Girvan Harbour
Dredge and Disposal

Best Practicable Environmental Option Assessment

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Report No: 102_REP_01

Date: 05/06/2023

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Document Control

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Effective Date:	**05/06/2023**

Revision No:	Signature	Comments	Date
1A	[Redacted]	For internal review	01/06/2023
1B		Issue to client	05/06/2023
1		For submission	14/06/2023

Contents

1 Introduction

This Best Practicable Environmental Option (BPEO) Report has been produced to support a three-year dredge and disposal marine licence application under the Marine Works (Scotland) Act 2010 for Girvan Harbour. The application will be submitted on behalf of the Port Authority, Ayrshire Roads Alliance (ARA), and this report has been produced by Affric Limited on behalf of the Client's engineering firm, Wallace Stone.

1.1 Report Aims and Objectives

The purpose of this report is to identify and assess the available options for the disposal of dredged materials, to support the submission of a marine licence for dredge and disposal for Girvan Harbour.

The objectives are:

- To provide an overview of the required dredging works;
- Describe the proposed areas for which a dredging campaign is required, including estimated quantity of dredged material likely to be removed;
- Include a description of the BPEO methodology to be employed to complete the assessment; and
- To identify and assess options for disposal of dredged material to determine the BPEO for the disposal of dredge spoil.

2 Background

ARA is responsible for the management and maintenance of the port facilitates at Girvan Harbour. This role includes ensuring that access to the port remains navigable for the variety of vessels transiting the area. The port is used by commercial fishing vessels, recreational fishing vessels, commercial craft and other recreational vessels; also stationed at the harbour are the Girvan Royal National Lifeboat Institution (RNLI) All Weather Class and Inshore Lifeboats.

Access to the channel and associated inner basin has become impeded through the decreased draft from sediment build up. Continued deposition attributed to fluvial action from the Water of Girvan river and associated longshore drift are the main contributing factors to the siltation of the channel and basin. Due to this continued deposition of sediments within the channel and harbour area, there is a requirement to dredge the area to ensure the continued safety of operations within the harbour. Concerns have previously been raised by the RNLI that without maintenance dredging of the channel, the operational ability of the station may be jeopardised.

The first dredge is proposed to commence from 16th September 2023. Future dredge campaigns will be carried out between 16th September and 31st May. This is due to the site location being within 2km of designated bathing waters and the requirement for dredging campaigns to take place out with the Bathing Water Season (1st June to 15th September) (SEPA, 2016).

2.1 Previous Dredges

Girvan Harbour has historically been dredged to ensure continued harbour operations and the safe navigation of the approach channel and inner basin. Previous dredging campaigns' details (years and volumes) are provided in Table 2.1.1. All dredge material from these operations has been disposed of to the Girvan spoil disposal site (MA025). The previous dredge licence 06676/17/0 expired on 03 February 2022. No dredging has been completed since the expiry of licence 06676/17/0.

Table 2.1.1: Dredge Volumes of Previous Dredge Licence 06676/17/0

Year	Quantity Removed (m^3)
1998/99	35,000
2000	12,500
2005	13,300
2010	10,000
2013	4,300
2015	7,200
Year	**Quantity Removed (wet tonnes)**
2019	26,340
2020	10,700
2021	3,600

2.2 Description of Materials

The proposed dredge area is shown in Appendix 1. The dredge area includes the channel approach to the harbour entrance, the channel and the inner harbour basin. The channel dredge is proposed to take levels to 2.0m below chart datum, with the inner basin dredged to 1.5m below chart datum. The estimated volume of material to be extracted from this dredge is a maximum of 25,000m^3 per year, with a total volume of up to 75,000m^3 removed over the period of the dredge licence. From previous experience, it is expected less material may be required for removal in subsequent years, hence 25,000m^3 per year is a worst-case estimate. The average specific gravity from all samples was around 2.45, hence the mass of material to be removed is 61,250 tonnes per year with a total of 183,750 tonnes removed over the life of the dredge licence.

The sampling plan for the dredge area was developed by Wallace Stone. This was approved by the Marine Scotland Directorate's Licensing Operations team (MD-LOT) on 2nd February 2023 (refer to Drawing 2411-WS-XX-XX-D-C-0051; Appendix 1). Sampling was conducted by Aspect Land & Hydrographic Ltd. In line with licensing requirements, samples from 6 sample stations were required for a total dredge volume of up to 75,000m^3 (Marine Scotland, 2017). 3 surface grabs were taken from the inner harbour basin due to the proposed dredge depth of less than 1m in this area. The channel area has as proposed dredge depth of greater than 1m,

and consequently the requirement for core sampling. As agreed with MD-LOT, 3 vibrocore samples were taken within the channel.

