Port of Cromarty Firth Maintenance Dredge Licence

Best Practicable Environmental Option Report

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1 Introduction

The Invergordon Service Base (ISB) is a multi-user facility which provides infrastructure for both the offshore renewables sector and the cruise industry, owned by Port of Cromarty Firth (PoCF). The existing ISB encompasses 6 berths, the West Harbour and the Queens Dock, providing over 600m of berthing of depths between -3 and -14.5 metres (m) chart datum (CD). In addition, PoCF own and operate the Saltburn Pier to the east of the Service Base.

The PoCF require to carry out maintenance dredges of their facilities at the ISB, including the Queens Dock, berths 1 to 6, (note berths 5 and 6 are also known as Quay West) the West Harbour and the Saltburn Pier. Surveys show that there has been a build-up of natural material within the berthing areas of the ISB. The proposed maintenance dredge is key for PoCF to retain existing market share and attract new customers in both the offshore renewables and cruise sectors. As such, dredging is required in order to maintain suitable water depths for operations.

This Best Practicable Environmental Option (BPEO) report has been produced to support the dredge marine licence application under the Marine (Scotland) Act 2010 as amended, for a three-year maintenance dredge licence for the waters adjacent to the ISB and the Saltburn Pier.

1.1 Report Aims and Objectives

The purpose of this report is to identify and assess the available options for the use/disposal of materials arising from the maintenance dredge works associated with the operational berthing areas of the ISB.

The objectives are:

- To provide an overview of the required works;
- To describe the dredge material to be removed including volumes, physical and chemical characteristics;
- Describe the BPEO methodology employed to complete the assessment; and
- To identify and assess options for disposal of material to determine the BPEO.

2 Background

2.1 Dredge Arisings

Dredging of the berthing areas will be required to lower seabed levels and create a suitable berthing space to continue to have the ability to accommodate large vessels. The ISB requires dredging in order to maintain operational depths which are highlighted in Table 2.2.1, alongside the current depths.

As the application is for a maintenance dredge, this volume will be dredged over the three-year lifespan of the dredge licence. The volume to be dredged and the annual splits of anticipated dredge spoil is outlined in the Port of Cromarty Firth Dredge and Disposal Licence Environmental Supporting Document (Affric Limited, 2024).

2.2 Dredge Material Characteristics

2.2.1 Sampling

During July 2024, in conformance with the Pre-Disposal Dredge Sampling Guidance (Marine Scotland, 2017), core and grab samples were obtained from 11 locations at the ISB. Sampling was carried out at locations shown in shown in drawings PoCF_Dredge_QD_001 (Rev01), PoCF_Dredge_B1-4_001 (Rev01) and PoCF_Dredge_SB_Pier_001 (Rev01).

A mix of core and grab samples were retrieved, see Table 2.2.1 for further details. A total of five vibrocores were utilised to sample the area of the Queens Dock where depths of -12m CD are required and dredging of >1m will be carried out. Six grab samples were taken where dredging will be ≤ 1m. Grab sample stations were positioned at berths 1/2, 3 and 4, one in the West Harbour and one on either side of Saltburn Pier. Quay West was sampled in December 2023 for a plough dredge conducted in January 2024. As such, Quay West was not re-sampled in July 2024, but the results have been included in Table 2.2.1, as the maintenance dredge licence sought will cover berths 5 and 6 at Quay West too. Table 2.2.1 includes the current depths and the desired depths of each location. It is important to note that some locations currently exhibit the desired depth. The maintenance dredge licence is required for those areas as sedimentation is expected to build up over the period of the dredge licence.

Samples were retrieved from a total of 14 sample stations which will allow for up to 450,000m^3 of dredge spoil, as per the guidance (Marine Scotland, 2017).

Table 2.2.1: Site Location, Sample ID, Sample Type, and the Current and Desired Depths

Site	Sample ID	Co-ordinates	Sample Type	Current Depth (m CD)	Desired Depth (m CD)
Queens Dock	VC01	57˚ 41.07'N 004˚ 10.40'W	Core	-4 to - 12	-12
	VC02	57˚ 41.09'N 004˚ 10.38'W	Core		
	VC03	57˚ 41.11'N 004˚ 10.41'W	Core		
	VC04	57˚ 41.11'N 004˚ 10.36'W	Core		
	VC05	57˚ 41.09'N 004˚ 10.36'W	Core		
West Harbour	GS04	57˚ 41.09'N 004˚ 10.04'W	Grab	-1 to -3	-2 to -3
Berths 1 and 2	GS03	57˚ 41.07'N 004˚ 10.04'W	Grab	-3 to -19	-10.5
Berth 3	GS02	57˚ 41.06'N 004˚ 10.12'W	Grab	-9 to -16	
Berth 4	GS01	57˚ 41.05'N 004˚ 10.20'W	Grab	-9 to -17	-10.5 / -14.5
Quay West (Berths 5 and 6)	QW1	57° 41.04'N 004° 10.90'W	Grab	-11 to -16	-12
	QW2	57° 41.02'N 004° 10.98'W	Grab		
	QW3	57° 41.00'N 004° 11.09'W	Grab		
Saltburn Pier	GS05	57° 41.16'N 004° 08.19'W	Grab	-11 to -12	-11.5
	GS06	57° 41.18'N 004˚ 08.13'W	Grab	-5 to -6	-6

Core samples were obtained using a vibrocore device with aluminium core tubes. Once in position, the vibrocore system was deployed to the seabed by the vessel's crane and sampling was conducted at the relevant sampling locations. Following retrieval, cores were sub-sampled at 50-centimetre (cm) intervals, photographed and logged before being despatched for analysis.

