Appendix 8: Assessment of Impact of the Maritime Usage (AIMU)

MWP

Assessment of Impacts on the Maritime Usage (AIMU)

Proposed Maintenance Dredging, Aughinish, Co. Limerick

November 2023

Contents

Tables

Figures

List of Plates

Glossary

Acronym	Explanation/Full Term
SISAA	Supporting Information for Screening for Appropriate Assessment
AAL	Aughinish Alumina Ltd
DaS	Dumping at Sea (permit)
DoEHLG	Department of Environment, Heritage and Local Government
EC	European Commission
EPA	Environmental Protection Agency
FS	Foreshore
IEL	Industrial Emissions Licence
LR/B	Long-arm Reach Excavator on a Barge
MSFD	Marine Strategy Framework Directive
MUL	Marine Usage Licence
MWP	Malachy Walsh and Partners
NIS	Natura Impact Statement
NMPF	National Marine Planning Framework
NMS	National Monuments Service
SAC	Special Area of Conservation
SFPC	Shannon Foynes Port Company
SPA	Special Protection Area
TSHD	Trailing Suction Hopper Dredger
WFD	Water Framework Directive

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1. INTRODUCTION

Malachy Walsh & Partners (MWP) was commissioned by Aughinish Alumina Limited (AAL) to carry out baseline surveys, assess the impact on the environment and develop their Dumping At Sea (DaS) and Marine Usage Licence (MUL) applications for an 8 years period. AAL's current maintenance dredging permit (DaS Permit Nr. S0026-01) and Foreshore Licence (FS Nr. FS006578) expires on the 31st Aug 2024. AAL have a need to dredge to achieve design depth at the outer berth (A) and the inner berth (C) on the jetty and remove the accumulated silt at the cells (B) and along the approach arm (D) in order to allow the work crew boat to operate. The conditions of AAL's current Foreshore Licence allows them to plough dredge three sites for two 5-day periods per annum. This has proved inadequate to deal with the sediment that has accumulated in the above-mentioned areas. AAL is also proposing to dredge one additional area along the jetty approach arm.

AAL are also proposing to use Trailing Suction Hopper Dredger (TSHD) at the outer (A) and inner (C) berths. The sediment removed by this dredger will need to be dumped at another site. The most appropriate site identified for dumping this material was the dump site off Foynes Island that the Shannon Foynes Port Company (SFPC) is currently permitted by the EPA to use (EPA Nr. S0009-03) (see **Figures 2.1** and **2.4**). AAL are applying for permission to use an area within this dump site.

1.1 Site Location

AAL is the largest alumina refinery in Europe. Situated at Aughinish Island, Co. Limerick, it is approximately 3.5 km north-east of Foynes, 12.5 km south-west of Shannon, and 27 km west of Limerick City (see Error! Reference source not found.). Delivery of bauxite and export of finished product alumina is facilitated via a deep-water jetty which extends into the sub-tidal waters of the Shannon Estuary as shown in **Plate 1-1**.

Plate 1-1: View of refinery with deep water jetty

The dredge/dump sites are located within the River Shannon and River Fergus Estuaries SPA (Site Code IE004077) and Lower Shannon SAC (Site Code IE002165).

1.2 Studies undertaken as part of the Assessment

The following surveys and modelling were undertaken as part of this assessment of the impact on the environment:

Table 1-1: Surveys and Modelling undertaken as part of DaS and MUL applications.

Surveys/Modeling	Consultants Commissioned to undertake
Sediment sampling of the areas proposed for dredging and laboratory analysis of the samples (in accordance with Marine Institute requirements)	Hugh Power – Hydrographic Services
Tidal Current Survey	Hugh Power – Hydrographic Services
Bathometric survey (geophysical)	Hugh Power – Hydrographic Services
Benthic Survey	Louise Scally (MERCK Aquatic Services Unit)
Archaeological Assessment	Laurence Dunne Archaeology Ltd.
Marine Mammal Risk Assessment	Dr Joanne O'Brien University of Galway
Hydrological Modelling	MWP - Dr Michael O'Shea
Supporting Information for Screening of Appropriate Assessment	MWP – Otto Storan & Hazel Dalton
Risk Assessment for Annex IV Species	MWP – Otto Storan & Hazel Dalton

Descriptions of the methods and sampling procedures used are provided in Section 4. The alternatives considered are discussed in Section 5.

2. DESCRIPTION OF PROPOSED WORKS

2.1 Introduction

The AAL jetty was constructed in the early 1980's and there has been a need for ongoing maintenance dredging since 2016 when a DaS permit (Nr. S0026-01) and Foreshore Licence (Nr. FS006578) were granted to provide for ongoing maintenance dredging activity. This permit and licence covers an 8-year period, which will expire in August 2024. There now is a need for a new DaS permit to allow for ongoing maintenance dredging for a period of 8 years. A new MUL from MARA will also be required.

The current (2016) Foreshore Licence and DaS permit allowed for dredging by means of plough dredging at three defined locations (A-C) as shown on Figure 2.1 below.

- Area A is the main jetty berth where the larger ships berth to discharge raw materials.
- Area B is what is called the Cells which is the land-based area where the work boats that transfer crew is based.
- Area C is known as the inner berth, and this is used for smaller ships for the delivery of process materials and export of finished product.

The current permit allows for two dredge periods per year, and each period has a duration of 4-5 days and could only take place when the jetty berth was free due to a shut down for maintenance. This is a challenging window to dredge within. In addition, having only the plough dredge technology restricted the process of maintenance dredging in a marine environment which is very dynamic.

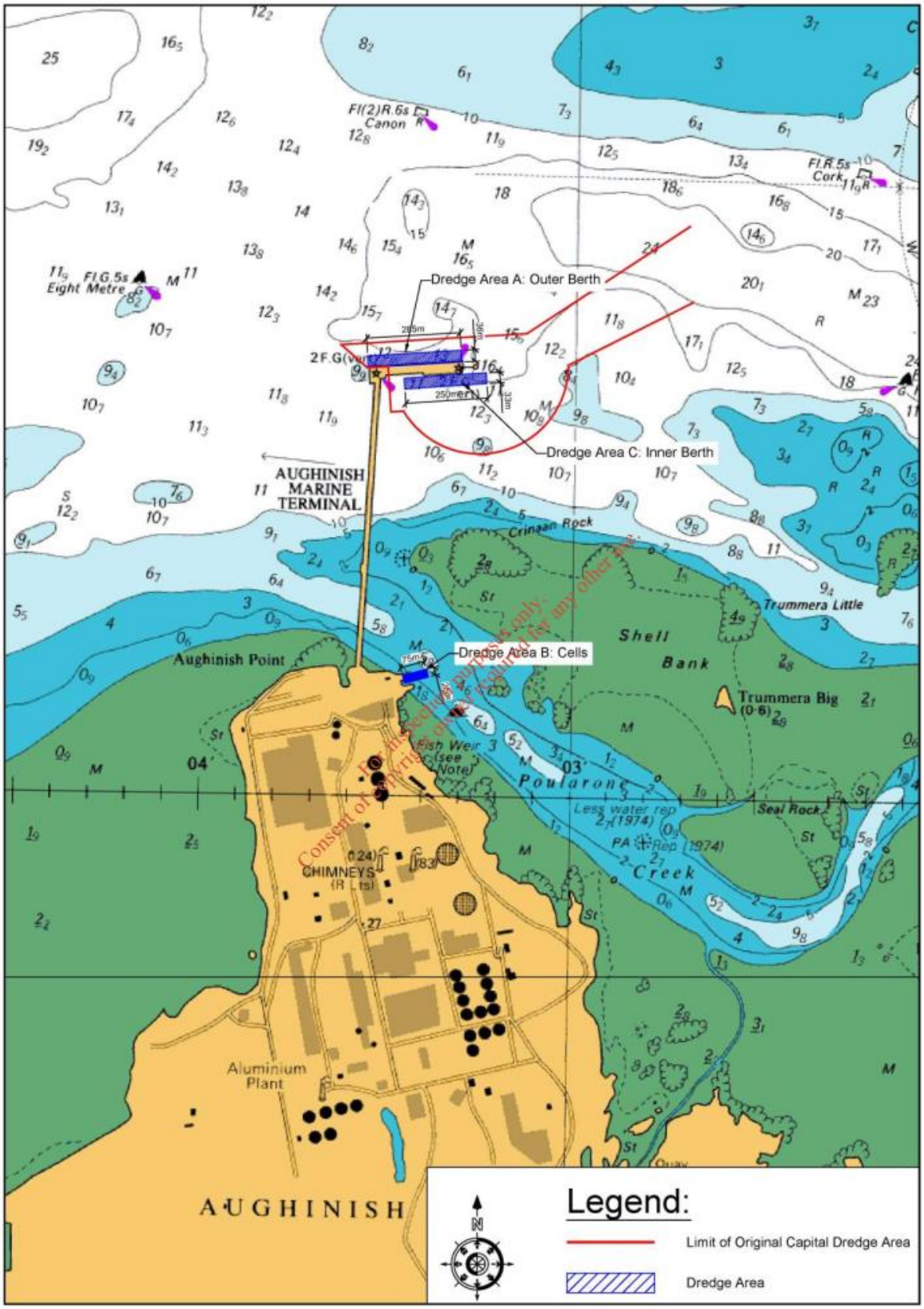

Figure 2-1 Map of current 2016 DaS permit dredge site locations

AAL have an ongoing need to undertake maintenance dredging to ensure that the accumulation of sediment around the jetty and ship berths does not impede the docking of cargo ships, and to allow the work crew boat to move between the shore and the berths at the end of the jetty. They need to achieve design depth at the outer and inner berths (A & C) on the jetty, remove the accumulated silt at the cells (Area B) and along the approach arm (Area D) in order to allow the work crew boat to operate. The conditions of AAL's current DaS permit allows them to use a plough dredger for limited periods per annum, and this has proved inadequate to deal with the sediment that has accumulated in the above-mentioned areas. AAL is therefore proposing to use additional dredging/dumping technologies and sites to remove the accumulated sediments.

2.2 Dredging Methods

AAL are requesting three changes with regard to their current DaS permit (Nr. S0026-01) and Foreshore Licence (FS Nr. FS006578) namely:

1. Using a TSHD at sites A and C and dumping this dredge material at the proposed EPA dumping site in the Shannon Estuary, which the SFPC are already permitted to dump at.
2. Using a long-arm reach excavator on a barge (LR/B) to move away sediment that has accumulated under and adjacent to the jetty structures. This moved sediment would then either be removed by the TSHD or spread by the plough dredger.
3. Dredge/Dump site D – on the eastern side of the jetty approach arm. Dredging in this area is needed to enable the mooring boat passage from the cells (site D) to the jetty (Sites A and C). Sediment has accumulated in this area and is hampering the passage of the mooring boat.

These loading/dredge site maps and associated coordinates are provided in Drawings 22855-MWP-ML-00-DR-C-0002 and 22855-MWP-ML-00-DR-C-0003.

This new application seeks to give better flexibility to the maintenance dredging process. The TSHD will remove sediment and will need to dump it at another site at sea. After considering different locations and having initial consultations with the EPA, the most appropriate site identified for dumping this material was the current dumping site off Foynes Island that the Shannon Foynes Port Company (SFPC) is permitted by the EPA to use (see Figure 2.2).

Another technology to be used is a LR/B. The use of a LR/B is necessary to move material that is not accessible to the plough dredger or the TSHD, for example material under the jetty structure or close to jetty structures.

In summary, to achieve the greater dredging flexibility and effectiveness, AAL propose to use a range of dredging technologies (plough dredger, LR/B and TSHD), wider periods for dredging, larger dumping areas to accommodate dredging and dumping activities, the introduction of a new dredge location adjacent to the jetty approach bridge (Area D), and a new dedicated dumpsite in the estuary to receive material dredged by means of a TSHD.

2.3 Dumping Sites

For the purposes of the new DaS permit and MUL applications there two main components or areas as follows:

1. The Dredge/Dumping Areas (4)
2. The Dump Site (1)

These are described in more detail below.

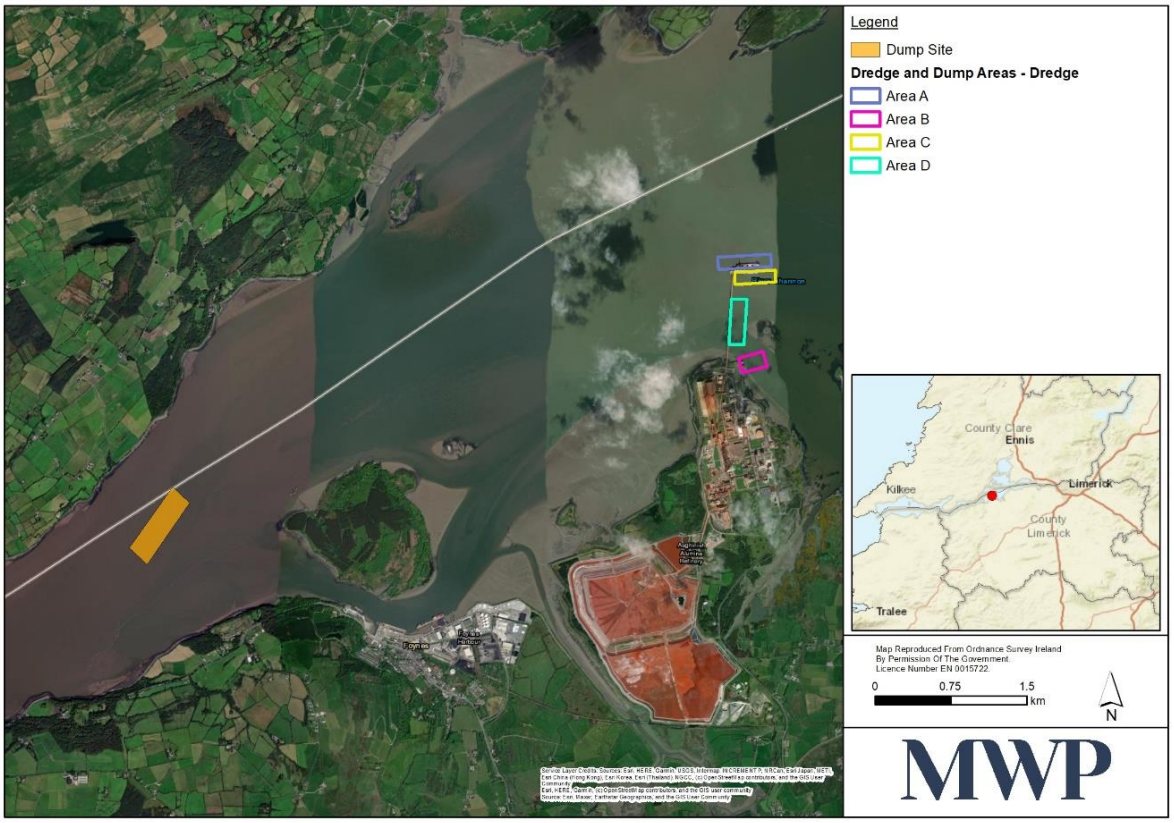

Figure 2-2 Location of proposed dumping site in the Shannon Estuary relative to the four dredge/dump sites at the AAL Jetty.

2.3.1 Dredging/Dumping Areas

There are four locations where dredging will take place and each area will utilise a number of dredging technologies. See **Figure 2.3** for the location of the dredge areas. **Plates 2-1 to 2-4** provide photographs and illustrations of the various dredge technologies.

Table 2-1: Details of the proposed dredge/dump sites and dredging technologies to be used at each.

