

Attachment A Description of Proposed Works

1. Purpose of the Operation

The purpose of the maintenance dredging operations at Drogheda Port is to maintain the safe navigation depths for the commercial traffic, fishing and leisure users of the River Boyne, Drogheda Port Company, its facilities and the town of Drogheda.

To understand the requirement for maintenance dredging, it is important to understand the hydrodynamics of the river and the nearshore coastal cell in respect of siltation, sediment transport and material deposition and its impacts/effects at the river mouth, the seaward approaches and estuarial channel to the town to Drogheda.

The River Boyne rises in the north midlands and exits to the sea at Mornington, Co. Meath. The river flows through the towns of Kells, Trim, Navan, Slane and finally Drogheda where international commercial shipping traffic uses the river to service Drogheda Port and third party facilities.

From Drogheda town to the sea at Mornington, the river has been hard engineered by means of training walls constructed around the 1850s by the then Drogheda Harbour Commissioners. The purpose of these training walls was to create estuarine polders either side of the main river channel. On the rising tide these estuarine polders fill up and retain the incoming water. On the ebb tide through designated "guts" the retained water is released.

The creation of the estuarine polders had two important effects i.e. through the release of water on the ebb tide it increased the tidal exit velocity thus producing a scouring or dredge effect. Following the immediate creation of the estuarine polder, the natural channel depth increased. In recent times, the original river walls constructed have fallen into dis-repair and the designed engineering effects of the polders have considerably diminished as the polders have largely silted up. Their effectiveness to cater for the modern freight vessel has long passed from that of the sailing ship or paddle steamer.

The freshwater flow and tidal exit velocities from the River Boyne were further enhanced in the late 1960s by the Boyne Drainage Scheme of the upper reaches between Kells, Trim and Navan.

The river maintains high ebb tide exit velocities during winter fresh flows supplemented with spring tides, however these exit velocities quickly fall off at the river mouth where the river exit flow meets the sea at Mornington.

The high velocities experienced allows the Boyne to carry a very substantial quantity of sediment and fluvial material out to the river mouth providing a natural scour to the estuary. However, while the river through engineering has an increased scour effect this does not eliminate the need for maintenance dredging particularly at the berths, artificial berth pockets, ship turning basins, river bends and locations where river flow ebb/exit velocities drop due to increased channel width.

Maintenance dredging at the berths, ship swing basins, artificial dredged pockets etc, would be at a higher frequency than the maintenance dredging within the defined navigation channel due in part to the localised accretion effects of ships' propeller wash and bow thruster wash, where the river silts are agitated and displaced locally within the ship manoeuvring radius. The manoeuvring of ships is a twice daily activity.

The high ebb/exit velocities have little or no effect at the river mouth or port approaches, where the exit stream meets the sea, hence maintenance dredging is required and at a higher frequency than within the main estuary, berths, artificial berth pockets and swing basins. This is primarily due to silt deposition where the exit velocities very quickly fall to zero.

The soft shallow entrance to the Boyne estuary lies roughly midway within the coastal cell between the hard rock outcrops of Clogherhead in the north and Bremeore to the south. The

coastline characteristic is one of a shallow shoaling sandy horseshoe bay where there is net annual nearshore sediment transport movement of material from south to north.

Since the late 1960's the Drogheda Port Company and formally the Drogheda Harbour Commissioners have carried out a considerable amount of coastal process and sediment movement analysis, studies and elevations, including the construction of a full physical river entrance simulation model (HR Wallingford 1969) and numerous modern day mathematical models with the latest modelling software lead by HR Wallingford (UK) Delft Hydraulics (Belgium) and KMM/RPS (Northern Ireland). A deep and detailed understanding of the coastal process and sediment transport regime of the shallow shoaling coastline within the coastal cell from Bremore in the south to Clogherhead in the north has been garnered.

This knowledge and understanding is absolutely essential to maintaining the port entrance safe for navigation from the impact of the (a) flood plain siltation but more importantly (b) the weather impacts and tidal surges.

In 1970 the Drogheda Harbour Commissioner constructed the training walls both north and south at the river mouth. At that time it was forecasted that the reserve capacity of the south training wall to retain sand would have a time frame or life span of circa 30-40 years, before full sediment bypassing would take place across the river entrance.

Both physical and mathematical studies have determined that circa 120,000m³ of sand sediment is the net northerly movement of material within the near shore coastal cell annually, accelerated in storm events (see Attachment B RPS - Drogheda Port Company Maintenance Dredging Licence Application Hydraulic Modelling Study, 25 May 2019). Estimated annual quantities of maintenance dredging of the berths, artificial berth pockets, ship swing basins, channel, river mouth and seaward approaches can also be drawn from the last 19 years of data on actual quantities dredged (see Attachment C Dredging history 2001 - 2019).

The engineered navigational entrance to the port is particularly vulnerable to gales from the northeast through to the southeast which deposits mobile sediments from the shallow gradient shoreline north and south into the engineered deeper dredged port approach channel. This engineered channel from at the breakwaters is circa 100metres in width and 700metres in length, on an east/west axis and immediately adjacent to the shallow shoaling coastline that stretches to Bremore in the south and Clogherhead in the north (the coastal cell). This deposition of mobile sediment is compounded by the fact that the sediment storage reservoir behind the south training wall constructed in 1970s has now been exhausted allowing full sediment bypass, accelerated by south easterly storm events and tidal surges. This immediately impacts the navigation channel, reducing the safe warranted depth thus affecting safe navigation. The stronger the winds, the greater the depth loss due to accelerated sediment deposition.

The following survey extracts serve to illustrate the weather impact of the river entrance & seaward approaches on the safe navigational depths, see Attachment D Dredging after Weather Events for further illustration of the below information.

17th December 2017	Good channel depth
16th January 2018	Storm Dylan – severe impact on channel safe navigation depth across the breakwaters
31st January 2018	Storm Eleanor – severe impact on channel safe navigation depth across the breakwaters
17th February 2018	Safe navigational depths restored following dredging

5th March 2018	Storm Emma - severe impact on channel safe navigation depth across the breakwaters and over the length and width of the entrance and seaward approaches
28th March	Safe navigational depths restored following dredging.
8th April 2018	Severe impact on channel safe navigation depth across the breakwaters
20th April	Safe navigational depth in restoration during dredging campaign

The above illustrates the vulnerability to storm events and the unpredictability of such events. It is difficult to actively pre-plan or forecast maintenance dredging activity other than to know that weather events will impact on the safe navigational depths particularly when the wind direction is from the north east through to south east.