Grab samples were obtained by a grab-bucket, lowered to the seafloor in a frame. Upon contact with the seafloor, a catch switch released the bucket which drove it into the sediment and the full bucket was recovered for analysis.

2.2.2 Sample Analysis

All samples were analysed by the Laboratory SOCOTEC who are ISO17025 accredited for marine sediment analysis, and which takes part in intercomparison exercises such as QUASIMEME. The laboratory also met the limit of detection (LOD) and sensitivity requirements set out in the Clean Seas Environmental Monitoring Programme (CSEMP) Green Book (Marine Assessment and Review Group, 2020).

2.2.3 Sample Results

The sample results are summarised in this section, and the entire set of sample results are available in the spreadsheet 129_FOR_01 PoCF Pre-Disposal Sampling Results Form (SOCOTEC, 2024), provided alongside this BPEO and dredge licence application. The Quay West sample results are available in 71_FOR_01 Quay West Pre-Disposal Sampling Results Form (SOCOTEC, 2023) and have been included in results tables where relevant due to being included in the maintenance dredge and disposal licence. An interpretive discussion on the Quay West Sample results can be found in 71_REP_16 – Quay West BPEO. Chemical concentrations of dredged material below Action Level (AL) 1 are generally assumed to be of no concern, chemical concentrations between AL1 and AL2 will typically trigger further investigation. If samples exhibit concentration levels above AL2 then they are usually considered unsuitable for at sea disposal, as per the Pre-Disposal Dredge Sampling Guidance (Marine Scotland, 2017).

All organohalogen concentrations are below AL1 and so will not be discussed further.

Asbestos was identified in one of the samples, GS01 at Berth 4. No other samples exhibited the presence of asbestos. It is noted that the presence of asbestos is a health and safety concern if the material is allowed to dry out but does not affect the ability to reuse or dispose of the material in the marine environment.

2.2.3.1 Physical Properties

On average the solids were 3.9% gravel, 22% sand and 74.09% silt. High levels of silt make the material unsuitable for reuse as engineering fill or construction material. The high concentration of silt could explain the high specific gravity, which is 2.55 on average across all samples, ranging from 2.49 to 2.65.

2.2.3.2 Trace Metals

No heavy metal sample results breached AL2 limits, however, some did surpass AL1. A full breakdown of samples which had trace metal concentrations (measured in milligrams per kilogram (mg/kg) dry weight) over AL1 is outlined in Table 2.2.2. From the July 2024 samples, all results above AL1 occur within the Queens Dock vibrocore samples. As such, none of the grab samples taken from Berths 1 to 4, the West Harbour and Saltburn Pier are included in Table 2.2.2, as none exceeded AL1. One sample from the December 2023 Quay West sample exceeds AL1 for one contaminant and is shown below in Table 2.2.2.

Table 2.2.2: AL1 and AL2 Limits with Trace Metal Dry Weight Sample Results Which Exceed AL1

Metal	AL1 (mg/kg)	AL2 (mg/kg)	No of Samples exceeding AL1	Highest Recorded (mg/kg)	Average across samples in the area (mg/kg)
Queens Dock					
Arsenic (As)	20	70	1	25.9	11.02
Chromium (Cr)	50	370	1	61.9	28.67
Copper (Cu)	30	300	4	83.4	26.56
Mercury (Hg)	0.25	1.5	2	0.47	0.15
Nickel (Ni)	30	150	2	39.4	19.49
Lead (Pb)	50	400	2	131	37.73
Zinc (Zn)	130	600	3	207	89.56
Quay West					
Hg	0.25	1.5	1	0.26	0.20

Having reviewed the results against the Marine Scotland ALs, the material within the Queens Dock and Quay West is not predicted to result in any negative environmental impacts resultant from heavy metal contamination, regardless of disposal method, as no level has exceeded AL2. Additionally, the samples which exceed AL1 are only marginally above. On average across the sample results in the areas of the ISB where heavy metal contaminants exceed AL1, results are considerably below AL1.

2.2.3.3 Polycyclic Aromatic Hydrocarbons

Sample results for Polycyclic Aromatic Hydrocarbon (PAH) concentrations (measured in micrograms per kilogram (µg/kg) dry weight) are displayed in the spreadsheet entitled 129_FOR_01 PoCF Pre-Disposal Sampling Results Form (SOCOTEC, 2024) and 71_FOR_01 Quay West Pre-Disposal Sampling Results Form (SOCOTEC, 2023) for the Quay West sample results. There are several hundred different PAHs; they are a large class of chemicals. Most often, PAHs occur as a complex combination of chemicals rather than simply as individual compounds (UK Government, 2018).

A full breakdown of samples which exhibit PAH concentrations exceeding AL1 is outlined in Table 2.2.3. In the absence of AL2 values for PAHs, Environment Canada's Probable Effect Levels (PELs) have been considered to aid in understanding the effect that the presence of these PAHs could have on the marine environment (Canadian Council of Ministers of the Environment, 2024).

Table 2.2.3 includes the AL1 and PEL value by PAH type alongside the sample results. Cells that are highlighted in blue indicate that the sample has breached AL1, while yellow cells indicate that the PEL has been exceeded. It should be noted that, due to the complex nature of PAHs, not all have been assigned PELs. Where this is the case, the cell has been left blank and Not Applicable (NA) entered in the cell.

