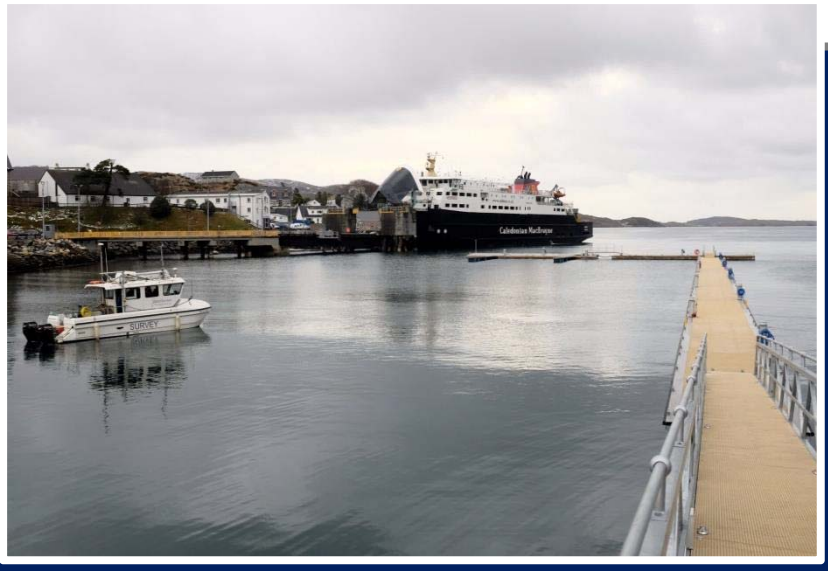
Appendix M.2: Vibrocore & Benthic Habitat Survey – Tarbert Ferry Terminal, Isle of Harris – December 2017

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Aspect
Land+Hydrographic Surveys
CHARTERED SURVEYORS

TEL: 01294 313 399 • WEB: WWW.ASPECTSURVEYS.COM



VIBROCORE & BENTHIC HABITAT SURVEY

TARBERT FERRY TERMINAL, ISLE OF HARRIS

DECEMBER 2017

PROJECT REF: A6488

REV: 00

Client:

Caledonian Maritime Assets Ltd
Municipal Buildings
Fore Street
Port Glasgow
PA14 5EQ

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

ices Approved Development Partner

Achilles

QAS INTERNATIONAL ISO 9001:2008 REGISTERED FIRM

QAS INTERNATIONAL ISO 14001:2004 REGISTERED FIRM

QAS INTERNATIONAL BS OHSAS 18001:2007 REGISTERED FIRM

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DOCUMENT ISSUE RECORD

DATE	REVISON	COMPILED	CHECKED	NOTES
01/02/2018	00	TAD	CDT	FIRST ISSUE

This document has been prepared for the Client named on the front cover. Aspect Land & Hydrographic Surveys Ltd (ALHS) accept no liability or responsibility for any use that is made of this document other than by the Client for the purpose of the original commission for which it has been prepared.

1. INTRODUCTION

Aspect Land & Hydrographic Surveys Ltd (herein ALHS) were contracted by Caledonian Maritime Assets Ltd [herein CMAL] to carry out benthic survey and sediment sampling using video transects, grab samples and vibrocores.

CMAL is in the process of planning and design for modifications to the existing pier infrastructure at Tarbert, Isle of Harris to accommodate the arrival of a new, larger vessel on the route.

There is therefore a requirement to deepen areas around the terminal which necessitates dredging, which will have an obvious impact on the local marine ecological environment.

The vibrocore survey was designed to provide core samples for analysis in order to understand the sediment type sub seabed and also to allow laboratory analysis in order to obtain dredging consent and to inform options on whether the material to be dredged could be used as infill in areas to be reclaimed.

The subtidal benthic ecology survey was undertaken by combined ROV video survey and sediment grab survey. The ROV video survey was used to ground-truth any existing geophysical survey work conducted and also to cross-validated with the grab sampling survey conducted.

2. GEODESY & DATUM

The horizontal datum used throughout the data gathering phase of the survey was OSGB36 (OSTN15). Data has been rendered in OSGB36 Datum, British National Grid.

The vertical datum for all bathymetric data is Chart Datum which at Tarbert, Isle of Harris is 2.74m below OD. OSTN15 defines OSGB36 National Grid in conjunction with the National GPS Network.

In this regard OSTN15 can be considered error free (not including any GPS positional errors). The agreement between OSTN15 and the old triangulation network stations (down to 3rd order) is 0.1m rms.

3. SCOPE OF WORKS

The upgrading works require the completion of an EIA and to inform this assessment a benthic survey and a sampling / vibrocore survey, with associated testing and reporting, was necessary.

The benthic survey was conducted in line with SNH ‘Guidance on Survey and Monitoring, Benthic Habitats (Saunders, Bedford, Trendall & Sotheran, 2011) with methods for conducting the visual survey follow the MESH ROG, the Marine Monitoring Handbook and the NMBAQC Scheme Operational Guideline.

The vibrocore sampling and testing procedures conformed to Marine Scotland Guidance notes http://www.gov.scot/Topics/marine/Licensing/marine/Applications/predredge

All analysis was completed by a laboratory accredited to the ISO17025 standard for marine sediment analysis, and also engages in inter-comparison analysis exercises such as QUASIMEME. The LOD and sensitivity requirements were met as per those set out in the CSEMP Green Book.

The order of events was to be:

- Benthic Video Transects
- Benthic Grab sampling
- Vibrocoring

Video transects were to be carried out as in Figure 1 and on completion of the benthic video transects No. 5 grab locations (Figure 2) were chosen to represent the different Biotopes located by video.

Vibrocore sampling was to be carried out in the areas depicted in Figure 3 below.

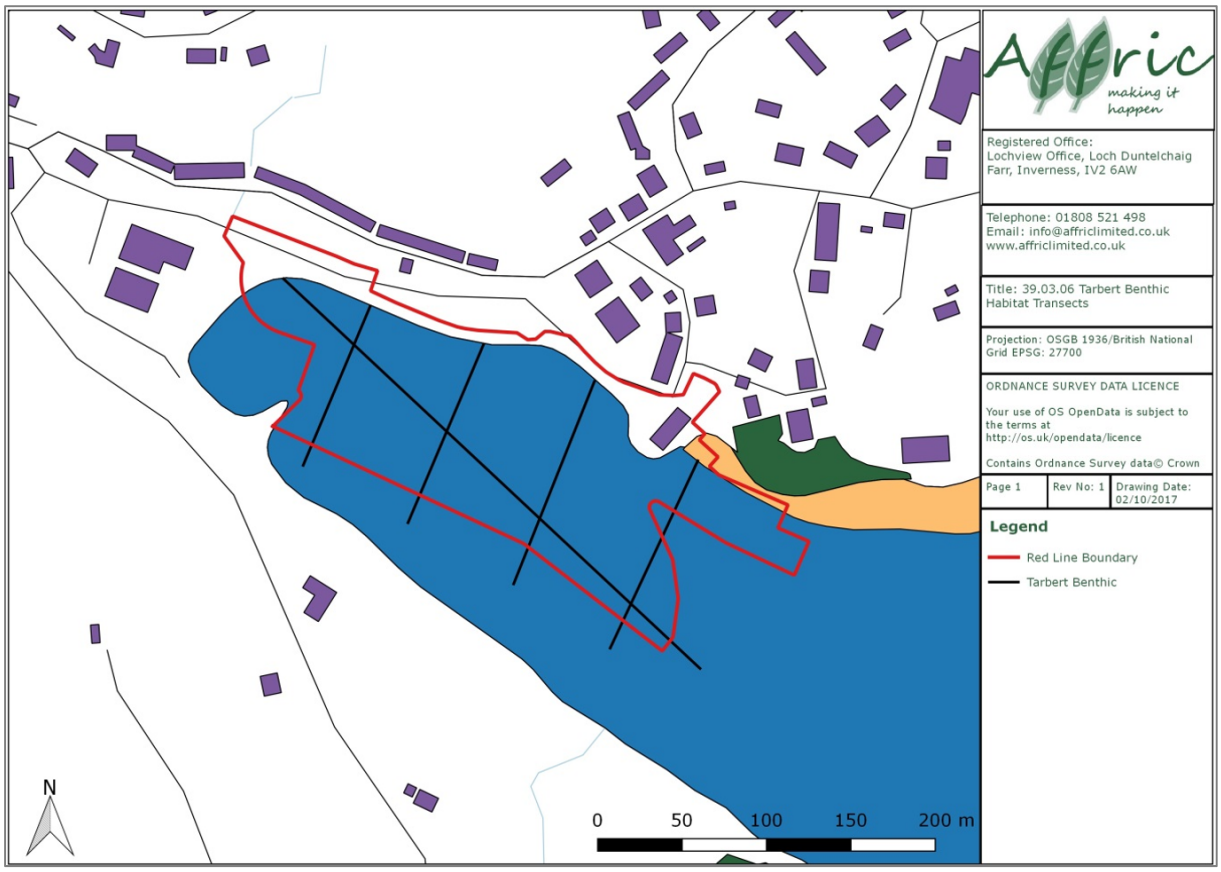


FIGURE 1 - BENTHIC TRANSECT LINES (BLACK)

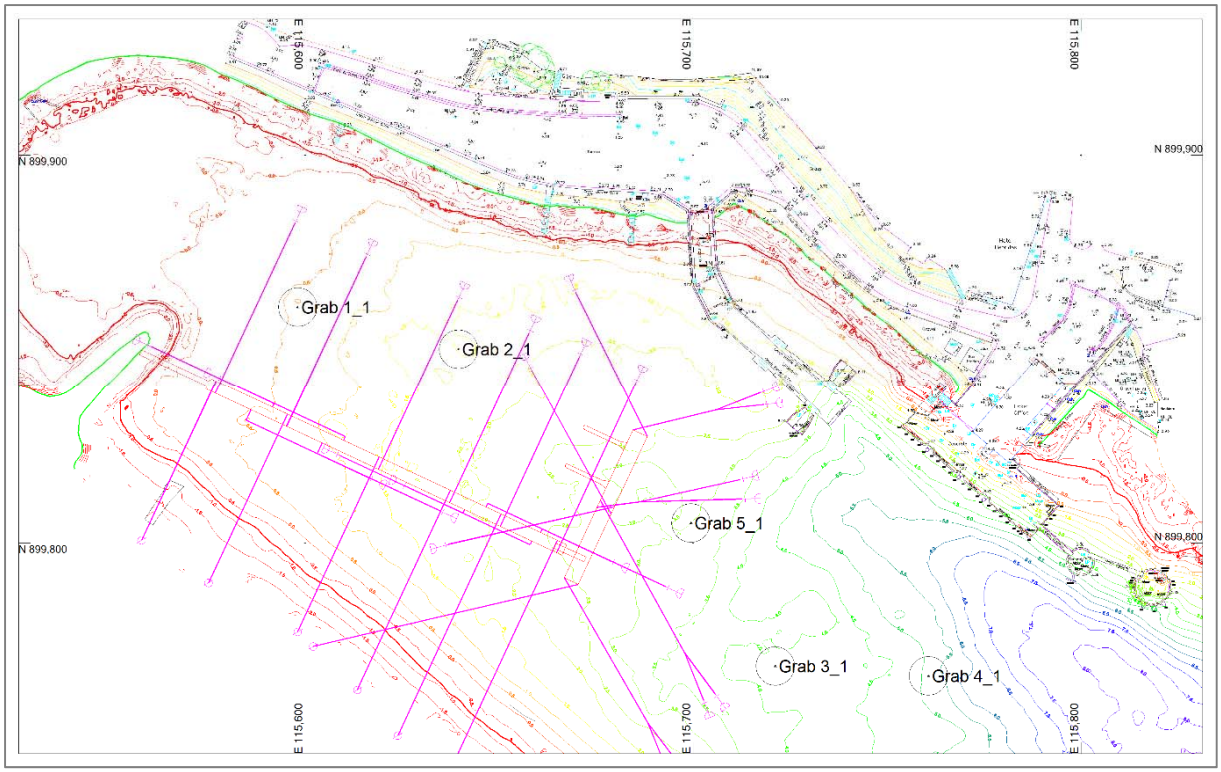


FIGURE 2 - SELECTED GRAB SAMPLE LOCATIONS

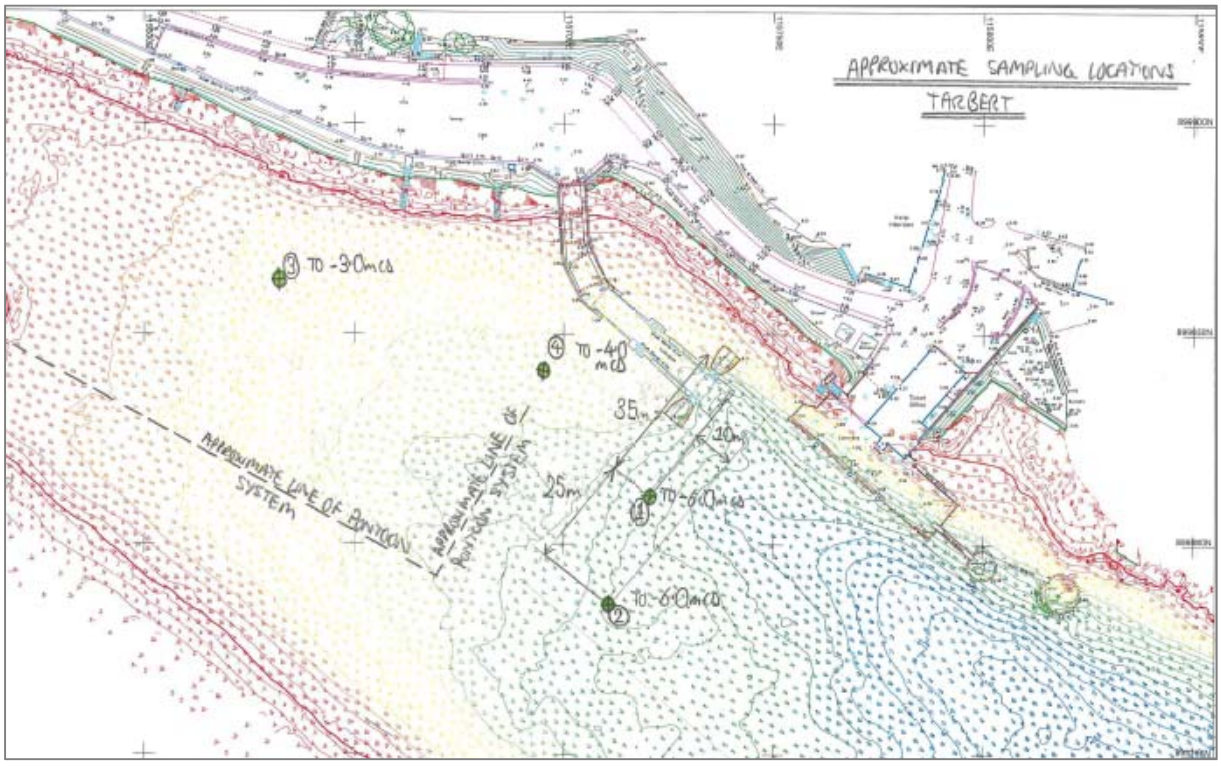


FIGURE 3 - INTENDED VIBROCORE LOCATIONS

Four vibrocore locations were planned and, on the request of the engineer on site, a fifth was requested and undertaken.

All cores were cut to 2.2m maximum length which exceeded the requirement for dredge licence application at all 4 planned locations. Two vibrocore samples were retained from each sample location and the aim was to obtain three sub samples from each core.

As a result of the placement of pontoons and associated anchor cables and anchors there was agreement that sample locations may need to be moved on site. This was indeed required for VB 1 & 2.

4. SEQUENCE OF EVENTS

Works were completed in the following order, taking into account predicted weather forecasts, tidal conditions and personnel availability.

DATE	EVENT
11 December 2017	Travel to Tarbert, Harris and mobilise Remote Sensor
12 December 2017	R.O.V Survey, mobilise Day Grab for following day.
13 December 2017	Grab Sampling, mobilise vibrocore equipment for following day.
14 December 2017	Vibrocore sampling.
15 December 2017	De-mobilise and transfer samples to laboratory for analysis.

TABLE 1 - SEQUENCE OF EVENTS

5. VIDEO TRANSECTS

Video transect conduct and analysis was sub contracted to APEM. The video transects were carried out using a Blue ROV2 remote operated vehicle with an integrated HD camera and lighting.

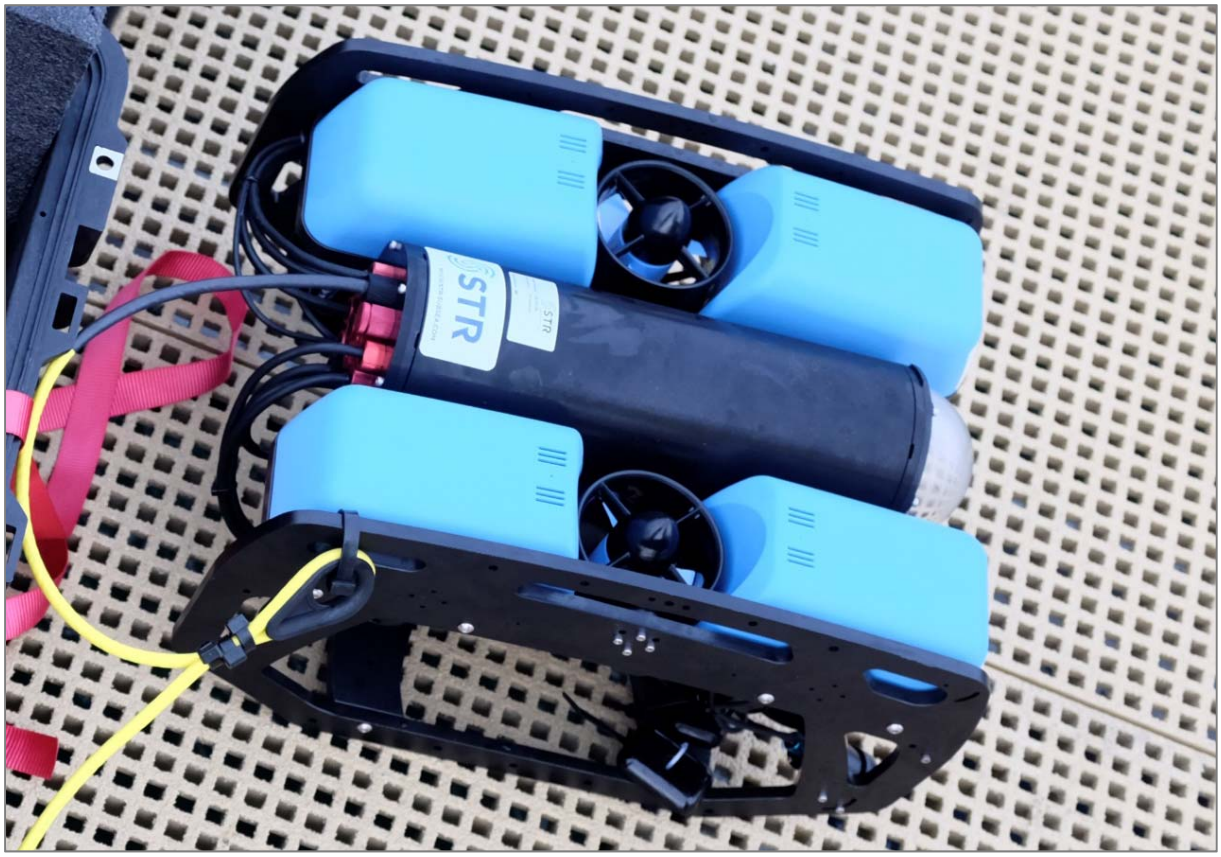


FIGURE 4 - BLUE ROV2 DEPLOYED TO SITE

The full details on the conduct and analysis of this survey is presented in APEM's report which accompanies this document.

P00002178_ Tarbert Ferry Terminal subtidal benthic ecology survey report_final 310118.pdf

The ROV transects were run between the following points.

Underwater video transect	Start coordinates		End coordinates	
	X	Y	X	Y
Transect 1	115589	899833	115611	899893
Transect 2	115628	899818	115653	899876
Transect 3	115706	899736	115746	899821
Transect 4_1 (original)	115758	899737	115795	899789
Transect 4_2 (repeated)	115787	899785	115752	899733
Transect 5	115788	899656	115561	899908

FIGURE 5 - TRANSECT START AND END POINTS

The ROV was positioned under the survey vessel with a drop weight to control the position of the ROV throughout the operation. The track of the vessel was logged on board the vessel and this was used to provide detail of the analysis of the transect results.

Separate biotopes were identified from the video transects as in Figure 6.

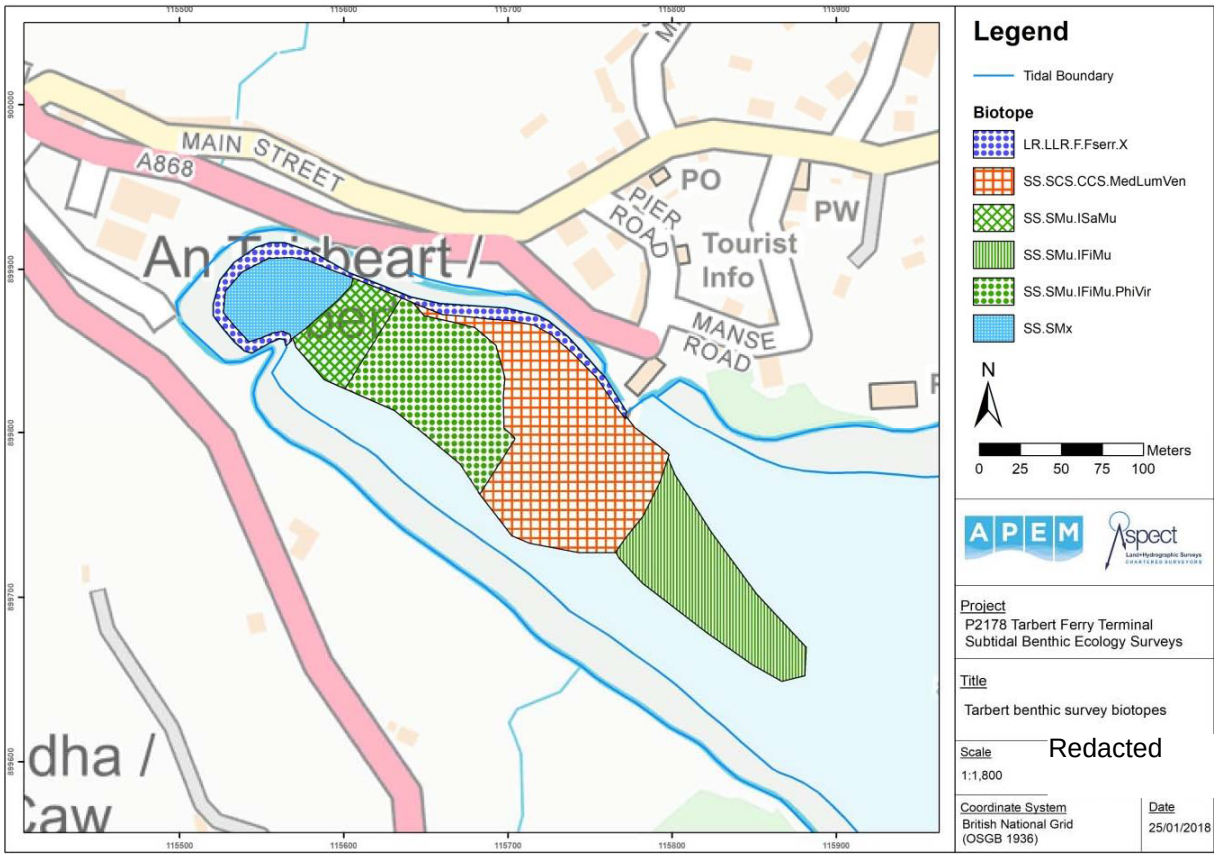


FIGURE 6 - TARBERT HARBOUR BIOTOPE MAP

Shape files of the biotope map have been provided in DWG Trueview Shape Source format for ingestion into the client's preferred GIS software.

6. BENTHIC GRAB SAMPLING

The benthic grab samples were located based on the results of the video transects following discussion between the AFFRIC representative, ALHS and APEM to allow a grab to be undertaken in each identified biotope.

A day grab was used in order to gain the samples. This was deployed from the over-side manually operated davit on the survey vessel Remote Sensor.

FIGURE 7 - DAY GRAB AND SAMPLE ANALYSIS ON REMOTE SENSOR

The grab samples were sieved on board to remove sediment allowing the biological material to be fixed in Formalin for transfer to the laboratory.

A second grab was undertaken and this was retained for PSD analysis.

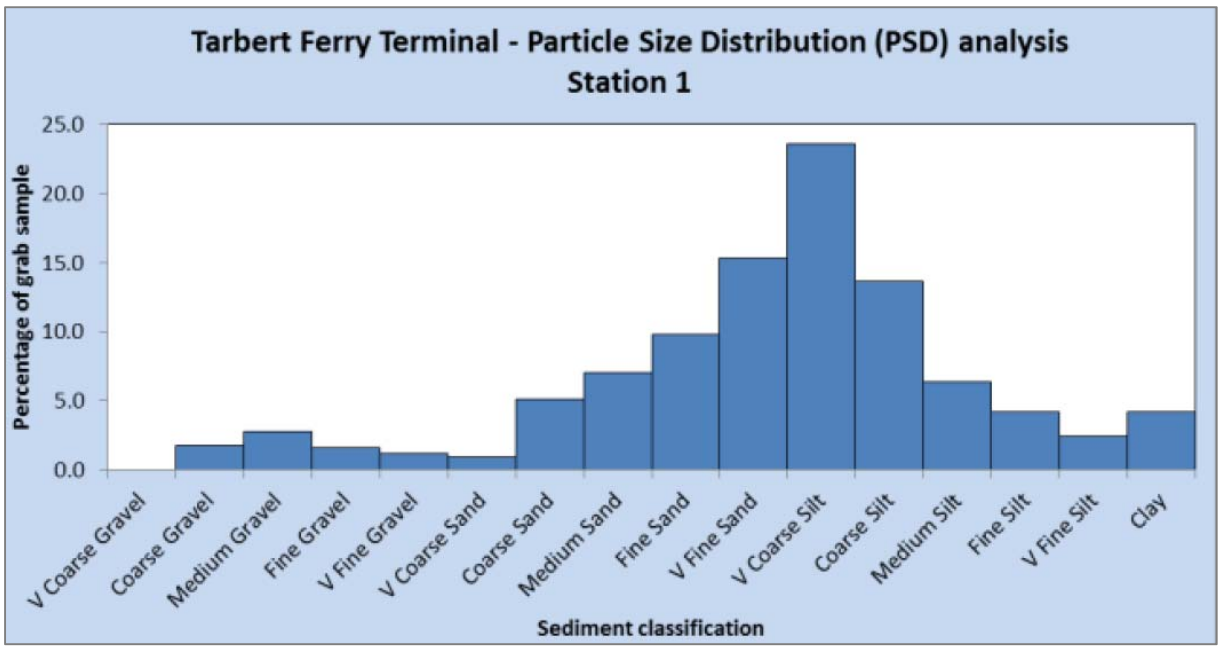


FIGURE 8 - GRAB 1 PSD

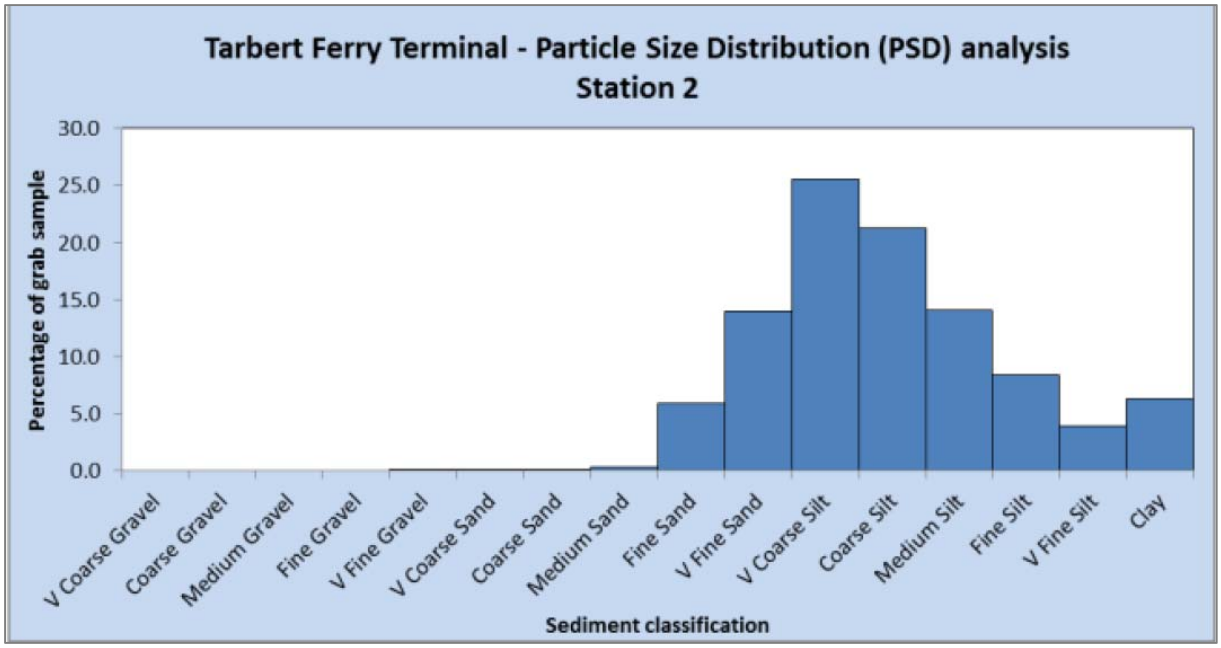


FIGURE 9 - GRAB 2 PSD

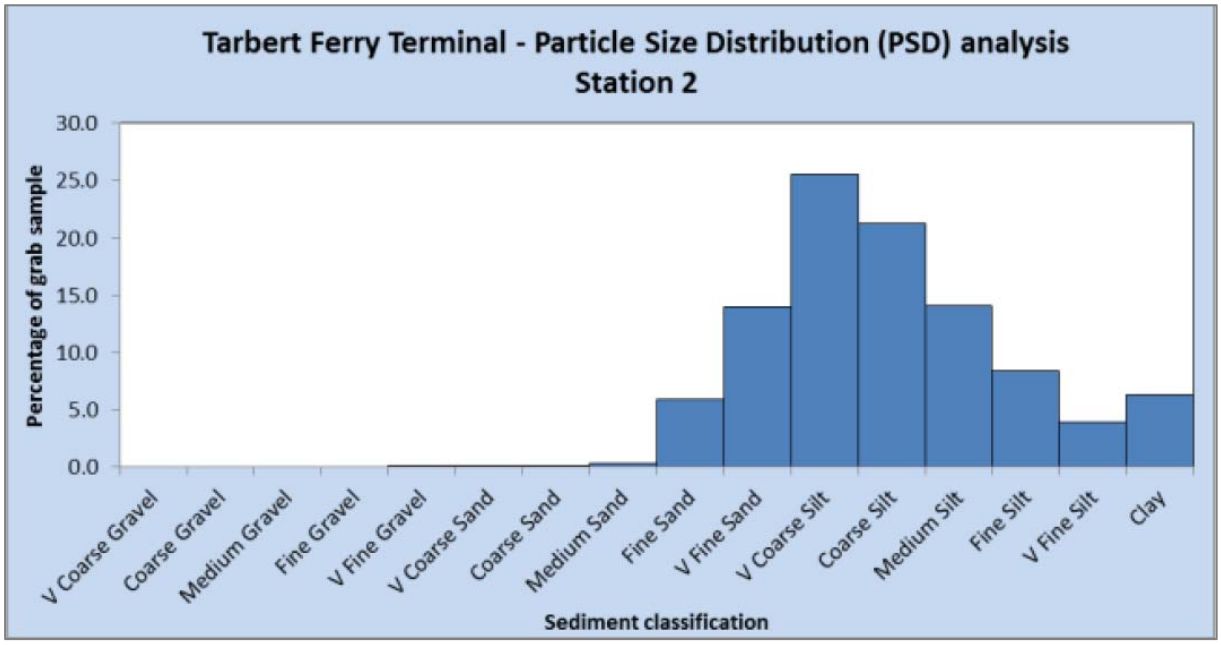


FIGURE 10 - GRAB 3 PSD

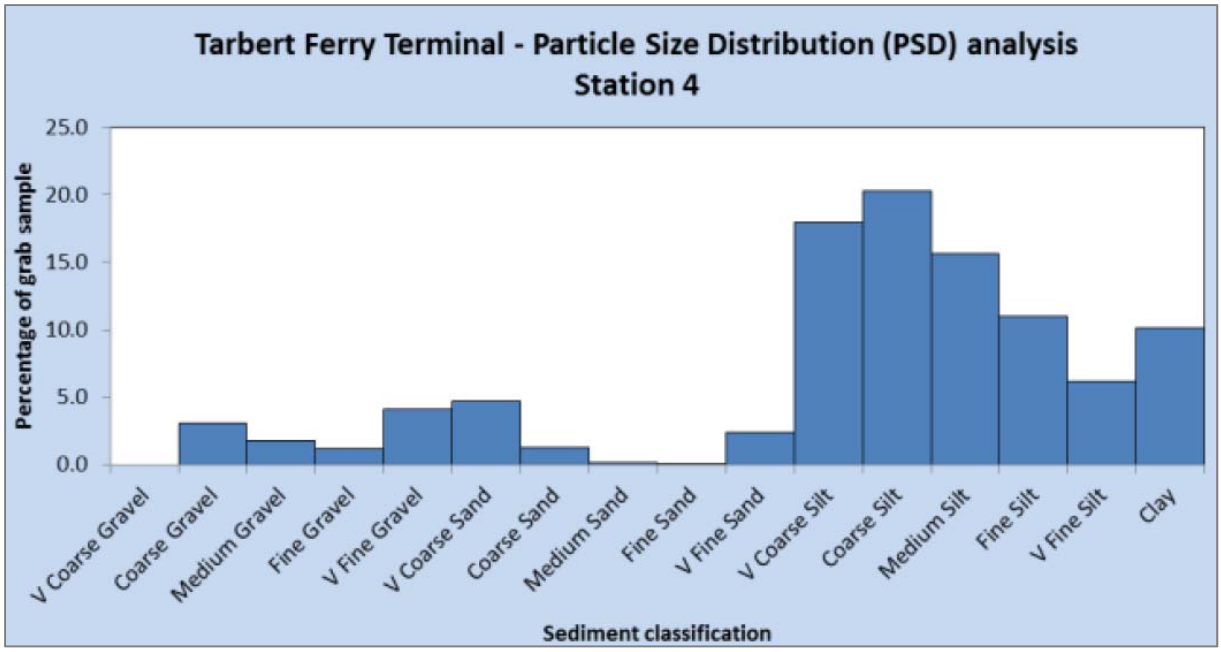


FIGURE 11 - GRAB 4 PSD

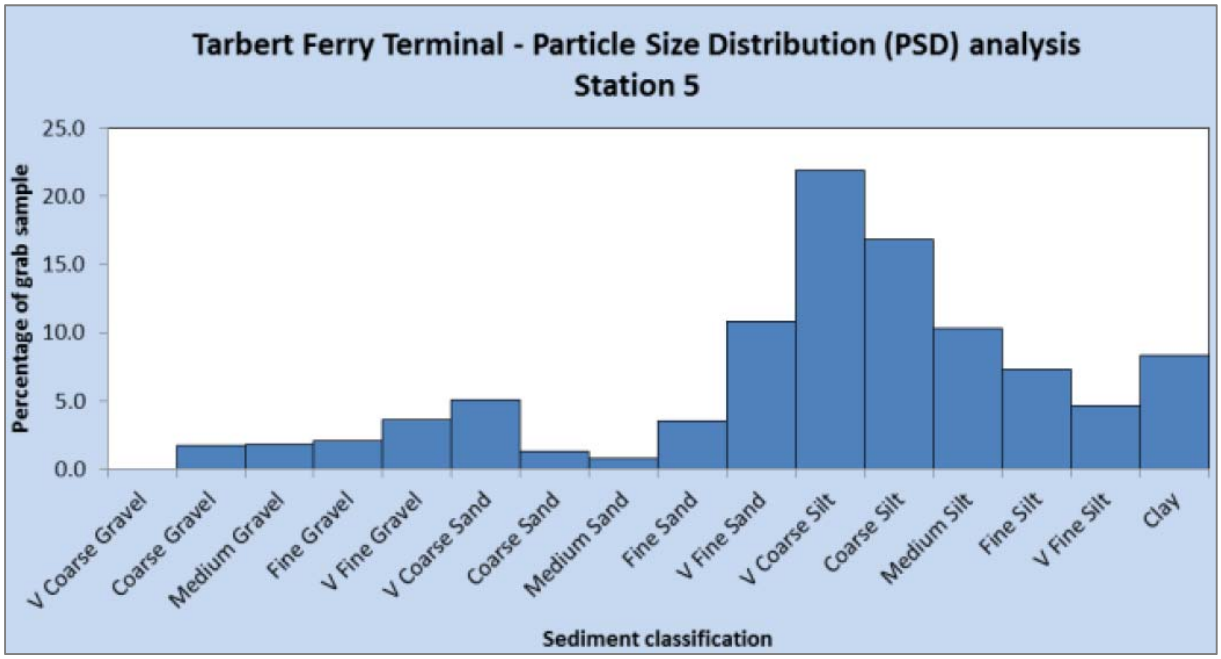


FIGURE 12 - GRAB 5 PSD

Full information on the conduct and analysis of the benthis grab samples are included in the accompanying report from APEM, *P00002178_ Tarbert Ferry Terminal Subtidal Benthic Ecology Survey Report_Final 310118.pdf* referenced in Appendix B of this document.