Grab samples were taken from the surface. Proposed vibrocore depths ranged between 1.2m and 1.5m depending on the depth of material to dredge at each location. Due to conditions experienced on site, some core locations were adjusted after initial attempts proved unsuccessful due to the consolidated state of the channel bed. Vibrocore locations produced differing core lengths due to the ability of the equipment to penetrate the seabed. Details of the final vibrocore and grab sample locations are provided in Table 2.2.1.

All grab and vibrocore samples were analysed by the Laboratory SOCOTEC who are accredited by United Kingdom Accreditation Service (UKAS) to ISO17025. Within each core, samples were taken at intervals outlined in Table 2.2.1. The results of the analyses have been summarised in this section; complete sample results are available in the spreadsheet entitled Pre-disposal Sampling Results Form Girvan Harbour submitted with the dredge and disposal licence application.

Table 2.2.1: Vibrocore Core Lengths and Sample Depth Intervals

Sample*	Easting	Northing	WGS84 LATITUDE	WGS84 LONGITUDE	Core length	Sample Depth (m)	Sample Depth (m)	Sample Depth (m)
VC01	218030	598327	55° 14' 43.68"	-4° 51' 50.60"	1.00m	0.0-0.5m VC01-Top	0.5-1.0m VC01-Middle	Unable to penetrate further
VC02	218243	598209	55° 14' 40.15"	-4° 51' 38.28"	0.90m	0.0 – 0.45m VC02-Top	0.45-0.9m VC02-Middle	Unable to penetrate further
VC03	218308	598184	55° 14' 39.43"	-4° 51' 34.55"	0.35m	0.0 – 0.35m VC03-Top	Unable to penetrate further	Unable to penetrate further
GS01	218318	598168	55° 14' 38.89"	-4° 51' 35.36"	NA	NA	NA	NA
GS02	218318	598141	55° 14' 38.06"	-4° 51' 33.88"	NA	NA	NA	NA
GS03	218379	598116	55° 14' 37.33"	-4° 51' 30.38"	NA	NA	NA	NA

*VC = Vibrocore, GS = Grab Sample, NA = Not Applicable

On average, samples contained 44.2% solid material, but individual samples ranged from 24.2 to 79.7% solids. The particle size distribution (PSD) of the proposed dredged area has a composition of sand (62.64%) with silt (31.36%) and gravel (6.00%). PSD showed considerable variation across the sample area. VC01 at the entrance to the harbour presented higher proportion of sand compared to VC02 and VC03, due to finer sediments being carried away by wave energy and tides. Grab samples GS01 – GS03, taken from within the Marina Area (inner basin) demonstrated roughly equal parts sand and silt as these locations are more sheltered from coastal turbulence.

All samples were tested for a suite of chemical parameters analysed against Action Levels (AL) as prescribed by MD-LOT in the Pre-disposal Sampling Guidance (Marine Scotland, 2017). The average samples were also compared to the Dutch Target and Intervention Values (the New Dutch List), (Ministerie can Volkshuisvesting, 2000) to understand the potential for onshore uses. Results from each sample returned values below the prescribed ALs for trace metals and organotins with the exception of Cadmium (Cd), Chromium (Cr), Copper (Cu), Nickel (Ni) and Zinc (Zn). Exceedances for each sample (taken as dry weight) are shown in Table 2.2.2 with ALs included for comparison. For parameters that exceeded AL1 as an individual sample by dry weight, the average sample result (as a wet weight) is included in Table 2.2.3.

Table 2.2.2: Review of Action Level Exceedances

Sample Point	Cadmium (Cd) mg/kg (dry weight)	Chromium (Cr) mg/kg (dry weight)	Copper (Cu) mg/kg (dry weight)	Nickel (Ni) mg/kg (dry weight)	Zinc (Zn) mg/kg (dry weight)
Marine Scotland AL1	0.4	50	30	30	130
Marine Scotland AL2	4	370	300	150	600
			Sample Results		
VC01 Top	0.12	179	17.3	220	80.2
VC01 Middle	0.05	156	17.3	197	76.9
VC02 Top	0.42	81.6	43.5	89.5	140
VC02 Middle	0.43	73.9	47.1	80.4	149
VC03 Top	0.21	67.2	71.2	75.2	139
GS01	0.34	62.9	46	68.4	137
GS02	0.38	65.1	49.5	71.5	156
GS03	0.38	63.4	46.7	69	140
Sample Point	Cadmium (Cd) mg/kg (dry weight)	Chromium (Cr) mg/kg (dry weight)	Copper (Cu) mg/kg (dry weight)	Nickel (Ni) mg/kg (dry weight)	Zinc (Zn) mg/kg (dry weight)
New Dutch List Target Value	0.8	100	36	35	140
New Dutch List Intervention Value	12	380	190	210	720
Average[1]	0.29	93.64	42.33	108.88	127.26

[1] Dry weight average for comparison with the New Dutch List standards only, see Section 4.2.2.

