2A

Galway Harbour Company

Galway Harbour Extension

ENVIRONMENTAL IMPACT STATEMENT

ADDENDA / ERRATA TO CHAPTERS

JANUARY 2015

0 INTRODUCTION

A planning application, including an Environmental Impact Statement (EIS) and Natura Impact Statement (NIS), for a proposed Extension to Galway Harbour, were submitted to An Bord Pleanála for consideration on the 10th January 2014.

Subsequently, a Response to a Request for Further Information was submitted in 16th October 2014. The Response included documents outlining Errata and Addenda to the Natura Impact Statement and Environmental Impact Statement (these documents were dated October 2014).

Following review of submissions on the Response to Further Information, some additional information has been prepared in further Addendum/Errata documents to the NIS and EIS. This document presents the additional Addenda/Errata to the EIS, namely EIS Addendum/Errata Document II, January 2015. Where addenda or errata are presented, they are cross-referenced to their location in the October 2014 document, giving the previous page number and paragraph or table number.

Generally, the information presented in this EIS Addendum / Errata Document II, is new information which should be considered as ADDITIONAL to that included in the NIS and NIS Addendum/Errata Documents, January 2014 and October 2014, respectively.

0.1 APPENDICES TO EIS ADDENDUM / ERRATA DOCUMENT II

This document includes the following Appendices:

Addendum / Errata to Chapter 7 – Flora and Fauna

Addendum to Chapter 8 – Water

Addendum / Errata to Chapter 9 – Air Quality

Errata to Appendix 10.3 – Noise and Vibration

Addendum to Chapter 13.2 - Archaeology

Addendum to Chapter 7 – Flora and Fauna

7 FLORA AND FAUNA

The following information replaces Section 7.4.1.3.1 (Terrestrial Habitats in the Zone of Potential Influence) and Section 7.7.3.1(Impacts on Terrestrial Habitats) of the EIS Addendum/Errata Document as submitted in response to An Bord Pleanála's Request for Further Information in October 2014. Note that Figure 1 is an amended Figure previously included in the EIS; Figure 2 is a new figure which was not previously included within the EIS.

Dr. Michelene Sheehy-Skeffington, an acknowledged expert on salt marshes and stony bank habitats in Ireland and who is familiar with the shingle bank at Renmore since the 1980's, was commissioned to undertake a site visit and to prepare a report in the light of the comments raised within An Bord Pleanála's Request for Further Information and comments from DAHG, in March 2014 and December 2015. In order to respond to the relevant points, the site was visited on 22nd July, 2014, with the findings outlined below.

A visit was made to the seaward edge of L. Atalia to establish the changes in habitat brought about by the winter storms. The upper strandline, shingle area and habitat immediately north of this ridge were walked.

The shingle bank, formerly *ca* 1m in height, was observed to have been completely altered. Most of the shingle has been moved inland, forming a spit immediately to the south of Renmore Lough (site number 1 in Fig. EIS (A2) 7.1 and area outlined in blue in Fig. EIS (A2) 7.2. More shingle had spread along the inner edge of the grassy bank that used to form the inner (northern) edge of the shingle. It is likely that there were two sources of shingle : 1) that present on the shore line and 2) material thrown up from the sea floor to the south of Renmore Lough. The shingle has been moved to such an extent that the seaward edge now forms part of the strandline and vegetation comprises species tolerant of tidal submergence such as spear-leaved orache, sea rocket, sea mayweed and sea radish. On the higher ground, the vegetation and its soil was broken up, but still formed a band of grassy vegetation with creeping bent grass, perennial ryegrass, red fescue and false oatgrass forming the grass layer and a mixture of ruderal (weed) species such as colt's foot, nettle, ragwort, perennial sow-thistle and smooth sow-thistle, along with calcareous coastal grassland species such as ribwort plantain, field medick, bird's foot trefoil and kidney vetch.

The shingle, between sections of grassland, supports sea radish, spear-leaved orache and curled dock.

Notable on the strandline and shingle was the rare blue lettuce, once abundant on the shingle, but which had disappeared in recent years. This is the only known site for this alien species in Ireland. The disturbance of the storms has exposed the seed-bank and this and the rare native *Brassica nigra* (black mustard), have appeared, the latter occurring sporadically on the inner edge of the shingle. This is the first time black mustard has been recorded here, or in all of east county Galway (EIS (A2) Fig. 7.3), though it has been recorded on Inishbofin and on Inishmore, Aran Islands in the past. Another rare transient coastal species that used to be common on this shingle bar is henbane. It had disappeared since the 1980s, and was rediscovered in August of 2014. This illustrates the conservation interest of such naturally disturbed habitats as shingle. Such intermittent disturbance is essential to maintain this habitat. The proposed development is likely to significantly reduce this disturbance and therefore will reduce the extent and occurrence of the habitat and its constituent species.

Though the former shingle ridge has largely now been flattened and the shingle is close to the strand-line, observations indicate that the current High Water Spring Tide does not encroach on this shingle. In other words, it is not low enough to be susceptible to regular inundation by the sea from the south. Thus the effect of the proposed development, by decreasing exposure to storms, will stabilise the shingle, resulting in it being colonised by species from the adjacent

grassland. The proposed development will not affect the frequency and extent of tidal inundation and the source of saline water will continue to be from the north, via L. Atalia. Only storm surges (extreme high tides) will wash over the shingle, but these, if regular enough, *i.e.* ca at least every 10 years, will prevent the spread and establishment of scrub with bramble sycamore and ash –all noted sporadically on this ridge. The complex of shingle and strandline vegetation comprises a mosaic of grassland and EU Habitats Directive Annex I habitats 1210 Annual vegetation of drift lines and 1220 Perennial vegetation of stony banks. This area is depicted in EIS (A2) Fig. 1.1, which also indicates the relevant extent of the cSAC in the area. The total area of this complex inside the blue boundary is 0.31ha, of which 0.18ha lies within the cSAC.

The southwest edge of the shingle merges into an eroded salt marsh. It is not clear to what extent it was intact before the storms, but it probably has been fragmentary for some time. Upper marsh species are present such as red fescue, sea milkwort, sea arrow-grass, salt marsh rush, scurvy grass and sea aster. The shelter provided by the proposed development may stabilise this salt marsh and result in it becoming less fragmented, though not significantly greater in extent.

Most of the vegetation at Renmore Lough landward of the shingle bar comprises marsh and wet grassland. A small, probably brackish, pond has abundant reedmace (Area 2 on map EIS (A2) Fig. 1.1) and areas possibly intermittently flooded support extensive creeping bent grass with a fringe of sea rush. The edge of the inlet south of the railway line is bordered by some sea rush and salt marsh rush as well as sea club-rush and all three species indicate that this is largely a lagoonal type salt marsh. All of this area is mapped as brackish saltmarsh in EIS (A2) Fig. 1.1. The drier –more elevated– parts of this area support bracken and some hawthorn bushes (disturbed grassland/hedgerow on EIS (A2) Fig. 1.1). Some reed also occurs nearer the railway line.

In summary, there is now a low area of cobbles on the sand below High Water Spring Tide (HWST) with strand-line species here as well as on the higher bank behind this. that the higher bank comprises mixed shingle and grassland on soil. This bank would only be overtopped by a storm surge. The proposed construction will attenuate the wave force and therefore it is less likely that the shingle bank will be structurally altered to any extent in the future, let alone to the extent it was in January 2014. The proposed construction will not affect the flooding of Renmore Lough, via the inlet from Lough Atalia to the north, and therefore the salinity of the lagoonal salt marsh and grassland will not alter significantly. The vegetation, already a mosaic of species tolerant of brackish or saline water (lagoonal marsh) is thus unlikely to alter to any great extent.

The area to the east of Renmore Lough, which comprises a narrow shingle bank above a rocky shore as far as Ballyloughan Beach will be afforded the same level of protection from the proposed development, i.e. reducing its exposure to and disturbance from storms. However, this shingle shore is narrower and does not support a wide assemblage of shingle species, aside from the ubiquitous sea radish and therefore its habitat quality will not be significantly altered. There is no significant area of shingle along Ballyloughan Beach itself. Further to the east, the promontory opposite Hare Island has been protected from storm action by rock revetment and is of little to no conservation value.

To conclude, it is considered that the significant effect of the proposed Galway Harbour extension development will be to stabilise the shingle habitat and thus to permanently alter its nature and plant species composition. The other important factor of salinity, on the other hand, is not likely to alter to any extent as a result of the proposed development and therefore the plant communities that are affected by this are not likely to significantly change.

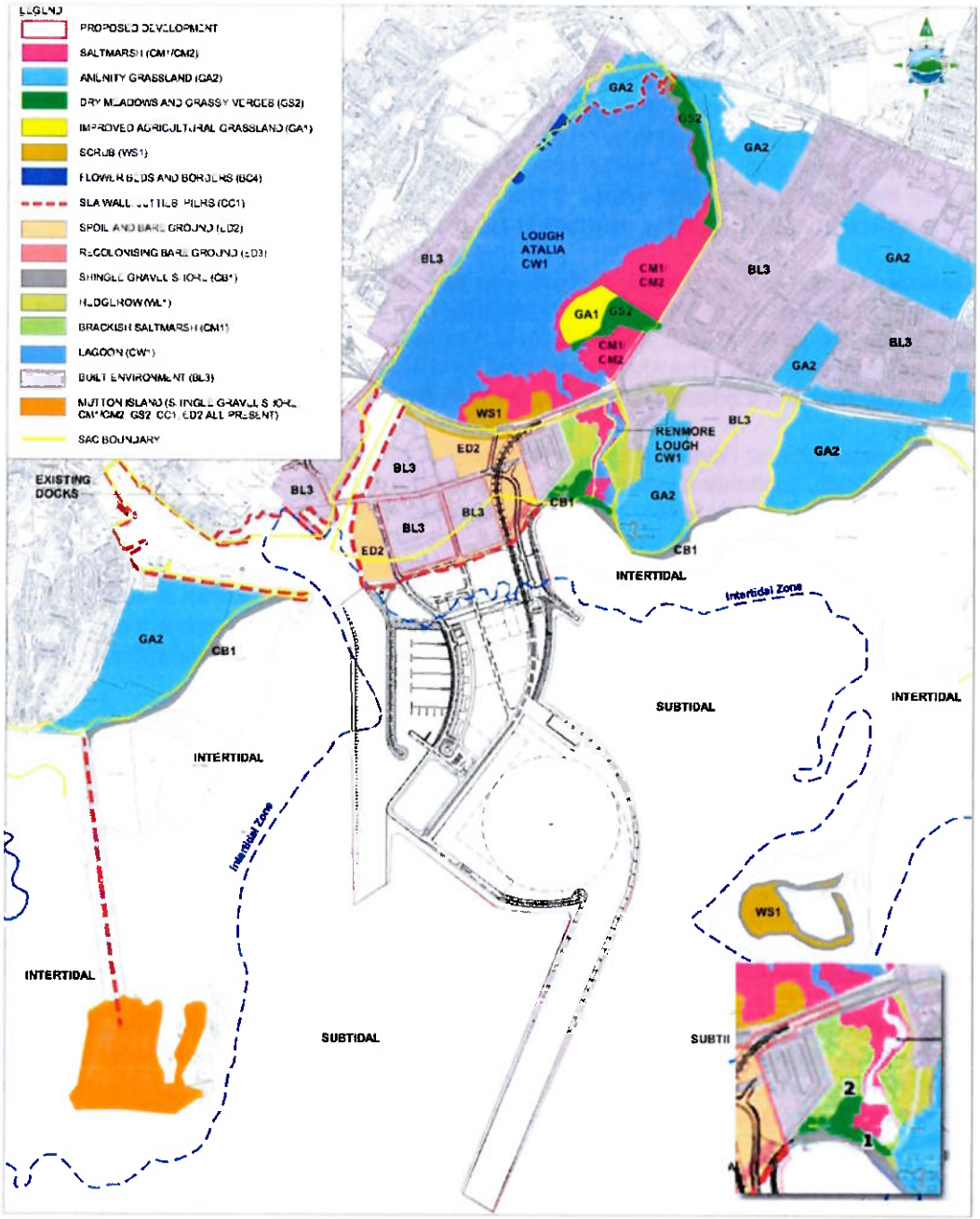


Figure EIS (A2) 1.1 (Previously Figure NIS (A) 3.2 from NIS Addendum/Errata Document I, October 2014) - Terrestrial (non-marine) habitats present in the vicinity of the proposed harbour extension N.B. Brackish saltmarsh is not defined by Fossitt (2000).

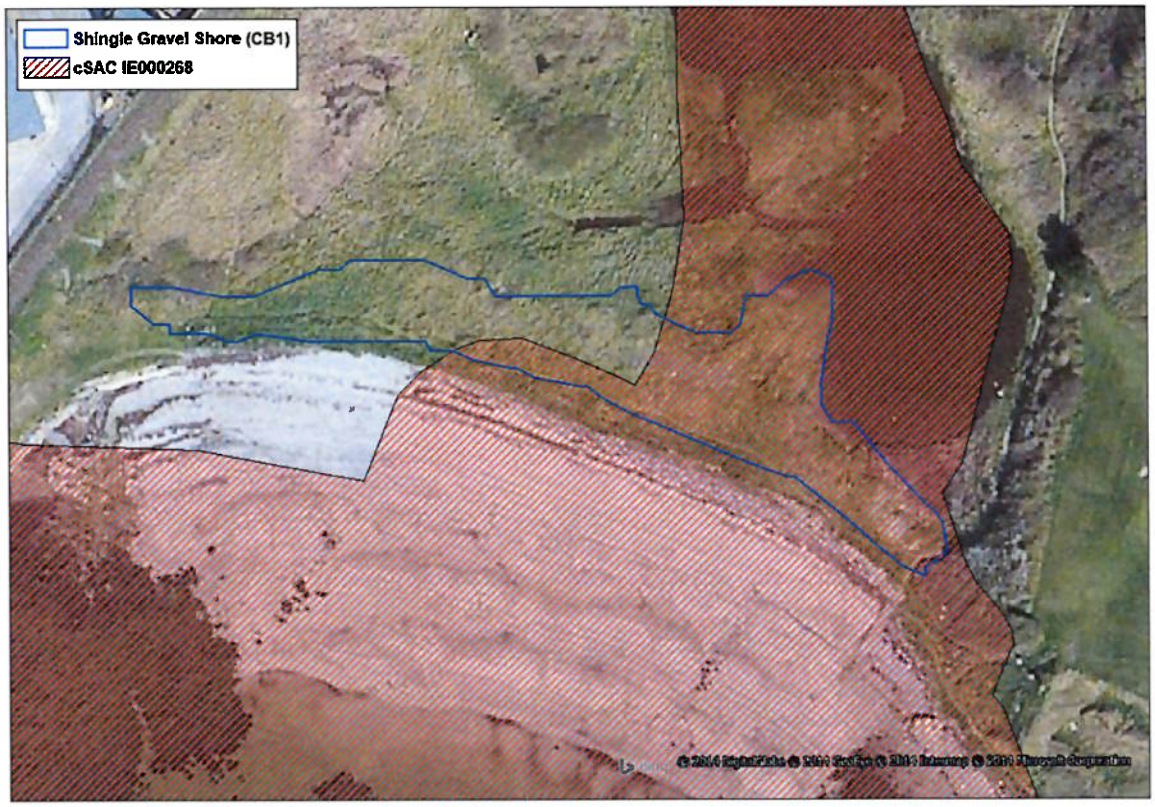


Figure EIS (A2) 1.2 Extended area of shingle outlined in blue and boundary of cSAC in striped red.

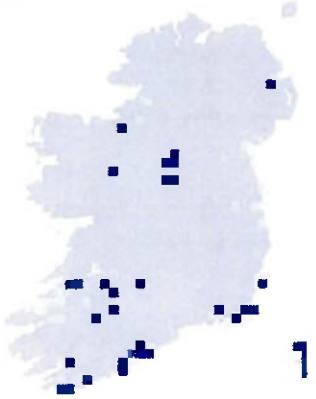


Figure EIS (A2) 1.3 ***BSBI map of 10 x 10km squares where Brassica nigra (black mustard) was recorded in Atlas 2000 (Preston et al 2001). Lighter squares represent pre-1970 records. Note its complete absence from mainland County Galway and from inner Galway Bay specifically.***

The coastal process models of Galway Bay used in the assessments were developed and applied to extreme return period hydrodynamic and wave climate conditions of a severity worse than observed in December 2013 and January 2014 and the results and impact findings presented remain valid over the full range of hydrodynamic and meteorological conditions.

Additional Monitoring

Additional information regarding marine mammal monitoring has now been added to Section 7.7.9 (of the EIS Addendum/Errata October 2014) with regard to Additional Monitoring.