It is noted that for the Samples taken in 2024, in all instances the highest recorded values were associated with GS02, taken in Berth 3. An average of the results excluding that sample has therefore been provided to provide an understanding of typical contamination levels across the rest of the dredge areas.

Table 2.2.3: PAH Results which Exceed AL1 and PELs

PAH	AL1 (µg /kg)	PEL (µg /kg)	No of Samples exceeding AL1	Highest Recorded (µg /kg)	Average across all samples (µg /kg)	Average across samples excluding GS02 (µg /kg)
	Queens Dock, Berths 1 to 4, West Harbour and Saltburn Pier					
Acenaphthene	100	88.9	1	1430	310.51	30.64
Anthracene	100	245	2	1400	129.44	23.56
Benz(a)anthracene	100	693	1	227	48.36	39.96
Benzo(a)pyrene	100	763	1	117	51.08	47.61
Benzo(b)fluoranthene	100	NA	1	117	61.3	58.37
Benzo(K)fluoranthene	100	NA	1	121	57.35	45.0
Chrysene	100	846	1	260	55.94	45.20
Diben(ah)anthracene	10	135	3	14.7	12	11.33
Fluoranthene	100	1494	6	4370	314.47	101.02
Fluorene	100	144	1	1270	207.21	30.08
Naphthalene	100	391	1	473	44.88	19.70
Phenanthrene	100	544	3	2770	201.02	65.81
Pyrene	100	1398	5	2570	214.75	90.79
Total Hydrocarbon Content (THC)	100,000	NA	19	314,000	177,050	NA
	Quay West					
Fluoranthene	100	1494	1	141	113.45	NA
Perylene	100	NA	1	101	75.7	NA
THC	100,000	NA	1	117,000	76,666	NA

On average across the 2024 samples, only one sample exceeds AL1 once results from GS02 are excluded. It is important to note that the sole exceedance of AL1 is negligible, over the threshold by 1.02% and significantly below the PEL of 4370 µg/kg. All other results present an average across the dredge areas which are comfortably below the AL1 thresholds.

When considering the PEL exceedances at Berth 3, the neighbouring berths (Berths 2 and 4) do not exhibit such high concentrations which suggests that the high concentrations are localised in nature. However, additional sampling will be required to characterise the nature and extent of the PAH concentrations within Berths 2, 3 and 4. As such, the Berths 2, 3 and 4 will be excluded from this maintenance licence and the following BPEO methodology will not consider these areas for the following sections.

It is not anticipated that the level of PAHs at the Queens Dock, Berth 1, the West Harbour and Saltburn Pier, will cause any significant environmental effects. Hence, it is not expected that these results will prohibit any dredge spoil options with Berths 2, 3 and 4 removed from the considerations.

3 BPEO Methodology

In identifying the BPEO for the proposed dredging works, the following methodology has been employed:

- Identification of options available for material disposal;

- Screening to eliminate unsuitable options;
- Scoring of remaining options; and
- Comparison of options and identification of the BPEO.

3.1 Option Identification

Options for management of material within the proposed dredge area were identified through discussions with the PoCF.

3.2 Screening

All options were screened against minimum criteria. Each option had to meet all the minimum criteria in order to be taken forward for detailed consideration. Any option which failed to meet one or more of the criteria was not taken forward for detailed assessment. The criteria are as outlined below:

- The proposed option must be suitable for the physicochemical characteristics of the material;
- It must be technically viable;
- It must be legally compliant; and
- Must not prevent operational activities at ISB.

3.3 Scoring

Attributes utilised in the options assessment were identified and scored out of 5, with 1 being the worst performing and 5 being the best. Each score has been designated a colour to aid visual comparison. Attributes are outlined in Appendix 1.

Options which met minimum criteria and progressed to detailed assessment were scored against each attribute (Appendix 2). Reasoning for the corresponding scores is provided in Appendix 3.

3.4 Comparisons of Options and Identification of the BPEO

Following the scoring of the options, a detailed comparison was undertaken to identify the BPEO.

4 Assessment of Options

4.1 Identification of Options Available

Several options were identified for the management of material within the proposed dredge area, including both terrestrial and marine based disposal options. Options identified are outlined below:

- Do Nothing;
- Disposal to Landfill;
- Dredge with Disposal to Sea – assumed at CR019 Deposit Site;
- Bed-Levelling by Plough Dredge;
- Beneficial Re-Use within the ISB; and
- Beneficial Re-Use elsewhere.

4.2 Unfeasible Options

Options were screened against the minimum criteria outlined in Section 3.2. This process eliminated four of the six options as they do not meet one or more of the screening criteria. The reasoning behind discounting the four options is discussed below.

4.2.1 Do Nothing

To not undertake dredge works within the identified area would impose a significant operational impact on the ISB. The seabed within the area must attain operational depths of up to -12m CD to allow a range of vessel types to berth, in keeping with the motive for the ISB. This option would breach the meet the minimum criteria of not preventing the operations at the ISB. As such, this option will not be taken forward to assessment.

4.2.2 Disposal to Landfill

This option involves the disposal of the dredge spoil to landfill. For this option to be possible, dredged material would need to be brought to land, de-watered and stored within the harbour area prior to loading onto trucks and transport to a landfill site. Following dewatering, the material would possess suitable physiochemical characteristics for disposal to land.