2. Loading Area

Within the waterway under the jurisdiction of the Drogheda Port Company, maintenance dredging takes place primarily and most frequently at the river mouth and seaward approaches. Thereafter, maintenance dredging takes place at any location within the commercial estuary as determined by the Port Company, in order of priority after the entrance and seaward approaches, i.e. the berths, artificial berth dredged pockets, ship swing basins and the general commercial estuary over its length from town to sea as determined by the Port Company as the navigational authority for the purpose of ensuring safe navigation.

Dredging locations and quantities are determined following hydrographical surveys. Drogheda Port Company has its own in-house hydrographical survey unit. The entrance and seaward approaches are surveyed monthly or at a greater frequency depending on the weather i.e. north east to south east winds and following storm events. The berths, artificial berth pockets and ship swing basins are surveyed quarterly and the complete commercial channel is surveyed at least annually. Additional surveys are carried out following reported issues by the port Pilots, and or ships' Masters or where a deterioration occurs in the river polder retaining walls.

The extent of the dredging area is shown on Attachment E Dredging Extent and Attachment F Loading Area. The co-ordinates referenced in Latitude/Longitude and Eastings/Northing are shown on Attachment G Loading Area coordinates.

The river under the jurisdiction of the Drogheda Port Company is approximately 7km in length from St. Mary Bridge in the town of Drogheda to the river mouth at Mornington. In the town on the river's north side there are four commercial working berths numbered 1- 4 (ref: BA Chart Extract 1431, plan 'B'). On the south side, there is one berth and two ship swing basins, one for ships of 90m and one for ships of 95m length overall respectively from west to east on the west side of the Boyne Viaduct. Immediately east of the Viaduct there is a ship swinging basin of 100m in width. The town quay berths are maintained generally to a depth of -2.0m at Chart Datum (CD) while the channel depth is maintained at -1.6m CD. At low water, vessels on these berths take the bottom in soft mud on level ground, thus complying with the port and charter party expression NAABSA (not always afloat but safe aground).

From the town at Drogheda, the river narrows to the point of Donors Green. Immediately east of this point on the south side of the river is the Flogas Hydrocarbon terminal. This berth is maintained at -3.0m CD within a dredged pocket of 100 metres x 25 metres. Vessels at this berth are required to remain afloat at low water.

From this location, the river is maintained at -2.2m at CD over the full length of the navigation to the sea at Mornington.

The berths of RHI Magnesita (formally Premier Periclase Ltd) are on the north shore. Depths are maintained at -1.6m CD over the 180m quay immediately adjacent to the deeper navigation channel at -2.2m CD. At low water, vessels on this berth take the bottom in soft sand/gravels (NAABSA).

The Tom Roes Point (TRP) berths to the north side of the channel lie within a deep water dredged pocket of a length of 210 metres, width of 25 metres excluding side slopes, and maintained to a depth of -5.5m CD. This dredged pocket is essential, as large vessels nominated to these berths are required to remain always afloat. Immediately west of the Tom Roes Point multi modal terminal is the Port's main ship swing basin where vessels up to 130m length overall can be swung.

To the east of this facility and 2km from the sea is the Fish Meal Quay. This berth is in state ownership and is used primarily for local fishing vessels and for the discharge of Class 1 cargoes, classified under the International Maritime Dangerous Goods Code. The berth has a depth of -2.5m CD.

From the Flogas Hydrocarbon terminal, the channel has been dredged to a uniform width of 50 metres with side slopes of a general 1:5 gradient. At the South Point beacon (53 43'.89N, 06 16'.14W) the channel width increases to 60 metres to the Carrick beacon (53 43'.76N, 06 15'.42W). From this point the channel width is maintained at 50 metres to the Bull beacon (53 43'.30N, 06 14'.62W) where the channel width is increased to 100 metres with side slopes 1:10 and extends to a point 700 metres east of Lyons Light (53 43.24N, 06 14'.26W).

A summary of depths within areas to be dredged is provided below.

Town Berths, No 1- 4	-2.0m CD
Town Swing Basins	-1.6m CD
River Channel from Town Berths to Flogas LPG terminal	-1.6m CD
LPG Flogas Terminal	-3.0m CD
Flogas LPG Berth to sea	-2.2m CD
RHI Magnesita (formally Premier Periclase)	-1.6m CD
Tom Roes Point Berth	-5.5m CD
Seaward Approach Channel	-2.2m CD

3. Details of the Loading Operation

3.1 Date of Commencement of loading operations:

The Dumping at Sea permit is sought for a period of 8 years to cover maintenance dredging requirements from 2021 to 2029. Other than the licence start and finish date, there is no date, time constraint or time limit sought for the maintenance dredging. Dredging at the river mouth and port approaches is generally driven by weather events that cannot be predicted or scheduled. This dredging activity is primarily weather driven i.e. persistent and continuous easterly wind and or storm events. Analysis of the Drogheda Port Company dredging history (Please see Attachment C Dredging History 2000 – 2019) clearly illustrates the unpredictability over any twelve month period. If the entrance or seaward approaches silts up due to a weather event resulting in impaired navigational safe depths, then dredging is immediately required.

If depths are not impaired then no dredging takes place.

Drogheda Port Company maintains a dredging contract with commercial dredging contractors for immediate plant response availability. These contractors are updated on each hydrographical survey so that they are aware at any point in time of the current depth condition of the Drogheda Port entrance and seaward approaches and the likelihood of a call up following a weather event.

Good management, prudent planning and experience does inform a degree of dredge forecasting i.e. Q3/4 and Q2/3 of each year, however this is primarily to inform and plan in the absolute knowledge that the forces of nature will ultimately dictate the number of dredge events annually.

3.2 Location and method of loading of the substance or material:

The primary locations for maintenance dredging are referred to in Attachment F Loading Area i.e. the entrance and seaward approaches, all berths, artificial berth dredged pockets, berths, ship swing basins and the main navigation channel. While some areas are dredged more than others, in reality and predictably, all areas will be dredged at some point over the life of the permit.