This information is also relevant to previously Section 7.8.3 of the EIS Addendum/Errata Document (October 2014)

Marine Mammal Monitoring

Since, studies carried out by the NPWS indicate that a minimum of 6-7 years of Harbour Seal count data are required to properly detect population trends, it is proposed that seals counts will be started immediately and will continue through construction for a period of seven years after operation begins. The suggested method is haul-out site counting, carried out during a period from two hours before to two hours after low tide and following the conditions on weather and visibility that are used by NPWS staff for the seal haul-out monitoring that they currently conduct. It is proposed that the major sites at Oranmore Bay, Kinvara Bay, Tawin and Deer Island, along with the largest haul-out in the harbour area (Rabbit Island) will be counted and that this will be done on a quarterly basis in February, May, August (moulting period) and November. Comparison will be also be possible with the annual August counts made by the NPWS at Oranmore Bay and Kinvara Bay.

Additional Mitigation Measures

The following additional mitigation is proposed. This information is relevant to Section 7.9 of the EIS Addendum/Errata Document (October 2014) as previously presented.

Incorporation of Wildlife Pass into layout/footprint design - The layout and footprint of the proposed development has evolved over the course of the design process with a view to minimising impacts on Natura 2000 sites, including the Galway Bay Complex cSAC and Inner Galway Bay SPA and their conservation objectives.

A wildlife pass, presented in Figure EIS (A2) 1.4 has been incorporated into the design of the scheme, to allow for passage of wildlife including otter, eel and possibly salmon and seal, thereby reducing requirements to swim around the total extension footprint.

The wildlife pass will be formed at the junction of the 400m quay with the 260m quay as shown on Drawing 2139-1212A, attached.

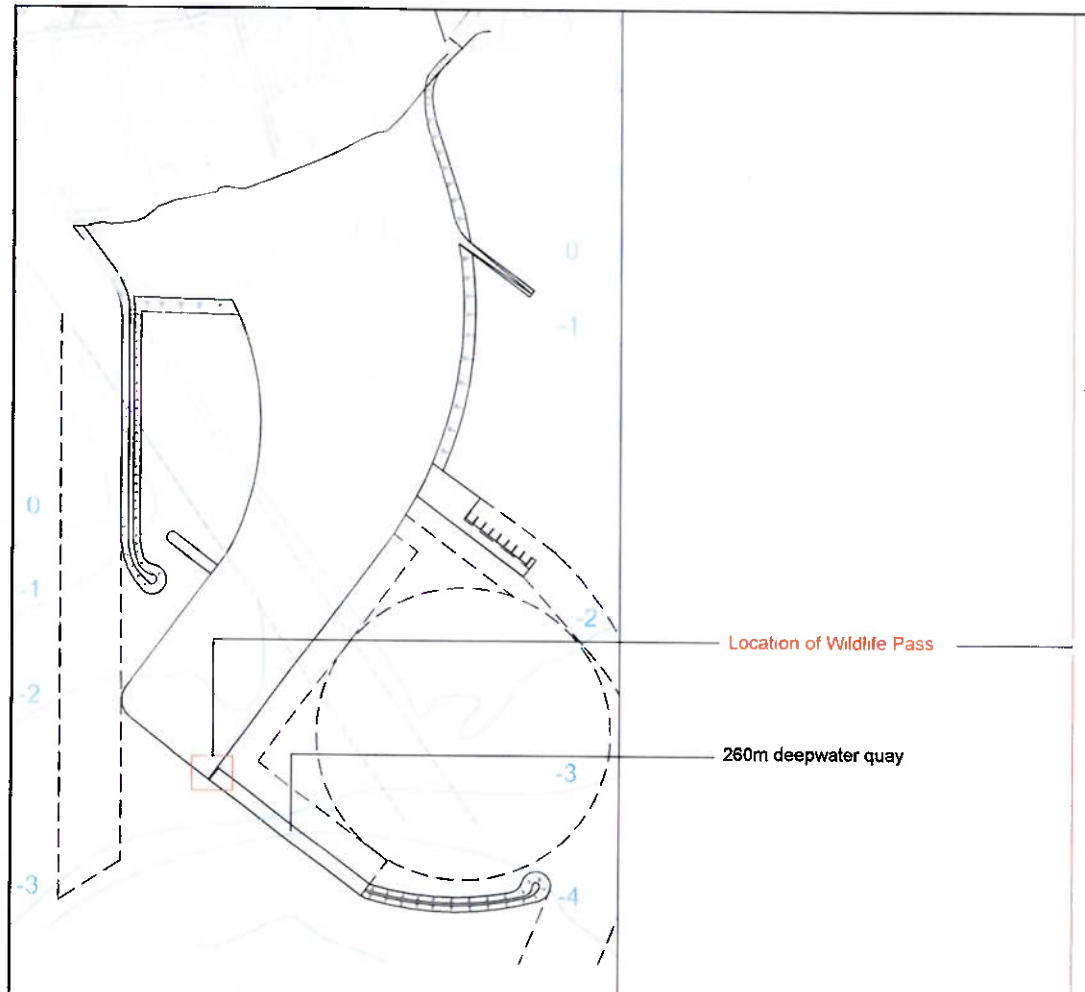
The width of the pass between sheet piles varies 2.0m to 2.7m as per sheet pile corrugation and 1.2m between the circular piles.

The variation in texture and width will provide the baffle effect required to prevent wave transmission from the seaward side to the port side.

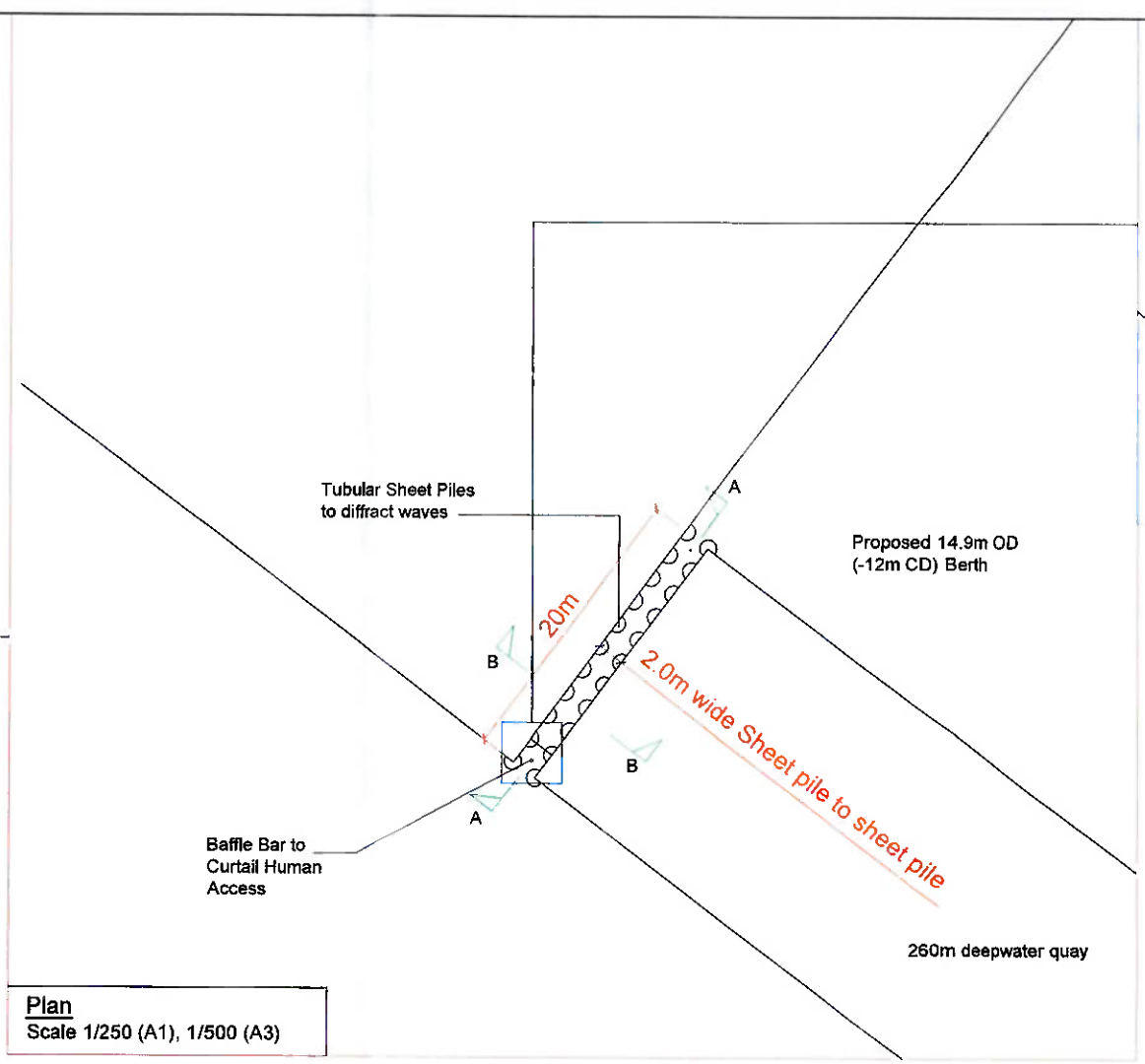
The bed level of the pass will be at -2.2m C.D. (-5.1 O.D.) i.e. 500mm above present seabed level to prevent seabed material migrating through into the lower dredged berth bed levels.

A free board of 0.75m will be available above M.H.W.S. to the soffit of the quay.

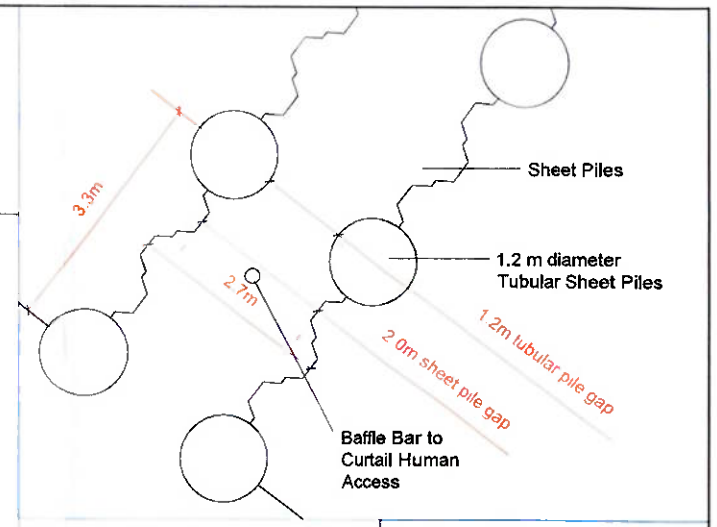
A single vertical bar baffle between sheet piles inside of either end will prevent human / kayak use of the pass as a short cut in the interest of safety, while allowing approx.1.0m for wildlife species.



Key Plan
Scale 1/5000 (A1), 1/10000 (A3)



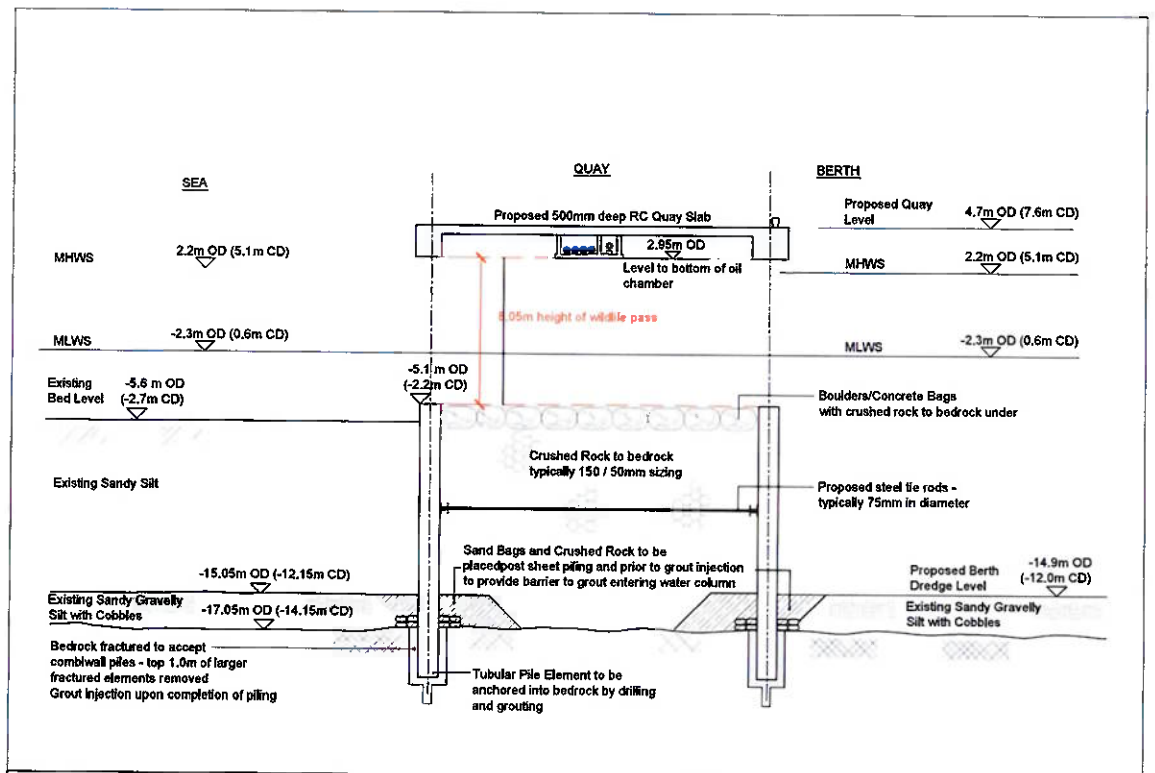
Plan
Scale 1/250 (A1), 1/500 (A3)



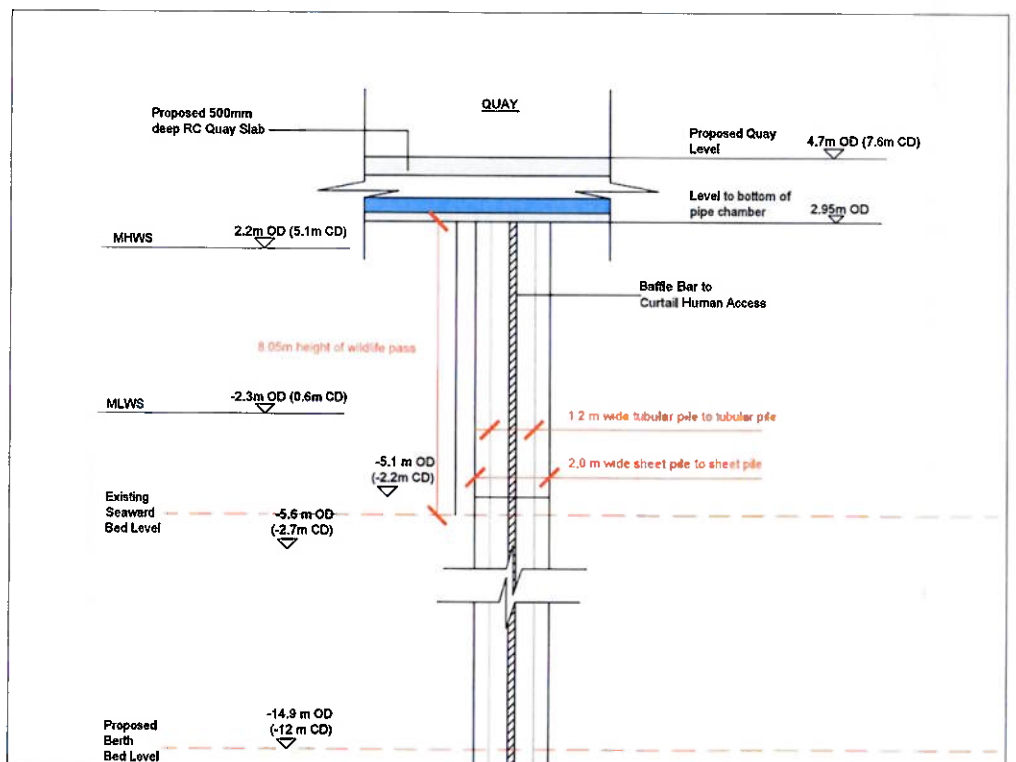
Plan Detail
Scale 1/50 (A1), 1/100 (A3)

NOTES:

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER/EMPLOYERS REPRESENTATIVE, AS APPROPRIATE, TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. THE CONTRACTOR SHALL UNDERTAKE A THOROUGH CHECK FOR THE ACTUAL LOCATION OF ALL SERVICES/UTILITIES, ABOVE AND BELOW GROUND, BEFORE ANY WORK COMMENCES
5. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD
6. LEVELS SHOWN IN BRACKETS RELATE TO CHART DATUM (-3.5 C.D.)