Dredge/Dump Area	Size	Distance from Shore	Type of Dredging
Area A (outer berth)	6.3 ha	0.9 km	Plough, TSHD and LR/B
Area B (the cells)	3.75 ha	0 km	Plough and LR/B
Area C (inner berth)	4.8 ha	0.88 km	Plough, TSHD and LR/B
Area D (approach arm)	6.75 ha	0.16 km	Plough and LR/B

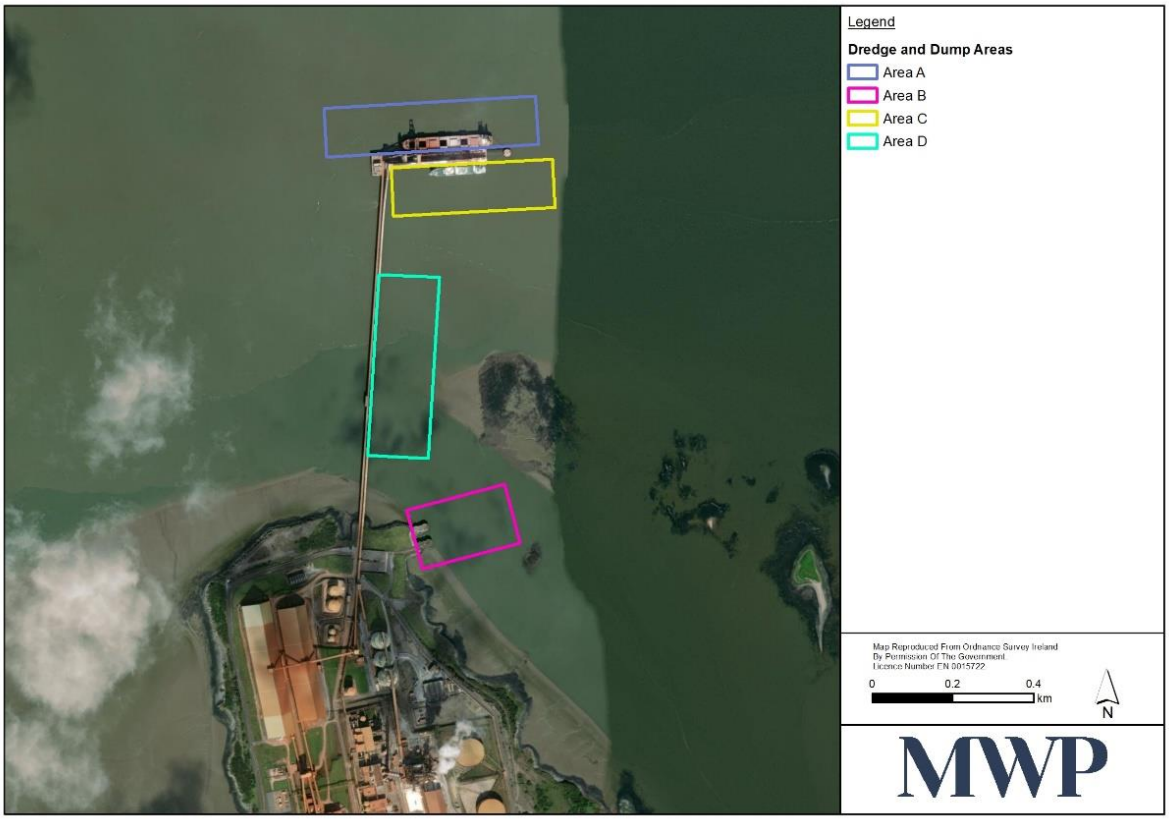

Figure 2-3 The proposed four dredge/dump sites around the AAL jetty.

Given that each area will employ a plough and other technologies, the dredging area is also the dump site area as the material will be moved within the approved dredge area. The physical areas of dredging within the approved dredge areas will be less and will be focussed on high points or accumulations of material on the seabed.

The dredging technologies of a plough (see Plate 2-4) and LR/B (see Plate 2-3) will facilitate material to be moved locally on the seabed and this will be located and disperse by the plough dredger within the approved dredge areas. The use of a LR/B is necessary to move material that is not accessible to the plough dredger or TSHD, for example material under the jetty structure or close to jetty structures.

TSHD (see Plate 2-1 and 2-2) will be utilised for the outer and inner berths (Area A and C), to restore the seabed to design depth. For that depth and volume of dredging the TSHD is the best solution. The TSHD is not expected to be used every year within the overall 8-year cycle. The material dredged by the TSHD at this site will be dumped at the designated dump site off Foynes Island.

The TSHD and LR/B dredging technologies were not included in the current DaS permit. However, based on experience since 2016 with the limitations of plough dredging, they are considered more appropriate to provide greater effectiveness and flexibility in the dredging campaigns going forward.

After using the TSHD or LR/B, the plough dredger will be used to move and spread out the sediment within the licenced dredging areas.

The plough dredger will be the main method to be used during every dredging campaign and will be supplemented by the LR/B and TSHD where needed.

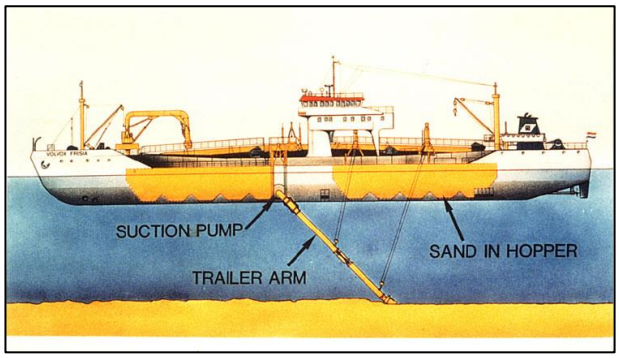

Plate 2-1 Drawing of a Trailing Suction Hopper Dredger (TSHD) in action.

Plate 2-2: Photograph of a TSHD

Plate 2-3: Long-Arm Reach Excavator operating from a Barge (LR/B)

Plate 2-4: Plough Dredger

2.3.2 Dump Site

When using the TSHD a dumpsite is required to dispose of the material. The dredged material that has been excavated from the seabed is held within the hold of the TSHD ship ready for transport away from the jetty and berths. Accordingly, a potential dump site location has been identified within the Shannon Estuary and is located within an area of the currently permitted SFPC dumpsite off Foynes Island. (EPA Nr. S0009-03) (see **Figure 2.2 and 2.4).**

The dumpsite area being sought has an area of 8.43ha and is shown in (**Figure 2.4** below). It is located approx. 1km due west of Battery Point on Foynes Island. The proposed dump site will only receive material from the TSHD activities from the main berth and from the inner berth where required.

It is envisaged that a maximum volume of 53,846 tonnes per annum could be deposited at the proposed Dumpsite. This volume will vary year to year depending on the dredging cycle, deposition rates and requirements within the main berth.

When TSHD dredging is required at the main berth it will be completed within one of the two dredging periods per year. Dredging periods will be no longer than 21 days. The TSHD will also be assisted by a plough for bed levelling and in some instances, there may be a need to deploy a LR/B to move hard to reach material under the jetty.

The TSHD will work within the berth/dredge area and remove material from the seabed down to the desired level. The dredge material is stored within the hold of the dredging vessel and then the vessels steam's down river to the west to the proposed Dump Site off Foynes Island. When the vessel arrives at the dumpsite it travels through and within the dumpsite area in a defined pattern and the bottom opening doors of the vessel allows material to be dropped to the seabed. The material as it drops to the seabed will also have a proportion of fine silt that will go into suspension in the water column. The heavier fraction will fall to the bed first and then over time the other lighter particles will settle out of suspension and onto the seabed. A proportion of the material will also disperse with the currents and tidal change regime.

A hydrodynamic model has been prepared which models the dredging and dumping durations/events and this models where the material deposits locally. The outputs from the model are included in section eight of this report and in a standalone report included in Appendix 11.

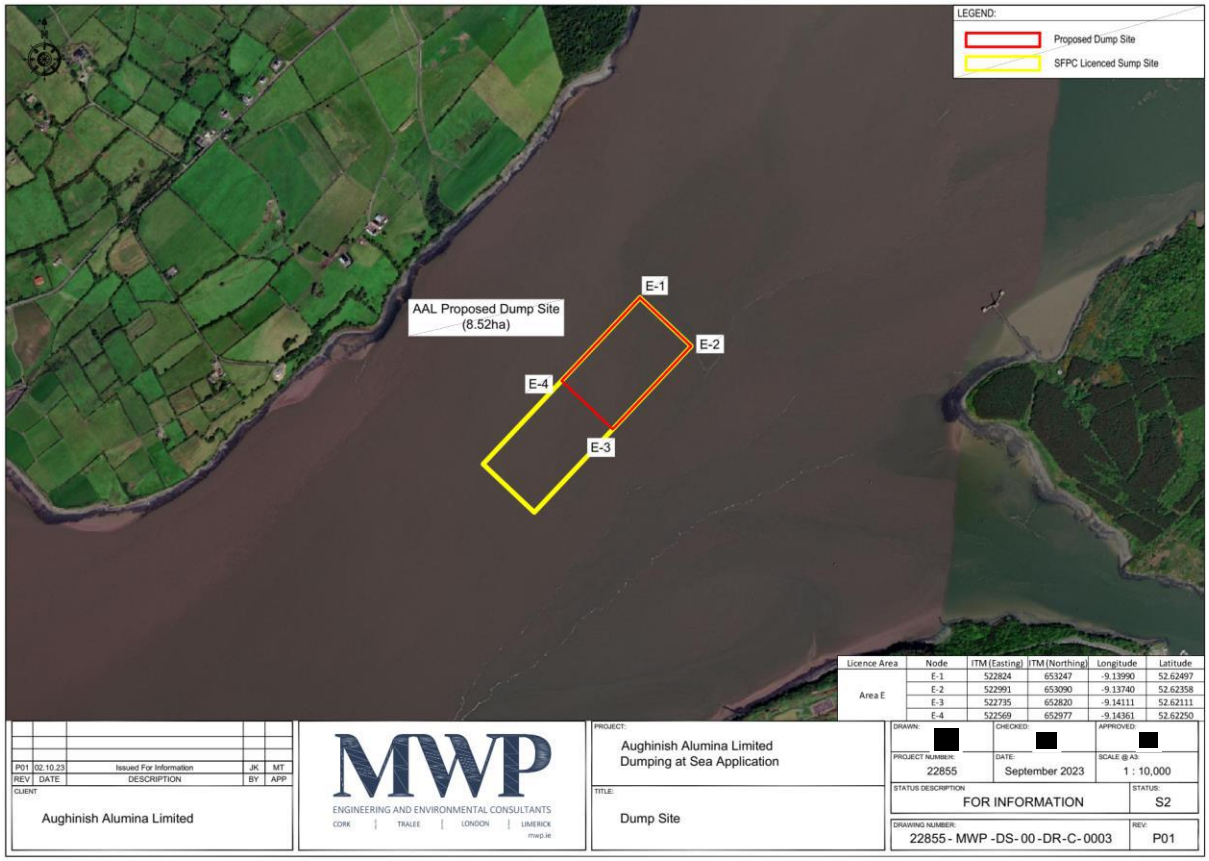

Figure 2-4 Details of proposed dump site off Foyne's Island

2.4 Volumes for dredging and Dumping at Sea

The application for a DaS Permit will cover a period of 8 years and will be based on a multi-annual dredge plan which will vary from year to year. The table below sets out the maximum volumes annually and over the 8 year period.

There are two distinct areas where material will be dumped at sea. Table 2-2 below relates to the material that will be dredged by means of the TSHD and brought to the Dumpsite off Foynes Island. Table 2-3 relates to dumping that occurs within the four dredge areas at the AAL jetty. That dumping emanates from the plough dredge process, where in effect your dredge area acts as your dump area.

Table 2-2 Quantity to be Loaded and Dumped at Sea

Dumping Site	Maximum annual quantity tonnes wet	Total Maximum quantity to be dumped over 8 years (Wet tonnes)
Dump Site (SFPC - Site "C" Foynes Island - Mid Channel)	53,846	430,771
Total	**53,846**	**430,771**

Table 2-3 Quantity of material to be plough dredged

Dumping Site	Maximum annual quantity tonnes wet	Total Maximum quantity to be dumped over 8 years (Wet tonnes)
Dumping site A Outer berth	13,309	106,470
Dumping site B Cells	2,520	20,160
Dumping site C Inner Berth	5,962	47,693
Dumping site D Approach Arm	7,920	63,360
Total	**29,710**	**237,683**

2.5 Dredging Periods/Scenarios

In order to provide extra flexibility in the dredging process it is intended to have provision in the DaS permit to dredge/dump twice a year. Each campaign would have a maximum duration of 21 days. Dredging operations will take place for 24 hrs per day during each 21-day cycle.

2.6 Management of Loading and Dumping Operations

The assessment of the impact on the receiving environment includes details on how the loading and dumping operations will be managed to ensure that they will comply with, or will not result in the contravention of:

- The Water Framework Directive 2000/60/EC,
- The Marine Strategy Framework Directive 2008/56/EC,
- The Priority Substances Directive 2008/105/EC.

The objectives of these Directives are outlined in **Sections 5 and 6** of this report.

As part of the DaS application, the particle sizes, chemical composition, and radiation of samples of the sediments from each of the dredge sites has been tested. These tests have been shown to be clean and within the agreed limits for DaS permits (results are provided in **Appendices 10**. They will not result in any pollution of the estuary. The potential effects of dredging and dumping on the estuary in terms of deposition and turbidity have also been modelled and shown to have no significant effect on the estuary and its habitats. AAL are also proposing monitoring of the dredging activities to ensure that they will not have any negative environmental effects on the estuary (see **Section 8** of this report).

2.7 Ongoing Monitoring during licence period

What follows below is a summary of the monitoring proposed to be undertaken during the licence/permit period:

1. Pre-dredge and post-dredge bathymetric surveys of the dredge/dump sites, and reporting.
2. Chemical and granulometric analysis of sediment samples from the dredge sites typically in years 2, 5 and 8, with associated reporting.
3. Baseline suspended solids sampling/analysis at the existing two sampling points (one upstream and one downstream of the jetty) prior to activities commencing, once every second day during dredging activities and one week post the dredging. Reports to be provided for all sampling and analysis.
4. Marine Mammal monitoring (by a qualified Marine Mammal Observer) within 500m of the dredging/dumping areas to ensure it is clear of marine mammals. The area should be reported as being clear of mammals within 30 minutes of any commencement of dredging/dumping activities or bathymetry surveys using sonar equipment. Report of results must be submitted.
5. Licensed archaeological monitoring should be undertaken of the initial dredging works in areas where the seabed has not been previously dredged or disturbed. The monitoring should be undertaken by a suitably qualified underwater archaeologist experienced in such monitoring of marine dredging works. Should the monitoring results in the first dredge campaign be negative then no further licensed monitoring in these areas is deemed necessary. A dive survey licence must be in place to allow for any potential archaeological inspection dives to take place should cultural material need to be assessed during the course of the works.

2.7.1 Sampling Points for Chemical and Granulometric analysis

The proposed sampling points for the chemical and granulometric analysis of sediments from the four jetty dredge sites are provided in Table 2-4 below. Figure 2-5 shows these locations around the jetty.

Table 2-4: Chemical and Granulometric sampling points for monitoring of dredge activities.

Dredge Site	Sample No.	Longitude (W)*	Latitude (N)*
A	1	-9.05688	52.64558
B	2	-9.05795	52.63691
C	3	-9.05688	52.64505
D	4	-9.05938	52.64094

*Coordinates in WGS84

2.7.2 Sampling points for Suspended Solids

The two proposed sampling points for the baseline suspended solids analysis are illustrated in Figure 2 below. These are the points at which AAL are currently monitoring turbidity. The coordinates for these points are provided in Figure 2 and Table 2-6.

Table 2: Sampling points for monitoring of suspended solids

Sample Site	Longitude (W)*	Latitude (N)*
Downstream	52.646316	-9.0067
Upstream	52.641066	-9.0448

Coordinates in WGS84

Figure 2-5: Location of the sediment sampling points for the chemical and granular analysis around the AAL Jetty.

Figure 2-6: Location of the two suspended solids monitoring points

3. DESCRIPTION OF EXISTING ENVIRONMENT AT LOADING AND DUMPING AREAS

3.1 Characteristics of the Dredge and Dump sites

3.1.1 Bathymetry and water depths

Bathymetry surveys were completed to establish existing bed levels and water depths in terms of navigation to Chart Datum. The survey showed varying elevations at each dredging and dumping site:

- Site A, elevations ranged from 10m CD to 18m CD.
- Site B exhibited elevations from 0m CD to 6m CD,
- Site C showed variations from 12m CD to 14m CD.
- Site D showed elevations ranging from 1m CD to 13m CD.
- The bed elevation levels at the dumping site off Foynes Island, were observed to fluctuate between 32m CD to 40m CD. The deepest area is proximal to the Shannon Foynes dumping site.

Table 3-1 below provides a summary of the bio-physical and habitat characteristics of the five locations where dredging/dump takes place.

3.1.2 Tidal Currents

Tidal current metering was completed in the spring of 2023 and had also been completed previously for the preparation of the 2016 DaS application. The outputs from the tidal current metering work showed that the tidal current regime in the vicinity of the jetty were as follows:

Spring Mid Ebb 1.0 to 1.1m/s

Spring Mid Flood 0.7 to 0.8m/s

Neap Mid Ebb 0.7 to 0.8m/s
Neap Mid Flood 0.5 to 0.6m/s

In both cases mid ebb currents are stronger than mid flood currents. Therefore, material from the dredging will tend to migrate downstream towards the sea over a tidal cycle. During this period the dredge material will disperse horizontally reducing the areas of maximum concentration.