Drogheda Port Company employs its own internal hydrographical unit to maintain an ongoing monitoring programme of the entrance and seaward approaches, berths, swing basins and channel.

Some pre-planning of maintenance dredging at the river mouth and seaward approaches is possible given the historical database of information over the previous decade and knowledge of the sediment transport taking into account weather and on-going monitoring. However, given the weather sensitive nature and effects of storm events, unplanned maintenance dredging also takes place to maintain safe navigation. For that reason, Drogheda Port maintains an open 24/7/365 maintenance dredging policy for the river mouth and seaward approaches without any encumbrances. This is essential to maintain the viability of port operations.

Generally internal port maintenance dredging i.e. within the estuary, berths, artificial berth pockets, ship swing basins and river channel etc. is pre-planned to coincide with plant attendance to dredge the entrance and seaward approaches. However, it must also be considered to avail of the opportunistic dredge event such as a passing dredger seeking work at favourable terms/market condition etc or offering plant for a specific dredge application i.e. backhoe or grab against a trailer suction dredge. Each type of dredge plant has its own application and a one type/size cannot do all the port requirement.

3.3 Dredging requirements

Over the decades but in particular since the Capital Dredging Port Development campaign 1999 – 2000 the port has accumulated a good deal of data and experience on the performance of the river, entrance and seaward approaches and the effects of weather. This coupled with mathematical modelling (Attachment B RPS - Drogheda Port Company Maintenance Dredging Licence Application Hydraulic Modelling Study, 25 May 2019) now allows realistic figures to be placed on our maintenance dredging quantity predictions going forward over the next permit application period 2021 - 2029.

Hydrographical monitoring of the entrance and seaward approaches, berth, artificial berth pockets, ship swing basins and main river channel carried out by the port internal hydrographic unit, maintains an almost real time check on depths particularly after easterly windstorm events.

Estimated annual quantities of maintenance dredging of the berths, artificial berth pockets, ship swing basins, channel, river mouth and seaward approaches are shown below in Table 1.

These estimates are averages, based on the last 18 years of data on actual quantities dredged (see Attachment C Dredging History 2000 – 2019. Annual requirements may increase or decrease on this average estimate depending on the severity of wind weather events.

Location	Estimated Annual Quantities
Channel from town to sea, including all berths and ship swing areas	30,000m ³
Entrance & Seaward approaches	90,000m ³
Contingency	100,000m ³

Table 1 Estimated Annual Quantities

An annual contingency of an additional 100,000m³ is to allow for the unexpected and unplanned events that may impair the safe navigational depth at the entrance and seaward approaches and or within the navigation channel. This is becoming more of a reality with changing weather patterns and increased severity of certain storm events.

This is to cover an unexpected weather event, seaward breakwater damage (occurred in 2018 from storm Eleanor) or collapse, or where the river estuarine polder retaining walls that created the estuarine polders breach (as occurred in 2000) and the sand/silt material contained within a polder flows out into the main navigation channel. This can occur due to a differential in the water pressure between the retained waters in the polder and the river falling tidal levels. The river walls were constructed in the 1850s and their construction and deteriorating condition leaves them very susceptible to the effects of modern large ship wash and hydrodynamic action.

The contingency also allows for unexpected weather events at the river mouth and seaward approaches.

3.4 Appropriate Plant

A range of dredging plant is suitable for maintenance dredging in the river Boyne. A contractor's selection of preferred plant utilization will be dependent on plant availability, location of dredging (i.e. bar, channel, berths or ship swinging areas), type of dredging required and unit rate per m³. Typical plant to include for utilisation on the river Boyne estuary, berths, artificial dredged pockets, ship swing basins, entrance and seaward approaches are:

- Trailer Suction Dredger (TSD): this is where the dredging vessel while underway drags a pipe on the riverbed and material is sucked up into the hold of the vessel. The material settles in the hold and excess water from the suction operation is returned to the sea as the hold reaches capacity. Once the hold is full, the vessel proceeds to the approved spoil dump site and discharges the material through bottom doors in her hull that open to release the hold contents. The vessel continuously passes over the area to be dredged gradually increasing the depths to the required levels. This is the primary method of dredging contracted at Drogheda Port. The typical vessel used is circa 80m in length and can manoeuvre with ease at the entrance and seaward approaches, linear berths town quay berths, Flogas LPG terminal, RHI berth, TRP berths and the general estuary. By virtue that the plant must be underway to dredge its efficiency and productivity is reduced when engaged to dredge the swing basins. Please see Attachment H Trailer Suction Dredger illustration for further details.
- Backhoe dredger: this is a stationary dredger similar to a flat top barge with an excavator attached. The vessel is maintained in position by spud legs that anchor it to the ground and the excavator digs the area to be dredged. The material is loaded into a self-propelled barge that moors alongside the backhoe. As each area is dredged to the required depth, the spud legs are raised, the backhoe re-positions itself and the anchoring/digging process is repeated. Some backhoes are self-propelled with a fitted excavator, hold and dumping capability. Ideally suitable to Drogheda for dredging of the ship swing basins and berth. Generally tends to have a very high commercial mobilisation cost and rate per m³.

- Split barge: this is a purpose built barge for receiving dredged material from a dredging vessel such as the backhoe. Once the hold of the vessel is filled, she sails to the approved dumpsite and through bottom doors in her hull that open, releases the material.
- Grab dredger: this is a vessel with a grabbing crane on board and dredges using a clam shell bucket. The material is generally deposited into the vessels hold for later sea disposal via bottom doors. This is a coarse dredger method, dredging holes to create the required depth. On occasions, bed levelling may be required following the dredging where the material does not naturally slump.
- Bed levelling: this is where a small tug or similar vessel tows a cage or plough and removes material to the required level. It is particularly useful after the work of the trailer suction dredger or backhoe to level out high spots remaining to obtain the required dredge level.
- Plough: similar to bed levelling, this is where a cage or plough is towed behind a small tug or similar vessel. The water is agitated with the material being placed in suspension and then carried away by strong currents to be recovered by the trailer suction dredger some distance downstream of the plough operations where the sediments settle out. Such plant would be used where larger vessels due to the size and manoeuvring characteristics cannot operate.

3.5 Total quantities to be loaded:

Estimates for the annual total quantities to be dredged for the Dumping at Sea Permit application period 2021 – 2029 are outlined above in Table 1 with an annual 100,000m³ additional contingency.