Section A-A
Scale 1/200 (A1), 1/400 (A3)



Section B-B
Scale 1/100 (A1), 1/200 (A3)

Rev	Date	Description	By	Chkd.
A	JAN 2014	Preliminary Design	JOM	JPK

Client:
GALWAY HARBOUR COMPANY

Project:
GALWAY HARBOUR EXTENSION

Title:
PROPOSED WILDLIFE PASS
SHEET 2 OF 2

Scale @ A1:	AS SHOWN
Prepared by: JOM	Checked: JPK — Date: JAN 2014
Project Director:	J.P. KELLY
Drawing Status:	PLANNING & EIS

TOBIN
Patrick J. Tobin & Co. Ltd
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Drawing No.: 2139-1212
Revision: A

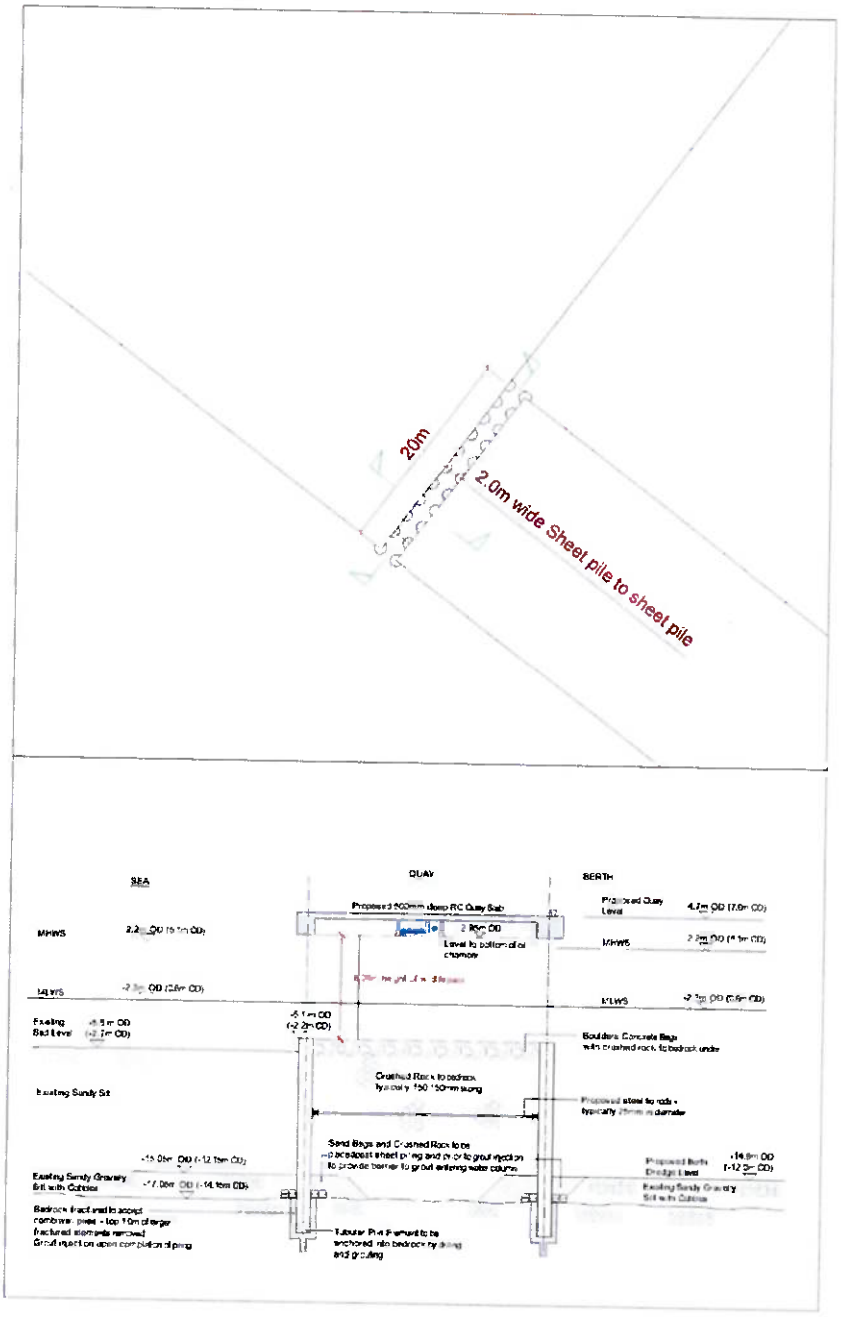


Figure EIS (A2) 1.4 Wildlife Pass Design Layout

In Combination Effects of the Project

Section 7.7.10.3.1 of the EIS Addendum/Errata Document (October 2014) has been replaced with the following, with regard to in-combination effects associated with aquaculture developments in Galway Bay.

Aquaculture

The Inner Galway Bay SPA: Appropriate Assessment of Aquaculture and Shellfisheries & Fisheries Risk Assessment identified that there was a potential risk of impact to Sandwich Terns and Common Terns, due to mussel bottom culture in Rinville Bay, which is within the likely core foraging range of their colonies, and occurs partly within shallow water zones where benthic fish prey would be accessible to terns. As the GHE development is not considered likely to have measurable impacts on foraging resources for the Sandwich Tern colony, there is no potential for cumulative impacts in-combination with impacts from mussel bottom culture for this species. In the case of the Common Tern, the GHE development could possibly have a measurable, but not significant, impact, so, the assessment in the aquaculture AA, raises the possibility for significant cumulative impacts in-combination with impacts from mussel bottom culture for this species.

The aquaculture AA reviewed the biotope characteristics of the mussel bottom culture plots in Rinville Bay in relation to fish survey data from Kinvarra Bay and concluded that the plots could contain suitable benthic prey resources for terns. However, this conclusion was not informed by local knowledge of the area. More specific information on Rinville Bay indicates that, in fact, the area is not likely to provide important benthic prey resources for feeding terns:

Rinville Bay is of minor value as a feeding resource for terns as the sea bed is anoxic and benthic production is therefore low. This is due to the fact that water exchange with Galway Bay is restricted due to the narrow and shallow opening to the open sea. It behaves more like a mill pond than an open mouthed bay - the tide rises and falls quite passively giving rise to low current speeds. It also acts as a sink for suspended sediments - these fall out to the sea bed at slack high water and are not exported on the following ebb tide as bottom velocities are not high enough to re-mobilise them. However, there is no reason why juvenile fish (including sand eels) cannot enter the bay giving rise to at least some source of prey items for fish-eating birds.

Conclusion of In Combination Effects

Section 7.7.10.3.6 of the EIS Addendum/Errata Document (October 2014) has been replaced with the following, with regard to In-Combination Effects.

Having considered other plans and projects within the vicinity of the relevant Natura 2000 sites, it is regarded that the proposed project and implementation of effective mitigation measures to avoid impacts does not have the potential for further in-combination impacts arising in combination with any other plans and projects, with the exception of previous loss of habitat associated with development at the Galway Harbour Enterprise Park.

Assessment of Residual Impacts

Section 7.7.11 of the EIS Addendum/Errata Document (October 2014) included in Table 7.13 which was a Summary of Impacts. This information has been amended, as presented below.

Summary Table of Impacts on Annex I Habitats, cSAC QIs and SCI Species								
Habitat Type/Species		Existing Galway Harbour Enterprise Park	Construction Stage			Operations		
			Permanent Loss	Totals	Temporary Loss	Permanent Gain	Temporary Loss	Permanent Gain
		A	B		C	D	E	F
1	Stony Banks	0.28 ha	0.18ha *	0.46 ha	None	None	None	None
2	Salt Marsh (incl Transitional)	7.39 ha	None	7.39 ha	None	None	None	None
3	Intertidal (including wetland for birds)	8.58 ha	5.93 ha	14.51 ha	0 ha**	1.69 ha	1.34 ha***	None
4	Otter	8.58 ha	5.22 ha	13.80 ha	None	18.8 ha	None	None
5	Seal	8.58 ha	26.93 ha	35.51 ha	51.78 ha**	None	51.78 ha***	None
6	Salmon	8.58 ha	26.93 ha	35.51 ha	51.78 ha**	None	51.78 ha***	None
7	Lamprey	8.58 ha	26.93 ha	35.51 ha	51.78 ha**	None	51.78 ha***	None
8	All SCI species	8.58 ha	26.93 ha	35.51 ha	51.78 ha**	None	51.78 ha***	Possible
9	Wetland for birds	16.27ha	26.93 ha	43.2 ha	51.78 ha**	None	51.78 ha***	Possible

Amended Table 7.13 of EIS Addendum/Errata Document (October 2014) - Summary Table of Impacts on Annex I Habitats, cSACs, QIs & SCI Species

Notes:
** Even though there is no direct loss of area of this habitat, adopting the precautionary principal and on the basis that it cannot be said without reasonable scientific doubt that potential impacts would not be significant, for the purpose of this assessment, such habitat loss and impact on species is being treated as significant.*
*** This denotes temporary loss of seabed during capital dredging of approach channels and turning circle*
**** This denotes temporary loss of seabed during maintenance dredging of approach channels and turning circle (which is estimated to be every 10 years).*
*****Cell references applied to identify source of areas of impact noted in subsequent tables*

On the basis of these amended areas and following more critical assessment, including the addition of a wildlife pass as a design mitigation feature, the following tables, as previously presented in the EIS Addendum/Errata Document (October 2014) have been amended:

Table EIS(A) 7.14 – Mudflats and Sandflats

Table EIS(A) 7.18 – Stony Banks and Annual Driftlines

Table EIS(A) 7.19) – Atlantic Salt Meadows

Table EIS(A) 7.20) – Mediterranean Salt Meadows

Table EIS(A) 7.22 – Otter

Table EIS(A) 7.23 – Harbour Seal

Table EIS(A) 7.26 SPA SCIs – Common Tern

Table EIS(A) 7.26 SPA SCIs – Wetlands

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Mudflats and sandflats not covered by seawater at low tide [1140]** and reefs [1170]**** **NPWS describes the intertidal community at the proposed development site as "fucoid-dominated intertidal reef complex", these two habitats are considered together.	
	Attribute: Distribution **Target:** The distribution of reefs is stable or increasing, subject to natural processes.	Permanent loss of *5.93* ha (see 6B of table 7.13) of this habitat.
	Attribute: Habitat Area **Target:** The permanent habitat area is stable or increasing, subject to natural processes. The mud/sandflat habitat area was estimated using OSI data as 744ha. The reef habitat area was estimated as 2,773ha using survey data.	Permanent loss of *5.93* ha of this habitat.
	Attribute: Community Distribution **Target:** Conserve the following community types in a natural condition: intertidal sandy mud community complex and intertidal sand community complex	Permanent loss of *5.93* ha of this habitat.
	Attribute: Community Extent **Target:** Maintain the extent of the *Mytilus*-dominated reef community, subject to natural processes.	*Permanent loss of 5.93 ha of this habitat.*
	Attribute: Community Structure: *Mytilus* density **Target:** Conserve the high quality of the *Mytilus*-dominated community, subject to natural processes.	Permanent loss of *5.93* ha of this habitat.
	Attribute: Community Structure **Target:** Conserve the following community types in a natural condition: fucoid-dominated community complex, *Laminaria*-dominated community complex, and shallow sponge-dominated community complex.	Permanent loss of *5.93* ha of this habitat.
Impacts during Construction Phase	Permanent loss of intertidal plant and animal communities due to infilling in the construction site. Suspended sediment levels will temporarily increase around the construction site; this will have a minimal impact on the neighboring intertidal communities. There is the potential for contamination of the nearby intertidal area if spillages occur during the construction phase; however, strict adherence to the Environmental Management Plan will minimise the impact.	

Impacts during Operational Phase	The changes to the physical oceanography of the area will result in a change in grain size distribution and therefore faunal communities present; however, model predictions show these changes will only occur in the dredge site and approach channel and these are too far from the intertidal areas to have an impact. The predicted increase in traffic levels will have no impact on the intertidal areas. The intertidal communities to the east of the proposed development will experience increases in salinity and as a result euryhaline species will dominate in these areas. There will be no discharges from the development into the marine environment and therefore there will be no impact from this activity.
In Combination Effects	Permanent loss of 14.51 ha (3A+3B of table 7.13)
Proposed Mitigation	There are no specific mitigation measures available to reduce the loss of habitat.
Level of Residual Impact	The permanent loss of 5.93 ha (3A of table 7.13) of this Annex I habitat equates to a residual negative impact on one of the targets and attributes of the qualifying interest of the Galway Bay Complex cSAC. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. The level of residual impact is not considered to be significant as the habitats present are of poor quality. However, adopting the precautionary principal and on the basis that it cannot be said beyond reasonable doubt that the impacts would not be significant, for the purpose of this assessment, such habitat loss and impact on species is being treated as significant.

Amended Table 7.14 of EIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Mudflats and Sandflats

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Perennial vegetation of Stony banks [1220] and Annual vegetation of drift lines (Natura 2000 Code 1210)**	
	Attribute: Habitat Area **Target:** Area stable or increasing, subject to natural processes, including erosion and succession.	Potential impact associated with increased shelter of area.
	Attribute: Habitat Distribution **Target:** No decline or change in habitat distribution subject to natural processes.	Potential impact associated with increased shelter of area.
	Attribute: Physical Structure: functionality and sediment supply **Target:** Maintain the natural circulation of sediment and organic matter, without any physical obstructions.	Reduced supply of sediment anticipated.
	Attribute: Vegetation structure: zonation **Target:** Maintain range of coastal habitats including transitional zone, subject to natural processes.	Potential impact associated with increased shelter of area. Numbers of species characteristic of stony banks likely to decrease.
	Attribute: Vegetation composition: typical species and sub communities **Target:** Maintain the typical vegetated shingle flora including range of subcommunities within the different zones.	Potential impact associated with increased shelter of area. Numbers of species characteristic of stony banks likely to decrease.
	Attribute: Vegetation composition: negative indicator species **Target:** Negative indicator species (including non-natives) to represent less than 5% cover.	Potential impact associated with increased shelter of area. Negative indicator species (including non-natives) to represent greater than 5% cover.
Impacts during Construction Phase	No loss of, or impact on this habitat is expected during the construction phase.	
Impacts during	***Impacts associated with increased shelter to the habitat following***	

Operational Phase	***construction of proposed development.***
In Combination Effects	An assessment of previous works completed at the Galway Harbour Enterprise Park has identified loss of this habitat, of a total extent of *ca* 0.28 ha (1A of table 7.13)
Proposed Mitigation	Further to mitigation by design, no additional suitable mitigation is considered available.
Level of Residual Impact	***Potential for residual negative impact on the targets and attributes of this habitat, a qualifying interest of the Galway Bay Complex cSAC exist. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. This will arise due to the greater level of protection afforded by the new structure preventing storms and waves surges from accessing the stony bank habitat. Stabilised shingle becomes colonised with a heath grassland and/or grassland community, with a reduction of the adventive ruderals that benefit from the regular disturbance of the cobbles.***

Amended Table 7.18 of EIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Stony Banks and Drift Lines

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]**	
	Attribute: Habitat Area **Target:** Area increasing, subject to natural processes, including erosion and succession.	No impact anticipated.
	Attribute: Habitat Distribution **Target:** No decline or change in habitat distribution, subject to natural processes.	No impact anticipated.
	Attribute: Physical Structure: sediment supply **Target:** Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions.	No impact anticipated.
	Attribute: Physical Structure: sediment supply **Target:** Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions.	No impact anticipated.
	Attribute: Physical Structure: creeks and pans **Target:** Maintain creek and pan structure subject to natural processes, including erosion and succession.	No impact anticipated.
	Attribute: Physical Structure: flooding regime **Target:** Maintain natural tidal regime.	No impact anticipated.
	Attribute: Vegetation Structure: zonation **Target:** Maintain range of coastal habitat zonations including transitional zones, subject to natural processes, including erosion and succession.	No impact anticipated.

Amended Table 7.19 of EIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Atlantic Salt Meadows

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]**	
	Attribute: Vegetation structure: vegetation height **Target:** Maintain structural variation within sward.	No impact anticipated.
	Attribute: Vegetation structure: vegetation cover. **Target:** Maintain more than 90% area outside creeks vegetated.	No impact anticipated.
	Attribute: Vegetation composition: typical species and sub-communities. **Target:** Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project.	No impact anticipated.
	Attribute: Vegetation composition: negative indicator species – *Spartina anglica* **Target:** There is currently no spartina in this cSAC.	No impact anticipated.
Impacts during Construction Phase	No loss of, or impact on this habitat is expected during the construction phase.	
Impacts during Operational Phase	No impacts are expected during the operational phase.	
In Combination Effects	Permanent loss of *ca* 7.39 ha (This includes for both Atlantic and Mediterranean salt meadows).	
Proposed Mitigation	There are no specific mitigation measures available to reduce the loss of habitat.	
Level of Residual Impact	The permanent loss of 7.39 ha of this Annex I habitat equates to a residual negative impact on one of the targets and attributes of the qualifying interest of the Galway Bay Complex cSAC. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. However for the purpose of this assessment, given that the loss albeit of poor quality habitat is permanent, such habitat loss is being treated as significant.	