7. CONDUCT OF VIBROCORE SAMPLING

The vibrocore apparatus used was a lightweight rig, and as such did not rely on overall mass as an additional means of penetration. The equipment relies primarily on the vibrational frequency of the equipment and liquefaction of surrounding sediments to enable effective penetration.

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 No. 4 cores in total across the site, of up to 2m in length, from sample points indicated on Figure 3. Each sample core was split into sections and samples for analysis collected from the upper, middle and lower sections as a minimum.

The vessel was manoeuvred to each of the locations in turn and anchored fore and aft to avoid swinging during the sampling operation.

FIGURE 13 - VIBROCORE DEPLOYED ON REMOTE SENSOR

All vibrocore locations were sampled on 14 December 2017 at the following locations:

VIBROCORE POINT	SAMPLED EASTING	SAMPLED NORTHING	CORE LENGTH
VB1	115719.4	899809.6	2.0m
VB2	115697.0	899792.3	2.0m
VB3	115630.4	899862.7	2.0m
VB4	115695.2	899841.8	2.0m
VB5	115642.7	899811.3	2.0m

8. EQUIPMENT USED FOR CORING

A Speciality Devices Incorporated D-4 vibrocorer was used for all samples. A 76mm diameter, 2.2m 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.

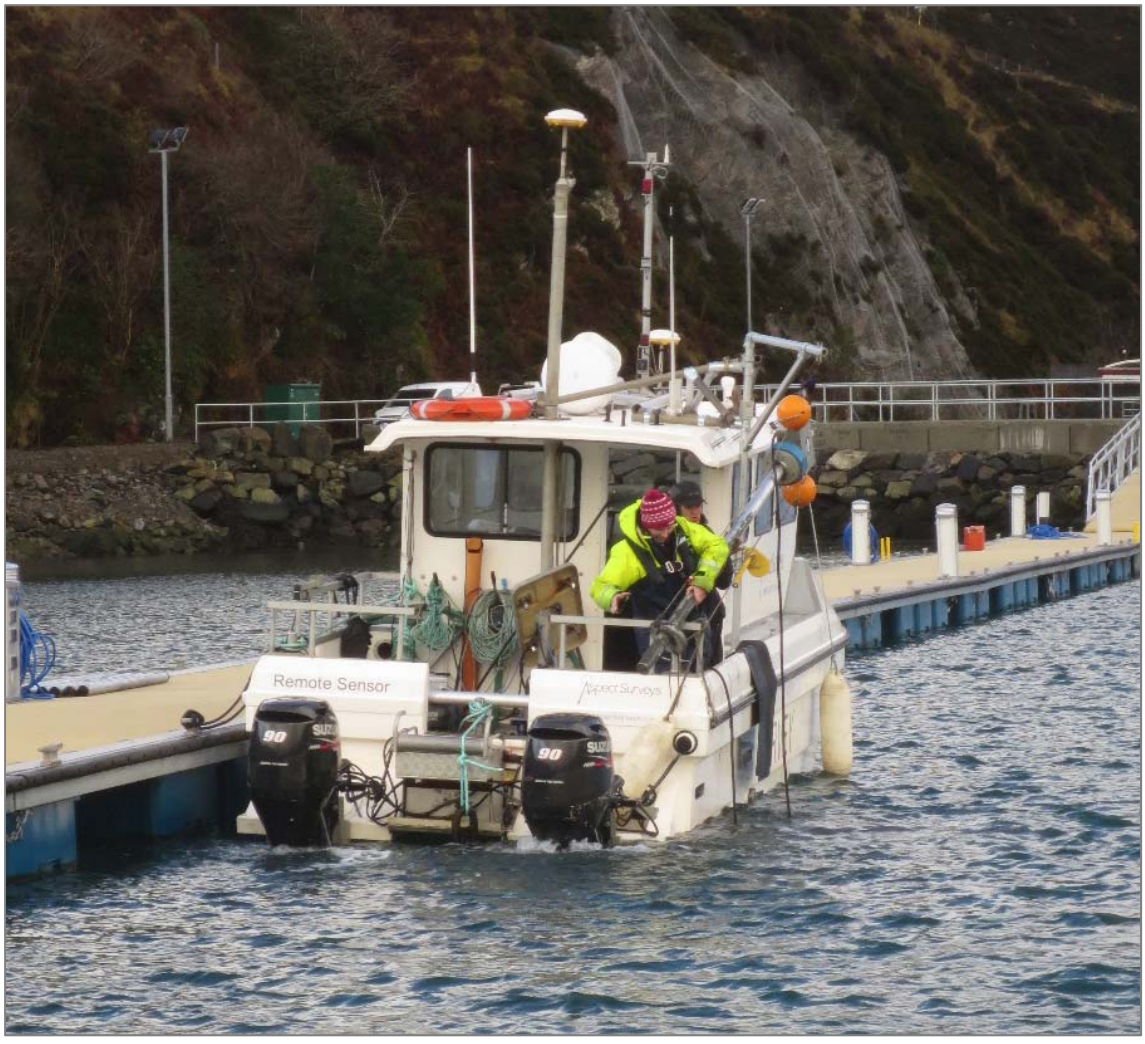


FIGURE 14 - SDI D-4 VIBROCORER ON DECK

9. SAMPLE ANALYSIS

The laboratory analysis was carried out by SOCOTEC (previously ESG) in Burton on Trent. 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 Chemicals.

	Marine Scotland Suite (Table 2)				
	CRM &/Or In-House Reference Material to be run with each batch and data included in report				
sediment	Moisture content	Documented in-house method, oven drying @ 105°C, **PAHSED**		0.2%	12
sediment	**Sieving < 63 um** (samples for trace metals analysis should be sieved to <63 um) Seive size used to be noted on report	IHM			12
sediment	**Metals Suite including low level Mercury at 0.01 mg/kg** *As(0.5), Cd(0.04), Cr(0.5),Cu(0.5), Pb(0.5), Hg(0.015), Ni(0.5), Zn(2)*	Documented in-house method using aqua regia extraction and ICPMS, **ICPMSS**	U (Hg UKAS accredited at 0.015mg/kg)	Detection Limits in brackets (mg/kg)	12
sediment	Low Level TBT	In house method: OGSNSED		1 ug/kg	12
sediment	PCBs, ICES 7 Congeners (PCB: 28, 52, 101, 118, 138, 153, 180)	Documented in-house method Triple Quad, **PCBMS3Q (marine seds)**		0.1µg/kg	12
sediment	PAHs: 2 to 6 ring aromatics by GC-MS and/or + 16 USEPA (as required)	Documented in-house method using DTI specification by GC-MS, **PAHSED**	U (16 USEPA + Dibenzthiophene & Benzo(e)pyrene only)	0.001	12
sediment	Particle size distribution by wet and dry sieving to **BS 1377** and Laser Diffraction	Subcontracted to **Kenneth Pye Associates**			12
	Waste Acceptance Criteria - 5 Day Turnaround				
	WAC: Full Suite				**12**
soil	Moisture content	Documented in-house method, oven drying @ 105°C, **TMSS**		0.2%	
soil	Total Organic Carbon (TOC)	Documented in-house method with carbonate removal and sulfurous acid/combustion at 800°C/NDIR, **WSLM59**		0.02%	
soil	BTEX (Benzene, toluene, ethylbenzene and xylenes) plus MTBE	Documented in-house method based on USEPA Methods 3810 and 8015. Technique used is headspace gas chromatography with flame ionisation detection, **BTEXHSA**		0.01 (MTBE & Xylenes 0.02)	
soil	PCBs, ICES 7 Congeners (PCB: 28, 52, 101, 118, 138, 153, 180)	Documented in-house method using solvent extraction and determination by GCECD, **PCBECD**		0.005	
soil	TPH by GCFID, (C8 to C40) **to include TPH Band >C10-C40**	Documented in-house method based on TNRCC method using gas chromatography with flame ionisation detection, **TPHFIDUS**		10	
soil	17 PAHs (inc Coronene) by GCMS	Documented in-house method using ultrasonic extraction with GCMS detection, **PAHMSUS**		0.08	
soil	pH	Documented in-house method using pH electrode, **PHSOIL**		n/a	
soil	LOI / ash residue @ 450°C	Documented in-house method using furnace combustion, **LOI%(MM)**		0.2%	
soil	Acid Neutralisation Capacity	Documented in-house method using acid based titration to preset pH, **ANC**		0.1mol/kg	
soil	Leachate preparation	BS EN12457-3 LS 2-10 Two Stage, **WSLM19**		n/a	
leachate	**Metals Suite dissolved (ICPMS):** *As(1), Cd(0.1), Cr(1), Cu(1), Pb(1), Hg(0.1), Mo(1), Ni(1), Sb(1), Se(1), Zn(5)*	Documented in-house method using ICPMS, **ICPMSW**	U	Detection Limits in brackets as µg/l	
leachate	*Barium*	Documented in-house method using ICP-OES, **ICPWATVAR**	U	0.01	
leachate	Chloride	Documented in-house method by automated discrete colorimetric analysis, **KONENS**	U	1	
leachate	Fluoride	Documented in-house method by Multiple Known Addition using an Automated Ion Selective Electrode based on the Standard Methods for the Examination of Water and Wastewater, **ISEF**	U	0.1	
leachate	Sulphate (sulphur expressed as sulphate)	Documented in-house method using ICP-OES, **ICPWATVAR**	U	3	
leachate	TDS (Total Dissolved Solids)	Documented in-house method based on BS2690 Part 121 (1981), **WSLM27**		2	
leachate	Phenol Index (total)	Documented in-house method using segmented flow analysis, **SFAPI**	U	0.05	
leachate	DOC (Dissolved Organic Carbon)	Documented in-house method with uv-persulphate oxidation/IR detection, **WSLM13**		0.1	
	additional if required				

Soil / water	Test	Method (method code in bold)	Accreditation U=UKAS M=MCERTS	Method Reporting Limit, ppm unless stated otherwise	Qty
sediment	Brominated Flame Retardants **CFAS/MMO PBDE Suite**	Subcontracted to RPS Mountainheath, Letchworth **Ref: 170504/06**		0.1ug/kg	r/o
sediment	**Stage 1**: Asbestos ID according to HSG 248 (2016)	Analysis carried out by SOCOTEC Asbestos Lab, Bretby - ID of presence or absence of asbestos in suspected ACM, fibre bundles and soil, using visual assessment of whole sample and stereomicroscopy of a sub-sample, plus PLM analysis for fine fibres.	U	n/a	r/o
sediment	**Stage 2:** Asbestos Quantification - Gravimetric Analysis **(in addition to Stage 1)**	Analysis carried out by SOCOTECAsbestos Lab, Bretby - Visual inspection and removal of presumed ACM and fibre bundles with gravimetric analysis to determine percentage by weight.	U	0.001%	r/o
sediment	**IMPORTANT:** If multiple free dispersed fibres/bundles are identified as present which cannot be weighed in Stage 2, then Stage 3 dispersion/ID/counting method is recommended to ascertain the percentage of fibres and/or the concentration of respirable fibres present in the sample. If the result at the end of Stage 2 is greater than 0.001%, then Stage 3 is recommended but not compulsory.				
sediment	**Stage 3:** Asbestos Quantification - Free/dispersed respirable fibre analysis **(in addition to Stages 1 and 2)**	Analysis carried out by SOCOTECAsbestos Lab, Bretby - Liquid dispersion of a soil subsample, with filtration of aliquots to collect free respirable fibres, followed by fibre discrimination, counting and measurement to determine asbestos fibres percentage by weight.	U	0.001%	r/o

SAMPLE LOCATION	SAMPLE ACHIEVED	ANALYSIS ORDERED	FIELD ANALYSIS SEDIMENT DESCRIPTOR	LAB ANALYSIS SEDIMENT DESCRIPTOR
VB1	2.0m core	3 sub samples for PSD, Metals, WAC & Chemicals	0.0 - 0.25m Green Brown Mud, small Gravel broken Shell 0.5 - 1.0m Green Brown Mud and broken Shell 1.5 - 2.0m Green Brown Mud broken Shell	0.0 - 0.25m Mud 0.5 - 1.0m Slightly Gravelly Sandy Mud 1.5m - 2.0m Mud
VB2	2.0m core	3 sub samples for PSD, Metals, WAC & Chemicals	0.0 - 0.25m Green Brown Mud & broken Shell 0.5 - 1.0m Green Brown Soft Sticky Mud 1.5 - 2.0m Green Brown Mud & broken Shell	0.0 - 0.25m Sandy Mud 0.5 - 1.0m Sandy Mud 1.5 - 2.0m Slightly Gravelly Sandy Mud
VB3	2.0m core	3 sub samples for PSD, Metals, WAC & Chemicals	0.0 - 0.25m Brown Green Mud 0.5 - 1.0m Brown Green Mud & broken Shell 1.5 - 2.0m Sticky Brown Green Mud (Clay)	0.0 - 0.25m Slightly Sandy Gravelly Mud 0.5 - 1.0m Sandy Mud 1.5 - 2.0m Slightly Gravelly Sandy Mud
VB4	2.0m core	3 sub samples for PSD, Metals, WAC & Chemicals	0.0 - 0.25m Brown Green Mud & broken Shell 0.5 - 1.0m Brown Green Mud & broken Shell 1.5 - 2.0m Brown Green soft Mud & broken Shell	0.0 - 0.25m Muddy Gravel 0.5 - 1.0m Sandy Mud 1.5 - 2.0m Mud
VB5	2.0m core	3 sub samples for PSD, Metals, WAC & Chemicals	0.0 - 0.25m Brown Green Mud 0.5 - 1.0m Brown Green Mud 1.5 - 2.0m Brown Green Mud & broken Shell	0.0 - 0.25m Sandy Mud 0.5 - 1.0m Slightly Gravelly Sandy Mud 1.5 - 2.0m Mud

TABLE 1 - VIBROCORE SAMPLE FIELD & LAB ANALYSIS

The samples have been analysed against the Action Levels quoted by Marine Scotland and are presented in the standard Marine Scotland spreadsheet format: *A6488_Pre-disposal Sampling Results Form.xlsx* referenced in Appendix C of this document.

Details on the analysis of individual items are also provided in the accompanying laboratory records for each sample. In general the field analysis and laboratory analysis were in agreement.

The PSD from both the grab and vibrocore showed a high proportion of fines dominated by Silt throughout in the top 2m of overburden.

10. SURVEY VESSEL

ALHS' MCA Cat III survey vessel *Remote Sensor* was mobilised for the survey operations. The ability to achieve rapid mobilisation with this vessel meant that short weather windows could be taken advantage at this time of year when suitable longer weather windows to mobilise a larger vessel are limited.

The shallow draught and high manoeuvrability of *Remote Sensor* made it ideal for operating in the survey area which was both shallow and navigationally constrained. The vessel was transported to Tarbert Harbour by road and launched at the slipway in the harbour.

FIGURE 15 - ALHS' SURVEY VESSEL REMOTE SENSOR

11. SURVEY PERSONNEL

The following personnel were involved in the survey:

NAME	POSITION
Redacted	Project Management / Party Chief / QA Data Release
	Hydrographic Surveyor
	Survey Coxswain

All staff have marine survey experience, and adhered to Health & Safety instructions, including the wearing of life jackets at all times. All personnel participated in an induction to the vessel and toolbox talks on the conduct of all aspects of the operation prior to commencement of the work.

Annex A
Horizontal & Vertical Positioning System Precision

A6488

Differential GNSS Positioning Precision

	HORIZONTAL ACCURACY
dGPS	±0.5m + 1ppm RMS

Annex B
APEM Benthic Report

A6488

P00002178_ TARBERT FERRY TERMINAL SUBTIDAL BENTHIC ECOLOGY SURVEY REPORT_FINAL 310118.PDF

Tarbert Ferry Terminal - Subtidal Benthic Ecology Survey Report

Aspect Land & Hydrographic Surveys Ltd.

APEM Ref P00002178

January 2018

Redacted

Client:	Aspect Land & Hydrographic Surveys Ltd.
Address:	Unit 1, Thornhouse Business Centre Ballot Road Irvine KA12 0HW Ayrshire
Project reference:	P00002178
Date of issue:	31st January 2018

_____

Project Director: Redacted

Project Manager: Redacted

_____

APEM Ltd
The Technopole Centre
Milton Bridge
Nr Penicuik
Midlothian
EH26 0PJ

Tel: 0131 526 3186
Fax: 0161 432 6083

Registered in England No. 02530851

Report should be cited as:

"Tarbert Ferry Terminal - Subtidal Benthic Ecology Survey Report (January, 2018). APEM Scientific Report P000002178a. Aspect Land & Hydrographic Surveys Ltd. 15pp."

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1	25/01/2018	All	All	Document creation	Redacted
2	31/01/2018	2	All	Amendment following ALHS review	

Contents

List of Figures and Tables

1. Introduction

APEM Ltd has been commissioned to undertake a survey of the subtidal benthic ecological habitats and species present in Tarbert Harbour on the Isle of Harris, on behalf of Aspect Land & Hydrographic Surveys (ALHS) and Caledonian Maritime Assets Ltd (CMAL). Tarbert Ferry Terminal is located in a sheltered bay on the east coast of the Isle of Harris, and provides a direct ferry link to the Isle of Skye. This survey will provide data to enable an Environmental Impact Assessment (EIA) of proposed improvements to Tarbert Ferry Terminal (the proposed development) to be conducted.

In accordance with Saunders et al. (2011), this survey will gather information for the EIA process by identifying whether there are any benthic habitats or species of note present (i.e. priority, rare, protected or invasive) and identify the spatial distribution and abundance of these species in the area. This will allow an assessment to be conducted of how these habitats or species will be affected by the proposed development and the significance or implications of any damage or loss incurred, which is beyond the scope of this survey report but it is understood will be conducted by CMAL and Affric Ltd. for the proposed development.

The aim of the survey was to collect underwater video and grab samples to provide data on the subtidal benthic ecology habitats, community composition and sediment composition within the area of the proposed development, to enable the subtidal benthic ecology of Tarbert Harbour to be characterised, and the effect of the improvements to Tarbert Ferry Terminal to be assessed.

This report provides a full description of the survey and analysis conducted by APEM Ltd. to obtain the data for characterisation, and the complete datasets for use along with a summary description of the datasets obtained.

2. Methodology

2.1 Field survey

All survey permissions, including a Marine Licence Exemption and Crown Estate Consent, were obtained by CMAL prior to the survey commencing.

The survey operations were conducted in December 2017 from the vessel Remote Sensor, operated by ALHS and shown in Figure 2-1 below. Remote Sensor is an 8.4m catamaran survey vessel (MCA Cat III) with high manoeuvrability, which was an essential requirement due to the constrained characteristics of the survey area.

The survey was overseen by an attending marine ecologist from Affric Ltd., on behalf of CMAL, who conducted quality assurance during the survey and specified grab sample locations whilst on-site using the footage from the underwater video.

The methodologies for collection of the underwater video and grab samples are provided in Sections 2.1.1 and 2.1.2 below respectively.

Figure 2-1 The survey vessel Remote Sensor used for the Tarbert Ferry Terminal subtidal benthic ecology surveys

2.1.1 Underwater video survey

The underwater video survey was conducted on the 12th December 2017 in daylight hours.

Although not yet operational at the time of the survey, a new floating pontoon had been installed shortly prior to the survey. The pontoon anchorage and other entanglement hazards likely to be present in the area as a result of the new pontoon were considered in the survey design phase, leading to the requirement for use of a Remote Operated Vehicle (ROV) for the underwater video survey, rather than a Drop Down Video (DDV) camera.

APEM's methodology was discussed with Scottish Natural Heritage (SNH), who confirmed that they were content with the use of a video system, and that there was not a requirement to use a camera system capable of taking independent still photographs. Instead, SNH requested pauses in the transects to allow capture of the seabed:

"The proposed benthic baseline monitoring grid at Tarbert looks suitable and I'd be content that the transects are taken between the months you have indicated - please ensure there is sufficient lighting and the operator makes frequent 'pauses' in the footage to allow the camera to capture a 'still' of the seabed (approximately every 20-30 metres). The pauses should be long enough to let any sediment plume disperse and allow the camera focus (if on auto) to perform. Should the survey discover any sensitive habitat or species of conservation interest it'd be helpful to chart its full character and extent by adapting the methodology at the time of survey. This would avoid any possible requirement to re-survey should anything of conservation importance be found (unlikely as that may be)."

APEM was provided with a specification of transect routes for the underwater video survey, shown in Figure 2-2, which had been discussed and agreed with Scottish Natural Heritage (SNH) by CMAL and Affric Ltd. prior to the pontoon being constructed. APEM was therefore allowed dispensation to adapt the transect routes whilst on-site to avoid the pontoon and pontoon anchorage if required due to accessibility or entanglement risk, whilst still maintaining a series of transects across the site (approximately south west to north east) and a single transect down the site and seabed contours (approximately south east to north west).

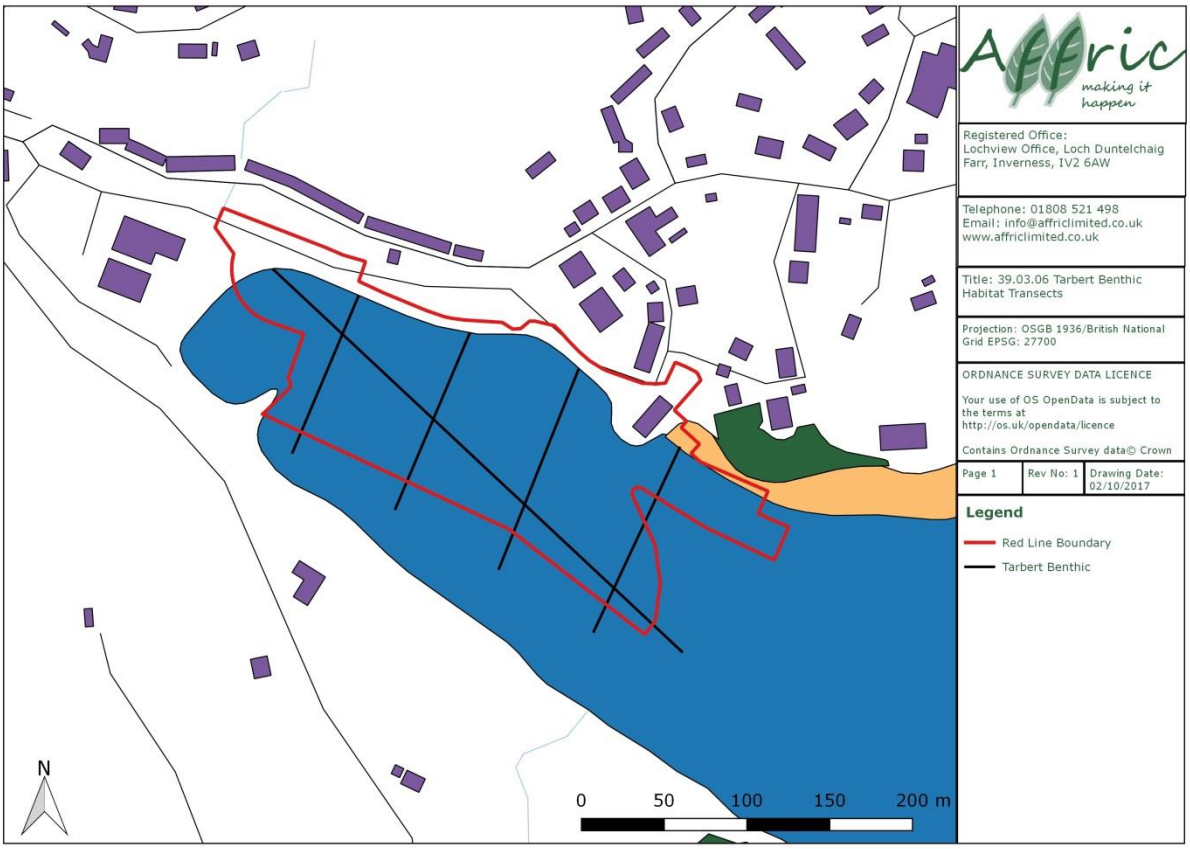


Figure 2-2 Tarbert Ferry Terminal transect location specification for underwater video survey

The underwater video transects were completed using Subsea Technology and Rental's (STR) "BlueROV2", a small hand-launch 6-thruster ROV with a high-definition 1080p resolution camera. The ROV was flown by a trained ROV pilot provided by STR, and the transect routes flown are shown in Figure 2-3, with grid coordinates of the start and end points of each transect given in Table 2-1. Whilst APEM had to make small adjustments to the transect routes to avoid entanglement, these were limited given the choice of a manoeuvrable vessel and ROV system, and so the transects were obtain in a similar layout to the required specification.

Although most of the underwater video transects were conducted from south west to north east, Transect 4 was repeated in the opposite direction due to some bottom low visibility on the first attempt. The second attempt collected enough data to integrate with the first passage.

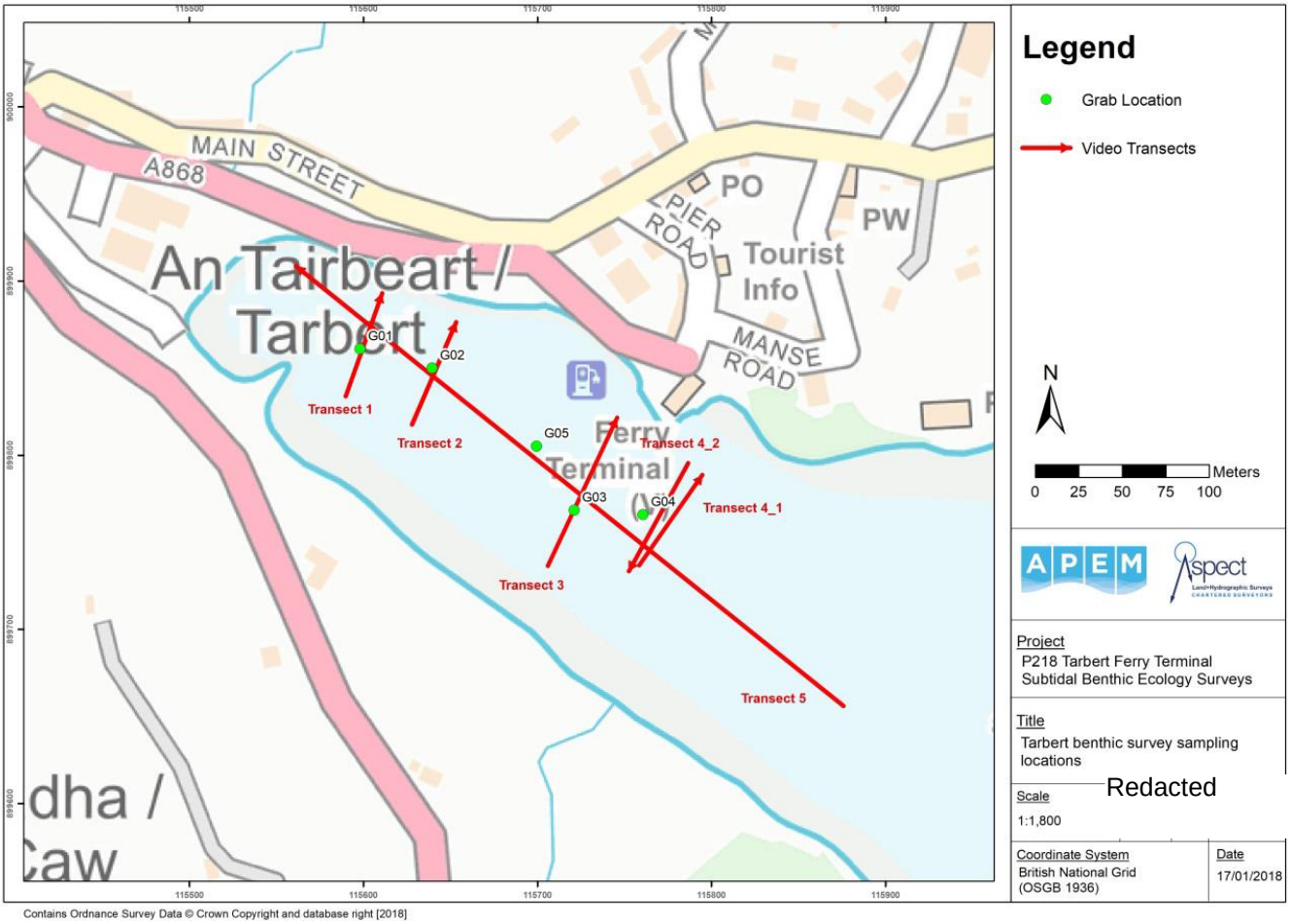


Figure 2-3 Location of the underwater video transect routes, with arrows indicating the transect direction flow, and location of the grab sampling stations.

Table 2-1 Start and end point coordinates for each underwater video transect. Coordinates are presented in the Ordnance Survey/British National Grid Project Coordinate System format.

Underwater video transect	Start coordinates		End coordinates	
	X	Y	X	Y
Transect 1	115589	899833	115611	899893
Transect 2	115628	899818	115653	899876
Transect 3	115706	899736	115746	899821
Transect 4_1 (original)	115758	899737	115795	899789
Transect 4_2 (repeated)	115787	899785	115752	899733
Transect 5	115788	899656	115561	899908

2.1.2 Grab sampling survey

The subtidal grab sampling survey was conducted on the 13th December 2017 in daylight hours.

No specification for the number or location of the grab sampling stations was provided by CMAL or Affric Ltd. prior to the survey, as the grab sampling stations were to be sited by Affric Ltd.'s attending marine ecologist based on the findings of the underwater video survey conducted on 12th December 2017.

During the survey design phase, it was specified by CMAL and Affric Ltd. that there was no requirement to obtain replicate grab samples for macrobenthic analysis. It was stated that the purpose of the survey was to characterise the subtidal benthic ecology habitats, community composition and PSD to assess the habitat and species types that may be lost as a result of the proposed development. As the habitats surveyed will be lost under the footprint of the proposed development they will be subject to a direct effect, and so there is no requirement to obtain replicate grab samples for compilation of a baseline dataset upon which a future monitoring programme for indirect effects could be defined. This also meant that there was no requirement to conduct formal *a priori* statistical power analysis to define the number of samples required by the survey, as the data collected prior to construction would not be quantitatively compared to any data collected post-construction and as such the statistical power of the survey design was not a relevant consideration.

Following review of the underwater video survey outputs, APEM proposed five grab sampling station locations within Tarbert Harbour that were agreed with Affric Ltd., and these are shown on Figure 2-3 with coordinates provided in Table 2-2. At each of these stations, grab samples were collected for macrobenthic and Particle Size Distribution (PSD) analysis using a 0.1 m^2 Day Grab. A single grab sample was obtained for macrobenthic analysis, and a further separate single grab sample was obtained for PSD analysis as close as possible to the original macrobenthic grab sample location.

Table 2-2 Coordinates for each grab sample station. Coordinates are presented in the Ordnance Survey/British National Grid Project Coordinate System format.

Grab sample station	Site code	X	Y
Station 1	G01	115598	899861
Station 2	G02	115640	899850
Station 3	G03	115721	899768
Station 4	G04	115761	899766
Station 5	G05	115700	899805

Whilst conducting the grab sampling, a minimum sediment volume limit of 5 litres was defined as an acceptable size for a grab sample to be considered successful. If this minimum volume was not obtained then a further two attempts were to be made at the same location, followed by three attempts at a different location at least 50m from the original target. At station 3, the first PSD grab attempt was rejected due to a stone blocking the grab jaws. The second attempt retrieved a suitable size sample (>7l).

For each grab attempt the following information was recorded on the survey log-sheet:

- Survey name, location and project code;
- Survey Date;
- Survey Team staff;
- Site information including: site/replicate, sample position (lat/lon; WGS84), collection time, water depth, weather conditions;
- Sampling equipment including sieve mesh size;
- Salinity for later use in the WFD IQI calculation
- Sample description, including sediment description, grab depth in cm, volume, type, profile, concretions, surface features, burrows, algae, colour and colour changes, smell, etc.;

- Any obvious or notable (e.g. Annex 2 species) taxa observed;
- Notes (e.g. anoxia, anthropogenic debris, any problems encountered, etc.);
- Photograph of the unsieved sample (an example is presented in Figure 2-4 below).

Figure 2-4 Unsieved grab sample from Station 4 in Tarbert Harbour.

Biological samples were sieved on board through a 1.0mm sieve as is standard for subtidal surveys in marine conditions. All material retained on the sieves was fixed with 4% buffered formaldehyde solution in seawater and stored in sealed crates.