Table 3-1 Characteristics of the Dredge and Dump sites

Characteristics	Dredging and Dumping Site A	Dredging and Dumping Site B	Dredging and Dumping Site C	Dredging and Dumping Site D	Shannon Estuary Dumping Site
Distance from nearest shore	0.9km	0	0.8km	0.17km	0.4km
Average depth of water (referenced to OD Malin);	14m CD [-17m OD Malin]	3m CD [-6m OD Malin]	13m CD [-16m OD Malin]	6m CD [-9m OD Malin]	36m CD [-39m OD Malin]
Minimum Depth of water	10mCD [-13m OD Malin]	0mCD [-3m OD Malin]	12m CD [-15m OD Malin]	1mCD [-4m OD Malin]	32mCD [-35m OD Malin]
Maximum Depth of water	18m CD [-21m OD Malin]	6m CD [-9m OD Malin]	14m CD [-17m OD Malin]	13m CD [-16m OD Malin]	40m CD [-43m OD Malin]
Sediment characteristics;	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Muddy Sandy Gravel	Slightly Gravelly Muddy Sand	Rocky seabed without significant sediment.
Nature of seabed habitats	Muddy Estuarine Habitat. Subtidal sand to mixed sediment with *Nephtys spp* community complex.				Subtidal sand to mixed sediment with Anemone-dominated subtidal reef community.
Current/flow/tidal regime; etc	Tidal currents are high and turbulent, ranging from 0.5 to 0.6m/s at neap mid flood, to 1.0 to 1.1m/s at spring mid ebb. Natural turbidity is high. Tidal range is variable but on average is 3.3m.				Max speed of 2.32/4.5 m/s. Natural turbidity is high. Tidal range varies from 2.2 to 6.3m
Tonnage Previously Dumped at site	374.90 tonnes (2022)			N/A	N/A
Duration of Previous Dumping	18th August 2022 - 23rd August 2022			0	N/A

Characteristics	Dredging and Dumping Site A	Dredging and Dumping Site B	Dredging and Dumping Site C
Previous Impacts	• There were two incidental sightings of marine mammals during the maintenance dredging campaign. These sightings occurred while dredging operations were already underway and no mitigation action was required. • The local small level increase in noise in the marine environment from the plough dredging operations had the potential to cause low level disturbance such as masking / behavioural impacts such as displacement but as the Shannon Estuary is a busy shipping port the disturbance from these operations are likely to be minimal. • Short lived spikes in turbidity at the site were attributed to localised biofouling such as seaweed and are, therefore, of no concern for operations at the site.	N/A	No impact on benthic resources, marine mammals or archaeology.
Previous DAS permits	Nr. S0026-01 Nr. S0026-01 Nr. S0026-01	N/A	SFPA DaS Nr. S0009-03

3.1.3 Tidal Range

Tidal range will vary depending on the time of year with higher tidal ranges in spring tide periods as against lower tidal range at neaps. There are also times where higher than average tidal ranges occur. These are called Highest Astronomical Tides (HAT) or Lowest Astronomical Tides (LAT) and these can add significantly to the tidal range. Weather, strong winds and Low Pressure can also influence tidal range or extremes in the average range of tides.

For Foynes Island the following are the range of tides.

MLWS +0.3	MLWN +1.8	LAT -0.6
MHWS +5.2	MHWN +4.00	HAT +5.7
Range for spring tides is 4.9m	Range for neap tides is 2.2m	Max tidal range 6.3m

3.1.4 Turbidity

The baseline Aquafact turbidity survey at the AAL jetty (December 2015) showed that ambient concentration of suspended sediment as turbidity is high in the vicinity of the jetty berths with NTU values of 40 to 280. Often a factor of 3 is used to convert NTU's to suspended solid concentrations in mg/l, which suggests potential ambient suspended solid concentrations of 100 to 800mg/l in the receiving waters. These levels reflect the normal naturally high turbidity that exists in this estuary particularly in the middle and upper estuary reaches where mud flats are present and where the large river inflows and high turbulent tidal velocities mobilise such sediments.

Turbidity survey data and analysis for the 2022 dredging campaign at the AAL jetty during dredging activities is included in AAL's 2022 Dredging AER. This survey and analysis was undertaken by IDS Monitoring. Their report shows that there were no readings that exceeded or came close to exceeding the permitted upper threshold of 280 NTU during the dredging period. Figure 3.1 shows the turbidity readings collected for the dredging period as well as two weeks pre- and post-dredging. The green box in Figure 3.1 highlights the dredging period itself. No single turbidity reading above 22 NTU was recorded during the dredging period. As such, the dredging operations, in terms of impact on suspended sediment, was compliant and operated within the terms of the dredging permit.

There was only a single reading shown in Figure 3.1 where measured values exceeded the upper threshold of 280 NTU. This was due to biofouling on the Nephelometer (e.g. seaweed blockage), which then cleared very quickly (within the next 10-minute sample period) as the flow of water cleared the blockage.

The report also noted that these 2022 turbidity values were below those seen on previous dredge campaigns. This was attributed to less fluvial discharge and tide size. The variation in ranges over the period in Figure 3.1 is due to the spring and neap tidal cycle, where more material is naturally resuspended during spring tides. This is as previously seen at this, and many other, sites.

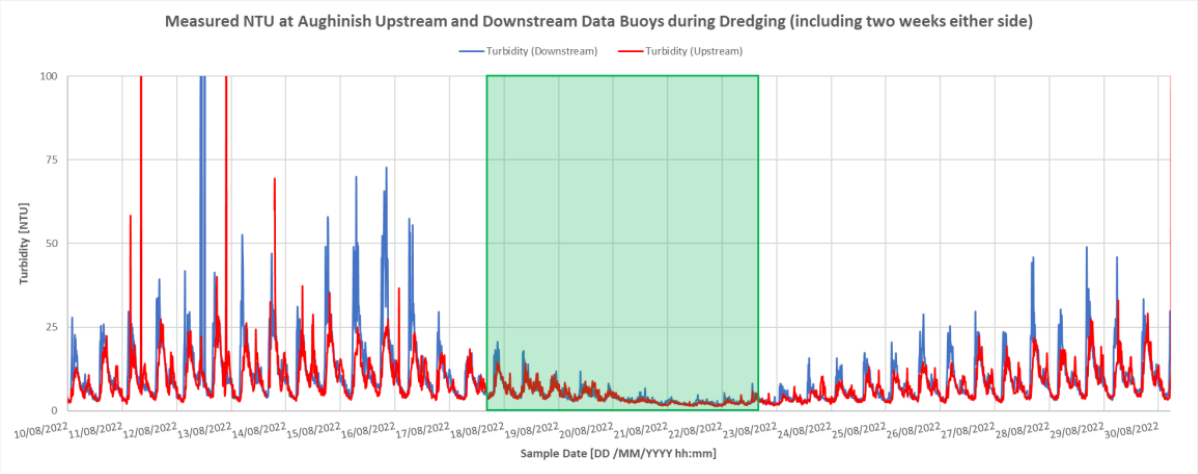

Figure 3.3-1 Data from Dredge period (green box) including two weeks pre- and post-dredging periods.

3.2 Characteristics and Composition of the Substance of Material for Disposal

3.2.1 Seabed sampling and analysis – geochemical/grain size composition

The assessment involved rigorous sediment characterisation for dredge areas in compliance with established guidelines and the methodology prescribed by the Marine Institute. Multiple samples were collected, ensuring representation of seafloor substrate. Various analyses, including grain size, density, pH, organic matter, heavy metal, and nutrient content, were conducted. Benthic surveys indicated a diverse and balanced ecosystem.

Four samples taken at the four dredge sites for granulometry, organic carbon and chemical composition. Another three samples were collected for radiation analysis. Details about the sampling locations and methods and the laboratory test results are provided in Appendices 10 (Benthic Report).

Mixed sediments dominated the stations sampled around the jetty and surrounding area at Aughinish Island. Sediments were defined as slightly gravelly muddy sands or gravelly muddy sands. Silt/clay particles (<63µm) contributed between 40-48% of the sediments at 7 of the stations and 19% and 29% respectively at stations 3 (west of the outer berth (dredge site A) & 9 (west of dredge site D). Sands of all size fractions were present at all stations but very fine (63-125µm) and fine (125-249µm) sands tended to dominate. Gravels (>2mm) contributed small amounts, less than 4.5%, at the majority of stations but were recorded at 37% and 10% at stations 3 & 9 respectively. Total organic carbon was moderate, ranging from 5.6% at station 6 to 12.2% at station 2. These results were as expected for the sediment type and position of the stations within an estuary.

The radiological analysis was carried out on a composite sample of stations 1, 2 and 3. The radiological results were low and do not give rise to any radiological hazard (see results provided in Appendix 5– Benthic Report). The chemical analysis results indicate the samples are within the agreed limits for dumping at sea (see results provided in Appendix 10 – Benthic Report.

3.2.2 Benthic Environment

A separate benthic report was produced by Merc Environmental Ltd (see Appendix 10).

Sediment samples were taken at nine stations in and around the dredge sites for macrofauna (animals that live within the seabed sediments and that are greater than 1mm in size). Faunal communities were characteristic of

muddy estuarine habitats. Number of taxa and diversity was low for the majority of samples. Generally, fewer than 10 taxa were recorded per replicate and Shannon-Weiner diversity was less than 2. However, evenness tended to be high (>0.5) which showed that communities were not dominated by one taxa and numbers were spread evenly across those taxa recorded. Sample stations 2, 3, 5, 6, 7 & 8 formed the major cluster of samples. The polychaete Nephtys hombergii and the bivalve Macoma balthica were commonly recorded at these stations. Also found were the tube-dwelling polychaete Pygospio elegans and the capitellid Heteromastus filiformis. These are all typically estuarine species. Whilst these species were also present in samples from stations 4 and 9, the estuarine polychaete Aphlochaeta marioni were more abundant in these communities. Samples from station 1 were dominated by the amphipod Corophium volutator. This species is typical of very shallow muddy banks. Sediments and total organic carbon varied only slightly between stations and it was therefore likely that the small differences seen between communities was due to position, depth and closeness to the shore rather than any measured physical attribute. The macrofauna results are provided in **Appendix 10** – Benthic Report))

The dredge site resembled estuarine sublittoral muds with healthy biodiversity, while the dump site featured an "Anemone-dominated subtidal reef community." Chemical and radiological analyses confirmed compliance with safety standards. Dredging was predicted to have a minimal impact on habitat, and dumped sediments were expected to disperse naturally, preserving ecosystem integrity. All results met national and international regulatory standards, indicating suitability for dredging and dumping operations.

3.3 Marine Mammals

The marine mammal risk assessment conducted by Irish Whale and Dolphin Group Consulting (IWDG) evaluates the potential impact of dredge and dumping operations at the AAL Jetty (see **Appendix 9**). The study focused on the presence and behaviour of marine mammals, specifically Harbour Seals, Grey Seals, European Otters, and Bottlenose Dolphins, in the vicinity of the proposed works.

In Irish waters, a rich diversity of marine mammals has been observed, comprising 26 cetacean species and two seal species, namely the Grey Seal and Harbour Seal. These species have been documented through both strandings and sightings, providing valuable insights into the marine mammal population in the region. The presence of these species highlights the varied habitats, ranging from shallow continental shelves to deep waters, contributing to Ireland's status as a habitat hotspot. Key findings of the report were:

- Harbour seals and otters were not recorded near the proposed works.
- Grey seals were sporadically observed in 2009 based on telemetry data.
- Bottlenose dolphins were found to be present on 21% of monitored days at AAL. Their activity was consistent across seasons, with more sightings during neap tides and night-time hours.

3.4 Archaeology Resources

An archaeological Impact Assessment has been conducted by Laurence Dunne Archaeology Ltd (see **Appendix F12**). The report shows that while known shipwrecks will not be impacted by the proposed dredging activities, potential impact on unknown underwater archaeology exists, especially in Area B where some previous archaeological records have been noted. A field inspection undertaken as part of the 2016 and 2023 AAL DaS application found no traces of these recorded archaeological resources, and past dredging monitoring was negative. Documented research showed no recorded shipwrecks.

3.5 Plans, Projects and Other Activities

The 2020 DaS Guidance document requires that the cumulative impacts of the proposed and previous dredging are assessed. The EC 2018 notice related to the Habitat's Directive also requires that cumulative impacts of the proposed development are assessed along with other plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans'. As the underlying intention of the in-combination provision is to take account of cumulative effects (DoEHLG, 2010) it is necessary to identify not only these aforementioned projects or plans but all likely sources of effects in the existing environment (DoEHLG, 2010) with which the proposed development could interact synergistically to cause in-combination impacts.

3.5.1 Plans

A review of the relevant plans that could potentially interact with the proposed project was undertaken. Plans that could interact synergistically with the project include:

- Limerick Development Plan 2022-2028
- Clare County Development Plan 2017–2023
- Strategic Integrated Framework Plan for the Shannon Estuary 2013-2020

3.5.2 Projects

Projects are defined (EC, 2021) as undertakings that involve construction works, installations and other interventions in the natural environment, including regular activities aimed at utilising natural resources. A search of the adjacent local authorities' on-line planning enquiry systems determined that there are an abundance of permissions and applications associated with projects distributed throughout the wider geographical area. As would be expected these are primarily for minor development works typical of rural settings with a mix of small towns and villages, interspersed with dispersed dwellings, where agriculture is the dominant activity. The projects include, *inter alia*, dwelling houses with ancillary works (WWTS, extensions, landscaping, etc.), farm structures (silage pits, sheds, etc.).

There are two exceptions notable because of their proximity and the characteristics of the works involved. One is the expansion of the bauxite residue disposal area (BRDA) raise planning application, originally submitted by AAL in 2021, and the other is a port capacity expansion planning application submitted by the SFPC at Foyne port granted in 2018.

The AAL planning application to ABP (PA91.312146 and 318302) is for the raising of the BRDA, an extension to the existing Salt Cake Disposal Cell and an extension of the permitted borrow pit at their facilities on Aughinish Island. This application is currently being reconsidered by ABP.

The permitted SFPC Foynes port capacity extension works (PA91.301561 granted in 2018) [1] will consist of:

- Construction of an open-piled jetty structure with suspended 116.5 m concrete deck connecting the West Quay to the East Jetty.
- Quayside furniture, including quay fenders, mooring bollards, safety ladders, toe rail and lighting columns.

[1] Bord Pleanála Case reference: PA91.301561

- Construction and remedial works to both the existing West Quay and East Jetty ends to facilitate structural tie-in of the proposed new jetty structure.
- Removal of the existing small craft landing pontoon walkway from its current position affixed to the shore between the West Quay and the East Jetty and provision of a new, small craft, landing pontoon and walkway affixed to the western side of the West Quay wall.
- All associated site development works.

The development will include a phased expansion of the port estate, on 33.95 ha of land immediately adjacent to the east of that existing, to provide serviced industrial land and to accommodate marine-related industry, port-centric logistics, and associated infrastructure that will be provided in accordance with a development framework programme prepared for the overall expansion area.

The BRDA raise planning application is focused on land and won't interact or have effects to the maintenance dredging works at the Jetty and so from a cumulative perspective is not of concern.

The proposed Foynes Port expansion works will have both marine and land-based activities in terms of heavy civil engineering works. The works in expanding the pier structure and upgrading facilities will be located within a marine environment and within an area that is regularly dredged for maintenance purposes. The works will not have effects or contribute cumulatively to the dredging and dumping at sea works proposed for AAL.

While both projects are relevant in terms of location on the estuary and in proximity to AAL maintenance dredging works, they will not contribute to or increase cumulative effects.

3.5.3 Other Activities

3.5.3.1 Dredging and Dumping Activities in the Estuary

SFPC is permitted to conduct annual dredging campaigns, estimating between 75,000 and 150,000 wet tons of material per annum. This includes dumping material at the dump site off Foynes Island – that AAL are now proposing to use part of (see Figure 2.4). Waterways Ireland is planning a campaign near Limerick city above Shannon Bridge, but details and licensing status are unclear.

3.5.3.2 Estuary Operations

The Shannon Estuary is one of the most important navigation channels in the country as the deep waters provide access by some of the largest marine vessels entering Irish waters to ports such as Shannon and Foynes as well as numerous industries located along the estuary's shores. Due to the level of industry in the region significant numbers of vessels utilise the channel, including cargo vessels which berth at the existing deep-water jetty at AAL, and as such activity associated with these vessels could potentially result in in-combination effects as a result of the proposal.

3.5.3.3 Agriculture

Agriculture is the dominant activity in the geographical area surrounding the estuary and is considered the main pressure on surface water quality in the various river systems draining to it. As a result, there is potential for the proposed dredging and dumping at sea to contribute to in-combination impacts on the quality of marine waters within the relevant Natura 2000 sites. This derives from the potential for sediments and other pollutants entering the estuary waters as a result of the dredging and dumping at sea. Within this landscape commercial woodland

plantations are also present but the distribution of these is relatively diffuse in the flood plain of the River Deel that extends eastwards from the ridge of the Mullaghareirk Mountains that tracks southwards from the coast.

3.5.3.4 Aquaculture

The closest designated shellfish waters are ca. 27 km west of AAL at Ballylongford. A study of the marine atlas showed that the closest fishing ground is Pot fishing for shrimp ca.19.6 km west of AAL.

There is one aquaculture site in the vicinity of AAL. This is located approximately 317 m to the east of the AAL Site B dredge site at its nearest point. This shellfish farm has been in operation for 10 years and is located on the site of a previous farm that had operated for 25 years. The farm produces under 10 tons of finished oysters per annum.

