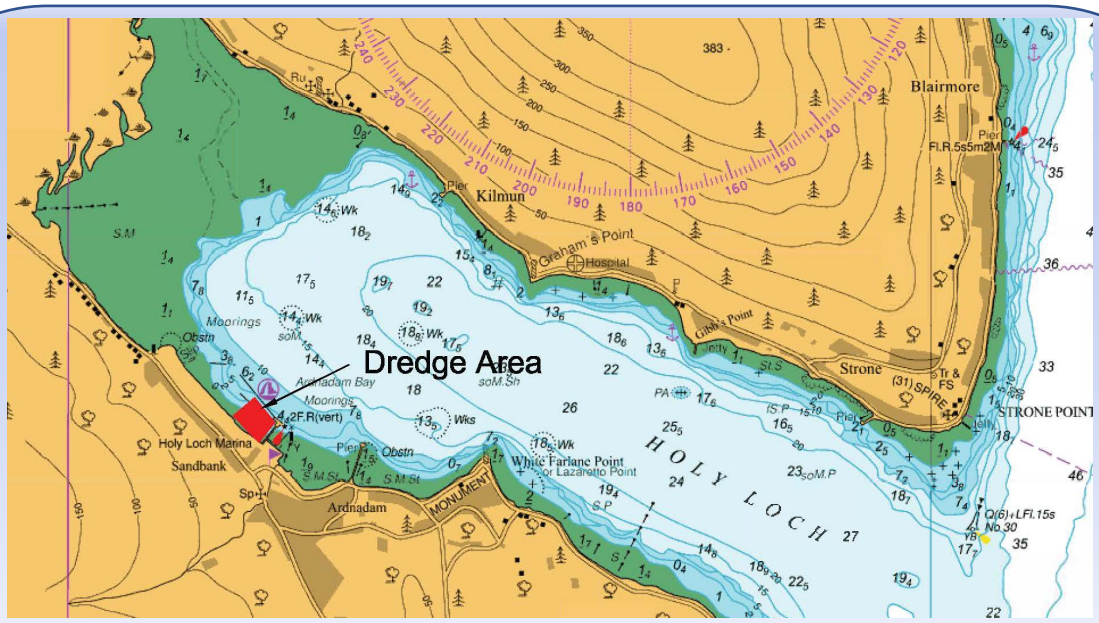
Holy Loch Marina

Capital Dredging Application

Best Environmental Practicable Option Assessment



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TUESDAY, 07 MAY 2019

Contents

1. Scope

The purpose of this document is to determine the Best Practicable Environmental Option (BPEO) for dealing with dredged material from the proposed dredging works at Holy Loch Marina. Methods will be considered against their environmental suitability, strategic benefit, health and safety, and cost.

Section 4.2 of the report also details the General Policies from Scotland's National Marine Plan that support this proposal and therefore in conjunction promote the long term development of Holy Loch Marina.

The report is structured as shown below:

Section 2 – Introduction

Section 3 – Available Options

Section 4 – Most Practicable Option

Section 5 – Supplementary Information

Section 6 – Conclusions

2. Introduction

2.1. Background

Figure 1. 1 - The View Seaward from Holy Loch Marina

Holy Loch Marina Ltd aims to carry out a dredging operation to improve the operational efficiency of the marina and assist the access and egress of all vessels using the facility. Operationally the Marina now experiences frequent and sometimes acute difficulties at low tide. To allow for the safe use of this important local facility the minimum depth of water available needs to be urgently increased.

The construction methods used to form the marina, mean that the current sea bed profile is not uniform. Also, the natural movement of waterborne sediment has resulted in the settlement of silt and fines in important areas of the marina. This has reduced the depth available, at low tide, to the point where larger vessels are restricted in the time that they can refuel or from entering their designated berths. It is envisaged that the only method of dealing with these issues is to carry out a dredging operation as further outlined in this assessment.

2.2. Proposed Dredging Works

Figure 2. 1 - Coastworks's workboat Challenger.

The proposal is to dredge an area of approximately 1.2ha. The aim is to increase the depth available within the dredge area by an average of 660 mm. It has been estimated that the dredging work will remove a volume of 7,200m3 or circa 9360 tonnes (wet weight).

