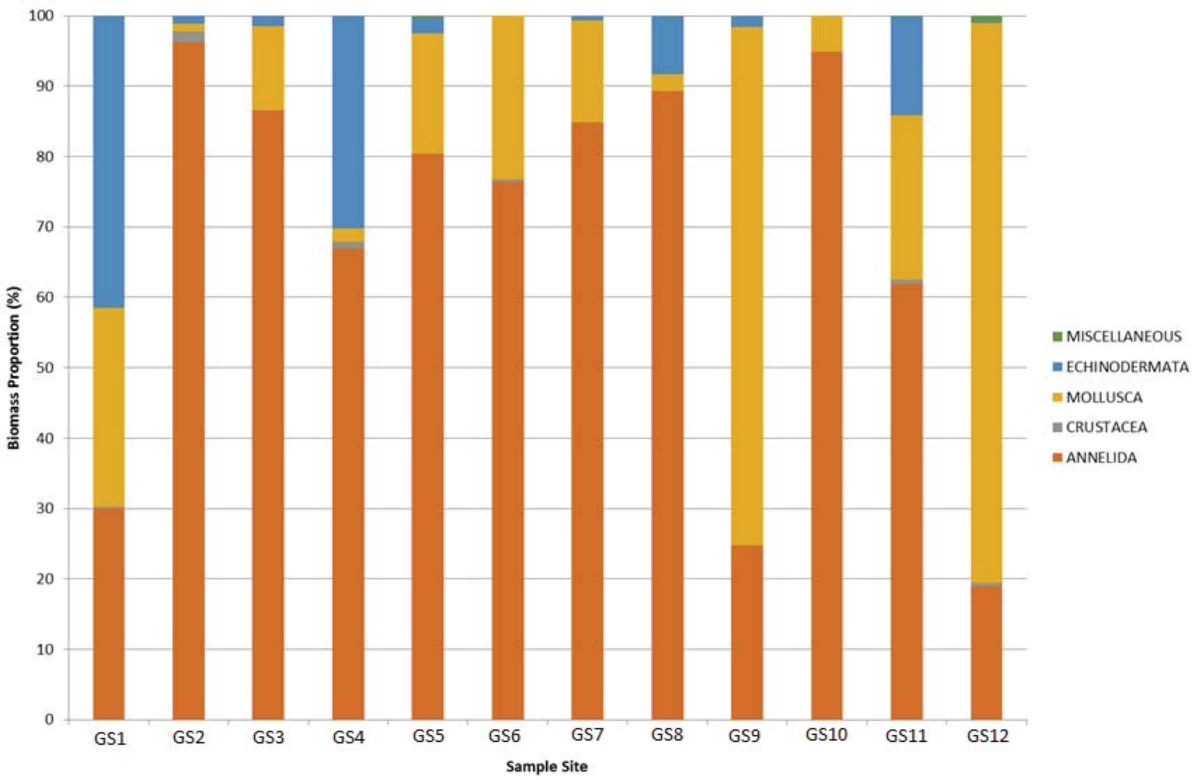
Taxon Group	Number of Species	Mean Abundance (Individuals/m^2)
Polychaeta	28	145
Crustacea	4	4.2
Mollusca	14	66.7
Echinodermata	4	10
Nemertea	1	0.8
Phoronida	1	1.7
Sipuncula	1	0.8
Cnidaria	1	0.1
Total	**54**	**223.9**

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.

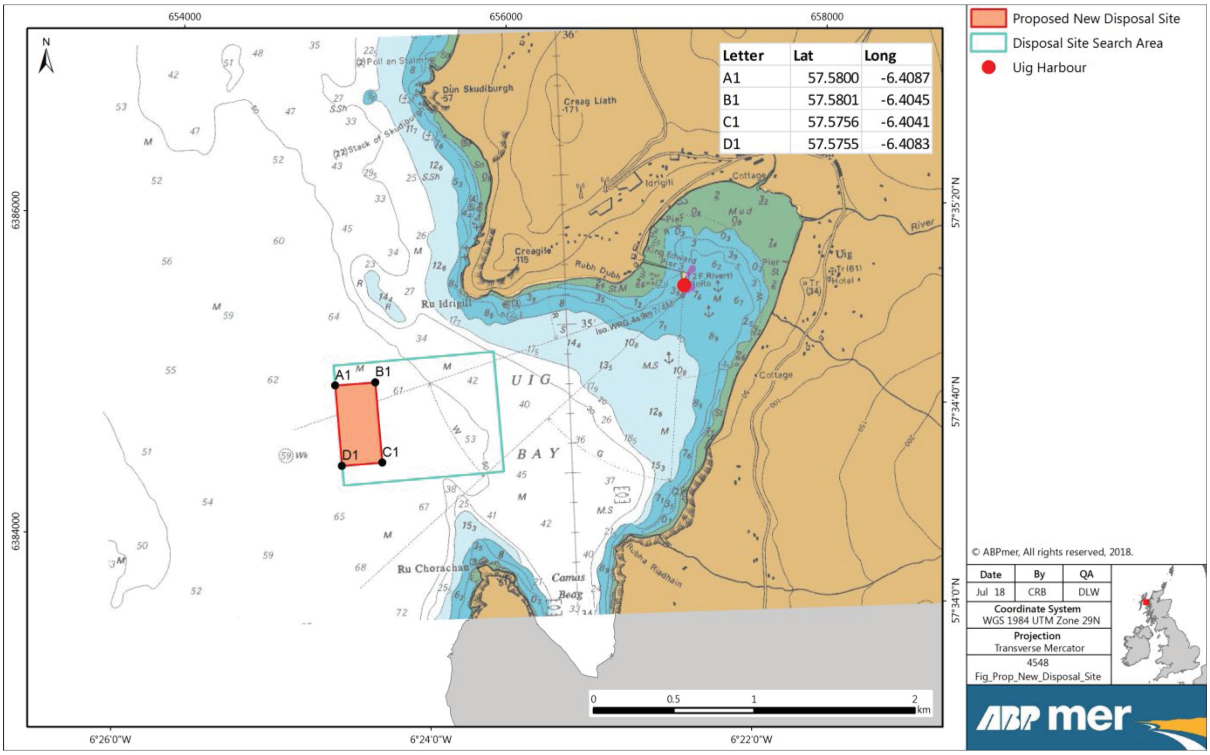


Figure 14. **Location of the proposed new disposal site**

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

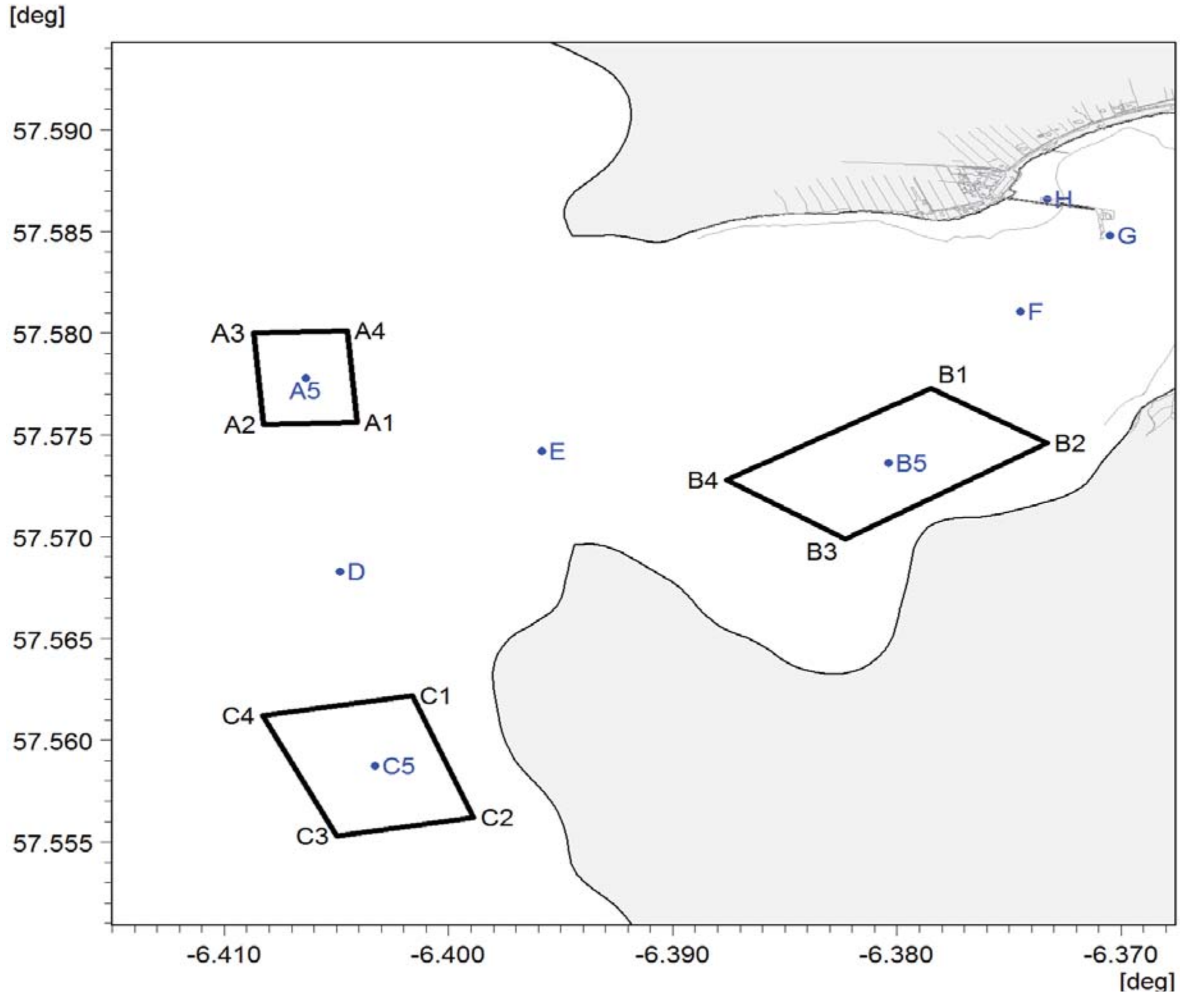
Sediment dispersion modelling was undertaken using the DHI MIKE21 PT (Particle Tracking) module, to simulate the fate of dredged sediment suspended through the disposal process. The calibrated hydrodynamic model (set up for the Uig Harbour EIA studies; AECOM, 2018b) was used to drive the PT module with 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.

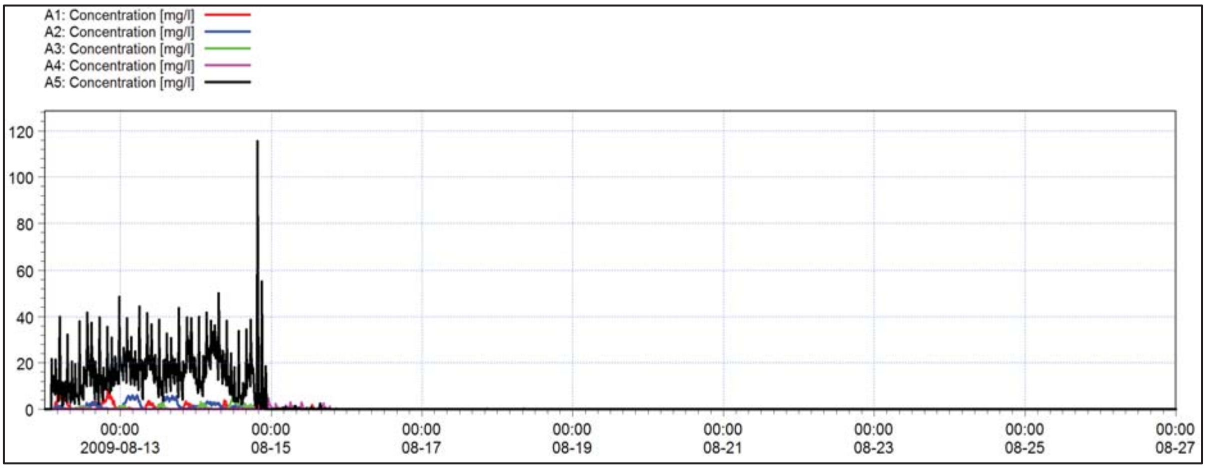
Table 16. Maximum increase in SSC for all 12 model scenarios

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.

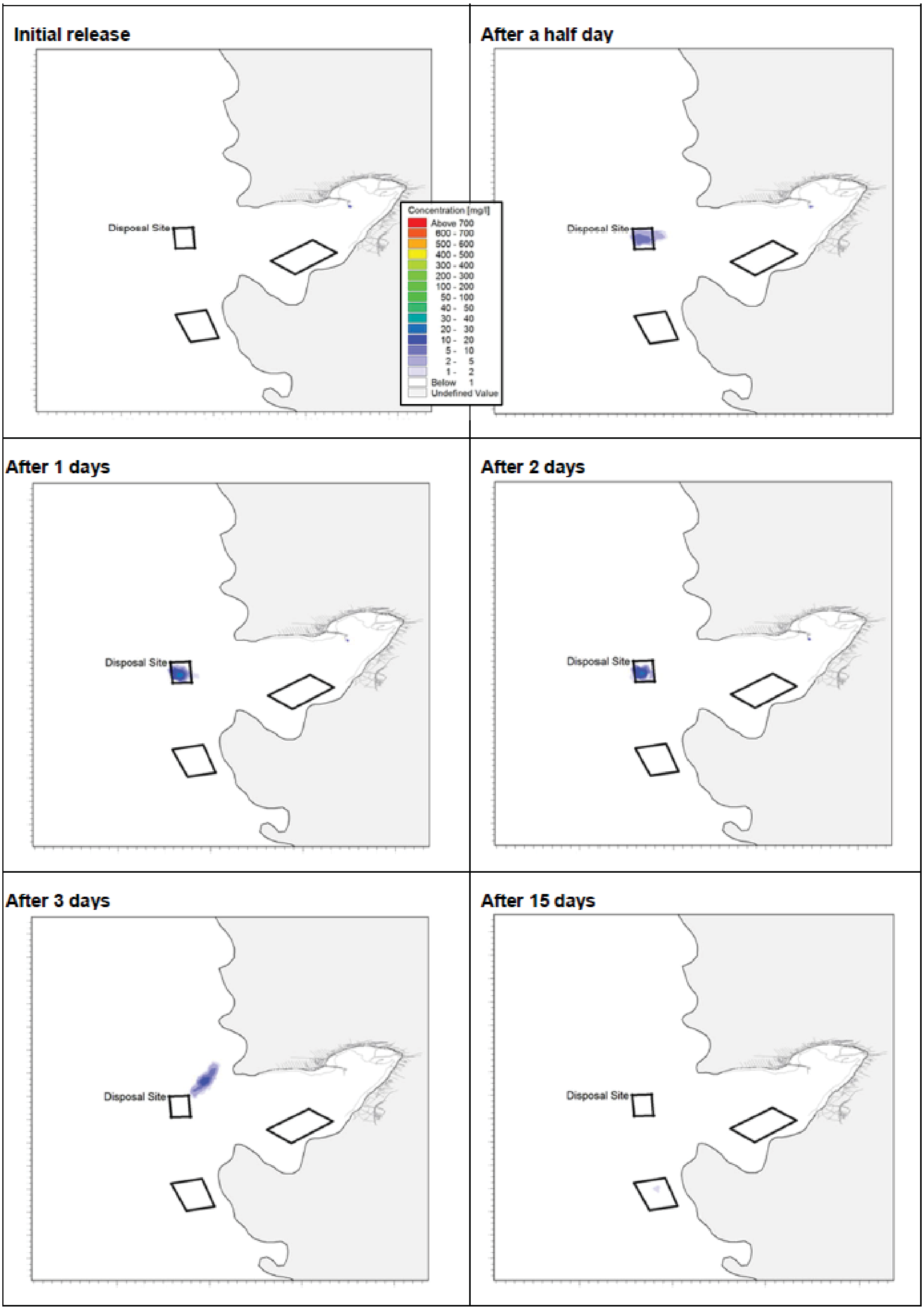
Summary

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:

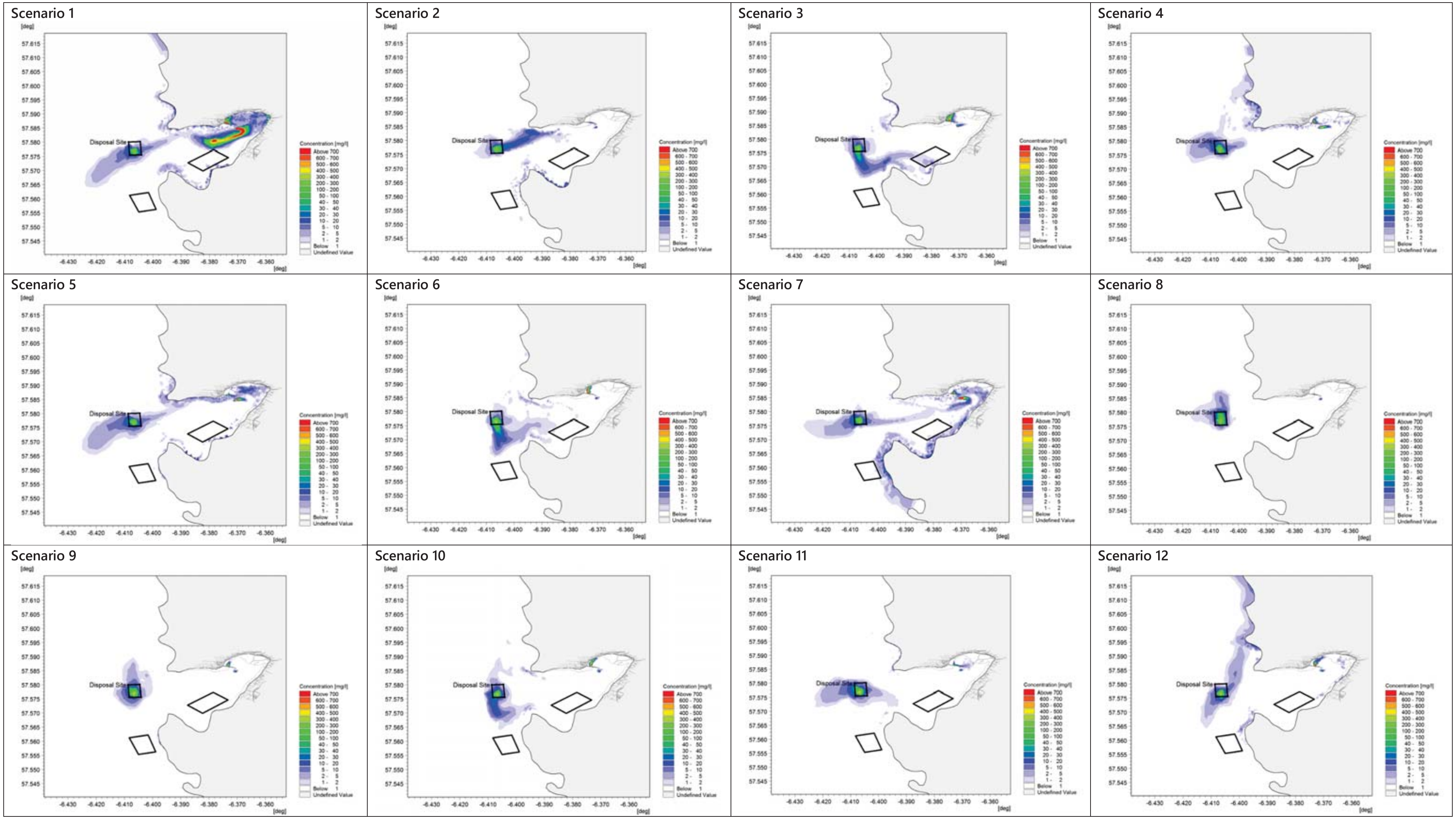
- Increases in depth averaged SSC of up to 212 mg/l are predicted (Table 16) at the proposed new disposal site, for the duration of the disposal activity;
- Following cessation of disposal operations, predicted increases in SSC rapidly reduce such that after 1-day following the final disposal, concentrations 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



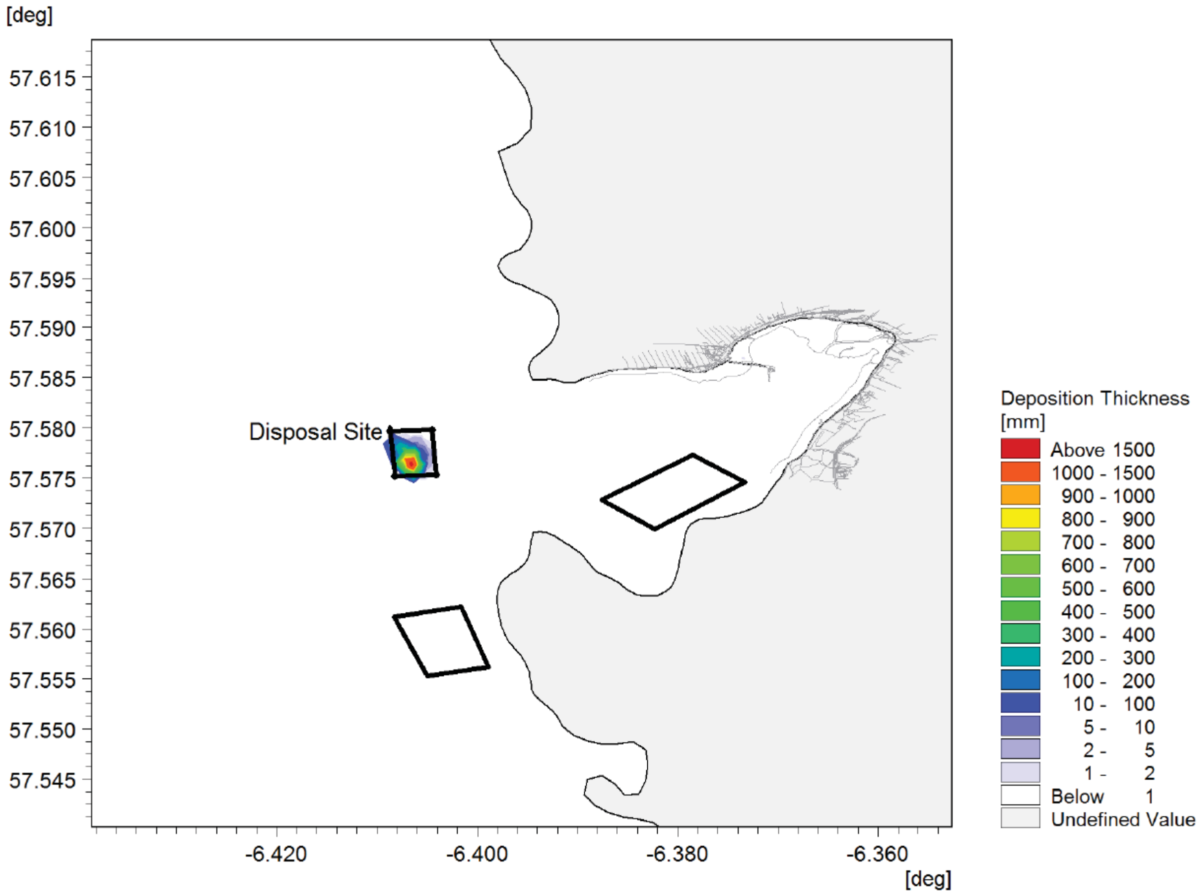
Source: AECOM, 2018b

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).

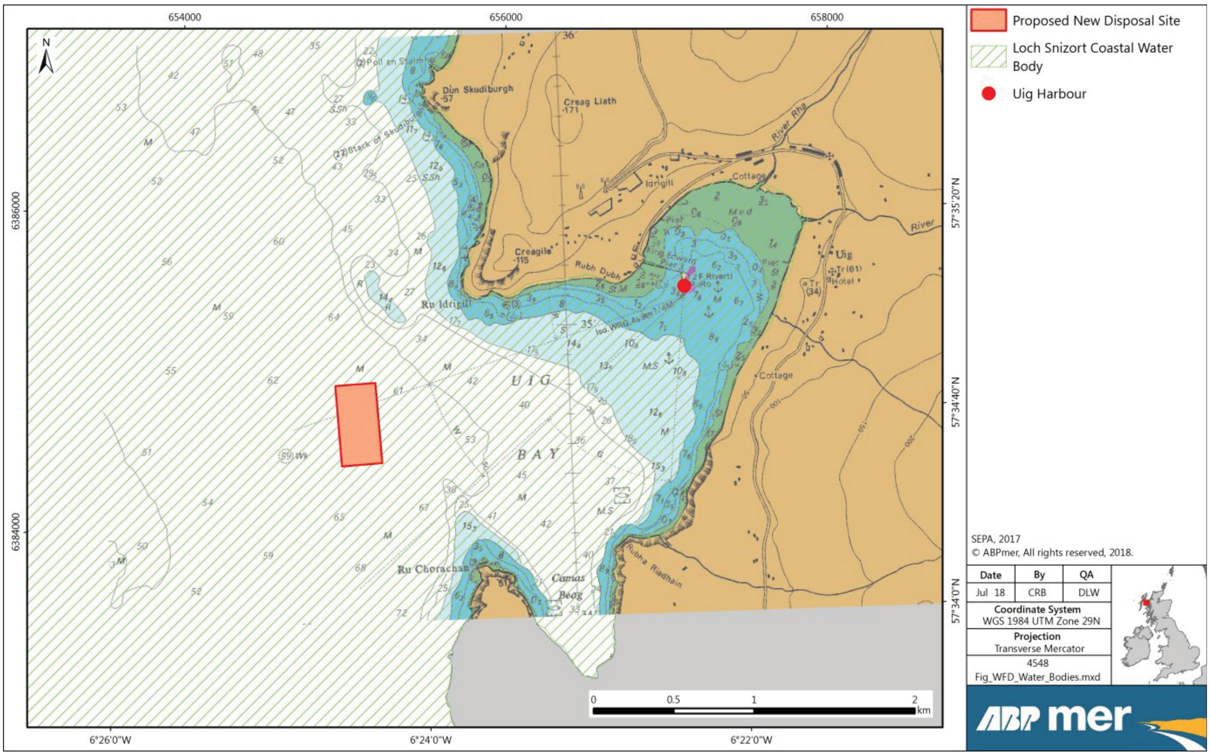


Figure 20. Water Framework Directive water bodies in the vicinity of the proposed new disposal site

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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3. Project Description

3.1 Current Ferry Timetable for Uig

TEXT CODE 22

UIG (SKYE) - LOCHMADDY (NORTH UIST)

Table 22

DAY	Uig Depart	Lochmaddy Arrive	Lochmaddy Depart	Uig Arrive
Operates 29 March - 3 May and 10 September - 20 October				
MON	0930	1115	1145	1330
	1830	2015	-	-
TUE	-	-	0715	0900
	1400	1545	1615	1800
WED	0930	1115	1145	1330
	1930	2115	-	-
THU	-	-	0715	0900
	1400	1545	1615	1800
FRI	0930	1115	1145	1330
	1830	2015	-	-
SAT	-	-	0730	0915
	1430	1615	1645	1830
SUN	-	-	1100	1245
	1835	2020	-	-
Operates 4 May - 09 September				
DAY	Uig Depart	Lochmaddy Arrive	Lochmaddy Depart	Uig Arrive
MON	0930	1115	1145	1330
	1830	2015	-	-
TUE	-	-	0715	0900
	1400	1545	1615	1800
WED	0930	1115	1145	1330
	1930	2115	-	-
THU	-	-	0715	0900
	1400	1545	1615	1800
FRI	0930	1115	1145	1330
	1830	2015	2040 A	2225 A
	2240 AB	0025 AB	-	-
SAT	-	-	0730	0915
	1430	1615	1645	1830
SUN	0930	1115	1145	1330
	1835	2020	2040	2225

CODE

A	Operates from 21 June - 30 Aug only
B	Arrives following morning

NOTE

Check-in closes for vehicles 45 minutes and passengers 30 minutes prior to departure
Commercial vehicle bookings are handled at individual ports. When calling your selected port to make a commercial vehicle booking, please select option 2 on a touch-tone phone. Contact Uig port office on 01470 220116 or Lochmaddy on 01876 522509
For information on bus services in this area, contact Traveline on 0871 200 2233 or visit www.traveline.info

FARES

UIG - LOCHMADDY		Single	Return
Driver/passenger		£6.50	£13.00
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.25	£6.50
Car or 4x4 (excludes driver)		£31.65	£63.30
Motorhome (excludes driver)	Up to 6m	£31.65	£63.30
	Up to 8m	£47.50	£95.00
	Up to 10m	£63.30	£126.60
Caravan, boat/baggage trailer	Up to 2.5m	£15.85	£31.70
	Up to 6m	£31.65	£63.30
	Up to 8m	£47.50	£95.00
Motorcycle		£15.85	£31.70
Pedal cycles (restricted numbers)		Free	Free
LOCHMADDY - TARBERT		**Single**	**Return**
Driver/passenger		£6.75	£13.50
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.40	£6.80
Car or 4x4 (excludes driver)		£33.25	£66.50
Motorhome (excludes driver)	Up to 6m	£33.25	£66.50
	Up to 8m	£49.90	£99.80
	Up to 10m	£66.50	£133.00
Caravan, boat/baggage trailer	Up to 2.5m	£16.65	£33.30
	Up to 6m	£33.25	£66.50
	Up to 8m	£49.90	£99.80
Motorcycle		£16.65	£33.30
Pedal cycles (restricted numbers)		Free	Free
This route is not valid via Uig (SKYE)			
Groups of 6 or more pedal cycles must inform the relevant port office in advance of travel. It should be noted that as we may not be able to offer the first sailing of choice, therefore groups may not always be able to travel together			
Light goods vehicles exceeding 6 metres in length or 3.5 tonnes in weight, or 3 metres in height, or 2.3 metres in width are charged at commercial vehicle rate			

NORTH UIST

TEXT CODE 22

UIG (SKYE) - LOCHMADDY (NORTH UIST)

Table 22

DAY	Uig Depart	Lochmaddy Arrive	Lochmaddy Depart	Uig Arrive
MON, WED, FRI	0940	1125	1150	1335
	1800	1945	-	-
TUE,SAT	-	-	0730	0915
	1400	1545	1610	1755
THU	-	-	0730	0915
	0940	1125	1150	1335
SUN	-	-	1115	1300
	1430	1615	-	-
OPERATES 26 DECEMBER 2018 AND 2 JANUARY 2019 ONLY				
DAY	Lochmaddy Depart	UIG Arrive	UIG Depart	Lochmaddy Arrive
WED	0730	0915	1400	1545

CODE

A	Departs for Tarbert, arriving 1930

NOTE

All vehicle drivers and their passengers must be in possession of a valid travel ticket and be available for boarding no later than 45 minutes before departure otherwise travel cannot be guaranteed. Foot passenger check-in closes 30 minutes before departure
No service 25 December and 1 January
Commercial vehicle bookings are handled at individual ports. When calling your selected port to make a commercial vehicle booking, please select option 2 on a touch-tone phone. Contact Uig port office on 01470 220116 or Lochmaddy on 01876 522509

FARES

UIG - LOCHMADDY		**Single**	**Return**
Driver/passenger		£6.30	£12.60
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.15	£6.30
Car or 4x4 (excludes driver)		£30.90	£61.80
Motorhome (excludes driver)	Up to 6m	£30.90	£61.80
	Up to 8m	£46.35	£92.70
	Up to 10m	£61.80	£123.60
Caravan, boat/baggage trailer	Up to 2.5m	£15.45	£30.90
	Up to 6m	£30.90	£61.80
	Up to 8m	£46.35	£92.70
Motorcycle		£15.45	£30.90
Pedal cycles (restricted numbers)		Free	Free
LOCHMADDY - TARBERT		Single	Return
Driver/passenger		£6.55	£13.10
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.30	£6.60
Car or 4x4 (excludes driver)		£32.45	£64.90
Motorhome (excludes driver)	Up to 6m	£32.45	£64.90
	Up to 8m	£48.70	£97.40
	Up to 10m	£64.90	£129.80
Caravan, boat/baggage trailer	Up to 2.5m	£16.25	£32.50
	Up to 6m	£32.45	£64.90
	Up to 8m	£48.70	£97.40
Motorcycle		£16.25	£32.50
Pedal cycles (restricted numbers)		Free	Free
This route is not valid via Uig (SKYE)			
Groups of 6 or more pedal cycles must inform the relevant port office in advance of travel. It should be noted that as we may not be able to offer the first sailing of choice, therefore groups may not always be able to travel together			
Light goods vehicles exceeding 6 metres in length or 3.5 tonnes in weight, or 3 metres in height, or 2.3 metres in width are charged at commercial vehicle rate			

HARRIS

TEXT CODE 24

UIG (SKYE) - TARBERT (HARRIS)

Table 24

Operates 29 March - 3 May and 10 September - 20 October				
DAY	Uig Depart	Tarbert Arrive	Tarbert Depart	Uig Arrive
MON	-	-	0720	0900
	1410	1550	1620	1800
TUE	0930	1110	1140	1320
	1830	2010	-	-
WED	-	-	0720	0900
	1410	1550	1620	1800
THU	0930	1110	1140	1320
	1830	2010	-	-
FRI	-	-	0720	0900
	1410	1550	1620	1800
SAT	0950	1130	1210	1350
	1900	2040	-	-
SUN	-	-	0845 A	1245 A
	1415	1555	1625	1805
	1835 A	2230 A	-	-
Operates 4 May - 09 September				
DAY	Uig Depart	Tarbert Arrive	Tarbert Depart	Uig Arrive
MON	0515	0655	0720	0900
	1410	1550	1620	1800
TUE	0930	1110	1140	1320
	1830	2010	-	-
WED	-	-	0720	0900
	1410	1550	1620	1800
THU	0930	1110	1140	1320
	1830	2010	-	-
FRI	-	-	0720	0900
	1410	1550	1620	1800
SAT	0950	1130	1210	1350
	1900	2040	2110	2250
SUN	1415	1555	1625	1805

CODE

A	Operates via Lochmaddy 31 March - 28 April and from 15 September - 20 October

NOTE

Check-in closes for vehicles 45 minutes and passengers 30 minutes prior to departure
Commercial vehicle bookings are handled at individual ports. When calling your selected port to make a commercial vehicle booking, please select option 2 on a touch-tone phone. Contact Uig port office on 01470 220116 or Tarbert on 01859 570376
For information on bus services in this area, contact Traveline on 0871 200 2233 or visit www.traveline.info

FARES

UIG - TARBERT		Single	Return
Driver/passenger		£6.50	£13.00
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.25	£6.50
Car or 4x4 (excludes driver)		£31.65	£63.30
Motorhome (excludes driver)	Up to 6m	£31.65	£63.30
	Up to 8m	£47.50	£95.00
	Up to 10m	£63.30	£126.60
Caravan, boat/baggage trailer	Up to 2.5m	£15.85	£31.70
	Up to 6m	£31.65	£63.30
	Up to 8m	£47.50	£95.00
Motorcycle		£15.85	£31.70
Pedal cycles (restricted numbers)		Free	Free
Groups of 6 or more pedal cycles must inform the relevant port office in advance of travel. It should be noted that as we may not be able to offer the first sailing of choice, therefore groups may not always be able to travel together			
Light goods vehicles exceeding 6 metres in length or 3.5 tonnes in weight, or 3 metres in height, or 2.3 metres in width are charged at commercial vehicle rate			

HARRIS

TEXT CODE 24

UIG (SKYE) - TARBERT (HARRIS)

Table 24

DAY	Uig Depart	Tarbert Arrive	Tarbert Depart	Uig Arrive
MON WED FRI	-	-	0730	0910
	1400	1540	1600	1740
TUE SAT	0940	1120	1150	1330
	1815	1955	-	-
THU	1500	1640	-	-
SUN	-	-	0900 A	1300 A
	1430 A	1820 A	-	-
OPERATES 26 DECEMBER 2018 AND 2 JANUARY 2019 ONLY				
DAY	UIG Depart	Tarbert Arrive	Tarbert Depart	UIG Arrive
WED	0940	1120	1150	1330

CODE

A	Operates via Lochmaddy

NOTE

All vehicle drivers and their passengers must be in possession of a valid travel ticket and be available for boarding no later than 45 minutes before departure otherwise travel cannot be guaranteed. Foot passenger check-in closes 30 minutes before departure

No service 25 December and 1 January

Commercial vehicle bookings are handled at individual ports. When calling your selected port to make a commercial vehicle booking, please select option 2 on a touch-tone phone.
Contact Uig port office on 01470 220116
or Lochmaddy on 01876 522509

FARES

UIG - TARBERT		Single	Return
Driver/passenger		£6.30	£12.60
Child 5-15 (Infant under 5 free, must have a valid ticket)		£3.15	£6.30
Car or 4x4 (excludes driver)		£30.90	£61.80
Motorhome (excludes driver)	Up to 6m	£30.90	£61.80
	Up to 8m	£46.35	£92.70
	Up to 10m	£61.80	£123.60
Caravan, boat/baggage trailer	Up to 2.5m	£15.45	£30.90
	Up to 6m	£30.90	£61.80
	Up to 8m	£46.35	£92.70
Motorcycle		£15.45	£30.90
Pedal cycles (restricted numbers)		Free	Free

Groups of 6 or more pedal cycles must inform the relevant port office in advance of travel. It should be noted that as we may not be able to offer the first sailing of choice, therefore groups may not always be able to travel together

Light goods vehicles exceeding 6 metres in length or 3.5 tonnes in weight, or 3 metres in height, or 2.3 metres in width are charged at commercial vehicle rate

4. Legislative and Planning Context

4.1 Technical, topic specific legislation and policy

Appendix 4.1 – Technical Topic Specific Legislation, Policy and Guidance

Chapter 8: Marine Water and Sediment Quality

Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EEC) establishes a framework for the management and protection of Europe's water resources. The overall objective of the WFD is to achieve good status in all inland, transitional (estuarine), coastal and ground waters (out to one nautical mile from the low water mark) by 2015, unless alternative objectives are set and there are appropriate reasons for time limited derogation. It is implemented in Scotland through the Water Environment and Water Services (Scotland) Act 2003 and the Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activity Regulations (CAR).