2.2 Sample analysis

2.2.1 Macrobenthic analysis of grab samples

Samples were processed according APEM's in-house Standard Operating Procedures (SOP's) and in full compliance with North East Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC) guidance (Worsfold and Hall, 2010). To standardise the sizes of organisms and improve sorting efficiency, samples were sieved through a stack of sieves of 4.0, 2.0 and 1.0 mm meshes in a fume cupboard following UKTAG guidance for benthic invertebrate sample analysis for coastal waters (WFD-UKTAG, 2014). All biota retained in the sieves were then extracted under low power microscopes, identified and enumerated, where applicable.

Taxa were identified to the lowest possible practicable taxonomic level using the appropriate taxonomic literature. For certain taxonomic groups (e.g. nemerteans and, nematodes), higher taxonomic levels were used due to the widely acknowledged lack of appropriate identification tools for these groups. The NMBAQC Scheme has produced a Taxonomic Discrimination Protocol (TDP) (Worsfold and Hall 2010) which gives guidance on the most appropriate level to which different marine taxa should be identified, and this guidance was adhered to for the laboratory analysis. Where required, specimens were also compared with material maintained within the laboratory reference collection. Nomenclature followed the World Register of Marine Species (WoRMS), except where more recent revisions were known to supersede WoRMS.

At least one example of each taxon recorded from the surveys was set aside for inclusion in APEM's in-house reference collection. This collection acts as a permanent record of the biota recorded.

2.2.2 PSD analysis of grab samples

PSD analysis was performed in accordance with NMBAQC Scheme best practice guidance for PSA for supporting biological analysis (Mason, 2016). A combination of dry sieving and laser diffraction was used due to the range of particle sizes present in the samples.

The PSA data were entered into GRADISTAT (Blott and Pye, 2001) to produce sediment classifications, following Folk (1954) (Figure 2-5). Summary statistics were also calculated including mean particle size, sorting, skewness and kurtosis (following Blott and Pye, 2001).

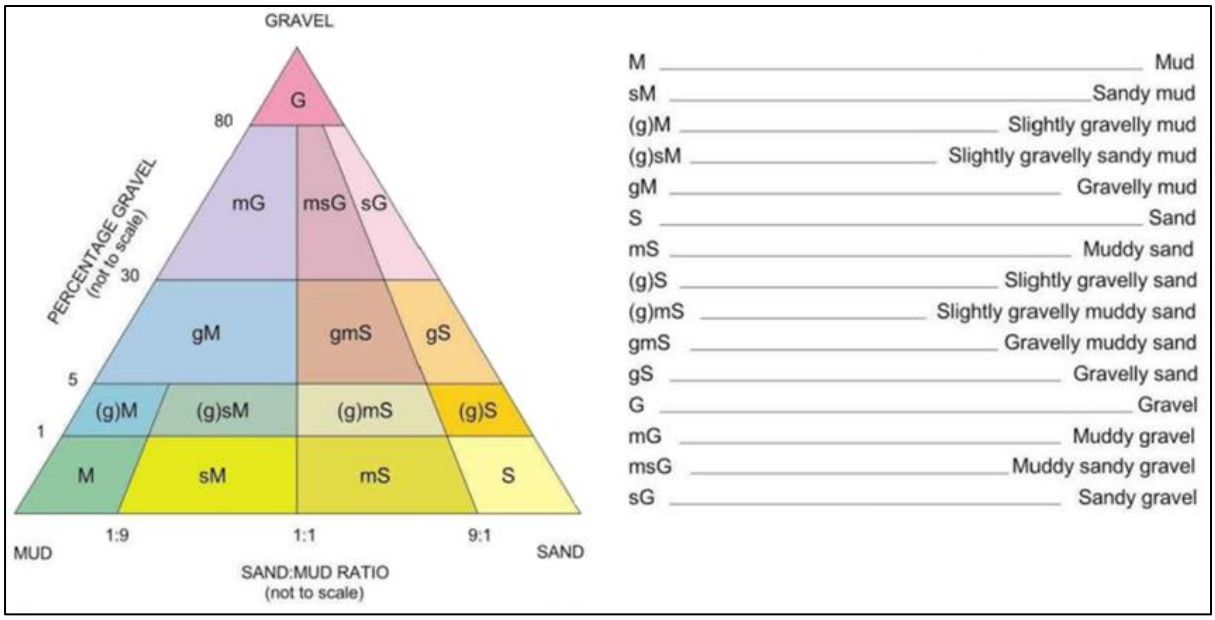


Figure 2-5 Folk sediment classification pyramid (Folk, 1954).

2.2.3 Imagery analysis of underwater video capture

The underwater video was analysed by an experienced marine benthic taxonomist and image analyst to provide habitat/biotope extent and transition data and enable the identification of any small-scale habitats outside the subtidal grab sampling target habitats (such as rock outcrops).. The video captures for each transect were re-played in the laboratory and the biotopes and notable taxa along each transect identified and recorded.

The timing of the transitions between each habitat along the transects in the underwater video were also noted, and these were then related to the ROV and vessel position within the survey logs to identify the position of habitat transitions.

3. Results

3.1 Macrobenthic analysis data

The full suite of enumerated macrobenthic data from each grab sample is provided in Appendix 1. A summary of the prevailing conditions at the time of each macrobenthic grab sample is provided in Table 3-1 below, and the biotopes assigned to each grab sample are provided in Table 3-2. The most abundant species was the Polychaete *Lumbrineris cingulata* agg. with more than 300 individuals across 5 samples and an abundance peak of more than 160 individuals in Station 3. The most abundant Mollusc was the Gastropod *Philine quadripartita* with 82 individuals in Station 2.

Table 3-1 Prevailing water depth and salinity conditions at the time of collection of each macrobenthic grab sample

Grab sample station	Collection time	Water depth (m)	Volume (l)	Salinity (ppm)
Station 1	10:06	0.7	10	35.66
Station 2	13:05	1.5	9.8	35.94
Station 3	12:19	4.2	10	35.96
Station 4	11:35	5.2	10	35.48
Station 5	13:46	3	7	35.67

Table 3-2 Biotopes assigned to macrobenthic grab samples

Grab sample station	Biotope	Description
Station 1	SS.SMu.ISaMu	Infralittoral sandy mud
Station 2	SS.SMu.IFiMu.PhiVir	Philine aperta and Virgularia mirabilis in soft stable infralittoral mud
Station 3	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
Station 4	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
Station 5	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel

3.2 PSD analysis data

The full suite of PSD analysis data from each grab sample is provided in Appendix 2. A summary of the prevailing conditions at the time of each PSD grab sample is provided in Table 3-3 below and the Folk (1954) classifications provided in Table 3-4. Finally, histograms of particle size classifications are presented in Figure 3-1 for each PSD grab sample.

Table 3-3 Prevailing water depth and salinity conditions at the time of collection of each PSD grab sample

Grab sample station	Time	Water depth (m)	Volume (l)	Salinity (ppm)
Station 1	10:37	0.7	10	35.66
Station 2	14:16	1.5	10	35.94
Station 3	12:55	4.2	7	35.96
Station 4	12:10	5.3	10	35.48
Station 5	14:07	3	9.8	35.67

Table 3-4 Visual descriptions and Folk (1954) classifications of PSD grab samples

Grab sample station	Visual description of >1 mm fraction	Folk (1954) classification
Station 1	Slag/cinders, shell and organics including peat	Gravelly Mud
Station 2	Very minor shell	Slightly Gravelly Sandy Mud
Station 3	Degraded shell, gravel/slag	Muddy Gravel
Station 4	Largely shell	Gravelly Mud
Station 5	Largely shell	Gravelly Mud

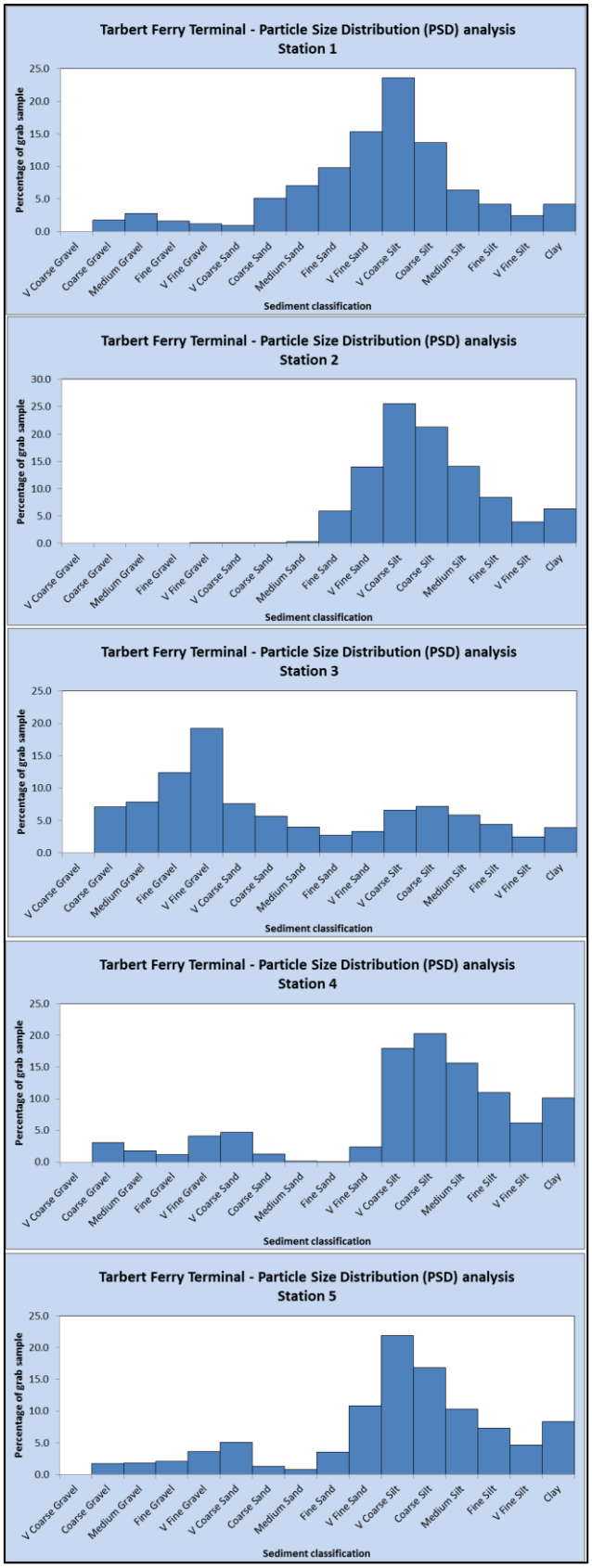


Figure 3-1 Sediment classification distribution graphs for each sample station

3.3 Underwater video data

The full suite of habitat classification data for each transect is provided in Appendix 3. The biotopes found to be present in Tarbert Harbour, with example images of each biotope from the underwater video survey, are provided in Figures 3-2, 3-3 and 3-4. The biotopes identified by the underwater video imagery have been mapped along each of the transect routes in Figure 3-5.

 #

Figure 3-2 SS.SMu.IFiMu – Infralittoral fine mud

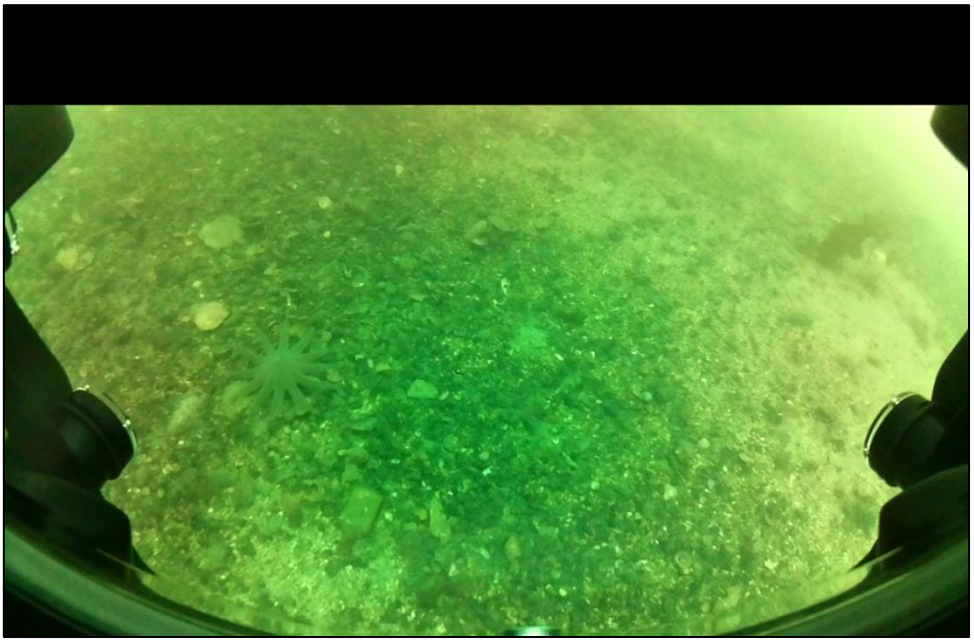


Figure 3-3 SS.SMx – Sublittoral mixed sediment

Figure 3-4 LR.LLR.F.Fser.X – *Fucus serratus* on full salinity lower eulittoral mixed substrata

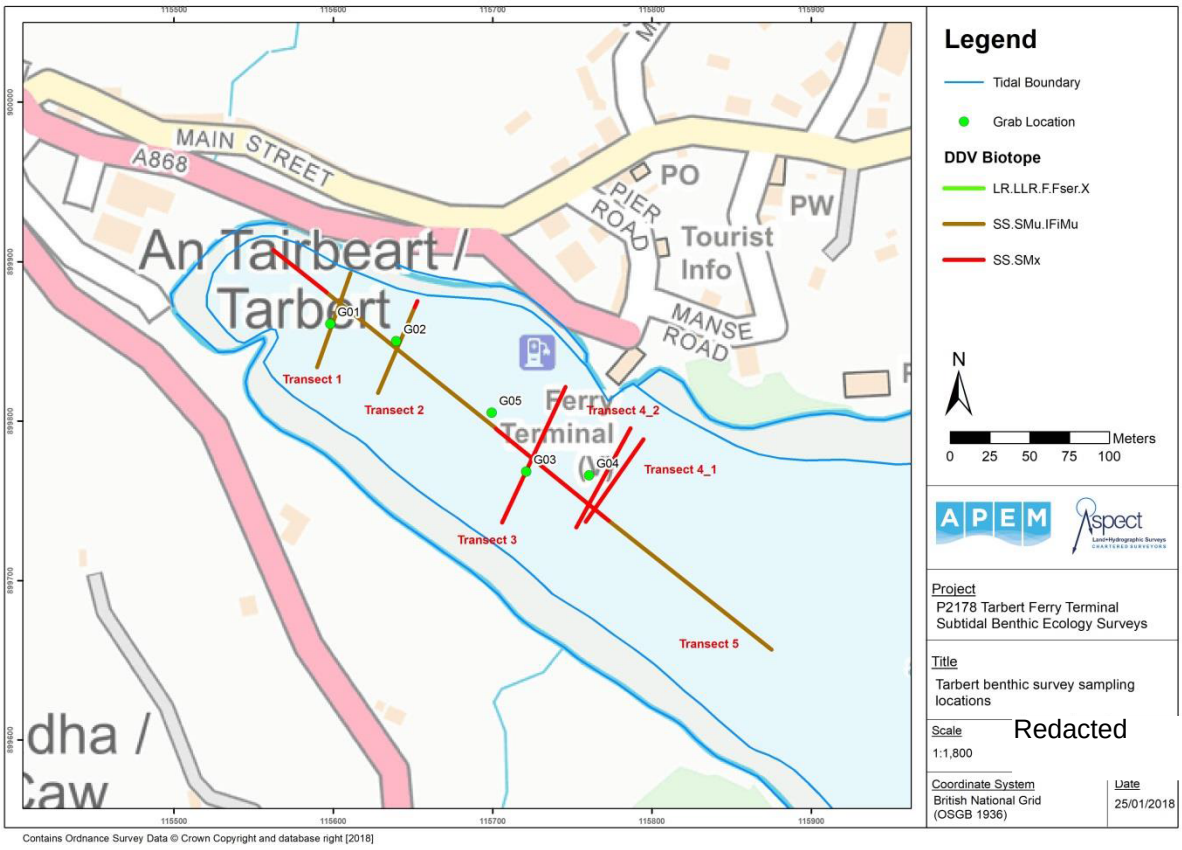


Figure 3-5 Transect routes with mapped biotopes overlaid

3.4 Tarbert Harbour biotope mapping

The macrobenthic count data, PSA data and underwater video biotope classification data has been compiled to allocate biotopes to each point along the underwater video transects and at the grab sample stations. Biotopes were allocated following JNCC's National Marine Habitat Classification for Britain and Ireland: Version 04.05 (Connor *et al*. 2004). EUNIS codes corresponding to each biotope have also been provided (JNCC 2010, Parry 2015).

As the survey coverage across Tarbert Harbour has transects running across the harbour and down the full length of the shore and at various depths, it has been possible to extrapolate between the known biotopes along the transects to provide a more complete biotope map of the harbour. This plan is shown in Figure 3-6. It is acknowledged that this is an extrapolation of the known data and so the biotope assignment away from the transects and grab sample locations is with a lower level of confidence to the biotope assignment at the grab sample stations and transects.

The biotope map presented in Figure 3-6 is an interpretive map based on an extrapolation of the raw data collected in the grab samples and along the underwater video transects, to delineate approximate habitat biotope boundaries within Tarbert Harbour. Following the approach set out by Saunders et al. (2011) the confidence in this biotope map would be enhanced by conducting a geophysical survey of the harbour to allow the grab sample point data and underwater video line data to act as reference points for the habitats in the rest of the harbour defined using the geophysical survey.

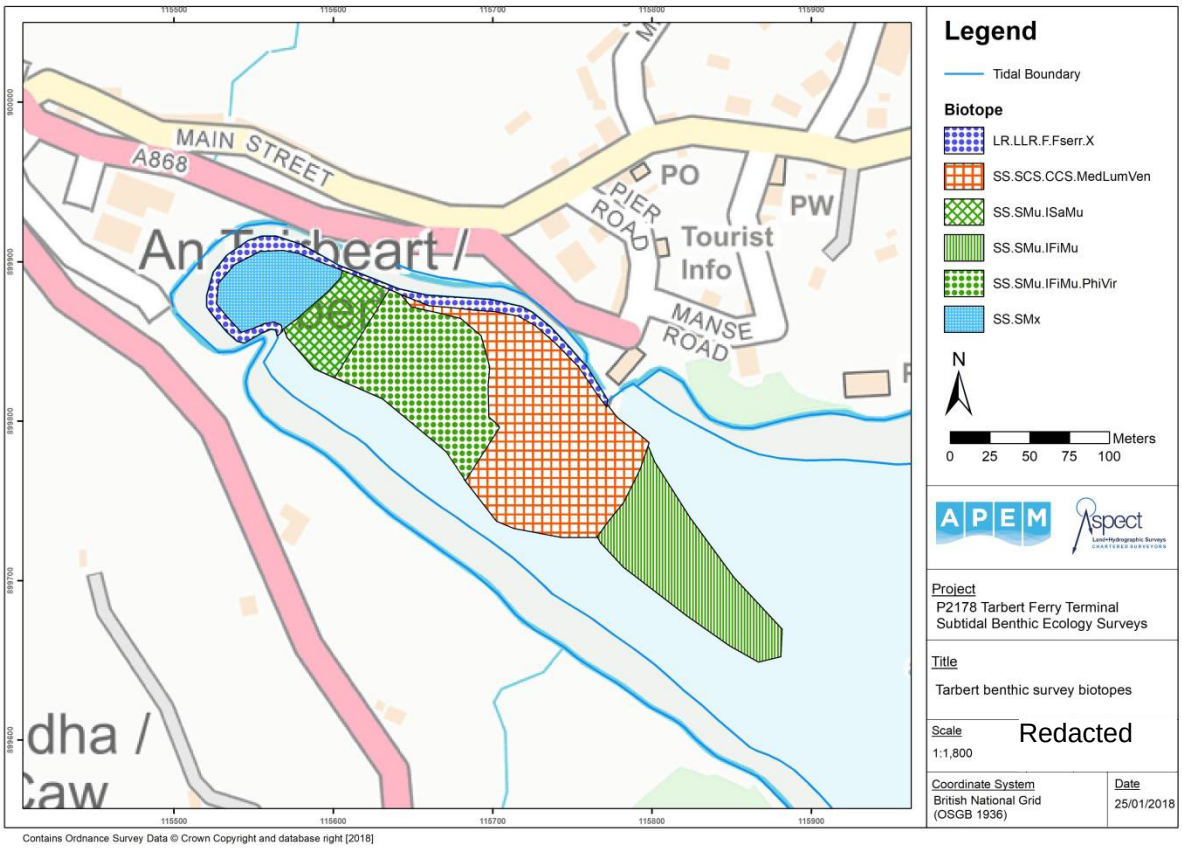


Figure 3-6 Tarbert Harbour mapped subtidal benthic biotopes

4. References

Blott, S. J. & Pye, K. 2001. GRADISTAT: a grain size distribution and statistics package for the analysis of unconsolidated sediments. *Earth Surface Processes and Landforms* 26, 1237-1248.

Connor, D. W., Allen J. H., Golding, N., Howell, K. L., Lieberknecht, L. M., Northen, K. O., Reker, J. B. 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough ISBN 1 861 07561 8 (internet version). Available online.

Folk, R. L., 1954. The distinction between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology* 62(4): 344-359.

JNCC, 2010. Handbook for Phase 1 habitat survey - a technique for environmental audit, ISBN 0 86139 636 7.

Mason, C. 2016. NMBAQC's Best Practice Guidance. Particle Size Analysis (PSA) for Supporting Biological Analysis. National Marine Biological AQC Coordinating Committee, 77pp, First published 2011, updated January 2016. Available online.

Parry, M. E. V. 2015. Guidance on Assigning Benthic Biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland *JNCC report* No. 546.

Proudfoot, R. K., Elliott, M., Dyer, M. F., Barnett, B. E., Allen, J. H., Proctor, N. L., Cutts, N., Nikitik, C., Turner, G., Breen, J., Hemmingway, K. L. & Mackie, T. 2003. *Proceedings of the Humber Benthic Field Methods Workshop, Hull University 1997. Collection and processing macrobenthic samples from soft sediments: a best practice review*. Environment Agency R&D Technical Report E1 – 13/TR, 128pp. Available online.

Saunders, G., Bedford, G. S., Trendall, J. R., and Sotheran, I. 2011. Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

Thomas, N. S. 2001. *Procedural Guideline No. 3-9. Quantitative sampling of sublittortal sediment biotopes and species using remote-operated grabs*. *In*: Marine Monitoring Handbook, ed. by J. Davies, J. Baxter, M. Bradley, D. Connor, J. Khan, E. Murray, W. Sanderson, C. Turnbull and M. Vincent, 275-283. Joint Nature Conservation Committee, Peterborough.

WFD UKTAG. 2014. UKTAG Transitional and Coastal Water Assessment Method Benthic Invertebrate Fauna. Infaunal Quality Index.

Worsfold, T. M., Hall, D. J. & O'Reilly, M. (Ed.) 2010. *Guidelines for processing marine macrobenthic invertebrate samples: a Processing Requirements Protocol: Version 1.0, June 2010*. Unicomarine Report NMBAQCMbPRP to the NMBAQC Committee. 33pp. Available online.

Appendix 1 Macrobenthic data from grab samples

APEM Ltd.
Diamond Centre
Works Road
Letchworth
Herts, SG6 1LW

Marine Benthic Invertebrate Analysis Report

The analysis on adjacent tab(s) of this workbook has been carried out by APEM Ltd under method MINV-01.

Client Name:	Aspect Surveys Ltd.	
Address:	Unit 1, Thornhouse Business Centre Ballot Road Irvine KA12 0HW Ayrshire	
Phone Number:	01294 313399	
P.O. Number:	ASP 2235	
Prepared by:	Redacted	Letchworth Lab Manager
Approved and issued by:	Redacted	Marine Technical Specialist
Issue Date:	25/01/2018	

If you have any comments or complaints regarding this or any other piece of work conducted by APEM Ltd, please contact Redacted

APEM Report No. P00002178-01

APEM Report No. P00002178-01

Sample Number	Sample Date	Sample Method	Watercourse	Site Description	Analysis Type	Analysis Date	Analyst	QC Date	APEM location	Notes
60531	13/12/2018	Day Grab	Isle of Harris	Grab St. 1	1.0mm mesh	08/01/2018	CA	08/01/2018	Letchworth	-
60532	13/12/2018	Day Grab	Isle of Harris	Grab St. 2	1.0mm mesh	04/01/2018	CA	04/01/2018	Letchworth	-
60533	13/12/2018	Day Grab	Isle of Harris	Grab St. 3	1.0mm mesh	08/01/2018	NP	08/01/2018	Letchworth	-
60534	13/12/2018	Day Grab	Isle of Harris	Grab St. 4	1.0mm mesh	04/01/2018	NP	04/01/2018	Letchworth	-
60535	13/12/2018	Day Grab	Isle of Harris	Grab St. 5	1.0mm mesh	04/01/2018	CA	05/01/2018	Letchworth	-

APEM Report No. P00002178-01

Sample Number		60531	60532	60533
Sample Date		13/12/2018	13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris	Isle of Harris
Site Description		Grab St. 1	Grab St. 2	Grab St. 3
Analysis Type		1.0mm mesh	1.0mm mesh	1.0mm mesh
Analysis Date		08/01/2018	04/01/2018	08/01/2018
Analyst		CA	CA	NP
Code	Taxa ID	Qualifiers	60531	60532	60533
D0759	Edwardsiidae		-	-	2
F0002	Turbellaria		-	-	1
G0001	Nemertea		-	-	6
G0047	Lineidae		-	-	-
HD0001	Nematoda		-	2	8
K0030	Loxosomella murmanica		-	-	P
N0014	Golfingia elongata		-	-	1
N0017	Golfingia vulgaris		-	-	2
N0034	Phascolion strombus		-	-	2
P0050	Malmgrenia darbouxi		-	-	12
P0065	Harmothoe impar	aggregate	-	-	4
P0067	Malmgrenia arenicolae		-	-	2
P0092	Pholoe baltica (sensu Petersen)		-	-	2
P0094	Pholoe inornata (sensu Petersen)		-	-	-
P0118	Eteone longa	aggregate	-	-	3
P0152	Eulalia bilineata		-	-	2
P0167	Eumida sanguinea	aggregate	-	-	15
P0176	Paranaitis kosteriensis		-	-	-
P0256	Glycera alba		-	-	-
P0260	Glycera lapidum	aggregate	-	-	5
P0268	Glycinde nordmanni		-	-	-
P0271	Goniada maculata		-	-	-
P0305	Psamathe fusca		-	-	8
P0312	Oxydromus pallidus		-	-	2
P0313	Oxydromus flexuosus		-	-	2
P0319	Podarkeopsis capensis		-	-	11
P0358	Syllis parapari		-	-	2
P0421	Parexogone hebes		-	-	2
P0494	Nephtys	juvenile	43	18	-
P0499	Nephtys hombergii		7	13	-
P0574	Lumbrineris cingulata	aggregate	-	-	138
P0638	Protodorvillea kefersteini		-	-	28
P0699	Paradoneis lyra		-	-	-
P0722	Aonides oxycephala		-	-	8
P0731	Laonice	juvenile	-	-	-
P0750	Dipolydora coeca		-	-	-
P0754	Dipolydora flava		-	-	1
P0761	Dipolydora saintjosephi		-	-	3
P0765	Prionospio fallax		2	1	-
P0790	Spio symphyta		-	-	-
P0804	Magelona alleni		-	-	4
P0806	Magelona minuta		-	-	-
P0827	Chaetozone vivipara		-	1	-
P0829	Caulleriella alata		-	-	-
P0832	Chaetozone elakata		-	-	-
P0840	Dodecaceria		-	-	-

APEM Report No. P00002178-01

Sample Number		60531	60532	60533
Sample Date		13/12/2018	13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris	Isle of Harris
Site Description		Grab St. 1	Grab St. 2	Grab St. 3
Analysis Type		1.0mm mesh	1.0mm mesh	1.0mm mesh
Analysis Date		08/01/2018	04/01/2018	08/01/2018
Analyst		CA	CA	NP
Code	Taxa ID	Qualifiers	60531	60532	60533
P0889	Macrochaeta		-	-	3
P0906	Capitella		-	-	-
P0919	Mediomastus fragilis		-	-	93
P0923	Notomastus		-	-	11
P1025	Scalibregma inflatum		-	-	6
P1026	Scalibregma celticum		-	-	1
P1093	Galathowenia oculata		-	-	-
P1102	Amphictene auricoma		-	-	-
P1124	Melinna palmata		-	-	6
P1174	Terebellides		-	-	3
P1185	Amphitritides gracilis		-	-	-
P1210	Nicolea venustula		-	-	3
P1216	Pista	juvenile	-	-	-
P1217	Pista mediterranea		-	-	1
P1235	Polycirrus		-	-	12
P1257	Sabellidae		-	-	-
P1268	Chone fauveli		-	-	-
P1315	Pseudopotamilla		-	-	-
P1324	Serpulidae		-	-	22
P1334	Hydroides norvegica		-	-	-
P1340	Spirobranchus lamarcki		-	-	51
P1341	Spirobranchus triqueter		-	-	3
R2173	Melinnacheres terebellidis		-	-	-
S0131	Perioculodes longimanus		-	1	-
S0503	Cheirocratus	female	-	-	2
S0792	Gnathiidae	juvenile	-	-	1
S1445	Paguridae	juvenile	-	-	-
S1472	Galathea intermedia	juvenile	-	-	1
W0053	Leptochiton asellus		-	-	5
W0159	Gibbula magus		-	-	7
W0161	Gibbula tumida		-	-	2
W0163	Steromphala cineraria		-	1	4
W0174	Jujubinus montagui		-	-	1
W0371	Onoba semicostata		-	-	10
W0747	Tritia incrassata		-	-	-
W0748	Tritia pygmaea		-	-	-
W0804	Mangelia costata		-	-	-
W1038	Philine quadripartita		1	82	-
W1118	Elysia viridis		-	-	1
W1569	Nucula nitidosa		-	-	-
W1837	Thyasira flexuosa		1	-	-
W1906	Kurtiella bidentata		2	-	67
W2006	Phaxas pellucidus		-	-	-
W2059	Abra alba		12	11	-
W2061	Abra nitida		2	11	-
W2098	Chamelea striatula	juvenile	-	-	-

APEM Report No. P00002178-01

Sample Number		60531	60532	60533
Sample Date		13/12/2018	13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris	Isle of Harris
Site Description		Grab St. 1	Grab St. 2	Grab St. 3
Analysis Type		1.0mm mesh	1.0mm mesh	1.0mm mesh
Analysis Date		08/01/2018	04/01/2018	08/01/2018
Analyst		CA	CA	NP
Code	Taxa ID	Qualifiers	60531	60532	60533
W2147	Mya truncata		-	-	-
W2147	Mya truncata	juvenile	-	-	1
ZA0003	Phoronis		-	-	-
ZB0018	Asteroidea	juvenile	-	-	1
ZB0161	Amphipholis squamata		-	-	12
ZB0165	Ophiuridae	juvenile	-	-	1
ZB0193	Psammechinus miliaris		-	-	-
ZB0266	Cucumariidae	juvenile	-	-	-
ZM	Bryophyta		P	P	-
ZM0002	Rhodophyta		-	-	-
ZM0131	Cruoria		-	-	P
ZM0189	Hildenbrandia		-	-	-
ZM0431	Gracilaria		-	-	P
ZM0554	Pterothamnion plumula		-	-	P
ZM0581	Heterosiphonia plumosa		-	P	-
ZM0655	Polysiphonia		-	-	P
ZR0191	Ralfsia verrucosa		-	-	-
ZR0288	Sphacelaria		-	-	P
ZS0174	Ulva		-	-	P

APEM Report No. P00002178-01

Sample Number		60534	60535
Sample Date		13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris
Site Description		Grab St. 4	Grab St. 5
Analysis Type		1.0mm mesh	1.0mm mesh
Analysis Date		04/01/2018	04/01/2018
Analyst		NP	CA
Code	Taxa ID	Qualifiers	60534	60535
D0759	Edwardsiidae		-	1
F0002	Turbellaria		-	-
G0001	Nemertea		5	14
G0047	Lineidae		5	-
HD0001	Nematoda		5	-
K0030	Loxosomella murmanica		P	-
N0014	Golfingia elongata		-	-
N0017	Golfingia vulgaris		-	-
N0034	Phascolion strombus		1	-
P0050	Malmgrenia darbouxi		-	-
P0065	Harmothoe impar	aggregate	1	-
P0067	Malmgrenia arenicolae		-	-
P0092	Pholoe baltica (sensu Petersen)		1	1
P0094	Pholoe inornata (sensu Petersen)		1	-
P0118	Eteone longa	aggregate	1	2
P0152	Eulalia bilineata		-	-
P0167	Eumida sanguinea	aggregate	-	1
P0176	Paranaitis kosteriensis		1	1
P0256	Glycera alba		-	9
P0260	Glycera lapidum	aggregate	3	-
P0268	Glycinde nordmanni		-	5
P0271	Goniada maculata		1	-
P0305	Psamathe fusca		2	-
P0312	Oxydromus pallidus		-	-
P0313	Oxydromus flexuosus		2	4
P0319	Podarkeopsis capensis		3	3
P0358	Syllis parapari		1	-
P0421	Parexogone hebes		-	1
P0494	Nephtys	juvenile	-	-
P0499	Nephtys hombergii		-	1
P0574	Lumbrineris cingulata	aggregate	164	52
P0638	Protodorvillea kefersteini		12	-
P0699	Paradoneis lyra		1	-
P0722	Aonides oxycephala		35	2
P0731	Laonice	juvenile	-	2
P0750	Dipolydora coeca		1	-
P0754	Dipolydora flava		-	-
P0761	Dipolydora saintjosephi		3	-
P0765	Prionospio fallax		-	36
P0790	Spio symphyta		-	2
P0804	Magelona alleni		7	2
P0806	Magelona minuta		-	2
P0827	Chaetozone vivipara		-	-
P0829	Caulleriella alata		2	2
P0832	Chaetozone elakata		-	1
P0840	Dodecaceria		2	-