Table 2.2.3: Average mg/kg (wet weight) for Exceedances

Sample Point	Cadmium (Cd) mg/kg (wet weight)	Chromium (Cr) mg/kg (wet weight)	Copper (Cu) mg/kg (wet weight)	Nickel (Ni) mg/kg (wet weight)	Zinc (Zn) mg/kg (wet weight)
Average Across Dredge Area	0.11	52.7	18.2	62.7	55.6[2]

Cd was marginally in exceedance of AL1 (Cd AL1 = 0.4 mg/kg) in VC02 top and middle samples (0.42 and 0.43 mg/kg respectively). This marginal elevation in VC02 is not expected to result in any detrimental environmental impact and furthermore, the average wet weight concentration across all samples was 0.11 mg/kg, below the dry weight AL1.

All seabed surface grabs and core samples indicated Cr concentration above AL1 (Cr AL1 = 50 mg/kg). The highest concentration was from top and middle samples of VC01 (179 and 156 mg/kg respectively) near the harbour entrance, however these results were still considerably less than AL2 (Cr AL2 = 370 mg/kg). The average wet weight concentration for Cr across all samples was only slightly higher than the AL1 for dry weight (52.7 mg/kg compared to AL1 = 50 mg/kg). Subsequently, no adverse impact is expected from this slight exceedance of the guidance AL and the material is considered appropriate for sea disposal.

With the exception of VC01, all samples showed results for Cu above AL1 (Cu AL1 = 30 mg/kg) but considerably lower than AL2 (Cu AL2 = 300 mg/kg). The highest dry-weight concentration was recorded from VC03 with a result of 71.2 mg/kg. Other values exceeding AL1 ranged from 43.5 to 49.5 mg/kg. The average wet weight concentration of Cu across all samples was 18.2 mg/kg, considerably below the dry weight AL1.

All samples showed the presence of Ni above AL1 (Ni AL1= 30 mg/kg) with individual sample results ranging from 68.4 mg/kg to 220 mg/kg. Top and middle samples taken at VC01 showed Ni concentration above AL2 (Ni AL2 = 150 mg/kg) with results of 197 and 220 mg/kg respectively. It is understood this concentration elevation is localised to an isolated area at the entrance of the harbour. The average wet weight concentration for Ni was 62.7 mg/kg, well below the dry weight AL2, and hence, the material is considered appropriate for sea disposal. The average dry weight Ni concentration was 108.88 mg/kg, in exceedance of the New Dutch List Target Value for soil/sediment of 35 mg/kg, but well below the Intervention Value of 210 mg/kg.

All samples, with the exception of VC01, demonstrated Zn results in exceedance of AL1 (Zn AL1 = 130 mg/kg) but below AL2 (Zn AL2 = 600 mg/kg). Concentrations of Zn ranged from 76.9 to 156 mg/kg, and the average wet weight concentration across all samples was 55.6 mg/kg, well below the dry weight AL1 for Zn.

With the exception of Cr and Ni, all parameters returned an average wet weight concentration below AL1 of the Pre-Disposal Sampling Guidance (Marine Scotland, 2017). It is not unusual

to detect high spots o[2]f Cr and Ni in harbour areas, as nichrome alloy materials are regularly used in the marine sector due to its resistance to corrosion (Corrothem International, 2023), and hence the source is likely to be from vessels. The average wet weight concentration of Cr and Ni are only slightly elevated above the respective AL1 (that is, 52.7 mg/kg for Cr relative to an AL1 of 50 mg/kg and 62.7 mg/kg relative to an AL1 of 30 mg/kg). These averages are well below the AL2 guidelines and as such the dredge material is considered acceptable under the prescribed levels for disposal at sea in accordance with Marine Scotland's Pre-Disposal Sampling Guidance (Marine Scotland, 2017).