Holy Loch Marina intends to appoint Coast Works Operations Ltd to undertake the dredging work. These two companies have a long-standing relationship as Coastworks assisted with elements of the marina's original construction work. During a pre-application consultation with Brian Young of Coastworks, it was proposed that plough dredging would be the most appropriate method of removing the volume of sediment required here.

Coastworks use powerful shallow draught workboats to carry out plough dredging. These vessels are twin engine, and keel cooled which makes them well suited to working in shallow and confined areas where good manoeuvrability is key to successful operations. For the works at Holy Loch Marina, Coastworks wants to use their vessel Challenger as shown in Figure 2. 1.

Plough dredging using Challenger is one of the most economical, flexible and quiet forms of dredging available. Challenger can work around other vessels and within the confines of the marina without disrupting the area outwith the dredge boundary. As a further benefit to using this vessel, there are no hazards associated with anchors and wires as used by some dredgers.

2.3. Source of Material

The marina was originally dredged using a system of carefully located causeways or isthmuses that allowed a land-based dredging operation to be completed. Earthmoving plant was used to dredge the seabed with the arisings transported to onsite settlement lagoons, where it was left to dry out and consolidate as part of a carefully designed land reclamation operation. Construction of Holy Loch Marina was carried out under a terrestrial planning application as issued by Argyll and Bute Council in 2007 ref No: 06/00589/DET

Figure 2. 2 - Ordnance Survey Aerial Image, showing remnants of the most Northerly dredging isthmus

Although the long reach excavator used during the original dredging operation had an early form of machine control, this Prolec system could not coordinate the effective realignment of each bucket during the excavation process. Therefore a lot of the dredging work relied heavily on the skill of the operator who had to work blind and feel through machine feedback that dredging was progressing in the correct location and at the correct depth. Subsequent hydrographical surveys of the area show that this operation has left some high spots. These are either in areas that were beyond the reach of the excavator or have occurred due to the seabed surcharging under the combined load of the causeway and earthmoving plant.

Although most of the material to be dredged can be attributed to high spots, omitted from the original dredging work, some must be associated with the natural settlement of sediment. As can be seen from the aerial image in Figure 2. 2, the marina is surrounded by shallower areas of foreshore. From the sampling procedure, we know that the particle analysis of this sediment describes significant amounts of silts and clays. These will readily enter suspension when exposed to wave action. As the marina is as sheltered as possible from the effects of wave action and tidal currents it is easy to understand why natural sedimentation effects are exaggerated in the proposed dredge area.

2.4. Material Testing

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Testing of sediment deposits has been carried out by RPS (compound testing & particle size analysis). The test results are provided in PDF format as supplied by the laboratory and in Marine Scotland's Pre-Disposal Sampling spreadsheet, both of which accompany this document.
An extract from the sample results is given below which confirms that the majority of the sediment is made up of mud (silts and clay).

Table 2. 1 – RPS Particle Size Analysis – Sediment Samples 1 – 6

			Customer Sample No	**Sample 01**	**Sample 02**	**Sample 03**	**Sample 04**	**Sample 05**	**Sample 06**
			Customer Sample ID	Pre-Dredge	Pre-Dredge	Pre-Dredge	Pre-Dredge	Pre-Dredge	Pre-Dredge
			RPS Sample No	399506	399507	399508	399509	399510	399511
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location						
			Sample Depth (m)						
			Sampling Date	26/03/2019	26/03/2019	26/03/2019	26/03/2019	26/03/2019	26/03/2019
			Sampling Time						
Sediment	**mm**	**phi ϕ**	**Units**						
Very coarse gravel	>32<64	<-5>-6	%	0.00	0.00	0.00	U/S	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	0.00	0.00	6.90	U/S	11.80	0.00
Medium gravel	>8<16	<-3>-4	%	0.00	0.00	0.39	U/S	12.00	4.98
Fine gravel	>4<8	<-2>-3	%	0.00	0.00	0.24	U/S	10.10	2.07
Very fine gravel	>2<4	<-1>-2	%	0.00	0.00	0.33	U/S	14.90	2.72
Very coarse sand	>1<2	<0>-1	%	0.00	0.00	0.30	U/S	8.82	2.29
Coarse sand	>0.5<1	<1>0	%	0.00	0.00	1.09	U/S	8.61	11.10
Medium sand	>0.25<0.5	<2>1	%	0.00	0.07	2.63	U/S	3.54	5.06
Fine sand	>0.125<0.25	<3>2	%	0.00	0.25	1.54	U/S	0.11	0.86
Very fine sand	>0.0625<0.125	<4>3	%	3.00	5.18	10.10	U/S	3.73	11.70
Very coarse silt	>0.03125<0.0625	<5>4	%	28.10	28.70	24.00	U/S	7.61	19.40
Coarse silt	>0.015625<0.03125	<6>5	%	31.70	30.70	23.00	U/S	6.43	15.60
Medium silt	>0.007813<0.015625	<7>6	%	15.60	14.70	11.70	U/S	4.82	9.25
Fine silt	>0.003906<0.007813	<8>7	%	11.10	10.40	8.64	U/S	3.76	7.22
Very fine silt	>0.001953<0.003906	<9>8	%	5.53	5.24	4.63	U/S	2.05	4.00
Clay	<0.001953	>9	%	4.96	4.76	4.66	U/S	1.80	3.80
Statistics*	Mean (phi)			5.84	5.76	5.21	U/S	0.272	4.00
	Sorting			1.46	1.48	2.95	U/S	4.16	3.33
	Skewness			0.373	0.364	-0.166	U/S	0.380	-0.257
	Kurtosis			1.02	1.04	2.29	U/S	0.717	1.00
	% Silt/Clay		%	96.99	94.50	76.63	U/S	26.47	59.27
	Textural Group**			Mud	Mud	Gravelly Mud	U/S	Muddy Gravel	Gravelly Mud