Daily, weekly or monthly dredge quantities are difficult to define in the absence of a contract where the contractor can advise on the dredge plant's production capacity. Production capacity is also dependant on the dredge material type, location in the dredge zone, location of the spoil ground for disposal, initial depth restriction for which the plant is engaged or contracted, tidal heights visa via the dredger ballast and loaded draft at the dredge site.

Experience to date at Drogheda Port with the range of suitable TSD dredge vessels for maintenance dredging at the entrance and seaward approaches in a shallow water would have a per tide range of between 4,500 – 5,500m³

With continuous running over two tides per day (*optimal performance/production*):

Per tide: 4,500m³ – 5,500m³

Per day: 9,000m³ – 11,000m³

Per week: 77,000m³

(NOTE: The above figures are never achieved due to a myriad of vessel operational constraints).

Following a weather event where the TSD dredge has been tasked to respond to impaired depths at the entrance and seaward approaches a contract duration of twelve to fourteen days, dredging twice daily would not be un-typical. Initially dredging is slow with low productivity as the TSD dredger must work its way over the created shoal dredge area with productivity increasing as the contract progresses and depth increase. Spring or neap tide may also impact the dredger progress and the depth over the shoal will vary.

Dredging within the commercial estuary i.e. channel, berths, artificial dredge pockets and ship swing basins, the daily production and duration is dependent on the location, material quantity and the operational constraints of the particular vessels contracted, dredge area accessibility and steaming time to/from the seaward spoil disposal site and constraints by other vessels

operating in the channel. Productivity with the TSD is less than that achieved at the entrance and seaward approaches.

4. Dumping Site Selection

Drogheda Port Company has two sea disposal sites or dumpsites, 'A1' the seaward site and 'A2' the north inshore site (see Attachment I Location of Maintenance Dredging Dumpsites). This application is seeking to continue the use of these two historical and established sites as per the existing EPA Dump at Sea (DAS) operational conditions attached to DAS Permit S0015-02.

Dumpsite 'A1' (see Attachment J Hydrographic Survey Dumpsite A1) is considered as the primary all weather and all material (sand, silts muds & gravels) site and has been used in the past for both port maintenance and capital dredging. The use of this site stretches back to pre-1990's having been designated by the then Department of Marine.

This site is the requested site and to continue as the primary site for the future maintenance dredging disposal from the berths, artificial berth dredge pockets, ship swinging basins and overall channel i.e. from town to the river entrance catering for the full range of Dredge Material (DM) i.e. muds, silts, sand & gravels. Additionally, this site is also sought for the sand material disposal from the river mouth and seaward approaches when dumpsite 'A2' is not available (ref below).

Despite the long historical use of the site there have been no changes to the depths at the site and DM migration is minimal as determined by the Hydrographic Survey Drogue Survey Nov 2006, Reviewed 2019. (See Attachment L Survey Report on Drogue Release at Drogheda Offshore Dumpsite).

Dumpsite 'A1' is contained within the defined port limits of the Drogheda Port Company and is regulated as such from a navigational and control of shipping perspective. The site is located within the designated anchorage of Drogheda Port in a depth of 13-15 metres of water at Chart Datum. The site is also within the designated ship quarantine area for the implementation of the International Ship and Port Facility Security Codes (ISPS) and EU Security Directive 65/2005.

The site is not used for fishing.

As stated above, dredge material has been disposed of at the site over the last three decades including the capital dredge schemes of 1999-2000 and 2006. There has been no significant impact or reduction on navigational depths or impact to the overall site hydrodynamics.

'A2' is the 2nd dumpsite sought for the sands from the entrance and seaward approaches (see Attachment K Hydrographic Survey Dumpsite A2). This north in-shore dumpsite is located within the defined pilotage limits of the Drogheda Port Company and regulated as such from a navigational and control of shipping perspective. This site has been determined by hydraulic and hydrodynamic mathematic computer modelling to be advantageous to aid the coastal process and beach re-nourishment (see Attachment B RPS Drogheda Port Company Maintenance Dredging Licence Application Hydraulic Modelling Study, 25 May 2019). The site is located within the nearshore surf zone with depths of circa 4m at Chart Datum.

This site is only suitable for sand material from the channel entrance and seaward approaches.

The site is used by local fishing vessels for razor fishing but vacated when Drogheda Port Company dredging operation are in progress i.e. the site primary purpose recognised by the Sea Fisheries Protection Authority, (See Attachment M EPA & SFPA Correspondence on the use of the 'A2' site).

The depth at this site is shallow with only 4 metres of water at Chart Datum. TSD dredgers use bottom doors to release their payload of DM and as such increase their draft immediately prior to DM release. Therefore, dredger access for safe material dumping is conditional on

weather, wind directions and strength, state of the tide, sea conditions, dredger manoeuvrability etc and the use of the site visa via the 'A1' site is at the sole discretion of the dredger Master and the operationally safe condition to facilitate its use.

5. Characteristics of Dumping Sites

5.1 Dump site 'A1'

The seaward Dumpsite 'A1' has been used as the primary all material dumpsite for over the past two decades by the Drogheda Port Company for maintenance and capital dredging material disposal. Drogheda Port Company is the only permit holder in respect of the 'A1' dump site. The site is located within the designated anchorage of Drogheda Port approximately 2.5km from the shore. The minimum depth of the water is 10.7m, the maximum depth is 16.2m and the average depth is 13.45m at Chart Datum.

Detailed data about past disposal operations are included in an Excel spreadsheet (see Attachment C Dredging history 2001 - 2019).

The estuarine habitat of the Boyne Estuary encompasses two Annex I habitats: Estuaries [1130] and Mudflats and sandflats not covered by seawater at low tide [1140]. The site comprises mainly a river channel that supports subtidal habitat, and the mudflats and sandflats to the north and south within the estuary and the beaches outside the breakwaters. The site is dominated by sedimentary habitats, with muddier sediment found upstream within the estuary, becoming more sand-dominated close to the river mouth and outside the breakwaters. The ecology of benthic marine habitats is described through a combination of the substratum and the fauna living within or on it. Please see Chapter 8 of Attachment N Environmental Report for further details.