Concentrations of a range of Polyaromatic Hydrocarbons (PAH) were identified in exceedance of AL1 in the sample suite. These can be seen in detail in the Pre-disposal Sampling Results Form (submitted with this BPEO). PAHs are produced by incomplete combustion processes and are present in coal tar and associated products which were historically utilised in the treatment of wood. Girvan Harbour has been a fishing harbour since the 17th Century. Wood treatments from wooden vessels may explain the occurrence of PAH in the area. When these results are taken as an average for wet weight across the dredge area, no PAH parameters were in exceedance of the respective AL1 (refer to 'PR_Details' tab of the Pre-disposal Sampling Results Form).

The colour of the sampled material was predominantly black, as shown in Figure 2.2.1.

Figure 4.2.1: Material colour of sample VC01 left and VC03 right (Aspect, 2023)

3 BPEO Method

3.1 Introduction

In identifying the BPEO for this proposed dredge campaign the following methodology has been employed:

- Identification of options available for the disposal of material;
- Screening to eliminate unsuitable options;
- Assessment of remaining options; and

[2]the Marine Scotland Pre-Dredge Disposal Results Form submitted with this application has an average Zn value of 55.6 mg/kg highlighted as red However, as Zn AL1 = 130 mg/kg), 55.6 mg/kg is not an exceedance of ALs. Dibutyltin is also incorrectly highlighted red but exhibits no exceedance of ALs. This is the result of an error in the template available from https://www.gov.scot/publications/marine-licensing-applications-and-guidance/.

- Comparison of options and identification of the BPEO.

3.1.1 Option Identification

In addition to the standard options considered (Do Nothing, Dispose to Sea and Dispose to Land), additional potential options for disposal of the material were investigated. Discussions with ARA identified the potential opportunity for beach nourishment (see Section 4.2.1) or the potential reuse of the material at the South Ayrshire Girvan Municipal Golf Course (see Section 4.2.2).

3.1.2 Screening to Eliminate Unsuitable Options

All options have been screened against a minimum criterion. These are the criteria each option must meet for it to be considered further. Any option which failed to meet one or more of the criteria was not taken forward to the detailed assessment of remaining options. The criteria are as outlined below:

- Proposed option would allow dredge campaigns to be completed between the 16th of September and the 31st of May each year (as per SEPA guidance for sites within 2km of designated bathing waters);
- The proposed option must be suitable for the characteristics of the dredge material;
- Technically viable option; and
- Allows for the continued operation of Girvan Harbour.

3.1.3 Attribute Identification and Scoring

Attributes to be utilised in the options assessment were initially identified. Attributes were 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 2.

Options meeting the minimum criteria were scored against each attribute (Appendix 3). Reasoning for the corresponding scores are provided in Appendix 4.

3.1.4 Comparison 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 disposal of the dredged material, including both terrestrial and marine options. Options identified are outlined below:

- Do nothing;
- Disposal to landfill;
- Spreading on agricultural land;
- Beach nourishment;
- Beneficial reuse of material;
- Disposal at sea; and
- Plough dredging.

4.2 Screening of Options

Options were initially screened against the minimum criterion as outlined in Section 3.1.2 which eliminated five of the options. The reasoning for discounting certain options as not viable is outlined below.

4.2.1 Do Nothing

This option has been discounted as the cessation of dredging within the area would have a significant impact on the safe and continued use of the harbour. Should the area become unnavigable due to reduced depth there would be a social and economic effect on Girvan, primarily due to the decline in commercial activities and tourism. Furthermore, there is a potential risk to the operational ability of the RNLI to continue launching from the harbour with significant effects on the emergency response capability in the area.

4.2.2 Spreading on Agricultural Land

This option has not been considered further due to the appropriateness of the material to be spread on agricultural land. The high saline content makes the material unsuitable for spreading onto agricultural land without significant further treatment. Salinity is a key environmental limiting factor for the productivity of plant growth; many crops are salt sensitive therefore excess salinity is a threat to agriculture (Flowers, 2005).

The Marine Directorate AL are set with regard to marine sediments, and as such may not be appropriate for consideration of land uses of the material, as the pathways to receptors including humans are very different. Hence, the sample results were compared against the Dutch Target and Intervention Values (the New Dutch List), (Ministerie can Volkshuisvesting, 2000) for soil/sediment, utilised for the assessment of contaminated land. The New Dutch List utilises dry weight values. A comparison of the metals average dry weight of the dredge samples (detailed in Table 2.2.2) against the New Dutch List identified that only Nickel at 108.88 mg/kg exceeded the target value of 35 mg/kg, however it does not exceed the intervention value of 210mg/kg. With regard to PAH, the New Dutch List combines 10 PAHs into one value (PAH(sum10)). The PAH(sum10) for the Girvan samples is 0.38 mg/kg, which is comfortably below the target level of 1 mg/kg.