3. Available Options

3.1. Land Incineration, Spreading on Land, Landfill and Soil Conditioning

This section outlines the methods that will be considered as part of the BPEO assessment. Where a method is deemed impractical, the justification for this will be provided, and the method will not be progressed further.

Due to the location of the marina any option involving the removal of the material by road would meet with significant public objection. The pier adjacent to the marina is used as a timber extraction facility and is frequently served by class one heavy goods vehicles. In general, the Sandbank residents object to the use of this facility, seeing the movement of HGV's within the community as a nuisance. So increasing HGV movements in the area by approximately five hundred journeys would exacerbate this situation.

Also to avoid endangering other road users, arisings would have to be allowed to dry, thus reducing the water content in the dredged material to a point where it would not leak or slop from locally available tipper trucks. The only possible method of doing this would be to store the arisings onsite, in a settlement lagoon, before its onward transportation to a suitable landfill site. Although the marina carried out a similar procedure of drying sediment for subsequent use in land reclamation, during the initial construction operation, all of the areas previously allocated for this process are now full to capacity. Of course, specialist tanker vehicles could be hired that would remove the need for this drying procedure, but as none are locally available, the cost would be prohibitive.

Note also that the nearest landfill site that can accommodate this volume of sediment is more than sixty miles away, local land is used for grazing and ground loss as the result of spreading is not cost effective.

It is therefore concluded that road transport based options including land incineration, spreading on land, landfill and soil conditioning do not warrant further consideration

3.2. Beach Replenishment

The relatively high amount of clay and silts shown in the particle size analysis from the sediment samples suggests that the dredge material would be unsuitable for beach replenishment. This alternative would also require the transportation of the material over public roads. As explained in section 3.1 HGV journeys to neighbouring beaches would be deemed by the local community as a nuisance. Also, there are no local sites that require this treatment or that could allow access to the amount of plant required for the safe deposition of this volume of sediment. This option can, therefore, be discounted.

3.3. Coastal Protection / Land Reclamation

There are no nearby areas that would benefit from the dredged material (e.g. salt marshes, etc.). Further afield destinations would involve significant transport distances. Given that this would have to be done by vessel (i.e. road transport as discussed in section 3.1 is not locally acceptable) and there may be issues regarding the contamination levels of the material this option for disposal has therefore been discounted.

3.4. Sea Disposal

During pre-application consultation with Coastworks, the use of sea disposal was discounted as it is a far more expensive way of dredging relatively small volumes. The greater expense is due to the increased amount of specialist plant required. These items of plant would also occupy a greater area within the dredge site. This would cause a significant operational burden on the continued use of the marina during the dredging works.

To carry out the dredge in this manner the following plant would be needed:-

1. A split hopper barge as shown in Figure 3. 1
2. Suitable tug or workboat to tow the split hopper to MA021 disposal site
3. Either Spud leg barge and excavator or specialist dredging apparatus to load the split hopper with dredged arisings.