Amended Table 7.19 of EIS Addendum/Errata Document (October 2014) Cont. - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Atlantic Salt Meadows

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Mediterranean salt meadows (*Juncetalia maritimi*) [1410]**	
	Attribute: Habitat Area **Target:** Area stable or increasing, subject to natural processes including erosion and succession.	No impact anticipated.
	Attribute: Habitat Distribution **Target:** No decline, subject to natural processes.	No impact anticipated.
	Attribute: Physical Structure: sediment supply **Target:** Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions.	No impact anticipated.
	Attribute: Physical Structure: Creeks and Pans **Target:** Maintain creek and pan structure, subject to natural processes, including erosion and succession.	No impact anticipated.
	Attribute: Physical Structure: flooding regime **Target:** Maintain natural tidal regime.	No impact anticipated.
	Attribute: Vegetation Structure: zonation **Target:** Maintain range of coastal habitat zonations including transitional zones, subject to natural processes, including erosion and succession.	No impact anticipated.
	Attribute: Vegetation structure: vegetation height **Target:** Maintain structural variation in the sward.	No impact anticipated.

Amended Table 7.20 of EIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Mediterranean Salt Meadows

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annex I Habitat	**Mediterranean salt meadows (*Juncetalia maritimi*) [1410]**	
	Attribute: Vegetation structure: vegetation cover. **Target:** Maintain more than 90% of area outside creeks vegetated.	No impact anticipated.
	Attribute: Vegetation composition: typical species and sub-communities. **Target:** Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project.	No impact anticipated.
	Attribute: Vegetation composition: negative indicator species – *Spartina anglica* **Target:** No *Spartina* in the SAC at present.	No impact anticipated.
Impacts during Construction Phase	No loss of, or impact on this habitat is expected during the construction phase.	
Impacts during Operational Phase	No impacts are expected during the operational phase.	
In Combination Effects	An assessment of previous works completed at the Galway Harbour Enterprise Park has identified loss of Salt Marsh habitat, of a total extent of *ca* 7.39ha (2A of table 3.14) - mosaic of Atlantic and Mediterranean Salt Meadows habitats).	
Proposed Mitigation	Further to mitigation by design, no additional suitable mitigation is considered available.	
Level of Residual Impact	The permanent historic loss of ca 7.39 ha (2A of table 7.13) of this Annex I habitat equates to a residual negative impact on one of the targets and attributes of the qualifying interest of the Galway Bay Complex cSAC. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. The level of residual impact is not considered to be significant as the habitats present are of poor quality. However and given the status of the overall site and adopting the precautionary principle, for the purpose of this assessment, such habitat loss is being treated as significant.	
Level of Residual Impact	The permanent historic loss of *ca* 7.39 ha (2A of table 7.13) of this Annex I habitat equates to a residual negative impact on one of the targets and attributes of the qualifying interest of the Galway Bay Complex cSAC. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. For the purpose of this assessment, such habitat loss is being treated as significant.	

Amended Table7.20 of EIS Addendum/Errata Document (October 2014) Cont. - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Mediterranean Salt Meadows

Annex II Species Tables

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annexed Species		
Annex II Species	**Otter (*Lutra lutra*) [1355]**	
	Attribute: Distribution **Target:** No significant decline	Standard Otter survey technique normally applied to riverine rather than purely marine sites. Current range in Western RBD estimated at 70% (Bailey and Rochford 2006). No decline in overall distribution expected.
	Attribute: Extent of terrestrial habitat **Target:** No significant decline	Area mapped to include 10 metre buffer above HWM on shoreline. HWM on shoreline is against the rock wall of the existing harbour park. Since the land above this rock wall is open dry spoil and bare ground (ED2), this terrestrial habitat is of low potential for Otter. 0.58 ha will be lost. A further 2.1ha will be created by the new land reclamation area. Thus, the development will result in an increase in the total area of the type of terrestrial habitat that is currently available to Otter in the harbour park phase I.
	Attribute: Extent of marine habitat **Target:** No significant decline	Area mapped based on evidence that Otter tend to forage within 80 m of shoreline (HWM). 4.64 ha will be lost (table 7.13). A further 16.08 hectares (table 7.13) will be created adjacent to new land reclamation area. Thus, the development will result in an increase in the total area of the type of marine habitat (*i.e.* within 80 m of shoreline) that is currently available to Otter in the harbour park area.
	Attribute: Extent of freshwater (river) habitat **Target:** No significant decline	Proposed development will not affect extent of freshwater habitat.
	Attribute: Extent of freshwater (lake/lagoon) habitat **Target:** No significant decline	Proposed development will not affect extent of freshwater habitat.
	Attribute: Couching sites and holts	No known sites/holts will be affected.

	Target: No significant decline	
	Attribute: Fish biomass available **Target:** No significant decline	Resident freshwater fish, anadromous and catadromous fish are not expected to be affected. No significant effects expected on coastal fish prey species (*e.g.* rockling and wrasse), except loss of 24.8 ha of shallow subtidal habitat at development site (excluding 5.93 ha of intertidal). This is 0.25% of the total designated subtidal area. Minor negative impact.
	Attribute: Barriers to connectivity **Target:** No significant increase	Otter will regularly commute across stretches of open water up to 500m wide. The development will lengthen some potential commuting routes (*e.g.* from river mouth to Renmore Lough) but no complete barriers will be formed. An Otter/fish pass will be built in to the harbour extension design at the base of the deepwater pier (i.e. at the point that this is joined to the reclaimed part of the harbour extension) that will shorten the route from the east to the west (or vice versa) of the extension by a distance of one kilometre. No significant loss of connectivity.
Impacts during Construction Phase	There will be direct disturbance within 76.6 ha of subtidal habitat (excluding 5.93ha of intertidal) as a result of the proposed development and disturbance in the wider area around this, although the available area of terrestrial habitat and subtidal foraging area within 80 metres of the shoreline will be increased by 18.09 hectares and offsets a loss of 5.22 hectares along the current shorelines (thus giving a net gain of 12.87 hectares of such habitat). There is potential for physical damage and/or disturbance to be caused to individuals by noise/vibration/shock waves during blasting, dredging and pile driving operations during construction. There is potential for disturbance to feeding by individuals as a result of suspended solids generated during the construction works. There is also potential for negative impacts due to pollution from work areas during construction.	
Impacts during Operational Phase	There will be the loss of 24.8ha of shallow subtidal habitat at development site (excluding 5.93ha of intertidal), although the available area of terrestrial habitat and subtidal foraging area within 80 metres of the shoreline will be increased. There is potential for physical damage and/or disturbance to be caused to individuals by noise/vibration/shock waves during regular maintenance dredging. There is potential for disturbance to feeding by individuals as a result of suspended solids generated during regular maintenance dredging.	
In Combination Effects	An assessment of previous works completed at the Galway Harbour Enterprise Park has identified a loss of suitable habitat for Otter of a total extent of 5.52ha.	
Proposed Mitigation	Exclusion of drilling, blasting and pile driving during the hours of darkness. Limiting individual sizes of blasting charges. Infill/reclamation area lined with geotextile membrane to minimize impacts from suspended solid run off. Environmental Management Framework including measures on the storage and disposal of oily wastes, maintenance procedures for machinery etc, monitoring of levels of suspended solids and best practice with respect to the pouring of concrete.	

	Construction of an Otter/fish pass to save a distance of one kilometre of travel to get from one side (i.e. east to west or vice versa) of the development to the other.
Level of Residual Impact	The permanent loss of 24.8ha of shallow subtidal habitat at development site (excluding 5.93ha of intertidal), and disturbance within an area of a further 51.8ha of subtidal habitat equates to a residual negative impact on one of the targets and attributes of otter, a qualifying interest of the Galway Bay Complex cSAC and Lough Corrib cSAC. Similarly, a previous historic loss of *ca 8.58* ha associated with previous development within the Galway Harbour Enterprise Park has resulted in cumulative impacts associated with the development (Drg. 2139-2118 for Habitat Map of Lands pre 1990). This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. The NPWS considers that Otter in the marine environment do the majority of their foraging within 80 metres of the shoreline. There will be an initial loss of 4.64 hectares of such habitat. After 2-5 years (the time taken for the newly constructed coastline to be fully colonised by algae, invertebrates and fish), 16.08 hectares of new shoreline habitat will suitable foraging habitat for Otter. Thus, the initial loss of 4.64 hectares of main foraging habitat will be short-term, followed by a permanent gain of 12.87 hectares of prime Otter foraging habitat. Thus, the level of residual impact is not considered to be significant, given the mitigation of the barrier to easy passage through the area given by the pass and the net gain in the main foraging habitat for Otter. In addition, the habitats present at the site of the proposed development are extensive in the surrounding area and usage of the site by otter was recorded but not extensive.

Amended Table 7.22 of NIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Otter

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annexed Species		
Annex II Species	**Harbour seal (*Phoca vitulina*) [1365]**	
	Attribute: Access to suitable habitat **Target:** Species range within the site should not be restricted by artificial barriers to site use.	The proposed development will alter potential commuting routes for this species in the river mouth area, but the proposed development will not constitute an effective barrier to the movement of this species.
	Attribute: Breeding behaviour **Target:** Conserve breeding sites in a natural condition.	It is considered unlikely that haul out sites where pups are born will be significantly affected. Mating occurs in water with male visual and vocal displays (probably lekking) occurring near to haul out sites. The nearest significant breeding haul-out site is in Oranmore Bay, which is 5 kilometres from the construction site. A minor site (at which a pup or pups have apparently been recorded) is at rabbit Island, 1.5 kilometres from the construction site. Noise and Vibration Modelling as presented in Chapter 10 of the EIS and Appendix 1 of this document has indicated that disturbance will be low at distances of greater than one kilometre from the construction site.
	Attribute: Moulting behaviour **Target:** Conserve moult haul-out sites in a natural condition.	It is considered unlikely that moult haul-out sites will be affected by proposed development. The nearest moult site is at Earl's Rock, 2.3 kilometres from the construction site. Noise and Vibration Modelling as presented in Chapter 10 of the EIS and Appendix 1 of this document has indicated that disturbance will be low at distances of greater than one kilometre from the construction site.

	Attribute: Resting behavior **Target:** Conserve resting haul-out sites in a natural condition.	It is considered unlikely that significant resting haul-out sites will be directly affected by proposed development. The nearest such site is a Rabbit Island, 1.5 kilometres from the construction site. Noise and Vibration Modelling as presented in Chapter 10 of the EIS and Appendix 1 of this document has indicated that disturbance will be low at distances of greater than one kilometre from the construction site.
	Attribute: Disturbance **Target:** Human activities should occur at levels that do not adversely affect the harbour seal population at the site.	Important breeding sites will not be affected by the development. These sites are lie in shallow bays, which will not be affected by commercial shipping. Most smaller haul-outs are at distance from development footprint. No significant disturbance effects expected post-construction although the effect of increased ship sizes, while considered unlikely to have a significant impact, is difficult to predict given the research data available. However, applying the precautionary principle, this impact is treated as significant for the purposes of this assessment.

Impacts during Construction Phase	There will be direct disturbance within 76.6ha of subtidal habitat (excluding 2.1ha of intertidal habitat) (and disturbance in the wider area around this) as a result of the proposed development. There is potential for physical damage and/or disturbance to be caused to individuals by noise/vibration/shock waves during blasting, dredging and pile driving operations during construction. Research from the U.K. suggests that there is the potential for seals to be killed by ducted propellers if barges etc. with this propeller type are used in the construction works and perform manoeuvres while either static or moving slowly (*i.e.* while still operating the propeller/propellers). Examination of seal corpses found in the U.K. (eastern Scotland, north Norfolk and Strangford Lough) has led researchers (Thompson *et al.*, 2010) to believe that the seal had been killed by being drawn through ducted or cowled ship propellers, such as fixed Kort or Rice nozzles, or ducted azimuth thrusters. Indications are that these accidents are unlikely to have happened as a result of casual collisions. The workers have theorised that the seals were killed after being attracted to the vicinity of the propellers, either as a result of concentrations of prey fish close to vessels, or as an inappropriate response to the acoustic output of the propellers. This type of propeller is common in tugs, construction vessels and construction barges and is used when such vessels are either manoeuvring slowly, or trying to maintain position. This situation could occur for long periods during the construction phase. It should be possible to specify that vessels used by contractors are fitted with grilles or guards to prevent seals being pulled through the ducts. However, there is no way of stopping vessels fitted with such propellers from using the port of Galway and (if the mechanism is as the Sea Mammal Research Unit have posited) speed limits would not have any effect on the impact. It is worth stating that:

	(1) no dead seals with similar injuries have been found in Galway Bay (2) the impact, as suggested by the report, is theoretical in nature and may not actually exist, (3) it is not possible knowing if the port development will lead to an increase in the use of these types of propeller, or if the use of these types of propeller will change over time even if the development does not go ahead. There is potential for disturbance to feeding by individuals as a result of suspended solids generated during the construction works. There is also potential for negative impacts due to pollution from work areas during construction.

Amended Table 7.23 of NIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Harbour Seal

Attributes and Targets to Provide for Favourable conservation Condition of Relevant Qualifying Interests of cSACs		
Attributes	**Targets**	**Comment on Potential Impact on Attribute/Target**
Annexed Species		
Annex II Species	**Harbour seal (*Phoca vitulina*) [1365] contd/..**	
Impacts during Operational Phase	8 There will be a loss of 26.93 ha (5B of table 7.13) of potential sub-tidal and intertidal foraging habitat. 9 There is potential for physical damage and/or disturbance to be caused to individuals by noise/vibration/shock waves during regular maintenance dredging. 10 There is potential for disturbance to feeding by individuals as a result of suspended solids generated during regular maintenance dredging. Research from the U.K. suggests that there is the potential for seals to be killed by ducted propellers if the volume of shipping traffic with this propeller type that is either static or moving slowly while still operating propellers is increased as a consequence of the development.	
In Combination Effects	An assessment of previous works completed at the Galway Harbour Enterprise Park has identified loss of suitable habitat for Harbour Seal of a total extent of 35.51 ha (5A+5B of table 7.13)	
Proposed Mitigation	11 Blasting, drilling and pile driving will be carried out during daylight hours and at low tide. This blasting schedule will coincide with the time when the maximum number of seals are hauled out of the water and will thus be less at risk from blasting activities. 12 The individual sizes of blasting charges will be limited to minimize the size of the area of the zone of potential effect from any individual blast event. 13 If barges with ducted propellers are used during the construction stage and these are likely to be making the types of manoeuvres mentioned above, the fitting of acoustic deterrent devices (ADDs) to them will be considered or vessels will be fitted with mesh screens at the ends of the ducts to prevent seal entry to ducts. 14 Infill/reclamation area lined with geotextile membrane to minimize impacts from suspended solid run off. Environmental Management Plan including measures on the storage and disposal of oily wastes, maintenance procedures for machinery etc, monitoring of levels of suspended solids and best practice with respect to the pouring of concrete.	

Level of Residual Impact	Behavioural effects as a response to the construction phase are considered likely to arise, but significant effects will be mitigated by proposed mitigation measures. The permanent loss of 26.93ha (5B of table 7.13) of subtidal and intertidal habitat and disturbance within an area of 76.6ha of subtidal habitat (excluding intertidal) equates to a residual negative impact on one of the targets and attributes of Harbour Seal, a qualifying interest of the Galway Bay Complex cSAC. Similarly, a previous historic loss of 8ha associated with previous development within the Galway Harbour Enterprise Park has resulted in combination effects associated with the development. This is considered to be a negative impact on one of the conservation objectives of the Natura 2000 site. The level of residual impact is not considered to be significant as the habitats present are extensive in the surrounding area and usage of the site by Harbour Seal was recorded but not extensive. However, given that it cannot be predicted beyond all scientific doubt that there will be no significant impact and on the basis of the precautionary principle, this impact is considered to be significant for the purposes of this assessment.

Amended Table 7.23 of NIS Addendum/Errata Document (October 2014) - Attributes and Targets to provide for Favourable Conservation Condition of Relevant Qualifying Interests of cSACs – Harbour Seal

SPA Special Conservation Interests

An amended version of Table 7.26 of the EIS Addendum/Errata document dated October 2014, with regard to Common Tern is presented below. This takes into consideration comments made regarding in-combination effects associated with aquaculture developments as amended and presented above.

Attributes and targets to provide for favourable conservation condition of relevant Special Conservation Interests of SPA	
SCI Species	
Annex I species	**Common Tern (*Sterna hirundo*) [A193]**
Level of Residual Impact	The Appropriate Assessment of aquaculture and fisheries in Inner Galway Bay (Gittings and O'Donoghue, 2014) considered potential impacts from mussel bottom culture to the fish-eating SCI species of Inner Galway Bay. In the case of the Common Tern, the GHE development could possibly have a measurable, but not significant, impact, so, the assessment in the aquaculture AA, raises the possibility for significant cumulative impacts in-combination with impacts from mussel bottom culture for this species. The aquaculture AA reviewed the biotope characteristics of the mussel bottom culture plots in Rinville Bay in relation to fish survey data from Kinvarra Bay and concluded that the plots could contain suitable benthic prey resources for terns. However, this conclusion was not informed by local knowledge of the area. More specific information on Rinville Bay indicates that, in fact, the area is not likely to provide important benthic prey resources for feeding terns: *Rinville Bay is of minor value as a feeding resource for terns as the sea bed is anoxic and benthic production is therefore low. This is due to the fact that water exchange with Galway Bay is restricted due to the narrow and shallow opening to the open sea. It behaves more like a mill pond than an open mouthed bay - the tide rises and falls quite passively giving rise to low current speeds. It also acts as a sink for suspended sediments - these fall out to the sea bed at slack high water and are not exported on the following ebb tide as bottom velocities are not high enough to re-mobilise them. However, there is no reason why juvenile fish (including sand eels) cannot enter the bay giving rise to at least some source of prey items for fish-eating birds.* The potential impact of bottom mussel culture to prey resources to terns is limited to impacts on benthic prey. Therefore, in light of the further assessment, it can be concluded that the precautionary assessment in the aquaculture AA is incorrect and that, beyond reasonable scientific doubt, there will not be any significant impact from bottom mussel culture on benthic prey resources for terns. Therefore, no potential cumulative impacts from the GHE development in-combination with impacts from mussel bottom culture arise.