Dewatering does, however, require space and time to be implemented effectively. As the port is operational with clients utilising laydown space currently, an appropriate area for the volume of dredge material would not be technically viable, nor would it be practicable within a suitable timeframe to avoid impacts to operations at the ISB. In addition, disposal of dredge material to landfill does not align with the waste hierarchy and government policy.

The option of dredging with disposal of dredge spoil to landfill does not meet two of the minimum criteria: being technically viable and not causing risk to operations. With spatial issues and impact to operations considered, this option presents an unacceptable risk and will not be taken forward to assessment.

4.2.3 Beneficial Re-Use Within the ISB

Dredged material can be suitable as infill material if the appropriate particle size distribution (PSD) and chemical characteristics are meet and that there is sufficient volume available for reuse. Suitable material is generally made up of sands and gravel. Large volumes are also required to ensure the costs of processing is viable.

An average of 74.09% silt content across the total dredge area indicates that the dredged material from this area would not be technically suitable for re-use as a construction material, for example as infill material within the ISB. As such, this option will not be brought forward for considerations.

4.2.4 Beneficial Re-Use Elsewhere

As outlined in Section 4.2.3, dredged material may be suitable for re-use in construction scenarios, dependant on the dredge spoil material PSD, chemical characteristics and available volume. Other uses for dredge spoil include coastal remediation works, agricultural works, habitat creation or improvement, among other things.

A number of steps must be taken before dredge spoil can be re-used at another site. First it must be landed to an appropriate laydown space which will be able to accommodate the volume of dredge spoil being removed. In order to transport the material, it must be dewatered. Dewatering does, however, require space and time to be implemented effectively. As the port is operational with clients utilising laydown space currently, a suitable area for dewatering may not be available in the time scales required. Following dewatering, the material would require to be loaded onto sealed HGVs, to minimise the risk of spillage. Hard standing areas would be required to allow HGVs to receive the dredge spoil loaded by mechanical excavators. Once loaded, the dredge spoil would be delivered to another site for re-use.

This option requires a large amount of space for storage and processing of dredge spoil, including dewatering, loading of trucks for transport to the reuse location. The space required, in conjunction with the high silt content of the dredge spoil, it is not deemed technically viable, and so this option will not be taken forward for further consideration.

4.3 Assessment of Feasible Options

Following the screening process, the options to take forward for detailed assessment are to:

- Dredge with Disposal to Sea; and
- Bed-Levelling by Plough Dredge.

Each of these options have been assessed against the attributes detailed in Appendix 1. The options scoring is provided in Appendix 2 with the reasoning for attribute scoring provided in Appendix 3.

4.3.1 Dredge with Disposal to Sea – Assumed at CR019 Deposit Site

Backhoe and cutter suction dredge techniques have proved successful at the ISB before and there are numerous dredge spoil deposit sites in Scottish waters for the deposition of dredged material. Dredge Spoil Deposit Site CR019, henceforth known as Sutors, is an open spoil deposit site which is located approximately 11 km east of the proposed dredge works at the ISB.

Sutors has been identified as the most appropriate disposal site due to its geographical location in relation to the proposed works, being located approximately 11km east. Initial mobilisation of equipment to conduct dredging operations is minimal, and the 22 km round-trip for disposal of the material is unlikely to impact timescales to complete the dredging campaign. Subsequently, cost is also kept relatively low with this option, due to the nearby location of the disposal ground which will reduce the running cost of marine plant required for dredge and disposal.

Environmental impacts are minor but will need to be mitigated, due to the potential for physical harm to marine mammals during dredge disposal at the Sutors.

It is recognised that disposal of material to sea disposal sites is established industry practice and has been completed by PoCF regularly. As the activity is standard practice, the legislative complexities involved are relatively simple with little management required to comply with legislation.

Overall, the Dredge with Disposal at Sea option scores: **31 out of 40.**

4.3.1 Bed-Levelling Plough Dredge

Plough dredging involves the redistribution of sediment from higher areas of the seabed to lower parts using a plough which is dragged by a vessel that passes over the area, hence levelling the sediment to a determined depth.

At the ISB, the maintenance dredge will cover various areas across the ISB site: the Queens Dock, berths 1, 5, and 6, the West Harbour and Saltburn Pier. Each location will exhibit varying levels of sediment build up, depending on the individual location and associated current movements. As such, plough dredging may be viable at some locations, at some point in time.

In areas of significant sediment build up, where excessive sediment would need to be removed to maintain a depth, a disproportionate number of plough dredge vessel passes would be necessary, which would make this option technically unviable. Knock-on time implications would be expected due to the length of time that the plough dredge vessel would need to be in the ISB to level the areas of significant sediment build up. This could result in clashes with ongoing operational activities at the ISB and other activities associated with the ISB. However, there may be areas where plough dredging would be an appropriate method to level the seabed where areas of sedimentation are limited.

In areas where sediment build up is limited, the option to plough dredge exhibits few logistical and cost impacts. Material removed from the high points of the seabed will be distributed to deeper areas of the identified bed-levelling area. This will maintain water depths across the entire area and hence achieve an appropriate operational depth at berthing areas in the ISB.

In areas of the ISB where an appropriate volume of sediment is being redistributed via plough dredge, then there are no anticipated operational constraints associated with this option, and the material does not cause concern for public or environmental health within the proposed dredge location. Environmental effects on water quality from a plough dredge are very limited, localised and temporary.