The Proposed Development is located within the Loch Snizort coastal water body (ID: 200141; 120.3 km2) in the Scotland river basin district and reported in the Scotland River Basin Management Plan (RBMP; Scottish Government, 2015a). It is necessary to consider whether the Proposed Development might compromise achievement of WFD objectives for this water body, as well as adjacent water bodies.

Priority Substance Directive

There have been two amendments to the WFD through the development of the Priority Substances Directive (2008/105/EC and 2013/39/EU). Compliance with chemical status objectives under the WFD is assessed in relation to environmental quality standards (EQS) for a specified list of 'priority' and 'priority hazardous' substances. These substances were first established by Directive 2008/105/EC which entered into force in 2009. It sets objectives, amongst other things, for the reduction of these substances through the cessation of discharges or emissions. As required by the WFD and Directive 2008/105/EC, a proposal to revise the list of priority (hazardous) substances was submitted in 2012. Subsequently, an updated Priority Substances Directive (2013/39/EU) was published in 2013, identifying new priority substances, setting EQSs for those newly identified substances, revising the EQS for some existing substances in line with scientific progress and setting biota EQSs for some existing and newly identified priority substances.

Shellfish Waters Directive

The Shellfish Waters Directive (2006/113/EC) was repealed in December 2013 and subsumed within the WFD. In Scotland, it has been replaced by the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order 2013 which came into force on 22 December 2013, and subsequently updated in 2016. The Order identifies 85 coastal areas as shellfish water protected areas which are identified on a series of maps. The Water Environment (Shellfish Water Protected Areas: Environmental Objectives etc.) (Scotland) Regulations 2013 make provisions in relation to the setting of environmental objectives and the programme of measures to be applied to these protected areas. The Scotland River Basin District (Quality of Shellfish Water Protected Areas) (Scotland) Directions 2015 direct SEPA to assess and classify the quality of each shellfish water protected area as either good, fair or insufficient (by reference to specified criteria and standards, as described in Article 3).

Bathing Water Directive

The revised Bathing Water Directive (rBWD) (2006/7/EC) was adopted in 2006, updating the microbiological and physico-chemical standards set by the original Bathing Water Directive (BWD) (76/160/EEC) and the process used to measure/monitor water quality at identified bathing waters. The rBWD focuses on fewer microbiological indicators, whilst setting higher standards, compared to those of the BWD. Bathing waters under the rBWD are classified as excellent, good, sufficient or poor according to the levels of certain types of bacteria (intestinal enterococci and Escherichia coli) in samples obtained during the bathing season (May to September). The BWD was repealed at the end of 2014 and monitoring of bathing water quality has been reported against rBWD indicators since 2015. The new classification system considers all samples obtained during the previous four years and, therefore, data has been collected for rBWD indicators since 2012.

Nitrates Directive

The Nitrates Directive (91/676/EEC) aims to reduce water pollution from agricultural sources and to prevent such pollution occurring in the future (nitrogen is one of the nutrients that can affect plant growth). Under the Nitrates Directive, surface waters are identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water body. Specifically, the Directive requires Member States to apply agricultural action programme measures throughout their whole territory or within discrete nitrate vulnerable zones (NVZ's). Action programme measures are required to promote best practice in the use and storage of fertiliser and manure.

Urban Waste Water Treatment Directive

The Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) aims to protect the environment from the adverse effects of the collection, treatment and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges. It was transposed into legislation in Scotland by the Urban Waste Water Treatment (Scotland) Regulations 1994, amended by the Urban Waste Water Treatment (Scotland) Amendment Regulations 2003.

In general, the UWWTD requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water. Sensitive areas under the UWWTD are water bodies affected by eutrophication of elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

London Convention 1972 and London Protocol 1996

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, commonly referred to as the London Convention 1972, is one of the first global conventions to protect the marine environment from human activities and has been in force since 1975. The key objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. In 1996, the London Protocol was agreed to further modernise the London Convention and, eventually, replace it. Under the London Protocol, all dumping is prohibited, except for possibly acceptable wastes on the so-called "reverse list". The London Protocol entered into force on 24 March 2006.

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic, commonly referred to as the OSPAR Convention, was open for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992, and entered into force on 25 March 1998.

The OSPAR Convention embraces a more holistic responsibility for environmental protection in the region, including its biodiversity.

Of particular relevance to the Proposed Development, the 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 in accordance with the provisions of the Convention. The dumping of all wastes or other matter is prohibited, except for those wastes or other matter listed in Annex II of the Convention which includes dredged material. As required under Annex II (Article 6) of the Convention, Agreement 2014-06 presents the latest guidelines for the management of dredged material at sea (OSPAR Commission, 2014).

Waste Water Framework Directive

The Waste Framework Directive (WaFD) (2008/98/EC), which entered into force on 12 December 2008, provides the legislative framework for the collection, transport, recovery and disposal of waste. It includes a definition of waste, specifically 'any substance or object which the holder discards or intends or is required to discard'. The Directive requires all EU member states to take the necessary measures to ensure waste is recovered or disposed of without endangering human health or causing harm to the environment and includes permitting, registration and inspection requirements. It establishes the waste hierarchy (Article 4), the main objective of which is the complete prevention of waste. Where waste cannot be avoided, the hierarchy aims for re-use, recycling or recovery of waste, with disposal (whether to landfill or at sea) the least favourable option.

In terms of disposal activity, it was necessary to consider the requirements of the Proposed Development against the waste hierarchy and, subsequently, identify and characterise a proposed new disposal site. Therefore, a Disposal Site Characterisation Report (ABPmer, 2018) has been prepared separately, including reference to the waste hierarchy assessment and rationale for identifying the proposed new disposal site in the outer Uig Bay.

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.

This chapter discusses potential impacts to Marine Water and Sediment Quality as a receptor in its own right. However, this has also been used to inform potential impacts on nature conservation designated sites, marine habitats/species and relevant human uses in their respective chapters.

Marine Strategy Framework Directive

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) came into force in 2008 and aims to achieve Good Environmental Status (GES) of the marine environment across Europe by 2020. Each Member State is required to develop and implement a marine strategy, reviewed on a six-yearly basis. This should comprise an initial assessment of the current environmental status of its marine waters, a determination of what GES means for those waters, targets and indicators designed to show whether GES is being achieved, a monitoring programme to measure progress towards GES and a programme of measures designed to achieve or maintain GES.

The MSFD was transposed into UK law by the Marine Strategy Regulations 2010 which came into force on 15 July 2010, and which created a clear legal framework for the implementation of the MSFD in the UK. There are 11 'Descriptors' of GES, including (amongst others) seafloor integrity, biological diversity and introduction of energy (e.g. noise). GES will be assessed at the level of the European Marine Regions, of which there are two covering UK waters: Greater North Sea and the Celtic Seas (the Proposed Development is located within the latter). However, given the anticipated scale of effects associated with the Proposed Development, it is considered that reference to the MSFD (and potential assessment) would not be proportionate.

UK Marine Policy Statement

The UK Marine Policy Statement (HM Government, 2011), prepared for the purposes of Section 44 of the Marine and Coastal Access Act 2009, was adopted by the four UK devolved administrations in March 2011. It provides the framework for preparing Marine Plans (such as Scotland's National Marine Plan; Scottish Government, 2015b) and taking decisions affecting the marine environment in UK territorial waters, including marine dredging and disposal. There are also a number of UK National Policy Statements that provide more detailed guidance for specific sectors including ports (Department for Transport, 2012).

Scotland's National Marine Plan

Scotland's National Marine Plan (Scottish Government, 2015b) is a single framework, enabling the sustainable development of Scotland's marine area in a way which will protect and enhance the marine environment whilst ensuring the sustainable growth of both existing and emerging marine industries. It covers Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles), developed in accordance with the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009. Of particular relevance to this chapter, General Policy 12 (GEN 12; Water quality and resource) of Scotland's National Marine Plan states that developments and activities should not result in a deterioration of the quality of waters to which the WFD, MSFD or other related Directives apply.

Chapter 9: Flood Risk and Climate Change

Overarching Legislation

A number of specific regulations have been enacted to implement the statutory European and national legislation into UK law - these regulations include:

- EU Directive 2000/60/EC (Water Framework Directive (WFD)), transposed into the Water Environment and Water Services Act (Scotland) 2003 ('the WEWS Act');
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) in respect of discharges to surface or groundwater ('the CAR Regulations'); and,
- Flood Risk Management (Scotland) Act 2009 and the Flood Risk Management (Flood Protection Schemes, Potentially Vulnerable Areas and Local Plan Districts) (Scotland) Regulations 2010 ('the Flood Risk Management Act').

This legislation aims to protect and enhance the status of aquatic ecosystems, prevent further deterioration to such ecosystems, promote sustainable use of available water resources, and contribute to the mitigation of floods and droughts.

National Policy and Guidance

Planning Advice Notes (PANs) provide national guidance on various topics and Scottish Environment Protection Agency (SEPA) has produced a number of guidance documents covering a range of environmental issues. Those documents relevant to the water environment are listed below:

- Scottish Government. (2014). Scottish Planning Policy (SPP).
- Scottish Executive Environment and Rural Affairs Department and the Scottish Environment Protection Agency (SEPA) (Revised 2006). Planning Advice Note 51 - Planning, Environmental Protection and Regulation Scottish Environment Protection Agency. (2015). Technical Flood Risk Guidance for Stakeholders.
- SEPA. (2017). Planning Background Paper - Flood Risk.
- SEPA. (2017). Land Use Planning System SEPA Development Plan Guidance Note 2a - Development Management Guidance: Flood Risk.
- SEPA. (2018). Land Use Planning System SEPA Guidance - Flood Risk and Land Use Vulnerability Guidance.
- Scottish Natural Heritage (SNH), (2013). A Handbook on Environmental Impact Assessment.

Scotland's National Marine Plan

Scotland's National Marine Plan exists under the requirements of the both the Marine (Scotland) Act 2010 (which governs Scotland's inshore waters) and by the Marine and Coastal Access Act 2009 (which governs Scotland's offshore waters).

The plan contains both general and topic specific policies, the policies that are of relevance to the Proposed Development are:

- "GEN 5 Climate change: Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change."

- "GEN 8 Coastal process and flooding: Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding"

Highland Wide Local Development Plan (2012)

The Highland Wide Local Development Plan was adopted in April 2012. The Plan sets out the council's stance on what development should take place within the area and its policy preferences. Site specific proposals are included and the purpose of the plan is to guide development and any changes in land use in a manner that will serve the public interest.

The following policies are relevant to the Proposed Development:

- Policy 49 Coastal Development – "The site should not be at risk from coastal erosion or flooding or cause an unacceptable impact as a result of natural coastal processes which it triggers or accentuates. In relation to medium or high flood risk areas: water-based uses and sub-sea cables may be acceptable; and essential infrastructure, which cannot be located elsewhere, may be acceptable, both subject to mitigation, as appropriate."
- Policy 64 - Flood Risk – "Development proposals should avoid areas susceptible to flooding and promote sustainable flood management."

West Highland and Islands Proposed Local Development Plan (WestPlan) (2017)

The West Highland and Islands Proposed Local Development Plan (WestPlan) is currently being developed by the local planning authority. A consultation document (Main Issues Report) has been produced in order to highlight early issues which will be considered within the finalised LDP. Once the LDP is adopted this will replace the current Local Plan.

The LDP is similar to a Local Plan in that it sets out a vision and strategy for how an area, including its towns, villages and countryside, should be developed over time. It also includes policies and guidance to manage the process of development and ensure that environmental, social and economic interests are all taken into account.

The LDP for Uig shows that the site of the Proposed Development is designated for mixed use development and is seen as a potential opportunity for development and enhancement of the area as part of the works to upgrade the pier. Flood risk must be considered however, to ensure development is suitable to the level of flood risk.

One of the listed placemaking priorities for Uig is to "Encourage and safeguard crofting interests and, in particular, in bye croft land."

West Highland and Islands Local Plan As Continued in Force 2012)

The West Highland and Islands Local Plan was adopted in September 2010 and continued in force in 2012. The Plan is currently retained until it is replaced by the WestPlan.

Chapter 10: Ground Conditions, Contamination and Waste

Redevelopment of brownfield land must take into account the regulatory context of the work, provide information that is appropriate for the proposed development, and be in accordance with UK good practice.

National Legislation

The regulation and management of land contamination throughout the UK is enacted through Part IIA of the Environmental Protection Act 1990. The Act sets out a regulatory framework for the identification and remediation of contaminated land and includes a statutory definition for contaminated land: "*land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that significant harm is being caused or there is a significant possibility of such harm being caused; or pollution of controlled waters is being, or is likely to be, caused.*"

The Act is developed by the Contaminated Land (Scotland) Regulations 2000 (Ref 10.1) and the Contaminated Land (Scotland) Regulations 2005 (Ref 10.2), which form the current basis for regulation of contaminated land (and the water environment) by the local authority (and under some circumstances, SEPA).

Along with PAN 33 (Planning Advice Note 33: Development of Contaminated Land (Revised 2000)) (Ref 10.3), the Act embraces a risk-based "suitable for use" approach, which is defined within PAN 33 as "*ensuring that land is made suitable for any new use [by] assessing the potential risks from contamination upon the basis of the proposed future use and circumstances, … and, where necessary, to avoid unacceptable risks to human health or the wider environment, remediating the land before the new use commences*".

Legislation aimed at protecting water environment receptors from contamination include the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (Ref 10.4), while the Control of Substances Hazardous to Health (COSHH) Regulations (2002) (Ref 10.5) and the Construction, Design and Management (CDM) Regulations (2015) (Ref 10.6) place specific duties on the designer, THC and contractors to protect employees and other persons from the hazards of substances and ensure health, safety and welfare are prioritised during construction projects.

While the Proposed Development does not necessarily constitute an overall change in the existing use of the site area, this assessment has embraced the basis of the above approach and has been prepared within the context of the Proposed Development.

Geological and geomorphological features of importance are protected via designation as Sites of Special Scientific Interest (SSSI) or Regionally Important Geological Sites (RIGS), administered and monitored by Scottish Natural Heritage (SNH).

Planning Policy Context

Within Scotland, the management of contaminated or potentially contaminated land is regulated under two regimes: the Contaminated Land Regime, which implements the provisions of Part 2A of the Environmental Protection Act (EPA) 1990 (Ref 10.7) (as inserted by section 57 of the Environment Act 1995 (Ref 10.8) and the Planning Regime, implementing the Town and Country Planning Act (Scotland) 1997 as amended by The Planning etc. (Scotland) Act 2006 (Ref 10.9).

Whilst the Contaminated Land Regime and the Planning Regime are distinct regimes, there is considerable overlap between the two in that both are underpinned by the risk-based 'suitable for use' approach, which the Scottish Government considers as the most appropriate to deal with historic contamination. The purpose of the Contaminated Land Regime is to investigate, identify and if necessary remediate contaminated land to ensure that it is suitable for its current use. The management of contaminated land within the Planning Regime is achieved by assessing risks posed by contamination in relation to the proposed use of the site and ensuring that it is suitable for use before planning permission is granted. Under both regimes, it is the existence of potentially unacceptable risk due to contamination, rather than the presence of contamination alone that is the 'driver' for remedial action.

Under Part 2A of the EPA, sites are identified as 'contaminated land' if they are: (a) causing significant harm, or if there is a significant possibility of such harm, or (b) if the site is causing, or could cause, pollution of controlled waters. A revision to the wording of the EPA by the Contaminated Land (Scotland) Regulations 2005 (Ref 10.2) has modified definition (b) to 'significant' pollution of controlled waters. It should be noted that in Scotland, the term 'the Water Environment' is analogous to 'controlled waters'. The Contaminated Land (Scotland) Regulations 2005 have also modified the Contaminated Land (Scotland) Regulations 2000 (Ref 10.1) in the light of the Water Environment and Water Services (Scotland) Act 2003 (Ref 10.10). The Contaminated Land (Scotland) Regulations 2000 provide for the circumstances in which contaminated land requires to be designated as a 'special site' and provides for a remediation regime in that regard. The Water Environment and Water Services (Scotland) Act 2003 implements Directive 2000/60/EC (Ref 10.11) - commonly known as the Water Framework Directive (WFD) - and provides for a single system of water management at the river basin or catchment level.

Once a site is determined to be contaminated land then remediation may be required to render significant pollutant linkages insignificant (i.e. the source-pathway-receptor relationships that are associated with significant harm and/or pollution of the water environment), subject to a test of reasonableness.

The Planning Regime becomes relevant whenever any form of development or redevelopment is contemplated. Land contamination is a material planning consideration and a planning authority may require investigation and, if necessary, remediation (to protect human and environmental receptors, including the water environment) as a condition of granting planning permission.

Existing guidance on assessing risks to health and the water environment with respect to the planning regime is contained in Planning Advice Note 33 (PAN33) – Development of Contaminated Land (Ref 10.3) and PAN51 – Planning, Environmental Protection and Regulation (Ref 10.12).

PAN33 provides guidance as to the implications of the Contaminated Land Regime for the planning system, and a recommended approach for undertaking the assessment and remediation of land within the planning system. PAN51 provides more general guidance as to the role of the planning system in relation to the wider range of environmental protection regimes, including contaminated land, in support of national policy.

Other Guidance

British Standards and other guidance consulted in the preparation of this chapter and relevant to the Development include:

- Contaminated Land Report (CLR) 11, Model Procedures for the Management of Contaminated Land (2004) (Ref 10.13);
- British Standard 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites - Code of Practice (2017) (Ref 10.14);

- Contaminated Land Exposure Assessment (CLEA) Science Report, Updated Technical Background to the CLEA Model (SC050021/SR3) (2009) (Ref 10.15);
- Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination (2006) (Ref 10.16);
- Control of Water Pollution from Construction Sites - Guide to Good Practice SP156 (Construction Industry Research and Information Association (CIRIA), 2002) (Ref 10.17);
- Control of Water Pollution from Construction Sites C532 (CIRIA, 2001) (Ref 10.18);
- Environmental Good Practices - Working on Site C503 (CIRIA, 2000) (Ref 10.19);
- Environmental Good Practice on Site C741 (CIRIA, 2015) (Ref 10.20);
- Scottish Environment Protection Agency (SEPA) Position Statement WAT-PS-10-01. Assigning groundwater assessment criteria for pollutant inputs. Released: June 2011 (Ref 10.21);
- SEPA Water Pollution Arising from Land Containing Chemical Contaminants, 2nd edition 2012 (Ref 10.22); and
- Land Remediation and Waste Management Guidelines (SEPA, 2009) (Ref 10.23).

Chapter 11: Marine Ecology & Nature Conservation Areas

International and European Conventions and Legislation

The Natura 2000 network is a European Union (EU) wide network of protected sites designated to ensure long-term protection of some of Europe's most valuable and threatened habitats and species. Habitats and species listed on Annex I and Annex II of the Habitats Directive (European Council Directive 92/43/EEC) respectively, are those considered to be of community interest whose conservation requires the designation of Special Areas of Conservation (SAC). The network of sites comprises a range of individual Special Areas of Conservation (SAC) designated under the Habitats Directive and Special Protection Areas (SPA) classified under the Bird Directive (European Council Directive 2009/147/EC).

In addition to the protection provided by designated sites to habitats and species listed in the Habitats Directive, species listed in Annex IV of the directive are classed as European Protected Species (EPS). They include all species of cetaceans (whales, dolphins and porpoises), marine turtles and the Atlantic sturgeon.

Ramsar sites are designated under the Convention on Wetlands of International Importance. The mission of the Convention is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". Scotland has 51 Ramsar sites designated as internationally important wetlands, covering about 313,000 hectares in total. Most Ramsar sites in Scotland are linked to the Natura 2000 network - either as a Special Protection Area (SPA) or Special Area of Conservation (SAC). All are underpinned by Sites of Special Scientific Interest (SSSIs) (see below). These sites may be of importance for their wide variety of waterbirds, bogs, lochs, coastal wetlands and other water-dependent habitats and species. It is Scottish Government policy to apply the same level of protection for Ramsar sites as is applied for Special Protection Areas classified under the EU Birds Directive.

The OSPAR Convention represents a commitment by 15 western European governments to protect the North-east Atlantic marine environment. Scotland's existing marine Natura sites and Nature Conservation Marine Protected Areas are helping the UK to meet the OSPAR Marine Protected Area commitment.

The Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS) was concluded in 1991 under the auspices of the Convention on Migratory Species and entered into force in 1994. All small cetaceans regularly present in the Baltic and North Seas are listed in Appendix II to the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats). Originally only covering the Baltic and North seas, as of February 2008 the ASCOBANS area was extended westwards to include the North East Atlantic and Irish Seas. The agreement is now referred to as the "Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas". The ten Parties and four Range States who are currently signatories to the Agreement (including the UK) undertake to co-operate closely in order to achieve and maintain a favourable conservation status for small cetaceans. Parties apply conservation, research and management measures as prescribed in the Annex to the Agreement.

National Legislation

The Conservation (Natural Habitats, &c.) Regulations 1994 and associated amendments.

In Scotland, the Habitats Directive is translated into specific legal obligations by the Conservation (Natural Habitats, &c.) Regulations 1994, known as, the Habitats Regulations. These regulations have been subject to a number of amendments, most recently in 2012. Amendments have also been made to the equivalent legislation in England and Wales in the Conservation of Habitats and Species Regulations 2017, which consolidates the Conservation of Habitats and Species Regulations 2010 with subsequent amendments and extend to England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (in relation to reserved matters). In Scotland, on land and inshore waters up to 12 nautical miles, the Habitats Directive is therefore transposed through a combination of the Habitats Regulations 2010 (in relation to reserved matters) and the Conservation (Natural Habitats &c.) Regulations 1994 as amended.

The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 and associated amendments.

The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007, as amended by The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010 apply the Habitats Directive and the Birds Directive to activities in marine areas where the United Kingdom has jurisdiction beyond its territorial sea, from 12 nautical miles to 200 nautical miles from the United Kingdom's coastal baseline. Regulation 26 of the 2010 amendment regulations reflects the devolutionary expansion of Scottish ministers' powers within the marine environment.

The above legislation requires that specific consideration be given to the potential effects of the Proposed Development on sites and species of international nature conservation importance within the Natura 2000 network. This consideration is required to inform a subsequent Habitat Regulations Assessment to be completed by the Competent Authority: in this case Marine Scotland. This requirement is in addition to the requirements and obligations set out under the EIA regulations, which also govern the content of this report.

In Scottish inshore waters (within 12 nm of the coast), offences relating to the protection of marine EPS (listed on Schedule 2A) are provided for under the Habitats Regulations which prohibits the deliberate and reckless capture, injury, killing and disturbance of marine EPS.

It is possible to carry out certain actions which would otherwise be illegal by obtaining a licence. Licences are granted by SNH and Marine Scotland. A licence can only be issued under very strict instructions:

- The reason for the licence must relate to one of several specified purposes listed in Regulation 44(2) of the Conservation (Natural Habitats) Regulations 1994;
- There must be no satisfactory alternative;
- The proposed action must not be detrimental to the maintenance of the species at 'favourable conservation status'.

In Scotland, Regulations 39 and 43 of the 1994 Habitats Regulations make it an offence, with certain exceptions to deliberately or recklessly capture, injure or kill any EPS, harass, disturb or obstruct access to breeding sites or resting places, deliberately or recklessly to take or destroy the eggs of such an animal. It is also an offence to deliberately or recklessly disturb any dolphin, porpoise or whale. When considering activities that could affect EPS, the primary aim is to avoid any impact on them at all, including any activity that could otherwise constitute an offence. Offences can be avoided by:

- Modifying the location of a proposed action / piece of work;
- Timing operations to avoid times when the species is likely to be present;
- Retaining certain areas/structures used by the species;
- Modifying working practices;
- Looking at alternative solutions to problems.

If there are no satisfactory alternatives to avoiding an offence, a licence may be necessary but will only be granted after the appropriate authority is satisfied that there are no satisfactory alternatives and that such actions will have no detrimental effect on wild population of the species concerned.

Marine and Coastal Access Act 2009 and Marine (Scotland) Act 2010

The UK passed the Marine and Coastal Access Act 2009, which provided executive devolution to Scottish Ministers in relation to new marine planning and conservation powers in the offshore region. The Marine (Scotland) Act, which was introduced to Scottish Parliament on 29th April 2009 and gained Royal Assent on 10th March 2010, provides the legal mechanism to help ensure clean, healthy, safe, productive and biologically diverse marine and coastal environments, managed to meet the long term needs of both nature and people, by putting in place a new system for improved management and protection of the marine and coastal environment.

The Marine (Scotland) Act introduces new powers relating to functions and activities in the Scottish marine area, including provisions concerning marine plans, licensing of marine activities, the protection of the area and its wildlife and regulation of sea fisheries and by enabling Scottish Ministers to designate three types of Marine Protected Area (MPA) across Scottish territorial waters:

- Nature Conservation MPAs – for the conservation of Scotland's most important marine biodiversity and geodiversity features;
- Historic MPAs – for the protection of historically important marine sites such as wrecks or national monuments; and
- Research/Demonstration MPAs – to demonstrate or research new methods of managing Scotland's marine environment.

In April 2010 the Scottish MPA Project was established to help fulfil Scotland's contribution to international commitments for an ecologically coherent network of MPAs. The project covers all of Scotland's seas including territorial and offshore waters as Scottish Ministers also have devolved responsibility under the UK Marine and Coastal Access Act 2009 for the designation of MPAs for the conservation of important marine biodiversity and geodiversity out to 200 nautical miles.

Nature Conservation MPAs are selected using a science-based approach, underpinned by the presence of what have been termed MPA search features. These largely comprise the Priority Marine Features (PMFs) for which MPAs are considered the most appropriate conservation mechanism.

In July 2014, Scottish Ministers adopted a list of 81 priority marine features (PMFs), many of which are features characteristic of the Scottish marine environment. The list helps to deliver Marine Scotland's vision for marine nature conservation, as set out in "A Strategy for Marine Nature

Conservation in Scotland's Seas" (Marine Scotland, 2011). The strategy sets out aims and objectives for protecting and, where appropriate, enhancing valuable marine biodiversity. The strategy is designed to facilitate co-operation in pursuit of shared marine objectives in the UK and to meet national and international obligations. These include the achievement of Good Environmental Status under the Marine Strategy Framework Directive (MSFD).

The legislation also provides improved measures for the protection of seals. The Marine (Scotland) Act 2010 (Part 6 Conservation of Seals) makes it an offence to kill or take any seal at any time except under specific licence or to alleviate suffering. It also introduces in Section 117 a new offence of intentional or reckless harassment of seals at haul-out sites designated as such by Order by Scottish Ministers (The Protection of Seals (Designation of Seal Haul-out Sites) (Scotland) Order 2014. Both native seal species (grey seals and common or harbour seals) are listed as protected species under Annex II of the EC Habitats Directive 1992. In relation to such seal SACs, Scottish Natural Heritage should advise other relevant authorities of the conservation objectives and any operations which may cause deterioration of the habitats of the seal species or disturbance of seals of the species for which the site has been designated.

The Protection of Seals (Designated Sea Haul-out Sites) (Scotland) Order 2014 introduced additional protection for seals at 194 designated haul-out sites: locations on land where seals come ashore to rest, moult or breed.

Wildlife and Countryside Act 1981, as amended in Scotland (WCA)

The WCA provides for the further protection of sites of at least national importance for nature conservation and varying levels of protection for species in need of conservation action, or other protection, within the UK. Protection may include prohibition of some or all of: killing, injuring, disturbing, taking, sale/barter or possession of species and also protection of breeding and sheltering places. The WCA also provides for the designation of Marine Nature Reserves (MNRs) and gives powers to enact byelaws to protect such reserves.

Nature Conservation (Scotland) Act 2004

Requires government departments to have regard to the Convention on Biological Diversity and places a duty on all public authorities, including local planning authorities, to consider biodiversity in their work. Compels the Scottish ministers to produce a biodiversity strategy and a list of species and habitats of principal importance for biodiversity conservation in Scotland and to take or promote steps to further their conservation. The Act also amends and enhances the provisions for enforcement and sets out the procedure for Nature Conservation Orders and allows for the designation of Sites of Special Scientific Interest (SSSI).

Sites of Special Scientific Interest (SSSI) are those areas of land and water (to the seaward limits of local authority areas or MLWS) that Scottish Natural Heritage (SNH) considers to best represent natural heritage - its diversity of plants, animals and habitats, rocks and landforms, or a combinations of such natural features. Many are also designated as Natura 2000 sites (Special Protection Areas or Special Areas of Conservation). The national network of SSSIs in Scotland forms part of the wider UK series. SNH designates SSSIs under the Nature Conservation (Scotland) Act 2004. SSSIs are protected by law. It is an offence for any person to intentionally or recklessly damage the protected natural features of an SSSI.

Environmental Liability (Scotland) Regulations 2009, as amended

Extends the protection provided to species and habitats by various other legislation including the Birds and Habitats Directives to include habitats and species not only within, but beyond designated areas. Importantly, under these regulations competent authorities (Scottish ministers, Scottish Natural

Heritage or the Scottish Environmental Protection Agency with regard to species and habitats) may request information from operators to show compliance with the regulations. If damage occurs they may require the relevant operator to remedy the damage.

Guidance

The protection of Marine European Protected Species from injury and disturbance Guidance for Scottish Inshore Waters - Marine Scotland (2014)

Chapter 15: Ornithology

This appendix includes a summary of the most relevant aspects of legislation and policy. The actual documents should be referred to for authoritative information.