Figure 3. 1 – Coastworks split hopper barge in the open position

Although the disposal site MA021 is only about 4.5km from the marina, each return journey would take approximately two hours to complete. Also, safety considerations would prevent the towing operation from progressing in poor weather conditions. As the works are scheduled for early Autumn 2019, it is inevitable that weather delays would be encountered. For these reasons, sea disposal has been discounted.

3.5. Land Based Long Reach Excavators with Dredge Material Deposited in Deeper Water

This method of completing the dredging work has to discounted as the distance to the main dredging area from the foreshore is too large. To accommodate this distance, the size of plant required would be huge. Hire rates and transportation costs would, therefore, be disproportionate when set against the relatively small volume of material being excavated.

3.6. Barge Mounted Diggers with Dredge Material Deposited in Deeper Water

As discussed in section 2.3 the marina was originally formed using long reach excavators. The majority of the reason that this dredging work is now required is to overcome the inability of this plant to accurately control the level of excavation while working blind in silt-laden water. To overcome this problem specially designed dredging plant that utilises machine control systems and can accurately control the dredge level in conjunction with a three-dimensional dredge plan.

Unfortunately, this level of specialism comes at a cost which can not be associated with the small quantity of dredging work required here. Therefore this method of dredging has been discounted.

3.7. Do Nothing Approach

As previously described in section 2.1, depth restrictions in the marina are currently causing severe low tide operational difficulties. These limitations are now impacting on the long term viability of the marina. In recent years landing facilities at Holy Loch Marina have been used by cruise liners to allow passengers to visit the Cowal Peninsula. Currently only careful forward planning prevents these operational restrictions from impacting on the duration and timing of these visits. Our dredging proposal will ensure the that tenders, used to transfer cruise liner parties, can access the marina unhindered by tidal constraints.

The marina is an important local tourist facility which is heavily used. It benefits both the local residents as well as visiting boat owners. It has generated job opportunities for local people who contribute to the local economy. Also, visiting boat owners often stock up on supplies and eat out, either in the onsite cafe or by travelling into Dunoon. To maximise these benefits the marina requires to be operational at all times. Hence the crucial need for this application to be completed and for dredging work to progress as planned. Therefore the “do nothing approach” must be discounted.

3.8. Plough Dredge With Dredge Material Moved to Deeper Water

A discussed throughout this document early consultation between Holy Loch Marina and Coastworks suggested that plough dredging would be the most cost-effective way to complete the dredging required within the marina. In support of this proposal Brian Young of Coast works supplied a fact sheet. An extract of which is given below:-

Plough dredging with a suitable tug/workboat is one of the most economical, flexible and quiet forms of dredging available. The tug/workboat can work around other vessels such as ferries and cargo vessels without disrupting their normal program and there are no hazards associated with anchors and wires as used by some dredgers.

Mobilisation to remote areas to dredge small but critical quantities, such as ferry slips, and the entrances to harbours and marinas can be carried out quickly and cost-effectively. All required equipment is carried on board the tug/workboat and can be set up ready to start works within a few hours of arrival on site.

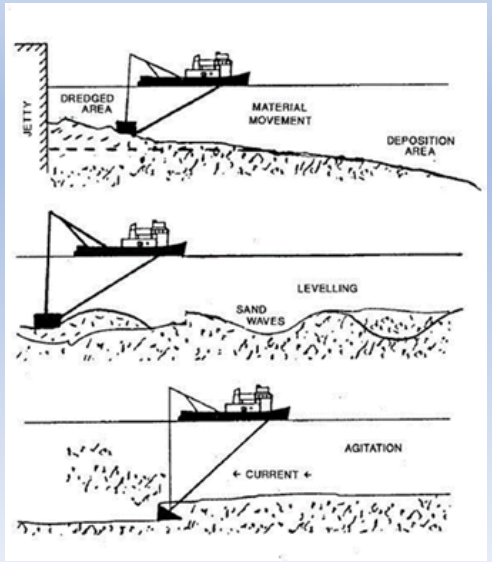


Figure 3. 2- Plough Dredging Diagram

Production levels vary depending on:

- *The type of material being moved.*
- *The distance the material is to be moved.*
- *The cycle time of the vessel.*
- *Tides, weather and traffic restrictions.*

For the above reason and as explained elsewhere in this assessment, plough dredging is the preferred option. Further justification for this decision is given in section 4.