Sediment Disbursement Analysis using tracking drogues was carried out in November 2006 at Dumpsite 'A1' (see Attachment L Survey Report on Drogue Releases at Drogheda Offshore Dump Site). This study demonstrated there is little or no movement of dumped sediment shoreward when released at Dump Site 'A1'. Hydrographical Surveys Cork have recently provided a statement dated 7th of May 2019 to confirm that the results of this survey are still valid due to the fact that no significant change in coastline has occurred and the tidal regime is likely unchanged as a result.

5.2 Dump Site 'A2'

This near shore dumpsite is used only for sand dredged at the channel entrance and seaward approaches. The site is close to the surf zone. The minimum depth of the water is 2.3m, the maximum depth is 6.6m and the average depth is 4.5m at Chart Datum. This sand being part of the coastal sediment transport regime and as part of a beneficial re-use process is deposited at the near shore site to aid the coastal process and beach nourishment (see Attachment B RPS - Drogheda Port Maintenance Dredging Modelling 2019). The current Dump at Sea Permit S0015-02 prohibits the use of this site in the months of July and August. This does not create any operational difficulty for Drogheda Port Company.

All dumpsites with their co-ordinates are illustrated in Attachment I Location of Maintenance Dredging Dumpsites.

Sediment samples were taken from both dumpsites and the dredging area and analysed for parameters stipulated in the Sampling and Analysis Plan provided by the Marine Institute, see Attachment O. The material consists of silt with varying proportions of sand and gravel and is not likely to contain any viruses, bacteria, yeasts, parasites of concern. The Office of Radiological Protection have stated that the dumping of these materials at sea will not result

in a radiological hazard. As the results of the suite of analyses on the range of analytes examined showed that none of them exceeded the upper limits, measurable physical, chemical or biological persistence is considered very unlikely. Accumulation and biotransformation in biological materials or sediments is also considered very unlikely. Please see Attachment P Sediment Sampling and Analysis Report for further detail.

6. Details of the Dumping Operation

Dredging at the entrance and seaward approaches is generally driven by weather events that cannot be predicted or scheduled. Analysis of the Drogheda Port Company dredging history (Attachment C Dredging history 2001 - 2019) clearly illustrates the unpredictability over any twelve month period. If the river mouth silts up due to a weather event resulting in impaired navigational safe depths, then dredging is immediately required and dumping of the dredged material will occur subsequently.

If depths are not impaired then no dredging/dumping takes place.

Drogheda Port Company maintains a dredging contract with commercial dredging contractors for immediate plant response availability. These contractors work very closely with the port and are updated on each hydrographical survey so that they are aware at any point in time of the condition of the Drogheda Port entrance and seaward approaches and the likelihood of a call up following a weather event. Drogheda Port has visibility of the contractor's plant location and contracted planned works programme. This allows for a rapid mobilisation following a weather event where Drogheda Port safe navigations depth become impaired.

The two dumpsites are shown on Attachment I Location of Maintenance Dredging Dumpsites.

Dredging and dumping is carried out by the same plant, which is usually a trailer suction dredger, see Section 3.4 above.

Estimated annual quantities of maintenance dredging (to be subsequently dumped at either Dumpsite 'A1' or Dumpsite 'A2') of the berths, artificial berth pockets, ship swing basins, channel, river mouth and seaward approaches are shown in Table 1 in Section 3.5.

7. Discussion of Alternatives

In order to investigate alternative means of disposal or reuse of the material dredged from the River Boyne estuary and seaward approaches, a STRIVE report commissioned by the EPA and compiled by the Cork Institute of Technology entitled 'Guidance on the Beneficial Use of Dredge Material in Ireland' was consulted by Drogheda Port Company. This document examines a wide range of beneficial uses of Dredged Material (DM). These may generally be categorised as:

1. Engineering uses: Involves beneficially using DM typically as an alternative to land based resources (for example quarry aggregate) and is common in many engineering projects, e.g. land reclamation, beach nourishment and coastal protection works.
2. Environmental Enhancement: Involves using DM as a resource with the potential for environmental enhancement when managed in a sustainable manner, e.g. habitat creation or sediment cell maintenance.
3. Agricultural and Product uses: Suitable DM may be used to form useful products or in the agricultural sector once the appropriate physical, chemical and biological properties comply with the appropriate industry standards, e.g. manufactured topsoil, landfill cover or production of ceramics/bricks/concrete.

Over the last two decades the Drogheda Port Company has, through its previous Dump at Sea Permits issued by the Department of the Marine/Marine Licence Vetting Committee (2 x capital dredging campaigns and 3 x maintenance dredging campaigns) and latterly the EPA

(maintenance dredging), examined and exhaustively studied the feasibility of the alternatives and beneficial reuse of the DM from the River Boyne estuary and seaward approaches. The dredged material is of two distinct types, silt/mud and sand/gravel.

The constraints to the use of the material with respect to maintenance dredging are wide and varied, i.e. suitability, environmental constraints, impact on the coastal process, plant suitability, sustainability of beneficial re-use activity, material demand and/or market conditions and material quantity. In the case of Drogheda, sustainability, alternative and beneficial use of the DM must be considered against the findings of the RPS Hydraulic Modelling reports 2012 – updated 2019 (see Attachment B RPS - Drogheda Port Maintenance Dredging Licence Application Hydraulic Modelling Study 2019). The conclusion of the Report in consideration of the coastal cell dynamic sediment transport regime validates the allowed use of the material for considered alternatives and beneficial re-use.

The above options were originally investigated by Kirk McClure Morton and presented in an Environmental Statement for the capital dredging scheme in 1999 - 2000, see Attachment Z-1 Options for Disposal. The findings of this investigation are included in the below sections. The conclusions drawn then remain valid given the intensification of environmental legislation and controls, now coupled with additional concerns of coastal flooding, water quality etc.

7.1 Engineering Uses

- (i) *Beach Nourishment (Previously considered for capital dredging and now actively used for maintenance dredging)*

Drogheda Port Company already actively implements beneficial reuse of DM for beach nourishment within the nearshore coastal cell. The north in-shore dumpsite 'A2' (see Attachment K Hydrographic Survey Dumpsite A2 and Attachment I Location of Maintenance Dredging Dumpsites) is only suitable for sand material from the channel entrance and seaward approaches. This sand is part of the coastal sediment transport regime and as part of a beneficial re-use process is deposited at the near shore site to aid the coastal process and beach nourishment. The sand material is ideal, natural to the area having already been mobile within the coastal cell, moving south to north. This site has been determined by hydraulic and hydrodynamic mathematic computer modelling to be advantageous to aid the coastal process and beach re-nourishment (see Attachment B RPS - Drogheda Port Maintenance Dredging Licence Application Hydraulic Modelling Study 2019). Dumpsite 'A1' (see Attachment J Hydrographic Survey Dumpsite A1) is considered as the primary all weather and all material (sand, silts muds & gravels) site.