APEM Report No. P00002178-01

Sample Number		60534	60535
Sample Date		13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris
Site Description		Grab St. 4	Grab St. 5
Analysis Type		1.0mm mesh	1.0mm mesh
Analysis Date		04/01/2018	04/01/2018
Analyst		NP	CA
Code	Taxa ID	Qualifiers	60534	60535
P0889	Macrochaeta		-	-
P0906	Capitella		-	1
P0919	Mediomastus fragilis		47	32
P0923	Notomastus		20	25
P1025	Scalibregma inflatum		-	-
P1026	Scalibregma celticum		-	-
P1093	Galathowenia oculata		-	17
P1102	Amphictene auricoma		-	1
P1124	Melinna palmata		18	42
P1174	Terebellides		15	-
P1185	Amphitritides gracilis		5	-
P1210	Nicolea venustula		-	-
P1216	Pista	juvenile	-	1
P1217	Pista mediterranea		2	-
P1235	Polycirrus		13	-
P1257	Sabellidae		1	-
P1268	Chone fauveli		1	-
P1315	Pseudopotamilla		1	-
P1324	Serpulidae		48	-
P1334	Hydroides norvegica		1	-
P1340	Spirobranchus lamarcki		93	-
P1341	Spirobranchus triqueter		5	-
R2173	Melinnacheres terebellidis		2	-
S0131	Perioculodes longimanus		-	-
S0503	Cheirocratus	female	-	-
S0792	Gnathiidae	juvenile	-	-
S1445	Paguridae	juvenile	2	-
S1472	Galathea intermedia	juvenile	-	-
W0053	Leptochiton asellus		3	-
W0159	Gibbula magus		-	-
W0161	Gibbula tumida		-	-
W0163	Steromphala cineraria		4	-
W0174	Jujubinus montagui		-	-
W0371	Onoba semicostata		1	-
W0747	Tritia incrassata		1	-
W0748	Tritia pygmaea		2	-
W0804	Mangelia costata		1	-
W1038	Philine quadripartita		-	1
W1118	Elysia viridis		-	-
W1569	Nucula nitidosa		1	2
W1837	Thyasira flexuosa		-	12
W1906	Kurtiella bidentata		23	-
W2006	Phaxas pellucidus		-	2
W2059	Abra alba		-	25
W2061	Abra nitida		-	7
W2098	Chamelea striatula	juvenile	-	2

APEM Report No. P00002178-01

Sample Number		60534	60535
Sample Date		13/12/2018	13/12/2018
Sample Method		Day Grab	Day Grab
Watercourse		Isle of Harris	Isle of Harris
Site Description		Grab St. 4	Grab St. 5
Analysis Type		1.0mm mesh	1.0mm mesh
Analysis Date		04/01/2018	04/01/2018
Analyst		NP	CA
Code	Taxa ID	Qualifiers	60534	60535
W2147	Mya truncata		1	-
W2147	Mya truncata	juvenile	1	-
ZA0003	Phoronis		1	-
ZB0018	Asteroidea	juvenile	1	-
ZB0161	Amphipholis squamata		-	-
ZB0165	Ophiuridae	juvenile	-	3
ZB0193	Psammechinus miliaris		1	-
ZB0266	Cucumariidae	juvenile	-	1
ZM	Bryophyta		-	-
ZM0002	Rhodophyta		P	-
ZM0131	Cruoria		P	-
ZM0189	Hildenbrandia		P	-
ZM0431	Gracilaria		-	-
ZM0554	Pterothamnion plumula		-	-
ZM0581	Heterosiphonia plumosa		-	-
ZM0655	Polysiphonia		-	-
ZR0191	Ralfsia verrucosa		P	-
ZR0288	Sphacelaria		P	-
ZS0174	Ulva		-	-

APEM Report No. P00002178-01

Sample Number	Sample Date	Site Description	Biotope	Description	EUNIS
60531	13/12/2018	Grab St. 1	SS.SMu.ISaMu	Infralittoral sandy mud	A5.33
60532	13/12/2018	Grab St. 2	SS.SMu.IFiMu.PhiVir	Philine aperta and Virgularia mirabilis in soft stable infralittoral mud	A5.343
60533	13/12/2018	Grab St. 3	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel	A5.142
60534	13/12/2018	Grab St. 4	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel	A5.142
60535	13/12/2018	Grab St. 5	SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel	A5.142

APEM Report No. P00002178-01

Code	Taxa ID	Qualifiers	Notes
P0092	Pholoe baltica (sensu Petersen)		sensu Petersen, 1998;
P0094	Pholoe inornata (sensu Petersen)		sensu Petersen, 1998;
P0319	Podarkeopsis capensis		Traditional usage; but possibly a related species;
P0358	Syllis parapari		Not formally recorded from UK;
P0574	Lumbrineris cingulata	aggregate	(Previously recorded as Lumbrineris aniara/cingulata);
P0750	Dipolydora coeca		May include undescribed species;
P0754	Dipolydora flava		(Previously included in D. coeca agg.);
P0761	Dipolydora saintjosephi		(Previously included in D. coeca agg.);
P0790	Spio symphyta		(Previously recorded as Spio filicornis agg.); Not formally recorded from UK;
P0827	Chaetozone vivipara		Cryptogenic;
P0832	Chaetozone elakata		(Previously recorded as Chaetozone species D);
P0906	Capitella		Representative of organic enrichment;
P1174	Terebellides		(Previously recorded as Terebellides stroemii; might include additional species);
P1315	Pseudopotamilla		May include undescribed species;
W0748	Tritia pygmaea		Possibly close to northern limit of distribution
W1038	Philine quadripartita		(Previously recorded as Philine aperta);

Appendix 2 PSD data from grab samples

APEM Project P00002178 - Tarbert Ferry Terminal Subtidal Benthic Ecology survey PSD analysis results

Sample	Date collected	Visual description of >1 mm fraction	Folk (1954) classification	Statistics calculated using Folk and Ward (1957) formulae								Primary Mode (µm)	d10 (µm)	d50 (µm)	d90 (µm)	Gravel (>2 mm) (%)	Sand (63-2000 µm) (%)	Mud (<63 µm) (%)	V Coarse Gravel (32-64 mm) (%)	Coarse Gravel (16-32 mm) (%)	Medium Gravel (8-16 mm) (%)	Fine Gravel (4-8 mm) (%)	V Fine Gravel (2-4 mm) (%)	V Coarse Sand (1-2 mm) (%)	Coarse Sand (500-1000 µm) (%)	Medium Sand (250-500 µm) (%)	Fine Sand (125-250 µm) (%)	V Fine Sand (63-125 µm) (%)	V Coarse Silt (31-63 µm) (%)	Coarse Silt (16-31 µm) (%)	Medium Silt (8-16 µm) (%)	Fine Silt (4-8 µm) (%)	V Fine Silt (2-4 µm) (%)	Clay (<2 µm) (%)
				Mean (µm)	Mean (description)	Sorting (µm)	Sorting (description)	Skewness (µm)	Skewness (description)	Kurtosis (µm)	Kurtosis (description)																								
Station 1	13/12/2017	slag/cinders, shell and organics including peat	Gravelly Mud	67.0	Very Fine Sand	7.592	Very Poorly Sorted	0.203	Coarse Skewed	1.660	Very Leptokurtic	37.7	6.9	54.4	720.2	7.3	38.2	54.5	0.0	1.8	2.7	1.6	1.2	0.9	5.1	7.0	9.8	15.3	23.6	13.7	6.4	4.2	2.4	4.2
Station 2	13/12/2017	very minor shell	Slightly Gravelly Sandy	24.0	Coarse Silt	3.777	Poorly Sorted	-0.243	Fine Skewed	1.207	Leptokurtic	37.7	3.8	27.9	103.5	0.1	20.4	79.5	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.4	5.9	14.0	25.5	21.3	14.1	8.4	3.9	6.3
Station 3	13/12/2017	degraded shell, gravel/slag	Muddy Gravel	559.9	Coarse Sand	18.237	Extremely Poorly Sorted	-0.466	Very Fine Skewed	0.753	Platykurtic	3400.0	7.1	1607.2	12359.7	46.5	23.2	30.3	0.0	7.0	7.9	12.4	19.2	7.6	5.6	4.0	2.7	3.3	6.6	7.2	5.9	4.4	2.4	3.9
Station 4	13/12/2017	largely shell	Gravelly Mud	36.9	Very Coarse Silt	14.842	Very Poorly Sorted	0.308	Very Coarse Skewed	1.995	Very Leptokurtic	26.7	1.9	20.3	2063.9	10.2	8.7	81.1	0.0	3.1	1.8	1.2	4.1	4.7	1.3	0.2	0.1	2.4	17.9	20.3	15.6	11.0	6.1	10.2
Station 5	13/12/2017	largely shell	Gravelly Mud	37.4	Very Coarse Silt	9.864	Very Poorly Sorted	0.117	Coarse Skewed	1.704	Very Leptokurtic	37.7	2.6	33.6	1783.8	9.1	21.5	69.4	0.0	1.7	1.8	2.0	3.6	5.1	1.3	0.8	3.5	10.8	21.9	16.9	10.3	7.3	4.6	8.3

Sample	Percentages of the distribution in each 'half-phi' size interval, expressed in µm																																						
	>63000	45000 to 63000	31500 to 45000	22400 to 31500	16000 to 22400	11200 to 16000	8000 to 11200	5600 to 8000	4000 to 5600	2800 to 4000	2000 to 2800	1400 to 2000	1000 to 1400	710 to 1000	500 to 710	355 to 500	250 to 355	180 to 250	125 to 180	90 to 125	63 to 90	44.19 to 63	31.25 to 44.19	22.097 to 31.25	15.625 to 22.097	11.049 to 15.625	7.813 to 11.049	5.524 to 7.813	3.906 to 5.524	2.762 to 3.906	1.953 to 2.762	1.381 to 1.953	0.977 to 1.381	0.691 to 0.977	0.488 to 0.691	0.345 to 0.488	0.244 to 0.345	0.173 to 0.244	0.122 to 0.173	0.086 to 0.122	0.061 to 0.086	0.043 to 0.061
Station 1	0.0	0.0	0.0	0.6	1.2	1.4	1.4	0.8	0.8	0.7	0.5	0.5	0.4	1.8	3.3	4.0	3.0	3.7	6.1	6.9	8.2	11.4	12.4	8.5	5.2	3.6	2.8	2.3	1.9	1.4	1.0	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.0
Station 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.3	1.5	4.3	6.1	7.7	11.6	14.2	11.9	9.3	7.7	6.3	4.9	3.5	2.3	1.6	1.2	0.9	0.8	0.8	0.7	0.6	0.5	0.4	0.3	0.1	0.0
Station 3	0.0	0.0	0.0	4.5	2.6	4.1	3.8	5.1	7.4	11.1	8.1	5.7	1.8	2.6	3.1	2.4	1.5	1.3	1.4	1.4	1.8	2.8	3.9	3.8	3.4	3.1	2.8	2.4	2.0	1.4	1.0	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.0	0.0
Station 4	0.0	0.0	0.0	2.3	0.8	1.5	0.4	0.4	0.8	1.8	2.3	2.7	2.0	1.0	0.3	0.1	0.1	0.0	0.0	0.0	2.2	7.3	10.8	10.9	9.4	8.3	7.3	6.1	4.9	3.6	2.6	2.0	1.7	1.4	1.3	1.1	0.9	0.7	0.5	0.3	0.1	0.0
Station 5	0.0	0.0	0.0	0.3	1.4	1.3	0.5	0.8	1.2	1.8	1.8	2.7	2.4	1.0	0.3	0.1	0.7	1.1	2.4	4.5	6.1	10.0	12.2	9.7	7.2	5.6	4.7	4.0	3.3	2.6	2.0	1.6	1.4	1.2	1.1	0.9	0.7	0.5	0.4	0.2	0.1	0.0

Appendix 3 Underwater video analysis log

APEM Project P00002178 - Tarbert Ferry Terminal Benthic Ecology Survey video imagery analysis results

Transect	Transect biotope assignment	Start time	End Time	Video track time	Assigned Biotope (MNCR Code)	Classification (Exact copy of MNCR descriptor)	Notes
Transect 1	Tr 1 - 2017-12-12_11.32.08_Biotope 1	11:32:08	11:54:09	00:22:01	SS.SMu.IFiMu	Infralittoral fine mud	
Transect 2	Tr 2 - 2017-12-12_10.51.27_Biotope 1	10:51:27	11:10:55	00:19:28	SS.SMu.IFiMu	Infralittoral fine mud	
	Tr 2 - 2017-12-12_10.51.27_Biotope 2	11:10:55	11:13:07	00:21:40	SS.SMx	Sublittoral mixed sediment	
	Tr 2 - 2017-12-12_10.51.27_Biotope 3	11:13:07	11:14:15	00:22:48	LR.LLR.F.Fser.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata	Area exposed at low tide
Transect 3	Tr 3 - 2017-12-12_13.59.08_Biotope 1	13:59:08	14:12:05	00:12:57	SS.SMx	Sublittoral mixed sediment	Small patches of *Mytilus edulis* present
Transect 4_1	Tr 4.1 - 2017-12-12_14.17.54_Biotope 1	14:17:54	14:25:10	00:07:16	SS.SMx	Sublittoral mixed sediment	Small patches of *Mytilus edulis* present
Transect 4_2	Tr 4.2 - 2017-12-12_14.28.47_Biotope 1	14:28:47	14:37:10	00:08:23	SS.SMx	Sublittoral mixed sediment	Small patches of *Mytilus edulis* present
Transect 5	Tr 5 - 2017-12-12_12.59.36_Biotope 1	12:59:36	13:15:16	00:15:40	SS.SMu.IFiMu	Infralittoral fine mud	
	Tr 5 - 2017-12-12_12.59.36_Biotope 2	13:15:16	13:27:46	00:28:10	SS.SMx	Sublittoral mixed sediment	
	Tr 5 - 2017-12-12_12.59.36_Biotope 3	13:27:46	13:39:31	00:39:55	SS.SMu.IFiMu	Infralittoral fine mud	
	Tr 5 - 2017-12-12_12.59.36_Biotope 4	13:39:31	13:43:26	00:43:50	SS.SMx	Sublittoral mixed sediment	
	Tr 5 - 2017-12-12_12.59.36_Biotope 5	13:43:26	13:43:53	00:44:17	LR.LLR.F.Fser.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata	Area exposed at low tide

Annex C
SOCOTECT Laboratory Analysis

A6488

A6488_TARBERT, HARRIS_PRE-DISPOSAL SAMPLING RESULTS FORM.XLSX

Pre-disposal Sampling Results Form

Version 2 - June 2017

This form should be used to submit the results from your pre-disposal sampling plan.
Full information must be provided in all relevant sheets of this workbook. The blue cells in each worksheet indicate where information can be entered.
Where information cannot be provided, or where there are more than 30 samples required, please contact the Marine Scotland - Licensing Operations Team (MS-LOT) using the contact details below.

Once you have completed this form, send it (including any reference number for the dredging and sea disposal marine licence application in the subject header of your email) to the following email address:
ms.marinelicensing@gov.scot

If you have any questions in relation to this form contact MS-LOT:

Marine Scotland - Licensing Operations Team
Marine Laboratory
375 Victoria Road
Aberdeen, AB11 9DB

01224 295579
ms.marinelicensing@gov.scot

Applicant Information

Applicant:	CMAL
Description of dredging:	TARBERT, LEWIS FERRY BERTHING AREA
Total amount to be dredged (wet tonnes)	

Sample Details & Physical Properties

Explanatory Notes:
An example of a 'Dredge area' is: 'Dock A, Harbour X'
Provide description of the dredge area and the latitude and longitude co-oridnates (WGS84) for each sample location. Co-ordinates taken from GPS equipment should be set to WGS84.
Note for sample depth that the seabed is 0 metres.
Gravel is defined as >2mm, **Sand** is defined as >63um<2mm, **Silt** is deinfed as <63um).

Sample information:

Sample ID	Dredge area	Latitude	Longitude	Type of sample	Sample depth (m)	Total solids (%)	Gravel (%)	Sand (%)	Silt (%)	TOC (%)	Specific gravity	Asbestos
CL/1888778	VB1-1-1	57°53.806'N	006°47.975'W	Core	0.125	61.1	0	1.4	98.6	2.1		
CL/1888779	VB1-1-3	57°53.806'N	006°47.975'W	Core	0.75	58.4	1.3	11.5	87.3	1.57		
CL/1888780	VB1-1-5	57°53.806'N	006°47.975'W	Core	1.75	61.5	0	4.5	95.5	1.48		
CL/1888781	VB2-1-1	57°53.796'N	006°47.997'W	Core	0.125	54.2	0.4	11.5	88.1	1.88		
CL/1888782	VB2-1-3	57°53.796'N	006°47.997'W	Core	0.75	60.6	0.4	11.9	87.6	1.73		
CL/1888783	VB2-1-5	57°53.796'N	006°47.997'W	Core	1.75	61	3.4	15.4	81.2	1.72		
CL/1888784	VB3-1-1	57°53.831'N	006°48.069'W	Core	0.125	59.7	3.7	15.8	80.5	4.97		
CL/1888785	VB3-1-3	57°53.831'N	006°48.069'W	Core	0.75	56.1	0.5	11.9	87.6	1.88		
CL/1888786	VB3-1-5	57°53.831'N	006°48.069'W	Core	1.75	58	1.6	13.5	84.9	1.7		
CL/1888787	VB4-1-1	57°53.823'N	006°48.002'W	Core	0.125	61.3	31.2	14	54.8	4.7		
CL/1888788	VB4-1-3	57°53.823'N	006°48.002'W	Core	0.75	53.8	0.2	13.4	86.4	1.72		
CL/1888789	VB4-1-5	57°53.823'N	006°48.002'W	Core	1.75	53.1	0	5.2	94.8	1.74		
CL/1888790	VB5-1-1	57°53.804'N	006°48.053'W	Core	0.125	60.4	0	15.9	84.1	1.86		
CL/1888791	VB5-1-3	57°53.804'N	006°48.053'W	Core	0.75	56.9	1.7	12.9	85.4	1.72		
CL/1888792	VB5-1-5	57°53.804'N	006°48.053'W	Core	1.75	56.7	0	3.4	96.7	1.76		
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									
		° . 'N	° . 'W									

Trace Metals & Organotins

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Dibutyltin (DBT)	Tributyltin (TBT)
				mg/kg dry weight									
CL/1888778	VB1-1-1	Core	0.125	6	0.29	30	13.1	0.05	22.3	10.1	50		<0.001
CL/1888779	VB1-1-3	Core	0.75	6.6	0.29	31	9.9	0.02	23.5	7.5	43.3		<0.001
CL/1888780	VB1-1-5	Core	1.75	6.3	0.2	33.1	10.8	0.02	25.3	8	46.2		<0.001
CL/1888781	VB2-1-1	Core	0.125	4.5	0.3	32	10.7	0.02	24.6	7.7	45		<0.001
CL/1888782	VB2-1-3	Core	0.75	4.7	0.32	32.4	11.1	0.02	25.4	7.6	46.4		<0.001
CL/1888783	VB2-1-5	Core	1.75	6.9	0.31	35.6	10.8	0.02	27	9.3	49.8		<0.001
CL/1888784	VB3-1-1	Core	0.125	5.8	0.33	28.6	37.1	0.25	21.9	257.3	103.7		<0.001
CL/1888785	VB3-1-3	Core	0.75	5.3	0.35	34.4	12	0.03	25.9	16.2	51.1		<0.001
CL/1888786	VB3-1-5	Core	1.75	6.7	0.19	28.6	10.5	0.02	22.2	7.7	40.3		<0.001
CL/1888787	VB4-1-1	Core	0.125	7.7	0.39	26	27.6	0.82	19.6	46.5	90		<0.001
CL/1888788	VB4-1-3	Core	0.75	5.8	0.25	29.5	10.6	0.03	23	8.1	45.6		<0.001
CL/1888789	VB4-1-5	Core	1.75	4.9	0.26	31.6	11	0.03	24.7	7.8	47.7		<0.001
CL/1888790	VB5-1-1	Core	0.125	5.2	0.28	29.5	10.3	0.1	23.2	8.3	46.3		<0.001
CL/1888791	VB5-1-3	Core	0.75	4.4	0.33	31.2	10.8	0.04	25.4	7.8	48.2		<0.001
CL/1888792	VB5-1-5	Core	1.75	5.5	0.25	29.5	10.4	0.06	22.9	7.7	44.2		<0.001
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										
0	0	0	0										

Polyaromatic Hydrocarbons (PAH)

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue

Definitions:

ACENAPTH	Acenaphthene
ACENAPHY	Acenaphthylene
ANTHRACN	Anthracene
BAA	Benz(a)anthracene
BAP	Benzo(a)pyrene
BBF	Benzo(b)fluoranthene
BEP	Benzo(e)pyrene
BENZGHIP	Benzo(ghi)perylene
BKF	Benzo(K)fluoranthene
C1N	C1-naphthalenes
C1PHEN	C1-phenanthrene
C2N	C2-naphthalenes
C3N	C3-naphthalenes
CHRYSENE	Chrysene
DBENZAH	Diben(ah)anthracene
FLUORANT	Fluoranthene
FLUORENE	Fluorene
INDPYR	Indeno(1,2,3-cd)pyrene
NAPTH	Naphthalene
PERYLENE	Perylene
PHENANT	Phenanthrene
PYRENE	Pyrene
THC	Total Hydrocarbon Conten

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	µg/kg																						
				ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF	BEP	BENZGHIP	BKF	C1N	C1PHEN	C2N	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR	NAPTH	PERYLENE	PHENANT	PYRENE	THC
CL/1888778	VB1-1-1	Core	0.125	50.0973236	41.31386861	198.6009732	333.163017	272.0316302	246.0583942	206.6788321	311.6301703	112.6277372	3097.944039	1263.442822	1999.476886	1833.077859	350.3041363	27.04379562	562.7615572	90.63260341	161.3381995	2417.080292	80.27980535	1354.841849	554.9513382	
CL/1888779	VB1-1-3	Core	0.75	<1	<1	<1	2.906205729	1.347109375	4.971773438	4.437106771	4.212588542	1.16540625	13.38650781	14.51014323	32.89348698	12.5991276	4.983260417	<1	3.364640625	2.41853125	3.050315104	3.506661458	29.34401042	10.87085938	3.240372396	
CL/1888780	VB1-1-5	Core	1.75	<1	<1	<1	2.138666667	1.181722449	5.153531973	4.352623129	4.005635374	1.016957823	15.58826122	16.06073197	30.43890068	14.39017143	4.753077551	<1	3.56589932	2.694065306	2.544576871	3.956533333	54.52617959	11.93179592	3.305112925	
CL/1888781	VB2-1-1	Core	0.125	2.769038702	2.36329588	4.861423221	15.25468165	14.07240949	18.50561798	15.53932584	14.14856429	8.610486891	24.34207241	32.29463171	55.47315855	24.32958801	19.01373283	2.560549313	25.82022472	5.820224719	11.44069913	7.770287141	62.5093633	32.00499376	23.85143571	
CL/1888782	VB2-1-3	Core	0.75	2.36101083	1.949458484	5.285198556	11.64620939	10.99157641	13.4645006	11.27918171	10.28760529	5.463297232	14.54271961	23.755716	36.87966306	14.78098676	14.54753309	2.060168472	26.39951865	5.033694344	8.91576414	4.522262335	66.67388688	30.32851986	27.11311673	
CL/1888783	VB2-1-5	Core	1.75	<1	<1	<1	2.993464052	1.466230937	5.125272331	4.529411765	4.166666667	1.565359477	15.5130719	18.11873638	36.92156863	14.8453159	5.315904139	<1	3.928104575	2.706971678	2.727668845	4.016339869	64.3583878	13.01960784	3.822440087	
CL/1888784	VB3-1-1	Core	0.125	134.2948993	112.1926174	369.7424832	1116.837718	1087.752819	985.7931544	774.7006711	700.6714765	450.4404698	357.3575839	1010.843154	429.3581208	471.1977852	1228.335436	123.4903356	2452.927383	182.4671141	747.117651	197.5867785	315.9886577	1577.443893	2181.625235	
CL/1888785	VB3-1-3	Core	0.75	4.886838868	3.333333333	11.16236162	32.81303813	31.9495695	33.50799508	27.84132841	26.12915129	14.01722017	30.40467405	47.25092251	57.35916359	33.22755228	38.54612546	4.781057811	61.5904059	7.595325953	24.41451415	10.3800738	31.97170972	47.47478475	60.68880689	
CL/1888786	VB3-1-5	Core	1.75	<1	<1	<1	2.844594828	1.675112069	4.9875	4.057646552	4.111534483	1.257767241	11.19607759	13.03858621	29.52256034	11.94018966	4.437155172	<1	3.658646552	2.142905172	2.840008621	2.923706897	29.87340517	9.320318966	3.604758621	
CL/1888787	VB4-1-1	Core	0.125	326.3009404	111.400209	384.4200627	1129.905956	1273.761755	1087.607106	886.7920585	811.2643678	580.1358412	655.6948798	999.8641588	586.5412748	555.3814002	1261.745037	152.1212121	2441.724138	278.4952978	927.2413793	330.6060606	344.7126437	1908.202717	2315.559039	
CL/1888788	VB4-1-3	Core	0.75	35.342723	46.66040689	112.941471	337.2995305	355.6406886	313.7577465	244.9327074	229.3533646	151.3965571	67.00970266	288.1452269	108.3693271	97.87793427	356.6773083	43.89358372	740.8400626	57.30954617	245.2757433	32.39812207	131.0998435	450.2735524	669.6964006	
CL/1888789	VB4-1-5	Core	1.75	<1	<1	1.435396226	6.489396226	29.27882075	8.710245283	7.567198113	8.001330189	2.58095283	19.94623585	22.7944434	55.61156604	19.98262264	8.61990566	1.562122642	6.307462264	3.53704717	5.523264151	5.464292453	29.27882075	15.60993396	5.795537736	
CL/1888790	VB5-1-1	Core	0.125	14.90407674	19.74820144	44.64388489	146.8561151	153.501199	127.442446	113.7925659	112.8872902	73.02997602	48.71103118	132.3453237	83.45083933	66.67745803	155.7589928	22.1294964	281.0419664	26.61510791	118.971223	20.73501199	64.99280576	180.0419664	275.5983213	
CL/1888791	VB5-1-3	Core	0.75	<1	<1	1.154986014	5.212034965	1.893055944	6.68	5.990979021	6.212867133	1.458622378	18.4318951	20.23502797	53.39562238	17.27457343	6.488475524	1.063895105	4.517174825	2.975636364	4.045370629	5.095251748	52.49405594	13.95559441	4.350174825	
CL/1888792	VB5-1-5	Core	1.75	1.151079137	<1	1.14028777	3.116306954	1.742206235	7.064748201	6.209832134	6.29616307	1.333333333	17.56834532	20.01558753	43.90407674	16.93045564	6.622302158	<1	4.40647482	3.177458034	4.009592326	3.979616307	120.8405276	15.0911271	4.294964029	
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							
0	0	0	0																							

Organohalogens

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.
ICES7 is the sum of PCB 28,52,101,138,153,180 and 118.

Definitions:

AHCH	alpha-Hexachlorcyclohexane
BHCH	beta-Hexachlorcyclohexane
GHCH	gamma-Hexachlorcyclohexane
DIELDRIN	Dieldrin
HCB	Hexachlorobenzene
PPDDE	p,p'-Dichorodiphenyldicloroethylene
PPDDT	p,p'-Dichorodiphenyltrichloroethane
PPTDE	p,p'-Dichorodiphenyldicloroethane

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB18	PCB105	PCB110	PCB128	PCB141	PCB149	PCB151	PCB156	PCB158	PCB170	PCB180
CL/1888778	VB1-1-1	Core	0.125	0.3119	0.3891	0.1646	<0.08	<0.08	<0.08											<0.08
CL/1888779	VB1-1-3	Core	0.75	0.2079	0.3328	0.0935	<0.08	<0.08	<0.08											<0.08
CL/1888780	VB1-1-5	Core	1.75	0.2286	0.2843	0.0837	<0.08	<0.08	<0.08											<0.08
CL/1888781	VB2-1-1	Core	0.125	0.2562	0.3374	0.1089	<0.08	<0.08	<0.08											<0.08
CL/1888782	VB2-1-3	Core	0.75	0.1857	0.2488	<0.08	<0.08	<0.08	<0.08											<0.08
CL/1888783	VB2-1-5	Core	1.75	0.1834	0.2295	<0.08	<0.08	<0.08	<0.08											<0.08
CL/1888784	VB3-1-1	Core	0.125	1.2967	1.2747	0.8042	0.5334	0.7687	0.5416											0.201
CL/1888785	VB3-1-3	Core	0.75	0.2954	0.4146	0.15	<0.08	<0.08	<0.08											<0.08
CL/1888786	VB3-1-5	Core	1.75	0.2206	0.278	0.0802	<0.08	<0.08	<0.08											<0.08
CL/1888787	VB4-1-1	Core	0.125	0.8169	1.2665	1.4724	1.085	2.6586	2.3186											0.7423
CL/1888788	VB4-1-3	Core	0.75	0.1576	0.2315	<0.08	<0.08	<0.08	<0.08											<0.08
CL/1888789	VB4-1-5	Core	1.75	0.1289	0.1842	<0.08	<0.08	<0.08	<0.08											<0.08
CL/1888790	VB5-1-1	Core	0.125	0.2327	0.3188	0.0871	<0.08	<0.08	<0.08											<0.08
CL/1888791	VB5-1-3	Core	0.75	0.2932	0.37	0.1222	<0.08	<0.08	<0.08											<0.08
CL/1888792	VB5-1-5	Core	1.75	0.3542	0.4729	0.1204	<0.08	<0.08	<0.08											<0.08
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	
0	0	0	0																	

Sample ID	PCB183	PCB187	PCB194	PCB31	PCB44	PCB47	PCB49	PCB66	ICES7	AHCH	BHCH	GHCH	DIELDRIN	HCB	DDE	DDT	TDE	BDE100	BDE138	BDE153	BDE154	BDE17	BDE183	BDE209	BDE28	BDE47	BDE66	BDE85	BDE99
						µg/kg																							
CL/1888778																													
CL/1888779																													
CL/1888780																													
CL/1888781																													
CL/1888782																													
CL/1888783																													
CL/1888784																													
CL/1888785																													
CL/1888786																													
CL/1888787																													
CL/1888788																													
CL/1888789																													
CL/1888790																													
CL/1888791																													
CL/1888792																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													
0																													

PR Details

Total amount to be dredged (wet tonnes)	

Explanatory Notes:
The values entered for each determinand should be an average wet weight concentration from all the samples representing the material to be disposed to sea. They should be entered in the units stated in the Unit of measurement column in the table below.
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Average for the total dredge area:

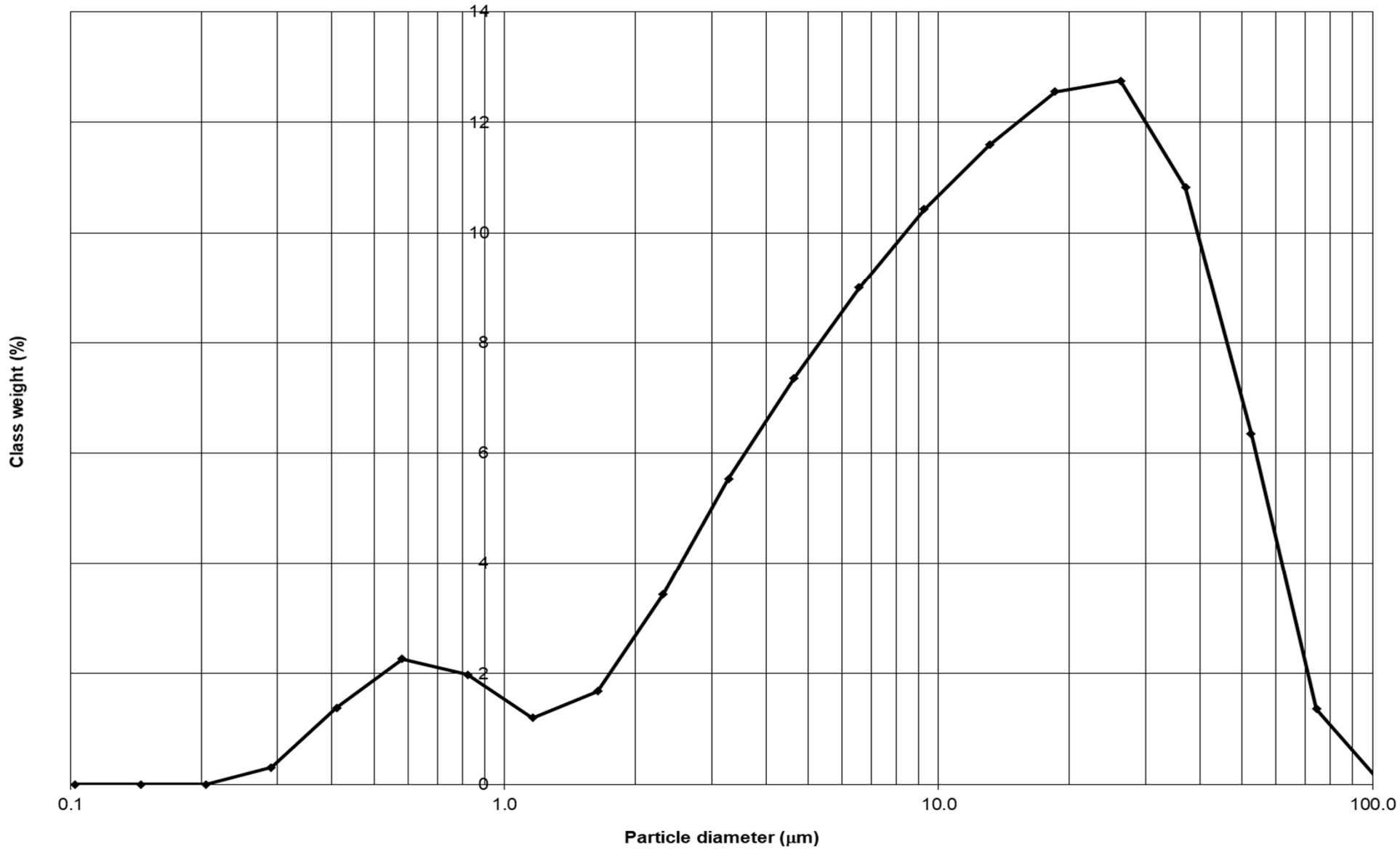
Sample ID	Unit of measurement	
Total Solids	%	
Gravel	%	
Sand	%	
Silt	%	
Arsenic (As)	mg/kg	3.482253
Cadmium (Cd)		0.174925
Chromium (Cr)		18.60134
Copper (Cu)		8.430253
Mercury (Hg)		0.063687
Nickel (Ni)		14.33044
Lead (Pb)		17.66168
Zinc (Zn)		32.34524
Dibutyltin (DBT)		
Tributyltin (TBT)		<0.001
Acenapth	µg/kg	43.5
Acenapthylene		25.1
Anthracn		83.8
BAA		125.1
BAP		193.1
BBF		114.2
BEP		92.3
Benzghip		89.3
BKF		93.1
C1N		166.3
C1PHEN		152.5
C2N		138.3
C3N		122
Chrysene		137.8
Debenzah		28.3
Flurant		263.7
Fluorene		26.8
Indypr		90.6
napth		114.1
perylene		57.8
phenant		223.3
pyrene		244.4
THC		
PCB28		0.21
PCB52		0.27
PCB101		<0.15
PCB118		<0.11
PCB138		<0.19
PCB153		<0.16
PCB18		
PCB105		
PCB110		
PCB128		
PCB141		
PCB149		
PCB151		
PCB156		
PCB158		
PCB170		
PCB180		<0.08
PCB183		
PCB187		
PCB194		
PCB31		
PCB44		
PCB47		
PCB49		
PCB66		
ICES7		
AHCH		
BHCH		
GHCH		
DIELDRIN		
HCB		
DDE		
DDT		
TDE		
BDE100		
BDE138		
BDE153		
BDE154		
BDE17		
BDE183		
BDE209		
BDE28		
BDE47		
BDE66		
BDE85		
BDE99		

Comments:

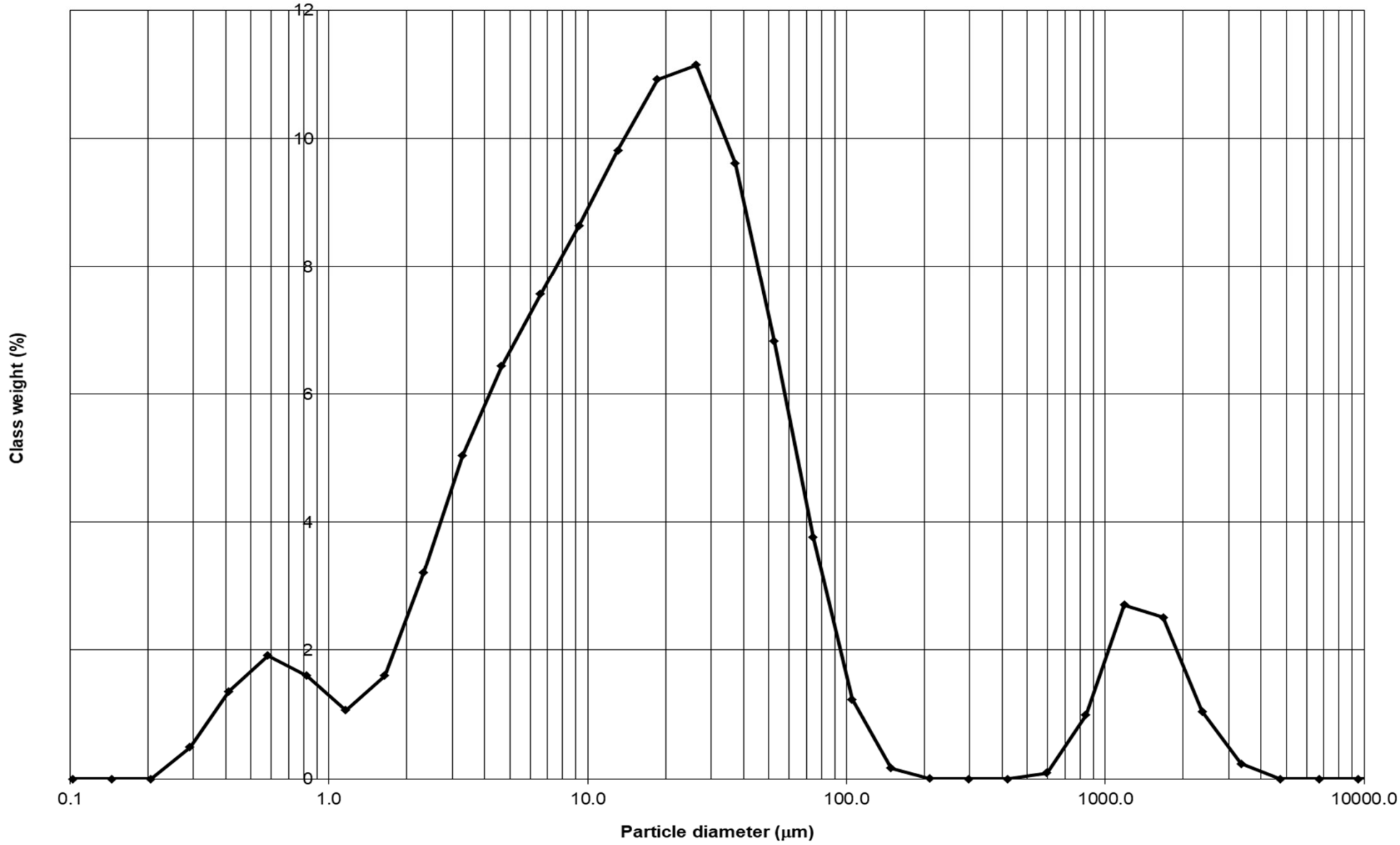
Aperture (microns)	S1888778	S1888779	S1888780	S1888781	S1888782	S1888783	S1888784	S1888785	S1888786	S1888787	S1888788	S1888789	S1888790	S1888791	S1888792
16000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11200.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	12.955	0.000	0.000	0.000	0.000	0.000
8000.000	0.000	0.000	0.000	0.000	0.000	0.000	3.381	0.000	0.000	7.816	0.000	0.000	0.000	0.000	0.000
5600.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.353	0.000	0.000	0.000	0.000	0.000
4000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.713	0.000	0.000	0.000	0.000	0.000
2800.000	0.000	0.240	0.000	0.190	0.090	0.791	0.000	0.117	0.361	1.927	0.033	0.000	0.000	0.362	0.000
2000.000	0.000	1.016	0.000	0.178	0.353	2.624	0.314	0.402	1.235	1.392	0.167	0.000	0.000	1.340	0.000
1400.000	0.000	2.582	0.000	0.873	0.989	3.441	0.314	1.216	1.855	1.927	1.229	0.000	0.000	2.975	0.000
1000.000	0.000	2.621	0.000	2.668	2.098	2.453	0.393	2.856	1.877	1.285	3.196	0.000	0.000	3.599	0.000
707.000	0.000	0.994	0.000	3.415	2.309	2.145	0.005	2.801	1.573	0.000	3.112	0.000	0.000	2.067	0.000
500.000	0.000	0.090	0.000	1.091	0.944	1.902	0.084	0.713	0.739	0.000	0.816	0.000	0.000	0.398	0.000
354.000	0.000	0.000	0.000	0.027	0.102	0.829	0.157	0.006	0.234	0.000	0.000	0.000	0.000	0.016	0.000
250.000	0.000	0.000	0.000	0.000	0.000	0.041	0.181	0.000	0.078	0.054	0.000	0.000	0.372	0.000	0.000
177.000	0.000	0.002	0.000	0.000	0.005	0.020	0.626	0.000	0.104	0.755	0.004	0.000	1.270	0.013	0.000
125.000	0.000	0.169	0.046	0.014	0.187	0.303	1.840	0.046	0.630	1.923	0.207	0.300	2.518	0.237	0.000
88.400	0.000	1.237	1.014	0.819	1.495	1.271	4.162	1.007	2.043	3.048	1.444	1.558	4.336	0.990	0.000
62.500	1.362	3.763	3.432	2.611	3.811	3.005	8.039	3.227	4.394	5.017	3.440	3.378	7.401	2.556	3.350
44.200	6.346	6.820	6.375	5.152	6.228	5.462	11.939	6.100	7.330	7.463	5.783	5.836	10.311	4.939	10.175
31.200	10.870	9.663	9.307	8.130	8.691	8.267	13.562	9.155	10.070	8.922	8.477	8.857	12.027	7.922	15.048
22.100	12.684	11.093	11.193	10.516	10.528	10.165	11.807	11.204	11.255	8.200	10.536	11.319	11.337	10.433	15.370
15.600	12.612	10.980	11.707	11.355	11.008	10.545	9.113	11.631	10.837	6.425	11.121	12.293	9.681	11.482	12.782
11.000	11.680	9.898	11.167	10.784	10.332	9.741	7.100	10.667	9.520	4.771	10.365	11.823	8.141	10.939	9.839
7.810	10.300	8.533	10.081	9.950	9.154	8.430	6.118	9.087	8.126	3.896	9.039	10.573	7.133	9.437	7.579
5.520	9.010	7.572	9.179	8.576	8.258	7.438	5.729	7.934	7.303	3.737	8.132	9.559	6.657	8.191	6.513
3.910	7.318	6.408	7.845	7.067	7.028	6.245	4.903	6.628	6.258	3.439	6.967	8.077	5.792	6.789	5.583
2.760	5.564	5.070	6.222	5.620	5.535	4.903	3.659	5.146	4.900	2.764	5.475	6.206	4.486	5.251	4.417
1.950	3.446	3.217	3.896	3.421	3.405	3.032	2.072	3.109	2.950	1.634	3.304	3.610	2.648	3.185	2.706
1.380	1.674	1.597	1.816	1.518	1.532	1.396	0.919	1.396	1.317	0.731	1.464	1.456	1.188	1.432	1.322
0.977	1.192	1.059	1.124	0.973	0.950	0.904	0.575	0.899	0.839	0.495	0.883	0.792	0.748	0.887	0.982
0.691	1.980	1.602	1.786	1.553	1.588	1.517	0.836	1.498	1.367	0.774	1.449	1.400	1.168	1.454	1.524
0.488	2.272	1.923	2.104	1.864	1.888	1.783	1.006	1.764	1.589	0.881	1.768	1.686	1.414	1.723	1.656
0.345	1.384	1.359	1.348	1.249	1.193	1.103	0.770	1.112	0.992	0.562	1.205	1.040	1.006	1.101	0.972
0.244	0.304	0.490	0.358	0.384	0.297	0.242	0.358	0.278	0.224	0.142	0.383	0.238	0.366	0.285	0.182
0.173	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.122	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.086	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Station	Treatment	Textural Group Classification	Folk and Ward Description	Folk and Ward Sorting	Mean mm	Mean phi	Sorting Coefficient	Skewness	Kurtosis	Major Sediment Fractions		
										% Gravel	% Sand	% Mud
S1888778	VB1-1-1	Mud	Medium Silt	Poorly Sorted	0.012	6.437	1.721	0.245	1.081	0.0%	1.4%	98.6%
S1888779	VB1-1-3	Slightly Gravelly Sandy Mud	Medium Silt	Very Poorly Sorted	0.015	6.072	2.521	-0.048	1.658	1.3%	11.5%	87.3%
S1888780	VB-1-1-5	Mud	Medium Silt	Poorly Sorted	0.012	6.435	1.787	0.181	1.055	0.0%	4.5%	95.5%
S1888781	VB2-1-1	Sandy Mud	Medium Silt	Very Poorly Sorted	0.014	6.197	2.406	-0.084	1.662	0.4%	11.5%	88.1%
S1888782	VB2-1-3	Sandy Mud	Medium Silt	Very Poorly Sorted	0.014	6.128	2.400	-0.067	1.562	0.4%	11.9%	87.6%
S1888783	VB2-1-5	Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	0.018	5.762	2.696	-0.155	1.606	3.4%	15.4%	81.2%
S1888784	VB3-1-1	Slightly Gravelly Sandy Mud	Coarse Silt	Poorly Sorted	0.023	5.474	1.933	0.151	1.135	3.7%	15.8%	80.5%
S1888785	VB3-1-3	Sandy Mud	Medium Silt	Very Poorly Sorted	0.015	6.072	2.386	-0.070	1.632	0.5%	11.9%	87.6%
S1888786	VB3-1-5	Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	0.017	5.901	2.402	-0.068	1.535	1.6%	13.5%	84.9%
S1888787	VB4-1-1	Muddy Gravel	Fine Sand	Extremely Poorly Sorted	0.160	2.640	4.422	-0.405	0.596	31.2%	14.0%	54.8%
S1888788	VB4-1-3	Sandy Mud	Medium Silt	Very Poorly Sorted	0.015	6.073	2.437	-0.087	1.585	0.2%	13.4%	86.4%
S1888789	VB4-1-5	Mud	Medium Silt	Poorly Sorted	0.012	6.363	1.667	0.129	1.026	0.0%	5.2%	94.8%
S1888790	VB5-1-1	Sandy Mud	Coarse Silt	Poorly Sorted	0.018	5.757	1.886	0.208	0.992	0.0%	15.9%	84.1%
S1888791	VB5-1-3	Slightly Gravelly Sandy Mud	Medium Silt	Very Poorly Sorted	0.015	6.043	2.495	-0.131	1.688	1.7%	12.9%	85.4%
S1888792	VB5-1-5	Mud	Medium Silt	Poorly Sorted	0.015	6.040	1.650	0.344	1.047	0.0%	3.4%	96.7%

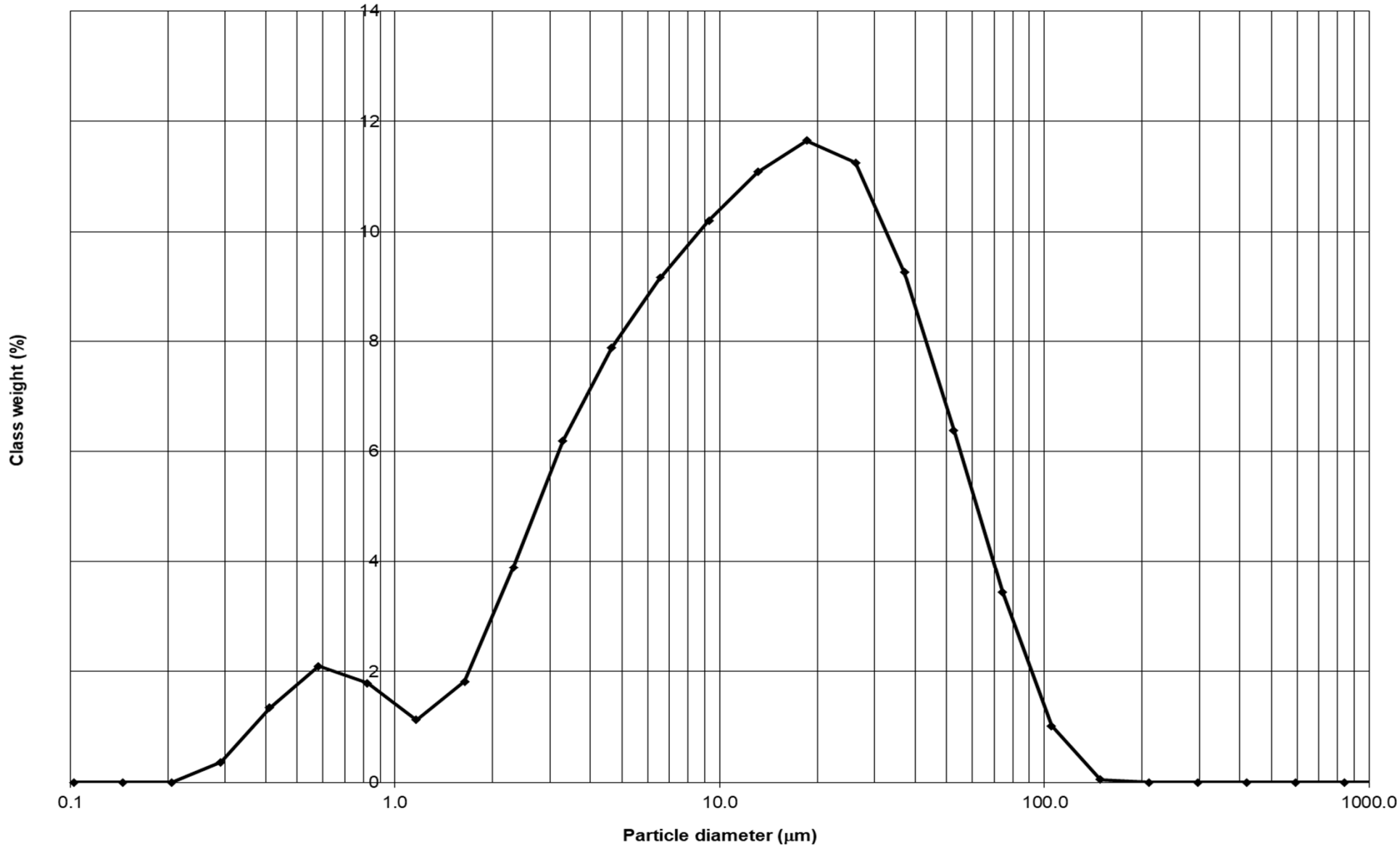
S1888778


14
12
10
8
6
4
2
0
Class weight (%)
0.1
1.0
10.0
100.0
Particle diameter (µm)

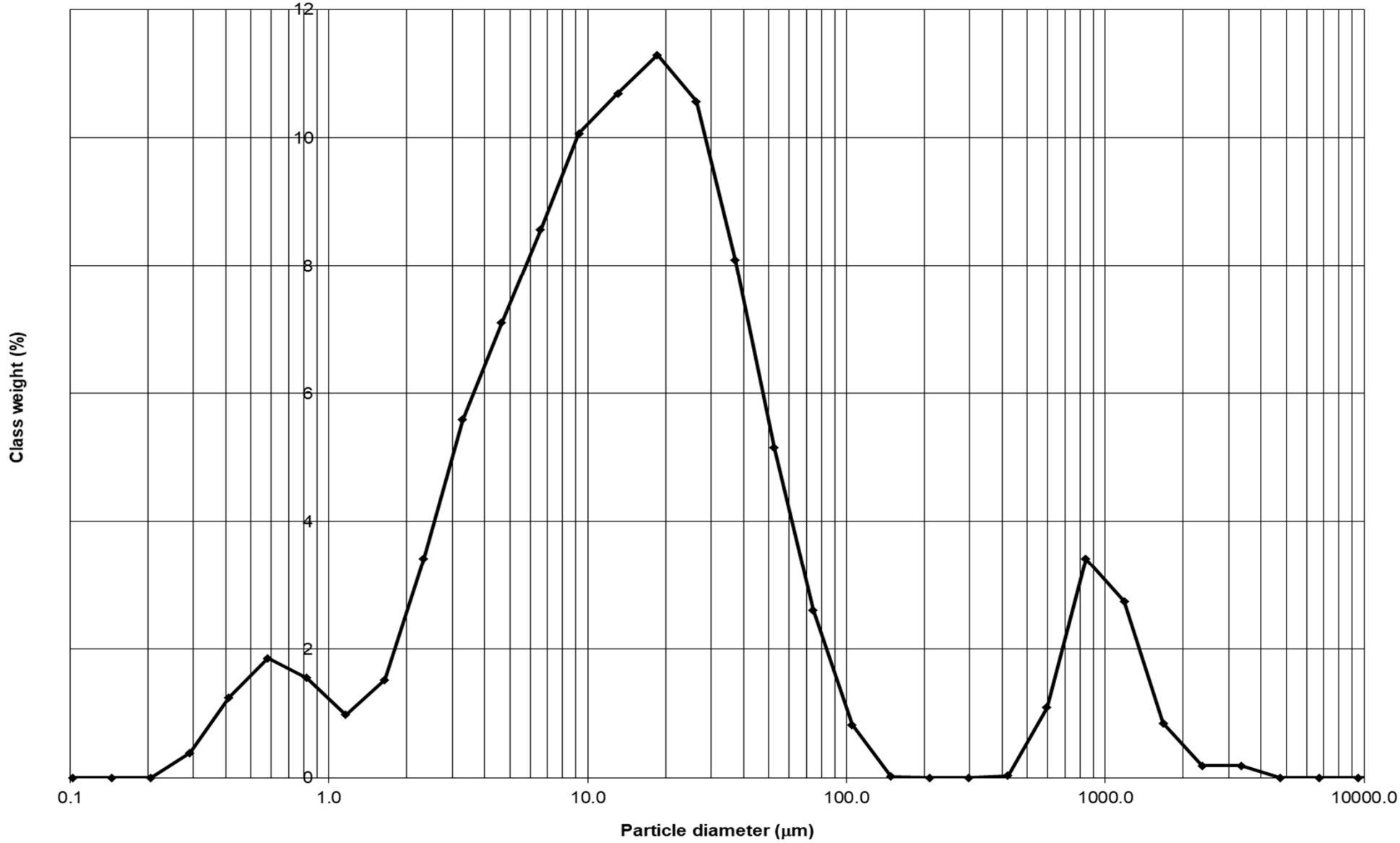
S1888779


Class weight (%)
0
2
4
6
8
10
12
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

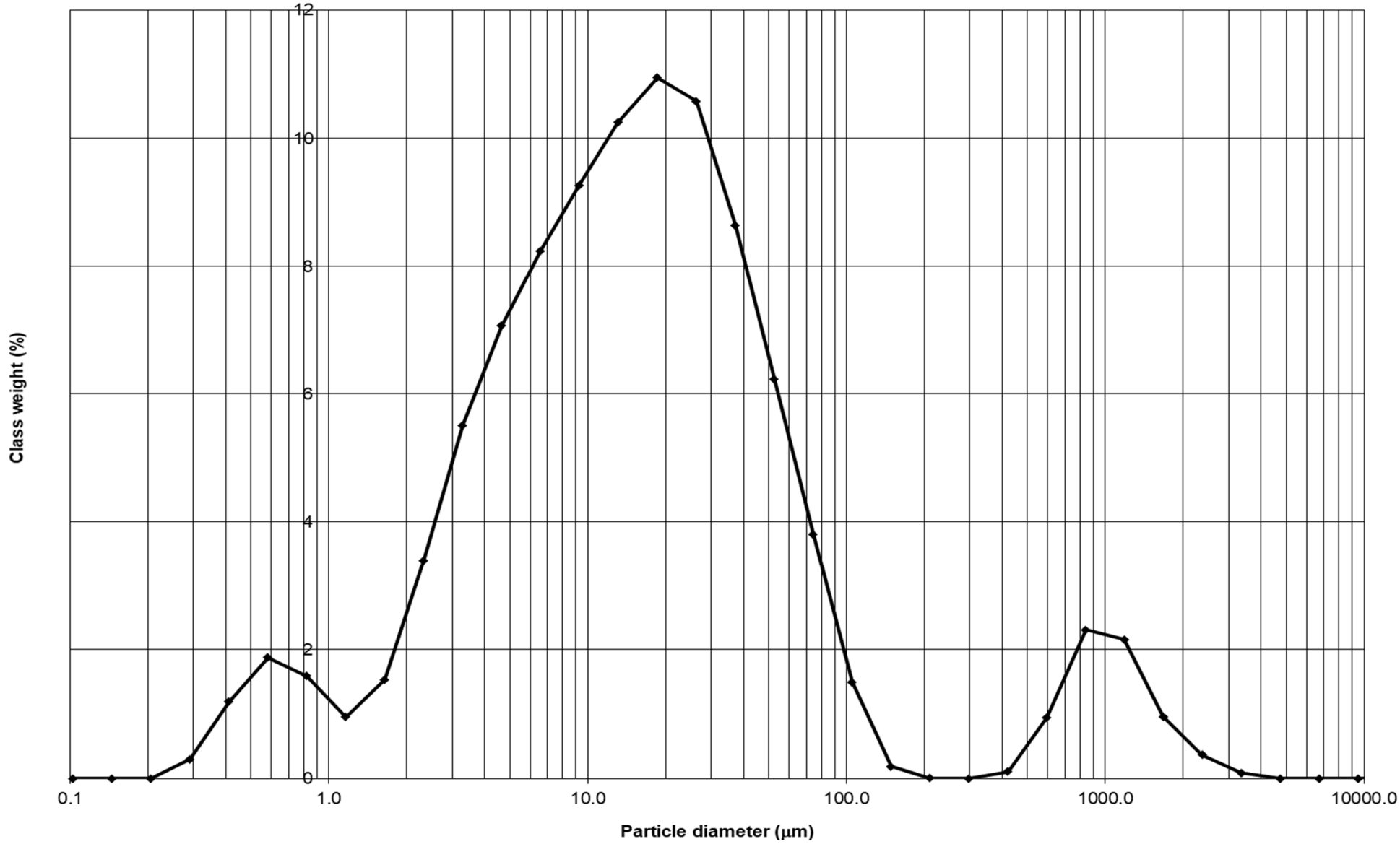
S1888780


14
12
10
8
6
4
2
0
Class weight (%)
0.1
1.0
10.0
100.0
1000.0
Particle diameter (μm)

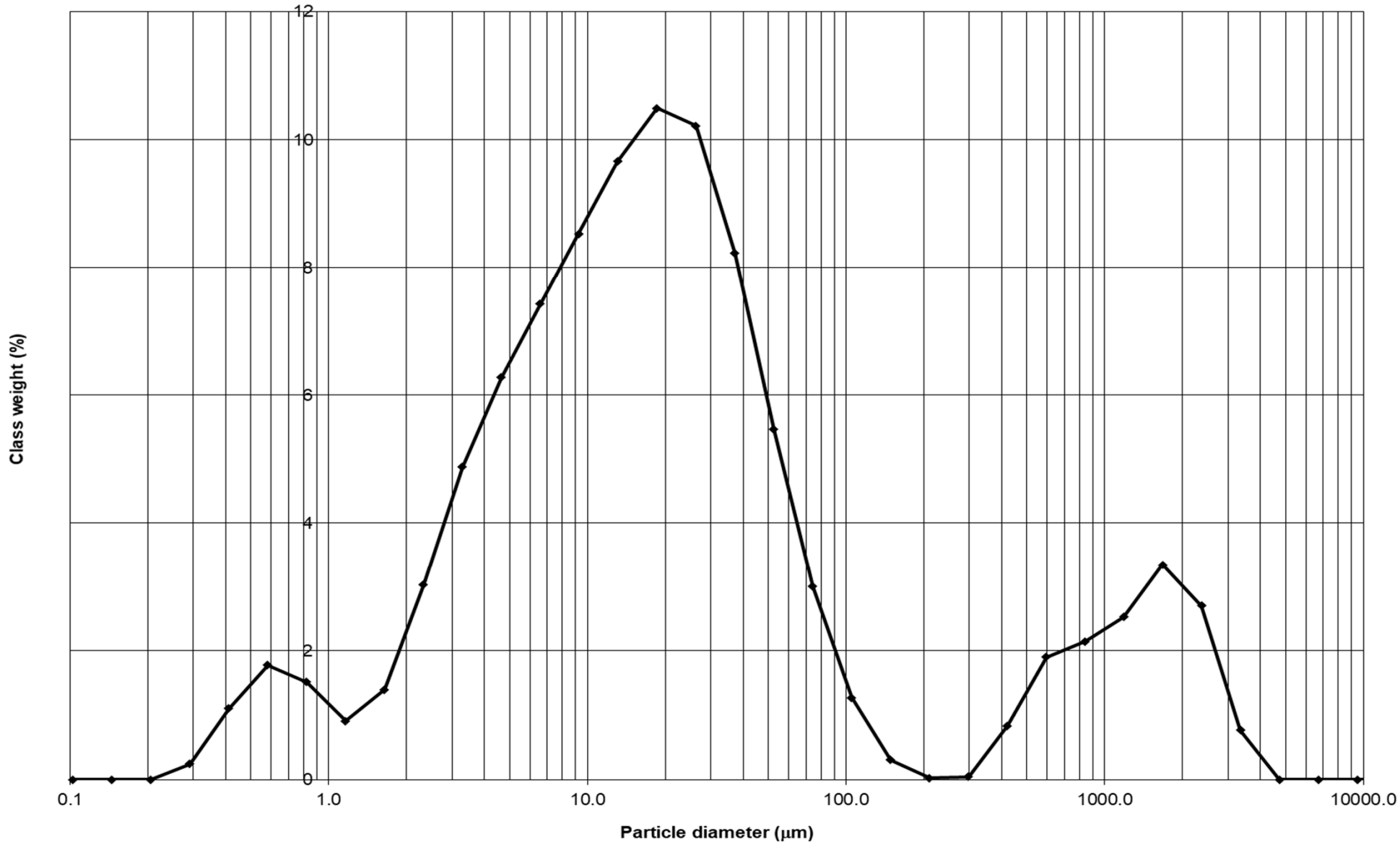
S1888781


Class weight (%)
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

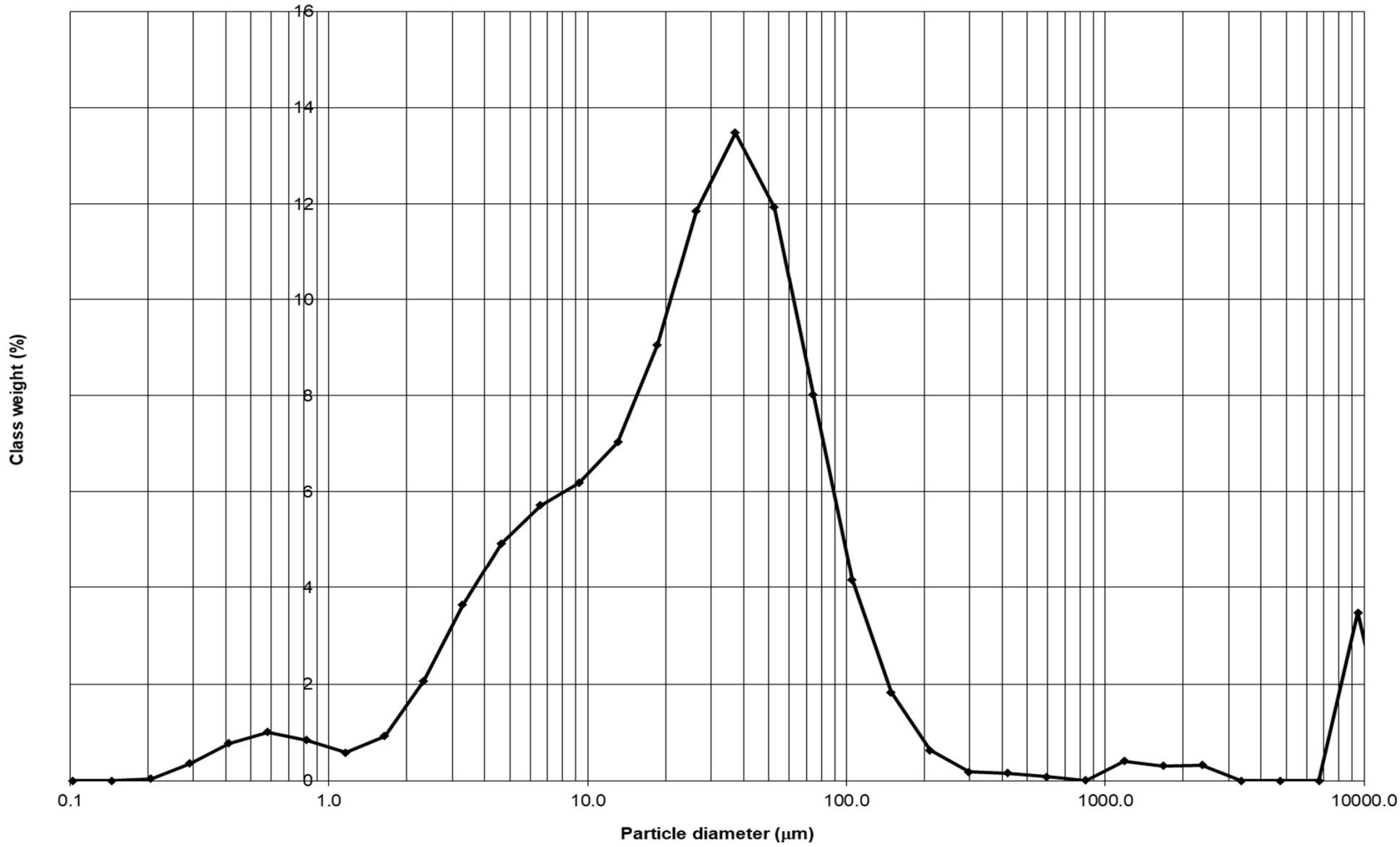
S1888782


Class weight (%)
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

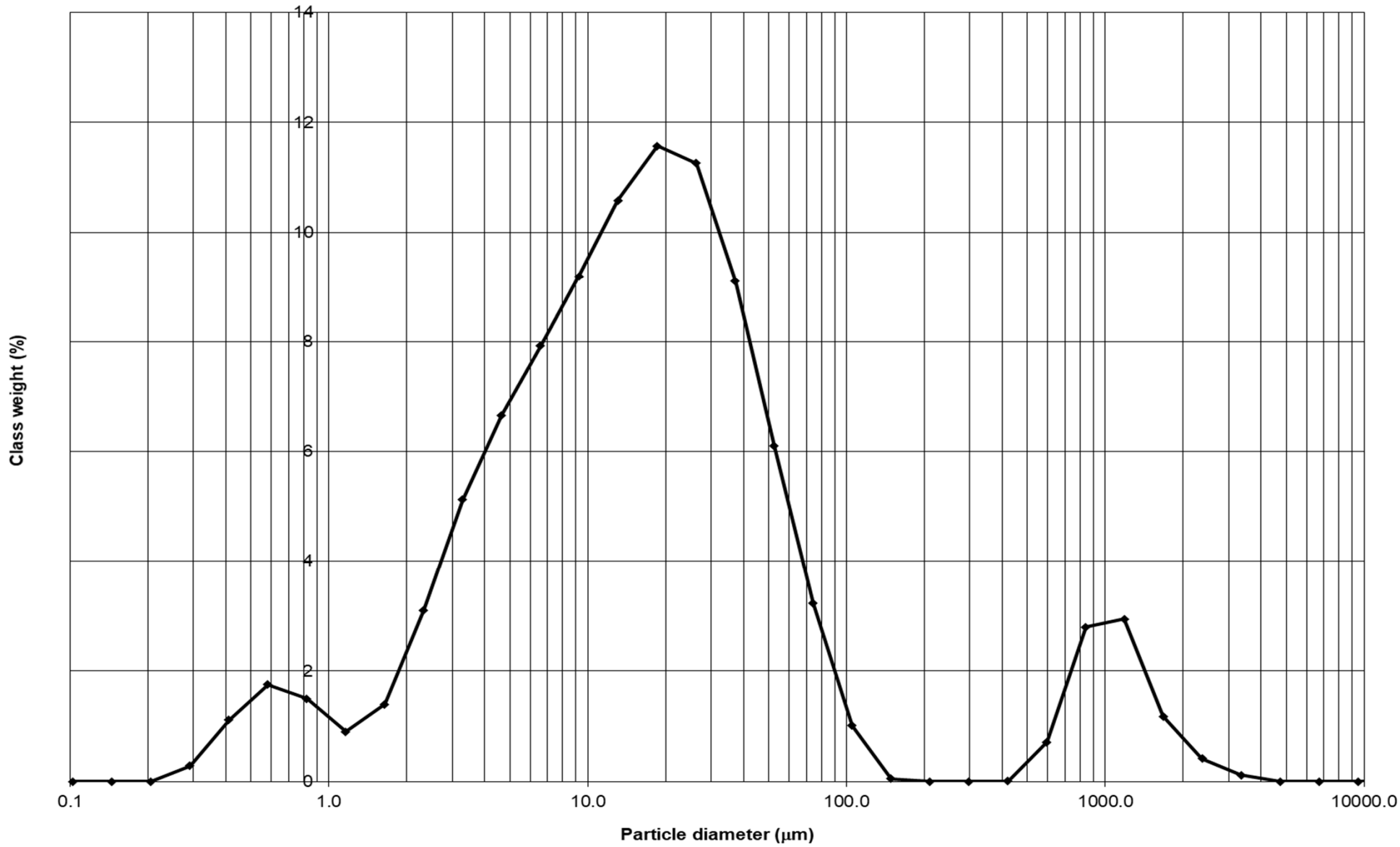
S1888783


12
10
8
6
4
2
0
Class weight (%)
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