Amended Table EIS (A) 7.26 of EIS Addendum/Errata Document, October 2014 contd/.. Attributes and targets to provide for favourable conservation condition of relevant Special Conservation Interests of SPA – Common Tern

An amended version of Table 7.26 of the EIS Addendum/Errata document dated October 2014, with regard to SPA Wetlands is presented below.

Attributes and targets to provide for favourable conservation condition of relevant Special Conservation Interests of SPA		
	Attributes and targets	Comment on Potential Impact on Attribute/Target
Qualifying Interest Habitat	**Wetlands [A999]**	
	Attribute: Habitat Area **Target:** The permanent area occupied by the wetland habitat should be stable or not significantly less than the area of 13,267 ha, other than that occurring from natural patterns of variation.	Loss of 2.1 ha of intertidal habitats plus 24.8ha of subtidal habitat plus 16.27ha of legacy wetland loss has been calculated. This constitutes 0.32% of the SPA. It is considered that the walling/edge of the new reclaimed land area will (after 2-5 years) have been covered by a natural growth of invertebrates and algae and will constitute intertidal shoreline reef habitat. The area of this habitat has been calculated at 1.69 ha. This habitat will be useful foraging habitat for Curlew, Redshank, Turnstone and Grey Heron and potential resting/roosting habitat for Cormorant, Common Tern and Sandwich Tern. Loss of 0.32% of the SPA wetland habitat is not considered significant in the context of the overall area of wetland. This is especially the case given that observed counts of SCI species in the subtidal zone have generally not been greater than recorded at comparison sites and given the limited tidal exposure of the intertidal zone at the site of the proposed development. However, since it cannot be predicted beyond scientific doubt that there will be no significant impact as a result of the net loss of habitat, on the basis of the precautionary principle, this impact is considered to be significant for the purposes of this assessment.

Amended Table EIS(A) 7.26 of EIS Addendum/Errata Document, October 2014 Attributes and targets to provide for favourable conservation condition of relevant Special Conservation Interests of SPA - Wetlands

EIS Addendum to Chapter 8 - Water

1. Capital dredge suspended sediment analysis addendum to EIS Section 8.4.2.8

1.1 Introduction

Additional sediment transport simulations are presented in this addendum to represent the proposed peak suction dredger rate of 17,000m^3 per day and the proposed mitigation measure of restricting dredging activity to the ebbing tide for capital dredge works to the proposed new navigation channel to the Docks.

1.2 Methodology

In order to evaluate the likely impact on the water column, Seven dredging locations were selected as previously used in the EIS (see Figure 1.1 for location of these representative dredging points). The dredge plume from each of these locations was modelled separately under critical conditions of Summer low Corrib flow (24.6 m^3/s) and mean Spring tides. The fine silt fractions was investigated at the full dredging capacity of 17,000 m^3 per day. These simulations were carried out for four days continuous 24hour dredging per location so as to evaluate the plume pattern, its dispersion and return over successive tides. A fine sediment fraction was selected so as to ensure conservatism in respect to predicting plume extent and suspended solids concentrations. The bed sediment sampling results (refer to Aquafact sample reference numbers 1 to 6, of Figure 1.2) showed the bed sediment to be generally classified as a fine sand, (refer to Table 1.1 below). Therefore the majority of the sediment will settle out close to the dredging location given the relatively low ambient velocities and associated bed shear stresses. Typical settling velocities for sands and silt are presented below in Table 1.2.

The simulation modelled a fine silt having a settling velocity of 0.0001 m/s and a critical bed shear for deposition of 0.08 N/m^2. For the purpose of modelling the dredging work the dredging rate is specified at 196.8 l/s based on a peak dredging rate of 17,000m^3 per day. An S-factor for the released concentration as a result of the dredging work of 6000 mg/l (based on the CIRIA Report C547 guidance document based on field measurements of losses from a trailing suction Hopper Dredgers) was specified. This represents a sediment release rate of 4,251 kg of sediment per hour into the water column at the dredge site. The sediment was released at the bottom layer and at the top layer of the TELEMAC3D model, at equal rates so as to represent potential losses/sediment disturbance at the suction head and at the surface due to overspill. It is likely that overspill / surface release from the suction dredger will be small.

The model was set-up with an immobile bed and an initial condition of a water column free of suspended solids. For this application, it is assumed that the sediment is non-cohesive, even the finer silt and the sediment settling velocity is based on the Van Rijn equation (1984) developed for non-cohesive sediments which ensures conservatism in respect to the prediction of suspended solids concentrations. In reality some degree of flocculation would happen with the finer sediments and the flocculated sediments would acquire a higher settling velocity and therefore a smaller sediment plume.

To minimise dredge sediment entering Lough Atalia on the flooding tide the proposed mitigation of confining dredging works to 6hours per tidal cycle to favour the outflowing ebbing tide was simulated for the dredge works in the navigation channel to the Docks. The simulations for sites B1 to B3 were confined to the ebbing tide period 6hour period from highwater to low water). For these simulations the daily peak rate of 17,000 m^3 per day was maintained by increasing (doubling) the dredging rate during ebbing dredge period.

1.3 Discussion of Results

The suspended solids plume plots for the dredging activities by a trailing suction hopper dredger at each of the dredging sites (A1-A4 and B1-B3) are presented in Figures 1.3 to 1.9 representing snapshots of sediment plume after four days of continuous dredging at the four principal stages of the tidal cycle (mid-ebb, Low water, mid-flood and highwater). Suspended silt concentrations down to 1 mg/l are shown in these plots which is well below natural ambient suspended solids levels for these coastal waters.

The findings from these simulations clearly show that dredging activities in the new approach channel to the old docks and Marina (as represented by B1 to B3) clearly reduces the direct impact of the concentrated dredge plume entering Lough Atalia as a result of the tidal balancing favouring the ebbing tide. The simulation results for sites A1 to A4 in the port and approach channel show no impact to Lough Atalia and generally undergo high dispersal and dilution as a result of the deeper open water at the dredge sites.

The sediment plume modelling for the seven test sites chosen to represent the capital dredge area show sediment deposition to be generally localised close to the dredging point. The simulations demonstrated that even when modelling a 100% fine silt (conservative approach), the suspended sediment concentrations are only significantly elevated in the vicinity of the dredging works with the plume enjoying reasonable dispersal thereafter. The actual monitored sediment characteristics classify the sediment as a fine sand with a fine silt/clay content varying between 4 and 40%. The coarse to fine sand fraction will deposit close to the dredge point whereas the silt will disperse with the inflowing and outflowing tides. Generally, concentrations remote from the dredging point are predicted to be less that 5 mg/l. At a concentration of 5 mg/l of silt, the depositional rate based on a settling velocity of .0001 m/s is 43.2g/m^2 per day which is considered insignificant and particularly so, given the temporary nature of the capital dredge activity being confined to only a two month period in year 1 (navigation channel to the Docks), 4month period in year 2 (Commercial Port and its navigation channel and turning circle), 3month period in year 3 (Commercial Port area) and a 1month period in year 5 (Marina and fishing pier).

Combining the sediment plume results for the seven dredge sites simulated a tidal average plume concentration plot is presented in Figure 1.10. This shows the extent of the impact are by the dredge plume with concentrations of less than 5mg/l considered low relative to ambient sediment concentrations. To convert suspended sediment concentration to potential depositional rates assuming an ability to settle based on the critical shear velocity a concentration of 5mg/l for a three month (twelve week period) represents a deposition depth of 2.2mm which is not significant.

1.4 Conclusions

The predicted suspended solids concentrations are only significant in the vicinity of the dredge works with good dispersal and dilution with the tidal flow away from the dredging site. The proposed mitigation measure of dredge works only on the ebbing tide for the proposed new navigation channel to the Docks protects Lough Atalia from potential concentrated plume impact on the flooding tide with only a relatively dilute plume entering on successive tides and primarily only dredging activities north of the proposed marina entrance.

Based on the hydrodynamic characteristics of the Harbour site a large portion of the suspended silt will widely disperse and form part of the overall sediment budget within Galway Bay. Low velocities within the Marina area and the commercial Port and Fishermans pier area will favour locally higher settlement of the suspended dredged sediment. The average concentration within Lough Atalia as a result of dredging activities at Site B3 (navigational channel north of the Marina) is less than 3mg/l which based on a 3month period (2months dredging and further 1 month for sediment conditions to return to normal) represents potentially a deposition rate of 1.3mm of sediment depth within Lough Atalia which is not significant in relation to normal annual suspended load and settlement rates.

Sediment size distribution							
Stations	Gravel (>1.5mm)	Very coarse sand (1.5mm)	Coarse sand (0.75mm)	Medium sand (0.38mm)	Fine sand (0.19mm)	Very fine sand (0.09mm)	Silt (<0.063mm)
1	0	0	0	17.65	75.29	2.3	4.77
2	0	20.19	0.36	5	21.01	22.09	31.35
3	0	0	0	28.98	65.87	0.6	4.54
4	0	2.27	0.99	4.19	23.19	24.73	44.62
5	0	18.38	0.07	17.92	53.05	4.34	6.24
6	0	0	0.7	32.69	63.44	0.33	3.47
Median	0	1.14	0.22	17.79	58.25	3.32	5.51
Maximum	0	20.19	0.99	32.69	65.87	24.73	44.62

Table 1.1 Sediment size distribution (percentage) at Proposed Harbour Site

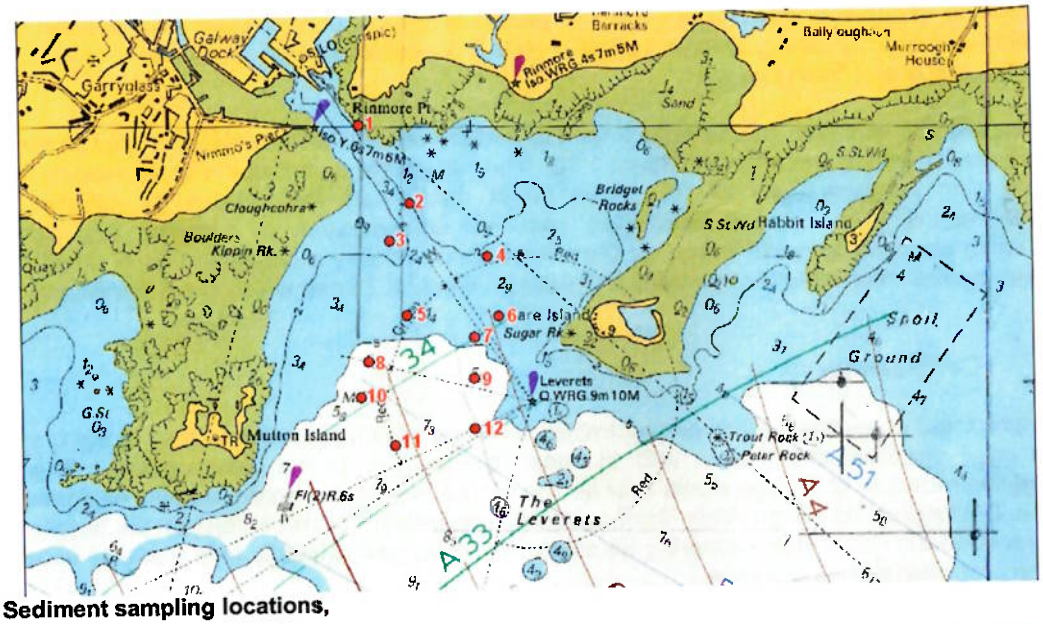


Figure 1.1 Sediment sampling locations,

Settling velocities for non-cohesive sands and silts		
Material Type	Sediment Size (mm)	Settling velocity (m/s)
Coarse sand	0.75	0.093
Medium sand	0.38	0.046
Fine sand	0.19	0.020
Very fine sand	0.09	0.0056
Coarse silt	0.047	0.0015
Very fine silt	0.01	0.00006

Table 1.2 Typical settling velocities for non-cohesive sand and silts. Note: settling velocities computed using the Van Rijn (1984) formula

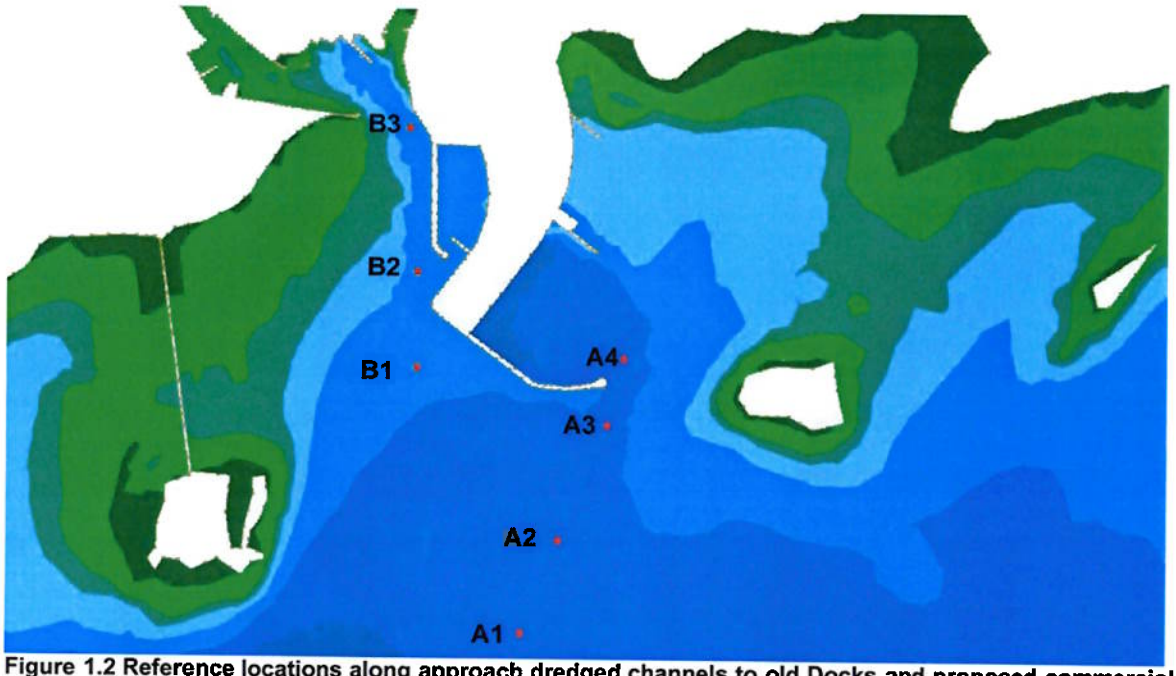


Figure 1.2 Reference locations along approach dredged channels to old Docks and proposed commercial port to assess suspended solids plume impact under capital dredge operations