Directive 2009/147/EC on the conservation of wild birds

This European Directive, commonly known as 'the Birds Directive', provides the framework for the conservation and management of wild birds, the main provisions being:

- the maintenance of populations of all wild bird species across their natural range;
- the identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed on Annex I and for all regularly occurring migratory species; and,
- the establishment of a general scheme of protection for all wild birds.

Member States must develop the legislative means to implement the requirements of the Birds Directive, which in Scotland is achieved mainly via the Habitats Regulations (see below) and Wildlife and Countryside Act 1981 (see below).

Conservation (Natural Habitats &c. Regulations (as amended)

These Regulations, commonly known as the 'Habitats Regulations', include implementation of that part of the Birds Directive requiring the designation and protection of SPAs.

It is Scottish Government policy to treat potential or proposed SPAs, and areas identified as compensation sites for adverse effects on SPAs, as if they were fully designated.

Wildlife and Countryside Act 1981 (as amended)

The Wildlife and Countryside Act 1981 (often abbreviated to 'WCA') includes implementation of parts of the Birds Directive (see above) and is the primary legislation affording protection to birds in Scotland. Under the WCA it is an offence to intentionally or recklessly:

- kill, injure or take a wild bird;
- take, damage, destroy or interfere with a nest of any wild bird whilst in use or being built;
- obstruct or prevent any wild bird from using its nest; and,
- take or destroy an egg of any wild bird.

For certain rarer species listed on Schedule 1 it is also an offence to intentionally or recklessly disturb them whilst building a nest or while in, on or near a nest containing eggs or young, or to disturb their dependent young. Certain vulnerable raptors are additionally protected from harassment at any time.

The Wildlife and Natural Environment (Scotland) Act 2011 (as amended)

The Wildlife and Natural Environment (Scotland) Act 2011, commonly known as the 'WANE Act', places a duty on all public sector bodies in Scotland to further the conservation of biodiversity.

The Scottish Biodiversity List (SBL) is a list of species and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The purpose of the SBL is to help public bodies carry out their biodiversity duty by identifying the species and habitats of highest importance for conservation.

Convention on Wetlands of International Importance

'Ramsar sites' are wetlands of international importance designated to meet the UK's commitments under this Convention, commonly known as the 'Ramsar Convention'.

Although there is no legal framework to protect them, it is Scottish Government policy to afford Ramsar sites the same protection as that afforded to SPAs. Ramsar sites are also underpinned via notification as Sites of Special Scientific Interest (SSSI), affording them statutory protection under the WCA.

Scottish Planning Policy 2014

Scottish Planning Policy (SPP) 2014 recognises the environment as a national asset offering opportunities for enjoyment, recreation and sustainable economic activity. In summary, the policy principles most relevant to this assessment of the potential impacts of the Proposed Development on ornithological features state that the planning system should:

- facilitate positive change while maintaining / enhancing distinctive landscape character;
- conserve and enhance protected sites and species, maintaining healthy ecosystems and the natural processes which provide important services to communities;
- protect and improve the water environment; and,
- seek biodiversity benefits from new development where possible.

SPP set outs the biodiversity duty of public bodies and the legislative requirements for protected sites and species.

Highland-wide Local Development Plan

Relevant local planning policies for the region are detailed in the Highland Council's Highland-wide Local Development Plan (HwLDP).Table A15-1 provides a summary of the local planning policies relevant to ornithological features. The precise wording of each specific policy can be found in the original HwLDP document (the Highland Council, 2012).

- Policy 28 – Sustainable Development: The Council will support developments which promote and enhance the social, economic and environmental wellbeing of the people of Highland. Proposed developments will be assessed on the extent to which they impact on habitats and species.
- Policy 57 – Natural, Built and Cultural Heritage: All development proposals will be assessed taking into account the level of importance and type of heritage features, the form and scale of the development and any impact on the feature and its setting
- Policy 58 – Protected Species: Surveys are required to confirm the presence of protected species on a site. Mitigation will be required, prior to determining the application, to avoid or minimise impacts on protected species. Development likely to adversely affect protected species will only be permitted where: there is no satisfactory alternative; there are reasons of public health or safety or other imperative reasons of over-riding public interest; and it will not be detrimental to the favourable conservation status of the species concerned.
- Policy 59 – Other Important Species: The Council will have regard to the presence of and any adverse effects of developments on other important species, including species protected under the Habitats Directive or WCA, and species listed in national and local Biodiversity Action Plans (BAPs) and the Scottish Biodiversity List (SBL).

- Policy 60 – Other Important Habitats: The Council will seek to safeguard the integrity of features of the landscape of major importance to wild fauna. The Council will have regard to the value of other important habitats, including: habitats on Annex I of the Habitats Directive; habitats of priority / protected bird species; and habitats listed in national and Local BAPs and the SBL.

Birds of Conservation Concern

Birds of Conservation Concern (BoCC) 4 (Eaton et al., 2015) is the latest review of the status of birds in the UK. Species are assigned to Red, Amber or Green lists depending on the degree of conservation concern.

Red list species are rare or locally distributed and/or have suffered a severe reduction in breeding population or range. Amber list species have suffered moderate reductions.

5. Summary of Consultation

5.1 Summary of Consultation

Appendix 5-1: Summary of Screening Responses

Consultee	Response	How the response has been addressed in the EIA Report
Transport Scotland	The Proposed Development is considered to be EIA development by virtue of its location and its potential to have a significant environmental effect on harbour porpoise within the Inner Hebrides and the Minches candidate Special Area of Conservation, and on other cetacean species.	The EIA has been prepared in accordance with relevant EIA Regulations as set out within Chapter 4 of this report.
Scottish Environmental Protection Agency (SEPA)	**Site Layout:** Existing built infrastructure must be re-used or upgraded wherever possible. The layout should minimise new works on previously undisturbed ground. Alternative locations or layouts may be required. Adequate maps must detail all proposed upgraded, temporary and permanent site infrastructure. This includes all temporary or permanent access tracks, excavations, buildings, borrow pits, pipelines, site compounds, laydown areas, storage areas and any other built elements.	Site layout plans are provided in **Figures 3.3 and 3.5 a to c.**
SEPA	**Surface Water Drainage:** Surface water runoff must be treated by sustainable drainage systems (SUDS). A site plan showing the proposed SUDS treatment train must be submitted. The Simple Index Approach calculation should be used for the lower risk areas within the site. For yard areas, refuelling areas or areas where there is a higher pollution risk, a detailed risk assessment must be submitted. Existing surface water discharges and their treatment systems must be shown on a site map. Consultation with the local authority flood prevention unit and with Scottish Water should also be sought.	**Chapter 3: Project Description** provides a description of the key surface water drainage design parameters.
SEPA	**Flood Risk:** The risk of increasing flood risk from the land reclamation should be assessed. SEPA request that the coastal wave study proposed for the Uig development include an assessment of flood risk. All new development, including on reclaimed land, should be above the estimated 1 in 200 year flood level for the area, unless that particular aspect of the proposal needs to be lower for operational reasons. SEPA recommend the use of water resistant materials and forms of construction as appropriate. SEPA recommend a minimum 600 mm freeboard is added to the Coastal Flood Boundary (CFB) levels to determine the estimated 1 in 200 year flood levels.	**Chapter 9: Flood Risk & Climate Change** sets out the results of the Flood Risk Assessment (FRA) which was based on numerical modelling using the levels identified in SEPA's advice. The methods and results of the numerical modelling are also provided in **Appendix 9-1.**
SEPA	**Pollution Prevention during Construction:** The schedule of mitigation should be supported by site specific maps and plans including reference to best practice pollution prevention and construction techniques. Daily responsibilities of ECOWs should be set out including site inspection recording and action plans and provision of a planning monitoring enforcement officer.	**Chapter 22: Summary of Mitigation**
SEPA	**Regulatory Requirements:** Any proposed engineering works within the water environment, above MHWS or any proposed abstractions or discharges will require authorisation under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). Management of surplus peat, soils or dredging spoil may require an exemption under The Waste Management Licensing (Scotland) Regulations 2011. Proposed crushing or screening will require a permit under The Pollution Prevention and Control (Scotland) Regulations 2012. Should Liquid Natural Gas (LNG) storage be proposed then this will fall under Control of Major Accident Hazards Regulations 2015 (COMAH). It may also be subject to a future Hazardous Substances application. In addition the Health and Safety Executive (HSE) will need to be consulted on any proposals for LNG storage. We recommend that	**Chapter 4: Legislative & Planning Policy** identifies the supporting regulations which are expected to apply to the Proposed Development. Options for managing dredging spoil have been considered within **Appendix 2.2: BPEO assessment** and **Appendix 2.3: Dredge disposal Site Characterisation Report**. As set out in **Chapter 3: Project Description**, consents for the LNG storage will be sought from

Consultee	Response	How the response has been addressed in the EIA Report
	the applicant consults us and HSE directly to discuss the implications of these regulations and how it may affect the layout of the proposals.	SEPA and the HSE by Calmac Ferries Ltd. (CFL).

Consultee	Response	How the response has been addressed in the EIA Report
Scottish Ministers (Marine Scotland and Transport Scotland)	**EIA: response** confirming that the works described in the Scoping Report fall under Schedule 2, paragraph 1(e), 10(g) and 10(m) of The Marine Works 2017 (amended).	**Chapter 4: Legislative and Planning Policy Context** sets out the legislative requirement for EIA.
Scottish Ministers (Marine Scotland and Transport Scotland)	**EIA Report:** Confirming requirement for an EIA Report in accordance with regulation 6 and contain the information specified in schedule 4 of The Marine Works 2017 (as amended). The EIA Report should be prepared by competent experts. The EIA Report must be based on the Scoping Opinion and must include the information that may be reasonably required for reaching a reasoned conclusion. The Scoping Opinion provided identifies the qualities of a good Environmental Statement (now known as an EIA Report).	This EIA Report has been prepared in accordance with regulation 6 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and contains the information specified in Schedule 4 of the regulations. The EIA Report has been produced by appropriately qualified experts from AECOM support by ABPMer. Both are certified members of the Institute of Environmental Management and Assessment (IEMA) Quality Mark in EIA Scheme. The Scoping opinion is included within **Appendix 1.2** of this report.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Non-Technical Summary (NTS):** The EIA Report must contain a NTS which should summarise the EIA, be concise and written in a manner that is appealing to read and easily understood.	A Non-Technical Summary is provided in **Volume 1** of this EIA Report.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Mitigation:** All mitigating measures should be clearly stated; accurate; assessed for their environmental effects; assessed for their effectiveness; fully described with regards to their implementation and monitoring; and described in relation to any consents or conditions. The EIA Report should contain a mitigation table providing details of all proposed mitigation discussed in the various chapters. Where potential impacts have been fully investigated but found to be of little or no significance, the reasoning for this conclusion should be clearly stated.	The proposed mitigation measures are set out in the assessment chapters (Chapters 7 to 20 in **Volume 2: Main Report**) and summarised in **Chapter 21: Summary of Mitigation.** The scoping report and subsequent scoping updates are set out in **Appendices 1.1 and 1.3** of this report. **Chapters 7 to 20** provide the results of the technical assessments and identify the likely significant effects.
Scottish Ministers	**Design Envelope:** Where flexibility in the design envelope is required, this must be defined within the EIA Report and	**Chapter 3: Project Description** sets out the worst-

Consultee	Response	How the response has been addressed in the EIA Report
(Marine Scotland and Transport Scotland)	the reasons for requiring such flexibility clearly stated. The Scottish Ministers will determine the application based on the worst case scenario. With regard to a multi-stage regulatory consent, any subsequent construction management statement (CMS) will freeze the design of the project and will be reviewed by the Scottish Ministers to ensure that the worst case scenario described in the EIA Report is not exceeded. Any changes produced after the EIA Report is submitted may require further environmental assessment and public consultation.	case scenario on which the technical assessments in **Chapters 7 to 20** are based.
Scottish Ministers (Marine Scotland and Transport Scotland)	**EIA Scope:** The Scottish Ministers are broadly satisfied that the topics identified in the Scoping Report encompass those matters required to be considered by regulation, however the following topics have also been identified for consideration within the EIA: Natural Resource Usage and Waste Impacts from Major Accidents and Disasters Marine Nature Conservation Sites Flood Risk and Climate Change Cumulative Impacts MS-LOT consider the terrestrial aspects scoped into the EIA to be out with the regulatory remit of Marine Scotland and therefore has no comment to make on the following proposed sections: Ground Conditions & Contamination Terrestrial Ecology Terrestrial Noise and Vibration	This EIA Report assesses the potential environmental effects of the construction and operation of the Proposed Development on the following topics: **Chapter 7: Marine Physical Environment** **Chapter 8: Marine Water & Sediment Quality** **Chapter 9: Flood Risk & Climate Change** **Chapter 10: Ground Conditions & Contamination** **Chapter 11: Marine Nature Conservation Areas** **Chapter 12: Benthic Ecology** **Chapter 13: Fish & Shellfish Ecology** **Chapter 14: Marine Mammals** **Chapter 15: Ornithology** **Chapter 16: Socio-Economics & Public Access** **Chapter 17: Terrestrial Noise & Vibration** **Chapter 18: Commercial & Recreational Navigation** **Chapter 19: Commercial Fisheries** **Chapter 20: Marine Archaeology & Cultural Heritage** Natural resource usage and waste associated with the Proposed Development is described in **Chapter 3: Project Description** whilst the potential effects of natural resource usage and waste are addressed in all the relevant technical assessments. Potential effects from major accidents and disasters are addressed in the relevant technical assessments. Cumulative effects are assessed in each of the technical chapters listed above.

Consultee	Response	How the response has been addressed in the EIA Report
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine Nature Conservation Sites:** Nature conservation designated areas should be scoped into the EIA process. The EIA Report should include underwater noise and disturbance modelling, which should inform the proposed mitigation. The EIA Report should also contain information required to inform Habitats Regulations Appraisal and possible EPS disturbance licence requirements (for cetaceans and potentially for Basking sharks). The applicant should consult the standard piling mitigation measures recommended by Joint Nature Conservation Committee (JNCC)[1]	The assessment of potential effects on nature conservation designated areas is provided in **Chapter 11: Marine Nature Conservation Areas.** This includes consideration of the results of underwater noise and disturbance modelling, also set out within **Chapter 13: Fish and Shellfish ecology**; and **Chapter 14: Marine Mammals**. A Habitats Regulations Appraisal screening has been undertaken, the results of which are provided in **Chapter 11: Marine Nature Conservation Designations.**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine & Physical Environment:** The EIA Report should include modelling of hydrodynamics, waves and sediments to determine the magnitude of effect arising from the proposed development.	Potential effects on the marine physical environment are addressed in **Chapter 7: Marine Physical Environment**.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine Water & Sediment Quality:** The EIA Report should include a review of the existing water quality conditions and chemical analysis of sediment located in the proposed dredge area and the potential dredge disposal site. If it is proposed to utilize this dredging spoil within the land reclamation then the EIA Report should demonstrate that the heavy metal spoil will not cause harm to the environment. A Water Framework Directive assessment will be undertaken to consider the potential impacts on the current status and future objectives of the relevant WFD water bodies. The EIA Report should assess surface water drainage as set out by SEPA to demonstrate that adequate space is available to treat surface water run-off. Waste water drainage should be directed to the public sewer, and this should be shown on site plans.	**Chapter 8: Marine Water & Sediment Quality** Sediment sampling was carried out at the dredging and dredge disposal site to inform this assessment; It is not proposed to utilise dredged material in the land reclaim for the marshalling yard. Consideration of status and objectives of the Water Framework Directive assessment is included in **Chapter 8: Marine Water and Sediment Quality**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Flood Risk & Climate Change:** The EIA Report should consider coastal flooding through modelling of wind and wave climate, extreme water levels, hydrodynamic modelling, wave transformation modelling, joint probability of waves and water levels and wave overtopping. This should also take into account the updated Coastal Flood Boundary levels for Scotland Autumn 2017, and updated climate change predictions available in Spring 2018.	The Flood Risk Assessment (FRA) is set out within **Chapter 9: Flood Risk & Climate Change** and was informed by [HOLD] modelling and was based on the Coastal Flood Boundary levels for Scotland and climate change predictions available at the time of undertaking the EIA. This approach was agreed with SEPA via email on 26th January 2018.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Benthic Ecology:** The EIA Report will contain a detailed intertidal survey to confirm the nature and distribution of the habitats present in Uig Bay and consider any habitats of conservation concerns or PMF (specifically seapens and burrowing megafauna in circalittoral fine mud). Additionally a sediment characterization study will be undertaken to determine the most suitable sea disposal location and methods for the dredge arisings.	Impacts on benthic ecology including reporting and interpretation of survey results are considered within **Chapter 12: Benthic Ecology.**

[1] [http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Piling%20protocol_August%202010.pdf].

Consultee	Response	How the response has been addressed in the EIA Report
Scottish Ministers (Marine Scotland and Transport Scotland)	**Fish & Shellfish Ecology:** Underwater noise propagation modelling will be undertaken to determine the likely level of disturbance to fish species, along with sediment dispersion modelling to determine the impact of water quality changes on fish and shellfish. These surveys will allow appropriate mitigation to be developed and implemented.	Impacts on fish and Shellfish are considered within **Chapter 13: Fish & Shellfish Ecology.** This assessment was informed by underwater noise propagation modelling and sediment dispersion modelling; Results of the sediment dispersion modelling of dredging and disposal activities are set out within **Chapter 7: Marine Physical Environment** and **Chapter 8: Marine Water and Sediment Quality**.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine Mammals:** The EIA Report should contain information required to inform Habitats Regulations Appraisal and a possible EPS disturbance licence. An appropriate impact assessment to determine the extent of the behavioural impacts on marine mammals as a result of the impact piling should be demonstrated.	This assessment was informed by underwater noise propagation modelling. Information required to allow the competent authority to complete an Appropriate Assessment on this issue is included within **Chapter 14: Marine Mammals.**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Ornithology:** Breeding birds are scoped out of the EIA as the habitats present are of low value to most breeding birds. Any impact which may occur will be mitigated through the design of the development and through the implementation of generic mitigation including a Breeding Bird Protection Plan during construction. Location and timing of the works with respect to White-tailed eagles should be considered.	Potential effects on birds are considered within **Chapter 15: Ornithology.**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Socio-Economics & Public Access:** A desk based assessment will be undertaken to identify socio-economic receptors and how these might be affected	**Chapter 16: Socio-Economics & Public Access**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Seascape, Landscape & Visual Effects:** The works are not considered to result in significant effects on the landscape or seascape resource or the visual amenity of local residents and visitors to the area.	Potential effects on Seascape, Landscape & Visual receptors have been scoped out of the EIA.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Traffic & Transport:** The EIA Report should demonstrate that the issue of disturbance to other vessels has been addressed and mitigation measures identified if necessary.	Marine traffic issues are addressed in **Chapter 18: Commercial and Recreational Navigation.**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Air Quality:** Dust and emissions mitigation controls will be detailed in a Construction Environment Management Plan (CEMP), or a schedule of Mitigation (SoM) prior to the commencement of construction. No specific section on Air Quality is required as part of the EIA Report and is scoped out of the EIA process.	Air Quality has been scoped out of the EIA. Standard dust and emissions mitigation measures to be included within the CEMP are set out in **Chapter 22: Summary of Mitigation.**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Greenhouse Gas Assessment:** An assessment of impacts from increased GHG emissions is not required as part of the EIA process.	Greenhouse Gas Emissions have been scoped out of the EIA.
Scottish Ministers	**Commercial & Recreational Navigation:** The EIA Report should demonstrate that the issue of disturbance to other	**Chapter 18: Commercial & Recreational**

Consultee	Response	How the response has been addressed in the EIA Report
(Marine Scotland and Transport Scotland)	vessels has been addressed and mitigation measures identified if necessary. The EIA Report should give due consideration to the Port Marine Safety Code (PMSC) and Guide to Good Practice (GTGP). A robust Safety Management System (SMS) for the project should be developed in consultation with THC and Calmac Ferries Ltd under this code. The Harbour Authority has a duty to conserve the harbour so that it is fit for use as a port, and a duty of reasonable care to see that the harbour is in a fit condition for a vessel to use it, during and after the construction. UK Hydrographic Office should be notified for consideration of updates to nautical charts and publications. The local coastguard and local MCA Marine Office should also be notified of the proposed works. The existing Aids to Navigation (AtoN) should be reviewed and an overall plan for AtoN at the ferry terminal should be discussed with the Northern Lighthouse Board.	**Navigation**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Commercial Fisheries:** Consultation with relevant organizations will be undertaken to develop understanding of the fishing activities in the area and the impacts during construction of the Proposed Development may cause. Impacts once operational are scoped out (with the exception of the potential for maintenance dredging).	**Chapter 19: Commercial Fisheries**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Other Users:** no other receptors have been identified therefore effects on Other Users have been scoped out of the EIA.	Other users have been scoped out of the EIA.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine Archaeology & Cultural Heritage:** should considered direct and indirect impacts, such as disturbance, contamination and loss to historic environment assets with appropriate involvement from archaeological experts.	**Chapter 20: Marine Archaeology & Cultural Heritage**
Scottish Ministers (Marine Scotland and Transport Scotland)	**Natural Resource Usage and Waste:** Details should be provided in the EIA Report of how waste generated on site will be stored and disposed of, including contaminated materials. Although there are some natural resources on the site that will be reused as part of the proposed works, some materials will have to come from elsewhere. For the proposed land reclamation, given the use of sheet piles, it is likely SEPA will regulate this activity under The Waste Management Licensing (Scotland) Regulations 2011 (WML) should waste dredging spoil be utilised. SEPA will have to advise on the likely consentability of this proposal and early consultation is recommended. Mitigation measures should then be included in the CEMP or as advised by SEPA, a schedule of mitigation with detailed site plans demonstrating how impacts on the environment have been minimised through site design.	Natural resource usage and waste associated with the Proposed Development is described in **Chapter 3: Project Description**. The dredged material will not be used in the land reclamation due to construction programme restrictions (see **Appendix 2.2** Best Practicable Environmental Option (BPEO)). The potential effects of natural resource usage and waste are addressed throughout the EIA in the relevant technical assessments **Chapter 22: Summary of Mitigation** sets out the mitigation measures that will be implemented to minimise environmental effects from natural resource use and waste.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Major Accidents & Disasters: T**he EIA Report should include the expected effects of Major Accidents and Disasters (according to regulation 5(4) of the 2017 regulations. With reference to Schedule 3 (1)(f), more emphasis on climate change should be demonstrated. The following impacts from major accidents and natural disasters require further consideration during the different	Impacts from major accidents and disasters are addressed in the relevant chapters as follows: The potential risks of major accidents and disasters associated with LNG will be identified in **Chapter 3:**

Consultee	Response	How the response has been addressed in the EIA Report
	phases of the proposed development and should be scoped into the EIA process: Proposed LNG storage tanks - risk of fire and impacts to other vessels Severe storms Marine transport accidents Flood risk / tidal surges – proposed to be assessed in separate section.	**Project Description.** The potential for major accidents and disasters associated with severe storms, flood risk and tidal surges are addressed in **Chapter 9 Flood Risk & Climate Change.** The risk of major accidents and disasters from marine transport accidents are addressed in **Chapter 18: Commercial & Recreational Navigation**.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Cumulative Impacts: T**he EIA Report should include the accumulation of the impact with the impact of other existing and/or approved works (reference to Schedule 3 (1)(b)).	The potential for cumulative affects is assessed where applicable in the relevant technical chapters (Chapters 7 to 20).
Scottish Ministers (Marine Scotland and Transport Scotland)	**Marine Planning:** When Scottish Ministers make decisions that affect, or might affect, the marine environment they must do so in accordance with the UK Marine Policy Statement 2011 and Scotland's National Marine Plan (NMP) 2015.	**Chapter 4: Legislative & Planning Policy Context** highlights the policies that are applicable to the Proposed Development which were considered when preparing this EIA Report, including the Marine Policy Statement and National Marine Plan.
Scottish Ministers (Marine Scotland and Transport Scotland)	**Language Requirements:** Where works are located in areas where Gaelic is spoken, applicants are encouraged to adopt best practice by publicising the project details in both English and Gaelic.	EIA Advertising will be published in both English and Gaelic
	Multi-Stage Regulatory Approval: When making an application for multi-stage approval the applicant must satisfy the Scottish Ministers that no significant effects have been identified in addition to those already assessed in the EIA report.	The parameters of the Proposed Development which have been assessed within the EIA are considered to be 'worst case' and are not expected to be exceeded.
	Pre-dredge sampling - if it is intended to dispose of any dredged material at sea, adequate pre-dredge sample analysis must be submitted in support of the EIA Report and marine licence dredging application. The licensing authority reserves the right not to accept an application in the absence of acceptable sediment analysis data. **Advertisement:** Where the applicant has provided the Scottish Ministers with an EIA Report, the applicant must publish their proposals in accordance with Regulation 16 of The Marine Works [EIA] 2017 (as amended) and ensure that a reasonable number of copies of the EIA Report are available for inspection at any place named in the publication. If additional information is submitted further public notices will be required. **EPS licence:** If any activity is likely to cause disturbance or injury to a European Protected Species a licence is required to undertake the activity legally.	The Site Characterisation Report for the proposed new disposal site is provided in **Appendix 2.3** The results of the sediment sampling and analysis are discussed in **Chapters 7: Marine Physical Environment** and **Chapter 8: Marine Water and Sediment Quality**. Details of the advertising for the EIA are included in **Chapter 1: Introduction.** Anticipated requirements for EPS licences at construction stage have been identified in the

Consultee	Response	How the response has been addressed in the EIA Report
		relevant technical chapters and in **Chapter 22: Summary of Mitigation**.
Scottish Natural Heritage (SNH)	**Underwater Noise:** The construction methods should be clarified following site investigations including: Piling – what types of piles would be installed; how many impact or vibratory piling; duration of installation. Dredging techniques and duration. Any blasting – what size of charge; how many; over what duration. SNH are not familiar with the Environment Agency methodology for underwater noise propagation modelling outlined in the fish section of the Scoping Report and would require detail on the methodology. However, their initial advice is that it is unlikely to be sufficient by itself. Noise levels for all noisy activities should be predicted. Received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound should be considered. For assessment of impact to marine mammals SNH advise that they consider both Southall and NOAA injury thresholds. Disturbance should also be assessed. Consideration should be given to the size of the piling mitigation zone and the best way to cover it.	**Chapter 3: Project Description** provides a description of the anticipated construction method. **Chapter 11: Marine Conservation sites, Chapter 13: Fish and Shellfish ecology** and **Chapter 14: Marine Mammals** set out the methodology used, input parameters assessed and the results of the underwater noise propagation modelling. .
SNH	**Priority Marine Features:** Priority Marine Features (PMFs) which may be affected by the proposals should be identified. In identifying the dredge disposal site, priority should be to avoid impacting on rarer biotopes and high quality examples rather than avoiding all impacts on the identified PMF "*Seapens and burrowing megafauna in circalittoral fine mud*" as this habitat is widespread. Given the limited records of "*Inshore Deep Mud with Burrowing Heart Urchins*" PMF habitat within this marine region and the recorded extent within Uig Bay, SNH are keen to establish how widespread it is in Uig Bay and recommend that the EIA should consider the likely impacts on this PMF. In particular this should be taken into account in the selection of the location and method of dredge disposal. Data on the presence of this biotope should be collected as part of the assessment for the dredge disposal site. It may also be possible to estimate the distribution of the habitat within the bay based on sediment characteristics. SNH recommend that the impacts of the dredged material on the PMF habitats be considered. Clarification was requested as to whether beach nourishment with maintenance dredge material went ahead in 2015 and, if so, where and how the dredge material was disposed of. SNH acknowledge that this may have already modified the benthic communities in that location.	Benthic surveys were carried out in an initial search area around the proposed disposal site in February 2018. The results of these surveys and existing marine data for the area informed the site identification as part of the site characterisation process (**see Appendix 7.2: Site Characterisation Report**). **Chapter 12: Benthic Ecology** provides a review of the existing data on benthic ecology for the Uig Bay area and the results of the benthic surveys, including a review of survey data for any evidence of the presence of heart urchins; these are provide the baseline for the assessment. Location of beach recharge in 2015 is shown on **Figure 12.4.**
SNH	**Otters:** SNH recommend that otter surveys are repeated if >18 months elapses between the original survey and commencement of works.	**Chapter 22: Summary of Mitigation** sets out all the measures that will need to be implemented before and during construction and operation. The requirement for further otter surveys if >18 months elapses between the original survey and commencement of works is included.
SNH	**White-tailed Eagles:** White-tailed eagles (WTE) breed and roost on the cliffs around Uig Bay. They have special	Data on white-eagle nesting / roosting sites in and

Consultee	Response	How the response has been addressed in the EIA Report
	protection. Given the existing disturbance, it seems unlikely that works at the pier will present significant issue. However, the dumping of dredge material may cause disturbance and should be considered in the EIA. Consultation should include the Highland Raptor Study Group co-ordinator for WTE for an update. If WTE have nest sites or roost sites within 1 km of any of the proposed works a mitigation plan should be produced. Any information which could allow the nest or roost sites to be identified should be supplied as part of a confidential annex.	around Uig Bay was requested from the Highland Raptor Study Group. The proposed disposal site was selected to remain at least 1 km away from a known nesting site as set out in the Site Characterisation Report in Appendix 7.2. Record of this consultation is provided in CONFIDENTIAL **Figure 15.2**.
Scottish Environment Protection Agency (SEPA)	SEPA previously provided general screening and scoping advice for the three projects at Uig, Tarbert and Lochmaddy. SEPA reviewed the proposed scope of the Uig EIA against this advice and they are generally supportive of the proposed scope.	The responses to SEPA's screening advice are detailed above.
SEPA	**LNG Storage:** SEPA encourage the Applicant to continue the dialogue regarding LNG storage to ensure that all required mitigation can be accommodated within the proposed layout. SEPA will advise on the likely consentability of the site layout during the planning application process and therefore it is vital that this dialogue continues and that all the required information is submitted in support of the planning application.	As set out in **Chapter 3: Project Description**, consents for the LNG storage will be sought from SEPA and the HSE by Calmac Ferries Ltd. (CFL).
SEPA	**Water Quality: S**urface water drainage should assessed as part of the EIA and should demonstrate adequate space is available to treat surface water run-off. Waste water drainage should be directed to the public sewer. Site plans should include any existing waste water outfalls.	Information on the proposed surface water drainage and the proposed measures to mitigate environmental impacts is set out within **Chapter 3: Project Description**. **Chapter 22: Summary of Mitigation** summarises the proposed mitigation measures.
SEPA	**Flood Risk:** Updated Coastal Flood Boundary levels for Scotland will be available by the end of 2017 and updated climate change predictions in the spring of 2018.	The Flood Risk Assessment (FRA) provided in **Chapter 9: Flood Risk & Climate Change** and associated modelling are based on the updated Coastal Flood Boundary Levels for Scotland and Climate Change Predictions. **Appendix 9-1** provides the results of the modelling which informed the FRA.
SEPA	**Borrow Pits:** SEPA assume that no borrow pits are propose given that these are not highlighted in the Scoping Report. SEPA requested that this be stated in the applications.	As set out in **Chapter 3: Project Description**, the Applicant does not anticipate that any borrow pits will be required.
SEPA	**Schedule of Mitigation and Detailed Site Plans: D**etailed site plans should be submitted to demonstrate how impacts on the environment have been minimised through site design. All mitigation measures should be detailed within a suitably robust site-specific schedule of mitigation as part of the application rather than a CEMP.	Site plans are provided **Figures 3.1 to 3.7**. **Chapter 22: Summary of Mitigation** sets out the agreed mitigation measures that will be implemented by the Applicant during the construction and operation of the Proposed Development.
SEPA	**Land Reclamation:** Should waste dredging spoil be utilised in the land reclamation, SEPA will likely regulate this activity under the Waste Management Licensing (Scotland) Regulations 2011 given the use of sheet piles. If it is	Dredged material will not be used in the land reclamation due to construction programme

Consultee	Response	How the response has been addressed in the EIA Report
	proposed to utilise the dredging spoil within the land reclamation then the submission should demonstrate that the heavy metal spoil will not cause harm to the environment.	restrictions (see **Appendix 2.2** Best Practicable Environmental Option (BPEO)).
The Maritime Coastguard Agency (MCA)	The MCA are content that any navigation safety concerns can be addressed by suitably worded conditions at formal marine licence stage. The MCA highlighted the Port Marine Safety Code (PMSC) and Guide to Good Practice (GTGP) and the need to liaise with the local Harbour Authority (THC) in consultation with Calmac Ferries Ltd. to develop a robust Safety Management System (SMS). The Harbour Authority has a duty to conserve the harbour so that it is fit for use as a port, and a duty of reasonable care to see that the harbour is in a fit condition for a vessel to use it, during and after construction. The MCA expects to see consideration given to potential impact of the construction works on vessels operating in the area and proposed risk mitigation methods. The Applicant should notify the UK Hydrographic Office at the Marine licence stage for consideration of updates to nautical charts and publications given the widening of the berth structure and new dredging. The local coastguard and local MCA Marine Office should also be notified of the proposed works.	**Chapter 18: Commercial & Recreational Navigation.**
Northern Lighthouse Board	Northern Lighthouse Board has no objections to these proposals and will reply formally in response to the Marine licence applications. Existing Aids to navigation (AtoN) should be reviewed and an overall plan for AtoN at the ferry terminal is discussed with the Northern Lighthouse Board.	Noted
Historic Environment Scotland	Historic Environment Scotland is content that significant impacts on terrestrial heritage assets and their settings are unlikely in this instance and would be content for terrestrial heritage assets within their statutory remit to be scoped out of the assessment. The EIA should give consideration to where the proposed works may affect undesignated wreck sites and unknown marine remains. The potential for direct and indirect impacts on any such assets should be considered with appropriate involvement of archaeological expertise. Impacts may include direct disturbance, contamination and loss to historic environment assets and the de-stabilisation of sites.	**Chapter 21: Marine Cultural Heritage & Archaeology** Terrestrial cultural heritage and archaeology have been scoped out of the EIA.
Royal Yachting Association (RYA)	The RYA did not require the collection of further data but recommended consultation with Alan Rankin, the Manager of the Scottish Marine Tourism Strategy, to see whether Uig has been identified as a possible location for growth in recreational or cruise traffic.	**Chapter 18: Commercial & Recreational Navigation.**
Defence Infrastructure Organisation (DIO)	The DIO confirmed that the Ministry of Defence (MOD) had no objection to the proposed activity.	Noted.
Whale and Dolphin Conservation	Whale and Dolphin Conservation noted concerns about the close proximity of the proposed development to the Inner Hebrides and the minches SAC for harbour porpoise. Full analysis of underwater noise propagation during development, especially for the noise generated during impact pile driving, would need to be conducted. If there was going to be significant noise from the development in the SAC, further mitigation methods, such as bubble curtains, may be required, and that an EPS licence would be required.	**Chapter 11: Marine Nature Conservation Areas** and **Chapter 14: Marine Mammals.**
The Highland Council (THC) (response to Marine Scotland	Impacts on the Inner Hebrides and the Minches candidate Special Area of Consideration should include cumulative and in-combination effects with the nearby fish farms (ref 14/01595/FUL: Ru Chorachan and 15/03667/FUL: Rubha Riadhain) due to any additional impacts of additions on the qualifying feature and any impacts of increased/changes in	**Chapter 11: Marine Nature Conservation Areas**