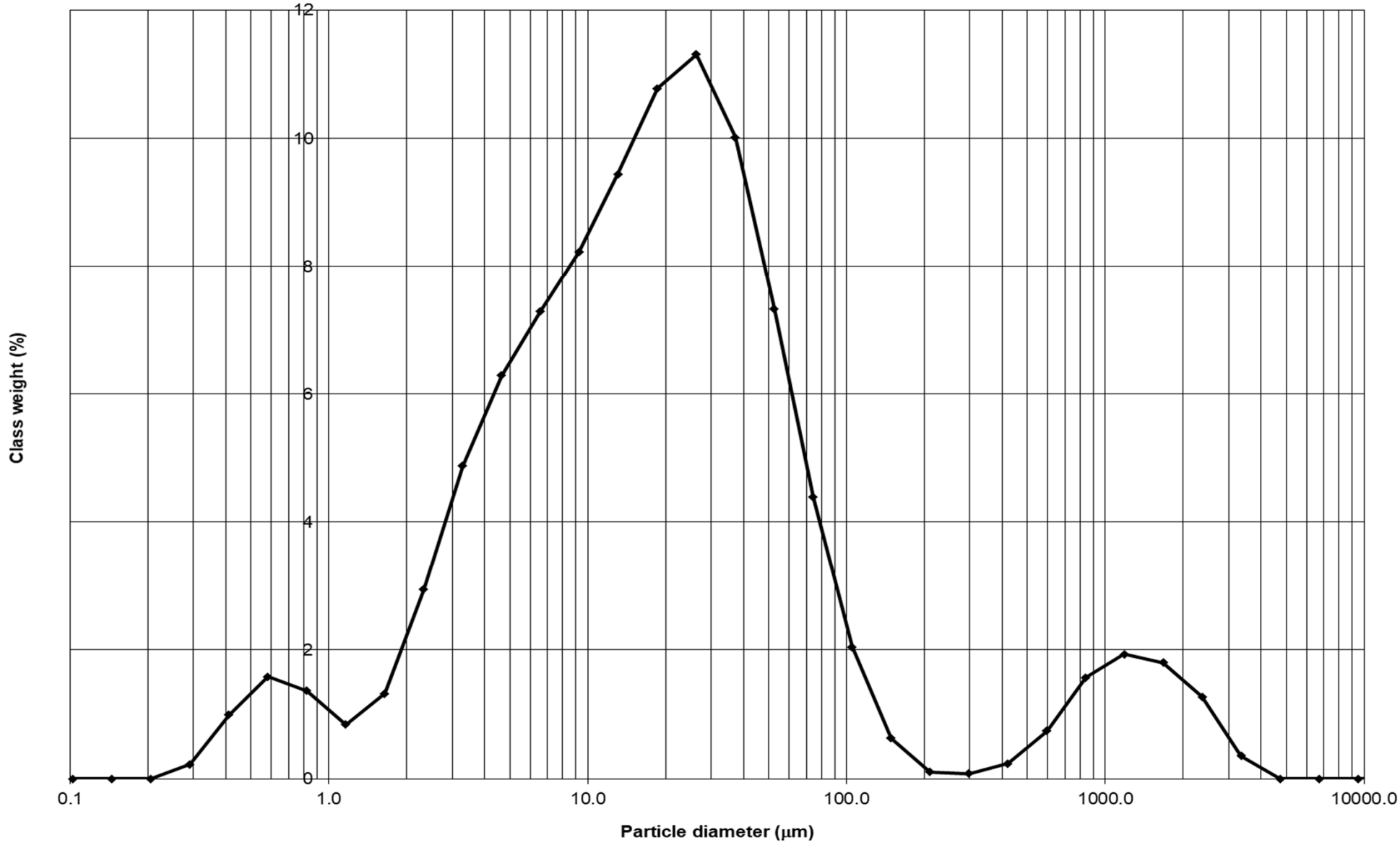
S1888784


Class weight (%)
16
14
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

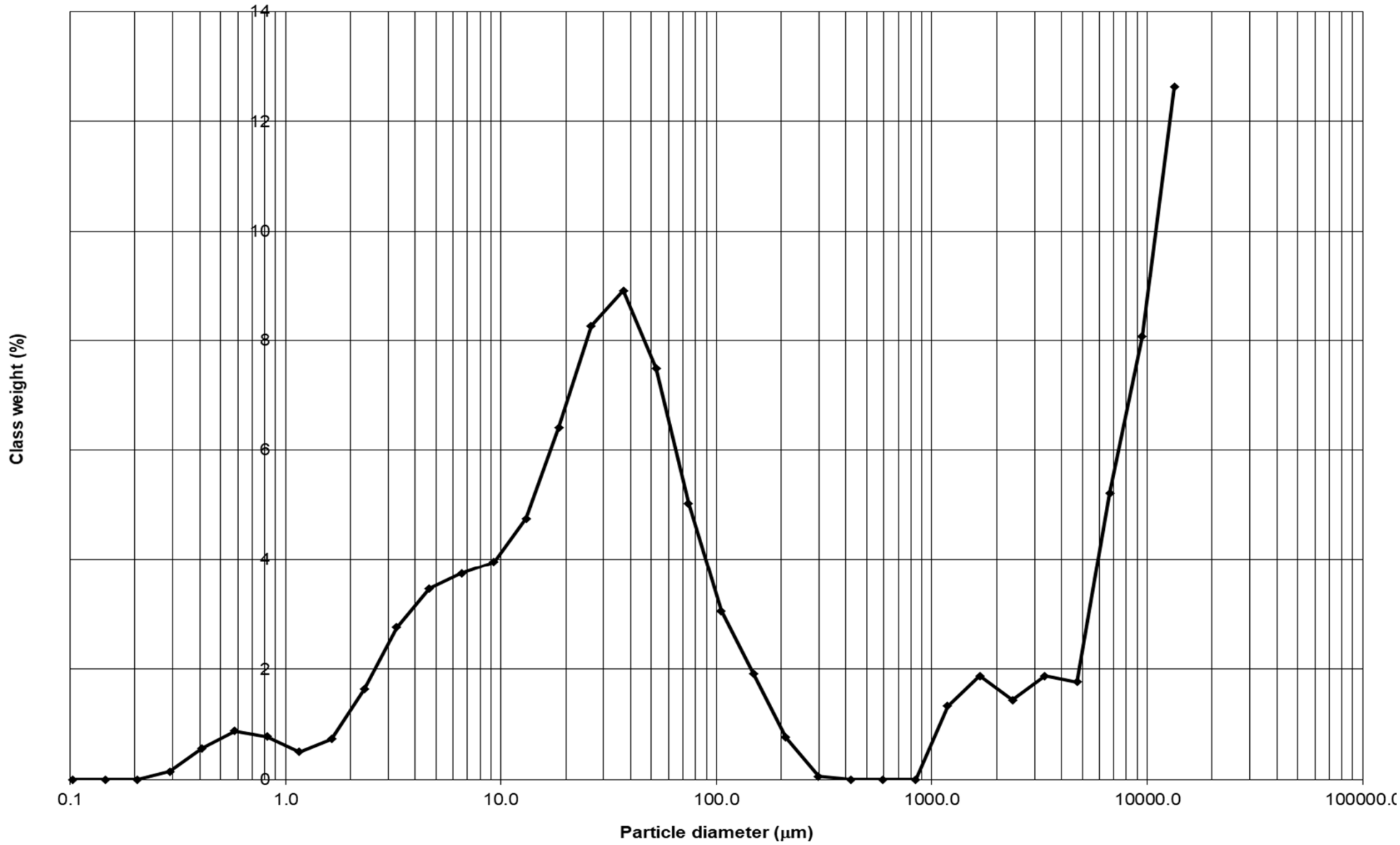
S1888785


Class weight (%)
14
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

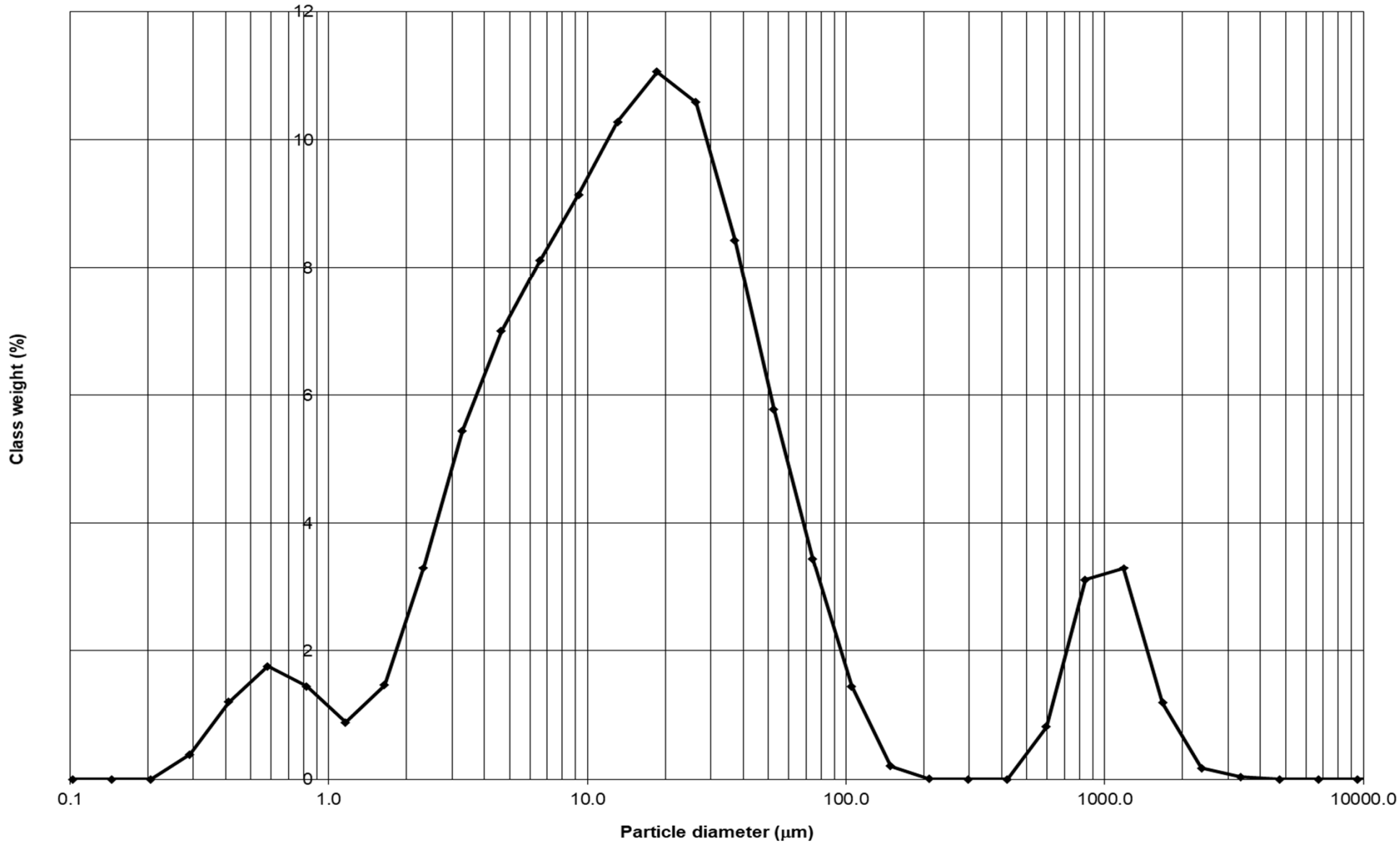
S1888786


Class weight (%)
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

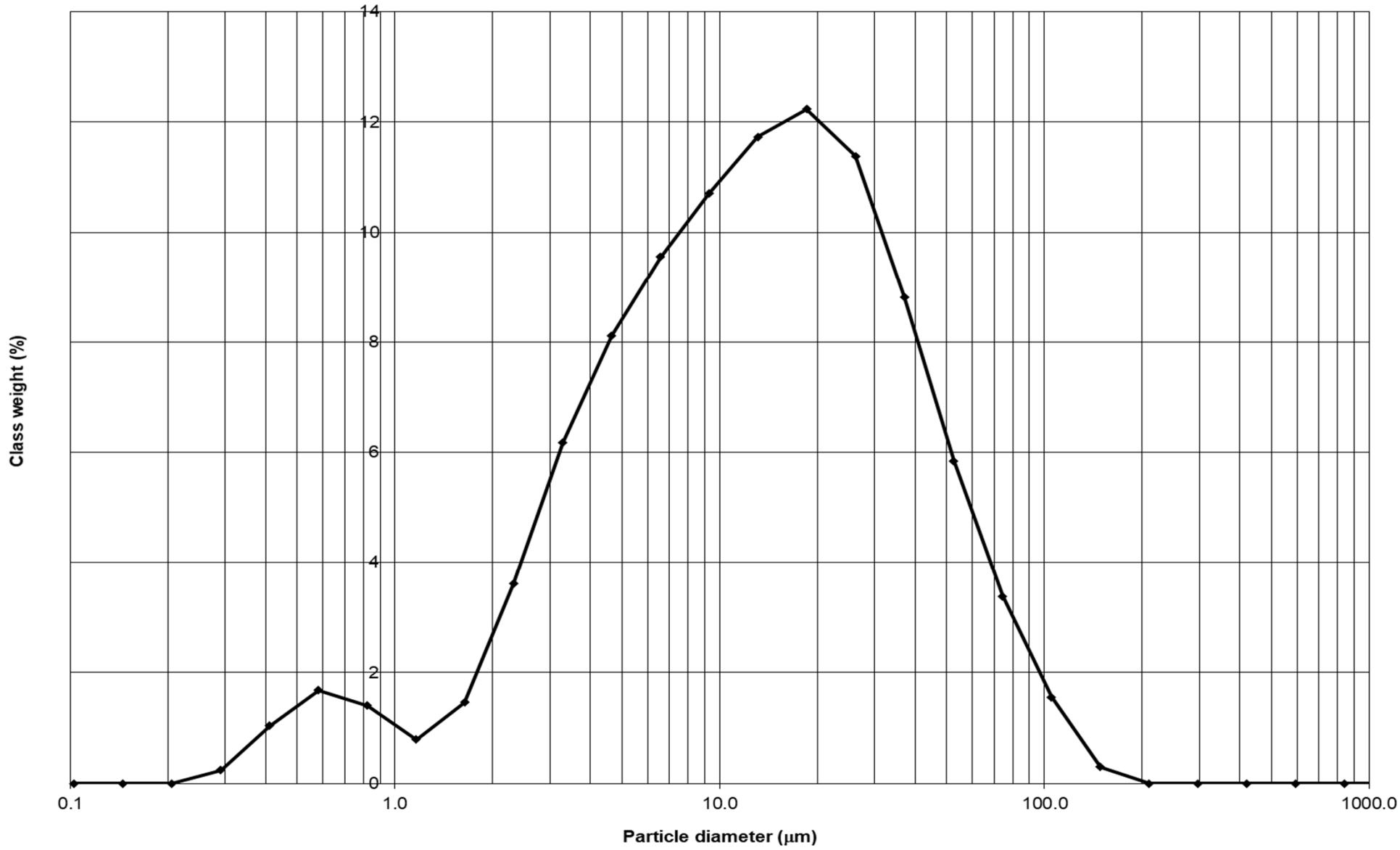
S1888787


Class weight (%)
14
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
100000.0
Particle diameter (μm)

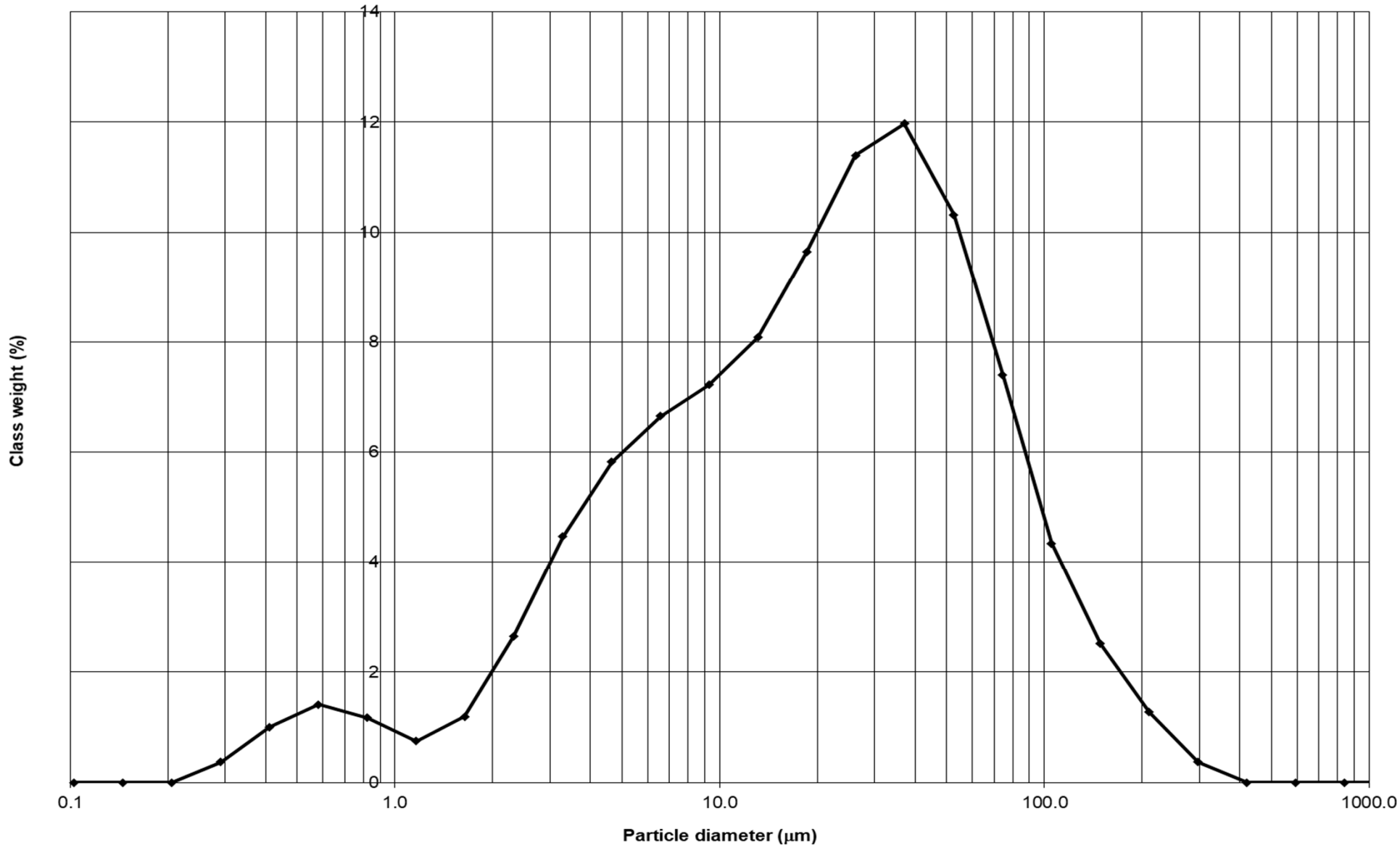
S1888788


Class weight (%)
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

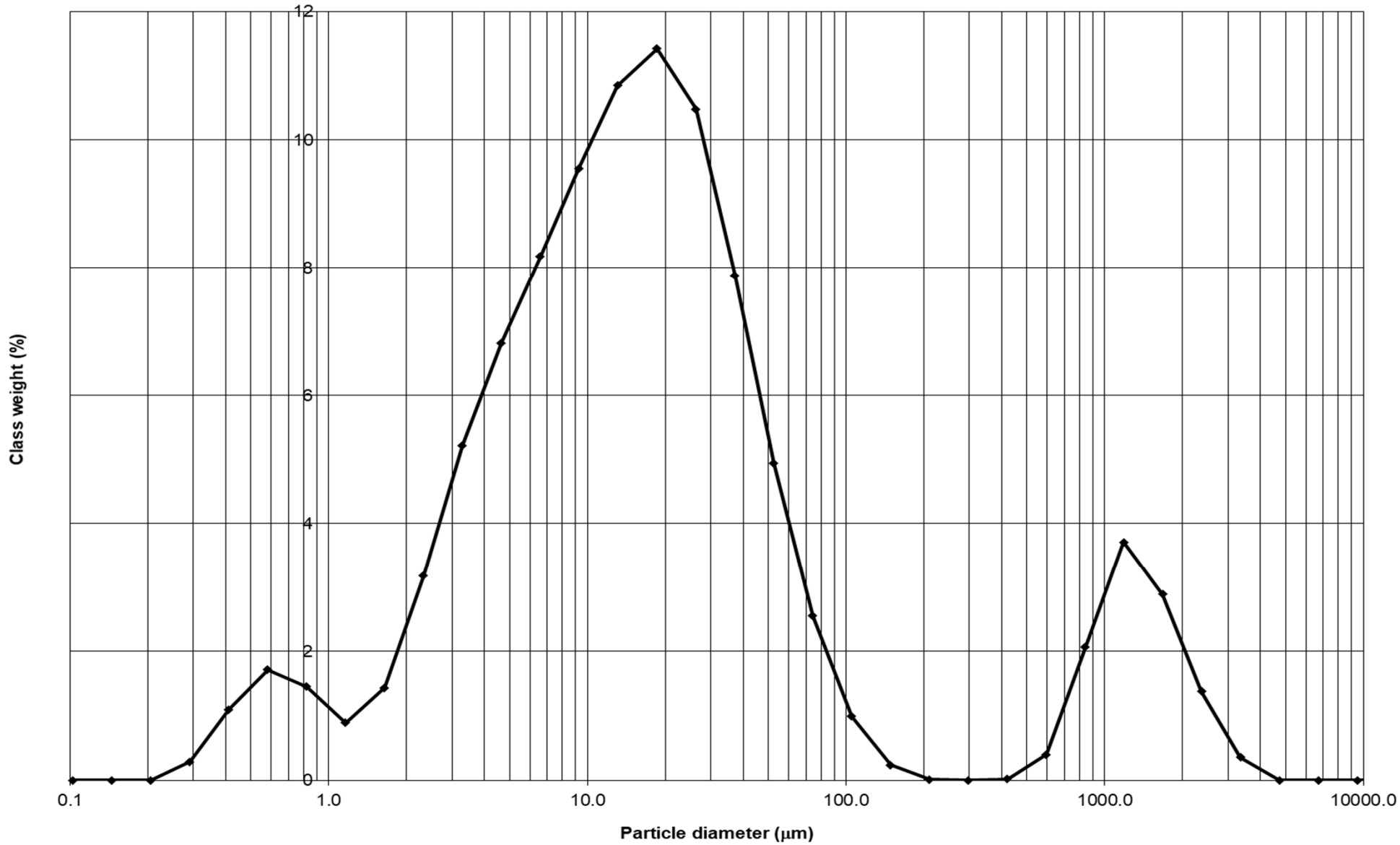
S1888789


Class weight (%)
14
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
Particle diameter (µm)

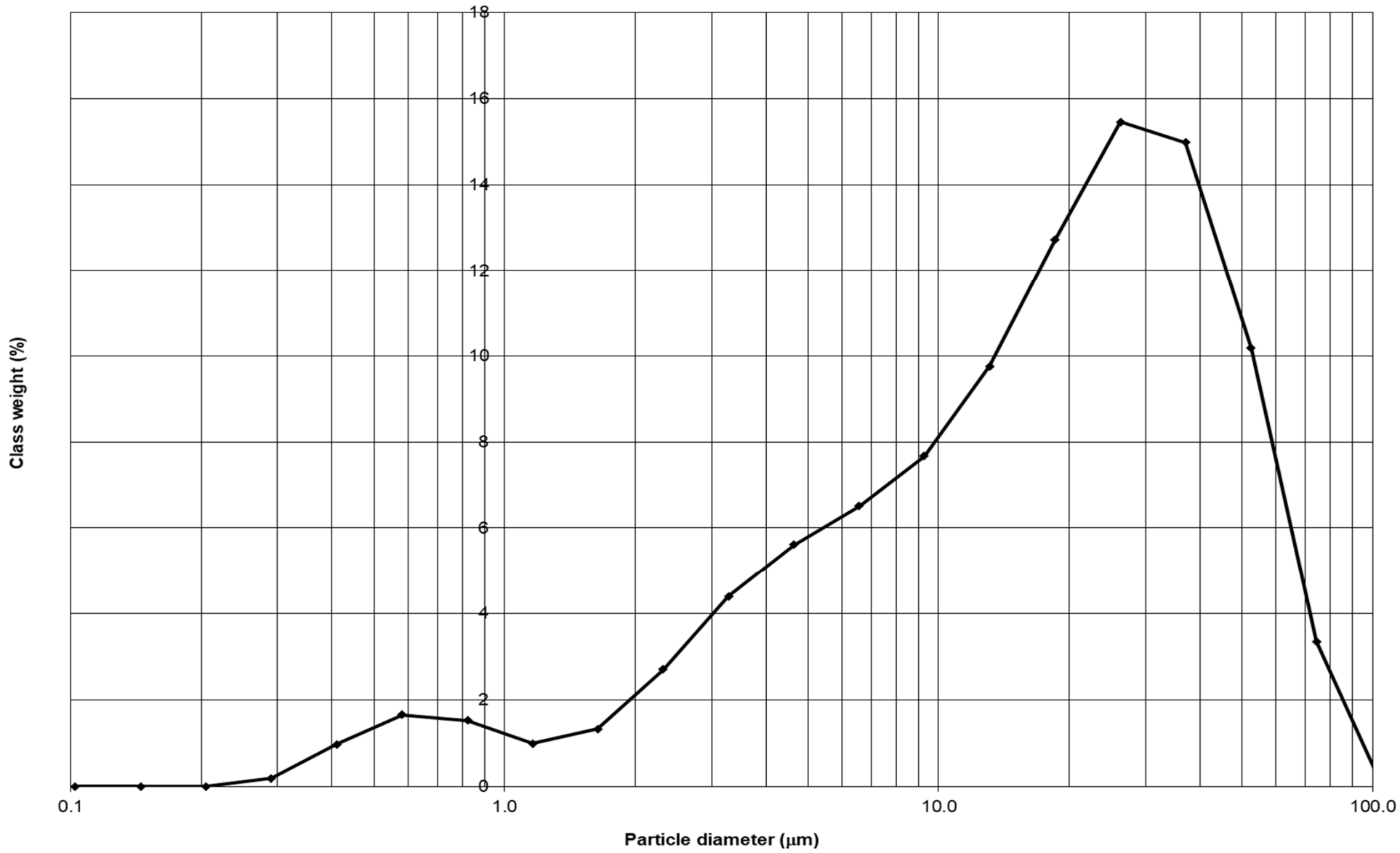
S1888790


Class weight (%)
14
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
Particle diameter (µm)

S1888791


Class weight (%)
12
10
8
6
4
2
0
0.1
1.0
10.0
100.0
1000.0
10000.0
Particle diameter (µm)

S1888792


18
16
14
12
10
8
6
4
2
0
Class weight (%)
0.1
1.0
10.0
100.0
Particle diameter (µm)

Laboratory Details

Explanatory Notes:
Please complete a separate worksheet for each laboratory (e.g. complete 'Laboartory_1' worksheet for 1 laboratory and complete 'Laboartory_2' worksheet for a second laboratory). If there are more than 3 laboratories then please contact MS-LOT.

Laboratory 1 Details:

Laboratory name:	SOCOTEC UK Limited
Year:	2018

LabRefMat	**Q1**	Does the laboratory carrying out the analyses undertake the analysis of blank samples and laboratory reference materials with each batch of samples of waste and other material dumped in the maritime area that is analysed by that laboratory?	Yes
CompAnal	**Q2**	Does the laboratory carrying out the analyses undertake periodic comparative analysis of laboratory reference materials and certified reference materials?	Yes
QAQC	**Q3**	Does the laboratory carrying out the analyses undertake the compilation of quality control charts based upon the data resulting from the analyses of the laboratory reference materials and certified reference materials, and the use of those quality control charts to monitor analytical performance in relation to all samples of dumped wastes or other materials?	Yes
InterlabCaleb	**Q4**	Does the laboratory carrying out the analyses undertake periodic participation in interlaboratory comparison exercises, including, where possible, international comparison exercises?	Yes
InternatCaleb	**Q5**	Does the laboratory carrying out the analyses undertake periodic participation in national and, where possible, international laboratory proficiency schemes	Yes
SpikedSamples	**Q6**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory analyse samples of substances which are provided by the organisers of the scheme?	Yes
BlindSamples	**Q7**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the composition of those samples is not disclosed in advance?	Yes
Ranking	**Q8**	If the answer to questions 4 or 5 is 'Yes' then does the laboratory confirm that the results of the scheme for each participating laboratory are made available to all participating laboratories?	Yes
FracAnal	**Q9**	Enter the size fraction that is analysed i.e. Whole or less than 63µm etc.	<63um(metals)
GranMeth	**Q10**	PSA method	NMBAQC
OCMeth	**Q11**	Organic Carbon method	carbonate removal and sulfurous acid/combustion at 800°C/NDIR,
MetExtrType	**Q12**	Method of extraction used for metal analysis	Aquaregia
MethOfDetMetals	**Q13**	Method of detection used for metal analysis	ICP-MS
PAHExtrType	**Q14**	Method of extraction used for poly aromatic hydrocarbon analysis	Methanol/DCM solvent extraction with silica clean up and copper clean up stages
MethOfDetPAH	**Q15**	Method of detection used for poly aromatic hydrocarbons analysis	GCMS
OHExtrType	**Q16**	Method of extraction used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	Ultrasonic acetone/hexane solvent extraction
MethOfDetOH	**Q17**	Method of detection used for organohalogens inc PCBs, pesticides, flame retardants etc analysis	GCMSMS
OTExtrType	**Q18**	Method of extraction used for organotin analysis	derivatisation and solvent extraction
MethOfDetOT	**Q19**	Method of detection used for organotin analysis	GCMS

		LOD/LOQ	Precision (%)	Recovery (%)
mg/kg	Hg	0.015	4.2	97.3
	As	0.5	2.7	98.04
	Cd	0.04	3.6	95.18
	Cu	0.5	2.9	92.61
	Pb	0.5	3	101.34
	Zn	2	2.6	94.86
	Cr	0.5	3.1	87.97
	Ni	0.5	3.6	96.26
	TBT	0.001	12.62	100.65
	DBT			
µg/kg	PCB28	0.1	12.56	95.55
	PCB31			
	PCB44			
	PCB47			
	PCB49			
	PCB52	0.1	6.999	104.3
	PCB66			
	PCB101	0.1	8.43	100.2
	PCB105			
	PCB110			
	PCB118	0.1	14.61	105.4
	PCB128			
	PCB138+163	0.1	12.93	96.65
	PCB141			
	PCB149			
	PCB151			
	PCB153	0.1	7.41	106.6
	PCB156			
	PCB158			
	PCB170			
	PCB180	0.1	9.85	105.05
	PCB183			
	PCB187			
	PCB194			
	DDE			
	DDT			
	DDD			
	Dieldrin			
	Lindane			
	HCB			
	BDE17			
	BDE28			
	BDE47			
	BDE66			
	BDE85			
	BDE99			
	BDE100			
	BDE138			
	BDE153			
	BDE154			
	BDE183			
	BDE209			
	ACENAPTH	1	6.68	105.98
	ACENAPHY	1	7.74	103.16
	ANTHRACN	1	4.95	103.44
	BAA	1	9.8	94.12
	BAP	1	9.07	92.16
	BBF	1	8.44	88.66
	BENZGHIP	1	13.46	92.72
	BEP	1	7.9	98.54
	BKF	1	8.9	100.46
	C1N	1	8.27	108.8
	C1PHEN	1	N/A	N/A
	C2N	1	N/A	N/A
	C3N	1	N/A	N/A
	CHRYSENE	1	7.87	99.32
	DBENZAH	1	19.23	87.66
	FLUORENE	1	5.25	106.26
	FLUORANT	1	4.36	102.24
	INDPYR	1	17.1	80.94
	NAPTH	1	3.02	100.7
	PERYLENE	1	N/A	N/A
	PHENANT	1	5.41	109.44
	PYRENE	1	4.29	101.22
	THC			

Annex D
Standard Disclaimer

A6488

1. All client-supplied data is taken on trust as being accurate and correct, and the subcontractor cannot be held responsible for the quality and accuracy of that data set.

2. Geophysical interpretation of bathymetry and sonar is based on an informed opinion of the supplied data, and is subject to inherent errors out with the control of the interpretational hydrographer or geophysicist, which include but are not limited to GPS positioning errors, navigation busts, data quality, assumed speed velocity sediment profiles in the absence of Geotechnical data, sub bottom profile pulse width, and induced scaling errors therein associated with seismic signature. Seabed geomorphology and sub-seabed geology should be further investigated by visual or intrusive methods.

3. The limits of this survey are defined by the data set; out with the survey limits are not covered at any level by the subcontractor.

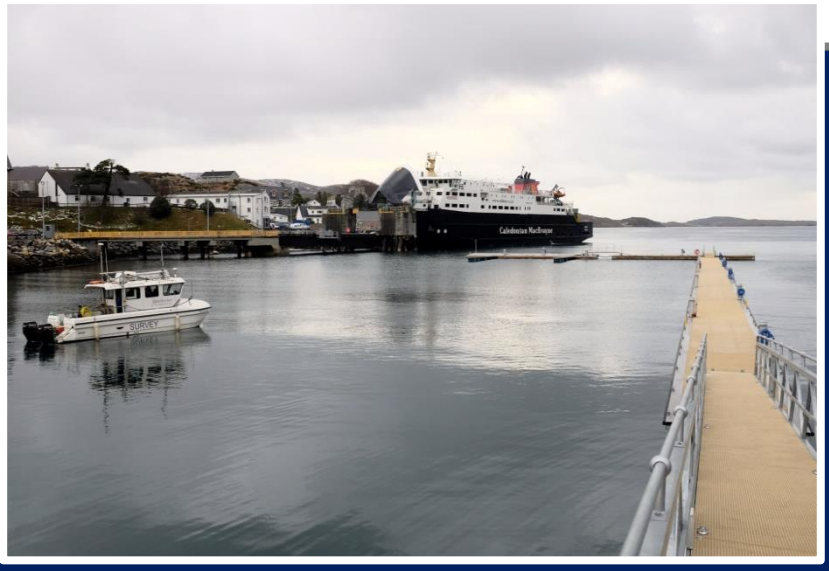
4. The data is accurate at the time of data acquisition, the subcontractor cannot be held responsible for environmental changes, and the client by accepting this report accepts that the environment of the seabed is subject to continuous change, that items of debris, hard contacts etc. may move, appear, be relocated or removed, thickness of surficial sediment change out with the knowledge of the subcontractor and they will not be held responsible for such actions at any level.

Appendix M.3: Additional Vibrocore & Benthic Habitat Survey – Tarbert Ferry Terminal, Isle of Harris – April 2018

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Aspect
Land+Hydrographic Surveys
CHARTERED SURVEYORS

TEL: 01294 313 399 • WEB: WWW.ASPECTSURVEYS.COM



ADDITIONAL VIBROCORE & BENTHIC HABITAT SURVEY

TARBERT FERRY TERMINAL, ISLE OF HARRIS

APRIL 2018

PROJECT REF: A6488/B

REV: 01

Client:

Caledonian Maritime Assets Ltd
Municipal Buildings
Fore Street
Port Glasgow
PA14 5EQ

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

ices Approved Development Partner

Achilles®

QAS INTERNATIONAL ISO 9001:2008 REGISTERED FIRM

QAS INTERNATIONAL ISO 14001:2004 REGISTERED FIRM

QAS INTERNATIONAL BS OHSAS 18001:2007 REGISTERED FIRM

LIST OF CONTENTS

LIST OF FIGURES

DOCUMENT ISSUE RECORD

DATE	REVISON	COMPILED	CHECKED	NOTES
30/05/2018	00	Redacted		FIRST ISSUE
1/6/2018	01			Amends after client comment

1. INTRODUCTION

Aspect Land & Hydrographic Surveys Ltd (herein ALHS) were contracted by Caledonian Maritime Assets Ltd [herein CMAL] to carry out benthic survey and sediment sampling using video transects, grab samples and vibrocores to bolster information previously gathered in December 2017 at Tarbert Harbour, Isle of Harris.