Plough dredging is technically a simple solution to ensure that the seabed is levelled without being over dredged, although would not be suitable for areas which exhibit significant levels of build-up. As such, only areas within the ISB which do not exhibit excessive sedimentation have been taken forward to be scored.

The Plough Dredge option scores: **38 out of 40.**

4.4 Comparison of Options

As detailed in Appendix 3, both options score well with Plough Dredge scoring equal or higher than Dredge with Disposal to Sea on all attributes. The use of a plough is most suited to removal of high spots, as it levels the material through the area. Dredge with Disposal is more appropriate for the removal of large pockets of material. This is reflected in the scoring with the option to Dredge with Disposal to Sea scoring 31 compared to bed levelling by Pough Dredge scoring 38 out of 40. However, as discussed in Section 4.3.1, plough dredging will not be appropriate or technically viable in all areas of the proposed maintenance dredge area. As such it is likely that both methods will be used at the ISB, as both options are the BPEO for use in different circumstances.

5 Conclusion

As highlighted in Section 2.2.3.3, the PAH results indicated that, due to high PAH levels present within the GS02 sample at Berth 3, additional sampling be required to characterise the level of contaminant and the area which exhibits levels of PAHs above AL1 and the PEL. As such the decision was made not to pursue a dredge licence for Berths 2-4 until additional sampling is completed.

For the rest of the dredge area, the options that passed screening are dredge with disposal to sea and bed levelling by plough dredge. Both scored favourably and will be appropriate for use in different scenarios within the ISB. Plough dredging will be appropriate for areas where high spots are localised and there is not an excessive build-up of sediment on the seabed, whilst dredging and disposing to sea will be more appropriate for the removal of large volumes of material. These options will avoid additional costs, time, and logistical constraints associated with other options that were considered, with minimal environmental disruption.

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Glossary

Acronym	Definition
AL	Action Level
As	Arsenic
BPEO	Best Practicable Environmental Option
CD	Chart Datum
cm	Centimetre
Cr	Chromium
CSEMP	Clean Seas Environmental Monitoring Programme
Cu	Copper
Hg	Mercury
ISB	Invergordon Service Base
LOD	Limit of Detection
m	Metre
mg/kg	Milligrams per kilogram
NA	Not Applicable
Ni	Nickel
PAH	Polyaromatic Hydrocarbons
Pb	Lead
PEL	Probable Effect Level
PoCF	Port of Cromarty Firth
PSD	Particle Size Distribution
THC	Total Hydrocarbon Content
µg/kg	Micrograms per kilogram
Zn	Zinc

Appendix 1: Attributes

Attribute	Description	1	2	3	4	5
Alignment with Policy	How complex are the regulator requirements and what risks are posed.	In direct conflict with policy.	Does not fully align with policy.	No policy implications.	In the spirit of policy.	Positively implements policy.
Cost	Financial Cost of the Option.	>£ 500,000	£300,000 to £500,000	£150,000 to £300,000	£50,000 to £150,000	<£50,000
Timescale	Impact of works on project programme.	Methodology would extend the project programme.	High risk works couldn't be completed within required timescale.	Slight risk works couldn't be completed within required timescale.	Allows works to be completed within required timescale.	Allows works to be completed comfortably within required timescale.
Distance	Impact location has on logistics for material movements.	Beyond 50 miles.	40-50 miles.	30-40 miles.	1-30 miles.	Within 1 Mile.
Material Suitability	Is the chemical makeup of the dredge material suitable for the option selected?	Not all of the material is acceptable.	Requires significant mitigation to be made suitable.	Acceptable with mitigation.	Acceptable material for option.	Ideal material for option.
Technical Feasibility	Is the option within the capabilities of PoCF to carry out?	Technology not proven.	Complex requirements, but proven technology.	Simple proven technology available.	Practicable with basic management.	Standard practice.
Environmental Effects	Potential environmental effects associated with implementing the option.	Very Significant.	Significant.	Minimal.	Trivial.	None.
Legislative Complexity	How complex are the regulator requirements and what risks are posed.	Significant risk additional permits, licences or consents will not be granted.	Requires significant additional permits, licences or consents.	Requires additional permits, licences or consents.	Minor management required to comply with legislation.	Complies with all relevant legislation.