4. Most Practicable Option

This section of the report considers the option judged to be practicable in sections 2.2 and 3.8 - that is Plough Dredging.

4.1. Plough Dredging & Natural Dispersal

4.1.1. Overview

Plough dredging will allow the surface of the sediment to be skimmed to the desired water depth in a controlled and targeted manner ensuring only the minimum amount is removed.

The disposal operation would involve dragging the sediment approximately one hundred metres into the adjoining deeper water. The waste will be spread over an equivalent area from which it was dredged. The ploughing will cause some material to become temporarily suspended in the water column. This will disperse naturally and settle on the seabed.

4.1.2. Environmental Consideration

4.1.2.1. Pollution / Contamination Implications

All sample results were generally found to be between action level AL1 and AL2 concentration. Distribution of contaminants seemed evenly spread throughout the area, apart from sample station 6, which did return Mercury, Nickel and Lead results that are above AL2. Station 6 is in the deposition zone and the area will not be disturbed by the proposed dredging works.

4.1.2.2. Public Health & Safety Implications

Plough dredging would present low risks to the public as all work will be undertaken offshore.

The work will require only a relatively short period of time estimated at one week. This along with two men being involved would result in negligible disruption to local residents and boats utilising the marina. There would be no impact on the local road network

4.1.2.3. General Ecological Implications

The material will be disposed of in its natural environment, it is not anticipated that there will be any significant impacts on ecology (flora and fauna).

This would be the preferred option given the immediate proximity of the disposal location and is a tried and successful method of disposing of the material from the dredging operation.

4.1.2.4. Interference with Exiting Activities

Plough dredging would minimise any disruption to other users of the marina, but work can be easily interrupted, if need be, to minimise this impact. Further to this, current users of the marina are aware that dredging works are required and are all supportive of this proposal. During the works there will be boat engine noise in the marina, but this is not deemed an issue as all dredging work will be carried out between approximately 09:00 and 17:00 hours.

4.1.2.5. Amenity / Aesthetic Implications

This method is the preferred option as it will remove the spoil from the area in a controlled and targeted manner. It would also allow the best aesthetic finish rather than more aggressive options e.g. using excavators.

4.1.2.6. Environmental Summary

Levels of contaminants within the dredged material are below that which would result in ecological impacts. Although sample station 6 has return Mercury Nickel and Lead results above AL2, it must be stressed that this sample location will not be dredged as it is in the deposition zone. As such this section of the seabed will be covered with arisings from the dredge area A.

Sediment sampling of the disposal area has shown that similar levels of contamination are evident over this area of the Holy Loch. Therefore it can be proven that this proposal will not increase contamination to areas outwith the dredging zone.

This option is viewed as the lowest impact environmentally.

4.1.3. Strategic Considerations

4.1.3.1. Availability of Suitable Sites

With reference to the Dredge Area Location Plan – Drg No J904/HLM/02- a suitable disposal location is immediately available in the deeper water of the Holy Loch.

4.1.3.2. Public Acceptability

Plough dredging would cause noise during the contract period. However, the noise generated will be no worse than that that accepted to be ambient on a normal working day. The area concerned is sufficiently far away from any properties to keep any noise to an unobtrusive level.

Hours of working for the dredging would be approximately 09:00 to 17:00 hrs thereby avoiding socially unacceptable working hours.

There would be no impact on public roads.

This will be the preferred disposal method for dredging as there will be no increase in the amount of HGV traffic, so it is likely to be viewed as acceptable to local residents.

4.1.3.3. Legislative Implications

The spoil will be a controlled waste material. It is understood that the works will require a licence from Marine Scotland.

4.1.3.4. Strategic Summary

This method is likely to result in minimal disruption to the public. Those most affected, the marina users, will be accepted as the work is for their benefit.

The amount of dredge material from this project is small and does not support the use of disposal options more suitable to larger scale projects. This option is viewed as the most appropriate method.

4.2. National Marine Plan

As all licence applicants are required to justify there proposal in conjunction with Scotland's National Marine Plan this proposal is deemed to comply with:-

- ***GEN 1 General planning principle:*** *There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan.*

  The promotion of tourism at Holy Loch Marina will ensure compliance with Gen 1. Refer to section 3.7 for more information.