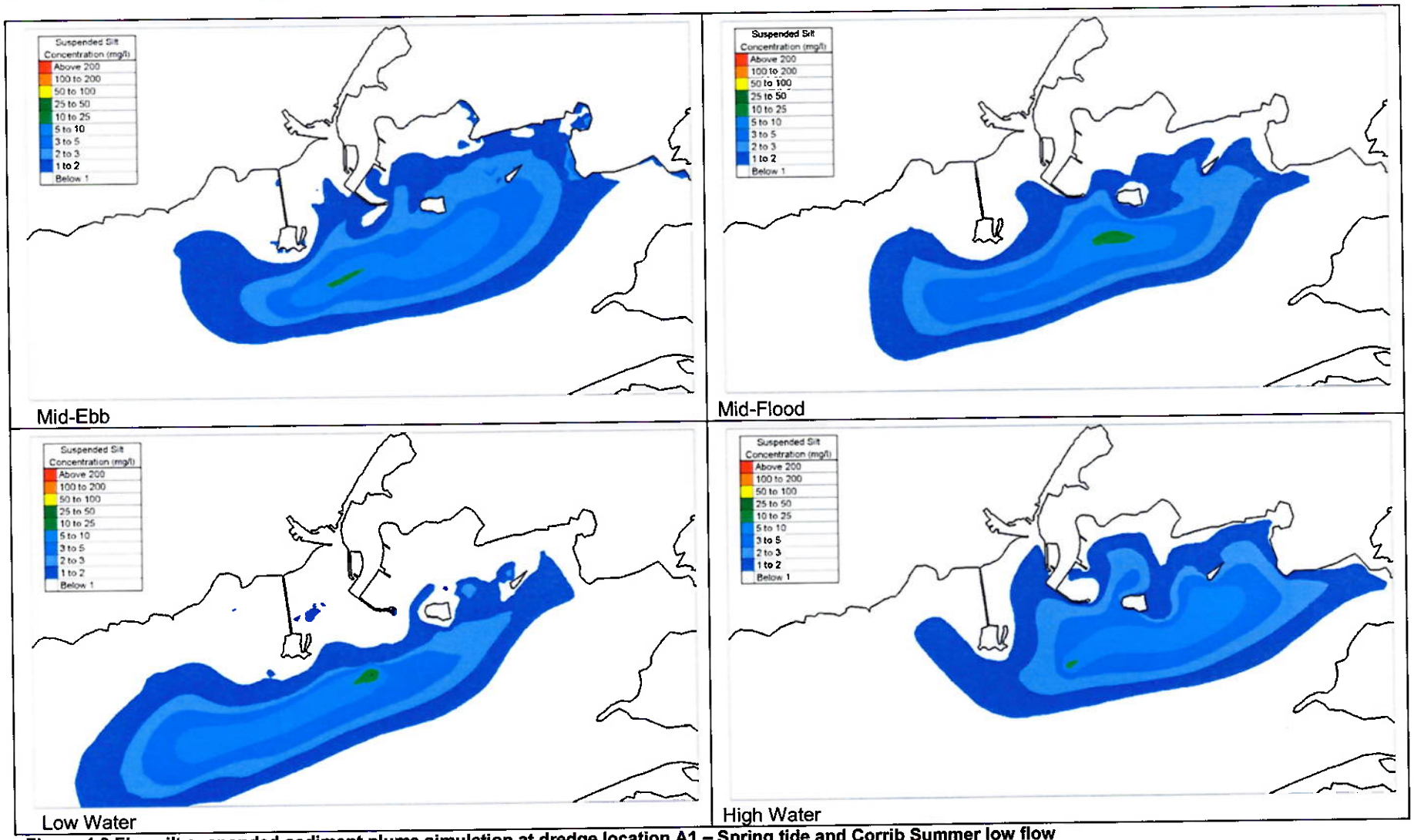


Figure 1.3 Fine silt suspended sediment plume simulation at dredge location A1 – Spring tide and Corrib Summer low flow

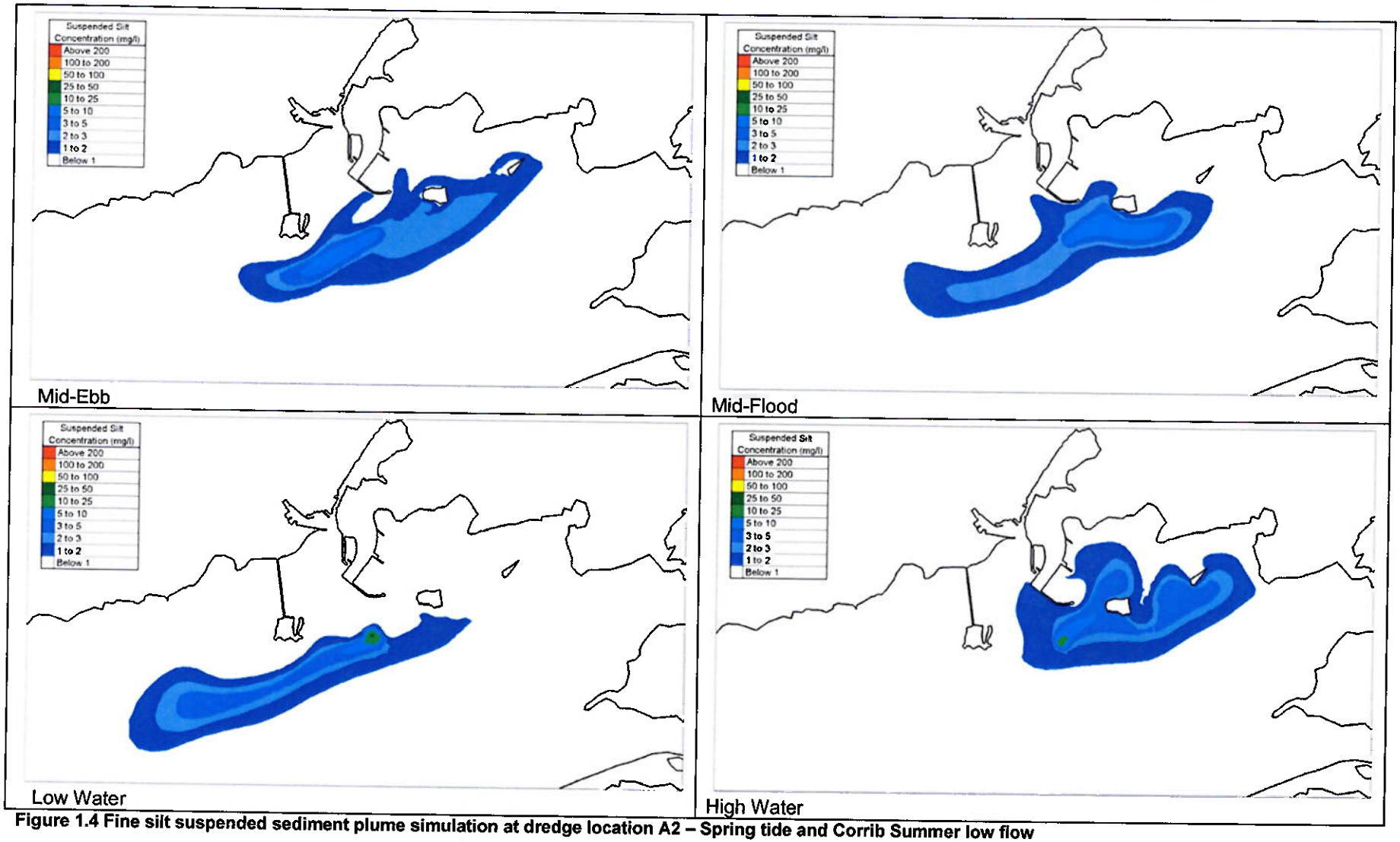


Figure 1.4 Fine silt suspended sediment plume simulation at dredge location A2 – Spring tide and Corrib Summer low flow

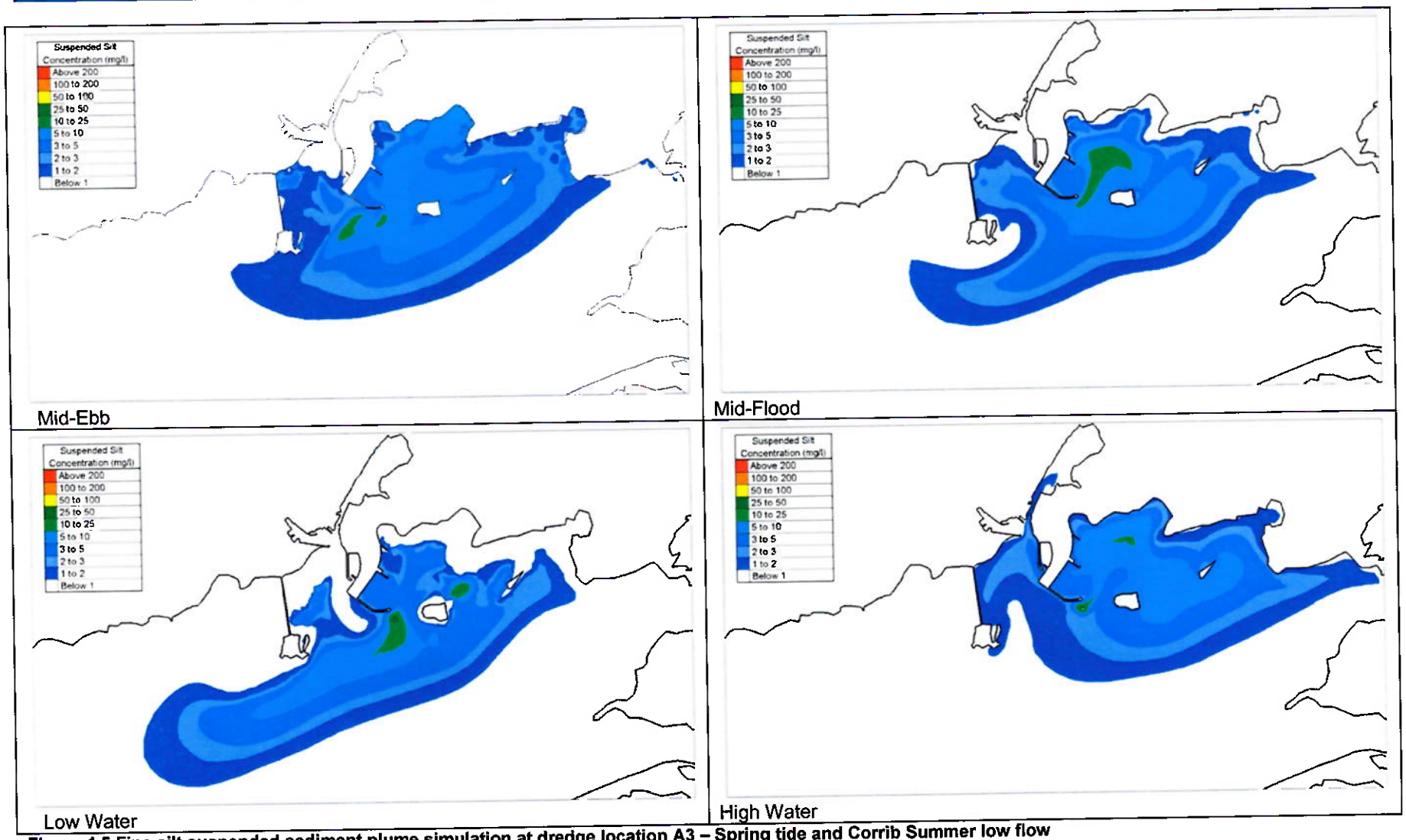


Figure 1.5 Fine silt suspended sediment plume simulation at dredge location A3 – Spring tide and Corrib Summer low flow

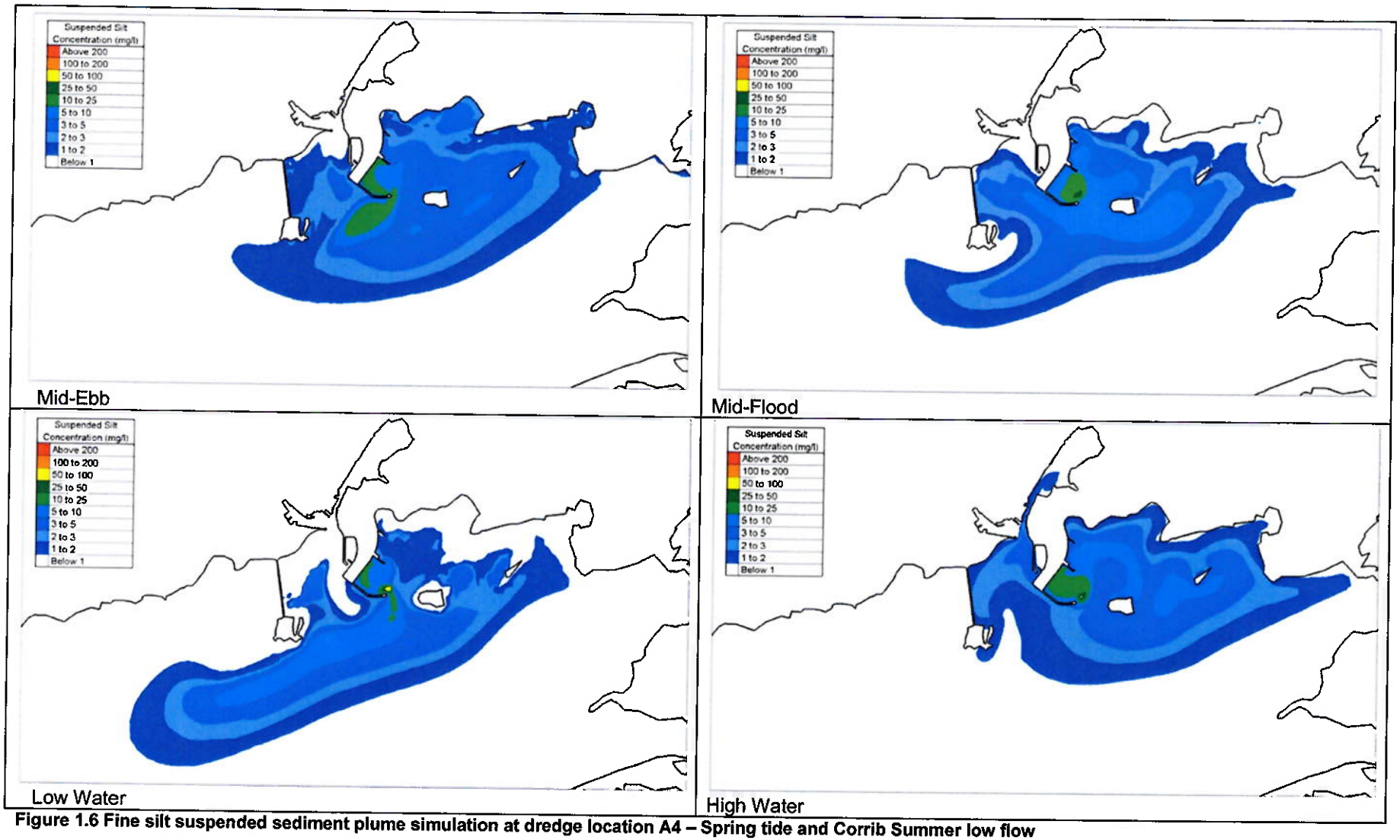


Figure 1.6 Fine silt suspended sediment plume simulation at dredge location A4 – Spring tide and Corrib Summer low flow

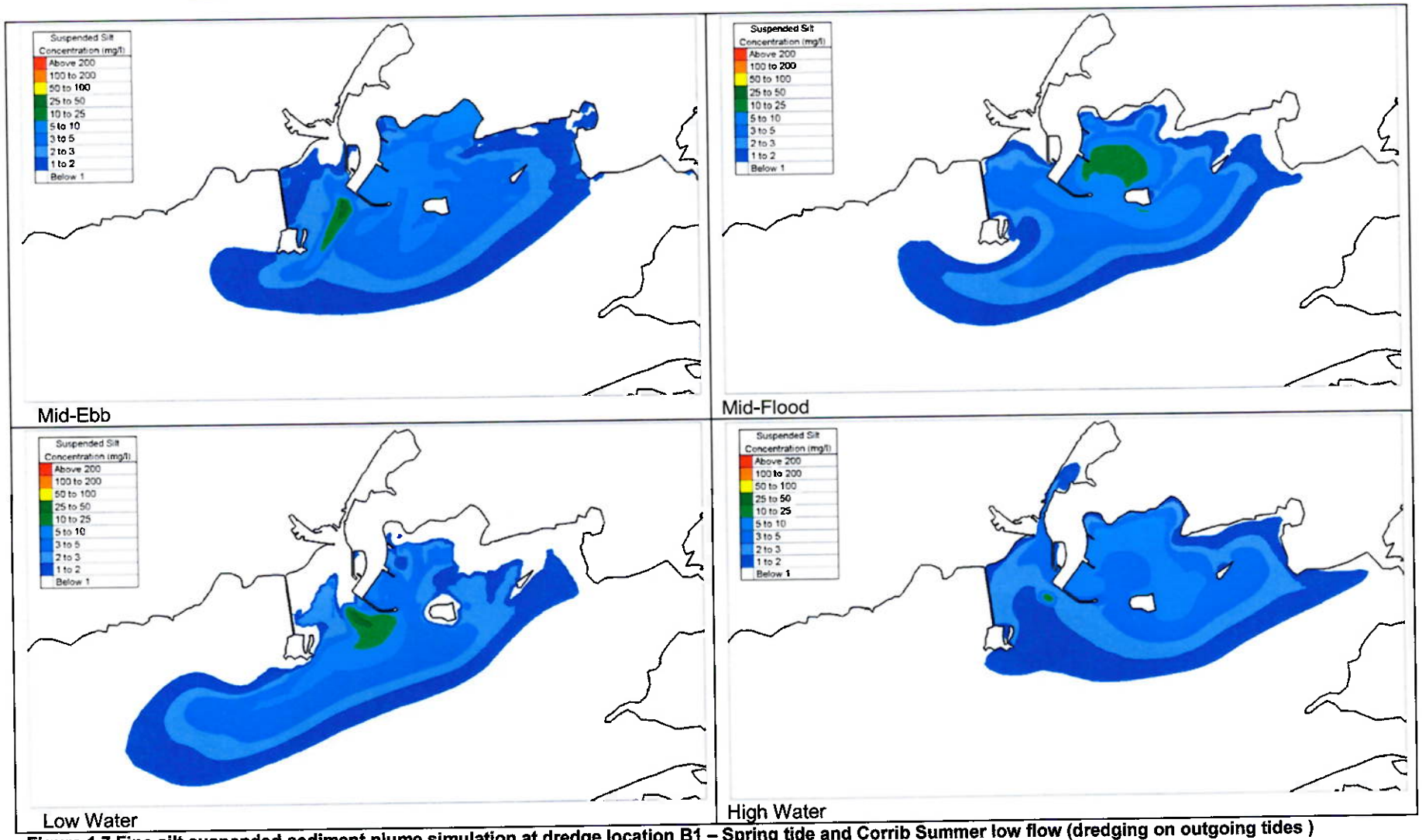


Figure 1.7 Fine silt suspended sediment plume simulation at dredge location B1 – Spring tide and Corrib Summer low flow (dredging on outgoing tides)