Consultee	Response	How the response has been addressed in the EIA Report
scoping consultation)	ferry use e.g. larger and/or more frequent vessels, as well as piling and dredging.	
The Highland Council (THC)	**Consenting Requirements** The THC Planning Service agrees that both onshore and offshore elements of the scheme should be assessed together. Both the planning and the marine licence applications should feature the full scheme. It will then be the responsibility of the planning authority and Marine Scotland to identify which considerations are material to their individual regulatory remits. As the scheme is considered EIA development, the normal permitted development rights available to the Harbour Authority as statutory undertaker do not apply.	This EIA Report assesses the Proposed Development as a whole, including both onshore and offshore elements as set out in **Chapter 1: Introduction.** **Chapter 4: Legislative & Planning Policy Context** sets out the loss of permitted development rights.
THC	**LNG Storage:** The LNG storage may require Hazardous Substances Consent from the planning authority.	CFL will be responsible for all consents for the LNG storage.
THC	**Flood Risk:** Finished floor levels are likely to be conditioned to exceed the 1:200 coastal flooding level by a further freeboard height.	**Chapter 3: Project Description**
THC	**Marine Protected Areas:** As the issue here is related to piling noise it is considered to fall outside the remit of the planning authority. However, it is considered that, at only a 1 km range, the potential impact on the Harbour Porpoise SAC could be significant and it is considered likely that an Appropriate Assessment will be required.	Underwater noise propagation modelling has been carried out to assess the potential effects on fish and marine mammals, and in turn marine conservation areas designated for marine mammals. The method and results of the underwater noise modelling are provided in **Chapter 11: Marine Nature Conservation Areas**, **Chapter 13: Fish & Shellfish** and **Chapter 14: Marine Mammals.**
THC	**Ornithology:** The survey work in respect of Corncrake is welcomed. Local RSPB officers should be able to assist as they have with other planning applications in the past.	**Chapter 15: Ornithology.** Pre-construction survey for corncrake is proposed, in the event that suitable habitat remains at the start of construction, and where construction may occur during the breeding season.
THC	**Socio-Economic Impact:** This is a potential material consideration for the authority and in respect of 'amenity impact' seems closely related to the proposed noise impact assessment proposed.	**Chapter 16: Socio-Economics & Public Access**
THC	**Visual Impact:** It is accepted that the overall visual impact will not be significant. However, the planning application should include at least two 'before and after' visualisations from raised positions on the southern and northern sides of the bay. Advice on these locations should be sought beforehand.	Seascape, landscape and visual effects were scoped out of the EIA. Two visualisations of the Proposed Development are provided in **Figures 3.4 a, b and c**. These were taken from two vantage points agreed with THC on 27 June 2018

6. Approach to EIA

No Appendices

7. Marine Physical Environment

No Appendices

8. Marine Water Quality and Sediment Quality

No Appendices

9. Flood Risk and Climate Change

9.1 Uig Harbour Redevelopment Flood Risk and Climate Change Technical Note

9.2 Uig Harbour Redevelopment Culvert Extension Technical Note

9.1 Uig Harbour Redevelopment Flood Risk and Climate Change Technical Note

Uig Harbour Redevelopment

Flood Risk & Climate Change

The Highland Council

25 January 2019

Quality information

Prepared by	Checked by	Verified by	Approved by
Redacted	Redacted	Redacte	Redacte
Principal Modeller	Principal Modeller	Technical Director	Project Director

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Revision	Revision date	Details	Authorized	Name	Position
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1. Introduction

AECOM has been commissioned to undertake a study of flood risk, including consideration of climate change, for the proposed Uig Harbour Redevelopment. The aim of this numerical modelling study is to assess the impact of the proposed development on coastal flood risk.

The MIKE21 Spectral Wave Model (SW) developed by the Danish Hydraulics Institute (DHI) was used to simulate wind-generated waves within Uig Bay including the various harbour structures. The model was operated in hindcast mode using wind data obtained from the UK Met Office. The modelling study was used to evaluate wave conditions for the existing and redeveloped layouts (i.e. including a solid jetty structure, reclamation and two dredged pockets).

Extreme water levels were taken from SEPA's Coastal Flood Boundary (CFB) dataset which includes the coastal waters near Uig Bay. Wind statistics were derived from the Met Office data for 12 directional sectors for 30° directional intervals. Extreme winds for each sector were estimated based on the Weibull probability distribution.

The wave model was run under northern and south-westerly wind conditions for the following range of return periods: 1, 2, 10, 20, 50, 100, 200 and 1000 years. Comparisons of wave overtopping between the existing ferry terminal and the scheme layout have been made to assess flood risk under the present day and climate change scenarios.

2. Extreme Water Levels

Extreme sea levels include tides, sea level rise and surge. Present day (2018) extreme sea levels were obtained from the CFB dataset. Figure 2-1 shows available data points near the study area. The point labelled '192-8-Skye-M' has been selected for Uig Bay.

In order to consider climate change for the 100 year (2118) epoch, the present day extreme water levels were factored with the UKCP09 95th percentile medium and high emission scenarios (including surge), as shown in Figure 2-1.

Figure 2-1. Local extreme sea level prediction points from the CFB database

Table 2-1 Extreme water levels near Uig Bay

Return Period (year)	Extreme Sea Levels (m, ODN)		
	Present Day (2018)	Future (2118) Medium Emission	Future (2118) High Emission
1	3.37	4.04	4.23
2	3.46	4.14	4.33
10	3.67	4.36	4.55
20	3.76	4.44	4.63
50	3.87	4.56	4.75
100	3.94	4.63	4.82
200	3.99	4.69	4.88
1000	4.15	4.86	5.05

3. Wave Modelling

AECOM developed a MIKE21 Spectral Wave Model (SW) for the specific requirements of the wave transformation study. The wave modelling report (UHRD-ACM-ZZ-GE-RP-MT-00001) provides further detail on the model set-up and calibration. MIKE21 SW is a state-of-the-art wave transformation model based on triangular mesh elements, which are able to provide enhanced resolution covering important features such as local variations in bathymetry.

Figure 3-1 and Figure 3-2 show the model mesh for the existing ferry terminal and the scheme layout, respectively.

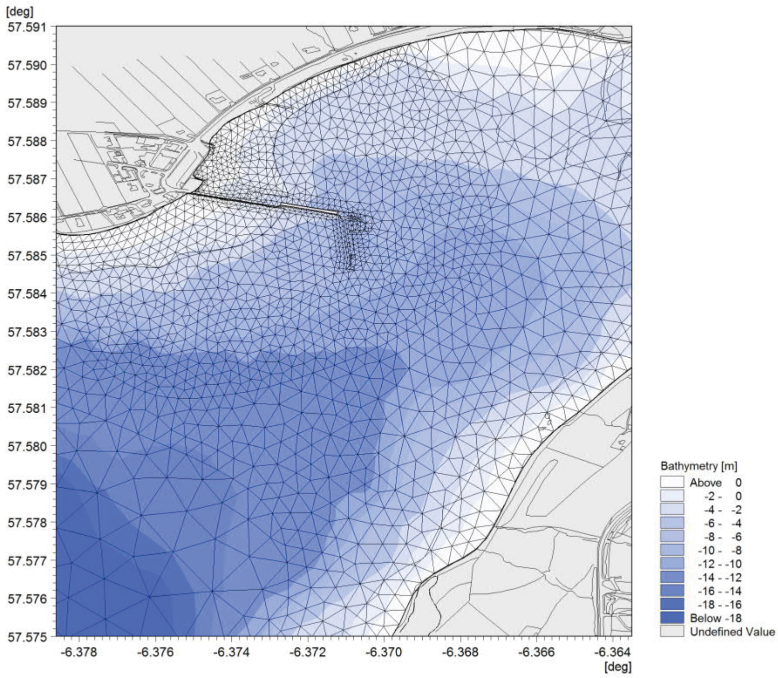

Figure 3-1. Mesh for the existing layout

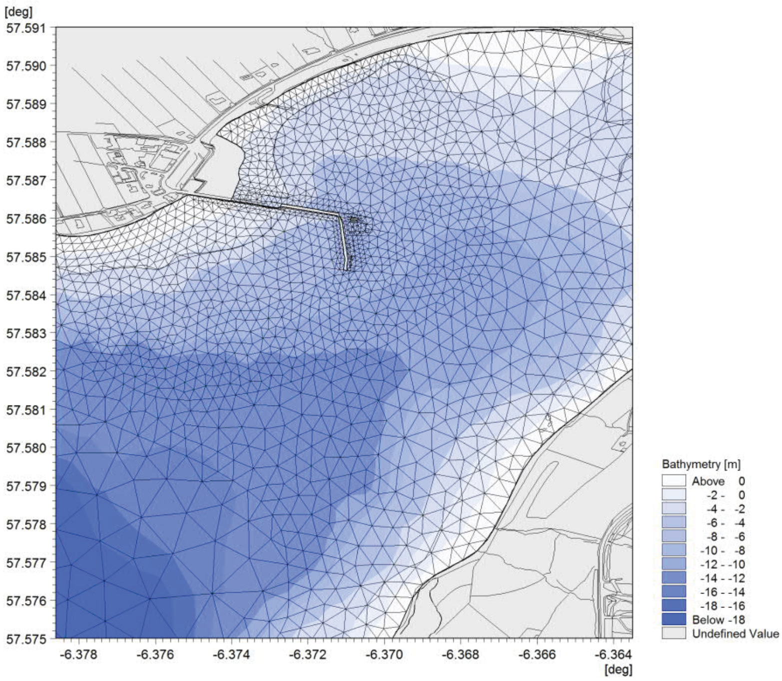

Figure 3-2. Model mesh for the scheme layout

4. Joint Probability Analysis

Joint probability refers to the chance of two or more conditions occurring at the same time. In this instance, with wave transformation modelling in mind, the coincidence of extreme waves and extreme water levels is of interest. A Joint Probability Analysis (JPA) of waves and water levels was undertaken. The simplified JPA approach, as described in the guidance (*Use of Joint Probability Methods in Flood Management: A Guide to Best Practice – R&D Technical Report FD2308/TR2, 2005*), has been used to establish combinations of waves and sea levels for the standard set of return periods previously identified. The guidance provides details of regional variations in the strength of correlation between waves and sea levels in UK waters (Figure 4-1). The correlation coefficient for Uig Bay itself is not provided therefore a 'well correlated' assumption has been assumed as a conservative approach.

The Uig Harbour ferry terminal and pier structures are exposed to wind waves propagating from the Little Minch into Uig Bay which are affected by diffraction and refraction processes and are also influenced by locally generated winds within the bay. The wave model covers a sufficiently large area to ensure that the wind generated waves can be fully developed within the model domain. The resulting significant wave heights at the toe of various structures were modelled by using combinations of extreme winds and water levels. Wave overtopping of the reclaimed area (north of the jetty) will be affected by the north-easterly (30°N sector) waves/winds, whilst south-westerly (270°N sector) winds are expected to generate the largest overtopping along the southern side of the jetty.

Directional extreme winds have been estimated based on the Weibull probability distribution involving the selection of individual storm events using the peaks over threshold method. This includes wind speeds for eight return periods of 1, 2, 10, 20, 50, 100, 200 and 1000 years. Wind extremes for the 30°N and 270°N sectors are provided in Table 4-1 and were used in the further joint probability analysis. For the climate change, high emission scenario was considered for water levels, and the allowances provided in Environment Agency Guidance 'Flood risk assessments: climate change allowances' (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) were applied for winds. This requires a 10% increase in wind speed up to 2115 from a 1990 baseline to investigate the range of impact.

The results of the joint probability analysis are provided in Table 4-2 to Table **4-5** and Figure 4-2 to Figure 4-5. Each table and figure present the joint exceedance return periods for a combination of extreme wind speed and sear levels.

Table 4-1 Extreme wind speeds (m/s) for present day and with future climate change

RP (yrs)	Sector 30°		Sector 270°	
	Present	Future	Present	Future
1	16.3	17.9	23.5	25.9
2	17.9	19.7	24.5	27.0
10	21.7	23.9	27.6	30.4
20	23.4	25.7	29.6	32.6
50	25.7	28.3	32.3	35.6
100	27.5	30.3	34.4	37.9
200	29.3	32.2	36.6	40.2
1000	33.6	37.0	41.7	45.9

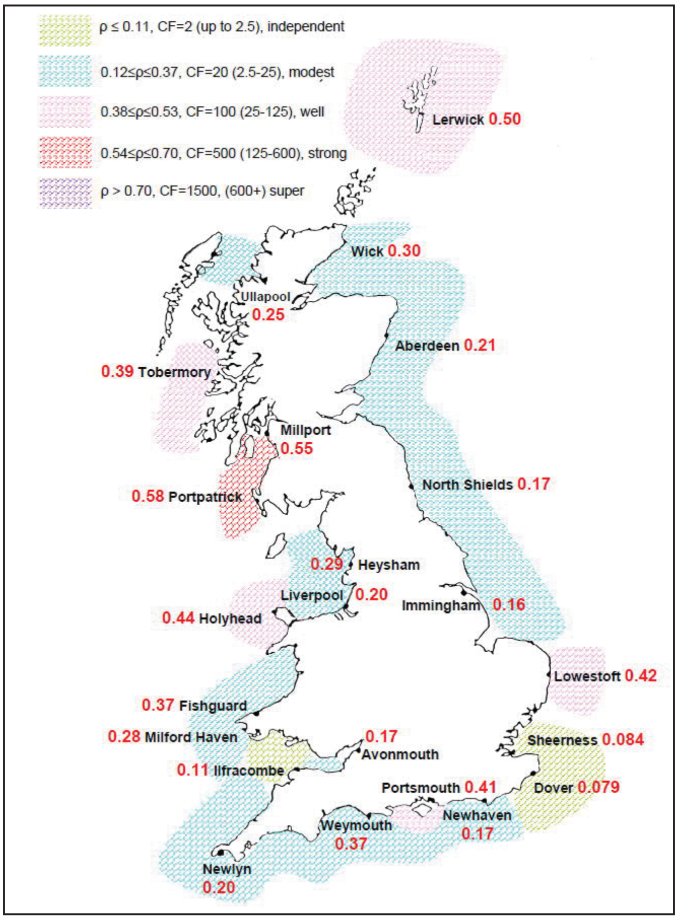

Figure 4-1. Correlation coefficient (wave height & sea levels)

Table 4-2. Joint probability for 30°N wind and water level (present day)

Wind Speed (m/s)	Joint exceedence return period (years)							
	1	2	10	20	50	100	200	1000
	Still Water Level (m, ODN)							
4.4	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
6.2	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
7.0	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
10.3	3.2	3.3	3.6	3.7	3.9	3.9	4.0	4.2
12.1	3.2	3.3	3.5	3.6	3.8	3.9	4.0	4.2
14.4	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1
16.3	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0
17.9		3.0	3.3	3.4	3.5	3.6	3.7	4.0
21.7			3.1	3.2	3.3	3.4	3.5	3.8
23.4				3.1	3.2	3.3	3.4	3.7
25.7					3.1	3.3	3.3	3.6
27.5						3.2	3.3	3.5
29.3							3.2	3.4
33.6								3.3

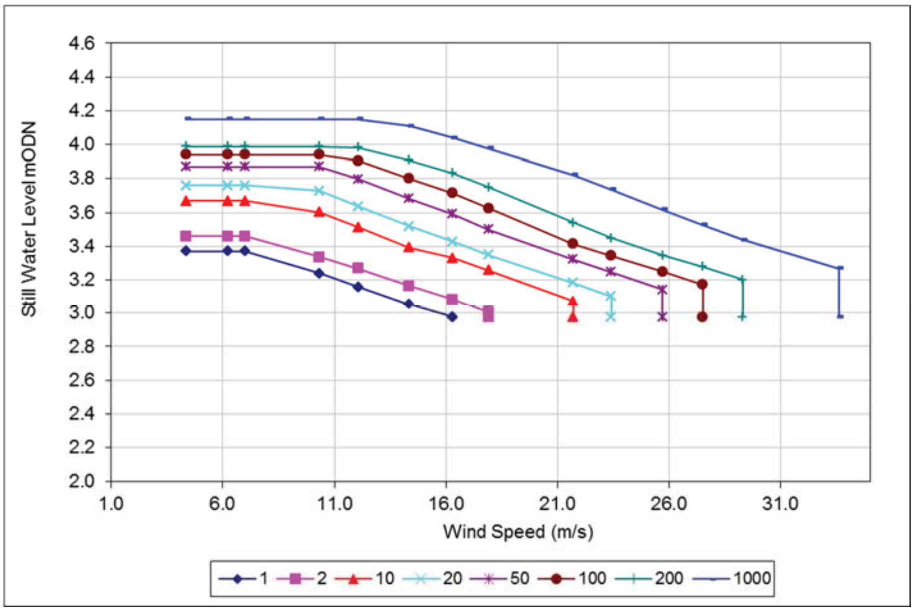

Figure 4-2. Joint probability distribution for 30°N wind and water level (present day)

Table 4-3. Joint probability for 30°N wind and water level (climate change)

Wind Speed (m/s)	Joint exceedence return period (years)							
	1	2	10	20	50	100	200	1000
	Still Water Level (m, ODN)							
4.8	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
6.9	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
7.7	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
11.4	4.1	4.2	4.5	4.6	4.8	4.8	4.9	5.1
13.3	4.0	4.1	4.4	4.5	4.7	4.8	4.9	5.1
15.8	3.9	4.0	4.3	4.4	4.6	4.7	4.8	5.0
17.9	3.8	3.9	4.2	4.3	4.5	4.6	4.7	4.9
19.7		3.8	4.1	4.2	4.4	4.5	4.6	4.9
23.9			3.9	4.0	4.2	4.3	4.4	4.7
25.7				4.0	4.1	4.2	4.3	4.6
28.3					4.0	4.1	4.2	4.5
30.3						4.0	4.1	4.4
32.2							4.1	4.3
37.0								4.1

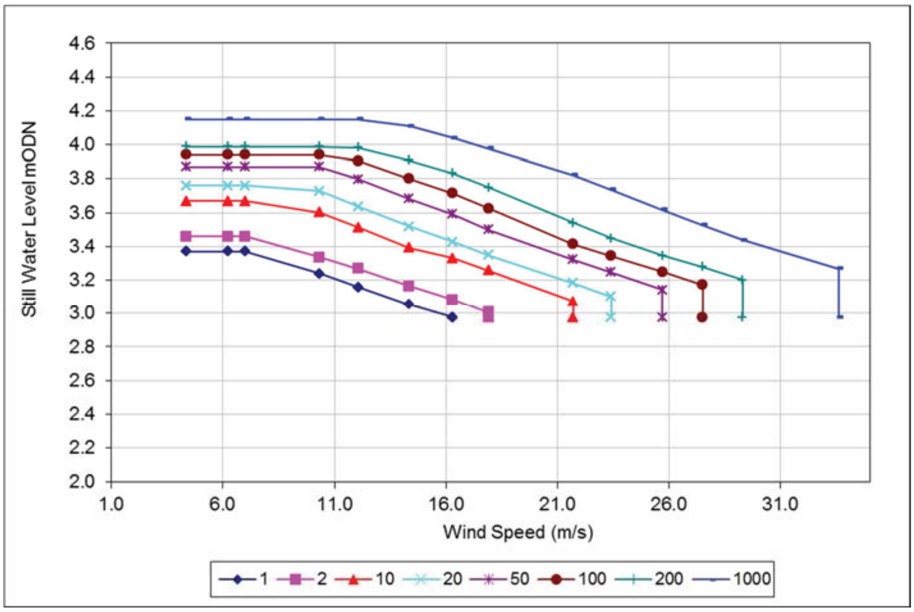

Figure 4-3. Joint probability distribution for 30°N wind and water level (climate change)

Table 4-4. Joint probability for 270°N wind and water level (present day)

Wind Speed (m/s)	Joint exceedence return period (years)							
	1	2	10	20	50	100	200	1000
	Still Water Level (m, ODN)							
9.1	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
11.8	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
13.6	3.4	3.5	3.7	3.8	3.9	3.9	4.0	4.2
16.3	3.2	3.3	3.6	3.7	3.9	3.9	4.0	4.2
18.2	3.2	3.3	3.5	3.6	3.8	3.9	4.0	4.2
20.6	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1
23.5	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0
24.5		3.0	3.3	3.4	3.5	3.6	3.7	4.0
27.6			3.1	3.2	3.3	3.4	3.5	3.8
29.6				3.1	3.2	3.3	3.4	3.7
32.3					3.1	3.3	3.3	3.6
34.4						3.2	3.3	3.5
36.6							3.2	3.4
41.7								3.3

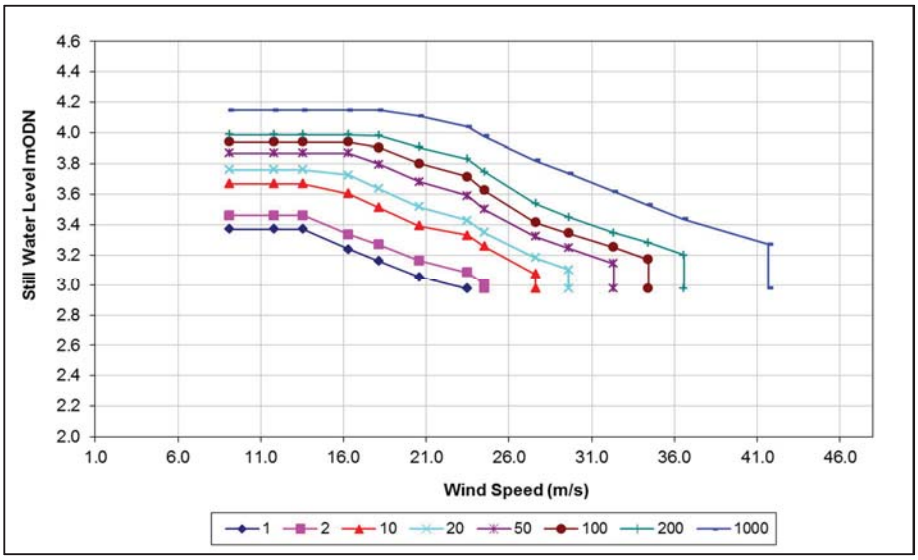

Figure 4-4. Joint probability distribution for 270°N wind and water level (present day)

Table 4-5. Joint probability for 270°N wind and water level (climate change)

Wind Speed (m/s)	Joint exceedence return period (years)							
	1	2	10	20	50	100	200	1000
	Still Water Level (m, ODN)							
10.0	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
13.0	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
14.9	4.2	4.3	4.6	4.6	4.8	4.8	4.9	5.1
17.9	4.1	4.2	4.5	4.6	4.8	4.8	4.9	5.1
20.0	4.0	4.1	4.4	4.5	4.7	4.8	4.9	5.1
22.6	3.9	4.0	4.3	4.4	4.6	4.7	4.8	5.0
25.9	3.8	3.9	4.2	4.3	4.5	4.6	4.7	4.9
27.0		3.8	4.1	4.2	4.4	4.5	4.6	4.9
30.4			3.9	4.0	4.2	4.3	4.4	4.7
32.6				4.0	4.1	4.2	4.3	4.6
35.6					4.0	4.1	4.2	4.5
37.9						4.0	4.1	4.4
40.2							4.1	4.3
45.9								4.1

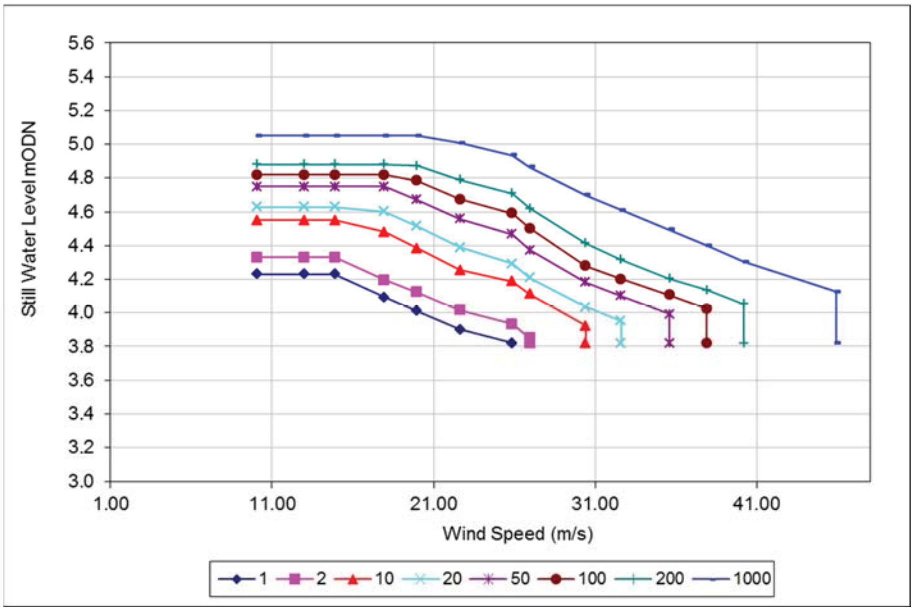

Figure 4-5. Joint probability distribution for 270°N wind and water level (climate change)

5. Overtopping Calculation

5.1 Approach

Wave overtopping is the process by which water is carried over the top of a coastal defence due to wave run-up exceeding the defence crest height. The calculations of wave overtopping discharge rate at the coastal defence structures were undertaken to identify the level of risk from coastal flooding for a range of return periods. The calculations were carried out using formulae provided in '*EurOtop – Wave Overtopping of Sea Defences and Related Structures Assessment Manual*' (2012) to determine the mean overtopping discharge (l/s/m) for a range of structure types. At present, the EurOtop guidance is regarded as best practice within industry. The required inputs to the calculation vary according to structure type, but typically consist of:

- significant wave height (m);
- mean wave period (s);
- structure freeboard (m);
- water depth at the structure toe (m); and
- roughness coefficients and the structure slope (if applicable).

5.2 Cross Sections

Wave overtopping discharge rates have been estimated at four cross sections for the existing ferry terminal (Figure 5-1 and Figure 5-2) and five cross-sections for the developed scheme (Figure 5-3). Typical geometry of the defence structures (crest level, bed level at toe, slope etc.) are provided in Table 5-1 and Table 5-2 based on structural design parameters and topographic survey information.

Figure 5-1. Cross sections for the existing ferry terminal

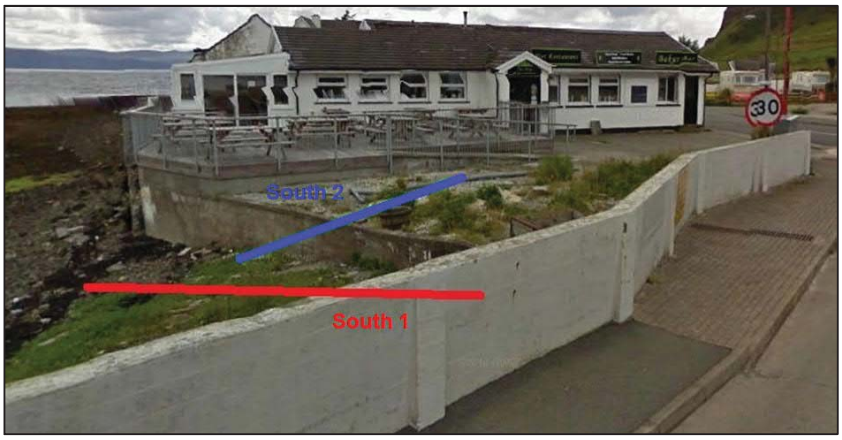

Figure 5-2. Cross sections for the existing ferry terminal (3D view)

Table 5-1. Cross-section details for the existing ferry terminal

Cross Sections	North	South 1	South 2	South 3
Crest Level (m, OD)	4.15	5.54	4.30	5.54
Crest Level (m, CD)	6.85	8.24	7.00	8.24
Bed level at toe (m, ODN)	0.80	2.20	2.20	-2.00
Slope	1/2	vertical wall	vertical wall	vertical wall

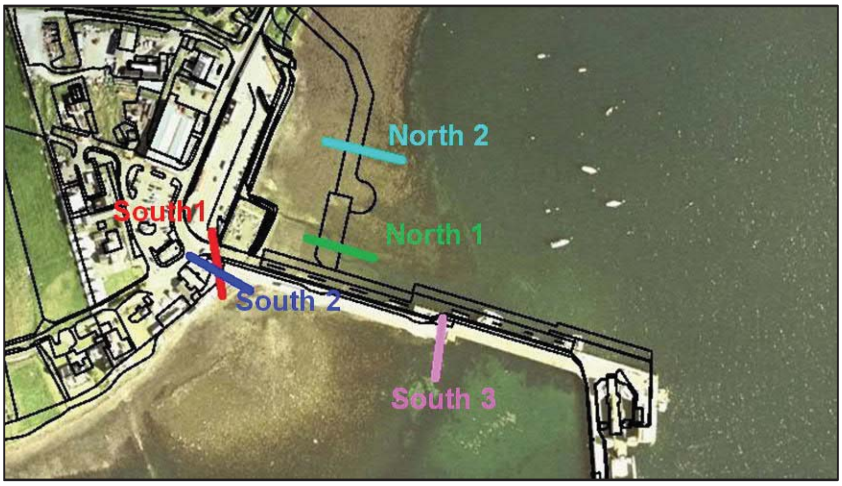

Figure 5-3. Cross-sections for the developed scheme

Table 5-2. Cross-section details for the developed scheme

Cross Sections	North 1	North 2	South 1	South 2	South 3
Crest Level (m, ODN)	4.80	4.80	5.54	4.30	5.54
Crest Level (m, CD)	7.50	7.50	8.24	7.00	8.24
Bed level at toe (m, ODN)	-1.70	-0.50	2.20	2.20	-2.00
Slope	vertical wall	1/2.5	vertical wall	vertical wall	vertical wall

5.3 Overtopping Discharge Rate

The range of sea levels and wave heights considered was based on the joint probability analysis presented in the Section 4. Wave overtopping discharge rates were calculated for combinations of wave and sea level for each cross-section. The results cover the full range of extreme events from 1 in 1 year up to a 1 in 1000 year event for both present day (2018) and a high emissions climate change scenario (2118). This resulted in a maximum wave overtopping discharge being derived for each joint probability event at each cross-section. These joint exceedance overtopping discharges are presented in Table 5-3 to Table 5-6. Figure 5-4 to Figure 5-11 shows the comparison between the existing terminal and the developed scheme. Based on these results the following conclusions can be drawn:

1. For the reclaimed area to the north of the terminal, wave overtopping discharges will be significantly reduced for the developed case due to an increase of 0.65m in the crest level of the defences.
2. For the area to the south of the terminal (Sections South 1, South 2 and South 3), wave overtopping discharges are predicted to increase due to the proposed new solid jetty structure.
3. The increase in overtopping discharge close to the coastline (Sections South 1 and South 2) is relatively small, although the proposed solid jetty has a more significant impact on overtopping near the jetty approach (Section South 3).

Further analysis suggests that the incoming waves are reflected from the proposed solid jetty structure increasing wave heights in front of the jetty approach. Figure 5-12 to Figure 5-15 show the comparison of significant wave height between the existing ferry terminal and the developed scheme. It can be seen that the proposed solid structure has a relatively small impact on wave heights (up to 9%) at the South 1 and South 2 sections. However, the increase in the incident wave height is more than 20% at the South 3 section.