3.5.3.5 Urban Waste-Water

Raw sewage, from an Agglomeration[2] with a Population Equivalent (PE)[3] of 592, is discharged to the estuary at Foynes[4] (Reg No. D0502-01). This discharge point is located approximately 4.5 southwest of the jetty at AAL.

3.5.3.6 EPA Licenced Facilities

Industrial and waste facilities are classed into different sectors depending on the nature of their activity and its potential impact on the environment. There are two Licenced Waste facilities within the port area in Foynes that are registered by the EPA, however, neither are currently active. One issued to Greenport Environmental Limited was withdrawn and the other issued to Irish Bulk Liquid Storage was never active. There are a further three in Limerick City, one in Ennis and another in Kilkee.

There is an Industrial Emissions Licenced (IEL) facility [Licence No. P0035-07[5]] situated within the AAL refinery. The Licence grants AAL permission to carry out the following activities in accordance with the requirements and conditions set out in the Licence:

- The production of inorganic chemicals;
- The combustion of fuels installations with a total rated thermal input of 50 MW or more; and
- The recovery or disposal of waste.

Submitting an Annual Environmental Report (AER), a summary of environmental information for a given year, is a requirement of all EPA licences. Each AER includes:

- Details of the licence holder's environmental goals achieved to maintain compliance and/or improve their environmental performance;
- Answers to questions regarding their facility's activities;
- Tables of results from monitoring emissions such as air, water, noise, and odour; and
- Details of waste generated, accepted and treated.

[2] An urban settlement (village, town or city area) which is connected through a pipe network to a wastewater treatment plant.
[3] Wastewater treatment plants are described in terms of their designed treatment capacity, which is generally expressed as PE
[4] https://gis.epa.ie/EPAMaps/SewageTreatment
[5] Class of Activity: Sectors 2 (Energy), 5 (Chemicals) and 11 (Waste)

4. NEED & ALTERNATIVES

4.1 Alternatives to Dumping at Sea

The following sections explore the options available for disposal of dredge material and demonstrate why the proposed approach is the lowest impact solution available for the jetty at AAL.

In terms of dealing with dredge materials the following are the options that were considered:

- Disposal on land at a waste facility
- Deposit within a marine structure
- Land reclamation on the coast or inland
- Re-use on land in combination with another activity, e.g. agriculture.
- Disposal at Sea – at existing permitted DaS sites within the estuary.
- Disposal at Sea – by means of plough dredging/bed levelling adjacent to Jetty structure.

4.1.1 Disposal on land at a waste facility

In order for the dredge material to be brought on land and to an appropriate waste facility, be it an inert waste facility or a landfill site for capping etc, it would first have to be brought on land via barge or be pumped from a dredger to a defined location on the shore nearby. This location would have to be on the coast and would need to be large enough and of the right contours to enable temporary storage. It would also need to be bunded in order to allow the material to settle and for the water to run off and settle out of the material. The temporary storage area would have to be suitable in terms of environmental constraints.

Once the material settles in the temporary storage area, the sea water would then need to be discharged back to the ocean. The water would need to go through a settlement and filtration pond before discharge and would need to be clean and suitable for discharge. Such a facility would need a discharge licence to be in place. Such a site would need planning permission and a waste licence in order to store it temporarily. In addition, the applicant would need to either own or have a lease on such lands.

Currently there is not a suitable site available to bring material on land for a temporary period and to then transhipthis off site to a permanent location in a waste facility, be it a facility for inert soils or as use for capping on a facility. In addition, the presence of saline material may not render it suitable for re-use or permanent placement at a waste facility.

This approach would require the physical removal of material from the bed by grab or suction dredger along with a barge or pumped pipe network to deliver it to land. This could be done using a TSHD which AAL are proposing to use. However, for logistical reasons AAL are only proposing to make use of this technology for short periods every other year at dredge site A and C only, as needed. Most of the dredging at all four sites is proposed to be done by plough dredger and a LR/B. There are two reasons for this. Firstly, the outer berth (site A) has a high occupancy rate with only short periods for dredging activities each year. Secondly, the TSHD vessels are commissioned from the UK or continental Europe. This restricts the availability of TSHD vessels at short notice and for potentially small quantities of material.

Logistically removing the silt from the sea and landing it is a complex solution for infrequent and relatively small quantities of dredge material. It also needs greater controls in place as the loss of material in the dredge process, lifting it from the bed up through the water column and placing it in barges or through floating on water discharge pipes brings more risks of increased sedimentation and turbidity. It also means the scale of vessels and equipment required are larger and the process involved would be potentially slower.

Together the above factors make it impractical and exorbitantly expensive and effectively not practical to use the TSHD technology to remove all the dredge material and deposit it on land. The use of a plough dredger or bed leveller which is locally based within the Shannon Estuary means that reaction times are faster, and the availability and logistics can be planned more accurately and flexibly.

4.1.2 Deposition within a marine structure

In some instances where there are marine engineering works taking place in a harbour or port, then dredge material can be used as bulk fill for within a structure or revetment. In that instance the material has to be clean, but also has to be suitably de-watered and of a suitable composition to be useful from an engineering perspective. In the case of soft silts, these would also need to be dewatered, surcharged and stabilised to become suitable for port and storage uses. This is a lengthy and expensive process that is generally not favoured for port reclamation projects. In addition, these types of port engineering or land reclamation projects would require planning and licencing in place to suit this type of solution and also coincide with the dredging plans of AAL.

Currently and in the short to medium term there are no suitable planned marine or land edge coastal reclamation structures to be developed in the Shannon estuary area that could take such suitable material. Accordingly, this is not an option for the proposed dredging at AAL.

4.1.3 Land Reclamation on the coast or inland.

In some instances, there are areas of coastline or lands adjoining the coast that may require coastal protection work in the form of engineered structures or there may be areas of low-lying lands that would be suitable for reclamation. In both instances the location would be subject to planning, Marine Usage licence and may also require a waste permit. In addition, the lands would need to have good access from the seaward side or on land via road.

The applicant would need to own the land or have a lease on the land and permission to use it for the purpose of reclamation or coastal protection.

At present there are no such suitable lands available adjacent to AAL jetty on the coast or inland at suitable distances. Neither is there any consent available for such projects. In addition, the practicality of depositing clean, dry and suitable dredge spoil to these locations is not technically feasible with the relatively small dredge volumes to be dredged around the AAL jetty.

This option would also require both a dredger and barges and additional land-based equipment to achieve a viable solution on land. The nature of the occasional annual dredging that would be required to remove high points on the seabed would mean that an engineered structure would be filled over time and at infrequent intervals when dredge spoil would become available. This would suit a structure that would require fill material over a long period of time and in a sequence or volume that would coincide with the dredge events.

This approach is impractical given the nature of what is required for the jetty.

4.1.4 Re-use on land in combination with another activity, e.g. agriculture

In order to adopt this approach, the dredge material would have to be transportable to such a location. The proposed use may require planning, waste permit or other consent. The material would need to be clean and dry and readily transportable in a truck. To achieve this, a large bunded holding and drying area and structure would need to be established within the AAL facility, or on the shoreline. It would then take time to dry, settle and drain off. A need for this type of material would be required within a reasonable travel distance. For use in an

agricultural use on land, the saline nature of the material may make this material unsuitable. In addition, you have the impacts of traffic and transportation, temporary storage solutions and possible implications with planning or conflicts with land management practice.

At present there is no identifiable location or activity that could re-use dredged material from the facility. In addition, there is no large suitably structured storage and drying area at the AAL facility to deal with any dredge material.

Consequently, this approach is not practical and has its own negative impacts in terms of managing the process, transport of materials, permits etc.

4.1.5 Disposal at Sea – at previously and currently permitted DaS sites within the estuary

There are a number of dump sites within the Shannon estuary that have been permitted to various companies. These include the following:

Table 4-1 Previous and Current Permitted DaS sites within the Estuary

Details	Description
	EPA Reg No. - S0009-02
Applicant:	Shannon Foynes Port Company Limerick.
Location of Loading	Foynes Port and Limerick Dock
Location of Disposal	Shannon Estuary
Description of Activity:	The application is for the loading and dumping at sea of a maximum of 1,656,000 tonnes of dredged material and the plough dredging of a maximum of 96,000 tonnes of dredged material from Foynes Port and Limerick Dock.
Final Decision date:	22/01/2013
	EPA Reg No. - S0009-03
Applicant:	Shannon Foynes Port Company Limerick.
Location of Loading:	Ted Russell Dock, and approach channel to Ted Russell Dock, Limerick. Foynes Harbour, Foynes (locations shown on drawings in Attachment A.8).
Location of Disposal	2nr approved dump sites for silt/mud dredged from Limerick, which have been used since 1999 and 2005 - Dump Site A & B (locations shown in Attachment A.8). 1nr approved dump site for silt/mud dredged from Foynes Harbour, which has been used since 1999, Dump Site C, located in the main channel of the River Shannon, west of Foynes Island (location show in Attachment A.8)
Description of Activity:	Maintenance dredging to maintain water depths by means of Grab/Trailer Suction Hopper Dredging and bed levelling (as detailed in Attachment A.8)
Final Decision date:	21/12/2020
	EPA Reg No. - S0019-01

Details	Description
Applicant:	Shannon Foynes Port Company Limerick.
Location of Loading:	Foynes Port
Location of Disposal	Centre of Main Channel of River Shannon
Description of Activity:	Reclamation of approximately 1.30 hectares of foreshore at the East Jetty in Foynes Port.
Final Decision date:	13/05/2014
	EPA Reg No. - S0020-01
Applicant:	L&M Keating Limited Clare.
Location of Loading:	Kilrush Marina
Location of Disposal:	Kilrush approach channel and estuary
Description of Activity:	The dumping at sea of a maximum of 19,000 tonnes of dredged material from Kilrush Marina Approach Channel by plough dredging.
Final Decision date:	25/02/2015
	EPA Reg No. - S0020-02
Applicant:	L&M Keating Maritime Limited Clare.
Location of Loading:	N/A
Location of Disposal:	N/A
Description of Activity:	Plough dredge silt from marina access fairway from lock gates to deep water in main channel.
Final Decision date:	5/12/2017
	EPA Reg No. - S0026-01
Applicant:	Aughinish Alumina Limited Limerick.
Location of Loading:	N/A
Location of Disposal:	Within the existing granted foreshore lease area adjacent to the jetty at Aughinish, Co limerick and the wider estuary where material will disperse to.
Description of Activity:	Maintenance dredging (Bed levelling using a plough dredger)
Final Decision date:	28/07/2016
	EPA Reg No. - S0008-01
Applicant:	ENDESA (Tarbert Generating Station) Kerry.
Location of Loading:	Tarbert River Shannon Estuary County Kerry.
Location of Disposal:	Tarbert River Shannon Estuary County Kerry.
Description of Activity:	Application is for the proposed disposal of dredge material at sea from maintenance dredging of the cooling water intake at Tarbert Generating Station.

Details	Description
Final Decision date:	20/07/2011

Each of the permitted DaS sites outlined above are located within the Shannon Estuary. The Endessa and L&M Keating sites are located near Tarbert/Kilrush which is at least 24km west of the AAL jetty. Both of these permitted sites were associated with activities to clear existing port facilities of silt to enable access and navigation. Consequently, these sites would not be suitable for allowing other companies to dump their sediments.

The Shannon Foynes Port Company (SFPC) has three sites (A, B and C – see Figure 4.1) within the estuary where they are permitted to dump dredged material from the Foynes and Limerick ports. Sites A and B are 23km and 16km upstream of the AAL jetty. These dump sites also have limited capacity to accept additional dredged material from other places.

Figure 4.4-1 SFPC dump sites in Shannon Estuary

AAL are applying for permission to make use site C that SFPC are permitted to dump at. This site is located off Foynes Island, 5km downstream of the AAL jetty and is the closest and most feasible dump site for AAL. This is proposed to be used for some of the dredge material from the outer berth (AAL site A and C) which will be extracted using a TSHD.

For the majority of the dredge material, the preferred method is to dredge using a plough dredger and LR/B. The plough dredger provides for the levelling of material locally on the seabed into depressions in the bed. This operation moves material locally on the bed and also within the water column which in turns disperses naturally with currents. This approach is the preferred solution as it ensures that the disturbance and increased turbidity or sedimentation occurs at the dredge/bed levelling location. This method is easier to control, relies on a locally

available bed leveller and gives flexibility in terms of availability and the speed at which the dredging can take place, rather than having to rely on securing an available dredger from outside this jurisdiction.

4.1.6 Disposal at Sea – by means of plough dredging/bed levelling adjacent to Jetty structure

This method of dredging uses a plough dredger or bed leveller. It is particularly suited to dealing with localised high points or accumulation of material close to a jetty or pier structure. This method would be commonly used in ports and harbours where the ability to deal with inadequate navigational depths or localised high points can be swiftly undertaken by a locally based plough unit.

This is the approach that has been used by AAL in its current DaS permit and Foreshore licence. It has also been adopted at Foynes Harbour particularly adjacent to the main pier and jetty structures. In addition, this dredge method has been adopted at Kilrush Creek to establish adequate depths on the approach channel.

The use of a locally based plough based on the estuary is efficient and controllable in terms of logistics. The availability of a locally based plough means you are not reliant on securing the availability of a dredger from outside this jurisdiction whose availability can be heavily controlled by weather, tides, and the commercial dredging market.

Bed levelling in this instance has the minimal level of disturbance, reduces the level of increased turbidity/sedimentation as the dredge event is at a defined location. That is, you do not have to deal with two locations, i.e. the dredge location and then the disposal location at a dumps site that is some distance from the jetty. The seabed at the jetty has sufficient depth below navigational design levels to facilitate the movement or relocation of material on the seabed by means of the plough. While this method also moves material into suspension, ultimately the material will settle out over the tidal cycles and in accordance with the local currents that exist. This process mimics what happen naturally when there are high levels of suspended material occurring naturally in the water body. The hydrodynamics of the estuary facilitate normal movement and deposition of material within the system. In effect the bed levelling process is redistributing naturally occurring material on the seabed to adjacent areas on the seabed, and then the cycle continues.

While AAL is proposing to make use of a TSHD for the outer and inner berths (dredge sites A and C), plough dredging, supplemented by a LR/B is the preferred and main method of dredging that AAL is proposing to use.

4.1.7 Conclusion

The main method of dredging proposed is bed levelling by means of a plough dredger, which will be supplemented by a LR/B and TSHD where needed. Consequently, most of the dredge material will be moved by a plough which moves material on the seabed and also disperses material in solution in the water column which disperses naturally through a number of tidal cycles.

A number of alternative approaches have been examined above. The only other method that is feasible and being applied for by AAL, is the use of a TSHD to remove accumulated sediment at the outer and inner berths (dredge site A & C) and dumping this at the proposed site off Foynes Island which the SFPC is already licenced to use as a dump site. The removal of the accumulated sediment is needed to deepen the berth for navigation and accommodate the potential increase in ship size/capacity being used to deliver and collect cargo from the AAL facility.

Other methods of disposing of dredge material at other sites on land was also considered but found to be more difficult to control, have associated risks, and not feasible due to the lack of suitable sites, users, storage facilities and permissions to enable the removal of the material from the sea and its reuse elsewhere.

The proposed dredging methods and dump sites are considered the lowest impact solution for this location and for the nature and quantity of material that needs to be moved and redistributed in the system each year.

4.2 Alternative Dump Sites

4.2.1 Dump site selection related to Dredging Method

The dump site selection is informed by the type of dredging and dumping methods to be used. Three methods of dredging are to be used, namely:

1. Trailing Suction Hopper Dredging (TSHD)
2. Long-arm Reach Excavator on aBarge (LR/B)
3. Plough Dredging (plough)

In the case of TSHD, the dredged material would be dumped at the dump site in the Shannon Estuary which the SFPC is already permitted to use (see section 2 below). Where the Plough dredger is used the dredged material will be levelled on the bed and also raised in suspension in the water column. The heavier sand fraction will settle out locally and re-distribute on the bed and the material in suspension will be dispersed within the wider estuary on the tidal cycle. The dredge area and the wider estuary are in effect the dumpsite and as such selecting an alternative site does not arise.

The LR/B will be used either in combination with the plough or with the plough and the TSHD. Consequently, the dump site for this method of dredging will depend on whether it is used with the plough or TSHD. At dredge site A all three methods will be used.

Table 4-2 below provides the details of what methods will be used at each site and the area it will be dumped in. The location of the dumping sites is indicated in Figure 2.1 and Figure 2.4 above. The co-ordinates of the dredge/dump areas are included in drawings of the dredge and dumping areas (see 22855-MWP-ML-00-DR-C-0002, MWP-ML-00-DR-C-0003.

Table 4-2 Dredge methods and dump sites for each dredging site.