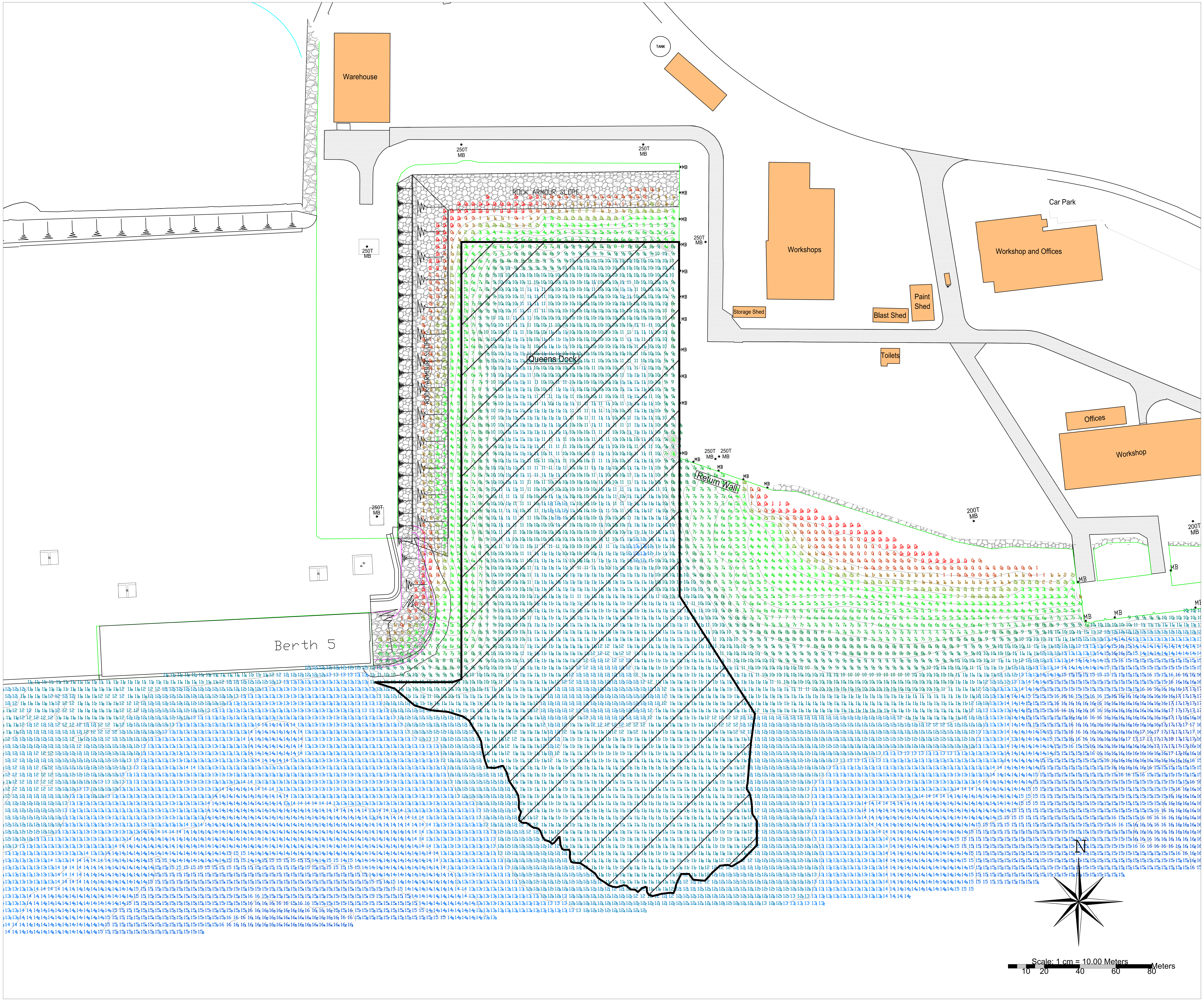
Appendix 2: Options Scoring

Attribute	Dredging with Disposal to Sea at CR019 Deposit Site	Bed-Levelling by Plough Dredging
Alignment with Policy	2	4
Cost	4	5
Timescale	4	5
Material Suitability	5	5
Distance	4	5
Technically Feasibility	4	5
Environmental Effects	3	4
Legislative Complexity	5	5
Total	**31**	**38**

Appendix 3: Reasoning for Attribute Scoring

Attribute	Dredging with Disposal to Sea	Bed-Levelling by Plough Dredging
Alignment with Policy	Disposal at sea is low on the waste hierarchy and as such does not align to policy.	This option does not give rise to waste and therefore is aligned with the Zero Waste Scotland by 2025 Policy (Scottish Government, 2010).
Cost	There are associated costs with marine plant required to conduct a dredge and transport the spoil to the disposal site.	There costs with marine plant required to conduct a plough dredge.
Timescale	The dredge and disposal at sea could be completed within the required timeline, additional time will be required to transport material to the Sutors.	The plough dredge can be completed in line with the required timeline.
Material Suitability	The dredge spoil will be suitable for disposal at sea.	The chemical and physical properties of the dredge spoil are suitable for plough dredging.
Distance	The distance from the Sutors site is 11km from the works site, meaning a 22km round trip would be required for disposal at sea.	There is no distance aspect associated with plough dredging.
Technically Feasibility	Disposal at sea is an established industry practice. PoCF have previously completed disposal to sea.	Plough dredging is standard practice and can be exempt from Marine Licencing.
Environmental Effects	The location of the Sutors within the Moray Firth SAC is an area popular with numerous marine mammal species. As such, visual marine mammal observations will generally be conducted at set observation locations at either North or South Sutor, or on the disposal vessel or separate observation vessel if required. Potential temporary increase in solids in the water column at both dredge and disposal grounds.	Increased sediment in the water column will be at depth only and reduce quickly.
Legislative Complexity	Legislative complexities around disposal at sea are relatively simple and will require minor management.	Legislative complexities around plough dredging are simple and will require minor management.