CMAL is in the process of planning and design for modifications to the existing pier infrastructure at Tarbert, Isle of Harris to accommodate the arrival of a new, larger vessel on the route.

There is therefore a requirement to deepen areas around the terminal which necessitates dredging, which will impact on the local marine ecological environment.

The vibrocore and grab sampling reported here was designed to provide further core samples for analysis in order to understand the sediment type sub seabed and also to allow laboratory analysis in order to obtain dredging consent and to inform options on whether the material to be dredged could be used as infill in areas to be reclaimed. In deeper areas grab samples were taken rather than vibracores to provide information on the seabed surface morphology.

The subtidal benthic ecology survey was undertaken by APEM using combined drop down video survey and benthic grab in habitats identified from the video. The Benthic sampling and analysis will be reported separately by APEM Ltd who carried out this work.

2. GEODESY & DATUM

The horizontal datum used throughout the data gathering phase of the survey was OSGB36 (OSTN15). Data has been rendered in OSGB36 Datum, British National Grid.

The vertical datum for all bathymetric data is Chart Datum which at Tarbert, Isle of Harris is 2.74m below OD. OSTN15 defines OSGB36 National Grid in conjunction with the National GPS Network.

In this regard OSTN15 can be considered error free (not including any GPS positional errors). The agreement between OSTN15 and the old triangulation network stations (down to 3rd order) is 0.1m rms.

3. SCOPE OF WORKS

The upgrading works require the completion of an EIA and to inform this assessment a benthic survey and a sampling / vibrocore survey, with associated testing and reporting, was necessary.

The vibrocore sampling and testing procedures conformed to Marine Scotland Guidance notes http://www.gov.scot/Topics/marine/Licensing/marine/Applications/predredge

All analysis was completed by SOCOTEC who's laboratory is accredited to ISO17025 standard for marine sediment analysis. They also engage in inter-comparison analysis exercises such as QUASIMEME. The LOD and sensitivity requirements were met as per those set out in the CSEMP Green Book.

The order of events was to be:

- Benthic Video Transects (reported by APEM)
- Benthic Grab sampling (reported by APEM)
- Grab Sampling for PSD
- Vibrocoring

Grab Samples for PSD were to be carried out at the locations on Figure 1. Vibrocore sampling was carried out as depicted in Figure 2.

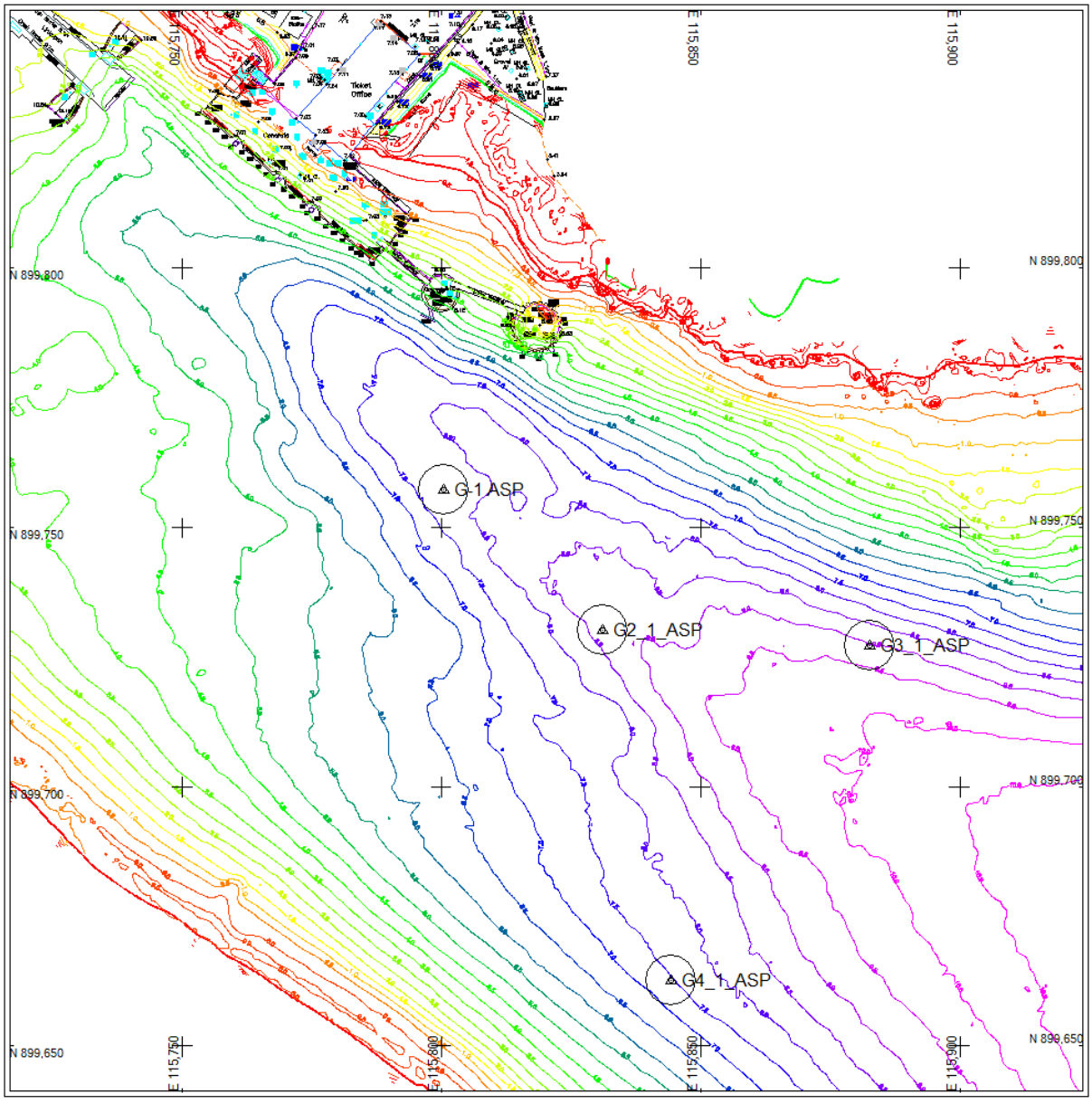


FIGURE 1 - GRAB SAMPLE LOCATIONS

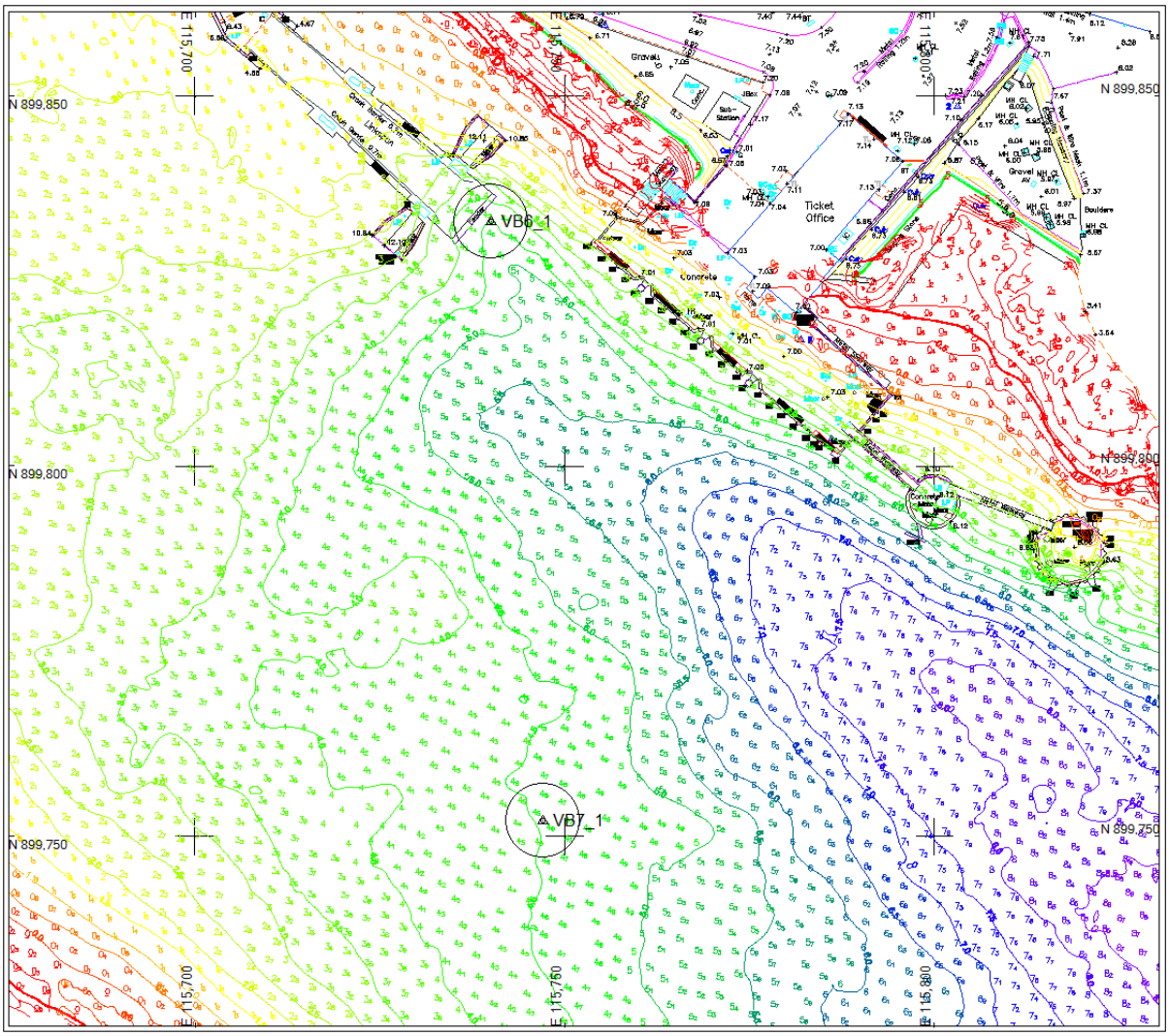


FIGURE 2 - VIBROCORE LOCATIONS

All cores were cut to 3m maximum length which exceeded the requirement for dredge licence application at all planned locations. One vibrocore sample was retained from each sample location.

4. SEQUENCE OF EVENTS

Works were completed in the following order.

DATE	EVENT
8 April 2018	Travel to Tarbert, Harris and mobilise Remote Sensor. Video Camera survey, mobilise Day Grab for following day.
9 April 2018	Benthic Grab Sampling (APEM), Grab Sampling (ASPECT) and Vibrocores
10 April 2018	De-mobilise, sample splitting and recording.
11 April 2018	Samples transferred to laboratory for analysis.

5. GRAB SAMPLING

The grab samples were carried out from the survey vessel Remote Sensor using a Day Grab. This was deployed from the over-side manually operated davit.

FIGURE 3 - DAY GRAB ON REMOTE SENSOR

Sample ID	G1_1	Location ID	A6488
Collection Date / Time	10/04/2018 08:56	Weather	Sunny & calm
Water Depth	7.8m	Sampler Name	CDT
Easting	115800.4	Northing	899757.3
Latitude (ETRS89)	57° 53' 46.9001"	Longitude (ETRS89)	006° 47' 53.4251" W

Notes on field Sampling:
Medium gravel, shell, broken shell, brown mud.

Lab Analysis:

GRAVEL	SAND	SILT
50.8	30.8	18.4

Full analysis is available in the accompanying lab report

Sample ID	G2_1	Location ID	A6488
Collection Date / Time	10/04/2018 10:34	Weather	Sunny & calm
Water Depth	8.7m	Sampler Name	CDT
Easting	115831.0	Northing	899730.2
Latitude (ETRS89)	57° 53' 46.096"N	Longitude (ETRS89)	6° 47' 51.458"W

Notes on Sampling
Green/brown mud, shell, broken shell, medium gravel.

Lab Analysis:

GRAVEL	SAND	SILT
27.4	11.9	60.7

Full analysis is available in the accompanying lab report

Sample ID	G3_1	Location ID	A6488
Collection Date / Time	10/04/2018 10:52	Weather	Sunny & calm
Water Depth	9.0m	Sampler Name	CDT
Easting	115882.7	Northing	899727.2
Latitude (ETRS89)	57° 53' 46.118"N	Longitude (ETRS89)	6° 47' 48.316"W

Notes on Sampling
Green/brown mud, broken shell, medium-small gravel.

Lab Analysis:

GRAVEL	SAND	SILT
4.6	21.5	73.9

Full analysis is available in the accompanying lab report

Sample ID	G4_1	Location ID	A6488
Collection Date / Time	10/04/2018 11:04	Weather	Sunny & calm
Water Depth	7.5m	Sampler Name	CDT
Easting	115844.3	Northing	899662.7
Latitude (ETRS89)	57° 53' 43.951"N	Longitude (ETRS89)	6° 47' 50.363"W

Notes on Sampling
Black/brown Mud and small amount of broken shell.

Lab Analysis:

GRAVEL	SAND	SILT
0	31.6	68.4

Full analysis is available in the accompanying lab report

6. CONDUCT OF VIBROCORE SAMPLING

The vibrocore apparatus used was a lightweight rig, and as such did not rely on overall mass as an additional means of penetration. The equipment relies primarily on the vibrational frequency of the equipment and liquefaction of surrounding sediments to enable effective penetration.

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 2 additional cores across the site, of up to 3m in length, from sample points chosen to supplement the 5 already conducted under the previous sampling campaign in December 2017. Each sample core was split into sections and samples for analysis collected from the upper, middle and lower sections.

The vessel was manoeuvred to each of the locations in turn and anchored fore and aft to avoid swinging during the sampling operation.

FIGURE 4 - VIBROCORE DEPLOYED ON REMOTE SENSOR

All vibrocore locations were sampled on 11 April 2018 at the following locations:

Sample ID	6_1	Location ID	A6488
Collection Date / Time	10/04/2018 15:30	Weather	Sunny, slight wind
Water Depth	4.4m	Sampler Name	Red
Easting	115739.988	Northing	899833.108
Latitude (ETRS89)	57 53 49.203 N	Longitude (ETRS89)	006 47 57.4071 W

Notes on Sampling

Core length 2.07m. Split into 4 sections for sampling

6_1_1
Sub Sample Depth 0.0-0.5m
5YR3/1
Green/Brown Mud, broken shell, medium gravel, fine sand.

6_1_2
Sub Sample Depth 0.5-1.0m
5YR3/1
Mud, fine sand, medium gravel, small amount of broken shell

6_1_3
Sub Sample Depth 1.0-1.5m
Retained

6_1_4
Sub Sample Depth 1.5-2.07m depth
5YR3/1
Green/brown Silt/clay, broken shell. Large piece of gravel at base.

Sample ID	7_1	Location ID	A6488
Collection Date / Time	10/04/2018 15:45	Weather	Sunny, slight wind
Water Depth	4.6m	Sampler Name	Red
Easting	115747.004	Northing	899752.021
Latitude (ETRS89)	57 53 46.6064 N	Longitude (ETRS89)	006 47 56.6364 W

Notes on Sampling

Core length 2.54m. Sampled into 5 sections for analysis / retention.

7_1_1
Sub Sample Depth 0.0-0.5m
5YR3/1
Green/brown Mud, broken shell, medium gravel.

7_1_2
Sub Sample Depth 0.5-1.0m
Retained

7_1_3
Sub Sample Depth 1.0-1.5m
5YR3/1
Green/brown Mud, very occasional broken shell.

7_1_4 –
Sub Sample Depth 1.5-2.0m
Retained

7_1_5 –
Sub Sample Depth 2.0-2.54m
5YR3/1
Green/brown Mud.

7. EQUIPMENT USED FOR CORING

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 5 - SDI D-4 VIBROCORER ON DECK

8. SAMPLE ANALYSIS

The laboratory analysis was carried out by SOCOTEC. All vibrocore samples were 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 Chemicals.

The samples have been analysed against the Action Levels quoted by Marine Scotland and are presented in the standard Marine Scotland spreadsheet format:

A6488_Tarbert_April 2018_Pre-disposal Sampling Results Form_MAR00030.xlsx

Details on the analysis of individual items are also provided in the accompanying laboratory records for each sample.

9. SURVEY VESSEL

ALHS' MCA Cat III survey vessel *Remote Sensor* was mobilised for the survey operations. The ability to achieve rapid mobilisation with this vessel meant that short weather windows could be taken advantage at this time of year when suitable longer weather windows to mobilise a larger vessel are limited.

The shallow draught and high manoeuvrability of *Remote Sensor* made it ideal for operating in the survey area which was both shallow and navigationally constrained. The vessel was transported to Tarbert Harbour by road and launched at the slipway in the harbour.

FIGURE 6 - ALHS' SURVEY VESSEL REMOTE SENSOR

10. SURVEY PERSONNEL

The following personnel were involved in the survey:

NAME	POSITION
Colin Thomson	Project Management / Party Chief / QA Data Release/ Survey Coxswain
Theresa Davies	Hydrographic Surveyor

All staff have marine survey experience, and adhered to Health & Safety instructions, including the wearing of life jackets at all times. All personnel participated in an induction to the vessel and toolbox talks on the conduct of all aspects of the operation prior to commencement of the work.

Annex A

Horizontal & Vertical Positioning System Precision

A6488

Differential GNSS Positioning Precision

	HORIZONTAL ACCURACY
dGPS	±0.5m + 1ppm RMS

Annex B
Standard Disclaimer

A6488

1. All client-supplied data is taken on trust as being accurate and correct, and the subcontractor cannot be held responsible for the quality and accuracy of that data set.

2. Geophysical interpretation of bathymetry and sonar is based on an informed opinion of the supplied data, and is subject to inherent errors out with the control of the interpretational hydrographer or geophysicist, which include but are not limited to GPS positioning errors, navigation busts, data quality, assumed speed velocity sediment profiles in the absence of Geotechnical data, sub bottom profile pulse width, and induced scaling errors therein associated with seismic signature. Seabed geomorphology and sub-seabed geology should be further investigated by visual or intrusive methods.

3. The limits of this survey are defined by the data set; out with the survey limits are not covered at any level by the subcontractor.

4. The data is accurate at the time of data acquisition, the subcontractor cannot be held responsible for environmental changes, and the client by accepting this report accepts that the environment of the seabed is subject to continuous change, that items of debris, hard contacts etc. may move, appear, be relocated or removed, thickness of surficial sediment change out with the knowledge of the subcontractor and they will not be held responsible for such actions at any level.

Annex C
Laboratory Reports

A6488

Appendix M.4: Caledonian Maritime Assets Limited Tarbert Ferry Terminal Upgrade Works – Assessment of Tidal Flood Levels

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

CALEDONIAN MARITIME ASSETS LIMITED

TARBERT FERRY TERMINAL

UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

Caledonian Maritime Assets Limited
Municipal Buildings
Fore Street
Port Glasgow
PA14 5EQ

Tel: 01475 749920

Wallace Stone
21 Tobson
Bernera
Isle of Lewis
HS2 9NA

Tel: 01851 612454
Fax: 01851 612352

June 2018

Member of the Association for Consultancy and Engineering

Document No: 1973/DOC/026

This document was prepared as follows:-

	Name	Signature	Date
Prepared By	Redacted		28.05.2018
Checked By			11.06.2018
Approved By			13.06.2018

and revised as follows:

REVISION STATUS INDICATOR

Page No	Date	Revision	Description of Change	Initial

This document has been reviewed for compliance with project requirements in accordance with Wallace Stone LLP Quality Management System.

CALEDONIAN MARITIME ASSETS LIMITED
TARBERT FERRY TERMINAL
UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

CONTENTS

Wallace Stone

CALEDONIAN MARITIME ASSETS LIMITED
TARBERT FERRY TERMINAL
UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

1. Introduction

As part of the major upgrading works proposed at Tarbert Ferry Terminal to accommodate the new, larger ferry, the existing marshalling area is to be extended to provide for the substantial increase in vehicle numbers.

While the finished surface levels at the extended marshalling area will be dictated by the levels and gradients of the existing area, and cannot be amended significantly, an assessment of tidal flood risk has been proposed to establish what the effects might be in extreme conditions.

This report considers the factors affecting extreme tide levels at the Tarbert Ferry Terminal, and presents the results of an assessment of tidal flood levels at the site in a 1 in 200 year event.

2. Factors Affecting Water Level

Water level at extreme events is governed by four factors: -

- **Astronomical**

The gravitational effect of the sun and the moon combine depending on their positions relative to the earth to determine the tidal range. During spring tides, which occur every fortnight, the range is larger than the mean with higher high tides and lower low tides. During neap tides which occur in between springs, the range is smaller than the mean with lower high tides and higher low tides.

Tidal range varies between sets of spring tides. The highest ranges tend to occur around the equinoxes. The average value of all the high spring tides in the year is known as mean high water at springs (MHWS), and the average value of all low spring tides as mean low water at springs (MLWS).

Once or twice a year the peak values, known as highest astronomical tide and lowest astronomical tide (HAT and LAT) occur.

In the absence of significant meteorological effects, the level of the tide at any given time is predictable with a fair degree of accuracy. Tables of predictions are published by the Admiralty for standard ports around the country, with variations for a large number of secondary 'ports'.

All tidal data and predictions are quoted relative to Chart Datum (CD) which approximates to lowest astronomical tide. Differences between CD and Ordnance Datum (OD) are listed in Admiralty tide tables for all standard and secondary ports.

- **Meteorological**

  Atmospheric pressure has a marked effect on water level, low pressure raising and high pressure lowering the level from its predicted value. The extent to which the level is affected and the time over which effects are experienced depends on the depth and size of the depression or anti-cyclone, and the speed and direction of its movement. The topography of the surrounding coastline also affects the way in which the level is modified.

  This kind of effect is referred to hereafter as a pressure surge. Its effects tend to cover large areas of water at any one time.

- **Topographical**

  Where wind is blowing onshore during a severe event, it tends to drive water level up and also to hold high tide levels for longer than the norm. Where the coastline is constricted locally by bays or inlets, this effect can be more pronounced.

  This effect is referred to hereafter as a wind surge. Its effects can be localised.

- **Wave Run-Up**

  Where wind is blowing on shore during a severe event, waves breaking on the shore will run-up to levels considerably above theoretical still water level. The extent to which this effect is experienced at any given location is governed by the fetch in the direction of the wind, the length of time it blows from that direction, the topography of the surrounding shoreline, and the local sea bed slope.

3. Combination of Factors

In assessing a severe weather event it is normal to consider a specific return period, such as 100 years, as the design criterion. Return period is defined as that period that, on average, separates two occurrences. It should be noted that this does not mean that exactly that number of years will separate two such occurrences.

For an event with a return period of 100 years, therefore, there is a 1% probability of occurrence in any one year, even the one following the occurrence. For a time interval equal to the return period there is a 63% probability of occurrence within the return period.

The probability of the overall event is obtained by combining the probabilities of each of the factors occurring simultaneously. It is normal to assume that where factors are independent of each other, their probabilities can be multiplied together.

Where factors can be affected by each other, their combined probability requires to be assessed.

It is assumed here that predicted tide level is independent of pressure surge (but see 5.2.4 below), wind surge and wave run-up, that pressure surge and wind surge can be dependent on a common cause, that pressure surge and wave run-up are independent of each other, and that wind surge and wave run-up can be dependent on a common cause.

4. Levels at Tarbert Ferry Marshalling Area

Levels around the perimeter of the proposed extension to the marshalling area are summarised below, and shown on marked up drawing no. 1973-998 in the Appendices.

Location	Reduced Level (in m. above OD)
Existing road level at linkspan abutment	+ 3.65m[1]
South extremity of existing marshalling area paving	+ 3.71m[1]
South extremity of proposed marshalling area paving	+ 3.95m
South extremity of proposed roundabout paving	+ 3.67m
Proposed boundary wall to marshalling area and roundabout	+ 4.26m
Existing extremity of pier structure	+ 4.27m
Proposed extremity of pier structure	+ 4.76m
Existing Terminal Building FFL (Finished Floor Level)	+ 4.36m
Proposed Terminal Building FFL	+ 4.86m

Points ([1]) are along the outer edge of the marshalling area, which is the lowest edge of the area. All other points on the proposed marshalling area are higher.

Other key levels from the low lying waterside areas at Tarbert, near to the proposed works:

Location	Reduced Level (in m. above OD)
Scottish Water site	+ 3.30m
Existing A868 (West of proposed works)	+ 3.78m
Existing A868 (East of proposed marshalling area)	+ 3.86m
Distillery external unpaved areas	+ 3.70m
Distillery parking areas	+ 3.80m
Distillery buildings FFL (minimum)	+ 4.38m
Head of existing slipway	+ 2.84m

5. Extreme Water Levels at Tarbert Terminal

5.1 Predicted Tide Levels

The level of Chart Datum at Tarbert can be obtained by reference to the information in Admiralty tide tables.

The level assumed is 2.74 metres below Ordnance Datum. The relevant predicted still water tidal levels at Tarbert are thus: -

Highest Astronomical Tide (HAT)	+ 3.16m OD
Mean High Water at Spring Tides (MHWS)	+ 2.26m OD
Mean High Water at Neap Tides (MHWN)	+ 0.96m OD

In assessing tidal flood levels at Tarbert, it is proposed to consider an extreme event with a return period of 200 years. This event has a probability of 0.5% (or 0.005) of occurring in any one year.

For calculation of the 1 in 200 year event it is necessary to assess the probability of various tide levels occurring during any particular storm.

It is assumed that all storms will be of sufficient duration to include one high water period.

The probability of any storm occurring at or above MHWN level is 1.0.

MHWS is exceeded by about one sixth of all high tides, and hence the probability of any storm occurring at that level or above is one sixth (0.167).

HAT is reached by approximately one two hundredth of high tides, leading to a probability of any storm occurring at that level of one two hundredth (0.005).

5.2 Storm Effects

5.2.1 Pressure Surge

Surge effects have been modelled over the Northwest European continental shelf (Flather, 1987) and by the DEFRA Joint Probability Study of 2005 and predictions produced for surge effects around the UK coastline.

The models used have made allowance for the effect of pressure surge and to a certain extent for overall wind surge. It is assumed no local wind surge affects are included. Tarbert lies on the predicted contour of one metre surge in a 50 year event.

During the violent storm of January 2005, the continuous tide gauge at Stornoway on Lewis recorded a maximum surge of 1.14 metres above predicted water level 2 hours after low water, where its effect would have been largely unnoticed. At the time of high water, the recorded surge was 0.64 metres above predicted water level.

It is not known how much of the surge at Stornoway resulted from pressure effects and how much from wind and topographical effects, although recorded wind directions might lead to the assumption that the effects were mostly pressure-related.

Based on the above theoretical and empirical data, values assumed for surges at Tarbert have been assessed, and are included in the table below.

The 200 year extreme still water level calculated here from assessment of records (3.96m above Ordnance Datum with assessed pressure surge) can be compared to levels published elsewhere for reference. The most recent analysis (Defra 'Technical Report on Joint Probability and Dependence' (2005)) refers to 'Estimates of Extreme Sea Conditions' by Proudman Laboratories, which is based on tide records. The table in the Proudman report for extreme sea levels indicates a 200 year still water level for Tarbert of 3.56m above Ordnance Datum.

These reports suggest a clear dependency between tide level and surge magnitude, reducing the surge level at high water. While adoption of this principle, and the lower predicted extreme 200 year still water level requires a degree of caution, we are content to use the recognised research value of 3.56m above Ordnance Datum.

Return Period	Assessed Pressure Surge	Pressure Surge from Defra Tech. Report
1 year	0.8 metres	0.4 metres
33 years	1.0 metres	0.5 metres
200 years	1.3 metres	0.7 metres

It is assumed that these figures include all pressure effects, and wind effects in the general area.

In the absence of any local wind surge, the extreme still water levels for the 200 year event are predicted as follows: -

Tide Level	Probability	Surge	Probability	Combined Probability	Predicted Water Level
+ 3.16m (HAT)	0.005	0.4m	1.0	0.005	+ 3.56m
+ 2.26m (MHWS)	0.167	0.5m	0.03	0.005	+ 2.76m
+ 0.96m (MHWN)	1.0	0.7m	0.005	0.005	+1.66m

5.2.2 Wind Surge

Minor local wind surge will be experienced on some occasions at this constricted sea loch. However, extreme south easterly wind speeds are considerably lower than from the south west or south, and the fetch is less than 50km. As a result, wind surge at Tarbert is unlikely to exceed 0.25m in extreme events.

The wind surge generated between Skye and Harris in easterly storms will be trapped in East Loch Tarbert and the wind surge effect at Tarbert might be increased by around one third to 0.35m.

As local surge would require prolonged south easterly winds, the probability of any overall storm surge accompanying prolonged south easterly winds must be assessed.

Assuming that 10% of storms might include prolonged south easterly winds at the site at the peak of the surge, it is necessary to reduce the relevant storm return period by a factor of 10 to retain the overall 200 year event.

Thus the following values are appropriate when a local wind surge occurs at the site.

Return period	Pressure Surge with Easterlies
1 month	0.25 metres
3 years	0.40 metres
20 years	0.60 metres

Extreme still water levels at Tarbert for the 200 year event with local south easterly wind surge are then predicted as follows, with the 1 in 10 year wind surge assessed as 0.27m: -

Tide Level	Probability	Pressure Surge	Probability	Wind Surge	Probability	Combined Probability	Predicted Water Level
(HAT) + 3.16m	0.005	0.25m	10	0.35m	0.1	0.005	+ 3.76m
(MHWS) + 2.26m	0.167	0.40m	0.3	0.35m	0.1	0.005	+ 3.01m
(MHWN) + 0.96m	1.0	0.60m	0.05	0.35m	0.1	0.005	+ 1.91m

5.2.3 Wave Run-up

Wave run-up is likely to be quite limited at this site. Waves approaching from the south east will be modified on the north shore by running along the pier structure and shoreline, and the significant wave height of 1.3m in mid loch, (recent wave study), can be expected to reduce to 0.4m at the site of the works. Wave run-up could be expected to reach 3.96m above OD.

With a freeboard of 500mm above still water level, the crest of the proposed boundary retaining wall and rock armouring will not be overtopped.

The linkspan abutment faces oncoming waves and is 110mm below the extreme still water level but water depths due to run up could be approximately 300mm at the linkspan bankseat. Within the proposed marshalling area, the surfacing rises to 3.91m above OD, 150mm above the extreme still water level. This acts as a weir and significantly limits wave run up penetration into the low lying landward areas.

Wave run up and extreme still water levels may penetrate and pond within the proposed marshalling area through access at the linkspan abutment. Wave penetration through wave run up will be comparatively minor and restricted to a period of only approximately one hour either side of the extreme HAT event. The volumes of penetrating sea water will tend to pond along the line of the drainage system installed at the interface between the existing and proposed marshalling areas and at the seaward edge of the proposed roundabout. Refer Drawing Number 1973-998, appended to this document for areas prone to extreme still water and wave run up at the proposed site.

Ponding water is unlikely to exceed the extreme HAT still water level of 3.76m above OD and therefore ponded water depths are unlikely to exceed approximately 100mm around the high tide period of an extreme HAT event.

Sea water ponding within the marshalling and roundabout area will then clear through the proposed drainage system and outfalls as the tide level ebbs. The proposed drainage system outfalls will be fitted with tidal flaps to prevent seawater backflow into the drainage system during high water conditions.

Consultation with local residents and pier users confirmed that there is no record of the linkspan and marshalling area having been flooded.

Large amounts of wind-driven spray will be carried some distance north westward in these extreme conditions, reaching over the armoured slopes, and generating additional surface water on parts of the marshalling area.

5.3 Climate Change

Predictions of climate change vary significantly depending on the model adopted. However, they all anticipate increased water levels in general, increased frequency of storm events, and increased severity of the most extreme events. Current efforts to reduce the emissions considered responsible for these factors are gathering pace and may result in some slowing of sea level rise. The likely rate of progress and effectiveness of measures proposed are a matter of conjecture, and may change as a result of political pressure.

It is therefore considered imprudent to make any definite assumptions about likely extreme water levels 50 years or more from now, beyond general trends.

In the circumstances the allowance of an additional 250mm on extreme water levels is considered appropriate.

6. Conclusions

From Section 5 above, the extreme maximum still water level in the 200 year return period at Tarbert Ferry Marshalling Area, excluding any effects of climate change, is assessed at 3.56m above OD. Making a suitable allowance for wind surge and the wave action that is possible at the site, the maximum run-up level in the 200 year return period is assessed at 3.96m above OD.

The predicted maximum run-up level is based on calculations, wave study, historical records of water level and current values for HAT, MHWS and MHWN.

However, it is only where extreme conditions occur during a period of HAT that there is a risk of flooding for the proposed works. Flood risk during an extreme HAT event would extend to surrounding areas including the adjacent Scottish Water site, slipway head area and landside areas surrounding the distillery buildings.

For an extreme event coinciding with lower MHWS and MHWN tide levels, the extreme still water levels are 750mm and 1850mm lower than the extreme HAT event. These extreme events do not result in any risk of flooding at the site or surrounding area.

In the extreme 200 year event, occurring at HAT, which might be experienced at any time, the predicted run-up level at the lowest point of the existing marshalling area, at the inner end of the linkspan, will result in water flooding the surface by up to 300mm. Wave run up and inundation during this same event, for approximately an hour either side of high water, will be able to penetrate to and pond to a depth of approximately 100mm within the lowest lying areas of the proposed marshalling and roundabout areas. This is still an improvement on the present situation where, during an extreme HAT event, the seaward edges of the existing marshalling area are susceptible to extreme water levels and coincident wave run up throughout.

Consultation with local sources confirmed that there are no records of flooding of the marshalling area or the surrounding low lying waterfront areas at Tarbert.

The effects of the extreme 200 year event are not expected to have any significant impact on the operation or integrity of the ferry terminal as any inundation is restricted to paved areas. In such extreme conditions all ferry services would be suspended.

The proposed new pier level has been raised by 500mm to give it a 1000mm freeboard to the extreme, 200 year, HAT event, water level at the site.

The proposed new terminal building level has been raised by 500mm to give it a 1100mm freeboard to the extreme, 200 year, HAT event, water level at the site.

It is universally accepted that, as a result of climate change, future high water levels are likely to exceed those currently experienced by a significant margin. The allowance of 250mm proposed in Section 5.3 above is considered a realistic estimate, based on current observations, of the extent to which the predicted values might be exceeded over the next 50 years.

It is recommended that future increases in tidal level are monitored, and measures taken, if required, when the linkspan comes up for replacement in the future, to raise levels locally as required.