- ***GEN 2 Economic benefit:*** *Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan.*

  For the last ten years, Holy Loch Marina has directly employed seven people who all live in the local community. The Marina also indirectly supports approximately twenty-two local companies, who between them have ninety-four employees. It can, therefore, be seen that as an important aspect of the local economy compliance with Gen 2 is unquestionable

- **GEN 3 Social benefit:** *Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan.*

  Prior to its development Holy Loch Marina was a former United States Navy Base. Regeneration of this military facility into a centre for recreation and tourism has provided a major social benefit to the area of Sandbank and wider Cowal community, therefore, supporting the principles defined in Gen 3.

- ***Chapter 12 – Recreation & Tourism*** *- Continued and improved access to marine and coastal resources for tourism activities and recreational use.*

  As noted in Gen 1 above and in section 3.7 Holy Loch Marina has become an important centre for recreation and tourism. Promotion of this proposal can, therefore, be seen to comply with the principles laid out in Chapter 12 of the National Marine Plan.

5. Supplementary Information

5.1. Control and Reduction of Sources of Contamination

As there are only some sources of low-level contamination in the samples tested by RPS, the relatively small amount of dredged material is considered unlikely to pose a pollution risk. Test samples taken in both the dredging and disposal areas are similar. Therefore removing any concern that plough dredging would simply be spreading contamination over a wider area.

The sediment is to be plough dredged South to North across the proposed area delineated in red in the pre-dredge hydrographical survey. This will move the sediment into the deeper water to the North of the marina. Given the scale of the proposed dredging and the proposed methodology, there is no opportunity to maximise the use of the dredged material as discussed in section 3.

5.2. The Minimisation of Volumes to be Dredged

The proposal is to “skim” the seabed within the 1.2ha area to remove the minimal amount of material to achieve the required depth. This will involve removing an average of 660 mm of sediment from the surface of the seabed.

6. Conclusions

6.1. Summary of Available Options

Due to the high public safety and environmental impact, of any road-based disposal option, these were discounted. Six options were then considered for the disposal of the dredged material from the marina. Of these only Plough Dredging with Material Moved to Deeper Water was deemed a viable option. The do nothing approach does not solve the immediate operational issues and does not support the future use and viability of the marina while placing costly infrastructure and vessels at risk in the long term.

Plough Dredging with Material Moved to Deeper Water is reviewed in summary form in table 6.1.

Table 6. 1 - Rating table for each dredging proposal.

Aspect (Acceptability Rating)	Plough Dredge	Land incineration, Spreading on Land etc	Beach Replenish	Coastal Protection / Land Reclamation	Sea Disposal	Land based with material moved to deeper water	Barge based with material moved to deeper water
Environmental Acceptability							
Pollution contamination	5	3	2	3	4	3	4
Public health and safety	5	3	3	3	4	2	3
General ecological implications	5	2	1	2	3	2	4
Interference-existing activities	4	2	2	3	4	3	3
Amenity/aesthetic	5	1	1	2	3	3	4
Strategic Acceptability							
Availability of suitable sites	5	2	2	2	3	4	5
Public acceptability	5	3	1	2	4	3	4
Legislative implications	4	3	2	2	3	2	4
RATING SCORE	**38**	**19**	**14**	**19**	**28**	**22**	**31**
Estimated Cost - £/m3	**£8 - £12**	**£30 - £75**	**£35 - 50**	**£35 - 50**	**£25 - £35**	**£45 - £50**	**£25 -35**

Rating Score	
Excellent	5
Good	4
Moderate	3
Poor	2
Avoidance	1

6.2. Rankings – Plough Dredging

With reference to Table 6. 1, with a rating score of 38, plough dredging is seen as the Best Practicable Environmental Option. This score was based on the following :-

- The method is likely to be the most environmentally acceptable option with a very low risk of significant impacts.
- This method is least likely to result in disruption or nuisance or safety risks to members of the public and is unlikely to cause any public concern.
- This method would allow a targeted approach with the minimum of material being removed.
- Dredged Material would be disposed of by natural means and not come in to direct contact with anyone as part of the works.