Table 5-3. Overtopping rates for the existing ferry terminal 2018

Return Period (years)	Overtopping Rate (l/m/s)			
	North	South 1	South 2	South 3
1	0.0	0.7	9.0	14
2	0.2	1.2	14	19
10	2.3	3.2	47	38
20	5.0	4.9	77	47
50	12	7.9	181	57
100	21	11	397	63
200	33	16	858	72
1000	76	31	1934	111

Table 5-4. Overtopping rates for the existing ferry terminal 2118

Return Period (years)	Overtopping Rate (l/m/s)			
	North 1	South 1	South 2	South 3
1	44	23	2077	73
2	68	32	2592	89
10	149	72	3791	171
20	195	99	4448	223
50	269	183	5039	323
100	334	286	5161	421
200	402	466	5483	610
1000	571	1171	7060	1290

Table 5-5. Overtopping rates for the developed scheme 2018

Return Period (years)	Overtopping Rate (l/m/s)				
	North 1	North 2	South 1	South 2	South 3
1	0.0	0.0	1.4	11	37
2	0.0	0.0	1.9	17	46
10	0.9	0.0	4.5	58	80
20	1.2	0.0	6.2	103	90
50	1.7	0.0	10.3	282	104
100	3.6	0.0	15	727	118
200	4.6	0.0	21	1330	144
1000	9.0	0.0	41	2392	252

Table 5-6. Overtopping rate for the developed scheme 2118

Return Period (years)	Overtopping Rate (l/m/s)				
	North 1	North 2	South 1	South 2	South 3
1	1.3	0.0	30	3045	142
2	3.3	0.0	42	3276	205
10	15	0.4	96	4940	384
20	25	2.0	135	5528	493
50	43	5.3	257	6322	727
100	62	7.0	409	6455	930
200	84	13	681	6853	1351
1000	156	30	2057	8925	3651

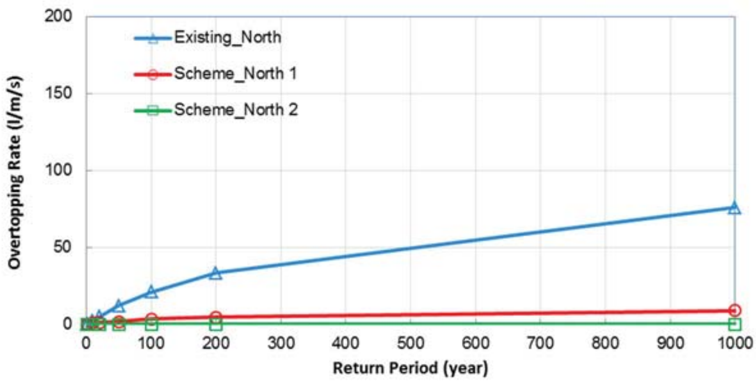

Figure 5-4. Comparison of overtopping for north sections (existing vs scheme - present day)

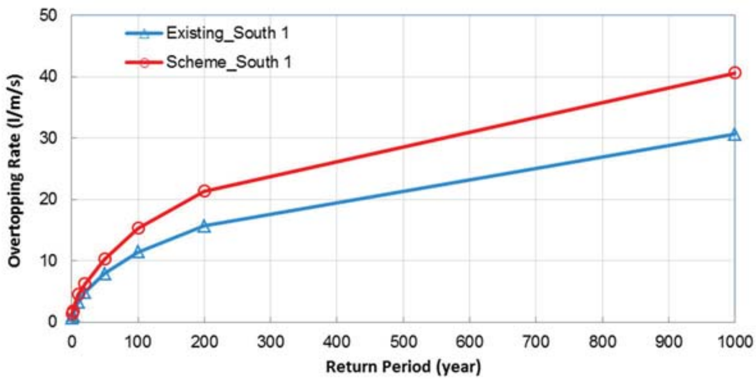

Figure 5-5. Comparison of overtopping for South 1 section (existing vs scheme - present day)

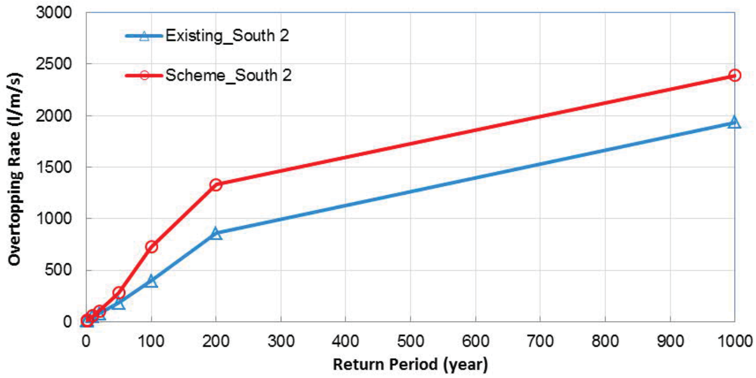

Figure 5-6. Comparison of overtopping for South 2 section (existing vs scheme - present day)

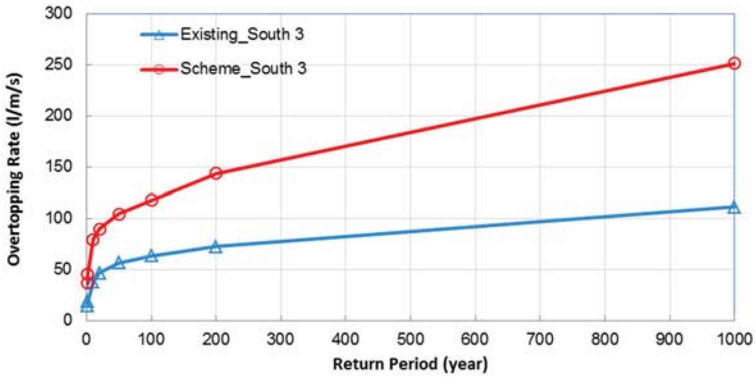

Figure 5-7. Comparison of overtopping for South 3 section (existing vs scheme - present day)

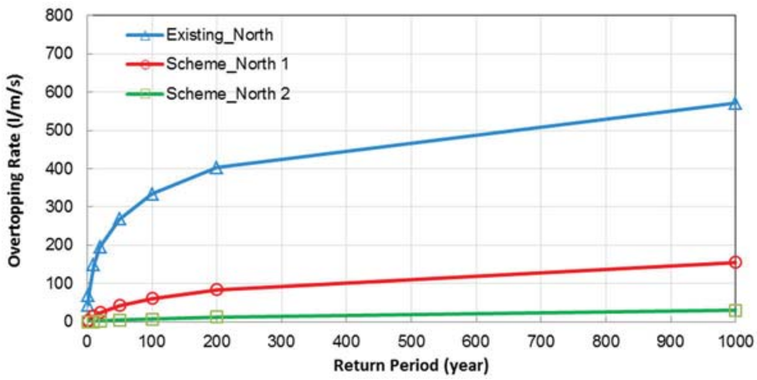

Figure 5-8. Comparison of overtopping for north sections (existing vs scheme - climate change)

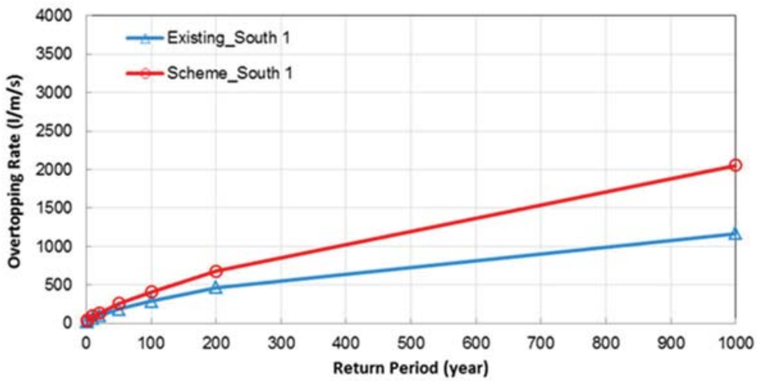

Figure 5-9. Comparison of overtopping for South 1 section (existing vs scheme - climate change)

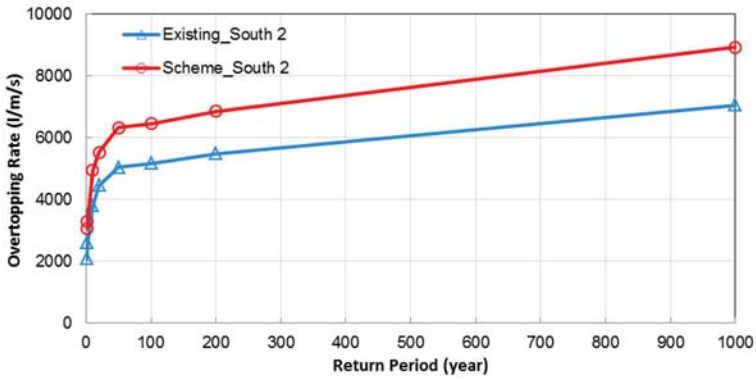

Figure 5-10. Comparison of overtopping for South 2 section (existing vs scheme - climate change)

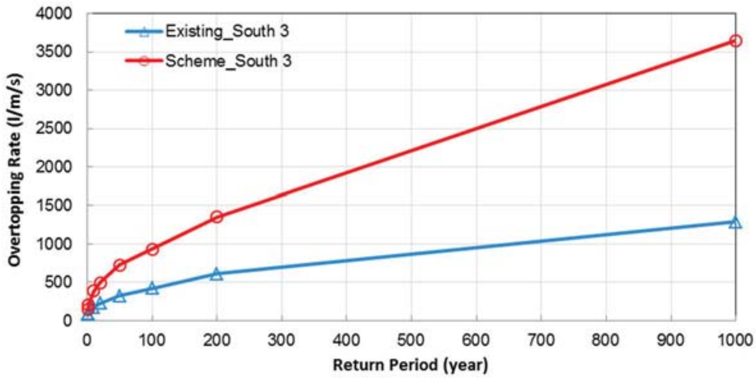

Figure 5-11. Comparison of overtopping for South 3 section (existing vs scheme - climate change)

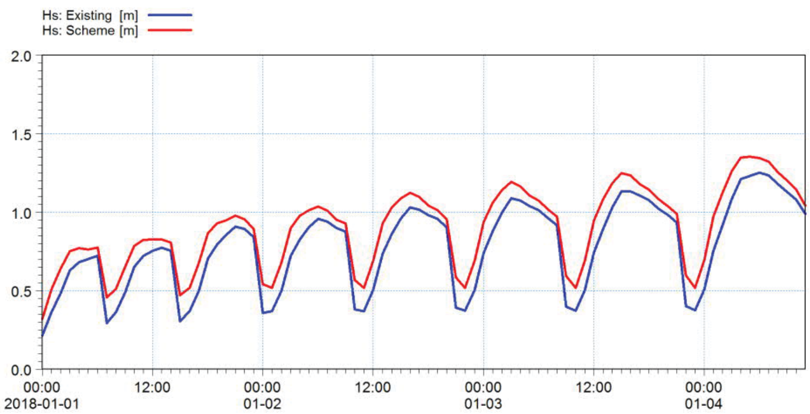

Figure 5-12. Comparison of Hs at South 1-2 sections (existing vs scheme - present day)

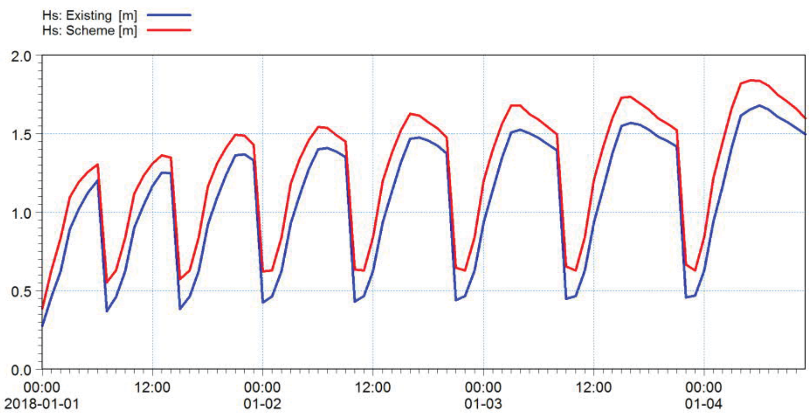

Figure 5-13. Comparison of Hs at South 1-2 (existing vs scheme - climate change)

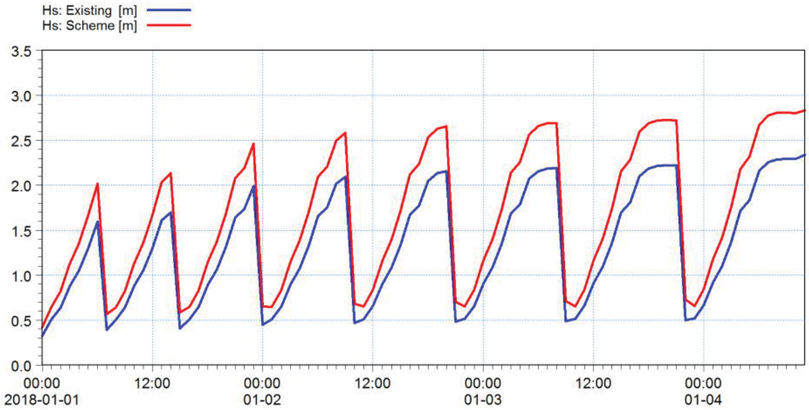

Figure 5-14. Comparison of Hs at South 3 (existing vs scheme - present day)

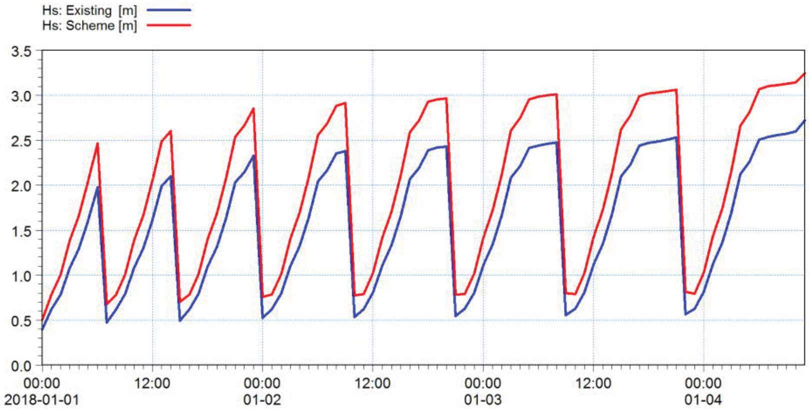

Figure 5-15. Comparison of Hs at South3 (existing vs scheme - climate change)

5.4 Validation

Estimations of overtopping have a large range of uncertainty. Ideally, field measurements of overtopping experienced during a storm event would be available to calibrate/validate the model setup and parameters used in the calculation. In the absence of such measurements we have collated available information on inundation close to the inland road and buildings from the port manager and local residents.

On 11th and 12th of January 2005 one of the worst wind storms hit Scotland and caused damage within Uig Bay. The magnitude (wind speed and direction) and the duration of the storm event are shown in Figure 5-16 which had an estimated return period of 1 in 40 years. According to the local residents, the wooden windows at the pottery were seriously damaged by the wave overtopping (Figure 5-17). The damaged windows are adjacent to Section 2 as identified in our analysis.

To simulate this event the wave model was driven with wind conditions as experienced during the January 2005 storm. The resulting significant wave heights and mean overtopping rates at South 2 are provided in Figure 5-18. EurOtop (2012) suggests that overtopping larger than 50 l/m/s may cause damage to a lightly protected structure (Table 5-7). Our calculation gave a mean overtopping rate of up to 102 l/m/s at Section 2, which would probably have been sufficient to cause damage to the wooden windows. This provides some reassurance that the results from our estimation of wave overtopping discharges are reasonable.

Moreover, the port manager suggested that the jetty approach regularly overtops, and overtopping can come close to buildings near the shore, but these are not regularly flooded. Table 5-3 provides wave overtopping rates for 8 return periods at the defined four sections. It can be seen that under the 1 in 1 year storm condition, the overtopping rates at the North, South 1, South 2 and South 3 sections (the jetty approach) are 0.0, 0.7, 9.0 and 14 l/m/s, respectively, which are consistent with the observation provided by the port manager.

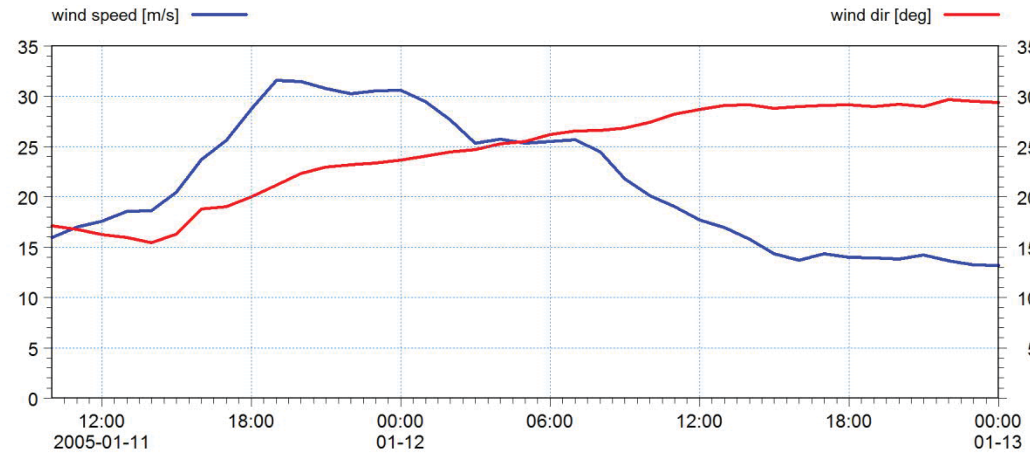

Figure 5-16. **Wind speed and directions on 11th-12th January 2005**

Figure 5-17. **Damage to properties caused by the storm on 11th-12th January 2005**

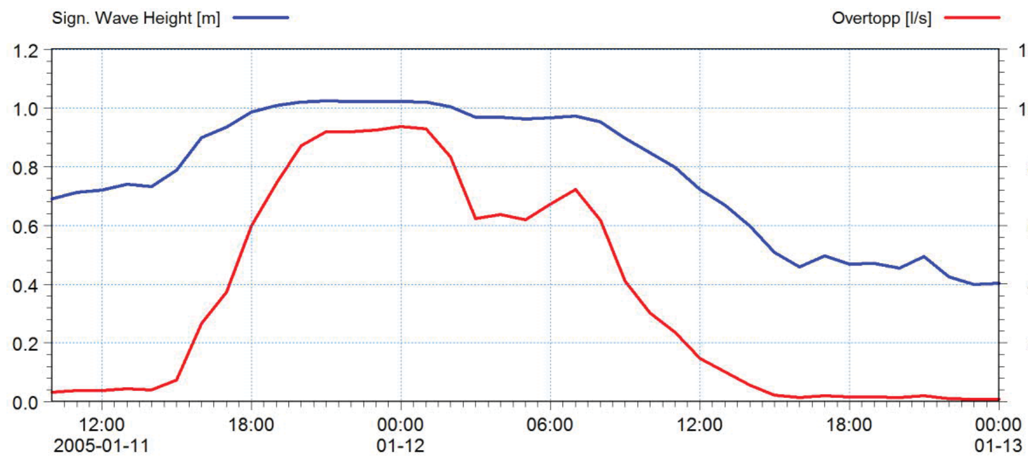

Figure 5-18. **Modelled Hs and overtopping rates for the South 2 section during the January 2005 storm**

Table 5-7 Estimated limits for overtopping damage to the defence crest or rear slope (EurOtop, 2012)

Hazard type and reason	Mean discharge q (l/s/m)
Embankment seawalls/sea dikes	
No damage if crest and rear slope are well protected	50–200
No damage to crest and rear face of grass covered embankment of clay	1–10
No damage to crest and rear face of embankment if not protected	0.1
Promenade or revetment seawalls	
Damage to paved or armoured promenade behind seawall	200
Damage to grassed or lightly protected promenade or reclamation cover	50

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9.2 Uig Harbour Redevelopment Culert Extension Technical Note

Technical Note

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Project:	**Uig Harbour Redevelopment**	Job No:	**60301293**
Subject:	**Hydraulic Assessment of Culvert**		
Prepared by:	Redacted	Date:	24/05/2018
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Introduction

As part of the harbour redevelopment works being carried out in Uig, Skye, it is proposed to extend the existing 750 dia. concrete culvert which extends from the western edge of the harbour terminal car park and discharges into the sea at the East of the site. This technical note explains the work carried out to evaluate the impact of the extension on hydraulic performance, in particular the headwater elevation of floodwaters at the inlet and any associated increase in flooding risk.

Hydrology

A small burn drains the moorland below Creag Liath and runs off the hillside down a steep gully. There it passes through two road culverts and some rough farmland towards the end of a lane next to the Isle of Skye Brewery. At this point the burn enters the culvert and is carried to the sea.

The catchment of the burn was categorised as small (< 50 ha.) and is not included in the 2013 FEH study so a catchment shape file and descriptors are not available. The IH124 methodology developed in 1994 was instead used to calculate the catchment hydrology to estimate the peak flows in the burn under a range of return period storm events.

The IH method is recommended within the Design Manual for Roads and Bridges (DMRB) and is a valid estimation method for small catchments where catchments descriptors are absent. Descriptors are therefore based on the FSR descriptors with rainfall SARR values based on the adjacent catchment.

Maps from the Flood Studies Report (1975) were consulted to obtain values for SAAR and SOIL and the catchment area was delineated using GIS map tools. The Mean Annual Flood Q_{BAR} was calculated using these parameters for an area of 50 hectares and multiplied by the relevant growth factor for the 1 in 100 year event. This was then factored down for the measured area of 24 ha. and gave a peak flow at the culvert inlet of 0.53 cumecs.

Sea Levels

Extreme sea levels in Uig Bay were taken into account in the analysis since a high sea level would present a flow restriction at the culvert outfall.

A dataset of present day extreme sea levels are provided by SEPA and the point “192-8-Skye-M” was selected for the bay. In order to account for future climate change, the present day levels were factored by the UKCP09 95th percentile medium and high emission scenario sea level rise projections. The high emission future extreme sea level for the 1 in 100 year scenario was taken as 4.82 mAOD.

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Culvert Extension

The culvert under investigation is a 750 dia. circular concrete pipe, 142m in length, and it is proposed to extend it to approximately 220m. The arrangement of the culvert inlet is unknown but the upstream channel is assumed to have a bank overflow level of 1m. The outlet is set in a concrete headwall which is around 1m high. The dimensions and parameters used as the model input are included in Table 1:

Table 1 – Culvert dimensions

Parameter	Value	Unit
Inlet invert level	7	mAOD
Outlet invert level	2.07	mAOD
Diameter	750	mm
Length	140 or 220	m
Max. allowable headwater elevation (bank threshold level)	8	mAOD
Tailwater elevation	4.82	mAOD
Manning's n	0.013	-
Inlet (assumed)	Square edge w/headwall	-
Entry loss K_e	0.5	m

CulvertMaster Modelling

CulvertMaster culvert modelling program was used to quickly assess the flow conditions in the pipe. The software can be set to calculate discharge, headwater elevation or pipe size depending on the data available.

The analysis found that for the baseline condition with a pipe length of 140m the computed headwater is 7.72 mAOD, and flow in the culvert is outlet controlled.

Under the proposed conditions with pipe length equalling 220m the computed headwater was unchanged at 7.72 mAOD and the flow control was at the outlet as before.

Sensitivity Analysis

When measuring the catchment area there was potential for error due to a lack of reliable contour information. Some other sources of error were the presence of field drains (the functioning of which is unknown); areas of hardstanding which could be fed into the burn; or road drainage which could carry flow away from the natural catchment.

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The catchment area was increased and decreased by 50% to see what effect, if any, this might have on headwater elevations before and after the pipe extension. This is a significant variance but should encompass any error in the area estimation. For a contributing area of 12 ha. the headwater elevation was unchanged between both culvert lengths – 7.49 mAOD, and for an area of 36 ha. the headwater elevation was 7.94 mAOD in both cases.

It can be concluded that changes in contributing area do not influence the effect of extending the culvert.

Conclusion

It can be concluded therefore that the proposed extension to the harbour culvert will not change potential headwater elevations and will therefore not increase or decrease flood risk at the upstream end.

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10. Ground Conditions and Contamination

No Appendices

11. Marine Nature Conservation Areas

No Appendices

12. Benthic Ecology

12.1 Intertidal Walkover Survey

Uig Harbour Redevelopment

Intertidal Ecology Walkover Survey

The Highland Council

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Quality information

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between October and November 2017 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

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Table of Contents

1. Introduction

1.1 Project Background

Uig Harbour is located in Uig Bay in the north east 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 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. (CFL).

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 and is currently programmed to arrive at the harbour in October 2018.

1.2 Project Description

The Proposed Development consists of redevelopment works to Uig Harbour to accommodate a larger ferry vessel. The vessel is expected to be approximately 3 m longer and 1.2 m wider than the current ferry. The design of the Proposed Development is still being finalised and a number of alternative options are still being considered.

The Proposed Development will include a number of works that have been identified, during the scoping exercise, to result in potential impacts to intertidal habitats. These activities are described in **Table 1-1** below.

Table 1-1 Description of the Proposed Development Activities with potential impacts for intertidal habitats

Works	Description	Potential impacts in the intertidal
Dredging	Dredging of approximately 25,000 m^3 of sediment in the berth area and widened approachway.	Disturbance to intertidal benthic habitats as a result of sediment dispersion during dredging
Increased marshalling area by land reclamation	Undertaking approximately 11,000 m^2 of land reclamation in the marine intertidal area using approximately 50,000 m^3 of infilling material with rock armour revetment and sheet piles.	Intertidal benthic habitat loss

2. Site Description

2.1 Study Area

The walkover survey covered the intertidal zone in Uig Bay, from just west of the Ferry Terminal, extending approximately 1.8 km around the Bay. The survey extent was determined after examination of the prevailing wind and water movements to ensure all foreshore areas that could be affected by sediment movements from the works on site were covered.

2.2 Objectives

The objective of the walkover survey was to identify the broad habitat types in the survey area, including recording where particular habitats and species of importance were located. Samples were not taken so only conspicuous species, observed during the walkover, have been recorded.

3. Methodology

3.1 Method

The purpose of the walkover survey was to identify the broad marine intertidal habitats and assess the potential for important habitats and protected species in the vicinity of the development site. The intertidal survey was undertaken during within 2 hours either side of spring tides on 19/10/2017, 20/10/2017 and 16/11/2017 by an experienced AECOM ecologist. The ecologist is a full member of the Chartered Institute for Ecology and Environmental Management (CIEEM).

The survey methodology comprised a walkover of the northern region of Uig Bay, in accordance with the guidance for intertidal resource mapping described in the Marine Monitoring Handbook[1]. During intertidal mapping, surveyors walk along the shore in order to identify and map the extent and distribution of the broad marine habitat types present. The sampling stations are shown on the map in **Appendix A.**

A number of transects, with stations at the high, mid and low shore were determined prior to the survey, but retaining the possibility to move transects based on the nature of the habitats observed at the time of the survey to ensure all major habitat types were covered.

The classification system for marine habitats, uses standard descriptions called ‘biotopes’ which categorise habitats based on the marine zone, the physical nature of the habitat and the biological communities observed. For example, marine habitats can be divided into littoral (also known as intertidal) and subtidal zones, and then classified according to the physical nature of the substratum, either rock or sediment, and the biological community found.

These ‘biotopes’ are defined by the Marine Habitat Classification for Britain & Ireland[2] and the European Union Nature Information System (EUNIS[3]). Biotope identification is carried out in the field and, in addition, species lists are taken where necessary.

The survey was undertaken at low tide, at an appropriate time of year and in suitable weather conditions for broad scale habitats and features of interest to be visible. Photographs and a collection of target notes were taken at a number of locations at regular intervals on site and where any marine ecological features of interest were observed.

The presence of any marine algae was recorded and note was taken of the more conspicuous fauna, and any evidence of, or potential for the presence of protected and/or notable marine species. Photographs and target notes for each station are shown in **Appendix B** and the location data is provided in **Appendix C**.

3.2 Limitations

There were no significant constraints to the field survey. The tides were sufficiently low, the weather was fair with at most slight rain, and all parts of the survey area could be accessed.

The goal of the survey was to identify and record broad habitat types and conspicuous species only so the composition of the in-faunal communities has not been investigated.

[1] Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., Sanderson, W., Turnbull, C. & Vincent, M. 2001. Marine Monitoring Handbook. UK Marine SACS project. Available from: http://jncc.defra.gov.uk/PDF/MMH-mmh_0601.pdf.
[2] UK Marine Habitat Classification hierarchy available at: http://jncc.defra.gov.uk/marinehabitatclassification.
[3] EUNIS classification available at https://www.eea.europa.eu/themes/biodiversity/eunis/eunis-habitat-classification.

4. Results

4.1 Survey Results

The site comprised two broad habitat types:

- *Littoral rock* (A1) – most areas of the intertidal region surveyed comprised boulders and cobbles of a size large enough to be categorised as littoral rock. There was however, very little bedrock in the intertidal area surveyed; and
- *Littoral sediment* (A2) – areas of mixed gravels, sands and muds largely found on the lower shore though there are patches of this biotope in the mid and high shore.

In reality, there is some difficulty defining boundaries between areas of mixed sediment with stable cobbles and boulders, and boulder fields which fall into the rocky shore (littoral rock) category and the difference between A1 and A2 habitat types can be relatively minor.

These habitats, with their European Nature Information System (EUNIS) and Marine Habitat Classification (MHC) biotope code and any conservation designations are summarised in **Table 4-1** below.

Table 4-1. Summary of intertidal benthic habitats (biotopes) found in Uig Bay survey area

EUNIS Biotope Code	MHC Biotope Code	Description	Priority Marine Features	Biodiversity Action Plan Habitats
A1	LR	Littoral rock		
A1.21	LR.MLR.BF	Barnacles and fucoids on moderately exposed shores	No	No
A1.31	LR.LLR.F	Fucoids on sheltered marine shores	No	No
A2	LS	Littoral sediment		
A2.24	LS.LSa.MuSa	Polychaete/bivalve-dominated muddy sand shores	No	No
A2.4	LS.LMx	Littoral mixed sediments	No	No
A2.5	LS.LMp.Sm	Coastal saltmarsh	No	No

4.2 Habitat Descriptions

4.2.1 Littoral rock habitats

A1 Littoral rock

Littoral rock includes intertidal habitats of bedrock, boulders and cobbles that are particularly common in the survey area. There are many physical variables affecting the biological communities that live on littoral rock, particularly wave exposure, salinity, temperature and the diurnal emersion and immersion of the shore. Wave exposure is most commonly used to characterise littoral rock communities from 'extremely exposed' to “extremely sheltered” shores. Exposed shores tend to support faunal-dominated communities of barnacles and mussels and some robust seaweeds. Sheltered shores are identified by a dense cover of fucoid seaweeds, with distinctive zones occurring down the shore. In between these extremes of wave exposure, on moderately exposed shores, mosaics of seaweeds and barnacles are more typical.

Just over three quarters of the stations noted were categorised as Littoral rock and in terms of extent was the most common biotope present in the intertidal zone in the survey region of Uig Bay. Of these stations most had very high algal cover as described more fully below.

A1.31 Fucoids on sheltered marine shores

This biotope comprises dense blankets of fucoid seaweeds dominating sheltered to extremely sheltered rocky shores and/or in locally sheltered patches on exposed to moderately exposed rocky shores. Typically, *Pelvetia canaliculata* occurs on the upper shore, with the wrack *Fucus spiralis* below. The middle shore is dominated by vast areas of the wrack *Ascophyllum nodosum* or the wrack *Fucus vesiculosus* or a mixture of both. The wrack *Fucus serratus* covers lower shore bedrock and boulders. Sheltered to very sheltered mixed substrata (pebbles and cobbles overlying muddy sand and gravel) shores can support fucoid communities.

This biotope was the most dominant across the survey area (recorded at 28 of the 45 stations recorded during the survey) covering substratum types comprising varying proportions of boulders, cobbles and pebbles. There is almost complete coverage of fucoid algae, including *Ascophyllum nodosum* a species indicative of sheltered conditions.

A1.21 Barnacles and fucoids on moderately exposed shores

This biotope is found on moderately exposed rocky shores and is characterised by a mosaic of fucoids and barnacles on bedrock and boulders, where the extent of the fucoid cover is typically less than the blanket cover associated with sheltered shores. Beneath a band of yellow and grey lichens at the top of the shore is a zone dominated by the wrack *Pelvetia canaliculata*, scattered barnacles and the black lichen Verrucaria maura may cover rock surfaces. Below, on the mid shore the wrack *Fucus vesiculosus* generally forms a mosaic with barnacles and limpets. The lower shore is dominated by the wrack *Fucus serratus*, while a variety of red seaweeds can be found underneath. Other species normally present and observed during the survey include winkles and red seaweeds. The presence of boulders and cobbles on the shore can increase the micro-habitat diversity, which often results in greater species richness.

This biotope was found at 6 stations across the survey area, five of which were on the upper shore, where fucoid cover was slightly reduced allowing barnacles to colonise rock surfaces.

4.2.2 Littoral sediment habitats

A2.4 Littoral mixed sediments

This biotope covers shores of mixed sediments ranging from muds with gravel and sand components to mixed sediments with pebbles, gravels, sands and mud in more even proportions. By definition, mixed sediments are poorly sorted. Stable large cobbles or boulders may be present which support epibiota such as fucoids and green seaweeds more commonly found on rocky and boulder shores. Mixed sediments which are predominantly muddy tend to support infaunal communities which are similar to those of mud and sandy mud shores.

It is probable that there are broad transition areas between areas of mudflat or sandy mudflat, and mixed sediment biotopes where the sediment consists principally of mud but has significant proportions of gravel and sand mixed in. Gravelly mud may occur in patches on mudflats. Similarly, there is unlikely to be an easily defined boundary between areas of mixed sediment with stable cobbles and boulders, and boulder fields which fall into the rocky shore category.

This biotope was found in small patches within wider areas of littoral rock habitats, mostly in the lower intertidal though patches were also observed on higher areas of the shore.

A2.24 Polychaete/bivalve-dominated muddy sand shores

Muddy sand or fine sand, often occurring as extensive intertidal flats on open coasts and in marine inlets. The sediment generally remains water-saturated during low water. The habitat may be subject to variable salinity conditions in marine inlets. An anoxic layer may be present below 5 cm of the sediment surface, sometimes seen in the worm casts on the surface. The infauna consists of a diverse range of amphipods, polychaetes, bivalves and gastropods.