Dredge/ Dump Site	Method of Dredging	Dredge Area	Dump Area	
			Size (m^2)	Locality
A1	TSHD + LR/B	20 800	8.4 ha	Off Foynes Island
A2	Plough + LR/B	20 800	63 000	Dredge site
B	Plough + LR/B	10 000	37 500	Dredge site
C1	TSHD	18 000	8.4 ha	Off Foynes Island
C2	Plough + LR/B	18 000	48 000	Dredge site
D	Plough + LR/B	20 000	67 500	Dredge site

4.2.2 The existing permitted dump site off Foynes Island (used by the SFPC)

For the material dredged from site A (outer berth) and site C (inner berth), the method of dredging proposed is the TSHD. This technology removes the material from the seabed for dumping at a permitted site elsewhere.

The choice of dump site for this material was informed by the following best practice criteria:

- Preferably be located in the main tidal channel of the Shannon Estuary where there are strong currents – so that the sediment can be quickly dispersed, and the water is deep enough that accumulation of sediment from dumping would not become an obstruction to shipping or fishing.
- Not be located within a licenced fishing or aquaculture area or close enough to potentially negatively affect these commercial activities,
- Not pose a threat to marine mammals or qualifying interests (for the SAC/SPA)
- Be located close enough to the dredge site to keep the costs of dredging reasonable/affordable.

Most of the licenced fisheries and aquaculture areas within the estuary are located downstream (west) of the AAL jetty site and the Shannon Foynes Harbour. All except one of the aquaculture sites are located 36km+ downstream of the AAL jetty (see **Figure 5.2**). The exception is an area just east of Aughinish Island, which has not been affected by dredging activities at the AAL jetty. There are two long fisheries licenced areas in the Shannon Estuary. The closest point of these to the AAL jetty is 7.5km downstream, beyond Foyne's Island (see **Figure 5.3**).

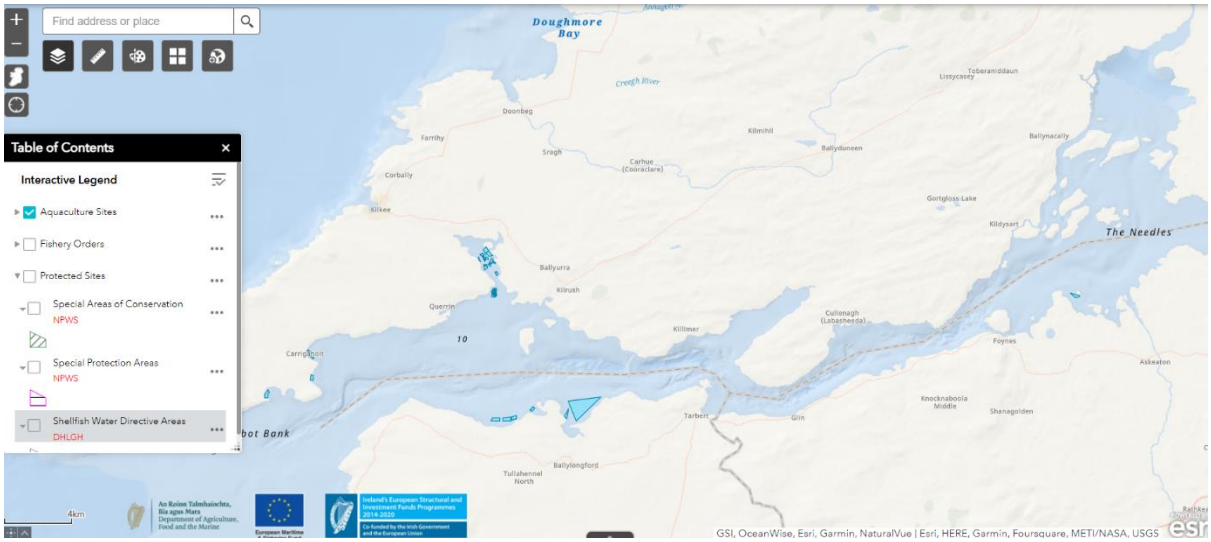

Figure 4.4-2 Licenced aquaculture sites in Shannon Estuary

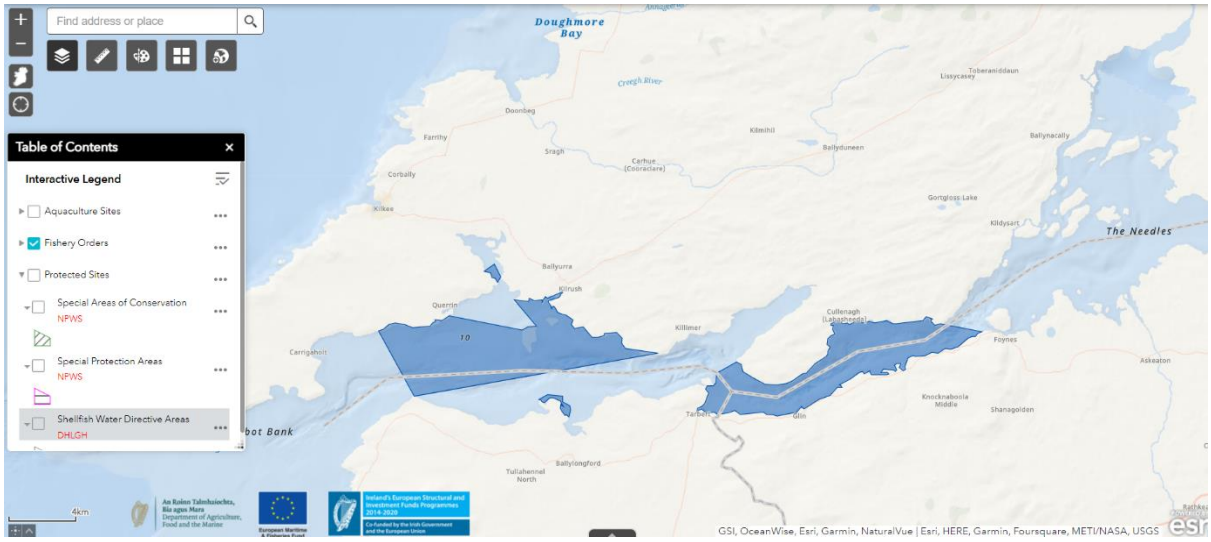

Figure 4.4-3 Licenced fisheries area in Shannon Estuary.

When identifying a suitable dump site option AAL considered four options. Three of these were the existing licenced SFPC dump sites (see **Figure 4-4**) namely:

SFPC - Site A - 23 km upstream close to Limerick city.

SFPC - Site B – 16 km upstream

SFPC - Site C – 5 km downstream

The fourth site was a potential new site in the main channel of the Shannon River, closer to the AAL jetty (see **Figure 4.5**) which has not previously been a permitted dump site. Given that two of the previously licenced dumpsites are located significantly upstream in the estuary it was considered prudent to explore whether there was any other potential location that could be considered in closer proximity to the jetty. This option would also have to be viable from an environmental perspective. Accordingly, the fourth site was reviewed and this along with the three other locations considered gave a wide spread of options. **Table 4-3** provides a comparison of the key features of these four sites that were used to inform the selection of an appropriate dump site. The selected or preferred option was then the subject of a full assessment.

As indicated in **Table 4-3**, the three SFPC sites have been used as dump sites by the SFPC and ongoing monitoring (as evidenced from AER returns) has indicated no harmful environmental effects from this dumping to date. The key differences between the 3 SFPC sites is the depth of the water and strength of the tidal movements and consequently, their capacity to receive dredged material. SFPC site C is deeper (34mDC) and located in the main channel in an area that is scoured by the tidal movements. The seabed at this site is mainly bedrock and gravels with very little sediment (See **Appendix 10** - Benthic Report). Sediment that has been dumped at this site by SFPC has been dispersed with the tidal movement and no accumulation of sediment has occurred. This site therefore has significant capacity to receive dumped sediment without the risk of compromising the navigation channel. The capacity at the other two SFPC sites is much lower.

Figure 4.4-4 SFPC dump sites in Shannon Estuary

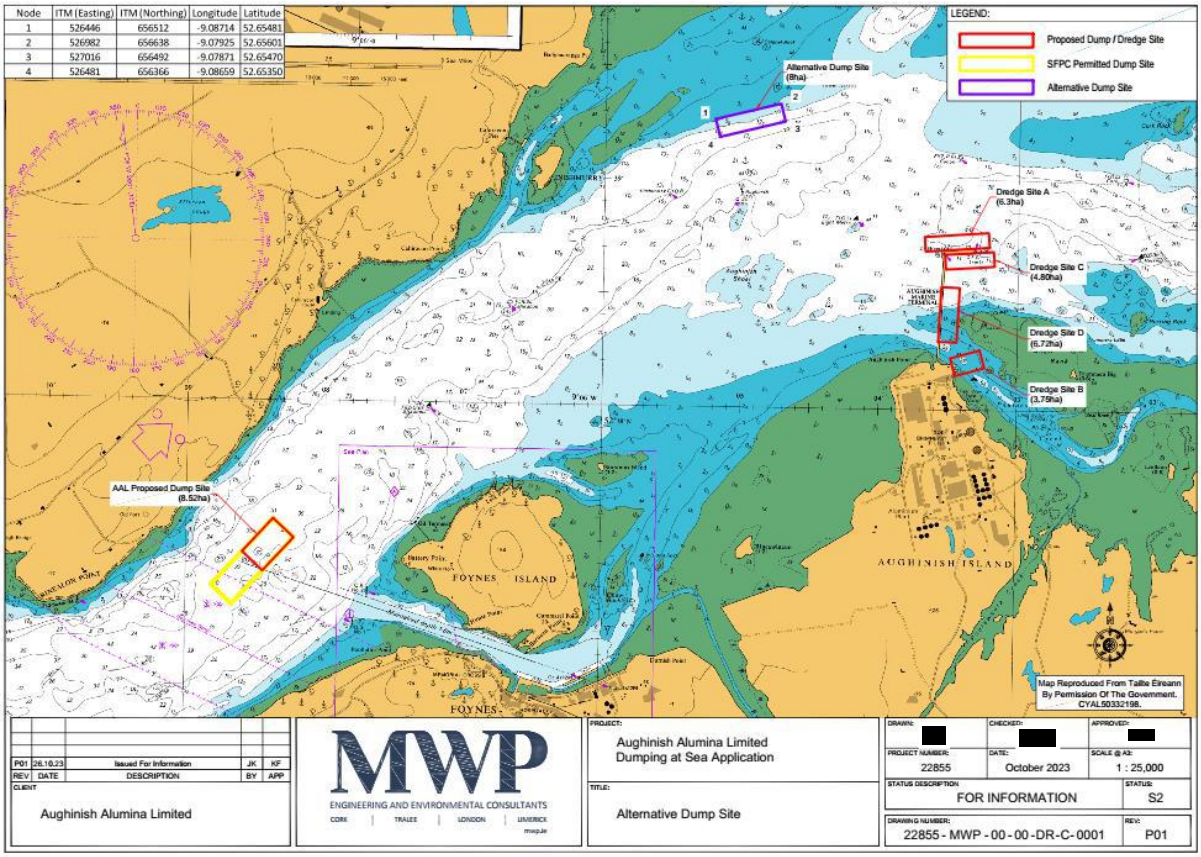

Figure 4.4-5 Location of an alternative additional dump site considered by AAL.

Table 4-3 Comparison of key characteristics of the four dump sites considered by AAL.

Criteria	SFPC Site C (off Foyne's Island)	SFPC Site B	SFPC Site A	Off AAL jetty
Distance from AAL Jetty	5km downstream	16km upstream	23km upstream	2.7km across the estuary
Water depth	34mCD (Average)	-2.5mCD (average) and	0.9mCD (average) and relatively slow ambient current speeds	10mCD (Average)
Year site 1st used as a dump site.	Used since 1999	Used since 2005	Used since 1999	Not previously used as dump site
Capacity	High capacity due to deep water and rapid current speeds, so more dispersion and less deposition. This reduces effects on flora and fauna.	Low capacity due to shallow depths and relatively slow ambient current speeds. So greater deposition and less dispersal.	Low capacity due to shallow depths and relatively slow ambient current speeds. So greater deposition and less dispersal.	Moderate capacity due to depth of water and location just outside the mid channel current, so less dispersion and more deposition than SPFC Site C. This increases potential effects on flora and fauna.
Navigation	Will not affect shipping	Not located in shipping channel	Not located in shipping channel	Not located in shipping channel
Ecological	Samples are clean and suitable for dumping	Samples are clean and suitable for dumping	Samples are clean and suitable for dumping	Un-tested to date.
Environmental Effect	Previous studies for SFPC have indicated only short-term effects with quick recovery	Previous studies for SFPC have indicated only short-term effects with quick recovery	Previous studies for SFPC have indicated only short-term effects with quick recovery	No existing data or survey information available for this location, so would need full investigation.
Archaeology	Prev. Assessed. No features of significance found.	Prev. Assessed. No features of significance found.	Close to a fish trap. Requires monitoring.	Un-investigated. Would need a full underwater archaeological assessment

Dumping at these three sites has been monitored and demonstrated that it has no impact on any fisheries or aquaculture activities in the estuary. All three of these sites are suitable from an environmental perspective.

The fourth site has an average water depth of 10m (with a range from 5 to 15m) is shallower than the SFPC site C but deeper than the other two sites, and outside the central estuary current area. In this case, dispersal by slacker currents may not be as effective as in SFPC site C. While this site would have the advantage of being closer to the AAL jetty (and associated dredge sites), it would be better from an environmental point of view to dump at an existing permitted site where the impacts of dumping have proven to be insignificant, rather than potentially affecting another part of the estuary.

Given that the SFPC Site C is relatively close to the AAL jetty, is permitted without any significant negative effects on the environment and no accumulation of sediment that would smother the benthic flora and fauna or compromise the navigation channel – this site was considered by AAL to the be most appropriate dump site option. The volume of sediment that AAL would be dumping annually over the 8-year permit period would also be significantly less than the volumes dumped by the SFPC.

Using the existing proven low impact location off Foyne's Island is a sustainable approach rather than establishing a new dump site within the estuary. In addition, and given that the volumes of material annually dredged/dumped from the AAL campaigns are significantly lower than that of SFPC, there is sufficient capacity and low risk of any effects on benthic communities or navigation.

In making its decision, AAL also consulted with the EPA about a suitable dump site (04/03/2022). The concluding recommendation from the EPA was to dump the dredged material at the licenced SFPC dump site C. AAL propose to use the eastern half of the licenced SFPC dump area which is 8,43 ha in size.

4.3 Need for Maintenance Dredging Annually

Annual dredging has taken place at the AAL jetty since 2016. It is required annually for the following reasons:

1. To maintain sufficient berthing depth for safe arrival and berthing of the bulk carrier ships through all stages of the tidal cycle. If dredging did not take place annually there is an increased risk of the ship hitting the seabed causing significant damage to the keel of the ship. Even if the seabed was not contacted, too small a gap between the ship's hull and seabed (known as under keel clearance) at certain tidal conditions increases loading on the mooring ropes to the point where the ship can break its mooring and strike the jetty infrastructure. Best practice for mooring management is outlined in "MEG4"[6]. For example, for a given current, the mooring ropes on a ship at 12.5m draft and under-keel clearance of 0.25m will have almost double the loads of a similar ship with 1.25m under keel clearance.
2. Design depth of the jetty is 14.3 metres. The maximum permitted arrival draft is 12.5 metres, which is not available close to the jetty infrastructure. Therefore, berthing is already limited to after low water, on a rising tide. Given the tidal cycle in the Shannon Estuary, any further loss of bed depth would further limit berthing windows to the point where the required shipping schedule is not achievable.
3. The Shannon Estuary itself has a naturally high level of suspended solids which settle in the vicinity of the jetty, in particular the berthing areas. This reduces bed depth and under keel clearance. Bathymetry has shown that close to the jetty itself bed depths are at 9 and 10 metres. As a result, the ships are pushed away from the jetty by 2 metres on a falling tide. Without annual dredging this distance from the jetty would increase to the point where the ships gangway would lose contact with the jetty, breaching shipping regulations.

[6] MEG4 – Mooring Equipment Guidelines – Fourth Edition 2018. Published by the OCIMF.

5. LEGALS AND CONSIDERATION OF THE DIRECTIVES

5.1 Legal

This Report has been prepared in accordance with the below mentioned directives and has regard to other relevant regulations including the Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022), the EPA Advice Notes on Current Practice in preparation of Environmental Impact Statements (EPA, 2003) and relevant European Commission guidance documents, as relevant, as well as the EPA Dumping at Sea Permit Application Guidance Note (2020) .

An Appropriate Assessment (AA) has been carried out to assess the potential of the proposed activity to affect the integrity of the Natura 2000 network. Its findings are provided in a Natura Impact Statement (NIS).