- (ii) *Beach Nourishment (considered for capital dredging and discounted for maintenance dredging)*

An alternative disposal site (capital dredging 1999-2000) for beach nourishment was considered behind the south training wall on the area of the accreting beach at Mornington. In this option it was proposed to excavate the sand which has built up behind the south wall and transport it southwards to form beach re-nourishment in the Bettystown/Laytown area which is suffering erosion. The dredged material would then be pumped directly to replace the excavated sand and the area covered with sand to replace the beach to the current levels. The scheme would have the benefit of improved beaches at Bettystown/Laytown but would increase the cost of the scheme by approximately €500,000 – 1,000,000. This proposal would require a sufficient volume of beach sand removal to permit dredged material infilling. However, the lowered beach levels after excavation would make the dunes in this proposed Natural Heritage Area (NHA) more vulnerable to erosion before infilling would be completed. The stretch of dunes closest to the training wall exhibit embryo dunes and evidence of seawards accretion. The habitat is also recognised by the proposed NHA status for environmental protection. In addition, beach surveys indicated that only 65% of the dredged material could be accommodated by excavating down to low tide level in a 1.8 km length of

beach south from the training wall. As this would leave the dunes very exposed to erosion, the option was considered both environmentally and technically unacceptable.

An alternative option incorporating beach nourishment and material disposal was considered i.e. the dredged material could be spread on the beaches to the north and south of the Boyne entrance. The material would be dredged, placed in barges and then delivered to the beaches by pumping through several pipelines from nearshore pumpheads to the beaches.

While the dredged materials consist mainly of sand and gravel which would be technically suitable for coast protection, the south beach and sections of the north beach near Termonfeckin are used extensively for recreation. Clogherhead beach holds the European Blue Flag status indicating consistently good water quality, beach management principles and safety guidelines in compliance with EU criteria. The proportion of gravel in the dredged material is such that the beaches would become stony and not acceptable for recreational use. This change in the nature of the beaches would also affect the fauna and particularly bird populations which use the beach and hinterland for feeding and roosting. This option was rejected on the grounds of suitability as well as the additional cost of double handling the dredged material.

(iii) Land Creation/Reclamation or Land Improvement (applicable only to capital dredging 1999-2000)

The option of using DM for land reclamation was considered.

This material would be virgin material, primarily of sand and gravel and exposed in breaking new depths. It is not available in a maintenance dredging programme, where new depths are not exposed and the material within this location is primarily a sand/mud/silt combination. This option was only feasible for the capital dredging campaign in 1999-2000 where new depths were achieved.

This option involved:

- Recovery of the main quantity of DM; sands and gravels located between Tom Roes Point and the Bar Mouth; for temporary storage and beneficial reuse – approximately 700,000m³.
- Disposal of the dredged material with highest silt content, from between the Steam Packet Quay and Tom Roes Point, to the Port's present maintenance dredging disposal site – approximately 160,000m³.

The principle of recovering dredged sands and gravels for beneficial reuse is in line with European Council Directives on recycling and a suitable temporary storage area was identified as the western polder at Stagrennan. This polder formerly extended from Stameen's Pier in the east to the Railway Viaduct at the west. The western end was utilised as the Town tip with progressive infilling and development. Current development includes the construction of the municipal pumping station adjacent to the Maxol and Flogas oil and gas terminals, and temporary storage of pipes and construction equipment for the Main Drainage scheme.

The western polder at Stagrennan has been excluded from the designation of proposed NHA and Special Protection Area (SPA) which cover the remainder of the estuary. The polder, which has been leased by the Department of Marine to Drogheda Port Company, has been designated for land use zoning objectives to provide development for port related industry and other uses.

The land use in the vicinity of the polder is industrial and commercial in nature. The polder lies to the south of the Premier Periclase Plant, to the west of Stameen's Pier and the paper storage warehouse, to the east of the wastewater treatment works and Maxol/Flogas depots and is bounded to the south by a grassed verge to the Mornington Road. The extent of the temporary storage material in the polder would be approximately 2m higher than road level and will have gradual slopes on each side.

The infill process would comprise the following procedures:

- Raise the level of the riverside weir to above high water level to impound the polder and prevent tidal water entering.
- Dredged sands and gravels will be pumped in suspension through disposal pipelines to the polder. The sands and gravels will quickly settle out of suspension and a settlement lagoon will be provided to allow settlement of the limited silt fraction.
- Bulldozers will operate within the polder area to relocate settled material to the required levels above the bank walls.
- Pumping sands and gravels in suspension and relocating to level will commence at the eastern end of the polder progressing westwards towards the weir.
- Higher settlement rates will be achieved in the early stages of the infilling as the settlement lagoon will be large. As infilling progresses westwards the volume of suspension entering the lagoon will be monitored to maintain at least 12 hours settlement prior to the water escaping over the weir and returning to the river. Intermediate bunds will be created if necessary.
- Towards the end of the dredging and infilling process the settlement lagoon will be maintained and the infilled material temporarily stockpiled by bulldozer higher than the average finished level.
- When the pumping of sands and gravels is completed, the lagoon will be infilled by dozer producing an average finished level of approximately +7.9m OD.

Temporary storage of the dredged material in the polder would be required for 3-5 years for beneficial reuse as fill in the construction industry in line with the Waste Framework Directive (EU) 2018/851. The material is suitable for road embankments or general fill at construction sites and commercial interest has been expressed in the material.

This scheme was carried out at Stagrennan Polder under Waste Licence EPA ref: W052. The site has since been restored and signed off by the EPA and the EU. Re-use of the site would not be allowed.