Appendix A – Photographs

Photo 1: Existing Marshalling Area

Photo 2: Existing Marshalling Area

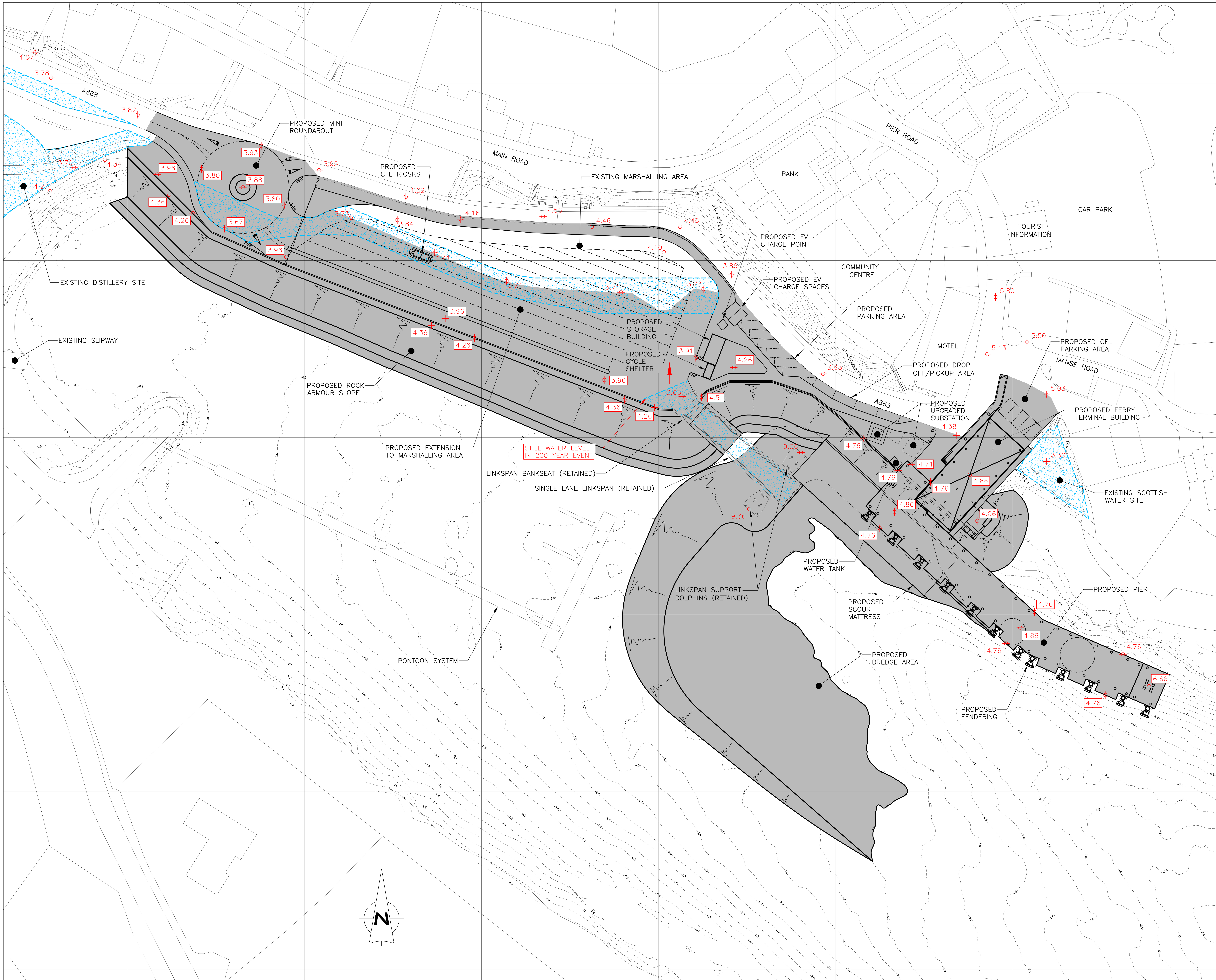
Photo 3: Linkspan Abutment – Lowest point

Photo 4: Tarbert Pier & Linkspan – East end

Photo 5: Marshalling Area – West end

Photo 6: Marshalling Area Edge (with adjacent distillery and slipway area in the background)

Appendix B – Drawing



MAPPING INFORMATION REPRODUCED WITH THE PERMISSION OF THE ORDNANCE SURVEY (c) CROWN COPYRIGHT 2017. ALL RIGHTS RESERVED. LICENCE NO. AL100002578.

GENERAL NOTES

1. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM UNLESS NOTED OTHERWISE.
2. TIDE LEVELS ARE AS FOLLOWS:
   HAT = +5.9mCD
   MHWS = +5.0mCD
   MLWS = +0.8mCD
   LAT = +0.1mCD
3. CHART DATUM IS 2.74m BELOW ORDNANCE DATUM.

LEGEND:

- AREA OF POTENTIAL PONDING TO STILL WATER LEVEL IN 200 YEAR EVENT DUE TO WAVE RUN–UP/INUNDATION
- WAVE RUN–UP PENETRATION AT LINKSPAN BANKSEAT DURING 200 YEAR EVENT
- 1.00 EXISTING LEVELS TO ORDNANCE DATUM
- 1.00 PROPOSED LEVELS TO ORDNANCE DATUM

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D

AMENDMENTS

CLIENT
CMAL

PROJECT
TARBERT FERRY TERMINAL UPGRADE WORKS

Wallace Stone
CONSULTING CIVIL ENGINEERS
GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk
DINGWALL 01349 866775 dingwall@wallacestone.co.uk
HEBRIDES 01851 612454 hebrides@wallacestone.co.uk

DRAWING TITLE
SITE LAYOUT PROPOSALS AND STILL WATER/RUN–UP LEVELS

Redacted

DATE	DATE	DATE
JUNE '18	JUNE '18	JULY '18

SCALE (A1) 1:500
STAGE INFORMATION
REVISION

PROJECT No. 1973
DRAWING No. 998

Appendix M.5: Water Framework Directive Assessment

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Appendix M.5

Water Framework Directive assessment: scoping template for activities in estuarine and coastal waters

Use this template to record the findings of the scoping stage of your Water Framework Directive (WFD) assessment for an activity in an estuary or coastal water.

If your activity will:

- take place in or affect more than one water body, complete a template for each water body
- include several different activities or stages as part of a larger project, complete a template for each activity as part of your overall WFD assessment

The WFD assessment guidance for estuarine and coastal waters will help you complete the table.

Your activity	Description, notes or more information
Applicant name	Caledonian Maritime Assets Limited (CMAL)
Application reference number (where applicable)	
Name of activity	Tarbert Ferry Terminal Upgrade
Brief description of activity	*Pier upgrade, terminal building upgrade, land reclamation and capital dredge.*
Location of activity (central point XY coordinates or national grid reference)	NG 1577 9985
Footprint of activity (ha)	2.12 ha
Timings of activity (including start and finish dates)	October 2019 to October 2021
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	See Volume 2, Chapter 2: Project Description of Tarbert Ferry Terminal Upgrade EIAR.
Use or release of chemicals (state which ones)	None

Water body[1]	Description, notes or more information
WFD water body name	Loch Tarbert
Water body ID	200164
River basin district name	Scotland
Water body type (estuarine or coastal)	Coastal
Water body total area (ha)	3010 ha
Overall water body status (2015)	High
Ecological status	High (2017)
Chemical status	Pass (2017)
Target water body status and deadline	Good
Hydromorphology status of water body	High (2017)
Heavily modified water body and for what use	No
Higher sensitivity habitats present	No
Lower sensitivity habitats present	No
Phytoplankton status	High (2017)
History of harmful algae	No
WFD protected areas within 2km	No

[1] Water body information can be found in the Environment Agency's catchment data explorer and the water body summary table. Magic maps provide additional information on habitats and protected areas. Links to these information sources can be found in the WFD assessment guidance for estuarine and coastal waters.

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

Consider if your activity:	Yes	No	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	Requires impact assessment	Impact assessment not required	Yes – Change in water depths associated with land reclamation, dredging and dredge disposal.
Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	Potentially at local level.
Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats [2]	Lower sensitivity habitats [3]
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	
subtidal kelp beds	
subtidal seagrass	

[2] *Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.*

[3] *Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.*

Consider if the footprint[4] of your activity is:	Yes	No	Biology habitats risk issue(s)
0.5km^2 or larger	Yes to one or more – requires impact assessment	No to all – impact assessment not required	No
1% or more of the water body's area			No
Within 500m of any higher sensitivity habitat			No
1% or more of any lower sensitivity habitat			No

[4] *Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area.*

Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if your activity:	Yes	No	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	Continue with questions	Go to next section	No
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	Requires impact assessment	Impact assessment not required	Yes – Construction potential to affect fish due to siltation and underwater noise.
Could cause entrainment or impingement of fish	Requires impact assessment	Impact assessment not required	No

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	Requires impact assessment	Impact assessment not required	No – Construction could affect water clarity but will be localised and highly unlikely to be continuous for 14 days.
Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	No – Loch Tarbert has a High status.
Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	No

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment	Impact assessment not required	Yes - Potential for loss of containment of fuels and oils during construction and operations
It disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment	Impact assessment not required	

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment[5]	Impact assessment not required	No – surface water outfalls, but separators will prevent the release of EQSD listed chemicals, that could arise.

[5] *Carry out your impact assessment using the Environment Agency's surface water pollution risk assessment guidance, part of Environmental Permitting Regulations guidance.*

Record the findings for water quality go on to section 4: WFD protected areas.

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

- special areas of conservation (SAC)
- special protection areas (SPA)
- shellfish waters
- bathing waters
- nutrient sensitive areas

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area[6]	Requires impact assessment	Impact assessment not required	No

[6] *Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.*

Record the findings for WFD protected areas and go to section 5: invasive non-native species.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	Requires impact assessment	Impact assessment not required	Yes – Via ballast water and biofouling associated with equipment and vessels required for construction.

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Flood and Coastal Processes.
Biology: habitats	No	
Biology: fish	Yes	Underwater noise and sedimentation.
Water quality	Yes	Loss of containment of contaminants during construction and operations.
Protected areas	No	
Invasive non-native species	Yes	Via ballast water and biofouling associated with equipment and vessels required for construction.

If you haven’t identified any receptors at risk during scoping, you don’t need to continue to the impact assessment stage and your WFD assessment is complete.

If you’ve identified one or more receptors at risk during scoping, you should continue to the impact assessment stage.

Include your scoping results in the WFD assessment document you send to your activity’s regulator as part of your application for permission to carry out the activity.

Appendix N.1: Baseline Conditions and Assessment of Potential Effects on the Seven Agreed Viewpoints

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Viewpoint: 1	
Baseline conditions	
Viewpoint location: Core Path near Beinn Tharsuinn	
Grid reference: E119969, N900832	**Drawing Number**:
Distance to Proposed Development: 4.28 km	**View direction:** 258°
Landscape character type: Mountain Massif One	**Landscape designation:** NSA

Context:

This viewpoint lies to the east-north-east of the proposed development, on the Urgha-Reinigeadal Core Path. The path is maintained by the North Harris Trust and follows the former postal route. It is signposted from a small car park beside Lacasadail Loch on the minor road to Scalpay (C78).

It provides elevated open views across An Loch an Ear, representative of the direct views experienced by path users heading west. Similar views would be possible from approximately 1 km of the path as it approaches Tarbert.

Current view:

Beyond the footpath, the view west-south-west is across open rocky moorland towards Tarbert, seen against a backdrop of Ceann Reamhar and adjacent hills that form the skyline on the far side of An Loch an Ear. A mast at Urgha is visible in the foreground and another above the buildings of Tarbert. Traffic moving along the C78 is evident below as the road approaches the town and the A859 can be seen following the far shore of An Loch an Ear. The existing ferry terminal is not readily discernible from this viewpoint, largely screened from view by buildings.

The view west-south-west forms part of a wide (135°) view that includes rugged mountains to the north-west and the sea to the south-west. Views to the north-east, east and south-east are short, curtailed by rising ground.

Landscape sensitivity

Susceptibility to change:

This medium scale, open, landscape is moderately varied. The rugged landform increases susceptibility, whilst the nearby mast, roads and the buildings and infrastructure within Tarbert reduce it slightly. Apart from views of Tarbert, the landscape has a remote and tranquil character, with little land use change evident. Overall susceptibility is assessed as med-high.

Landscape value:

Varied coastal views, dramatic landform, historical associations of the path route, recreational value and semi-natural vegetation contribute to landscape quality, although views of buildings and infrastructure detract slightly. Taking into account the landscape designation, the landscape value is assessed as high.

Visual receptors, receptor susceptibility to change and value of view

Recreational users:

- walkers come to enjoy the view – high susceptibility
- a moderately well promoted viewpoint with a small number of receptors – medium value

Assessment of predicted effects

Description of changes:

Although the proposed development is theoretically visible across approximately 2.6° of this view, in practice much of it would be hidden by adjacent buildings and vegetation. The terminal building and pier may be visible but hard to distinguish from the surrounding buildings at this distance. The larger ferry would be seen when berthed alongside the pier.	
Landscape effects: No landscape effect is predicted when no ferry is present. The larger ferries would be slightly more noticeable, temporarily affecting the sense of scale of the landscape. No other landscape characteristics would be affected however and the overall magnitude of effect is predicted to be negligible. **Construction effects:** Construction traffic moving along the A859 would be obvious, affecting the rural character of the backdrop and activity within the terminal may also be evident. Much of the activity would be screened from view, however, few landscape characteristics would be affected and the effect is predicted to be small.	
Visual effects: No visual effect is predicted when no ferry is present. The proposed development would lie at the natural focus of the view, where the sea meets the land. The C78 road is noticeable at present, in the middle distance below this focus. Larger ferries would be slightly more noticeable than the existing vessels, tending to draw the eye from the focus. Taking into account the temporary nature of the effect and the small proportion of the view affected, the magnitude of is predicted to be small-neg. **Construction effects:** Construction traffic on the A859 would be obvious and some activity within the terminal may also be visible. Overall the magnitude of visual effect is predicted to be small.	
Significance of visual effects	
Operational effects:	**Path users:** mod-minor (not significant)
Construction effects:	**Path users:** moderate (not significant)

Viewpoint: 2	
Baseline conditions	
Viewpoint location: A859	
Grid reference: E115610, N899635	**Drawing Number**:
Distance to Proposed Development: 221 m	**View direction:** 37°
Landscape character type: Rocky Moorland	**Landscape designation:** NSA

Context:

This viewpoint lies on the main road as it approaches Tarbert from the south. The road is also designated as National Cycle Network (NCN) Route 780. It provides close range views of the proposed development, representative of the direct views experienced by residents of nearby dwellings and oblique views for road users. The proposed development would be visible for approximately 0.9 km along this road, although the viewpoint represents the closest and 'worst case' view.

Current view:

Beyond the road, grass fields slope down to the open water of An Loch an Ear. On the far side of the loch, the existing ferry terminal occupies much of the foreground of the view. The generally small scale buildings of the town occupy the lower slopes, back clothed by bare rocky slopes that form the skyline.

The view north-east forms part of a moderately wide (140°) view, framed by rising ground to the north-west and a nearby dwelling to the south-east. A wind turbine, telecommunications mast and several overhead electricity transmission lines are visible to the west of the town and Scalpay Bridge can be seen to the south-east.

Landscape sensitivity

Susceptibility to change:

This medium scale, open coastal landscape is moderately varied with some rugged landform. Some linear patterns increase susceptibility slightly, but the buildings and infrastructure within Tarbert reduce it substantially. Outwith Tarbert the landscape has a more rural character, with little land use change evident, although the noise and movement of traffic on the main road is very noticeable. Overall susceptibility is assessed as medium.

Landscape value:

Coastal views and varied land use contribute to landscape quality, although nearby buildings, suburban style boundary treatment, eroded pasture and views of infrastructure detract. Taking into account the landscape designation, the landscape value is assessed as med-high.

Visual receptors, receptor susceptibility to change and value of view

Residents:

- views from dwellings - high susceptibility
- view moderately well promoted, small number of receptors – medium value

Road users:

- some road users are likely to be travelling for the view – med-high susceptibility
- view moderately well promoted, large number of receptors – med-high value

Assessment of predicted effects

Description of changes:

To the left of the view, the rock armour would be slightly more prominent. The larger

marshalling area would narrow the head of An Loch an Ear, and this would be evident. The storage building, cycle shelter, upgraded substation and additional lighting columns would be visible. The simplified connection with the linkspan would be clearly evident. The footprint of the new terminal building would appear similar to the existing structure, but the roof pitch would reflect that of other buildings in the town. To the right of this the enlarged pier and fendering would be very prominent. The proposed development would occupy approximately 58° of this wide view.	
Landscape effects: The proposed development would noticeably increase the extent of infrastructure evident, although few landscape characteristics would be affected, given the present urban context of the town and the sound and movement of traffic on the adjacent road. Changes would be evident, but with little effect on the experience of the landscape. The magnitude of effect is predicted to be small-med. When present, the larger ferry would be slightly more noticeable, but vehicles in the marshalling area would clearly emphasise its greater extent. This would result in a periodic increase in the magnitude of effect to medium. **Construction effects:** All construction activity would be evident from this viewpoint, resulting in a noticeable increase in the amount of movement and noise. The changes would be clearly evident and the magnitude of landscape effect is predicted to be medium.	
Visual effects: A relatively large proportion of this framed view would be affected, but the changes would mainly reflect the existing pattern. The longest part of the view, towards Scalpay would be less affected. The sensitive design of the new terminal building and linkspan improvements would help to reduce the visual effect although the numerous structures and additional lighting columns would increase the degree of clutter. Some residents would have open direct views and the magnitude of visual effect for them is predicted to be medium. Road users would have oblique views and experience a small-med magnitude of effect. The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the greater extent of the marshalling area. The magnitude is predicted to be med-large for residents and medium for road users at these times. **Construction effects:** Construction activity and vessel movements would be obvious from this viewpoint, extending across the view and also increasing the amount of traffic on the main road beside the viewpoint. The magnitude of visual effect is predicted to be med-large for residents and medium for road users during construction.	
Significance of visual effects	
Operational effects:	**Residents:** moderate (not significant), periodically mod-major (significant)
	Road users: moderate (not significant)
Construction effects:	**Residents:** mod-major (significant)

	Road users: moderate (not significant)

Viewpoint: 3	
Baseline conditions	
Viewpoint location: Seilebost Footpath	
Grid reference: E115449, N899846	**Drawing Number**:
Distance to Proposed Development: 120 m	**View direction:** 74°
Landscape character type: Rocky Moorland	**Landscape designation:** NSA

Context:

This viewpoint lies beside a stone marker above the A859 on a waymarked footpath that links with the Seilebost – Aird Mhighe Circular public right of way (PROW). It provides close range elevated views of the proposed development, representative of the views experienced path users heading north. Similar, slightly more oblique and distant views would be experienced along approximately 450 m of this path.

Current view:

The view north is dominated by the buildings in the town and infrastructure of the ferry terminal. The distillery lies directly below but most buildings in the town are spread out along the lower slopes, against a backdrop of bare rocky hills to the north.

The view north forms part of a moderately wide (170°) view, the longest part of which is to the south-east, towards Scalpay. A telecommunications mast and three small wind turbines can be seen to the west of the town, with numerous overhead electricity transmission lines beyond. These lines continue beside the footpath. Rising ground curtails views in other directions.

Landscape sensitivity

Susceptibility to change:

This is a medium scale, moderately open landscape with diverse land cover but no strong pattern evident. Frequent settlement and infrastructure reduce susceptibility. Although the townscape is much altered, there is little obvious change outwith the town. Overall the susceptibility is assessed as medium.

Landscape value:

The rugged landform, varied coastal views, semi-natural vegetation, recreational value all contribute to the landscape value. Noise from the distillery, traffic movement on the A859, the infrastructure and some buildings within Tarbert, electricity poles, the mast and wind turbines to the west detract. Taking account of the designation, the landscape value is assessed as med-high.

Visual receptors, receptor susceptibility to change and value of view

Path users:

- walkers come to enjoy the view – high susceptibility
- a moderately well promoted viewpoint with a small number of receptors – medium value

Assessment of predicted effects

Description of changes:

The mini-roundabout and the marshalling area would be very obvious, noticeably extending the existing area and reducing the width of An Loch an Ear. Rock armour would be more linear than at present and slightly more evident. The storage building, cycle shelter, upgraded substation and additional lighting columns would be visible. The simplified connection with

the linkspan would be clearly evident. The new terminal building would be obvious next to the pier and fendering, which would extend slightly further to the south-east. The proposed development would occupy approximately 54° of this view.
Landscape effects: The proposed development would noticeably increase the extent of infrastructure evident, although few landscape characteristics would be affected, given the present urban context of the town and the noise and traffic movement. Changes would be evident, but with little effect on the experience of the landscape. The magnitude of effect is predicted to be small-med. Vehicles within the marshalling area would emphasise its greater extent and the larger ferry would be slightly more noticeable. This would result in a periodic increase in the magnitude of effect to medium. **Construction effects:** The increase in traffic, vessel movements and activity due to construction would be very obvious from this viewpoint, resulting in a noticeable increase in the amount of movement and noise. The changes would be clearly evident, affecting the landscape experience and the magnitude of landscape effect is predicted to be medium.
Visual effects: The proposed development would lie directly below, but to the left of the longest part of the view. It would affect a relatively large proportion of the view, but some elements would fit the existing pattern. The scale of the terminal building would reflect that of the adjacent hotel and the simplified linkspan connection would also help to reduce the magnitude of visual effect, which is predicted to be medium. The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the greater extent of the marshalling area. The magnitude is predicted to be med-large at these times. **Construction effects:** Construction activity would be obvious from this viewpoint, extending across the view and also increasing the amount of traffic on the main road below the viewpoint. The magnitude of visual effect is predicted to be med-large during construction.
Significance of visual effects

Operational effects:	**Path users:** moderate (not significant), periodically mod-major (significant)
Construction effects:	**Path users:** mod-major (significant)

Viewpoint: 4	
Baseline conditions	
Viewpoint location: Distillery Breakwater	
Grid reference: E115520, N899915	**Drawing Number**:
Distance to Proposed Development: 27 m	**View direction:** 91°
Landscape character type: Crofting Two	**Landscape designation:** NSA

Context:

The viewpoint lies beside the distillery above the breakwater that protects the building. It provides close range views of the proposed development, representative of those experienced by visitors, many awaiting the ferry, who use the adjacent grass areas and footpaths.

Current view:

The view east is along rock armour beside An Loch an Ear towards Scalpay, which forms the focus. The buildings and ferry infrastructure within Tarbert frame the view to the left, backed by shrubs and trees that rise to bare rocky hills that form the skyline. The marshalling area is visible in the foreground, with the linkspan and terminal building beyond.

The wider (approximately 190°) view is framed on the right by steeply rising vegetated ground below the A859, along which moving traffic can be seen. The nearby distillery buildings curtail views to the west. Marina and ferry infrastructure is visible through almost 360°.

Landscape sensitivity

Susceptibility to change:

This is a medium scale, moderately enclosed, busy, low-lying diverse landscape with no obvious pattern. Strong urban influences, ferry and marina infrastructure and views of traffic on the main road reduce susceptibility, which is assessed as medium overall.

Landscape value:

Coastal views and rugged landform add to the landscape value, although some buildings and the clutter of infrastructure, sense of movement, noise and lighting detract. Taking the designation into account the landscape value is assessed as med-high.

Visual receptors, receptor susceptibility to change and value of view

visitors:

- most come to experience the view - high susceptibility
- moderately well promoted view, large number of receptors – med-high value

Assessment of predicted effects

Description of changes:

The most obvious change from this viewpoint would be the increase in the length and change in position of the rock armour and the narrowing of An Loch an Ear. The increase in the extent of the marshalling area would be less evident due to the low elevation of the viewpoint. The storage building, cycle shelter, upgraded substation and additional lighting columns would be visible. The simplified connection with the linkspan would be evident. The new terminal building would be obvious next to the pier and fendering, which would extend the infrastructure slightly further to the south-east. The proposed development would occupy approximately 57° of this wide view.

Landscape effects:

The changes would be evident, but within a busy, noisy urban context. The increase in the proportion of reclaimed area to open water would affect the sense of scale, but few other characteristics would be affected. Changes would be evident, but with little effect on the experience of the landscape. The magnitude of effect is predicted to be small-med.

Construction effects:

The increase in traffic, vessel movements and activity due to construction would be very obvious from this nearby viewpoint, resulting in a noticeable increase in the amount of movement and noise. The changes would be clearly evident, affecting the landscape experience and the magnitude of landscape effect is predicted to be medium.

Visual effects:

A large proportion of this framed view would be affected and the proposed development would partly obscure and draw the eye from the main focus, which is towards Scalpay. The changes would be similar in pattern to existing elements, the form of the terminal building would reflect that of the adjacent hotel and the simplified linkspan connection would also help to reduce the magnitude of visual effect, which is predicted to be med-large.

The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the larger marshalling area. The magnitude is predicted to be large at these times.

Construction effects:

Construction activity would be very obvious from this nearby viewpoint, extending across the view and also increasing the amount of traffic on the main road to the south.

The magnitude of visual effect is predicted to be large during construction.

Significance of visual effects	
Operational effects:	**Visitors:** mod-major (significant), periodically major (significant)
Construction effects:	**Visitors:** major (significant)

Viewpoint: 5	
Baseline conditions	
Viewpoint location: Pontoon access	
Grid reference: E115557, N899852	**Drawing Number**:
Distance to Proposed Development: 43 m	**View direction:** 73°
Landscape character type: Crofting Two	**Landscape designation:** none

Context:

This view is from the concrete apron of the pontoon. It represents views experienced by users of the marina as they access their boats.

Current view:

The view east-north-east is along An Loch an Ear, framed on the left by buildings and ferry infrastructure within Tarbert, backed by shrubs and trees that rise to bare rocky hills that form the skyline. The marshalling area is visible in the foreground, with the linkspan and terminal building beyond.

The wider (approximately 170°) view is framed on the right by steeply rising vegetated ground below the A859, along which moving traffic is visible. To the west, the nearby distillery buildings curtail views. Marina and ferry infrastructure is visible through almost 360°.

Landscape sensitivity

This is a medium scale, moderately enclosed, busy, low-lying and diverse landscape with no obvious pattern. Strong urban influences, ferry and marina infrastructure and views of traffic on the main road reduce susceptibility, which is assessed as medium overall.

Landscape value:

Coastal views and rugged landform add to the landscape value, although some buildings and the clutter of infrastructure, sense of movement, noise and lighting detract. Taking the designation into account the landscape value is assessed as med-high.

Visual receptors, receptor susceptibility to change and value of view

Marina users:

- most come to experience the view - high susceptibility
- moderately well promoted view, small number of receptors – medium value

Assessment of predicted effects

Description of changes:

The most obvious change from this viewpoint would be the increase in the length and change in position of the rock armour and the narrowing of An Loch an Ear. The increase in the extent of the marshalling area would be less obvious due to the low elevation of the viewpoint. The storage building, cycle shelter, upgraded substation and additional lighting columns would be visible. The simplified connection with the linkspan would be evident and the new terminal building would be partly hidden by the linkspan. The pier and fendering would be visible, extending the infrastructure slightly further to the south-east.

The proposed development would occupy approximately 111° of this view.

Landscape effects:

The changes due to the proposed development would be clearly visible, but within a busy and noisy urban context. The change in the proportion of reclaimed area to open water would

alter the sense of scale slightly, but few other characteristics would be affected. Changes would be evident, but with little effect on the experience of the landscape. The magnitude of effect is predicted to be small-med. **Construction effects:** The increase in traffic, vessel movements and activity due to construction would be very obvious from this nearby viewpoint, resulting in a noticeable increase in the amount of movement and noise. The changes would be clearly evident, affecting the landscape experience and the magnitude of landscape effect is predicted to be medium.	
Visual effects: A large proportion of this framed view would be affected and the proposed development would draw the eye from the main focus, which is towards Scalpay. The changes would be similar in pattern to existing elements, the form and scale of the terminal building would reflect that of the adjacent hotel and the simplified linkspan connection would also help to reduce the magnitude of visual effect, which is predicted to be med-large overall. The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the greater extent of the marshalling area. The magnitude is predicted to increase to large at these times. **Construction effects:** Construction activity would be very obvious from this nearby viewpoint, extending across the view and also increasing the amount of traffic on the main road to the south. The magnitude of visual effect is predicted to be large during construction	
Significance of visual effects	
Operational effects:	**Marina users:** mod-major (significant), periodically mod-major (significant)
Construction effects:	**Marina users:** major (significant)

Viewpoint: 6	
Baseline conditions	
Viewpoint location: War Memorial	
Grid reference: E115554, N899952	**Drawing Number**:
Distance to Proposed Development: 20 m	**View direction:** 140°
Landscape character type: Crofting Two	**Landscape designation:** NSA

Context:

This viewpoint lies within the war memorial garden, which is enclosed by hedges. It provides a slightly elevated view of the proposed development. Some adjacent dwellings along Main Street would have similar views, mostly from upper storey windows and with some partial screening by vegetation. The photograph is taken from the front edge of the garden in order to gain the most open, worst case view. Adjacent benches and the memorial itself provide more restricted views.

Current view:

The view south-east is towards Scalpay, framed by nearby trees and shrubs to the left and vegetated steep slopes below the A859 to the right. The pontoon dominates the foreground, but the eye is drawn out to sea, towards Scalpay and Trotternish beyond.

The view forms part of a wider (170°) view that includes the nearby distillery and steeply rising vegetated ground beyond to the south-west. Views to the north and east are short, curtailed by nearby buildings and vegetation, set against a backdrop of open rocky hill slopes.

Landscape sensitivity

Susceptibility to change:

This is a medium scale, moderately enclosed, busy, low-lying diverse landscape with no strongly linear patterns. Urban influences, ferry and marina infrastructure and views of traffic on the main road reduce susceptibility, which is assessed as medium overall.

Landscape value:

Coastal views and rugged landform add to the landscape value, although some buildings and the clutter of infrastructure, sense of movement, noise and lighting detract. Taking the designation into account the landscape value is assessed as med-high.

Visual receptors, receptor susceptibility to change and value of view

Visitors:

- most come to experience the view - high susceptibility
- moderately well promoted view, small number of receptors – medium value

Residents:

- views from dwellings - high susceptibility
- view moderately well promoted, small number of receptors – medium value

Assessment of predicted effects

Description of changes:

The mini roundabout and marshalling area would be highly visible in the foreground, appreciably narrowing An Loch an Ear beyond. Lighting columns and the ticketing kiosks would be clearly visible. The storage building and cycle shelter would partially conceal the substation, but most of the new terminal building would be seen. The simplified connection

to the linkspan would be evident but much of the pier and fendering would be screened from view. Due to the screening provided by adjacent vegetation, the horizontal angle occupied by the proposed development would differ widely, depending upon the position of the observer.	
Landscape effects: The changes due to the proposed development would be clearly evident, but within a busy and noisy urban context. The increase in the proportion of reclaimed area to open water would alter the sense of scale slightly, but few other characteristics would be affected. Changes would be evident, but with little effect on the experience of the landscape overall. The magnitude of effect is predicted to be small-med. **Construction effects:** The increase in traffic, vessel movements and activity due to construction would be very obvious from this nearby viewpoint, resulting in a noticeable increase in the amount of movement and noise. The changes would be clearly evident, affecting the landscape experience and the magnitude of landscape effect is predicted to be medium.	
Visual effects: A large proportion of this framed view would be affected and the proposed development would draw the eye from the main focus, which is towards Scalpay. The changes would be similar in pattern to existing elements and the simplified linkspan connection would also help to reduce the magnitude of visual effect, which is predicted to be med-large overall. The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the larger marshalling area. The magnitude is predicted to increase to large at these times. **Construction effects:** Construction activity would be very obvious from this nearby viewpoint, extending across the view and also increasing the amount of traffic on the main road to the south. The magnitude of visual effect is predicted to be large during construction	
Significance of visual effects	
Operational effects:	**visitors:** mod-major (significant), periodically major (significant)
	residents: mod-major (significant), periodically major (significant)
Construction effects:	**visitors:** major (significant)
	residents: major (significant)

Viewpoint: 7	
Baseline conditions	
Viewpoint location: Tarbert – Uig Ferry'	
Grid reference: E116230, N899445	**Drawing Number**:
Distance to Proposed Development: 508 m	**View direction:** 302°
Seascape Unit: Low Rocky Coasts CCU	**Landscape designation:** NSA

Context:

This view is from the aft deck of the departing ferry. It represents the view experienced by ferry passengers, but also that from yachts and other vessels using the marina. Similar views would be available throughout An Loch an Ear.

Current view:

The town and ferry terminal form a strong focus at the head of the loch. The distillery buildings are prominent beyond the marina. Traffic is visible on the A859 to the left against a backdrop of rocky hillside. To the right of the view the terminal building, pier, fendering and linkspan are all visible. Buildings in the town are spread out along the wooded base of the hill and a telecommunications mast is prominent above, all against a backdrop of bare rocky hill slopes.

The view north-west forms part of a wide panorama, limited only by the ferry superstructure. To the north, the rugged mountains of North Harris form the skyline above scattered settlement along the C78 road. To the south-west, two forest plantations, a few dwellings and numerous electricity poles mark the line of the A859.

Landscape sensitivity

Susceptibility to change:

This is a medium scale, moderately enclosed sound. There is a complex pattern of indented coastline but no strong linear pattern. Settlement, infrastructure, movement and lighting are predominantly limited to Tarbert and generally sparse elsewhere. Although low-lying, Tarbert forms a natural focus at the head of the loch. Urban influences, ferry and marina infrastructure and views of traffic on the main road reduce susceptibility, which is assessed as medium overall.

Landscape value:

Diverse coastal views, dramatic landform and the complex, indented coastline add to the scenic quality. Some of the buildings and infrastructure within and around Tarbert detract, although these would become less noticeable at greater distances. Taking the landscape designation into account the overall value is assessed as high.

Visual receptors, receptor susceptibility to change and value of view

Ferry passengers:

- focussed on the view – high susceptibility
- view moderately well promoted, large number of receptors – med-high value

Marina users:

- most come to experience the view - high susceptibility
- moderately well promoted view, small number of receptors – medium value

Assessment of predicted effects

Description of changes:

The pier, fendering and the terminal building would be the most obvious new elements. The rock armour and marshalling area would be less noticeable, being foreshortened due to the angle of view. Other elements would be partly concealed from view or difficult to discern, although additional lighting columns would be visible, particularly when lit. The proposed development would occupy approximately 5.5° of this view.

Landscape effects:

The increased extent of the infrastructure and the narrowing of the head of the loch would be evident but there would be little effect on the key characteristics, given the urbanised context.

The change would be slight and the experience of the landscape would be little changed. The magnitude of effect is predicted to be small.

The effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the larger marshalling area. The magnitude is predicted to increase to small-med at these times.

.

Construction effects:

Construction traffic on the A859 and activity within the ferry terminal would be obvious, resulting in a noticeable increase in noise, movement and lighting, affecting the experience of the landscape. The magnitude of effect is predicted to be small-med during construction.

Visual effects:

The proposed development would affect the focus of the view, although a small proportion of the overall view would be affected. Some elements would fit the existing composition and the new terminal building would appear similar in scale and form to the nearby distillery, representing an improvement upon the existing structure. The extension of the pier, fendering and additional lighting columns would increase the visual effect slightly, which is assed as small-med.

The visual effect would be periodically greater, due to the slightly larger ferry and the additional vehicles drawing attention to the larger marshalling area. The magnitude is predicted to increase to medium at these times.

.

Construction effects:

Construction traffic on the A859 and activity within the ferry terminal would be obvious, resulting in a noticeable increase in movement and lighting, albeit within a restricted part of this very wide view. The magnitude of effect is predicted to be medium during construction.

Significance of visual effects

Operational effects:	**Ferry passengers**: moderate (not significant), periodically mod-major (significant) **Marina users**: moderate (not significant)
Construction effects:	**Ferry passengers**: mod-major (significant) **Marina users**: moderate (not significant)