The high salinity content, in combination with an average dry weight Ni concentration significantly above the New Dutch List target value, make spread to agricultural land an unsuitable option for disposal of the dredge material.

4.2.3 Plough Dredging

Whilst plough dredging is often considered an immediate solution to allow for continued operation (and acceptable to be undertaken during bathing seasons), this option has not been taken further as this method would mean an increased burden to other areas of the harbour with the possibility of making these areas unnavigable due to material deposition decreasing depth. Hence, it does not meet the minimum criterion for the continued operation of Girvan Harbour.

4.2.1 Beach Nourishment

This option has been discounted as the characteristics of the dredge material were deemed unsuitable for beach nourishment. Nourishment material should ideally be of the same/similar PSD as the recipient beach.

The high silt content in the majority of samples is inconsistent with typical beach material. Furthermore, the sediment colour, as previously mentioned and depicted in Figure 2.2.1, is predominantly black. This material colour, which infers high organic content, in combination with high silt levels, more closely represents soil than beach material. This is supported by the understanding this material is brought into the harbour by fluvial action from agricultural land upstream along the Water of Girvan river. Deposition of black material to the beach would considerably alter the visual characteristic of the beach and is subsequently unsuitable for this purpose.

In addition, elevated Ni concentration above target levels for soils (refer to Section 4.2.2), may also make the material unsuitable for beach nourishment. Concerns could be raised for beach activities that put people, specifically children, in close contact with beach material. Hence, deposition of material with metal concentrations in exceedance of guidelines to beaches is not recommended.

4.2.2 Beneficial Reuse of Material

Dredge material can be suitable for land reclamation or coastal remediation works if exhibiting the appropriate PSD and chemical characteristics. Material grade and quality are critical for this purpose. Suitable material is generally made up of sands and gravel. Large volumes are also usually required to ensure the costs of processing and transport are feasible.

For dredge materials to be reused by another project, the material needs to meet the engineering specification for the planned use. High silt levels give rise to settlement issues which can be problematic for coastal remediation, where land is already under pressure from weathering processes, and particularly for land reclamation works which will likely be subject to considerable load-bearing. Whilst VC01 samples exhibited a majority sand content, the remaining samples showed silt levels of between 25.4% and 49.2% which is unlikely to be acceptable for engineered fill material. Hence, the majority of material would be considered unsuitable for reuse in land reclamation or coastal remediation due to the material characteristics.

The South Ayrshire Girvan Municipal Golf Course was previously raised as a potential receiving project for Girvan Harbour dredge material. The seaward side of the golf course is subject to coastal erosion events, and is suffering damage. Whilst this option would be consistent with Scottish government's Zero Waste policy, the PSD characteristics do not support the re-use of material in coastal remediation work as described above. Furthermore, the black colour of the material could impact visual amenity of the beach.

Previous sample results from Girvan Harbour have shown higher proportions of sand and gravel, and subsequently beneficial re-use may be a suitable option for future dredge material.

4.3 Assessment of Remaining Options

Following the screening process the following options have been selected to take forward for further analysis:

- Disposal to landfill; and
- Disposal at sea.

These options have been further discussed and analysed for their suitability to receive the dredged material based on the attributes identified in Appendix 2. The options scoring is

provided in Appendix 3 with the reasoning for attribute scoring provided in Appendix 4. Referenced scores are provided in brackets below.

4.3.1 Disposal to Landfill

Disposing of dredged material to landfill can take up valuable space within a facility when space with the UK landfill network is at a premium. With disposal to landfill there are also logistical steps that will need to be completed before removal to these sites. Dredged material will need landing, dewatering, storage and transport to a disposal site.

Two potential landfill sites were identified as being within a reasonable distance for the disposal of the dredged materials. Details are provided in Table 4.1 and both options have been scored in Appendix 3.

Table 4.1 Landfill Information

Landfill Site	Distance from Girvan and Approx travel distance and time	Operator	Local Authority Area	Description	Annual Capacity Allowance	Proposed Annual Dredge volume as a % of Annual Landfill Capacity
Straid Farm Landfill site, Lendalfoot, Girvan	6.6 Miles; 12 Minutes Approx	Straid Farm Ltd	South Ayrshire	Permitted to accept Non-Hazardous Waste	110,000 tonnes	55.7%
Barr Environment Ltd, Garlaff Landfill Site, Skares Rd, Cumnock	33.5 Miles; 54 Minutes	Barr Environment Ltd	East Ayrshire	Permitted to accept Non-Hazardous Waste	250,000 tonnes	24.5%

Source: SEPA, 2022.