Disposal of dredged material to the Port's current licenced disposal site will also be required. The highest silt contents at approximately 15% have been indicated in the zones between the Port and Tom Roes Point in the upstream stretch of dredging. This element of the dredged material is considered to be most suitable for disposal to the site used for routine maintenance dredging disposal, located approximately 2.5km from the mouth of the river. The area of the disposal site is 400 hectares and typical water depths are in the range of 11-16 m depth at Chart Datum.

For material of a high silt/mud content there is no other suitable alternation to dumping at sea.

(iv) Landfill Cover

Suitable DM can be used as an alternative barrier material to traditional natural clays which act as a capping layer for municipal waste landfills; it may be applied as a daily, intermediate or as a final permanent capping layer. Both coarse and fine grained DM may be deemed suitable depending on the cover material required. A DM with a low moisture content would generally be most suitable as dewatering and desalination (if salt content is > 500mg) of the DM is recommended for the 'ideal' DM capping layer before use. Ideally the DM should be free draining and, preferably, of low clay content with low permeability characteristics to provide the most efficient cover material. The following is recommended when assessing DM as viable landfill cover material:

- The recommended cap should consist of a 0.61m layer of fine clayey DM (low permeability layer) covered by a 0.31m layer of coarser DM (vegetative layer);
- The pH should be between 5.5 and 8;
- A minimum organic content of 1.5% by weight;
- A maximum soluble salt content of 500mg/l

Sediment samples were taken from both dumpsites and the dredging area and analysed for parameters stipulated in the Sampling and Analysis Plan provided by the Marine Institute, see Section B of this application. The material was found to consist of silt with varying proportions of sand and gravel. Gravel ranged from 0 to 39.6%, sand ranged from 12% to 99.2% and silt-clay ranged from 0.8% to 86%.

The DM was found to have a high moisture content which ranged from 22.4 to 70.8% which would make it unsuitable for landfill cover, which requires a low moisture content. The DM was also found to have a widely ranging clay content i.e. 0.8% to 86% which would make it unsuitable for landfill cover, which requires a low clay content.

(v) *Offshore Berm Creation*

There are generally two types of offshore berm with differing applications; a feeder (or active or dispersive) berm, in which sand is transported shoreward to the beach and a stable (or non-dispersive) berm where the material remains in the vicinity of the berm and causes damping of the waves and thus sheltering of the landward beach. A wide range of locally sourced clean DM may be used with berm creation often undertaken in conjunction with beach nourishment as the two processes can mutually interact in a beneficial way. Fine to medium sand is often considered the most suitable type of DM for constructing feeder berms while coarser, more substantial DM such as rock and gravel are more appropriate for use in stable berms. Offshore berms constructed from fine muddy material have also been successfully used.

Drogheda Port Company in conjunction with Meath County Council have carried out three studies looking at the sediment stripping on the southern beach particularly in the area of Laytown Co. Meath. The stripping is due to the natural forces of wind and tide within the cellular bay configuration accelerated by the hard coastal protection engineered and non-engineered structures adopted over many years. The use of bunds was not acceptable to arrest the beach stripping due to the environmental and amenity impacts on the beach and the historical Laytown Races, the only remaining horse racing on an intertidal beach in the world.

(vi) *Coastal Protection Works*

DM can be used to fill geotextile tubes which are used to retain and dewater DM to form the core of different types of coastal structure. Geotubes are used to control beach erosion, provide shore protection and act as river training structures. Different types of DM may be dewatered using geotubes, although the fill material used is generally sand based where the DM should consist of a minimum of 40% solids (i.e. sand) when used for marine structures.

Recommended selection criteria for the use of geotubes in association with a dredging project include:

- Shallow water with low tidal range and low wave energy;
- The geotubes must be maintained and covered;
- There must be no threat to life or property if failure occurs; and
- The project must have flexible height and alignment requirements.

The type of dredger selected is restricted because of the need to pump a minimum of 40% solids, to fill the tubes. A small cutter suction dredger of type DOP (Damen Onderwater Pomp) with a 6 to 8 inch pipeline would be a typical plant of choice.

The beach nourishment referred to above (Section (i) and (ii)) is complementary to coastal protection. The DM dredged from the entrance and seaward approaches is deposited at a depth of 4m within the intertidal surf zone and dispersed to the beach to nourish and mitigate against sediment stripping as found to the south.

7.2 Environmental Enhancement

(i) *Wetland Habitat Creation/Enhancement (considered for capital dredging but discounted)*

The option of extending the dunes on the foreshore to the north of the training walls has been thoroughly investigated. The “cut back” to the north of the north training wall is an area which is accreting naturally and lies within the proposed NHA and SPA. The sands and gravels from the dredging could be pumped directly to the site and used to form a new dune system in front of the existing dunes. The bulk of the dunes would be formed from the sand/gravel while the sand from the entrance channel would be used to provide a sand cover. The dunes would be contoured and planted to match the existing grey dune system.

This option was considered by Office of Public Works (OPW) to be unacceptable. The OPW cites the ecological impact on the bird populations in this SPA and particularly the impact on ‘priority habitat’ embryo dunes in this proposed NHA to be environmentally unacceptable. In addition, the dune habitat has been classified as a proposed Special Area of Conservation (pSAC).

(ii) *Sediment Cell Maintenance*

Sediment cell maintenance, also known as sustainable sediment relocation, involves the placement of DM in tidal estuary systems potentially reducing the erosion of tidal mudflats, banks and saltmarshes and also potentially improving both shallow sub-tidal and intertidal habitats. It typically applies to maintenance dredging projects where sediment contaminant levels are typically very low or entirely absent. The beneficial use of fine grained DM in sediment cell maintenance is suitable for maintenance dredging projects providing a continual and sustainable resource for the DM generated; the DM must be comparable in terms of physical, chemical and biological properties. The type of dredged sediment which is appropriate depends on the site specific requirements.

The sediment is commonly dredged using a hopper dredger and transported through a floating pipeline to a pontoon, from which it can be accurately deposited in the required area with a diffuser. When assessing a specific dredging site for the potential beneficial use of the DM in sediment cell management, it is important to include:

- Detailed field sampling and analysis of the existing sediment;
- Multivariate studies of the micro-benthic and macro-benthic communities;
- Computer modelling of the bed characteristics and sediment transport regime; and
- Post-disposal monitoring of the ecosystem to ensure no negative impacts.