5.2 Environmental Impact Assessment (EIA) Directive

This report aims to determine whether any of the proposed activities fall within a class of projects listed in Part 2 of Schedule 5 of the Planning Regulations Section 13A of the Foreshore Act 1933, as amended.

The legal basis for Environmental Impact Assessment (EIA) comes from a European Union (EU) Directive on the assessment of the effects of certain public and private projects on the environment, which was first adopted in 1985, and has been subsequently amended in 1997, 2003, 2009. The initial Directive of 1985 and its three amendments were codified by Directive 2011/92/EU of 13 December 2011. Directive 2011/92/EU was then amended in 2014 by Directive 2014/52/EU.

Under legislation, EIA is an assessment procedure required for certain prescribed projects and is required for others which are likely to have significant impacts on the environment, by reason of their nature, extent or location.

Article 2(1) of the Directive requires that:

"Member States shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects". These projects are defined in Article 4.

It is noted that Article 2(1) of the Directive makes specific reference to Article 4 for the definition of those projects which must undergo an assessment of their effects.

Article 4 distinguishes between two categories of projects. Article 4(1) of Directive 2011/92/EU requires that projects listed in Annex I of the Directive must always be subject to EIA. Article 4(2) of Directive 2011/92/EU requires that projects listed in Annex II of the Directive must be subject to EIA if it is determined, either via a case-by-case examination or on the basis of thresholds and criteria set by the Member State, that they are likely to have significant effects on the environment.

Therefore, for a project to be subject to an assessment of its environmental effects, in accordance with the procedural requirements of the EIA Directive it must be:

(i) A project of a type listed in Annex I; or
(ii) A project of a type listed in Annex II which either meets thresholds or criteria set by the Member State; or

(iii) A project of a type listed in Annex II which is under the threshold, but following case by case examination, is likely to have significant effects on the environment.

In Ireland, a number of pieces of legislation have been used to implement the EU Directive, but for the majority of projects in Ireland it is the Planning and Development Acts, Planning and Development Regulations 2001 as amended, and European Communities (Environmental Impact Assessment) Regulations 1989 as amended that are the key legal instruments at present.

Schedule 5 Part 1 and 2 of the Planning and Development Regulations 2001 (as amended) outlines the classes of development requiring EIA as transposed from the EIA Directive 2014/52/EU (see **Table 5-1** below).

Schedule 5 Part 1 of the Planning and Development Regulations 2001 (as amended) outlines projects which require a mandatory EIA. Schedule 5 Part 2 of the regulations lists other types of development for which an EIA is required when certain thresholds and criteria are met (see **Table 5-2** below).

Article 92 of the Planning and Development Regulations 2001 (as amended) interprets "sub-threshold development" as development of a type set out in Schedule 5 which does not exceed a quantity, area or other limit specified in that Schedule in respect of the relevant class of development.

The schedule of projects listed in Part 1 and Part 2 of Schedule 5 was consulted to determine whether the new development required an EIA. **Table 5-1** provides a summary of the Part 1 projects and their applicability to this development (relevant sections if applicable have been expanded and shown using italics). Error! Reference s ource not found. provides a summary of the Part 2 projects and their applicability to this development (relevant sections if applicable have been expanded and shown using italics).

Table 5-1 Schedule 5, Part 1 Checklist

Part 1 of Schedule 5		Relevant to Project Development Site
1	Crude-oil refineries	No
2	Thermal and Nuclear Power Stations	No
3	Reprocessing of irradiated nuclear fuel	No
4	Integrated works for the initial smelting of cast iron and steel and Installations for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes	No
5	Installations for the extraction of asbestos and for the processing and transformation of asbestos and products containing asbestos	No
6	Integrated chemical installations	No
7	A line for long-distance railway traffic	No
8	Inland waterways and ports for inland-waterway traffic and Trading ports, piers for loading and unloading connected to land and outside ports	No
9	Waste disposal installations for the incineration, chemical treatment of hazardous waste	No
10	Waste disposal installations for the incineration, chemical treatment of non-hazardous waste	No
11	Groundwater abstraction or artificial groundwater recharge schemes	No

Part 1 of Schedule 5		Relevant to Project Development Site
12	Works for the transfer of water resources between river basins	No
13	Wastewater treatment plants	No
14	Extraction of petroleum and natural gas for commercial purposes	No
15	Dams and other installations designed for the holding back or permanent storage of water	No
16	Pipelines for the transport of gas, oil, chemicals or carbon dioxide streams	No
17	Installations for the intensive rearing of poultry or pigs	No
18	Industrial plants	No
19	Quarries and open-cast mining	No
20	Construction of overhead electrical power lines	No
21	Installations for storage of petroleum, petrochemical, or chemical products	No
22	Any change to or extension of projects listed in this Annex where such a change or extension in itself meets the thresholds	No
23	Storage sites on the geological storage of carbon dioxide	No
24	Installations for the capture of CO2 streams for the purposes of geological storage	No

Table 5-2 Schedule 5, Part 2 Checklist

Part 2 of Schedule 5		Relevant to Project Development Site
1	Agriculture, silviculture and aquaculture	No
2	Extractive Industry	No
3	Energy Industry	No
4	Production and processing of metals	No
5	Mineral Industry	No
6	Chemical Industry	No
7	Food Industry	No
8	Textile, Leather, Wood and Paper Industries	No
9	Rubber Industry	No
10	Infrastructure Projects	No
(dd)	*All private roads which would exceed 2000 metres in length*	No

Part 2 of Schedule 5		Relevant to Project Development Site
(k)	*Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, where the length of coastline on which works would take place would exceed 1 kilometre, but excluding the maintenance and reconstruction of such works or works required for emergency purposes;*	No
11	Other Projects	No
(c)	*Waste-water treatment plants with a capacity greater than 10,000 population equivalent as defined in Article 2, point (6), of Directive 91/271/EEC not included in Part 1 of this Schedule;*	No
12	Tourism and Leisure	No
(c)	Holiday villages which would consist of more than 100 holiday homes outside built-up areas; hotel complexes outside urban areas which would have an area of 20 hectares or more or an accommodation capacity exceeding 300 bedrooms;	No
13	Any change or extension of projects listed in Annex I or this Annex (2), already authorised	No
14	Works of demolition carried out in order to facilitate a project listed in Part 1 or Part 2 of this Schedule where such works would be likely to have significant effects on the environment, having regard to the criteria set out in Schedule 7.	No
15	Any project listed in this Part which does not exceed a quantity, area or other limit specified in this Part in respect of the relevant class of development, but which would be likely to have significant effects on the environment, having regard to the criteria set out in Schedule 7 (EU Directive Annex III).	Possibly

It is evident that the proposed project does not fall under any class of development listed in Part 1 or Part 2 of Schedule 5, therefore, the proposed project is not a mandatory project for EIA or EIA Screening under Schedule 5.

Consideration was given to item 15 of **Table 5-2** above (Schedule 5, Part 2) as shown in red taking into consideration the criteria listed in Schedule 7 (see **Table 5-3** below). Criteria 1d, 2b and 2c (i), (ii), (v), (vi) (viii) are relevant to the proposed dredge/dump activities. The sensitive nature of the environment in which these activities would take place is the main factor that necessitates the need for an assessment of the environmental effects (as specified in the DaS and MUL application forms and guidance documents).

Table 5-3 Schedule 7 Criteria

Schedule 7 Criteria (EU Directive Annex III - SELECTION CRITERIA REFERRED TO IN ARTICLE 4(3))		Relevant to Project Development Site
1	CHARACTERISTICS OF PROJECTS	
	The characteristics of projects must be considered having regard, in particular, to:	No
	a the size and design of the whole of the proposed development;	No

Schedule 7 Criteria (EU Directive Annex III - SELECTION CRITERIA REFERRED TO IN ARTICLE 4(3))			Relevant to Project Development Site
	b	the cumulation with other existing development and/or development the subject of a consent for proposed development for the purposes of section 172(1A)(b) of the Act and/or development the subject of any development consent for the purposes of the Environmental Impact Assessment Directive by or under any other enactment;	No
	c	the nature of any associated demolition works;	No
	d	the use of natural resources in particular land, soil, water and biodiversity;	Yes
	e	the production of waste;	No
	f	pollution and nuisances;	No
	g	the risk of major accidents, and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge.	No
	h	the risks to human health (for example, due to water contamination or air pollution).	No
2	**LOCATION OF PROJECTS**		
	The environmental sensitivity of geographical areas likely to be affected by projects must be considered, having regard, in particular, to:		
	a	the existing and approved land use;	No
	b	the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground;	Yes
	c	the absorption capacity of the natural environment, paying particular attention to the following areas:	Yes
		(i) wetlands, riparian areas, river mouths;	Yes
		(ii) coastal zones and the marine environment;	Yes
		(iii) mountain and forest areas;	No
		(iv) nature reserves and parks;	No
		(v) areas classified or protected under legislation, including Natura 2000 areas designated pursuant to the Habitats Directive and the Birds Directive;	Yes
		(vi) areas in which there has already been a failure to meet the environmental quality standards laid down in legislation of the European Union and relevant to the project, or in which it is considered that there is such a failure;	No
		(vii) densely populated areas;	No
		(viii) landscapes and sites of historical, cultural or archaeological significance	No
3	**CHARACTERISTICS OF THE POTENTIAL IMPACT**		
	The potential significant effects of projects must be considered in relation to criteria set out in points 1 and 2, and having regard in particular to:		
	a	the magnitude and spatial extent of the impact (for example, geographical area and size of the population likely to be affected),	No
	b	the nature of the impact;	No
	c	the transboundary nature of the impact;	No
	d	the intensity and complexity of the impact;	No
	e	the probability of the impact;	No
	f	the expected onset, duration, frequency and reversibility of the impact.	No
	g	the cumulation of the impact with the impact of other existing and or development the subject of a consent for proposed development for the purposes of section 172(1A)(b) of the Act and/or development the subject of any development consent for the purposes of the Environmental Impact Assessment Directive by or under any other enactment;	No

Schedule 7 Criteria (EU Directive Annex III - SELECTION CRITERIA REFERRED TO IN ARTICLE 4(3))		Relevant to Project Development Site
h	the possibility of effectively reducing the impact.	No

5.3 Water Framework Directive (WFD)

Since the year 2000, water management in the European Union has been guided by the Water Framework Directive 2000/60/EC (WFD). This directive mandates all Member States, including Ireland, to safeguard and enhance water quality in all water bodies, aiming to achieve a good ecological status by 2015 or, at the latest, by 2027. In Ireland, this directive was enforced through the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) and is applicable to rivers, lakes, groundwater, and transitional coastal waters.

The WFD necessitates the development of management plans on a river basin basis and outlines a structured approach for their formulation. Currently, the WFD's Annex X contains a list of priority substances that Member States must monitor in surface waters. However, the standards for these substances are established in the Environmental Quality Standards Directive (EQSD). Meeting these standards is crucial for achieving good surface water chemical status in accordance with WFD Article 4 and Annex V.

The strategies and objectives of the WFD in Ireland have influenced a range of national legislation and regulations. These include the following:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. 122 of 2014);
- European Communities Environmental Objectives (Surface Waters); Regulations, 2009 (S.I. No. 272 of 2009)
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010); and
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011).

All new developments in Ireland that may have an impact on the water environment are required to comply with objectives of the Water Framework Directive (WFD), under European Communities Environmental Objectives

(https://www.irishstatutebook.ie/eli/ResultsTitle.html?q=environmental+objectives). This includes ensuring that no changes occur that cause a deterioration of the current status of any water body, and that the development does not prevent the achievement of the future status objectives of any water body. Water body status deterioration can occur as a result of deterioration of any of the quality elements that make up the overall status (e.g. biological, physicochemical or hydro-morphological elements for surface waters) even where this does not result in a lowering of overall water body status.

This environmental assessment (and all the associated surveys and specialist assessments) of the proposed AAL dredge/dumping activities has been undertaken to ensure compliance with the above mentioned WFD objectives.

5.4 Marine Strategy Framework Directive

The Marine Strategy Framework Directive (MSFD) mandates European Union member states, including Ireland, to attain or sustain good environmental status (GES) in the marine realm. Annex I of the Directive delineates 11 qualitative descriptors for determining GES under Article 9. These descriptors encompass various pressures on and states of the marine environment.

Formally adopted by the European Union in June 2008, the MSFD (2008/56/EC) is incorporated into Irish law through the European Communities (Marine Strategy Framework) Regulations, 2011 (SI No. 249 of 2011). The primary objective of the Directive is to safeguard Europe's marine waters. It achieves this by employing an ecosystem-based approach to manage human activities, ensuring the sustainable use of the marine environment for present and future generations. The Directive provides a legal framework for the formulation of marine strategies geared toward achieving GES in the marine environment by 2020.

The marine strategy entails defining GES, establishing environmental targets and indicators, implementing monitoring programs for ongoing assessment, and devising and executing measures to achieve or uphold GES. GES is defined as the environmental status of marine waters that are ecologically diverse and dynamic, clean, healthy, and productive within their intrinsic conditions. Additionally, the use of the marine environment must be sustainable, preserving the potential for uses and activities by current and future generations.

The assessment of GES is conducted using 11 qualitative descriptors that outline overarching objectives concerning key socio-economic or ecological aspects of the marine environment. These specifically require the consideration of the following:

- Biodiversity;
- Non-indigenous species;
- Exploited fish and shellfish;
- Food webs;
- Human-induced eutrophication;
- Sea-floor integrity;
- Alteration of hydrographical conditions;
- Contaminants in water and seafood;
- Marine litter; and
- Introduction of energy including underwater noise

Currently, an Initial Assessment, which comprehensively reviews the physical, chemical, and biological characteristics of the marine area, as well as human pressures acting upon it, has been undertaken (DEHLG 2013). The Marine Strategy Framework Directive Programme of Measures Summary Report, generated in July 2016, outlines the measures required to significantly contribute to the overall achievement of GES in coastal and marine waters. The proposed dredging and dumping activities will adhere to these specified measures.

6. PLANNING AND DEVELOPMENT

6.1 Statement of consistency with the National Marine Planning Framework (NMPF)

The National Marine Planning Framework (NMPF) was published on 30th June 2021 and is the key consideration for decision makers on marine authorisations. All applications for activity or development in Ireland's maritime area is considered in terms of their consistency with the objectives of the plan.

AAL is proposing to carry out dredging and dumping activities at Aughinish, Co. Limerick. The purpose and description of the proposed has been detailed under section 2 above. This section will set out how these proposed works are compliant with the relevant policies in the NMPF.

6.1.1 Heritage

Section 7.3 of the NMPF covers Heritage Assets Policy, which supports the conservation of the historic environment and heritage assets both along the coast and beneath the waves. The aim of the policy is to make sure proposals do not have a detrimental impact on marine and coastal heritage assets and to extend consideration to those assets that are, or have the potential to become, significant. Heritage Assets Policy 1 states that:

'*Proposals that demonstrate they will contribute to enhancing the significance of heritage assets will be supported, subject to the outcome of statutory environmental assessment processes and subsequent decision by the competent authority, and where they contribute to the policies and objectives of this NMPF. Proposals unable to contribute to enhancing the significance of heritage assets will only be supported if they demonstrate that they will, in order of preference:*

a) avoid,

b) minimise, or

c) mitigate harm to the significance of heritage assets, and

d) if it is not possible, to mitigate harm, then the public benefits for proceeding with the proposal must outweigh the harm to the significance of the heritage assets.'

As part of the application, an Archaeological Impact Assessment was undertaken by Laurence Dunne Archaeology Ltd. The report sets in place mitigation measures to ensure the protection of any monuments during construction, therefore complying with the NMPF policies.

6.1.2 Biodiversity

Ireland's marine environment, and the sustainable use of its resources, are legally underpinned by a number of European Directives and associated national legislation. The plan highlights that protected marine sites may take a wide variety of forms including the incorporation of existing SPAs and SACs under the Birds or Habitats Directives where measures are put in place to restrict certain human activities to protect vulnerable species and habitats. Protected Marine Policies state:

Policy 1

Proposals must demonstrate that they can be implemented without adverse effects on the integrity of Special Areas of Conservation (SACs) or Special Protection Areas (SPAs). Where adverse effects from proposals remain following mitigation, in line with Habitats Directive Article 6(3), consent for the proposals cannot be granted unless the prerequisites set by Article 6(4) are met.

Policy 2

Proposals supporting the objectives of protected marine sites should be supported and:

- *be informed by appropriate guidance*
- *must demonstrate that they are in accordance with legal requirements, including statutory advice provided by authorities relevant to protected marine sites*

Policy 3

Proposals that enhance a protected marine site's ability to adapt to climate change, enhancing the resilience of the protected site, should be supported and:

- *be informed by appropriate guidance*
- *must demonstrate that they are in accordance with legal requirements, including statutory advice provided by authorities relevant to protected marine sites*

A Screening for Appropriate Assessment Report and a Natura Impact Statement have been carried out by MWP which are attached with the permit application. There are potential impacts on two of the six Natura 2000 sites which occur within the zone of potential impact influence have been screened out due to a lack of credible or tangible source-pathway-receptor links between these sites and the proposed maintenance works area.