A2.5 Coastal saltmarshes and saline reedbeds

A narrow strip of saltmarsh was observed along the upper intertidal edge, beginning immediately north of the rip-rap reinforcement at the ferry terminal car park and extending north-eastwards around Uig Bay. Except in the far north-east part of Uig Bay between the river mouths, this saltmarsh strip is rarely more than 2 m wide and is often fragmented. A substantial part of it close to the ferry terminal has been covered with dumped earth.

The saltmarsh is dominated by fine-leaved graminoids comprising red fescue *Festuca rubra* and/or saltmarsh rush *Juncus gerardi*, with constant and often abundant sea plantain *Plantago maritima* and sea milkwort *Glaux maritima*. There are variable amounts of scurvy-grass *Cochlearia* sp. This vegetation corresponds to the saltmarsh NVC (National Vegetation Classification) type SM16, which is a common component of mid/upper saltmarsh around much of the UK including the west coast of Scotland.

There is also a small patch of mono-specific sea club-rush *Bolboschoenus maritimus* at the base of the rip-rap reinforcement at the ferry terminal car park. This corresponds to the swamp NVC type S21, which is also common around much of the UK including the west coast of Scotland.

4.3 Incidental Grey Seal Sightings

A female grey seal was seen during ornithological surveys on two separate occasions in October and November along the coast on the opposite of Uig Bay from the ferry terminal.

Another sighting of a grey seal was made in September in the bay just north of the ferry terminal. No hauled out seals were seen during the intertidal surveys, nor during the ornithological surveys which together covered all but the outer parts of Uig Bay.

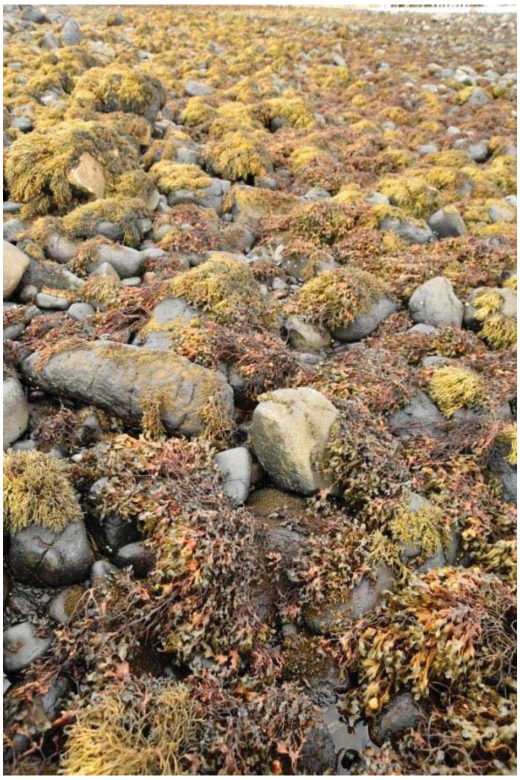
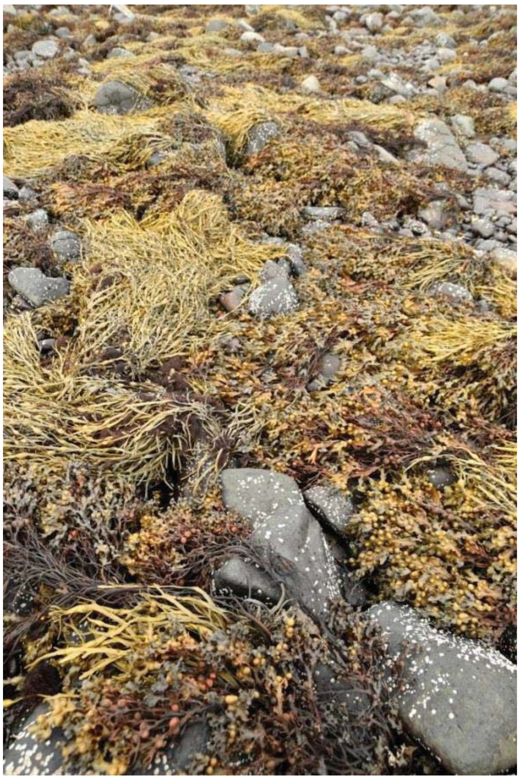
5. Conclusion

The intertidal walkover survey established the habitats in the survey area of Uig Bay were primarily habitats dominated by large boulders and cobbles with coverage of fucoid algae interspersed with occasional smaller patches of muddy, sandy or gravelly sediments. In general, the muddy areas were observed on the lower shore where polychaete worms and other infauna were in evidence.

The marine habitats and species seen in Uig Bay are considered to be typical and representative of intertidal habitats that are widespread in Scottish coastal waters. There were no habitats or species of conservation concern, such as Priority Marine Features, observed. The patches of saltmarsh present were very small and limited in extent and of generally low diversity.

Appendix A – Sample stations map

Appendix B – Survey log and photographs

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
1 – High shore	Boulders, cobbles and pebbles 75% algal cover: *Pelvetia canaliculata* and *Fucus spiralis* **A1.31 - Fucoids on sheltered marine shores**	
1 – Mid shore	Boulders, cobbles and pebbles 75% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus*. Barnacles, whelks (*Nucella lapillus*) and periwinkles (*Littorina* spp.). **A1.31 - Fucoids on sheltered marine shores**	

<table>
<tr><th>Station No.</th><th>Target Notes and EUNIS Biotope code</th><th>Supporting photograph</th></tr>
<tr><td>1 – Low shore</td><td>Boulders, cobbles and pebbles

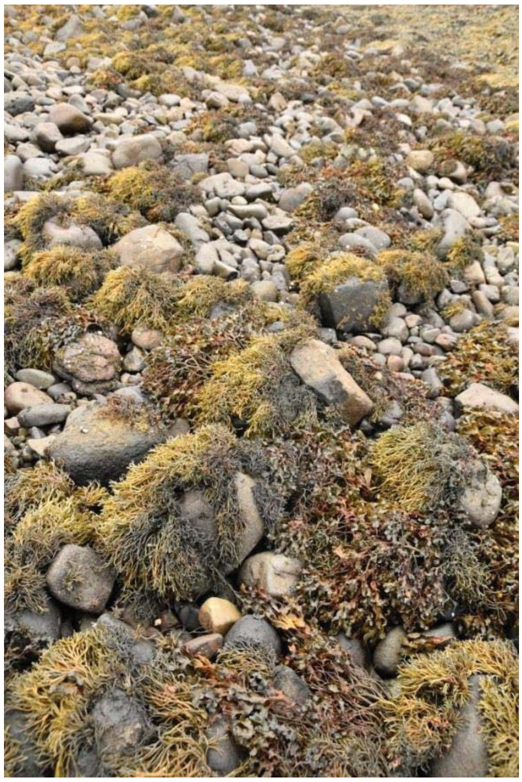
75% algal cover with Fucus vesiculosus and Ascophyllum nodosum

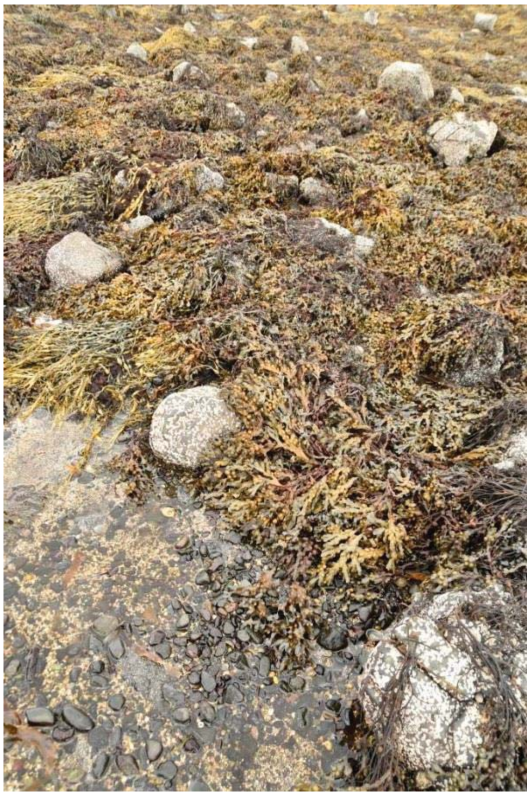
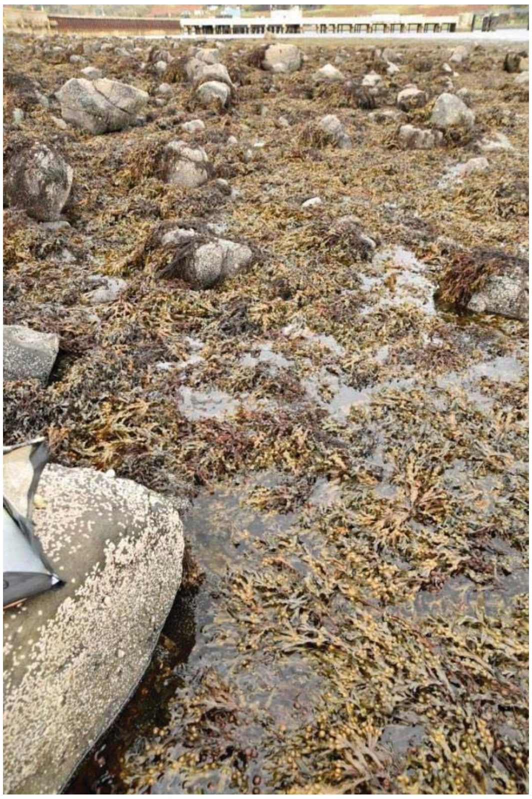
Barnacles, limpets, periwinkles (Littorina spp.), Calliostoma spp.

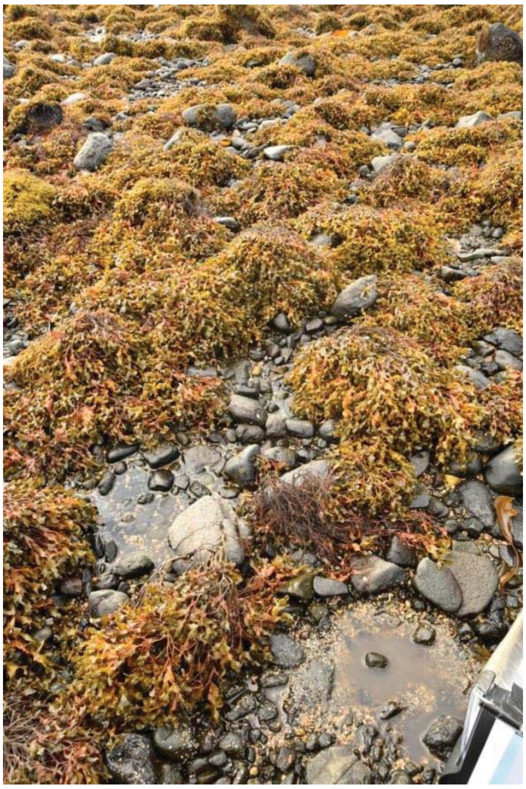
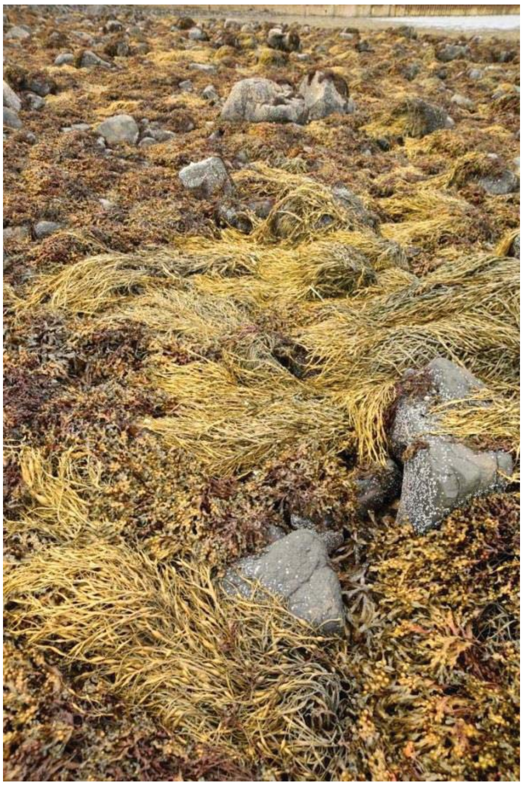
A1.21 – Barnacles and fucoids on moderately exposed shores</td><td></td></tr>
<tr><td>2 – High shore</td><td>Boulders and pebbles

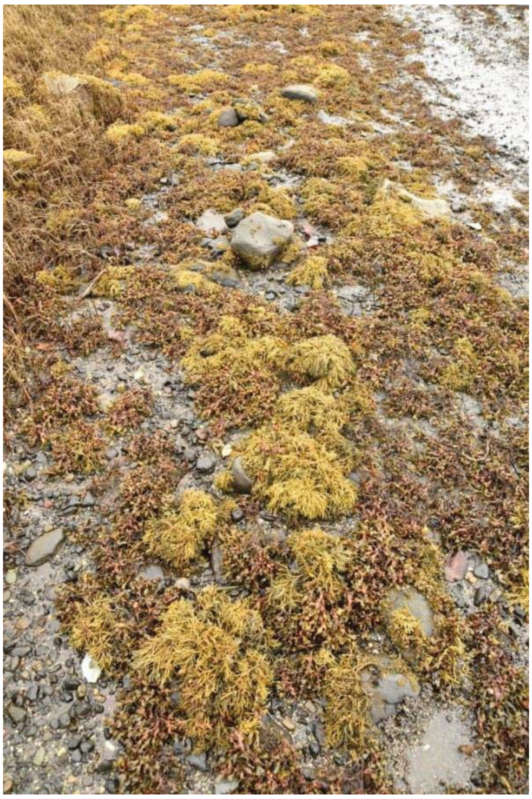
50% algal cover with Pelvetia canaliculata and Fucus spiralis.

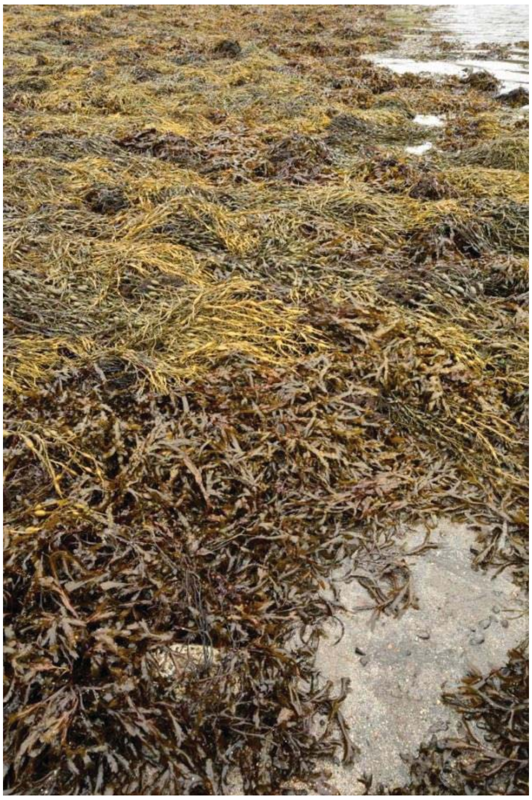
Barnacles and periwinkles (Littorina spp.).

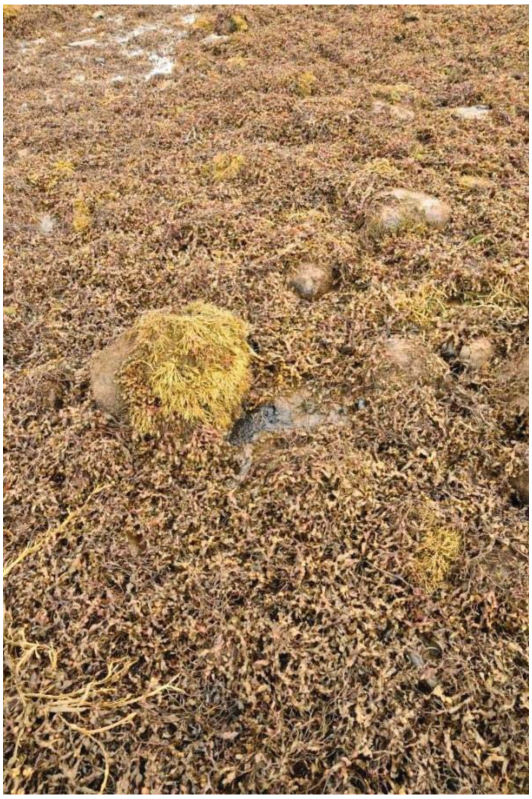
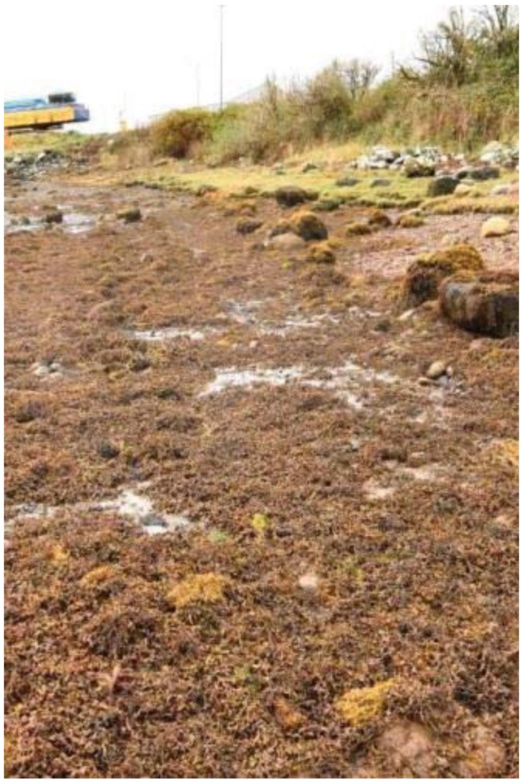
A1.21 – Barnacles and fucoids on moderately exposed shores</td><td></td></tr>
</table>

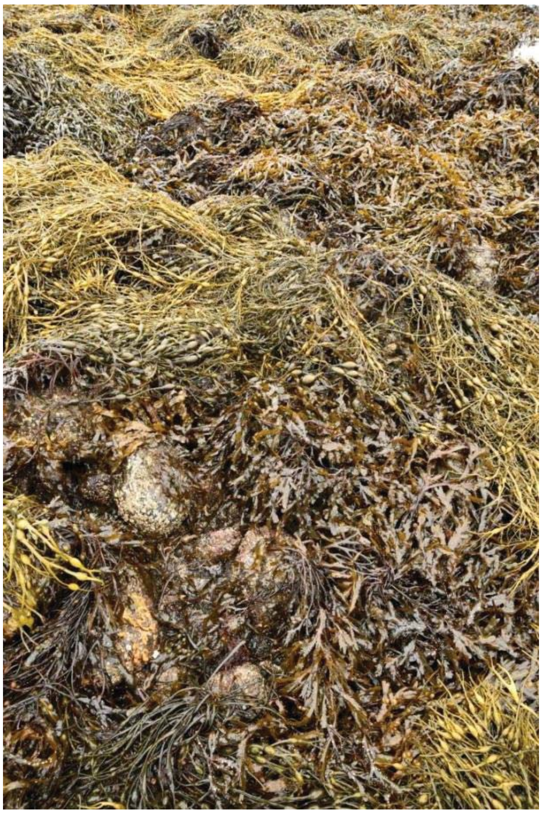
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
2 – Mid shore	Boulders, cobbles, some areas of pebbles and local shell deposits amongst the rocks. 90% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus. Polysiphonia spp.* found on *Ascophyllum nodosum* Barnacles, limpets, and periwinkles (*Littorina* spp.). **A1.31 - Fucoids on sheltered marine shores**	
2 – Low shore	Boulders and cobbles with shell deposits between. 99% algal cover with *Ascophyllum nodosum, Fucus vesiculosus, Fucus serratus* and encrusting calcareous red algae. Barnacles, periwinkles (*Littorina* spp.), whelks (*Nucella lapillus),* beadlet anemone. **A1.31 - Fucoids on sheltered marine shores**	

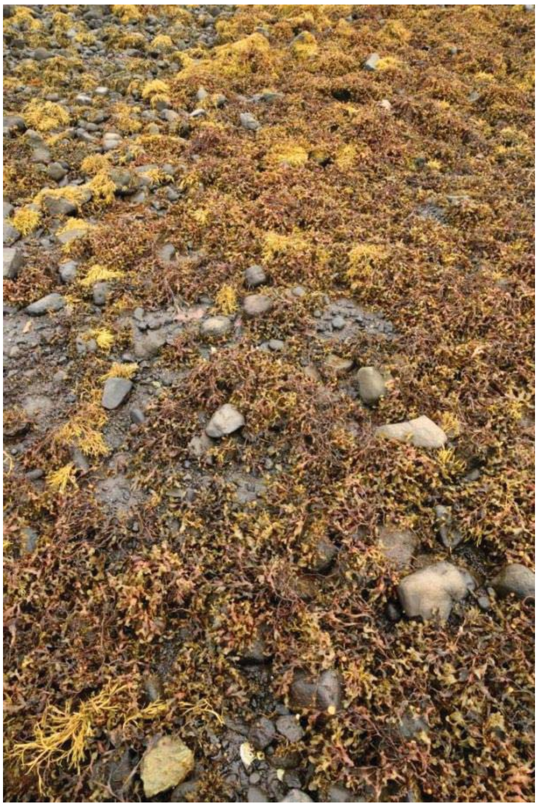
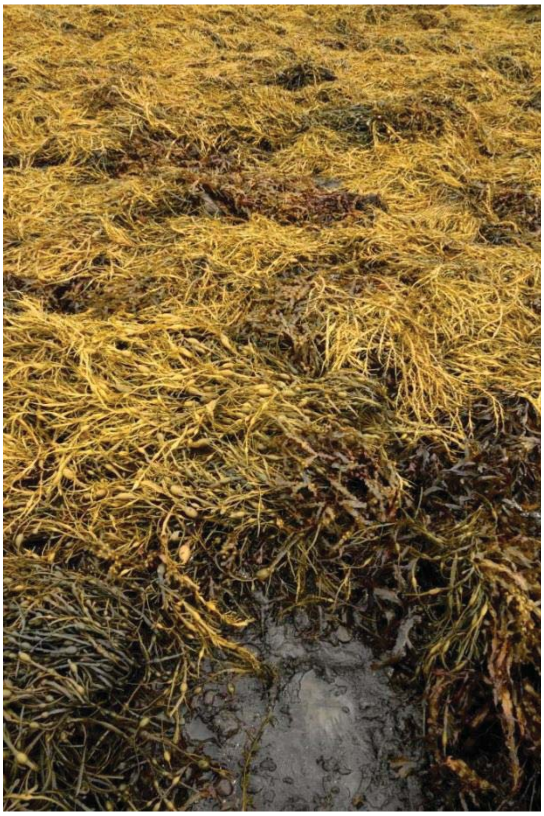
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
3 – High shore	Cobbles and pebbles with sand and shell patches 75% algal cover with *Pelvetia canaliculata* and *Fucus spiralis* Occasional barnacles on larger stones **A1.31 - Fucoids on sheltered marine shores**	
3 – Mid shore	Boulders and cobbles, with shell deposits 95% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus. Polysiphonia spp.* found on *Ascophyllum nodosum* Barnacles, limpets, and periwinkles (*Littorina* spp.). **A1.31 - Fucoids on sheltered marine shores**	

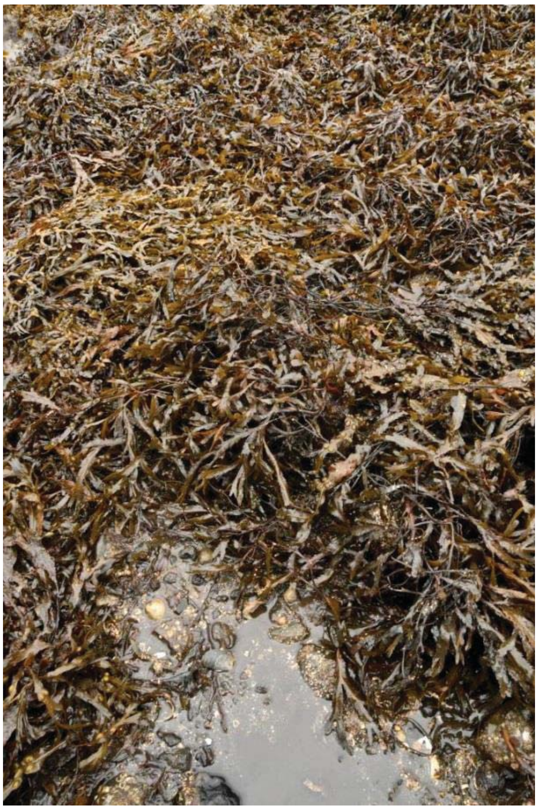
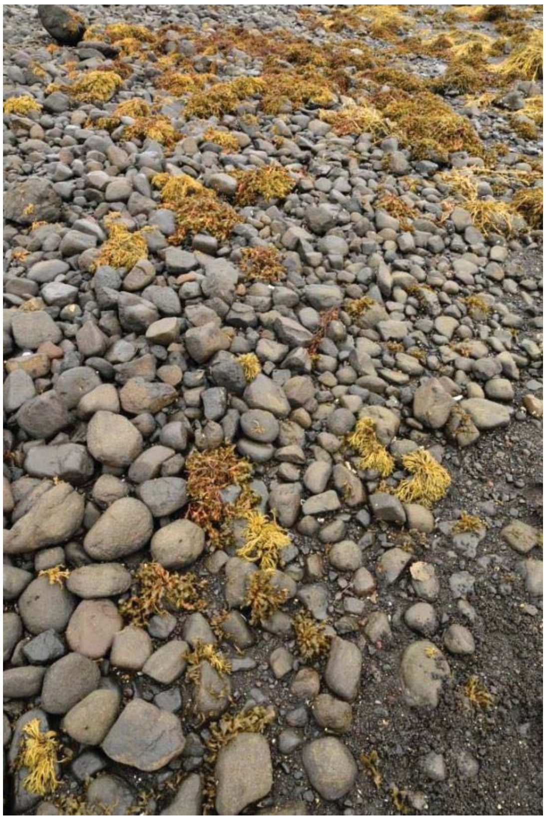
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
3 – Low shore	Boulders and cobbles with shell deposits amongst them. 99% algal cover mainly comprising *Ascophyllum nodosum, Fucus vesiculosus* and *Fucus serratus. Polysiphonia spp.* and *Ulva spp.* found on *Ascophyllum nodosum*. Encrusting red algae also present, and occasional *Chondrus crispus* and other foliose red algae. Barnacles, periwinkles (*Littorina* spp.), limpets and beadlet anemone. **A1.31 - Fucoids on sheltered marine shores**	
4 – High shore	Sand with mud, gravel and occasional cobbles. 75% algal cover with *Pelvetia canaliculata* and *Fucus spiralis.* **Additional observations** Small stand of sea club-rush *Bolboschoenus maritimus* present at upper limit of intertidal, adjacent to rip-rap reinforcement of terrestrial edge. Vehicular disturbance from adjacent track, which runs close to the rip-rap reinforcement along the terrestrial edge **A1.31 - Fucoids on sheltered marine shores**	

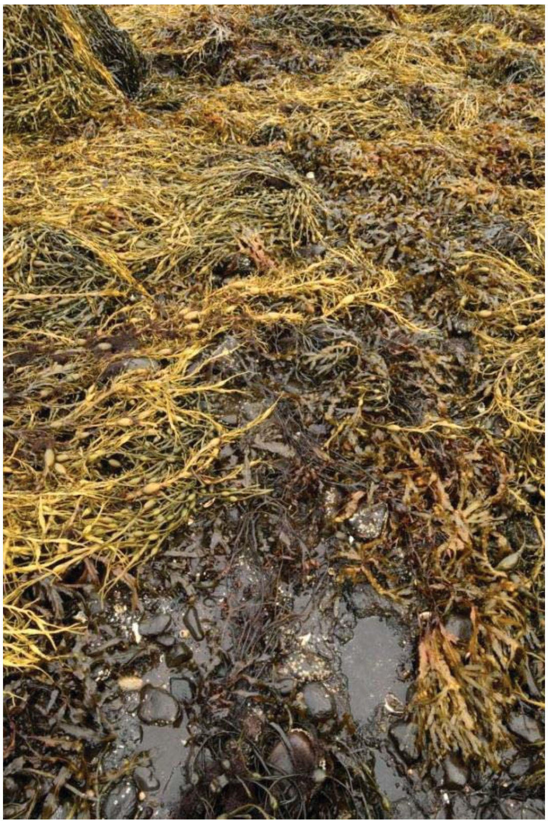
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
4 – Mid shore	Mud with mixed pebbles, scattered boulders. 80% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus. Polysiphonia spp.* found on *Ascophyllum nodosum* Barnacles on boulders, periwinkles (*Littorina* spp.) and cockles **A1.31 - Fucoids on sheltered marine shores**	
4 – Low shore	Sandy mud with pebbles, occasional cobbles 99% algal cover with *Ascophyllum nodosum, Fucus vesiculosus* and *Fucus serratus. Polysiphonia spp.* found on *Ascophyllum nodosum*. Occasional patches of the green alga *Ulva spp.* Barnacles on cobbles, periwinkles on macroalgae (*Littorina* spp.) **A1.31 - Fucoids on sheltered marine shores**	

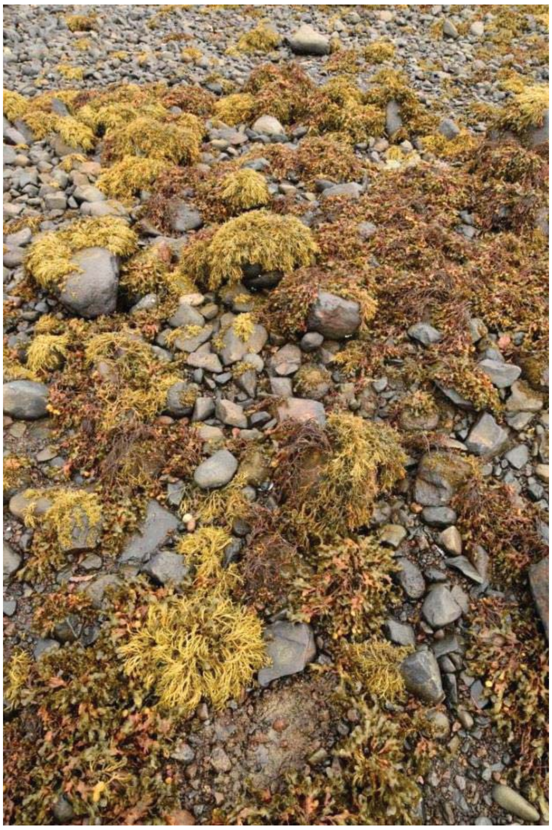
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
5 – High shore	Mud with mixed pebbles, cobbles and scattered boulders. 90% algal cover with *Pelvetia canaliculata*, *Ascophyllum nodosum* and *Fucus spiralis.* Scattered filamentous green algae. **Additional observations** Dumped earth on adjacent land, with material washed onto intertidal giving rise to patches of deep mud **A1.31 - Fucoids on sheltered marine shores**	
5 – High shore	On very high shore a narrow strip of saltmarsh was present though covered by dumped earth in a large section. **A2.5 - Coastal saltmarshes and saline reedbeds**	

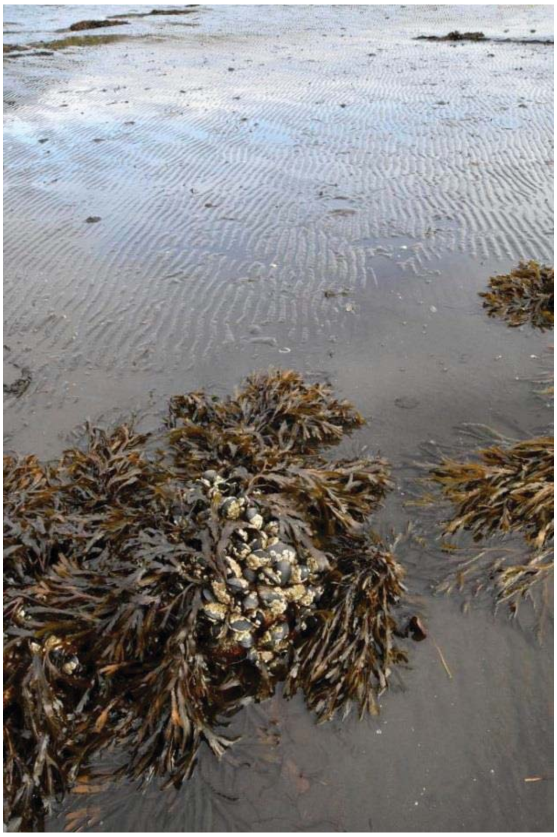
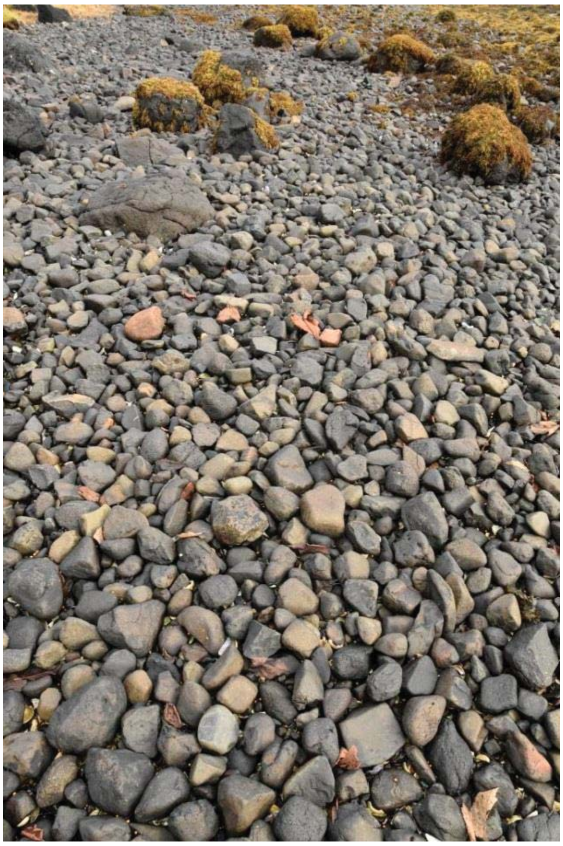
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
5 – Mid shore	Sandy mud, scattered pebbles, cobbles and boulders. 99% algal cover with *Ascophyllum nodosum. Polysiphonia spp.* found on *Ascophyllum nodosum* Washed up periwinkles (*Littorina* spp.) and cockles **A1.31 - Fucoids on sheltered marine shores**	
5 – Low shore	Cobbles and boulders with muddy sand and shell deposits between. 100% algal cover with *Ascophyllum nodosum, Fucus vesiculosus, Fucus serratus.* Also present encrusting calcareous red algae and occasional *Chondrus crispus.* Barnacles on cobbles, periwinkles (*Littorina* spp.) and breadcrumb sponge. Sand mason worms present in muddy sand. **A1.31 - Fucoids on sheltered marine shores**	