Straid Farm Ltd Landfill is the closest landfill to Girvan Harbour as such it scores slightly better for distance than Garlaff Landfill for distance (Appendix 4).

At it's maximum, the annual volume of dredge material would account for almost 25% of the annual waste disposal allowance for Garlaff Landfill, or almost 56% of the annual disposal allowance at the Straid Farm Landfill (Table 4.1). Existing landfill sites are required to cope with large volumes of domestic and industrial waste and dredged material would impose a considerable and unacceptable burden.

Furthermore, disposal to landfill requires material to be acceptable for the proposed landfill. Consideration would need to be made for effects on drainage and the chemical composition of the material leaching into the surrounding environment. Ultimately, the responsibility for accepting the waste material will be with the landfill operator, however the high salinity of the material has the potential to react with existing materials/chemicals within the landfill and subsequently may be environmentally and operationally unfavourable.

The Scottish Government launched a Zero Waste Plan for Scotland in 2010 with a vision for a zero-waste society. The plan has a target to recycle 70% of material and a maximum of 5% to landfill by 2025 for all Scotland's waste (Scottish Government, 2010). The disposal of dredged

material into existing landfill sites therefore does not align with the Scottish Government Policy where the onus is on reducing the amount of material being sent to a landfill site.

Transport of material to a landfill site by Heavy Goods Vehicles (HGVs) would be expected to generate a considerable increase in HGV traffic. On the assumption that an HGV could hold 20 tonnes of dredged material, this would require 9,187 round trips over the licence period. Connected with the use of HGVs is an increased cost of transportation, as well as the potential for short-term decrease in air quality within urban areas, increase in carbon emissions and increases in noise and vibration effects.

As previously mentioned, disposal to landfill would require dredged material to be dewatered and dried before transportation. This is expected to either require a large expanse of land or a smaller space that could delay dredge campaign schedules. Both alternatives would put pressures on Girvan Harbour to provide space and equipment to process the material, potentially interfering with other users of the harbour area. Additionally, this activity could be expected to have adverse visual effects on the local area. The material will also be subject to landfill tax per tonne of material, which will be significant for the volumes proposed.

4.3.2 Disposal at Sea

There are numerous open dredge disposal sites in Scottish Waters for deposition of dredged material, the closest of which is Girvan (MA025). The disposal of dredged material from the channel and inner basin at Girvan is an established process with dredging campaigns dating back to 1998. There have been no issues to date associated with the use of Girvan MA025, and due to the close proximity and associated efficiencies with regard to transit, it will score higher than other sea disposal sites on assessment. Hence only this site has been considered.

The material has been assessed as suitable for sea disposal in line with Marine Directorate's Pre-Disposal Sampling Guidance (Marine Scotland, 2017) as described in Section 2.2.

Disposal of material is low in the waste hierarchy and as such doesn't align with the Zero Waste Policy, however, dredge disposal is standard practice and scored high in technical feasibility (see Appendix 3 and 4).

4.4 Comparison of Options

As detailed in Appendix 4, the landfill options scored 3 or less against all attributes and as such are not preferred with a total score of 21 and 22 out of 45. Disposal at sea scored 36 out of 45 (refer to Appendix 3), the highest scoring option, and scored well with a 4 or higher on all but one category. A score of 2 for policy is assigned as disposing of material is not in alignment with the Scottish Government's Zero Waste Policy.

5 Conclusion

Following assessment of options as discussed throughout this document, the best practicable environmental option for disposal of dredged material is for the disposal at sea to the Girvan (MA025) Sea Disposal Site.

It is, however, recognised that Girvan Harbour dredged material may allow for beneficial reuse in future if a suitable, local project were available within appropriate timescales and dredge material characteristics be compatible with project specifications.