Drawing PoCF_Dredge_QD_001 (Rev01)



Notes:

Soundings, in metres and decimetres, are reduced to CHART DATUM, using automatic TG

Soundings shown in a 4m X 4m Matrix binned from lines of Multibeam, run using a Reson 7125 Echosounder with the MINIMUM depth in each cell, centred in the cell

Contours shown at 1m intervals

Grid in the Modelspace is OSGB

Dredge Boundary

Project:

Queens Dock Dredging

Source of Survey Data:

Multibeam Bathymetric Survey
Invergordon Quays -Invesigation Survey

Client:

Port of Cromarty Firth
Port Office
Shore Road
Invergordon
IV18 0HD

PORT OF CROMARTY FIRTH

Engineer:

Capt. G Grant
Port of Cromarty Firth
Port Office
Shore Road
Invergordon
IV18 0HD

Surveyed by:

CSL
CLYDESIDE SURVEYS LTD
Unit 10, 19 Gordon Avenue
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Glasgow, G52 4TG
Tel: 0845 00 66 211
Fax: 0845 00 66 212
Email: info@clydeside-surveys.co.uk

Date of Drawing:

15 February 2024

Date of Survey:

14 August 2023

Scale:

NTS

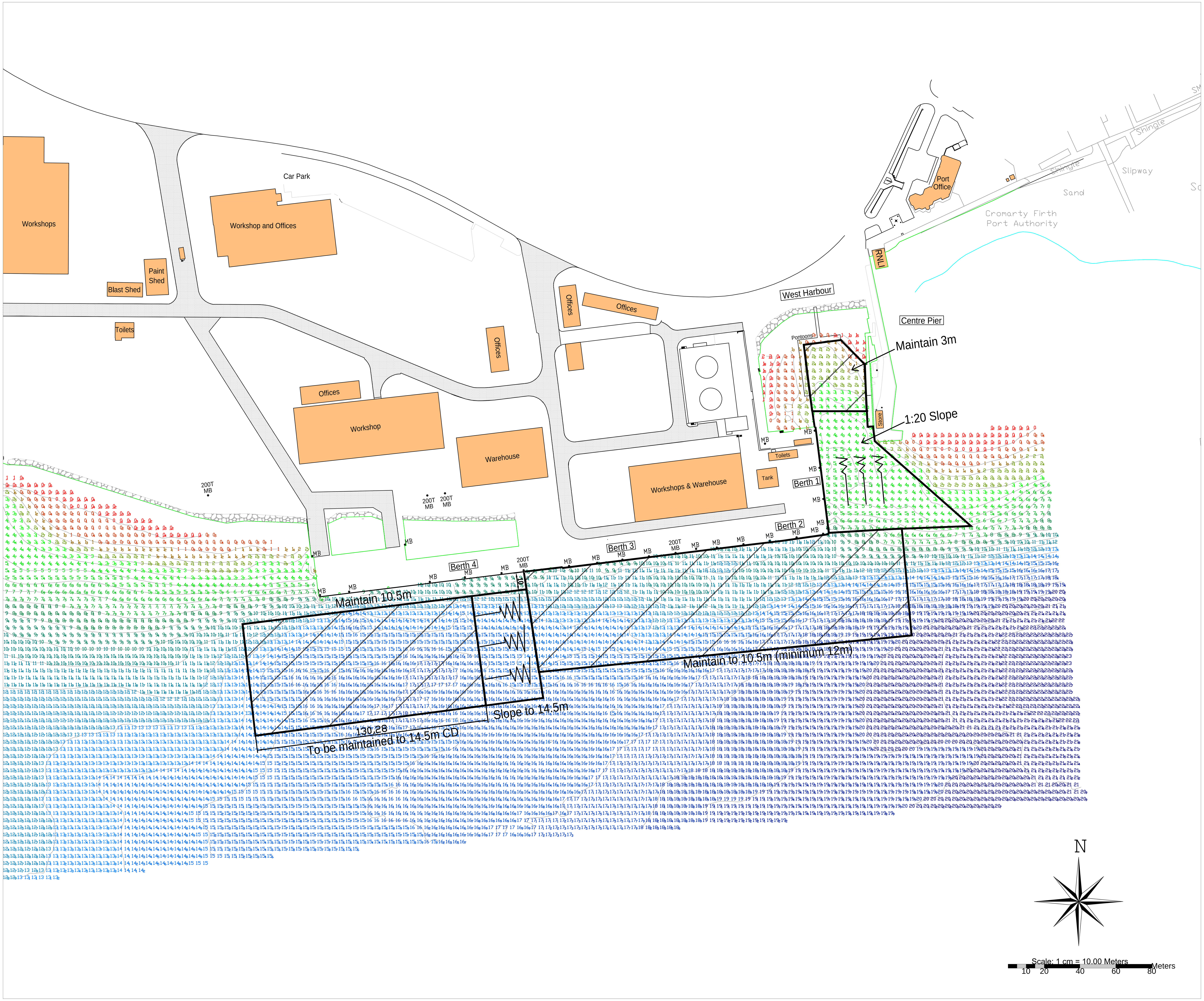
Project Drg No:

POCF_Dredge_QD_001 (Rev01)

Survey Drg No:

POCF-Quays_15-03
Sheet 3 of 3

Drawing PoCF_Dredge_B1-4_001 (Rev01)



Notes:

Soundings, in metres and decimetres, are reduced to CHART DATUM, using automatic TG

Soundings shown in a 4m X 4m Matrix binned from lines of Multibeam, run using a Reson 7125 Echosounder with the MINIMUM depth in each cell, centred in the cell

Contours shown at 1m intervals

Grid in the Modelspace is OSGB

Dredge Boundary

Project:

Queens Dock Dredging

Source of Survey Data:

Multibeam Bathymetric Survey
Invergordon Quays -Invesigation Survey

Client:

Port of Cromarty Firth
Port Office
Shore Road
Invergordon
IV18 0HD

PORT OF CROMARTY FIRTH

Engineer:

Capt. G Grant
Port of Cromarty Firth
Port Office
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CLYDESIDE SURVEYS LTD

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Email: info@clydeside-surveys.co.uk

Date of Drawing:

01 March 2024

Date of Survey:

14 August 2023

Scale:

NTS

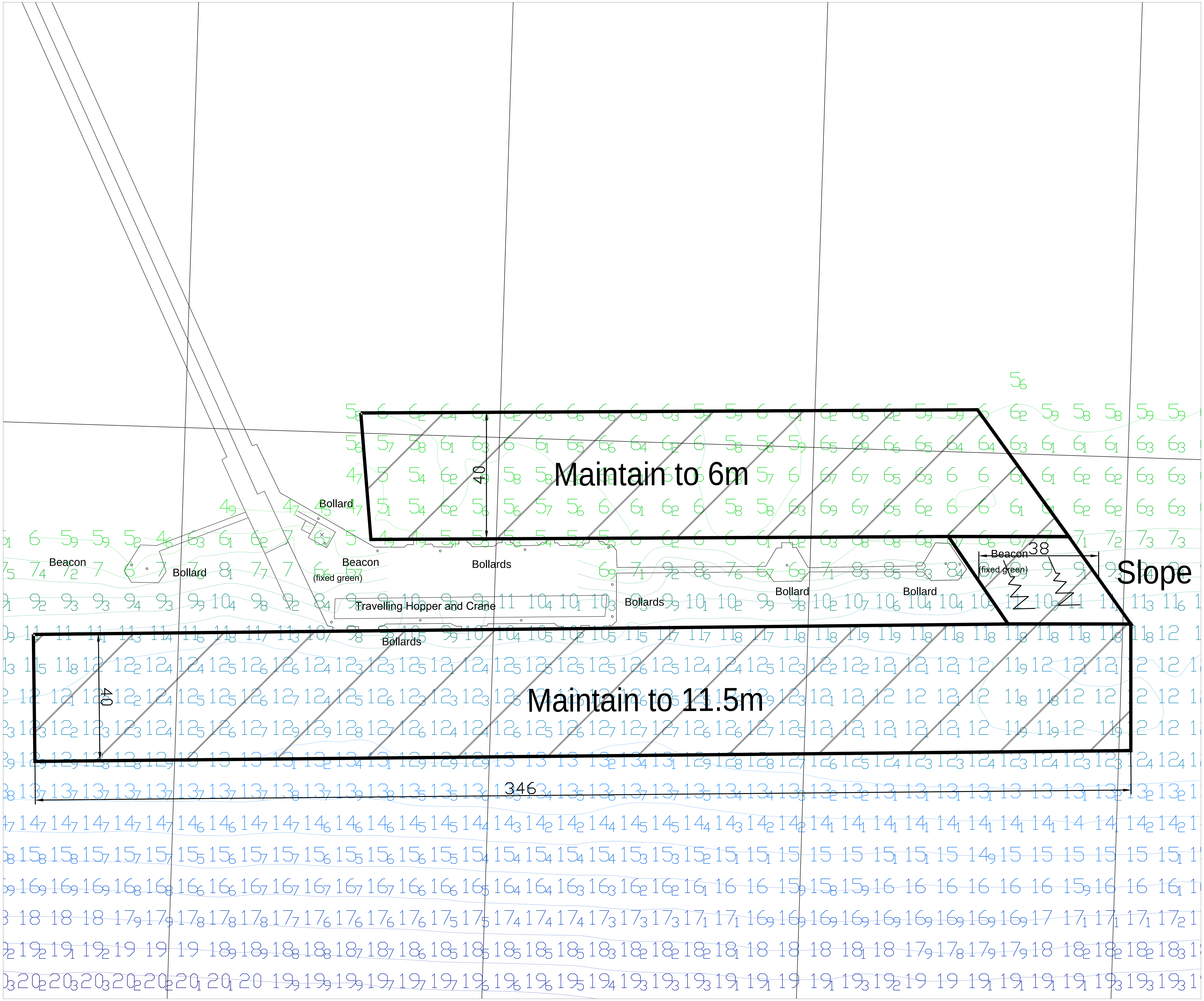
Project Drg No:

POCF_Dredge_B1-4_001 (Rev01)

Survey Drg No:

POCF-Quays_15-03
Sheet 3 of 3

Drawing PoCF_Dredge_SB_Pier_001 (Rev01)



Notes:

Soundings, in metres and decimetres, are reduced to CHART DATUM, using automatic TG

Soundings shown in a 4m X 4m Matrix binned from lines of Multibeam, run using a Reson 7125 Echosounder with the MINIMUM depth in each cell, centred in the cell

Contours shown at 1m intervals

Grid in the Modelspace is OSGB

Dredge Boundary

Project:

Saltburn Pier Dredging

Source of Survey Data:

Multibeam Bathymetric Survey
Invergordon Quays -Invesigation Survey

Client:

Port of Cromarty Firth
Port Office
Shore Road
Invergordon
IV18 0HD

Engineer:

Capt. G Grant
Port of Cromarty Firth
Port Office
Shore Road
Invergordon
IV18 0HD

Surveyed by:

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Date of Drawing:

7 March 2024

Date of Survey:

14 August 2023

Scale:

NTS

Project Drg No:

POCF_Dredge_QD_001 (Rev01)

Survey Drg No:

POCF-Middle Area_02_02
Sheet 2 of 8