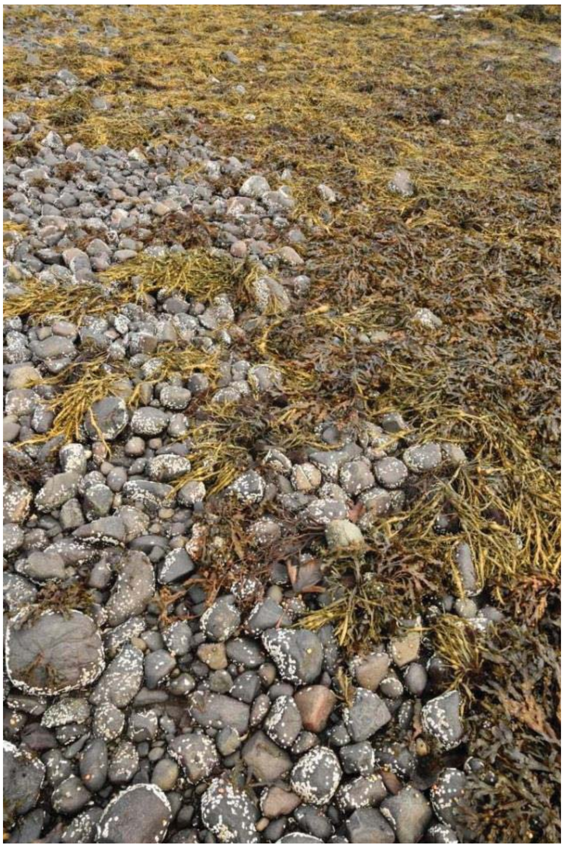
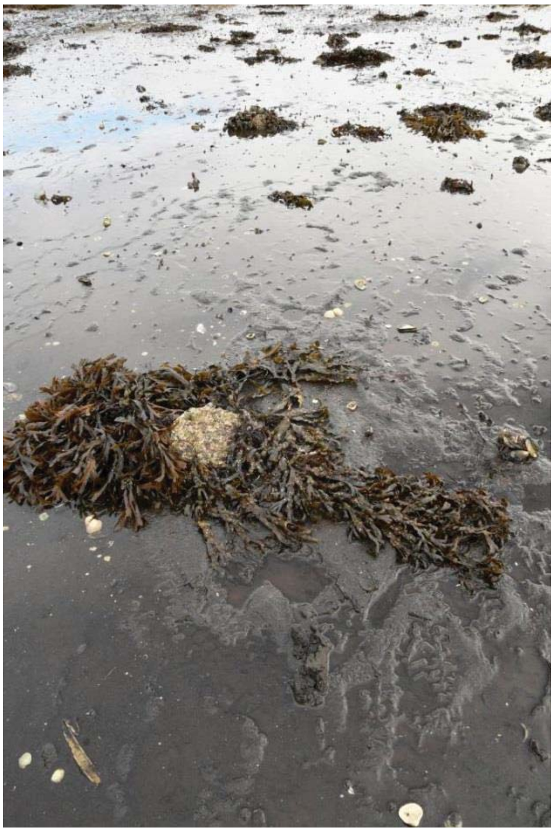
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
6 – High shore	Muddy sand with abundant surface pebbles and cobbles 75% algal cover with *Pelvetia canaliculata* and *Fucus spiralis.* Periwinkles (*Littorina* spp.) **A1.31 - Fucoids on sheltered marine shores**	
6 – Mid shore	Muddy sand with pebbles, scattered cobbles and boulders 99% algal cover with *Ascophyllum nodosum* and *Fucus serratus. Polysiphonia spp.* found on *Ascophyllum nodosum* **A1.31 - Fucoids on sheltered marine shores**	

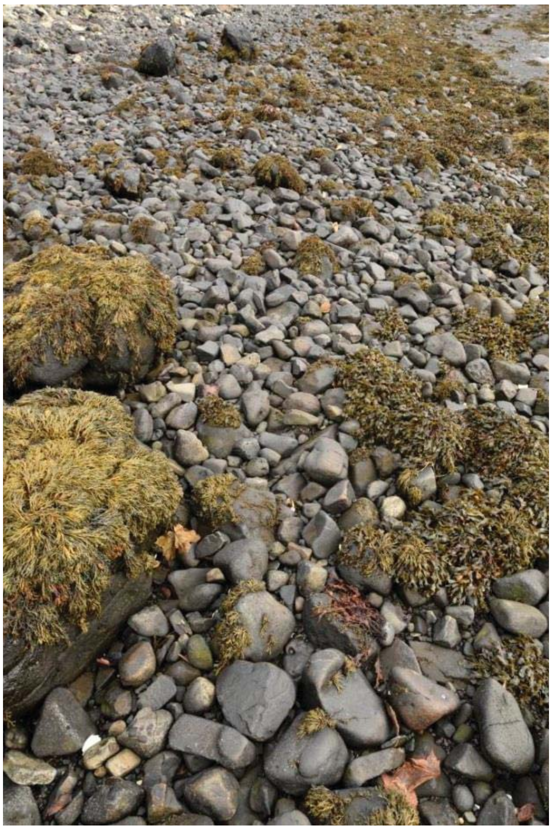
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
6 – Low shore	Muddy sand with scattered cobbles, pebbles and boulders. 99% algal cover with *Fucus vesiculosus and Fucus serratus* Flat periwinkle, limpet, barnacles, breadcrumb sponge, periwinkles (*Littorina* spp.). Sand mason worm present in muddy sand. **A1.31 - Fucoids on sheltered marine shores**	
7 – High shore	Cobbles, pebbles and gravel 10% algal cover with *Pelvetia canaliculata* and *Fucus spiralis.* Occasional barnacles **A1.21 – Barnacles and fucoids on moderately exposed shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
7 – Mid shore	Muddy sand with pebbles, scattered cobbles and boulders 99% algal cover with *Ascophyllum nodosum* and *Fucus vesciculosus. Polysiphonia spp.* found on *Ascophyllum nodosum.* Mussels and periwinkles (*Littorina* spp.). Scattered barnacles. **A1.31 - Fucoids on sheltered marine shores**	
7 – Low shore	Mud with pebbles, scattered cobbles and bolders 95% algal cover with *Fucus vesiculosus, Fucus serratus* and occasional *Ascophyllum nodosum* Barnacles, mussels and breadcrumb sponge on rocks, sand mason worm present in mud **A1.31 - Fucoids on sheltered marine shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
8 – High shore	Gravel andpebbles with sand under, and scattered cobbles/boulders 60% algal cover with *Pelvetia canaliculata* and *Fucus spiralis. Fucus ceranoides locally present in very small stream.* Occasional barnacles and whelks. **A1.31 - Fucoids on sheltered marine shores**	
8 – Mid shore	Sand and gravel with pebbles, and scattered cobbles and boulders 90% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus. Polysiphonia spp.* found on *Ascophyllum nodosum. Ulva spp.* scattered in percolating water from stream. **A1.31 - Fucoids on sheltered marine shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
8 – Low shore	Muddy sand, rippled <1% algal cover with *Fucus serratus* Barnacles and mussels on very occasional rocks, sand mason worm common in sand **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	
9 – High shore	Cobbles with scattered boulders 5% algal cover with *Pelvetia canaliculata* and *Fucus spiralis.* Saltmarsh present at upper edge of intertidal in thin strip **A1.21 – Barnacles and fucoids on moderately exposed shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
9 – Mid shore	Cobbles with occasional boulders 50% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus.* Periwinkles, barnacles **A1.31 - Fucoids on sheltered marine shores**	
9 – Low shore	Muddy sand, rare cobbles <1% algal cover with *Fucus serratus* and encrusting calcareous red algae. Barnacles and mussels on rare cobbles, occasional razor shell. **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	

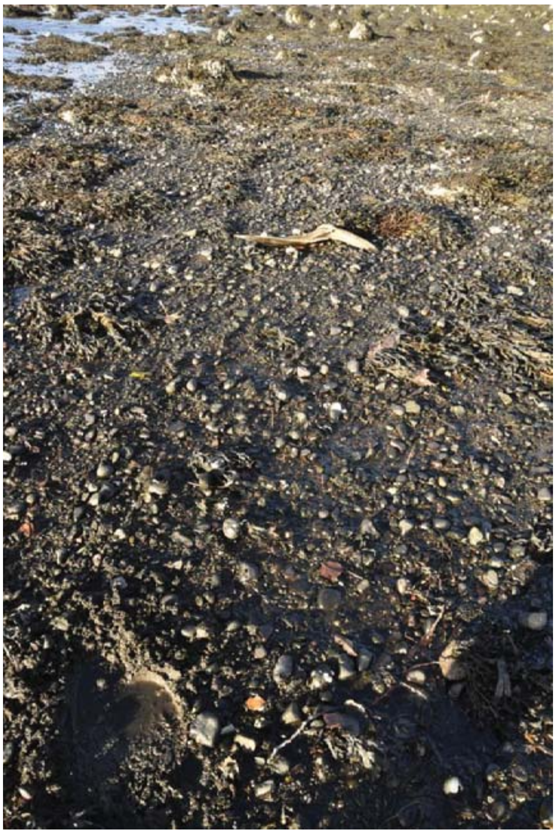
Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
10 – High shore	Cobbles and pebbles with scattered boulders 25% algal cover with *Pelvetia canaliculata* and *Fucus spiralis. Ulva spp.* in nearby small stream. **A1.21 – Barnacles and fucoids on moderately exposed shores**	
10 – Mid shore	Muddy sand with intermixed gravel and occasional cobbles/boulders 1% algal cover with *Ascophyllum nodosum* and *Fucus vesiculosus.* Sand mason worm, mussels **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
10 – Low shore	Muddy sand with intermixed gravel/pebbles and occasional cobbles <1% algal cover with *Fucus serratus* and *Fucus vesiculosus* Sand mason worms, periwinkles, barnacles and mussels on cobbles **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	
11- High shore	Sand with pebbles and scattered cobbles 25% algal cover with *Pelvetia canaliculata* and *Fucus spiralis* **A2.4 – Littoral mixed sediments**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
11- Mid shore	Pebbles with sand underneath 50% algal cover, mainly *Ascophyllum nodosum, with Fucus vesiculosus* **A1.31 - Fucoids on sheltered marine shores**	
11- Low shore	Pebbles and gravel with sand underneath 80% algal cover with *Fucus vesiculosus.* Mussels and barnacles on larger rocks **A1.31 - Fucoids on sheltered marine shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
12- High shore	Combination of sand, gravel and pebbles 2% algal cover with *Pelvetia canaliculata.* Small saltmarsh patches present, increasing towards upper intertidal edge. **A2.4 – Littoral mixed sediments**	
12- Mid shore	Pebbles with sand underneath 30% algal cover consisting of *Ascophyllum nodosum* and *Fucus vesiculosus* Barnacles present on larger stones **A2.4 – Littoral mixed sediments**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
12- Low shore	Pebbles and gravel with sand underneath. Scattered boulders 50% algal cover consisting of *Ascophyllum nodosum* and *Fucus vesiculosus*, occasional *Chondrus crispus.* Mussels and barnacles on larger rocks **A1.31 - Fucoids on sheltered marine shores**	
13- High shore	Cobbles and pebbles 2% algal cover consisting of *Pelvetia canaliculata* and *Fucus spiralis*. The adjacent river outflow contains abundant *Fucus ceranoides* **A1.21 – Barnacles and fucoids on moderately exposed shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
13- Mid shore	Pebbles and gravel over sand 25% algal cover consisting primarily of *Ascophyllum nodosum* as well as *Fucus spiralis* and *Fucus vesiculosus*. *Fucus ceranoides* abundant in adjacent river. **A1.31 - Fucoids on sheltered marine shores**	
13- Low shore	Sand with pebbles 30% algal cover, mainly *Fucus vesiculosus*, some *Fucus ceranoides* near the river Barnacles on larger scattered boulders. **A2.4 – Littoral mixed sediments**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
14- High shore	Sand with pebbles and scattered cobbles 5% algal cover consisting of *Pelvetia canaliculata*, *Fucus spiralis*, *Ascophyllum nodosum* with *Polysiphonia spp*. attached. Barnacles on cobbles. Patchy saltmarsh nearby becoming denser at upper intertidal limit. **A2.4 – Littoral mixed sediments**	
14- Mid shore	Sand with pebbles 20% algal cover mainly *Ascophyllum nodosum* and *Fucus vesiculosus* Barnacles on larger stones **A1.31 - Fucoids on sheltered marine shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
14- Low shore	Sand with pebbles, gravel and occasional cobbles/boulders <1% algal cover consisting of *Fucus vesiculosus* Barnacles and occasional live mussels on occasional larger rocks **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	
15- High shore	Sand with cobbles and pebbles 30% algal cover consisting of *Pelvetia canaliculata* and *Fucus spiralis* Washed up mussel shells **A1.31 - Fucoids on sheltered marine shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph
15- Mid shore	Sand with small pebbles and occasional cobbles 30% algal cover consisting of *Ascophyllum nodosum* and *Fucus vesiculosus* Barnacles present on cobbles and some washed up mussel shells present **A1.31 - Fucoids on sheltered marine shores**	
15- Low shore	Muddy sand with pebbles and cobbles 5-10% algal cover consisting of *Fucus vesiculosus*. Encrusting red algae is present on pebbles and shells. Live mussels present on occasional larger rocks. **A2.24 – Polychaete/bivalve-dominated muddy sand shores**	

Station No.	Target Notes and EUNIS Biotope code	Supporting photograph

Appendix C – Sample station location data and assigned biotope

Station No.	Shore position	Coordinate	EUNIS biotope code
1	H	NG 38434 63462	A1.31
1	M	NG 38436 63454	A1.31
1	L	NG 38441 63437	A1.21
2	H	NG 38485 63502	A1.21
2	M	NG 38493 63476	A1.31
2	L	NG 38505 63460	A1.31
3	H	NG 38544 63541	A1.31
3	M	NG 38569 63486	A1.31
3	L	NG 38577 63476	A1.31
4	H	NG 38588 63653	A1.31
4	M	NG 38616 63641	A1.31
4	L	NG 38680 63625	A1.31
5	H	NG 38632 63765	A1.31 & A2.5
5	M	NG 38658 63748	A1.31
5	L	NG 38685 63725	A1.31
6	H	NG 38710 63833	A1.31
6	M	NG 38717 63826	A1.31
6	L	NG 38739 63817	A1.31
7	H	NG 38792 63904	A1.21
7	M	NG 38800 63893	A1.31
7	L	NG 38821 63877	A1.31
8	H	NG 38854 63837	A1.31
8	M	NG 38854 63928	A1.31
8	L	NG 38877 63890	A2.24
9	H	NG 38991 63997	A1.21
9	M	NG 38996 63981	A1.31
9	L	NG 38998 63933	A2.24
10	H	NG 39108 64011	A1.21
10	M	NG 39105 63984	A2.24
10	L	NG 39086 63922	A2.24
11	H	NG 39240 63947	A2.4
11	M	NG 39212 63923	A1.31
11	L	NG 39150 63878	A1.31
12	H	NG 39351 63916	A2.4
12	M	NG 39306 63881	A2.4
12	L	NG 39256 63838	A1.31
13	H	NG 39465 63845	A1.21
13	M	NG 39416 63852	A1.31
13	L	NG 39283 63791	A2.4
14	H	NG 39514 63754	A2.4

Station No.	Shore position	Coordinate	EUNIS biotope code
14	M	NG 39467 63750	A1.31
14	L	NG 39354 63692	A2.24
15	H	NG 39540 63693	A1.31
15	M	NG 39496 63682	A1.31
15	L	NG 39417 63635	A2.24

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13. Fish and Shellfish Ecology

13.1 Underwater Sound Propagation Modelling and Results

Underwater Sound Calculations for Uig Harbour (21/11/2018)

Introduction

This Technical Note presents the results of calculations of sound levels and the preliminary determination of noise impact zones for proposed marine piling activities at Uig. For the purposes of this assessment, sound propagation has been calculated using a simplified spreading model which accounts for source sound levels and propagation of sound over distance.

Glossary

Ambient sound	Background environmental sound
dB	Decibel, unit used in the logarithmic measure of sound strength
dB_{peak}	Peak sound pressure over the measurement period, expressed in dB re 1 μPa
$dB_{peak\text{-}peak}$	Minimum to maximum peak sound pressure over the measurement period, expressed in dB re 1 μPa
dB_{rms}	Root mean square sound pressure over the measurement period, expressed in dB re 1 μPa.
Hz	Hertz. The number of cycles per second and refers to the frequency of the particular sound
L_p	Sound Pressure Level. The sound pressure averaged over the measurement period, expressed in dB re 1 μPa; applicable to peak, peak-peak and rms sound pressure levels.
M-weighting	Frequency weightings designed to best reflect the hearing sensitivity of marine mammals, similar to the use of the A-weighting for measuring sound impacts on humans.
PTS	Permanent Threshold Shift. Irreversible and permanent reduction in auditory sensitivity.
SEL	Sound Exposure Level. Sound energy over the measurement period expressed in dB re 1 μPa^2s. SEL is commonly used for impulsive underwater sound sources because it allows a comparison of the energy contained in impulsive signals of different duration and peak levels. The measurement period for impulsive signals is usually defined as the time period containing 90% of the sound energy.
SEL_{cum}	Cumulative Sound Exposure Level. Summation of the sound energy of multiple impulsive or transient signals over a defined assessment period expressed in dB re 1 μPa^2s i.e. SEL_{cum} = SEL + 10 log (*number of events*).
SL	Source Level. The intensity of underwater sound sources is compared by their source level, expressed in dB re 1 μPa for peak, peak-peak and rms sound pressure levels, and dB re 1 μPa^2s for SEL. The source level is defined as the sound pressure (or energy) level that would be measured at 1 metre from an ideal point source radiating the same amount of sound as the actual source being measured.
TTS	Temporary Threshold Shift. Short-term reversible reduction in auditory sensitivity. TTS will be gradually reversed upon removing exposure to the high sound levels that cause the change in hearing sensitivity.

Adopted Sound Metrics and Source Levels

It is understood that the piling will utilise a 100T crane using a 10T Drop Hammer or Vibro Hammer to drive the piles to the required depth. Source levels for the various proposed marine pile types are based on measured data[1] and are summarised below.

For the SEL_{cum} calculations, this has assumed impact piling every 15 seconds over a 15 minute accumulation period for a single pile, and vibratory piling occurring continuously over a 15-minute accumulative period for a single pile. The predictions are based on a stationary receiver and a stationary source assumption, and do not take into account any movement of the source or receiver, the frequency spectrum of the sound source or the hearing sensitivity weightings of the receptor species. As such it is considered that the SEL_{cum} predictions are representative of a worst-case scenario.

Combined scenarios have also been considered, whereby both impact and vibratory piling take place at the same time. In order to assess the range of effects, the highest and lowest source levels have been considered i.e.

- Combined scenario #1: Sheet piles = PU32 Arcelor mittal, impact and vibratory piling (highest level)
- Combined scenario #2: H piles = 204 mm x 207 mm, impact and vibratory piling (lowest)

Given the difference in source levels between impact and vibratory piling for sheet piles, the dominant sound source will be impact piling, and the combined source level would be equal to that of impact piling alone. As such any predicted noise impact zones for sheet piling would be the same as combined scenario #1.

Given the difference in source levels between impact and vibratory piling for H piles, the dominant sound source will be impact piling, and the combined Peak, RMS and SEL source level would be equal to that of impact piling alone. As such any predicted noise impact zones for H pile piling for Peak, RMS and SEL would be the same as combined scenario #2. However, the combined source level for the SELcum metric would be 182 dB.

Table 1. Pile Type Source Level

Pile Type and Dimensions	Impact Hammer Near-Source Level at 10 metres, dB				Vibratory Driver/Extractor Near-Source Level at 10 metres, dB			
	Peak	RMS	SEL	SELcum (15minutes)	Peak	RMS	SEL	SELcum (15minutes)
Sheet piles = PU32 Arcelor mittal	205	190	180	198	175	160	160	190
H piles = 204 mm x 207 mm	190	175	160	178	165	150	150	180
H piles = 465 mm x 460 mm	195	183	170	188	165	150	150	180
Tubular steel piles = 559 mm diameter with 25 mm steel casing	200	184	174	192	171	155	155	185
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing	203	190	177	195	180	170	170	200
Straight web sheet piles AS500-12.7	205	190	180	198	175	160	160	190

[1] The California Department of Transportation. (2007).Compendium of Pile Driving Sound Data.

Sound Level Threshold Criteria

The following table presents thresholds for key receptors (cetaceans, seals and fish) in the vicinity of the project area, for which the distance to onset for the thresholds has been assessed.

Table 2. Assessment Thresholds – Marine Mammals

Sensitivity	PTS (multiple pulse)	TTS/behaviour (single pulse)	Threshold source
Impulsive sound (impact piling)			
All cetaceans	230 dB$_{peak}$ 198 dB SEL	224 dB$_{peak}$ 183 dB SEL	Southall et al., 2007
Pinnipeds in water	218 dB$_{peak}$ 186 dB SEL	212 dB$_{peak}$ 171 dB SEL	
Low Frequency Cetaceans	219 dB$_{peak}$ 183 dB SEL$_{cum}$	213 dB$_{peak}$ 168 dB SEL$_{cum}$	NOAA, 2016 incorporating weighting functions
Mid Frequency Cetaceans	230 dB$_{peak}$ 185 dB SEL$_{cum}$	224 dB$_{peak}$ 170 dB SEL$_{cum}$	
High Frequency Cetaceans	202 dB$_{peak}$ 155 dB SEL$_{cum}$	196 dB$_{peak}$ 140 dB SEL$_{cum}$	
Phocid Porpoise	218 dB$_{peak}$ 185 dB SEL$_{cum}$	212 dB$_{peak}$ 170 dB SEL$_{cum}$	
Continuous sound (vibratory piling)*			
All cetaceans	230 dB$_{peak}$ 215 dB SEL	n/a	Southall et al., 2007
Pinnipeds in water	218 dB$_{peak}$ 203 dB SEL	n/a	
Low Frequency Cetaceans	199 dB SEL$_{cum}$	179 dB SEL$_{cum}$	NMFS, 2018
Mid Frequency Cetaceans	198 dB SEL$_{cum}$	178 dB SEL$_{cum}$	
High Frequency Cetaceans	173 dB SEL$_{cum}$	153 dB SEL$_{cum}$	
Phocid Porpoise	201 dB SEL$_{cum}$	181 dB SEL$_{cum}$	

Table 3. Assessment Thresholds – Fish (thresholds from Popper et al., 2014)

Sensitivity	Mortality/mortal injury	Recoverable injury	TTS	Low level disturbance
Impulsive sound (impact piling)				
Low sensitivity fish	213 dB$_{peak}$ 219 dB SEL$_{cum}$	213 dB$_{peak}$ 216 dB SEL$_{cum}$	186 dB SEL$_{cum}$	150 dB$_{rms}$
Medium sensitivity fish	207 dB$_{peak}$ 210 dB SEL$_{cum}$	207 dB$_{peak}$ 203 dB SEL$_{cum}$	186 dB SEL$_{cum}$	150 dB$_{rms}$
High sensitivity fish	207 dB$_{peak}$ 207 dB SEL$_{cum}$	207 dB$_{peak}$ 203 dB SEL$_{cum}$	186 dB SEL$_{cum}$	150 dB$_{rms}$
Eggs & larvae	207 dB$_{peak}$ 210 dB SEL$_{cum}$	-	-	-
Continuous sound (vibratory piling)*				
Low & Medium sensitivity fish	(N/I/F) Low	(N/I/F) Low	(N) Moderate; (I/F) Low	(N/I) Moderate (F) Low
High Sensitivity fish	(N/I/F) Low	170 dB$_{rms}$ for 48 hours	150 dB$_{rms}$ for 12 hours	(N) High (I) Moderate (F) Low

Calculation Methodology

The standard formula[2] used for estimating the transmission loss from underwater sound sources is:

$$TL = A \log(r) + B r + C$$

Where:

TL is the transmission loss at a distance r from the source.

A is the wave mode coefficient. For spherical waves (e.g. low frequency sound) A = 20, and cylindrical waves (e.g. high frequency sound) A = 10.

B is an attenuation factor that is dependent on water depth and sea bottom conditions.

C is a fixed attenuation due to acoustic screening. In open water this will be 0.

For the purposes of this assessment and to provide a reasonable estimate of sound propagation, an empirical wave mode coefficient A = 20 has been used. Transmission losses due to absorption, scattering and diffraction have been excluded from these predictions. Additionally, the effect of the ambient underwater sound environment has not been considered in this assessment.

For receptor locations without a direct line of sight to the sound source (such as due to physical obstructions) the received level would be substantially lower in comparison to a receptor location with direct line of sight. The actual level of attenuation is dependent on a number of factors (e.g. separation distance between receptor and source, frequency content of the sound source, and angle of view from the diffracting edge of the obstruction). For the purposes of this project however, in order to account for physical screening of the sound propagation path by land massing between piling locations into open water, an estimated attenuation factor of 30 dB has been applied.

Although the use of spherical and cylindrical formulae for predicting the sound propagation loss is widely used as a simple way of evaluation, this methodology does not entirely take into account the influence of both environmental characteristics (bathymetry, seafloor geo-acoustic properties, water salinity and temperature profiles etc.) and of signal frequency on the propagation of sound and hence the propagation loss may be under- or over-estimated. However for the purposes of undertaking a preliminary assessment of the effects of piling sound sources and the identification of noise impact zones, it is considered that the above calculation methodology is robust and provides a conservative yet reasonably realistic estimate of sound propagation.

[2] Lurton, Xavier. (2002). An introduction to underwater acoustics: principles and applications. Springer Science & Business Media.

Results and Conclusions

The following tables present preliminary recommendations for noise impact zones for each of the receptors and associ ated threshold criteria (as shown in Tables 2 and 3). The noise impact zones have been provided for receptor locations and propagation paths within the following scenarios:

- Scenario 1 – within Uig Harbour and/or in open water with direct line of sight to piling works (line of sight, “LoS”)
- Scenario 2 – in open water with no direct line of sight to piling works (no line of sight, “No LoS”)

It is considered that due to the impulsive nature of the sound emissions and the limitations of a simplified spreading model, the use of the Peak and RMS sound pressure level metrics provide the most realistic representation of potential effects on the various receptors considered in this assessment. Note that the use of the SEL_{cum} metric for a stationary source and stationary receptor may be overestimated, since the hearing sensitivities of a receiver have not been accounted for, together with the possibility of the receiver attempting to move away from a disturbing sound source.

As discussed above, sound propagation has been calculated using a simplified spreading model which accounts for source sound levels and propagation of sound over distance, and an estimated attenuation factor for physical screening by land massing. This methodology does not entirely take into account the influence of both environmental characteristics (bathymetry, seafloor geo-acoustic properties, water salinity and temperature profiles etc.) and of signal frequency on the propagation of sound. In addition, the far-field received sound signature would be also affected by the directivity of the selected sound source and the propagation path (including any reflections and physical screening interactions), which can be complex.

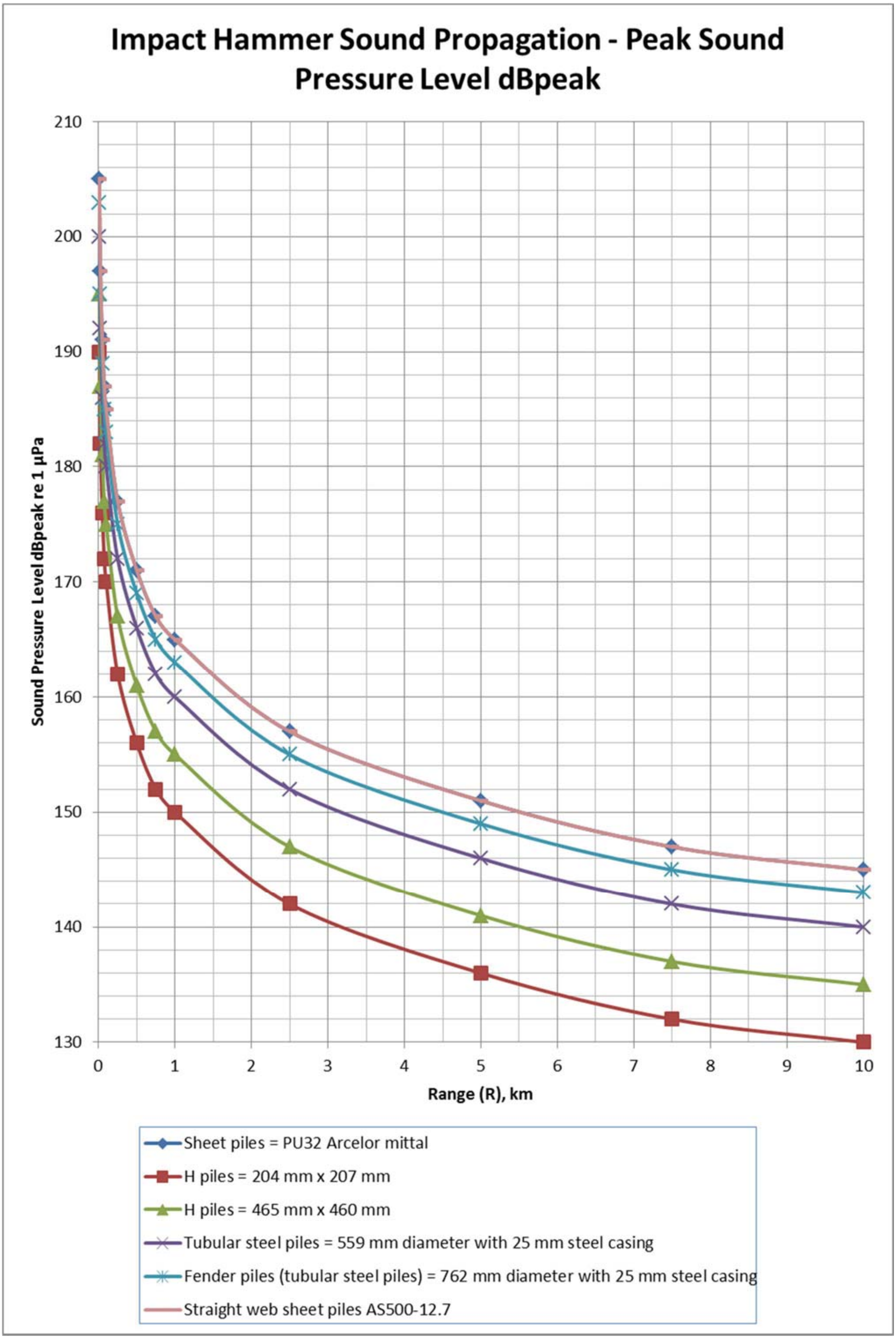
Table 4. Preliminary Recommendations for Noise Impact Zones – Marine Mammals