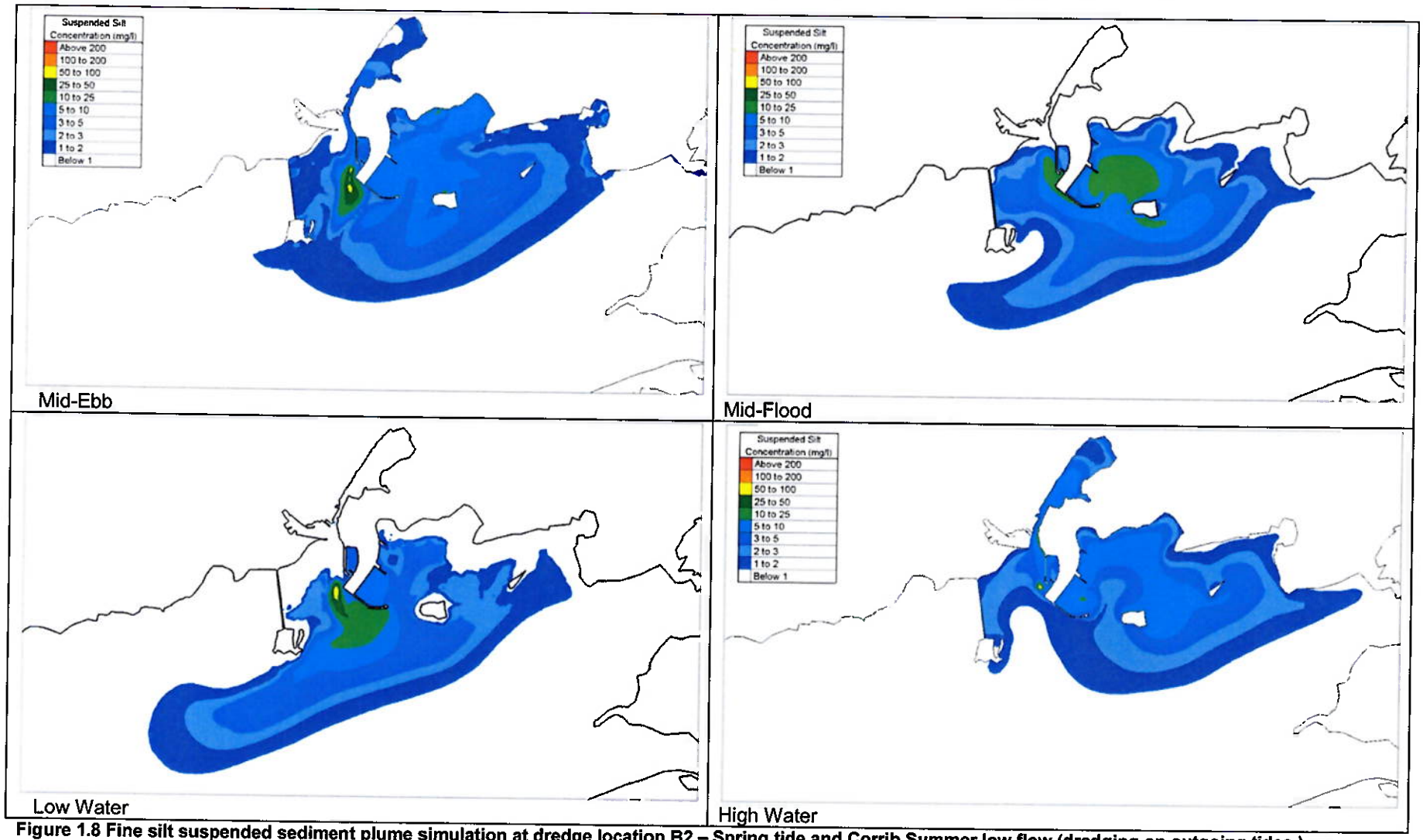


Figure 1.8 Fine silt suspended sediment plume simulation at dredge location B2 – Spring tide and Corrib Summer low flow (dredging on outgoing tides)

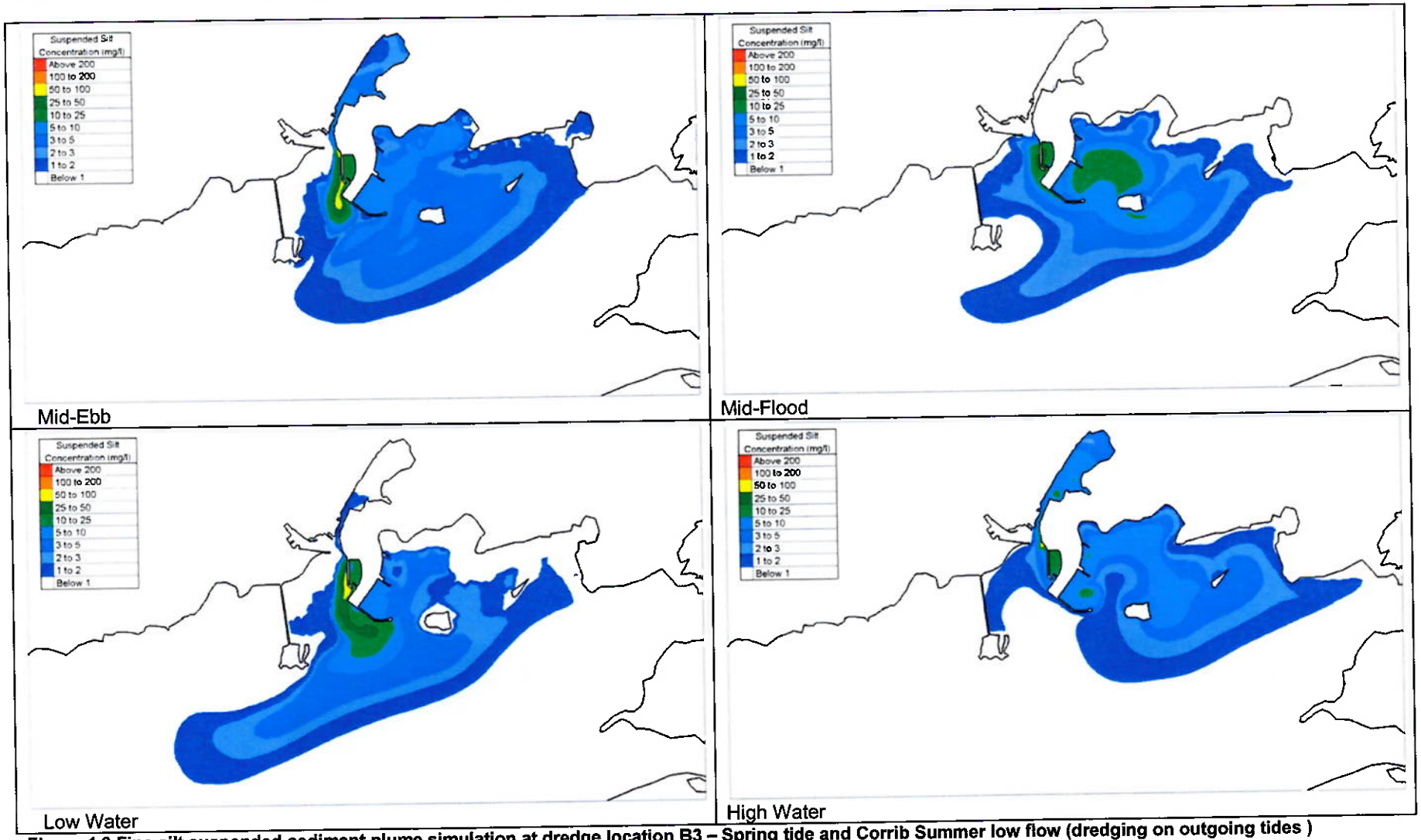


Figure 1.9 Fine silt suspended sediment plume simulation at dredge location B3 – Spring tide and Corrib Summer low flow (dredging on outgoing tides)

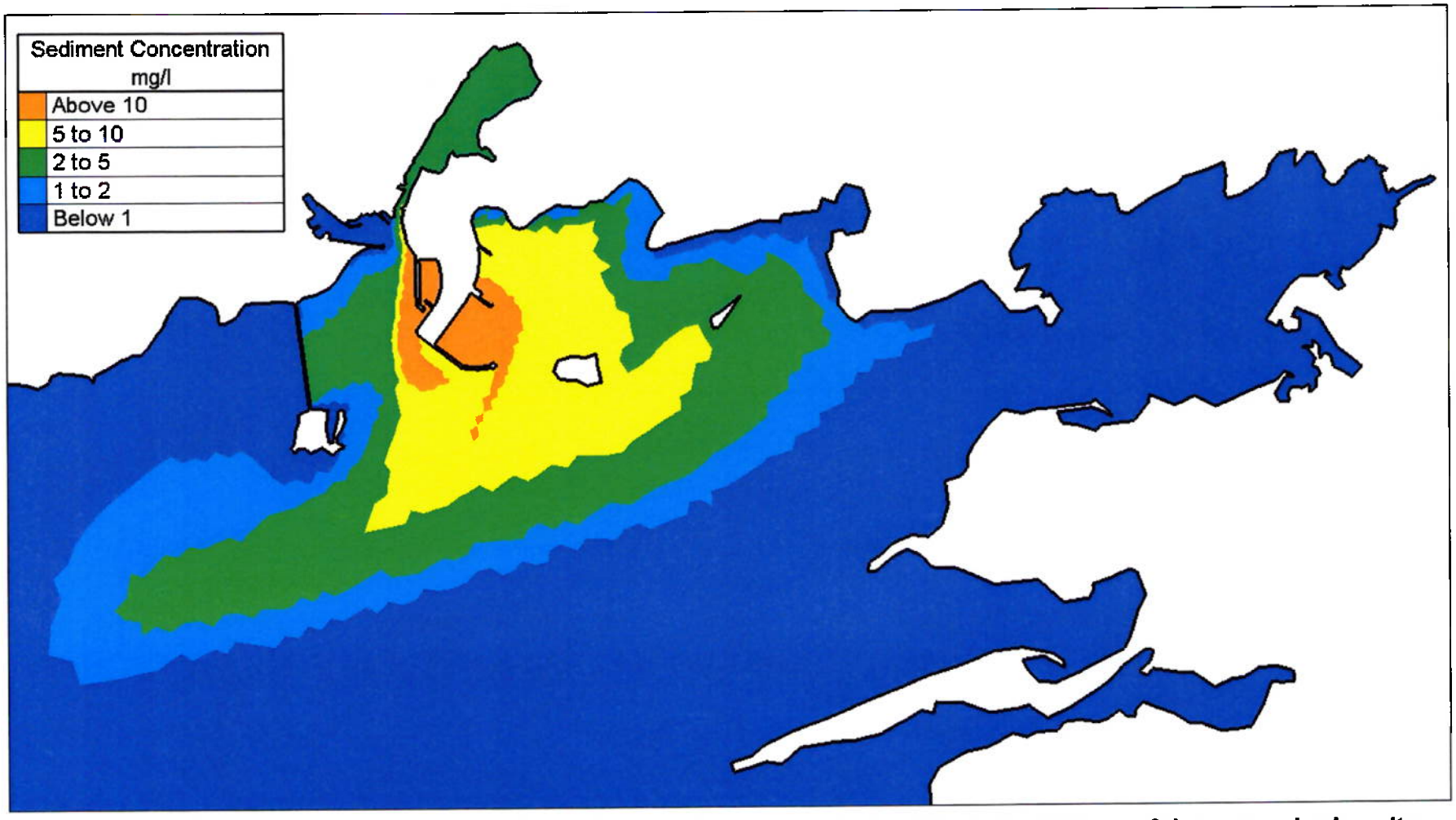


Figure 1.10 Capital Dredge tidal mean Silt Concentrations (mg/l) extrapolated from simulations of the seven dredge sites A1 – A4 and B1-B3 with mitigation for dredging of navigation channel to old Docks (Concentrations based on peak dredging rate of 17,000 m3 per day)

Galway Harbour Company

Galway Harbour Extension

ENVIRONMENTAL IMPACT STATEMENT

ADDENDUM CHAPTER 9

JANUARY 2015

9.1 ADDENDUM TO SHIP EMISSION CALCULATIONS

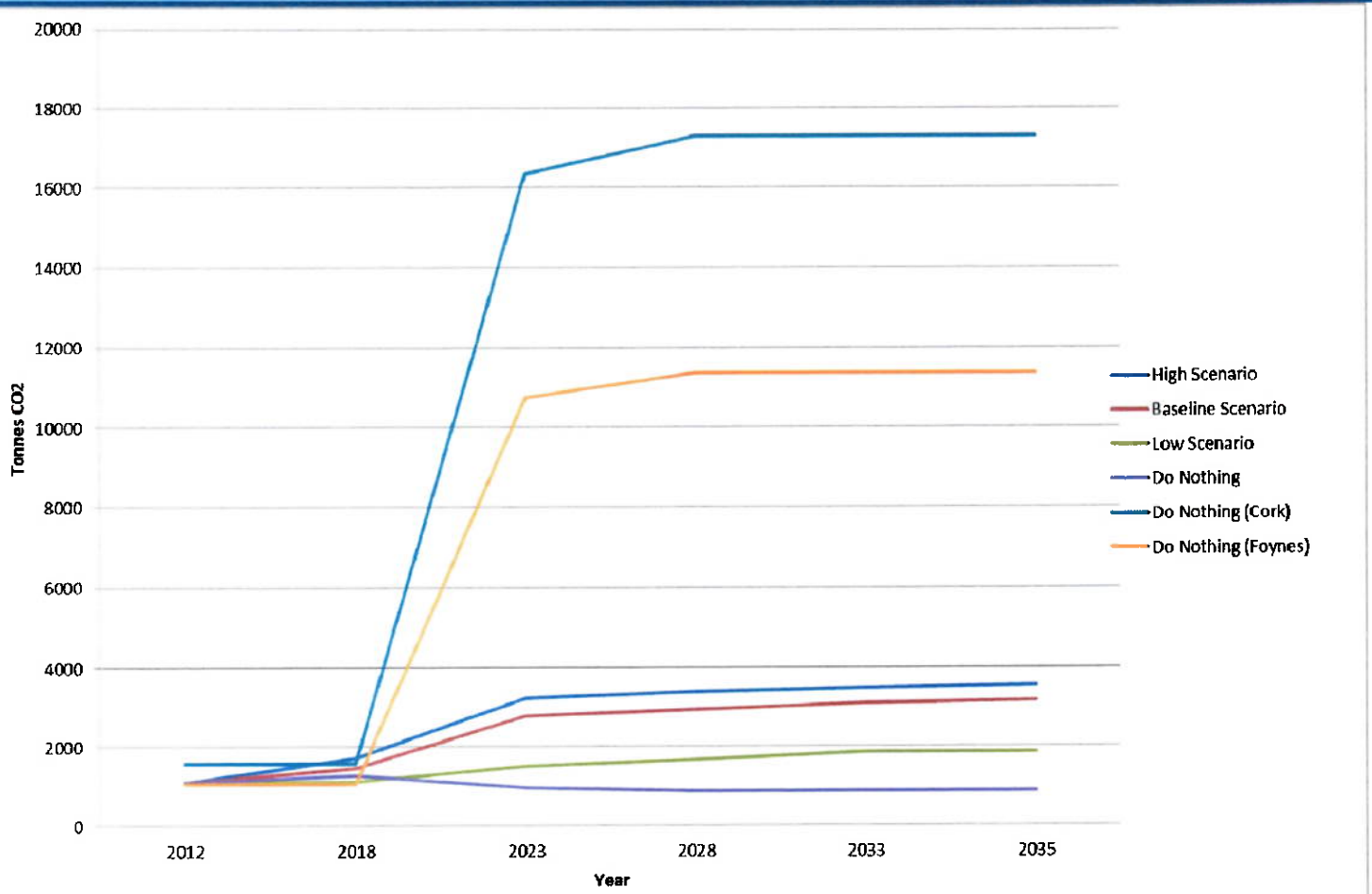
The EIS as published contained an inconsistency in the level of traffic considered in Chapters 2 (Planning and Business Case) and Chapter 9 (Air Quality). Last month the International Transport Forum at the Organisation for Economic Co-operation and Development (OECD) published a report on 'Shipping Emissions in Ports'[1]. The purpose of this report was to address the issue of a uniform definition and calculation methodology, so that emissions in different ports can be compared with each other.