The screening assessment concluded that habitat loss/alteration, species disturbance and/or displacement effects, habitat and species fragmentation, and potential cumulative/in-combinations effects could not be ruled out for the following Natura 2000 sites:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)

In conclusion, provided the recommended mitigation measures are implemented in full it is not expected that the a proposed programme of dredging and dumping at sea will result in an adverse effects on the Lower River Shannon SAC (002165) or the River Shannon and River Fergus Estuaries SPA (004077), in view of those sites' conservation objectives.

6.1.3 Landscape/Seascape

Many areas of our coastline are distinctive for their natural beauty and their diverse range of activities. This policy aims to make sure that proposals consider their potential impacts on the seascape and landscape of an area. This is not only important for the protection of iconic views and character but also to aid in the process of enabling development where it is most appropriate. The effects of development, such as through wind and tidal energy projects, port development, coastal defences, cable landings and pipelines, on an area's seascape and landscape should be considered.

Seascape and Landscape Policy 1

Proposals should demonstrate how the likely significant impacts of a development on the seascape and landscape of an area have been considered. Proposals will only be supported if they demonstrate that they, in order of preference:

a) avoid,

b) minimise, or

c) mitigate significant adverse impacts on the seascape and landscape of the area.

d) If it is not possible to mitigate significant adverse impacts, proposals must set out the reasons for proceeding.

The application site lies in the Shannon Estuary in Co. Limerick. The site is rural in nature with land-based activities comprising mainly of a mix of agricultural, industrial, port and residential facilities along the shoreline, with aquaculture and shipping activities taking place in the estuary. The area of the estuary in which the dredging/dumping activities will take place has been assessed and it was concluded that the works will have no effect on the seascape or landscape characteristics.

The proposed works will be fully compliant with the relevant policies of the National Marine Planning Framework, provided the proposed mitigation measures set out in the Archaeological Impact Assessment, Non-Statutory Environmental Report and the Natura Impact Statement are implemented.

7. ENVIRONMENTAL EFFECTS

7.1 Soils

The proposed LR/B will be used to move accumulated sediments under and adjacent to the jetty so that they can either be removed to the dump site off Foynes Island by the TSHD, or moved and spread by the plough dredger within the delineated dredge areas. The TSHD will be used to remove the accumulated sediments at the outer and inner berths to achieve the design depths needed to accommodate the cargo vessels docking at these berths. The current maximum depths needed at these berths (sites A and C) are 14.3 and 12.2m but some areas close to the jetty are as shallow as 9m. At sites B and D the current minimum depths vary between 1 and 2 m and the design depth needed is 3 m. The plough-dredging activities will level local high points on the estuary bed and drag sediment to adjacent areas, resulting in discrete alterations. However, no reduction in overall habitat area is anticipated.

Limited potential exists for indirect alteration due to sediment deposition. Although minor smothering impacts are possible, the quantity of material involved will be sourced from indigenous seabed, mitigating long-term effects.

The dumping of sediment at the dump site off Foynes Island is not expected to result in any significant accumulation of sediment in this area. The seabed at this dump site is rocky with very little sediment despite many years of dumping at this site by the SFPC. This is due to the strong scouring effect of the tidal movements which quickly removes any heavier sediment deposited on the seabed. Most of the sediment is fine silt that remains in suspension in the water and is dispersed throughout the estuary by the tides. No significant change is expected in bed levels at the existing licenced dump site at Foynes as a consequence of the proposed dredging and dumping campaigns.

Analysis of Sediments from proposed Dredge/Dump Sites

Four sediment samples were taken from the four dredge sites and analysed for grain size, density, chemicals, heavy metal, and radiation (see Appendix 10). The results of the sample analyses found that these sediments are clean and typical of the sediments in this part of the Shannon estuary. The results, analysed against Cronin *et. al.* 2006 and 2019 assessment guidelines for dredged material in Irish Waters, showed that all values are within the permissible limits.

Consequently, it is not anticipated that dredging and dumping activities will result in any significant impact on soil or seabed composition.

A separate sediment analysis was conducted by MERC Environmental Ltd. who obtained nine samples from sites in and around the proposed dredge areas. These were analysed for pH, organic matter, nutrient content, and benthic flora and fauna (see Appendix 10). The report shows that all the stations sampled are characteristic of estuarine muddy mixed sediments with a diverse and balanced ecosystem. A dive survey of this area conducted in 2005 (Aquafact, 2005) described the high turbidity levels of the water column in this area. This is consistent with dive surveys conducted throughout the estuarine areas of the Lower River Shannon SAC carried out by MERC in 2018 on behalf of the NPWS (Scally *et al*, 2020). Dredging of this area will not result in any long-term change to the benthic community present or lead to any impact on the conservation objectives to any of the benthic sediment communities.

Dump site

Due to the scouring effect of the main River Shannon channel at this site, the seabed is characterized by rocky seabed without significant sediment (despite the dumping of sediment by the SFPC at this site for many years). Any sediment dumped at this site, which is dominated by fine (63-125µm) and very fine (125-249µm) sands, will be washed away over a relatively short period of time (< 1 year). Consequently, any dumping in this area will not result in any long-term change to the seabed characteristics or the benthic community present or lead to any impact on the conservation objectives to any of the benthic sediment communities.

7.2 Water

The proposed dredging will lead to a minor increase in suspended sediment levels in the estuary water column due to bed disturbance and transportation of dredged material. Plough dredging, moving sediment to adjacent areas, will cause localized disturbances. Coarser sediments will settle quickly, and minor fractions may remain suspended in the water column temporarily and this will settle out of suspension in time over tidal cycles.

The dredge modeling assessment identified three worst case dredging campaigns and used the MIKE21 FM HD model to simulate the expected dispersion associated with the proposed maintenance dredging and the fate (deposition) of the dredge material at the proposed dump sites and through the Lower Shannon Estuary. The modeling results showed that dredging and dumping activities will temporarily increase turbidity levels in the River Shannon. However, given the overall naturally high levels of suspended solids throughout the estuary and the localised nature of high turbidity, it is unlikely that the additional turbidity resulting from the dredge disposal operations will have a significant negative impact on hydro environment i.e. the water column. The maximum bed thickness change which is an indication of potential habitat smothering, occurs equally and in the same locations for Campaigns 1 and 3 at a level of 130mm. The location of these depositions corresponds to natural mud flats which signifies the dredge material falls out of suspension and settles in the same manner as the natural sediment transport regime of the lower Shannon. This would indicate that adverse deposition in unsuitable areas will not occur as a result of these dredge campaigns. The quantity of 130mm bed thickness is considered insignificant and

not likely to impact benthic ecology of these areas. Given that the material being dredged has been tested and is suitable for disposal at sea the material has no contamination and its dumping/dispersal within the estuary will mimic what happens normally within this part of the coastal system and consequently will have no negative effects on water quality or seabed habitats or characteristics.

Consequently, considering natural fluctuations, clean material and species adaptability, the proposed dredging activities are not expected to cause significant adverse water quality risks.

Dredge vessels in the Shannon estuary pose a temporary short-term risk of fuel/oil spillage, directly linking to ecological receptors in the Natura 2000 sites. Section 9, outlines comprehensive measures to control and eliminate pollution sources, including fuel/oil spills, ensuring potential adverse water quality impacts are mitigated.

7.3 Biodiversity

7.3.1 Benthic Report

Dredge Sites: A benthic report has been produced by Merc Environmental. The results of the benthic sampling have shown the sediment community at the dredge sites to be similar to the "Intertidal sand to mixed sediment with polychaete, molluscs and crustaceans complex" described for the majority of the intertidal areas within Lower River Shannon SAC, although with obvious variations due to it being subtidal.

This study found that dredging of the four dredge/dump sites will not result in any long-term change to the benthic community present or lead to any impact on the conservation objectives to any of the benthic sediment communities for which the Lower River Shannon SAC is designated for.

Dump Site: The Benthic report found that any dredged sediment (which is dominated by fine (63-125µm) and very fine (125-249µm) sands) dumped at this site will be washed away over a relatively short period of time (< 1 year). It considered that any smothering of the epifaunal species that may occur at the location of the dump site will recolonise from upstream populations within a similar time period and no significant change to the conservation objectives of the Anemone-dominated subtidal reef community present at this location will occur.

7.3.2 Marine Mammal Risk Assessment (MMRA)

The Irish Whale and Dolphin Group Consulting (IWDGC) conducted an MMRA on behalf of MWP. The report summaries the impacts as below:

- Dredger operations emit noise levels similar to cargo ships.
- Studies show that marine mammals might exhibit avoidance behaviour due to dredging activities. Collision risks are low but possible, depending on dredger type, operation state, and local conditions.
- Noise generated from dredging is generally below injury thresholds but can cause masking or behavioural disturbances, particularly in baleen whales.
- The proposed works are considered unlikely to present a risk to bottlenose dolphins or other marine mammals that could be encountered at the site if the proposed mitigation measures (see section 8.3.1) are implemented. However, as this permit is for an 8-year period, a review of the operations should take

place after each maintenance campaign or an annual basis to ensure the mitigation is working or to identify potential issues that may arise to ensure effective mitigation over this permit period.

A detailed assessment is provided in Appendices 6 and 9.

7.3.3 SISAA, NIS and Risk Assessment of Annex IV Species

The proposed dredging and dumping operations in the Lower River Shannon Special Area of Conservation (SAC) were evaluated to determine potential impacts on the annexed habitat types within the vicinity of the jetty and proposed dump site. Detailed assessment is provided in Appendix 5, 6 and 7. Given the findings on impacts to the seabed, water quality, benthic habitats and mammals mentioned above, and the pollution control measures proposed (see Section 8.2), the proposed maintenance dredging and dumping activities are not expected to cause significant adverse effects to water quality, seabed characteristics or benthic habitat.

Non-mammal Species Disturbance/Displacement

Sea and river lamprey migration during dredging phases may occur, but the scale and nature of the works, coupled with the species' adaptive reproductive strategies, make significant impacts unlikely. Potential increases in suspended material are not expected to adversely affect lampreys passing through the area due to the temporary, localised, and minor nature of dredging-related disturbances.

Dredging and dumping activities are unlikely to significantly disturb or displace sea and river lamprey populations.

Atlantic salmon moves quickly through the estuary during migration, minimising their exposure to dredging-related disturbances. Dredging activities are unlikely to significantly disturb or displace Atlantic salmon populations.

Potential disturbances from dredging-related noise and reduced prey availability due to water quality impacts were considered. Otters are territorial and habituated to existing noise levels, minimising the impact of dredging-related noise. Temporary sedimentation is not expected to significantly reduce prey availability.

Dredging activities are not expected to significantly disturb or displace otter populations due to their territorial adaptability and the temporary nature of disturbances.

Potential effects to marine mammals are also considered minimal (see section 7.3.2 above)

7.4 Fisheries and Aquaculture

A range of commercial fishing activities take place in and near the Shannon estuary. There are around 8 licensed local boats which work mainly pots (crab, lobster and shrimp) gillnets, and tanglenets. There are no licensed commercial fishing activities in the immediate vicinity of the proposed AAL dredging/dumping works.

The proposed dredging and dumping sites are not located within any aquaculture areas. Large areas to the west of Foynes Island are permitted for shellfish aquaculture (see Figure 7.1). The closest aquaculture farm is located approximately 317 m to the east of the AAL Site B dredge site at its nearest point. This shellfish farm has been in operation for 10 years and is located on the site of a previous farm that had operated for 25 years. The farm produces under 10 tons of finished oysters per annum. It has not been affected by the AAL dredging activities over the last eight years and no complaints have been made.

As the proposed works are outside of the zone of influence on aquaculture sites, no likely significant effects on aquaculture are expected.

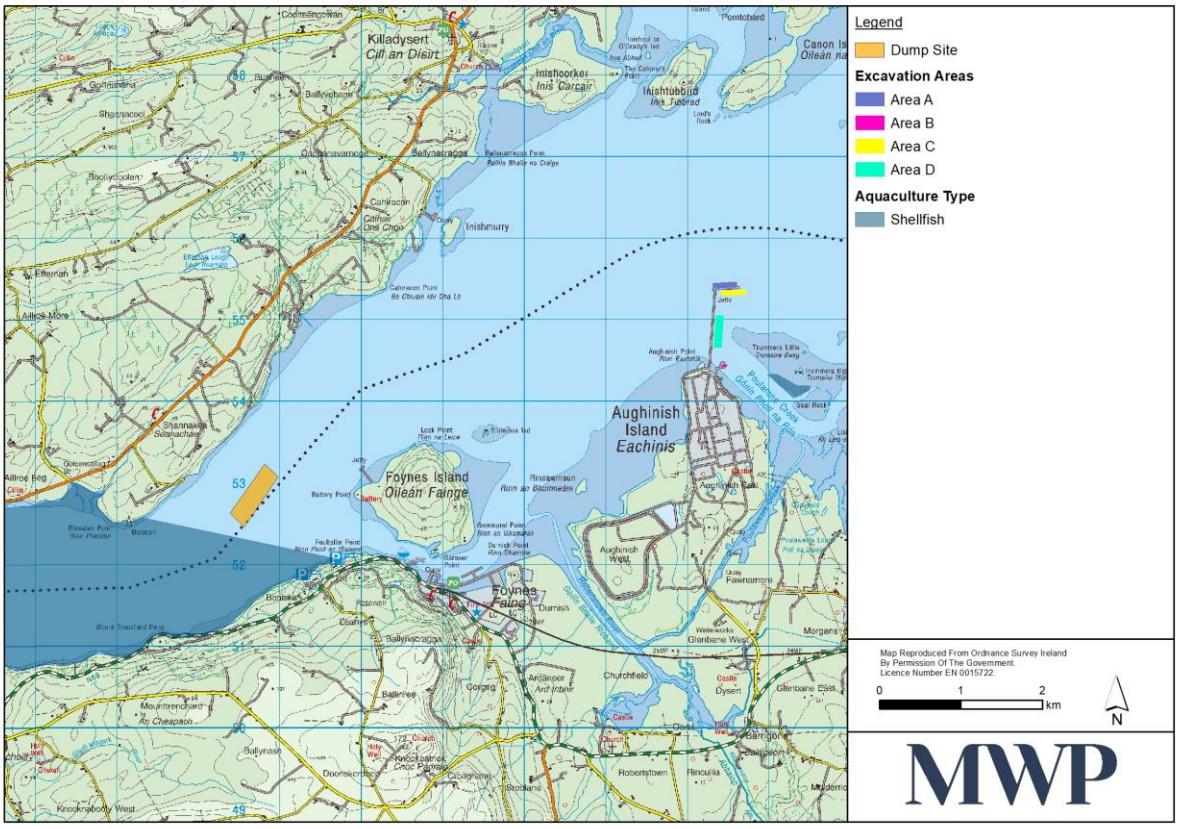

Figure 7.7-1 Aquaculture Sites Map

7.5 Air Quality

It is not expected that there will be any release of dust/emissions to air, other than vessels exhaust from dredging and material handling. The works are short-term and expected to last for 2 periods of 21 days each year. The location of the planned works is such that there are no sensitive receptors (residential properties, hospitals etc) close by, hence dust effects are not likely.

The proposed activity would be a continuation of existing small-scale and short-term dredging activities and will not result in any changes to air quality. .

7.6 Noise and Vibration

The proposed activities are based in the marine environment and are at a sufficient distance from the residential area to not have any ssignificant effects on human receptors. Dredging and dumping at night-time remains the only activity that has the potential to give rise to slight effects. But considering that the dredging activities will result in the same type of noise as from existing shipping activities in the estuary, no significant change in noise and vibration levels are expected.

The only potential noise effect of concern is the noise effects on dolphins and other mammals. As already discussed in section 8.3 above, marine mammals might exhibit avoidance behaviour due to dredging activities. Collision risks are low but possible, depending on dredger type, operation state, and local conditions. Noise generated from dredging and bathymetric surveys is generally below injury thresholds but can cause masking or behavioural disturbances to marine mammals. The proposed mitigation measures outlined in section 8.3.1 will result in insignificant short-term effects.

The assessment of noise effects on marine mammals shows that any significant noise and vibration impacts are unlikely to occur and can be effectively mitigated.

7.7 Landscape/Seascape

The Regional Seascape Character Assessment for Ireland, 2020, and Ireland's Marine Atlas shows that the proposed dredging and dumping site is located within Shannon Estuary and Tralee Bay seascape character area. For this seascape character area, views vary from panoramas across the Mouth of Shannon and over the Atlantic to more intimate, moderate scale views across the Shannon Estuary.

The seascape character type is identified as 'Large estuary' which is viewed as '*Important communications and transport corridor'* and has *'Historic urban core with modified estuarine edge and industrial activities associated with sheltered mouth of the river'.*

The proposed dredging and dumping activities are in keeping with the seascape character described above and will result in no change in character. This application is also for a continuation of an existing activity.