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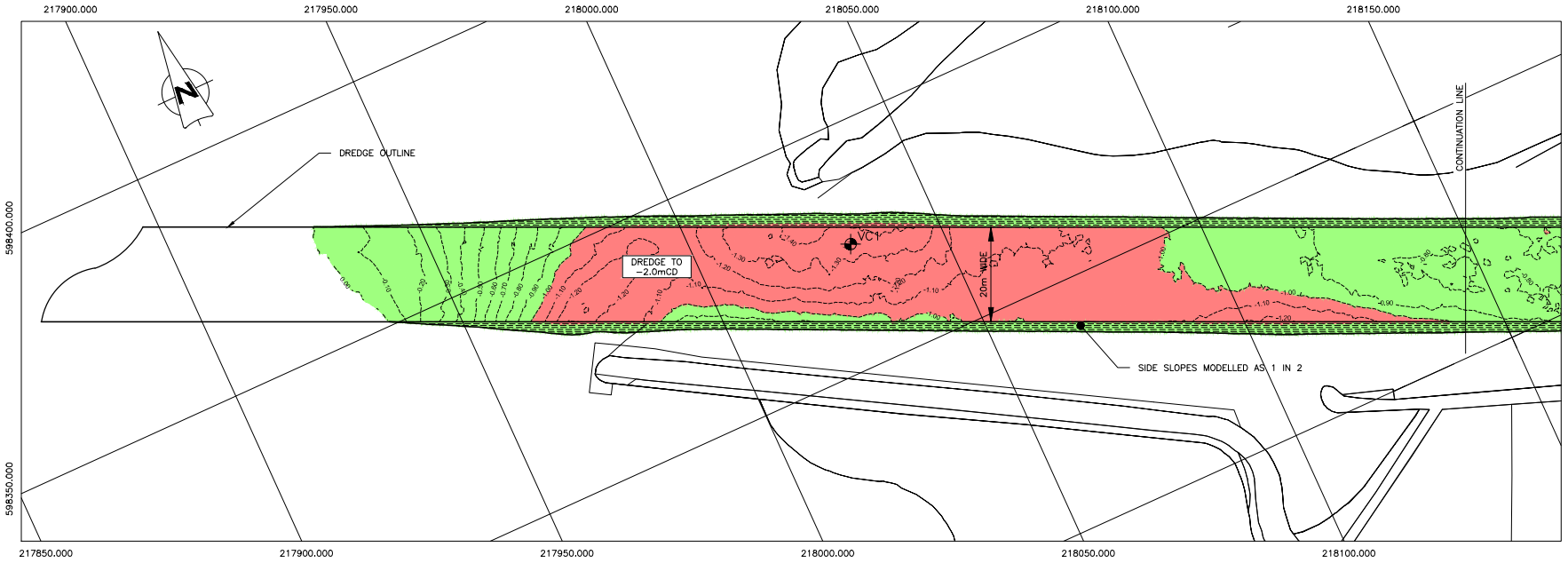
7 Glossary

Acronym	Definition
AL	Action Levels
ARA	Ayrshire Roads Alliance
BPEO	Best Practicable Environmental Option
Cd	Cadmium
Cr	Chromium
Cu	Copper
HGV	Heavy Goods Vehicle
MD-LOT	Marine Scotland Directorate's - Licensing Operations Team
Ni	Nickel
PAH	Polyaromatic Hydrocarbons
PSD	Particle Size Distribution
RNLI	Royal National Lifeboat Institution
SEPA	Scottish Environment Protection Agency
UKAS	United Kingdom Accreditation Service
Zn	Zinc

Appendix 1: Proposed Dredge Area



PLAN ON DREDGE – PART 1

SCALE 1:500

PLAN ON DREDGE – PART 2

SCALE 1:500

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.

VIBRO–CORE COORDINATES

SAMPLE NUMBER	EASTING	NORTHING
VC1		
VC2	218224.940	598238.455
VC3	218305.734	598187.064

GRAB SAMPLE COORDINATES

SAMPLE NUMBER	EASTING	NORTHING
GS1	218292.057	598168.058
GS2	218319.339	598141.236
GS3	218380.033	598117.630

LEGEND

VC — VIBRO–CORE SAMPLE LOCATION

GS — GRAB SAMPLE LOCATION

-1.00 — DREDGE DEPTH CONTOURS (METRES)

DREDGE DEPTH BANDING:

0.0m to 1.0m

1.0m to 1.74m

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D

AMENDMENTS

CLIENT

EAST AYRSHIRE COUNCIL

PROJECT

GIRVAN HARBOUR DREDGE

Wallace Stone
Consulting Civil Engineers
GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk
DINGWALL 01349 866775 dingwall@wallacestone.co.uk
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DRAWING TITLE

PROPOSED SAMPLE LOCATIONS

DRAWN	CHECKED	APPROVED
JM	GB	GB
DATE	DATE	DATE
JAN 23	JAN 23	JAN 23

SCALE (A1)	STAGE	REV
AS SHOWN	CONSENTS	P01

DRAWING No.