Sensitivity	Threshold source	Effect	Threshold	Sheet piles = PU32 Arcelor mittal		H piles = 204 mm x 207 mm		H piles = 204 mm x 207 mm (combined SELcum)		H piles = 465 mm x 460 mm		Tubular steel piles = 559 mm diameter with 25 mm steel casing		Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing		Straight web sheet piles AS500-12.7	
				Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres	
				LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS
Impulsive sound (impact piling)																	
All cetaceans	Southall et al., 2007	PTS	230 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			198 dB SEL	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	224 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			183 dB SEL	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
Pinnipeds in water		PTS	218 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			186 dB SEL	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	212 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			171 dB SEL	28	<10	<10	<10	n/a	n/a	<10	<10	14	<10	20	<10	28	<10
Low Frequency Cetaceans	NOAA, 2016 incorporating weighting functions	PTS	219 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			183 dB SEL_{cum}	56	<10	<10	<10	<10	<10	18	<10	28	<10	40	<10	56	<10
		TTS	213 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			168 dB SEL_{cum}	316	10	32	<10	50	<10	100	<10	158	<10	224	<10	316	10
Mid Frequency Cetaceans		PTS	230 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			185 dB SEL_{cum}	45	<10	<10	<10	<10	<10	14	<10	22	<10	32	<10	45	<10
		TTS	224 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			170 dB SEL_{cum}	251	<10	25	<10	40	<10	79	<10	126	<10	178	<10	251	<10
High Frequency Cetaceans		PTS	202 dB_{peak}	14	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	11	<10	14	<10
			155 dB SEL_{cum}	1413	45	141	<10	224	<10	447	14	708	22	1000	32	1413	45
		TTS	196 dB_{peak}	28	<10	<10	<10	n/a	n/a	<10	<10	16	<10	22	<10	28	<10
			140 dB SEL_{cum}	7943	251	794	25	1259	40	2512	79	3981	126	5623	178	7943	251
Phocid Porpoise		PTS	218 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			185 dB SEL_{cum}	45	<10	<10	<10	<10	<10	14	<10	22	<10	32	<10	45	<10
		TTS	212 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			170 dB SEL_{cum}	251	<10	25	<10	40	<10	79	<10	126	<10	178	<10	251	<10
Continuous sound (vibratory piling)																	
All cetaceans	Southall et al., 2007	PTS	230 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			215 dB SEL	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
Pinnipeds in water		PTS	218 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			203 dB SEL	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
Low Frequency Cetaceans	NMFS, 2018	PTS	199 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	11	<10	<10	<10
		TTS	179 dB SEL_{cum}	35	<10	11	<10	14	<10	11	<10	20	<10	112	<10	35	<10
Mid Frequency Cetaceans		PTS	198 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	13	<10	<10	<10
		TTS	178 dB SEL_{cum}	40	<10	13	<10	16	<10	13	<10	22	<10	126	<10	40	<10
High Frequency Cetaceans		PTS	173 dB SEL_{cum}	71	<10	22	<10	28	<10	22	<10	40	<10	224	<10	71	<10
		TTS	153 dB SEL_{cum}	708	22	224	<10	282	<10	224	<10	398	13	2239	71	708	22
Phocid Porpoise		PTS	201 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	181 dB SEL_{cum}	28	<10	<10	<10	11	<10	<10	<10	16	<10	89	<10	28	<10

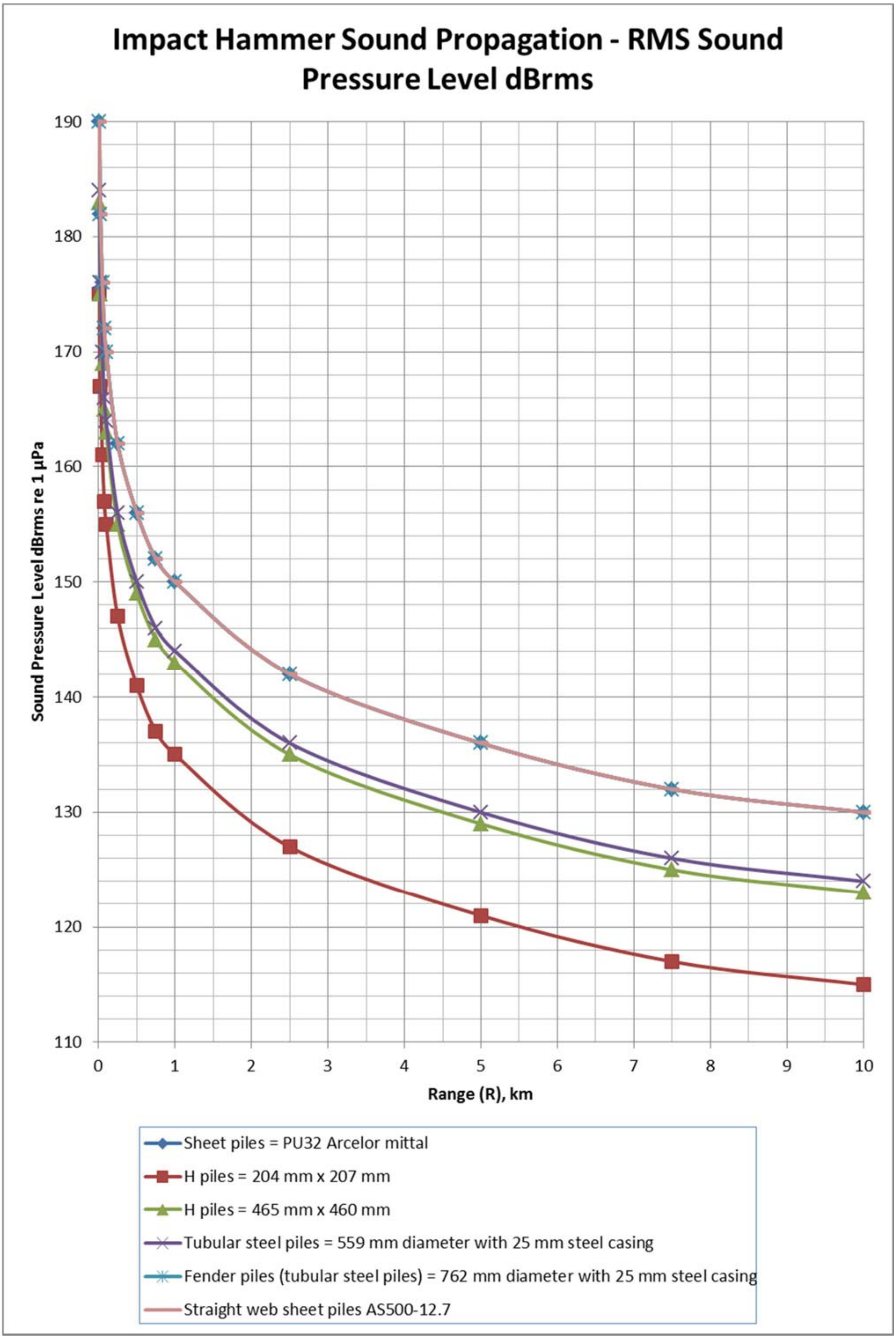
Table 5. Preliminary Recommendations for Exclusion Zones – Fish

Sensitivity	Threshold source	Effect	Threshold	Sheet piles = PU32 Arcelor mittal		H piles = 204 mm x 207 mm		H piles = 204 mm x 207 mm (combined SELcum)		H piles = 465 mm x 460 mm		Tubular steel piles = 559 mm diameter with 25 mm steel casing		Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing		Straight web sheet piles AS500-12.7	
				Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres		Impact zone, metres	
				LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS	LoS	No LoS
Impulsive sound (impact piling)																	
Low sensitivity fish	Popper et al., 2014	Mortality/mortal injury	213 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			219 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		Recoverable injury	213 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			216 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	186 dB SEL_{cum}	40	<10	<10	<10	<10	<10	13	<10	20	<10	28	<10	40	<10
		Low level disturbance	150 dB_{rms}	1000	32	178	<10	n/a	n/a	447	14	501	16	1000	32	1000	32
Medium sensitivity fish		Mortality/mortal injury	207 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			210 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		Recoverable injury	207 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			203 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	186 dB SEL_{cum}	40	<10	<10	<10	<10	<10	13	<10	20	<10	28	<10	40	<10
		Low level disturbance	150 dB_{rms}	1000	32	178	<10	n/a	n/a	447	14	501	16	1000	32	1000	32
High sensitivity fish		Mortality/mortal injury	207 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			207 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		Recoverable injury	207 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			203 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
		TTS	186 dB SEL_{cum}	40	<10	<10	<10	<10	<10	13	<10	20	<10	28	<10	40	<10
		Low level disturbance	150 dB_{rms}	1000	32	178	<10	n/a	n/a	447	14	501	16	1000	32	1000	32
Eggs & larvae		Mortality/mortal injury	207 dB_{peak}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	<10	<10	<10	<10
			210 dB SEL_{cum}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Continuous sound (vibratory piling)																	
High Sensitivity fish	Popper et al., 2014	Recoverable injury	170 dB_{rms}	<10	<10	<10	<10	n/a	n/a	<10	<10	<10	<10	10	<10	<10	<10
		TTS	150 dB_{rms}	32	<10	10	<10	n/a	n/a	10	<10	18	<10	100	<10	32	<10

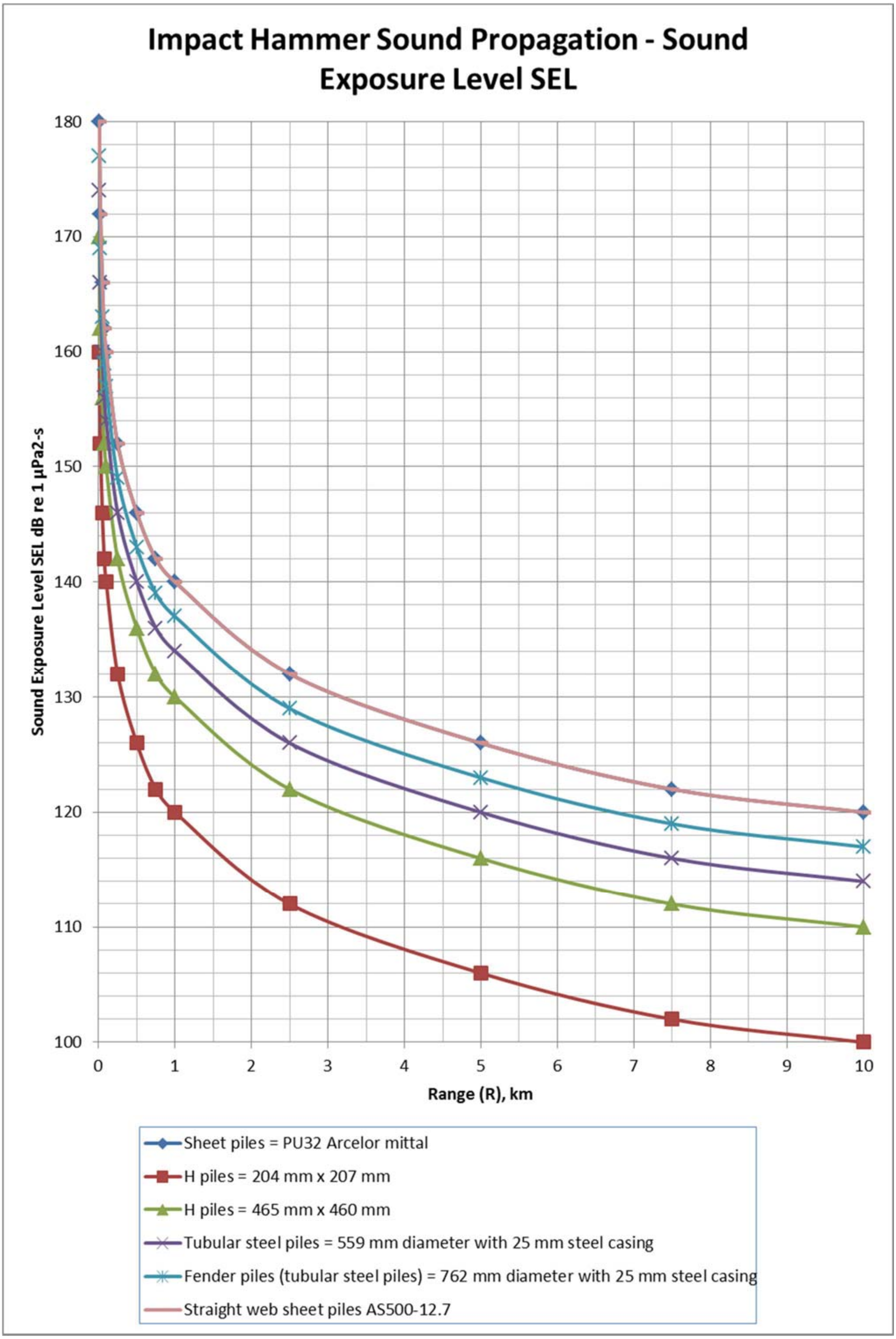
Sound Propagation Charts – Scenario 1 – within Uig Harbour and/or in open water with direct line of sight to piling works

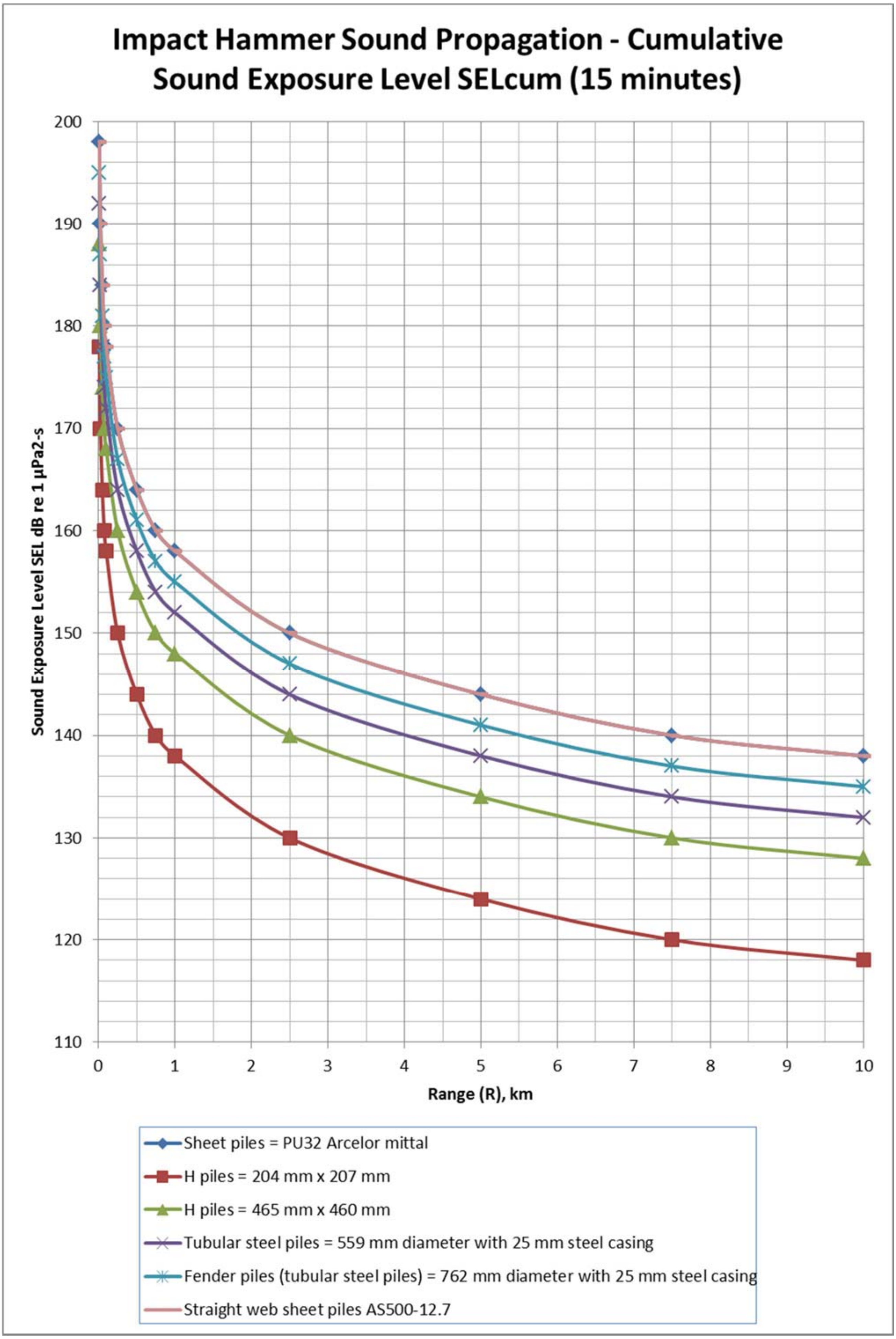


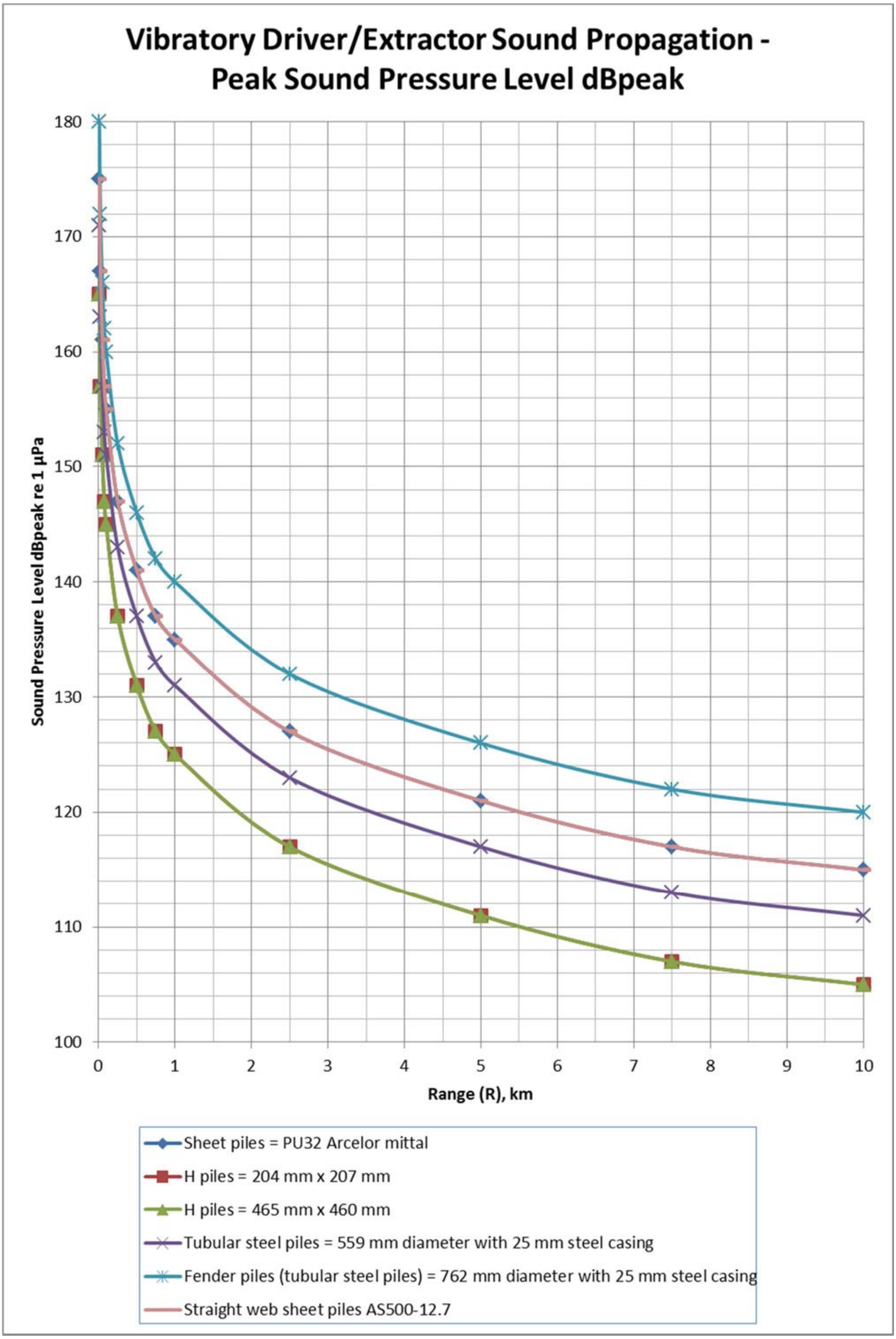
Impact Hammer Sound Propagation - Peak Sound Pressure Level dBpeak
Sound Pressure Level dBpeak re 1 µPa
210
200
190
180
170
160
150
140
130
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7

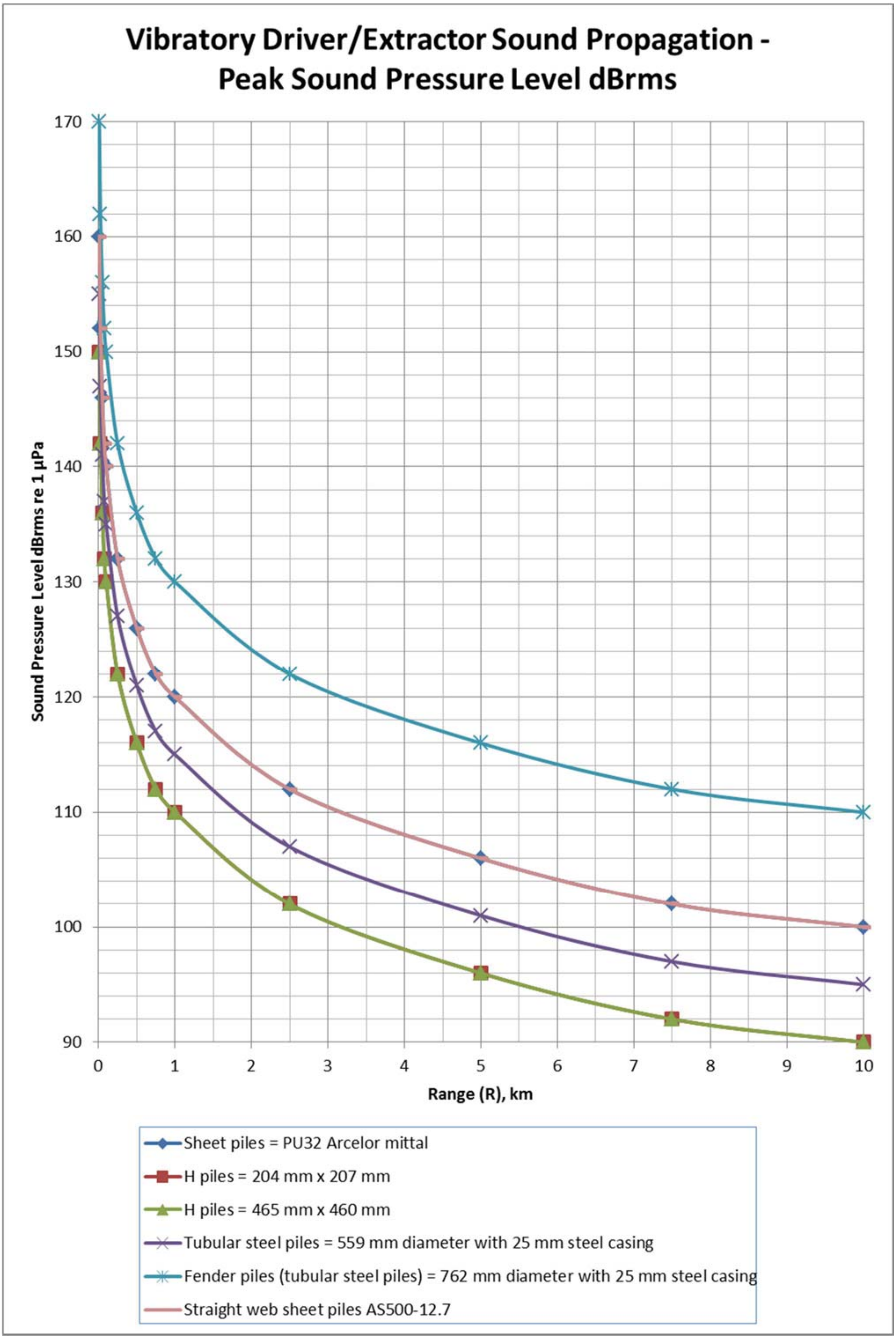


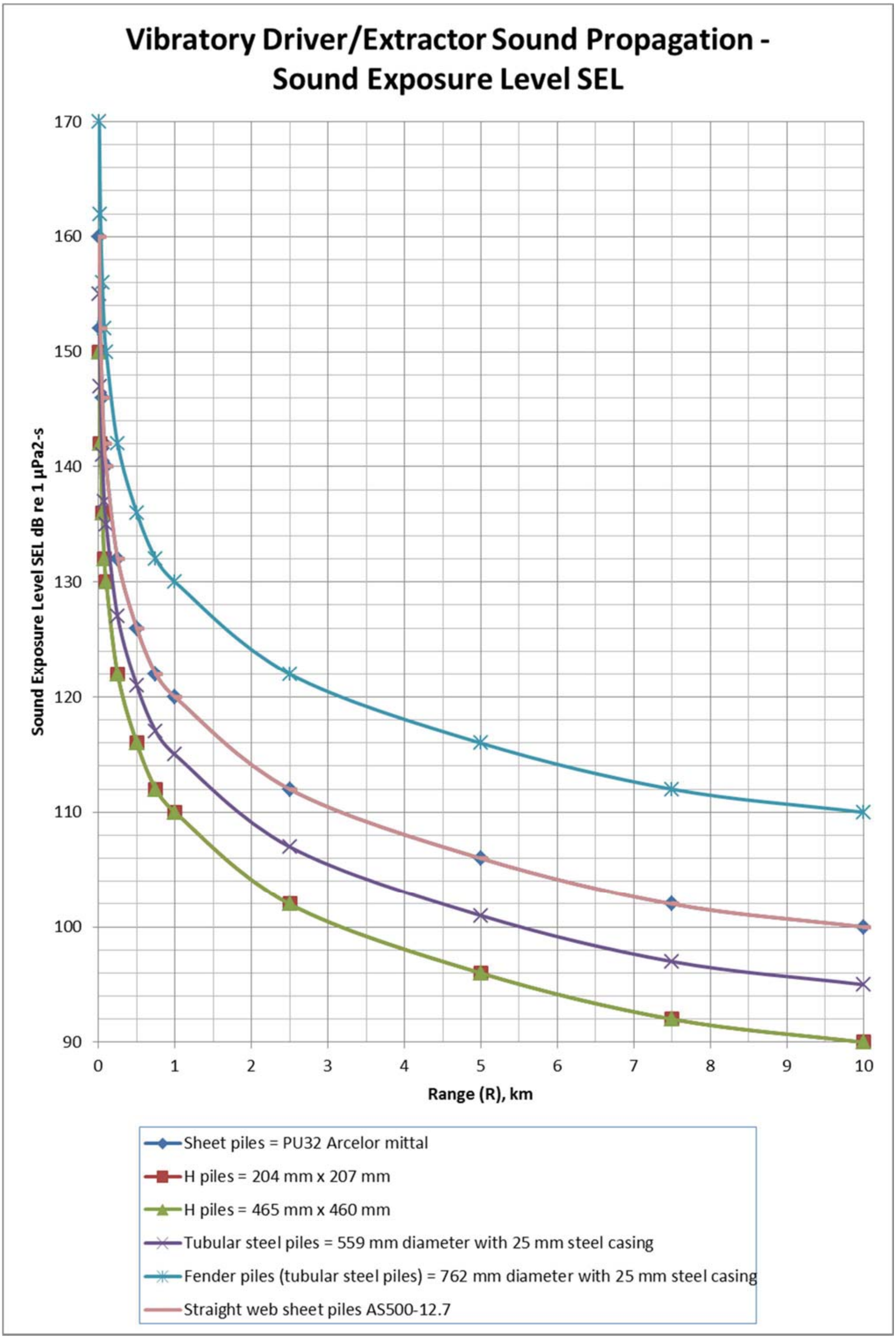
Impact Hammer Sound Propagation - RMS Sound Pressure Level dBrms
Sound Pressure Level dBrms re 1 µPa
190
180
170
160
150
140
130
120
110
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7


Impact Hammer Sound Propagation - Sound Exposure Level SEL
Sound Exposure Level SEL dB re 1 µPa2-s
180
170
160
150
140
130
120
110
100
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7

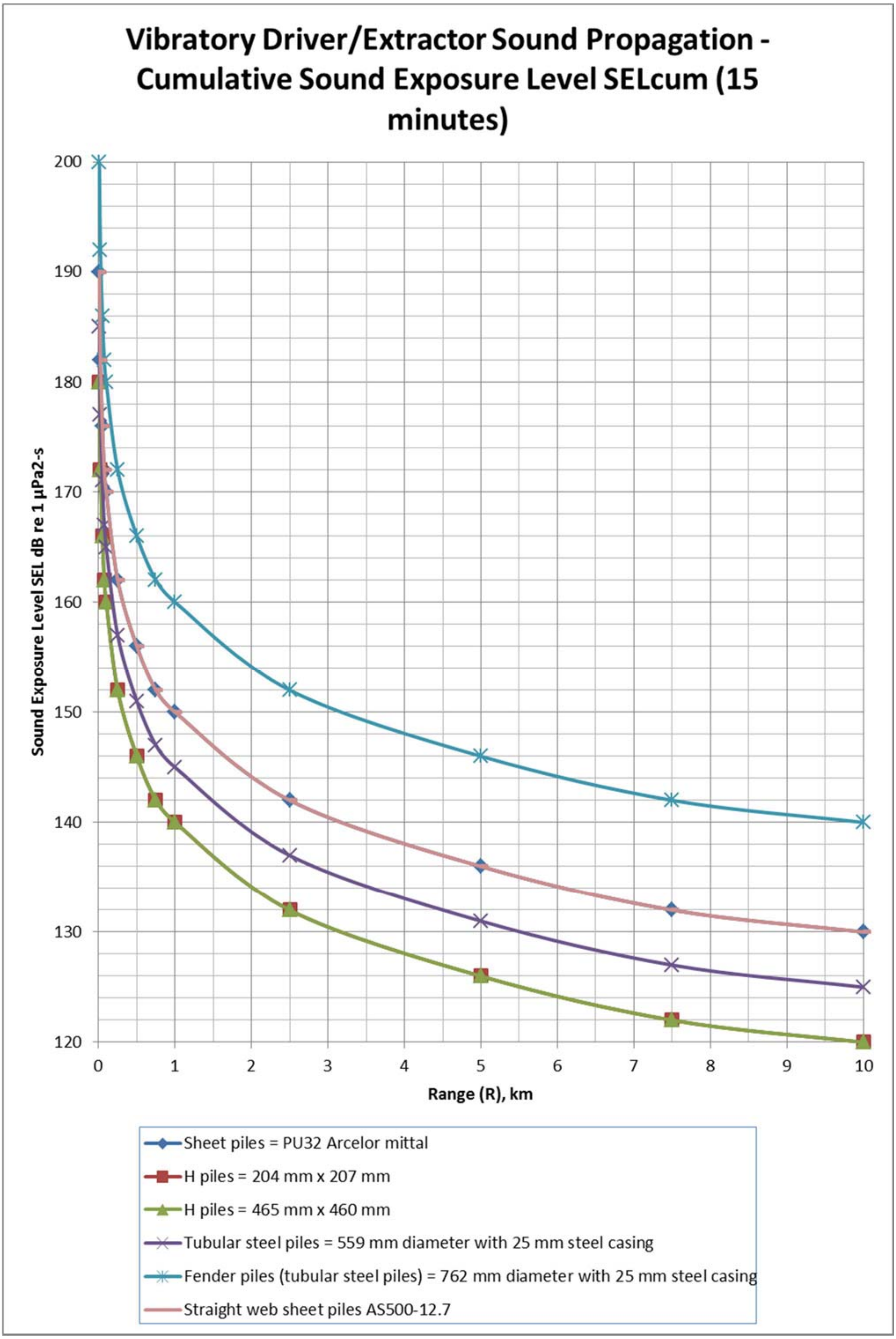

Impact Hammer Sound Propagation - Cumulative Sound Exposure Level SELcum (15 minutes)
Sound Exposure Level SEL dB re 1 µPa2-s
200
190
180
170
160
150
140
130
120
110
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7


Vibratory Driver/Extractor Sound Propagation -
Peak Sound Pressure Level dBpeak
Sound Pressure Level dBpeak re 1 µPa
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7


Vibratory Driver/Extractor Sound Propagation -
Peak Sound Pressure Level dBrms
Sound Pressure Level dBrms re 1 µPa
170
160
150
140
130
120
110
100
90
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7



Vibratory Driver/Extractor Sound Propagation - Sound Exposure Level SEL
Sound Exposure Level SEL dB re 1 µPa2-s
170
160
150
140
130
120
110
100
90
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7



Vibratory Driver/Extractor Sound Propagation - Cumulative Sound Exposure Level SELcum (15 minutes)
Sound Exposure Level SEL dB re 1 µPa2-s
200
190
180
170
160
150
140
130
120
0
1
2
3
4
5
6
7
8
9
10
Range (R), km
Sheet piles = PU32 Arcelor mittal
H piles = 204 mm x 207 mm
H piles = 465 mm x 460 mm
Tubular steel piles = 559 mm diameter with 25 mm steel casing
Fender piles (tubular steel piles) = 762 mm diameter with 25 mm steel casing
Straight web sheet piles AS500-12.7

14. Marine Mammals

No Appendices

15. Ornithology

15.1 Breeding Bird Survey Report

Uig Ferry Terminal

Ornithological Survey

June 2017

Alison Tyler
34 Valtos
Miavaig
Isle of Lewis
HS2 9HR

Summary

A desktop study was carried out to identify potential breeding and wintering bird species that may utilise the site.

A breeding birds survey was carried out of the area of Uig Ferry Terminal, Skye, in May 2017. Very few breeding birds were found in the vicinity of the ferry terminal, and no breeding Schedule 1 birds were found.

1 Introduction

1.1 Site Description

The area of the survey was the ferry terminal at Uig, Isle of Skye and all suitable breeding bird habitat within 250m of the terminal.

1.2 Aims of Survey

A desktop study was carried out to identify potential breeding and wintering bird species that may utilise the site.

A field survey was also carried out, which aimed to locate all breeding birds within the survey area and asses the requirement for further breeding bird survey visits to the area.

2 Methodology

Desktop Survey

The following were consulted for data on breeding and wintering birds in the vicinity of Uig ferry terminal:

BTO Wetland Bird Survey
BTO Breeding bird atlas
JNCC's Seabirds at Sea and European Seabirds at Sea database
Data collated for the Shiant Isles Seabird Recovery Project
Surveys carried out for the Inner Hebrides and the Minches candidate Special Area of Conservation

Field Survey
A standard walkover survey of the site, including the existing pier structure and a 250m buffer zone, was carried out by Alison Tyler on 24 and 25 May 2017. The survey was undertaken in good weather conditions. The area was surveyed between 0900 and 1800, and suitable long vegetation for corncrakes was surveyed again between 0015 and 0045.

The survey was undertaken by Alison Tyler, an experienced ornithologist.