6.3. Best Practicable Environmental Option

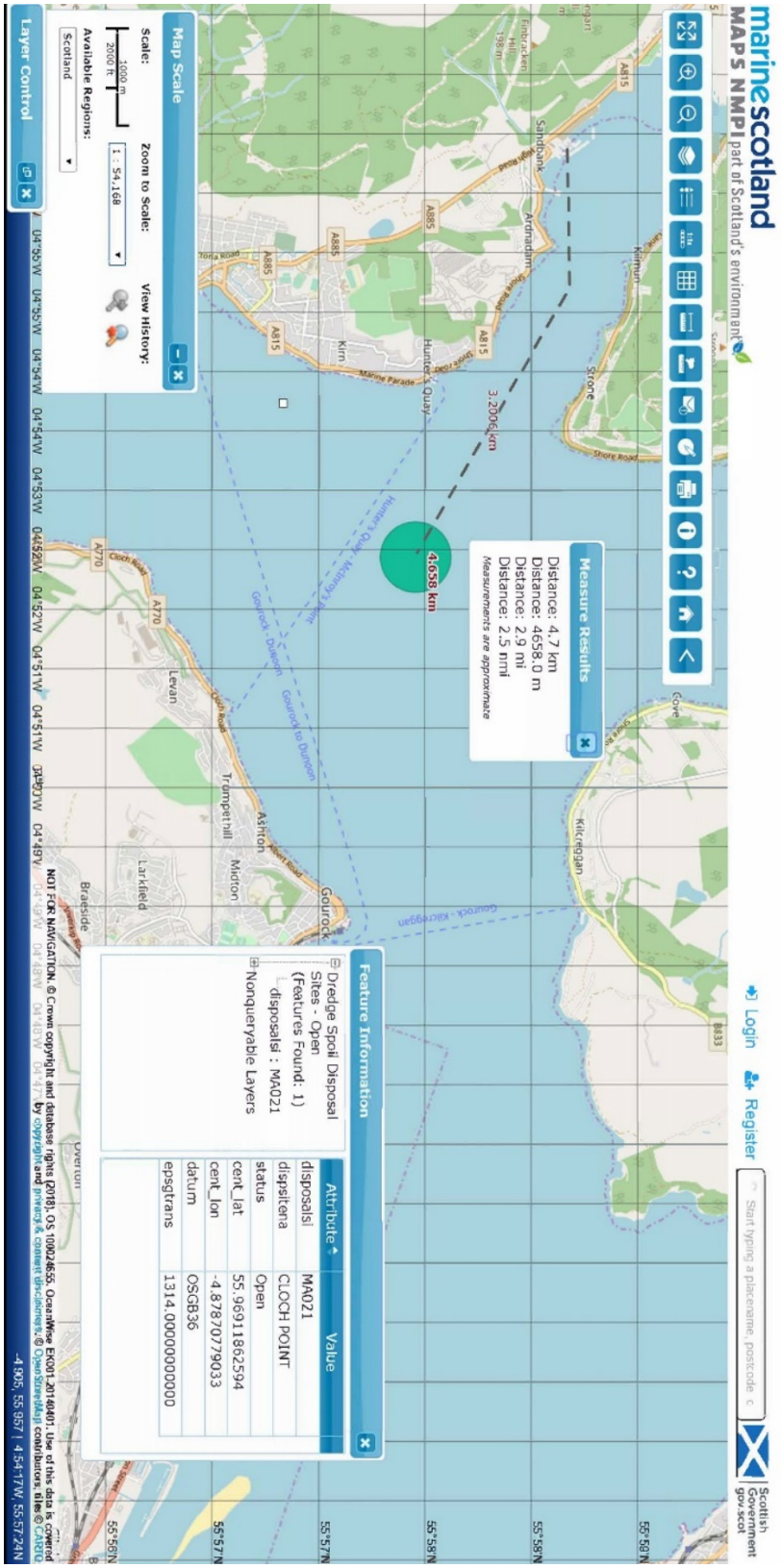
Based on the above, we consider that Plough Dredging presents the most practicable option in terms of environmental impact and strategic considerations. Such a disposal operation is therefore considered an acceptable option under the terms of the Marine (Scotland) Act 2010.

7. Files Accompanying This Document

- RPS Testing and sampling analysis – in PDF and Excel format.
- J904/HLM01 – Rev B Pre-dredge Hydrographical Survey – PDF format
- J904/HLM/02 -Rev 0 Dredging Plan – PDF format

8. Appendix A

Figure 8. 1 – Location for Cloch Point Disposal Site – MA021



9. List of Figures

10. List of Tables

11. List of Abbreviations

HGV – Heavy goods vehicle.