2411–WS–XX–XX–D–C–0051

Appendix 2: Assessment 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	>£2Million	£1M to £2M	£500,000 to £999,000	£100,000 to £499,000	<£100,000
Timescale	Will the timeframe for the option impact on the continued operations of the harbour, will the option impact on the dredging timeline?	Risk dredge couldn't be started before the 2024 bathing season.	High risk dredge couldn't be completed before the start of the 2024 bathing season.	Risk dredge couldn't be completed before the start of the 2024 bathing season.	Allows dredge to be comfortably completed prior to the 2024 bathing season.	Allows dredge to be completed promptly.
Material Suitability	Is the chemical makeup and PSD of 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.
Distance	Impact location has on logistics for material movements.	Beyond 40 miles.	10-40 miles.	6-10 miles.	1-5 miles.	Within 1 mile.
Technically Feasibility	Is the option within the capabilities of ARA 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
Impacts on Harbour Operations	Level of interference with normal harbour operations.	Very Significant	Significant	Minimal	Trivial	None
Legislative Complexity	How complex are the regulatory 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 3: Option Scoring

	LANDFILL DISPOSAL		SEA DISPOSAL
Attribute	**Straid Farm Landfill**	**Garlaff Landfill**	**Disposal at Sea MA025 Girvan**
Alignment with Policy	1	1	2
Cost	1	1	4
Timescale	3	3	5
Material Suitability	3	3	4
Distance	3	2	4
Technically Feasibility	3	3	5
Environmental Effects	3	3	4
Impacts on Harbour Operations	2	2	4
Legislative Complexity	3	3	4
Total	**22**	**21**	**36**

Appendix 4: Scoring Reasoning

Attribute	Straid Farm Landfill	Garlaff Landfill	Disposal at Sea; MA025 Girvan
	LANDFILL DISPOSAL		SEA DISPOSAL SITES
Alignment with Policy	1- Disposal to landfill doesn't align with the Scottish Government's Zero Waste Policy, it would also take up valuable landfill space.		2- Disposal at sea is low on the waste hierarchy and as such does not align to policy.
Cost	1- Costs will be associated with storage, handling and drying of material, procurement/hire of equipment, transport of material to designated site and landfill tax.		4- Estimated as lower cost than other options; dredge vessel would complete the disposal operation so no further costs associated with the works.
Timescale	3- Processing requirements (i.e. procure equipment, design/set up the drying area etc), road transport limitations and limited storage space could mean that dredge campaigns cannot be carried out as fast as normal.		5- It should be practical to implement this option within the required timescale, as disposal can be completed quickly with the dredge vessel.
Material Suitability	3- Material has been assessed as Acceptable with Mitigation - as dewatering will be required.		4- Material is acceptable for the option of sea disposal under the Pre-Disposal Guidance issued by Marine Directorate.
Geographical location to site	3- Site is ~6.6 miles from Girvan Harbour. Distance is tolerable, ~12 minutes by road.	2- Site is 33.5 miles from harbour and ~ 54 minute drive. This is a significant distance and time when considering the number of trips that could be required to complete removal.	4- Site is less than 2 miles from Girvan Harbour, therefore distance to steam is minimal.
Technically Feasibility	3- The drying of material is relatively simple; however, it will need to be appropriately managed in terms of throughput due to space restrictions.		5- Disposal at sea is an established and well-practiced methodology.

Attribute	Straid Farm Landfill	Garlaff Landfill	Disposal at Sea; MA025 Girvan
	LANDFILL DISPOSAL		SEA DISPOSAL SITES
Environmental Effects	3- There is the potential for environmental consequences with the inclusion of material into the landfill, though it is uncertain if this would be above standard environmental concerns associated with landfills. Further impact due to greenhouse gas emissions resulting from the use of HGVs to transport material.		4- Disposal at sea at an existing disposal site will have minimal environmental effects, temporary effects on water quality may occur.
Impacts on Harbour Operations	2- Space requirements to process materials ready for landfill expected to interfere with other harbour activities.		4- Dredging works are required in the main access to the harbour and the harbour marina itself. Harbour operations will need to be managed around the dredging works.
Legislative Complexity	3- Disposal to landfill is in line with current legislation, appropriate waste licences would be required from SEPA, however these should not be overly complex.		4- Disposal at sea would be permitted under the dredge and disposal marine licence.