No significant impacts are anticipated on landscape/seascape.

7.8 Traffic and Transport

Dredging could potentially impact shipping channels and navigation, both positively, by maintaining or improving them and negatively, by causing disruptions during dredging/dumping operations. In this case the dredging activities will take place around the AAL jetty only and will not affect shipping traffic in the main channel. AAL will also manage their dredging activities to avoid any effects on the ships docking at their jetty. The proposed dump site off Foynes Island is located in the main channel. Consequently, the dumping activity by the TSHD could potentially affect shipping traffic for short intervals during the dredging period. Given that shipping movements within the Estuary are managed by Shannon Foynes Port Company (SFPC) as the authority, any proposed dredging campaigns, timing and associated shipping will be reviewed with SFPC prior to works commencing. This will ensure that there will be no significant effects in terms of marine traffic or navigation within the estuary. The use of Marine Notices during the works will raise awareness for marine traffic in the estuary. The existing jetty facility attracts a significant volume of marine traffic each year and the level of vessel movement and interaction for the proposed dredging works is minimal in comparison to the existing annual traffic in this section of the estuary.

7.9 Cultural Heritage

An archaeological Impact Assessment report has been produced by Laurence Dunne Archaeology Ltd that accompanies the application as Appendix 12. The report found that there will be no impact on the known recorded shipwrecks by the proposed dredging/dumping works. Also, there is a low, possibly benign, possibility

of impacting on unknown shipwrecks. Section 8.9 provides some mitigation measures to ensure that any potential effects are managed and remain insignificant.

7.10 Population and Human Health

The dredging site in located adjacent to a large industrial facility with no adjacent residential or private port facilities. The Shannon Foynes Port is located 4.6 km to the south-west of the AAL jetty. The dredge sites are located outside of any marine navigation, fishing or aquaculture areas. The only activity that could potentially affect other marine traffic is the occasional dumping of sediment at the dump site off Foynes island by the TSHD. As mentioned in section 8.8 above this potential traffic risk is minor and can effectively be managed by the port authorities as part of their normal marine traffic management responsibilities. Considering the occasional and brief nature of this activity, these effects are unlikely and expected to be insignificant. A local communication plan will be established to ensure that any issues that arise will be managed promptly.

Considering the nature and location of the works, no other significant impacts e.g., noise, dust, on population and human health are expected from the dredging activities.

7.11 Major Accidents and Disasters

The proposed dredging and dumping activities are not anticipated to cause any accidents or disasters e.g., shipping accidents or pollution. Any risks to shipping can be effectively mitigated through the measures outlined in section 7.8 and 7.10 above.

The potential for natural disasters (associated with climate change) does exist. This would be related to severe weather and storms. In this case, dredging operations can be planned to avoid severe weather events. In the case of unexpected severe storms or tidal events dredging would be halted till the weather conditions become more suitable.

Considering the nature and duration of works, no significant effects are anticipated with mitigation measures in place.

7.12 Climate

The maintenance dredging and dumping will be conducted for two periods of time (21 days) each year over 8 years. This activity is also a continuation of an existing permitted activity.

Considering the temporary and short-term nature of works, no significant increases in carbon emission are expected and no potential for indirect effects on climate change.

7.13 Material Assets

The Ireland's Marine Atlas was reviewed to identify the infrastructure underlying the dredging and dumping site. It was observed that the area does not overlap with any material assets infrastructure.

As AAL jetty is an important infrastructure asset, without maintenance dredging the jetty would no longer be able to safely operate to its capacity. Hence, the proposed project represents a positive impact on material assets.

7.14 Waste

Waste arising during maintenance dredging and dumping may include various materials, such as off-cuts of metals and packaging materials associated with the welfare facilities. Where the waste streams are not appropriately managed, they may enter the marine environment and produce marine litter. Considering the duration of works, the quantities of the waste generated are expected to be small. Appropriate waste segregation and management measures will be applied to minimize any potential waste effects. The waste will be disposed of off-site by a licensed waste contractor.

With best practice measures, no significant impact is expected.

7.15 Interactions of Environmental Components

The proposed dredging and dumping activities have the potential to impact water quality, directly affecting the marine habitats and species.. Mitigation measures outlined in the section below aim to minimise any potential risks. To address this concern, the project includes measures to prevent water pollution, ensuring that the delicate balance of flora and fauna in the aquatic ecosystem is preserved.

Noise and vibration from the dredging and dumping activities can impact marine life, potentially causing behavioural changes and disturbances. However, the temporary and localized nature of these disturbances are expected to have minimal impact on biodiversity. Monitoring will be conducted, and best practice measures will be implemented to avoid such impacts.

Increased marine traffic might cause disruptions in shipping and navigation. To mitigate these potential effects, careful planning of dredging and dumping activities in consultation with the marine traffic authorities (SFPC) are proposed along with notifications of all potential stakeholders prior to dredging and dumping commencing.

7.16 Cumulation with Other Activities and Projects

Other activities, projects and plans that could potentially result in cumulative effects when combined with the proposed AAL dredging/dumping activity, are identified in section 4.9 of this report.

Adjacent Industrial and Port Planning applications

The AAL strategic infrastructure development planning application to An Bord Pleanála for the expansion of the bauxite residue disposal area would be a land-based activity that would not result in any water discharges to the Shannon estuary. The facility is also protected from flooding from the surrounding rivers/estuary. The existing management and mitigation measures for potential dust emissions also effectively mitigate from any deposition of sediment in the estuary from dust. There is consequently no potential for cumulative effects with the proposed maintenance dredging.

The SFPC permitted port expansion activities have not yet commenced. These activities would take place 4.6km downstream of the AAL site and would represent a continuation of the existing port maintenance dredging and management practices, which have very localised and minor effects on water quality. There is consequently no potential for cumulative effects with the permitted port expansion project.

Estuary Operation

The proposed dredging activity will be short-term and intermittent in duration. The characteristics of the sediment to be moved are the same nature as that found throughout the estuary and are considered clean and not a hazard or pollutant to the estuary system. The effects on water quality will be very small scale and temporary and will be much lower than the natural turbidity of the estuary which is strongly influenced by the tides. The volumes of

material to be dredged are also significantly smaller than those dredged and dumped by the SFPC. Consequently, the proposed dredging/dumping is not expected to produce cumulative effects with other dredging activities in the estuary.

Despite the high volume of vessels navigating the broader estuary area, the occasional and brief movements and activities of the TSHD vessel in the main channel are not anticipated to create significant combined traffic effects with other vessels operating in the region.

Other Activities

Agriculture is the dominant activity in the study area and within the lands bounding the estuary in Counties Limerick and Clare. There are also various urban and industrial activities in the estuary and in the upstream catchment area. Consequently, there exists the potential for the proposed dredging and dumping at sea activities to contribute to combined impacts with agriculture, industrial and urban pollution (water quality effects).

While discharges from agricultural, urban and industrial sources might affect physico-chemical parameters such as levels of dissolved nutrients, suspended solids, and certain elemental components, the pressures stemming from the proposed dredging and dumping primarily involves elevated sediment levels and, to a limited extent, a minor risk of fuel or oil spills. However, these sediment effects are deemed minor, given the substantial volumes required to cause any adverse impact and the short-term and localized nature of the dredging/dumping activities. Furthermore, the dredging/dumping effects are not anticipated to have any significant cumulative effect on the physico-chemical parameters within the water in the estuary.

8. MITIGATIONS

8.1 Soils

Following surveys and monitoring will be undertaken:

- Pre-dredge and post-dredge bathymetric surveys of the dredge/dump sites, and reporting.
- Chemical and granulometric analysis of sediment samples from the dredge sites in years 2, 5 and 8, with associated reporting.

8.2 Water

- Consult with relevant stakeholders prior to dredging, to inform them of dredging/dumping activities.
- Prepare contracts which meet the requirements of all licences, consents and agreements applicable.
- Fully brief the contractor beforehand on the sensitivities of the site, and any monitoring that will be taking place.
- Utilise advance dredging technologies to ensure reducing the volumes of sediment that escape into the water column and become suspended in the water column.
- The dredge captain has a fuel/oil management protocol for the vessel that ensures that there are strict controls for vessel operation, fuelling and servicing. Consequently, the risk of spillage is low and the process is manageable within the context of the proposed works.

The following water quality monitoring measures are proposed:

- Baseline suspended solids sampling/analysis at the existing two sampling points (one upstream and one downstream of the jetty) prior to activities commencing, once every second day during dredging activities and one week post the dredging. Reports to be provided for all sampling and analysis.

8.3 Biodiversity

8.3.1 Monitoring by Marine Mammal Observer

To minimise the risk of permanent or temporary injury and disturbance to marine mammals, especially bottlenose dolphins in the vicinity of dredging operations, the NPWS 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014' (NPWS, 2014) recommended that stated mitigation procedures for dredging are followed and monitored by a suitable qualified Marine Mammal Observer (MMO).

- A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms (as presented in Appendix 4; NPWS, 2014).

- A dedicated Marine Mammal Observer will conduct a 30-minute watch for marine mammals (specifically bottlenose dolphins at this site) within 500m of the dredging vessel prior to start up. If a seal, otter or bottlenose dolphin is sighted within 500m of the vessel, start-up must be delayed until the animals are observed to move outside the mitigation zone or the 30 minutes has passed without the animal being sighted within the mitigation zone.

Pre-start monitoring

- Dredging activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
- An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

Dredging operations

- Once normal dredging operations commence, there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

- If there is a break in dredging sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring must be undertaken in accordance with the above conditions prior to the recommencement of dredging activity.

Reporting

- Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority as outlined in Appendix 9 (NPWS, 2014).

Additionally, when bathymetry surveys are required to assess the levels of the seabed for dredging operations, the following NPWS mitigation is required in the vicinity of multibeam, single beam, side-scan sonar and sub-bottom profiler surveys.

- A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
- Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, acoustic surveying using the above equipment shall not commence if marine mammals are detected within a 500m radial distance of the sound source intended for use, i.e., within the Monitored Zone.

8.3.2 Emergency Plans and Procedures

The contractor will prepare an emergency response plan and set of procedures for events likely to cause pollution of the waters of the estuary with fuels/oils, spillages, etc. The following accident prevention and emergency response procedures are developed and implemented by AAL and Shannon Foynes Port Company (SFPC).

- AAL Marine Emergency Plan.
- AAL Accident Prevention Policy.
- SFPC Shannon Estuary Marine Emergency Plan.
- SFPC Accident Prevention Procedure.
- SFPC Standard Operating Procedure EHS/021 – Reporting Procedures for SFPC Water Craft.
- SFPC Standard Operating Procedure EHS/054 – Accident, Incident, Near Miss Reporting

8.4 Fisheries and Aquaculture

AAL will engage with the local fishing community in advance of any works commencing in to minimise any disruption due to the dredging and dumping activities on site.

8.5 Air Quality

As no likely impacts are expected on air quality in relation to the proposed project, no mitigation measures are proposed.

8.6 Noise and Vibration

- Ensure maintenance of all equipment used on site, including maintenance related to noise emissions;
- Ensure that machines are shut down between work periods or throttled down to a minimum.
- Where night time dredging is required, residents will be informed prior to dredging, and
- Ensure equipment and vehicles are maintained and are shut down when not in use.

Additionally, the mitigation measures for noise effects on marine mammals, mentioned under section 8.3.1, will be implemented where applicable.

8.7 Landscape/Seascape

As no likely impacts are expected on landscape/seascape in relation to the proposed project, no mitigation measures are proposed.

8.8 Traffic and Transport

- During the proposed work, the vessels will issue internationally recognized identification or warning signs.
- Navigational risks during the works will be addressed through engagement with the relevant stakeholders, including the Irish Coast Guard, the Department of Transport, Tourism and Sport, local ports and harbours at appropriate times.
- Formal notice will be issued to mariners and the port authorities in advance of the dredging and dumping activities.

8.9 Cultural Heritage

- Licenced archaeological monitoring should be undertaken where a TSHD and the LR/B is used in areas where the seabed has not been previously dredged or disturbed. The monitoring should be undertaken by a suitably qualified underwater archaeologist experienced in such monitoring of marine dredging works. Should the monitoring results be negative then no further licenced monitoring in these areas is deemed necessary.
- A dive survey licence must be in place to allow for any potential archaeological inspection dives to take place should cultural material need to be assessed during the works.

8.10 Population and Human Health

- All proposed dredging and dumping activities will take place in accordance with all relevant Health and Safety Legislation and Regulations, and in adherence to international shipping conventions, adopted by the International Maritime Organization (and the International Labour Organization).
- A local communication plan will be established to ensure that the issues will be managed promptly.

8.11 Major Accidents and Disasters

- For safety reasons, a formal marine notice will be issued in advance of the proposed works.
- During the proposed work, the vessels will issue internationally recognized identification or warning signs.

8.12 Climate

- Although there are no predicted significant effects with regard to climate change, best practice measures should still be implemented to minimise any potential risks posed.

8.13 Material Assets

As no likely impacts are expected on fisheries and aquaculture in relation to the proposed project, no mitigation measures are proposed.

8.14 Waste

- Although no significant effects were identified with regard to litter, steps should be taken to reduce the overall risks of litter reaching the marine environment, theses should be followed, in line with best environmental practice to reduce marine litter.
- Appropriate waste segregation and receptacles will be provided on the construction site.
- The waste will be carried off site by the licensed waste contractor after a regular interval.

9. CONCLUSION

This assessment has shown that the dredging activities will make small, localized alterations to the seabed in the dredged areas. The dumping activity off Foynes Island will also not result in significant accumulation of sediment on the seabed at this site. The turbidity of the water in the estuary is naturally high due to the strong tidal effects in the estuary and any elevated turbidity created by the proposed dredging activities will be localized and short-term and minor in comparison to the naturally high turbidity levels.

The analysis of sediment samples from the dredge sites found that the sediments to be dredged were clean and typical of the muddy mixed sediments in this part of the Shannon estuary with a diverse and balanced ecosystem. The results, analysed against standards, showed that all values are within the permissible limits and typical of the sediments found in this part of the Shannon estuary. The benthic assessment also concluded that dredging of this area will not result in any long-term change to the benthic community present or lead to any impact on the conservation objectives to any of the benthic sediment communities.

The dredge modeling assessment identified three worst case dredging campaigns and used the MIKE21 FM HD model to simulate the expected dispersion associated with the proposed maintenance dredging and the fate (deposition) of the dredge material at the proposed dump sites and through the Lower Shannon Estuary. The modeling results showed that dredging and dumping activities will temporarily increase turbidity levels in the River Shannon. However, given the overall naturally high levels of suspended solids throughout the estuary and the localised nature of high turbidity, it is unlikely that the additional turbidity resulting from the dredge disposal operations will have a significant negative impact on hydro environment i.e. the water column. The maximum bed thickness change which is an indication of potential habitat smothering, occurs equally and in the same locations for Campaigns 1 and 3 at a level of 130mm. The location of these depositions corresponds to natural mud flats which signifies the dredge material falls out of suspension and settles in the same manner as the natural sediment transport regime of the lower Shannon. This would indicate that adverse deposition in unsuitable areas will not occur as a result of these dredge campaigns. The quantity of 130mm bed thickness is considered insignificant and not likely to impact benthic ecology of these areas.

The MMRA concluded that marine mammals might exhibit avoidance behaviour due to dredging activities. Collision risks are low but possible, depending on dredger type, operation state, and local conditions. Noise generated from dredging and bathymetric surveys is generally below injury thresholds but can cause masking or

behavioural disturbances, particularly in baleen whales. The proposed works are considered unlikely to present a risk to bottlenose dolphins or other marine mammals that could be encountered at the site if the proposed mitigation measures (see Section 8.3.1) are implemented.

The SISAA, NIS and Risk Assessment for Annex IV Species reports took into consideration the findings on impacts to the seabed, water quality, benthic habitats and mammals and concluded that, with the adoption of the recommended pollution control measures (see Section 8.2), the proposed maintenance dredging and dumping activities are not expected to cause significant adverse effects to the Lower River Shannon Special Area of Conservation (SAC) and its qualifying interests.

The Archaeological Impact Assessment report found that there will be no impact on the known recorded shipwrecks by the proposed dredging/dumping works. In addition, there is a low, potentially benign, possibility of impacts on unknown shipwrecks. Section 8.9 provides some mitigation measures to ensure that any potential effects are managed and remain insignificant.

The impact of the proposed dredging and dumping activities on other maritime usages such as shipping, fishing, aquaculture and recreational usages in the Shannon estuary were also considered and found to be insignificant. Any potential impact to shipping will be managed through marine notification of dredge/dumping activities and consultations with the port authorities (SFPC).

The overall conclusion of this assessment is that the proposed dredging and dumping activities for the AAL jetty will have no significant environmental effect. The minor potential effects can effectively be mitigated by the implementation of the proposed mitigation and monitoring measures (as described in section 9).

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