The intertidal mudflats or Polders created in the 1850’s are already accreted and have lost a great deal of their originally engineered use. All the Polders are now bird feeding habitats and designated under various EU Environmental designations. Deposition of DM would not be allowed and would possibly have an adverse impact on the flood mitigation regime for the greater town of Drogheda and the villages of Baltray and Mornington.

(iii) *Fill for Abandoned Mines/Quarries*

The option of disposal of the DM to quarry sites outside Drogheda was considered. There are old quarry workings on the Dundalk side of the town which could contain the DM. In this option the DM would be placed in barges and brought to the town quay where it would be unloaded into trucks for transportation to the quarry.

Some 352,000 tonnes of material would have to be transported annually which would lead to heavy traffic. This volume of heavy traffic, in combination with the disruptions to traffic flow associated with other ongoing major capital works schemes within Drogheda would have significant implications for the residents of Drogheda Town and through traffic on the N1 in

terms of noise, traffic delays and airborne pollution. Even if the dredging programme was extended to 12 months (approximately 1 heavy vehicle trip every 2 minutes) the additional cost would remain similar and be such that the Harbour Development Scheme would be uneconomic.

7.3 Agricultural/Product Uses

(i) Concrete Manufacture (already engaged by Drogheda Port)

60,000m³ of the material which is dredged from the Boyne estuary and seaward approaches is brought ashore for use as a raw material in the construction industry. Sand is offloaded from the dredger using a clamshell grab bucket and placed in stockpiles on the quay. The material is left on the quay for 24 hours before being loaded using a front end loader onto forty tonne articulated haulage trucks. Each load of sand is sheeted before it leaves the docks. Every load is weighed on the weighbridge before the sand is tipped in designated stockpiles at the Kilsaran Concrete facility. Once delivered to the concrete works, the sand requires no further processing to be suitable as a raw material for concrete manufacturing.

Kilsaran Concrete commissioned physical and chemical analysis of the DM by RSK. The findings are outlined below.

The sand is very uniform in physical and chemical characteristics: it comprises a continuously graded natural sand fine aggregate typically comprising chiefly quartz (79%) and calcite (11%) with minor proportions of feldspar and ironstone, and traces of modern shell fragments, sandstone, siltstone, chert and granite rock. With regard to particle size, 95% of the sand lies within the fraction 0.150mm to 0.063mm and thus is assigned the designation 0/1 (sand).

The sand is most suitable as a raw material for the preparation of concrete for use in buildings, roads and other civil engineering works.

Dredged material is inspected before and after unloading onto the quay side, any material deemed not to be suitable for concrete production can be used for pipe bedding, haunching and surrounding of pipes as it conforms with the specification IS EN 13242 i.e. fine and all-in aggregate. To date, no material has been deemed unsuitable for either use. Furthermore, less than 1% of the sand that was not used for concrete was instead used as pipe bedding material.

(ii) Road Sub-base Construction (already engaged by Drogheda Port)

Coarse and fine DM can be used in different aspects of road construction, including both as a structural material and as a general fill for the construction of road embankments and roadworks. Road and infrastructure projects in Ireland may potentially provide a destination for recycled DM; either coarse grained or potentially fine grained where the mechanical characteristics would need to adequately spread wheel loads. In general, coarse DM is more easily integrated into road construction than fine grained sediment. For fine-grained DM, it is important to determine the saline and organic content of the DM as these components impact on the viability of using DM in road construction due to their negative impact on mechanical strength when the DM is stabilised with cement.

DM (sand) material brought ashore is available through the Drogheda Port contractor if sought by the industry.

(iii) Landfill Liner

DM can be used as a secondary protection mineral liner in conjunction with another stabilising material.

Precise quality control of the DM and the stabilising material mix is essential as the strength, landfill stability, permeability and durability of the lining system are important factors. The EPA has developed requirements for the properties of compacted clay liner which may be applicable when assessing the suitability of DM as a landfill liner. These requirements include:

- % fines (particles < 0.075mm) - ≥ 20%;

- % gravels (particles > 4.76mm) - ≤ 30%; and
- 0% moisture content.

Sediment samples were taken from both dumpsites and the dredging area and analysed for parameters stipulated in the Sampling and Analysis Plan provided by the Marine Institute, see Section B of this application. The material was found to consist of silt with varying proportions of sand and gravel. Gravel % ranged from 0 to 39.6%, sand (fines) ranged from 12% to 99.2% and silt-clay (fines) ranged from 0.8% to 86%. The gravel % i.e. 0 - 39.6% surpasses the requirement outlined by the EPA (≤ 30%) and the fines % i.e. 0.8% - 99.2% also surpasses the requirement outlined by the EPA (≥ 20%). The moisture content of the DM was found to range between 22.4% and 70.8% which surpasses the requirement outlined by the EPA i.e. 0%. For these reasons, the DM may not be optimal for use as a secondary protection mineral liner for landfills.

However, DM (sand) material brought ashore is available through the Drogheda Port contractor if sought by the industry. It have been used previously as a capping.

(iv) Manufactured Topsoil

DM may be directly used as topsoil material depending on its properties and the presence of organic material in the DM. However the use of engineered manufactured topsoil (MS) allows the use of DM combined with recycled organic waste material to produce a manufactured topsoil that can improve soil growth characteristics.

It is suited to a location where a continuous supply of DM is available to supply an MS facility; an on-going and periodic maintenance dredging project is appropriate. In addition a source of organic material is required with a local demand in evidence for the topsoil produced.

A mix of coarse and fine grained material should be used but this needs to be determined on a site specific basis.

Transport logistics are complex (dewatering and desalination required) but are crucial to treatment processes and economic feasibility.

DM (sand) material brought ashore is available through the Drogheda Port contractor if sought by the industry. It have been used previously as a cover for equestrian centres etc

(v) Production of Bricks/Ceramics

Fine grained DM can be used as a substitute for sand or clay to produce bricks.

Physical and chemical analysis of the DM is necessary to assess suitability of DM. DM is considered a suitable raw material for brick manufacture if the sand content does not exceed 30%. The physical analysis carried out on sediment samples taken from the dumpsites and the dredging area has shown that the sand content ranges from 12% to 99.2%, which exceeds the requirement for brick manufacture i.e. 30%. For this reason, the DM from the dredging area may not be suitable for use in brick manufacture.

Proximity of brick manufacturing facility to the DM recovery area is also a major factor as the cost of DM transport may be significant.