In order to provide a robust comparable analysis of in-port emissions, the air quality emissions were recalculated in accordance with the methodology used in the OECD paper. Using this methodology, the emission levels are lower than those stated in the EIS.

The following addendum contains an updated Figure 9.7.3 and revised tables for Appendix 9.1

[1] Merk, O., (2014), Shipping Emissions in Ports, Discussion Paper No. 2014-20, International Transport Forum at the Organisation for Economic Co-operation and Development, Paris. Available at www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201420.pdf

Figure 9.7.3 Galway Port Freight CO_2 Emissions in Tonnes



APPENDIX 9.1

Estimated Air Emissions from Shipping in Port

Table 9.7 Estimated Shipping Emissions in Tonnes 2012

	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM
Liquid Products	415203	113	24	2700		11	0	557	0	0
Dry Products	85538	23	36	2700		2	0	91	0	0
Cruise Vessels		6	14	24000		5	0	228	0	0
Other Vessels		3000	2	75		5	0	224	0	0
Total	500741	142				22	1	1100	0	1

Table 9.8 Estimated Shipping Emissions in Tonnes High Scenario 2018											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	603000	61	16	4800		9	0	449	0	0	
Dry Products	390000	46	28	4200		5	0	263	0	0	
Cruise Vessels		20	9	24000		13	0	645	0	1	
Other Vessels		3600	2	100		7	0	358	0	0	
Total	993000	128				35	1	1714	0	1	

Table 9.9 Estimated Shipping Emissions in Tonnes Medium Scenario 2018											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	586000	60	16	4800		9	0	436	0	0	
Dry Products	383000	46	28	4200		5	0	258	0	0	
Cruise Vessels		15	9	24000		10	0	484	0	0	
Other Vessels		3000	2	100		6	0	298	0	0	
Total	969000	120				30	1	1476	0	1	

Table 9.10 Estimated Shipping Emissions in Tonnes Low Scenario 2018											
	Tonnage	**Vessels**	**Hrs in Port**	**Engine kW**		**NO_x**	**SO_2**	**CO_2**	**HC**	**PM**	
Liquid Products	500000	51	16	4800		7	0	372	0	0	
Dry Products	290000	35	28	4200		4	0	195	0	0	
Cruise Vessels		10	9	24000		7	0	323	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	790000	95				22	1	1113	0	1	

Table 9.11 Estimated Shipping Emissions in Tonnes Do Nothing Scenario 2018											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	525000	143	16	2700		12	0	588	0	1	
Dry Products	315000	85	28	2700		6	0	308	0	0	
Cruise Vessels		5	9	24000		3	0	161	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	840000	233				26	1	1281	0	1	
Do Nothing Alternative											
Road Transport from Cork								1589			
Road Transport from Foynes								1045			

Table 9.12 Estimated Shipping Emissions in Tonnes High Scenario 2023											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	1370000	139	16	4800		21	1	1019	0	1	
Dry Products	792000	94	28	4200		11	0	533	0	0	
Cruise Vessels		30	9	24000		20	1	968	0	1	
Other Vessels		4200	2	170		14	0	709	0	1	
Total	2162000	264				65	2	3230	0	3	

Table 9.13 Estimated Shipping Emissions in Tonnes Medium Scenario 2023											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	1200000	122	16	4800		18	1	893	0	1	
Dry Products	732000	87	28	4200		10	0	493	0	0	
Cruise Vessels		24	9	24000		16	0	775	0	1	
Other Vessels		3600	2	170		12	0	608	0	1	
Total	1932000	233				56	2	2768	0	2	

Table 9.14 Estimated Shipping Emissions in Tonnes Low Scenario 2023											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	625000	64	16	4800		9	0	465	0	0	
Dry Products	330000	39	28	4200		4	0	222	0	0	
Cruise Vessels		10	9	24000		7	0	323	0	0	
Other Vessels		3000	2	170		10	0	507	0	0	
Total	955000	113				31	1	1516	0	1	

Table 9.15 Estimated Shipping Emissions in Tonnes Do Nothing Scenario 2023											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	290000	79	16	2700		7	0	325	0	0	
Dry Products	315000	85	28	2700		6	0	308	0	0	
Cruise Vessels		3	9	24000		2	0	97	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	605000	167				19	1	953	0	1	
Do Nothing Alternative											
Road Transport from Cork								16349			
Road Transport from Foynes								10749			

Table 9.16 Estimated Shipping Emissions in Tonnes High Scenario 2028											
	Tonnage	**Vessels**	**Hrs in Port**	**Engine kW**		**NO_x**	**SO_2**	**CO_2**	**HC**	**PM**	
Liquid Products	1370000	139	16	4800		21	1	1019	0	1	
Dry Products	792000	94	28	4200		11	0	533	0	0	
Cruise Vessels		35	9	24000		23	1	1129	0	1	
Other Vessels		4200	2	170		14	0	709	0	1	
Total	2162000	269				68	2	3391	0	3	

Table 9.17 Estimated Shipping Emissions in Tonnes Medium Scenario 2028											
	Tonnage	**Vessels**	**Hrs in Port**	**Engine kW**		**NO_x**	**SO_2**	**CO_2**	**HC**	**PM**	
Liquid Products	1200000	122	16	4800		18	1	893	0	1	
Dry Products	732000	87	28	4200		10	0	493	0	0	
Cruise Vessels		29	9	24000		19	1	936	0	1	
Other Vessels		3600	2	170		12	0	608	0	1	
Total	1932000	238				59	2	2929	0	3	

Table 9.18 Estimated Shipping Emissions in Tonnes Low Scenario 2028											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	625000	64	16	4800		9	0	465	0	0	
Dry Products	310000	37	28	4200		4	0	209	0	0	
Cruise Vessels		15	9	24000		10	0	484	0	0	
Other Vessels		3000	2	170		10	0	507	0	0	
Total	935000	115				34	1	1664	0	1	

Table 9.19 Estimated Shipping Emissions in Tonnes Do Nothing Scenario 2028											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	250000	68	16	2700		6	0	280	0	0	
Dry Products	278000	75	28	2700		5	0	272	0	0	
Cruise Vessels		3	9	24000		2	0	97	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	528000	146				18	1	872	0	1	
Do Nothing Alternative											
Road Transport from Cork								17297			
Road Transport from Foynes								11373			

Table 9.20 Estimated Shipping Emissions in Tonnes High Scenario 2033											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	1370000	139	16	4800		21	1	1019	0	1	
Dry Products	792000	94	28	4200		11	0	533	0	0	
Cruise Vessels		38	9	24000		25	1	1226	0	1	
Other Vessels		4200	2	170		14	0	709	0	1	
Total	2162000	272				70	2	3488	0	3	

Table 9.21 Estimated Shipping Emissions in Tonnes Medium Scenario 2033											
	Tonnage	**Vessels**	**Hrs in Port**	**Engine kW**		**NO_x**	**SO_2**	**CO_2**	**HC**	**PM**	
Liquid Products	1200000	122	16	4800		18	1	893	0	1	
Dry Products	732000	87	28	4200		10	0	493	0	0	
Cruise Vessels		34	9	24000		22	1	1097	0	1	
Other Vessels		3600	2	170		12	0	608	0	1	
Total	1932000	243				62	2	3091	0	3	

Table 9.22 Estimated Shipping Emissions in Tonnes Low Scenario 2033											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	650000	66	16	4800		10	0	484	0	0	
Dry Products	310000	37	28	4200		4	0	209	0	0	
Cruise Vessels		20	9	24000		13	0	645	0	1	
Other Vessels		3000	2	170		10	0	507	0	0	
Total	960000	123				37	1	1844	0	2	

Table 9.23 Estimated Shipping Emissions in Tonnes Do Nothing Scenario 2033											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	250000	68	16	2700		6	0	280	0	0	
Dry Products	278000	75	28	2700		5	0	272	0	0	
Cruise Vessels		3	9	24000		2	0	97	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	528000	146				18	1	872	0	1	
Do Nothing Alternative											
Road Transport from Cork								17297			
Road Transport from Foynes								11373			

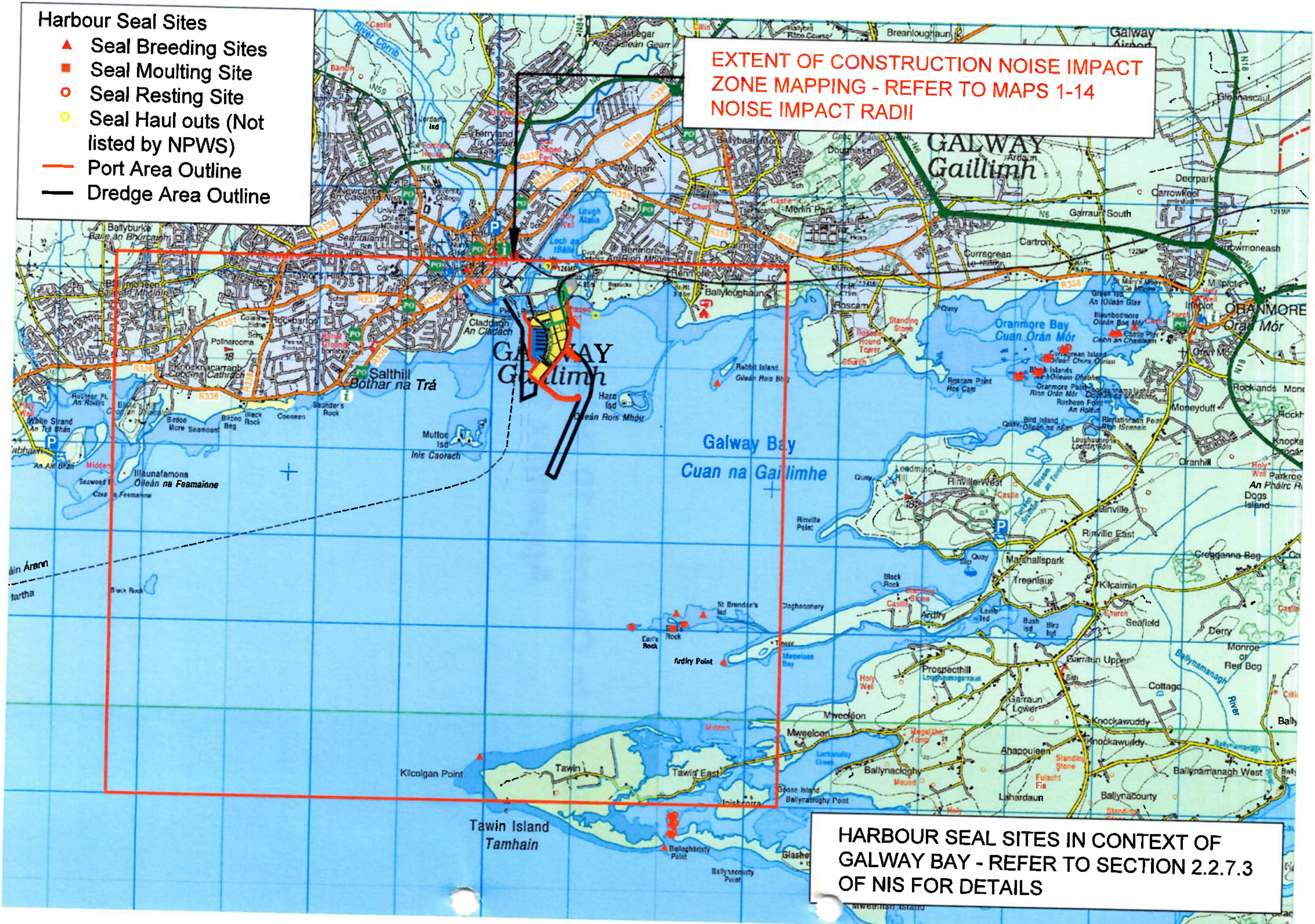
Table 9.24 Estimated Shipping Emissions in Tonnes High Scenario 2035											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	1370000	139	16	4800		21	1	1019	0	1	
Dry Products	792000	94	28	4200		11	0	533	0	0	
Cruise Vessels		40	9	24000		26	1	1291	0	1	
Other Vessels		4200	2	170		14	0	709	0	1	
Total	2162000	274				72	2	3552	0	3	

Table 9.25 Estimated Shipping Emissions in Tonnes Medium Scenario 2035											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	1200000	122	16	4800		18	1	893	0	1	
Dry Products	732000	87	28	4200		10	0	493	0	0	
Cruise Vessels		36	9	24000		23	1	1162	0	1	
Other Vessels		3600	2	170		12	0	608	0	1	
Total	1932000	245				64	2	3155	0	3	

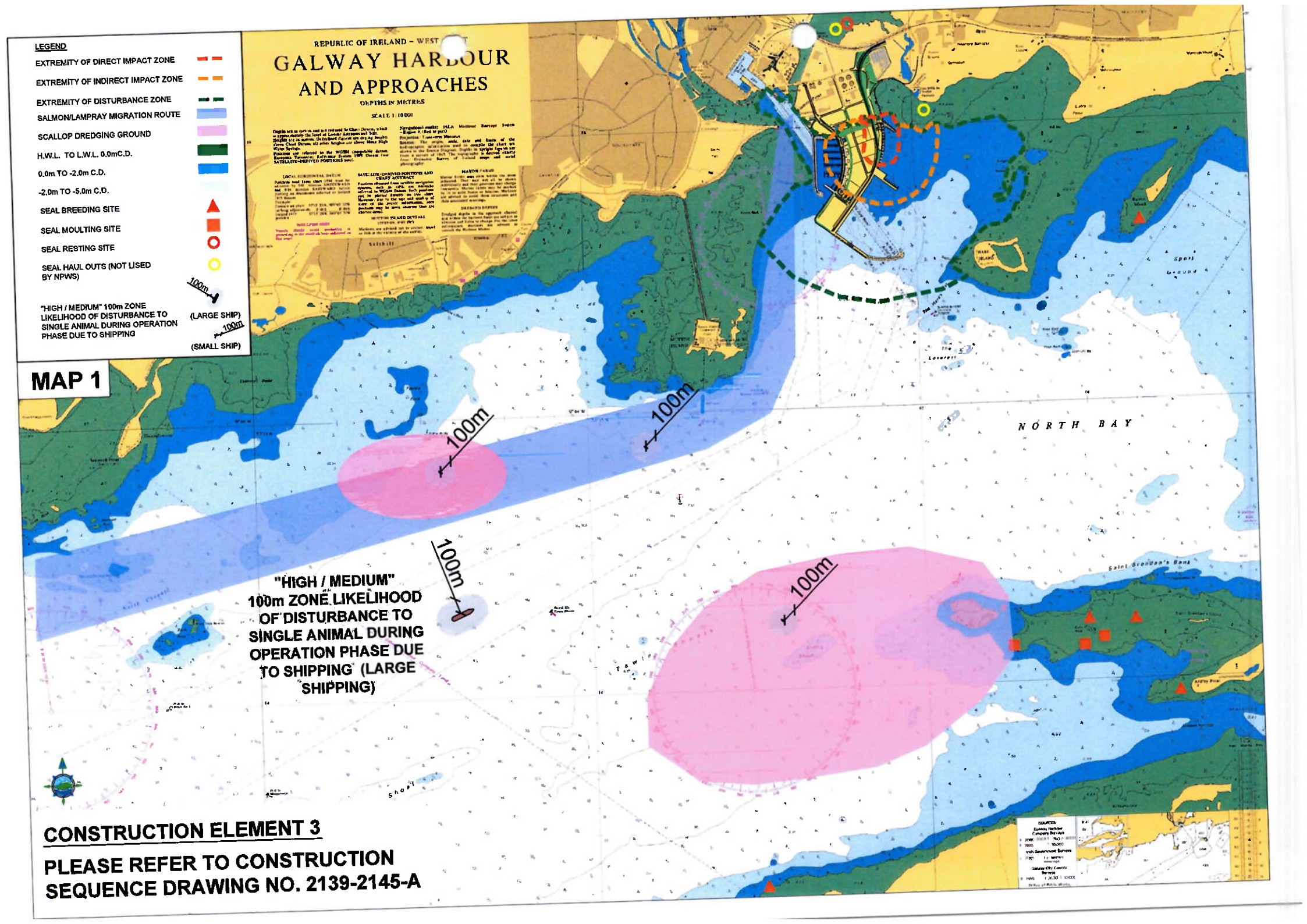
Table 9.26 Estimated Shipping Emissions in Tonnes Low Scenario 2035											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	650000	66	16	4800		10	0	484	0	0	
Dry Products	310000	37	28	4200		4	0	209	0	0	
Cruise Vessels		20	9	24000		13	0	645	0	1	
Other Vessels		3000	2	170		10	0	507	0	0	
Total	960000	123				37	1	1844	0	2	

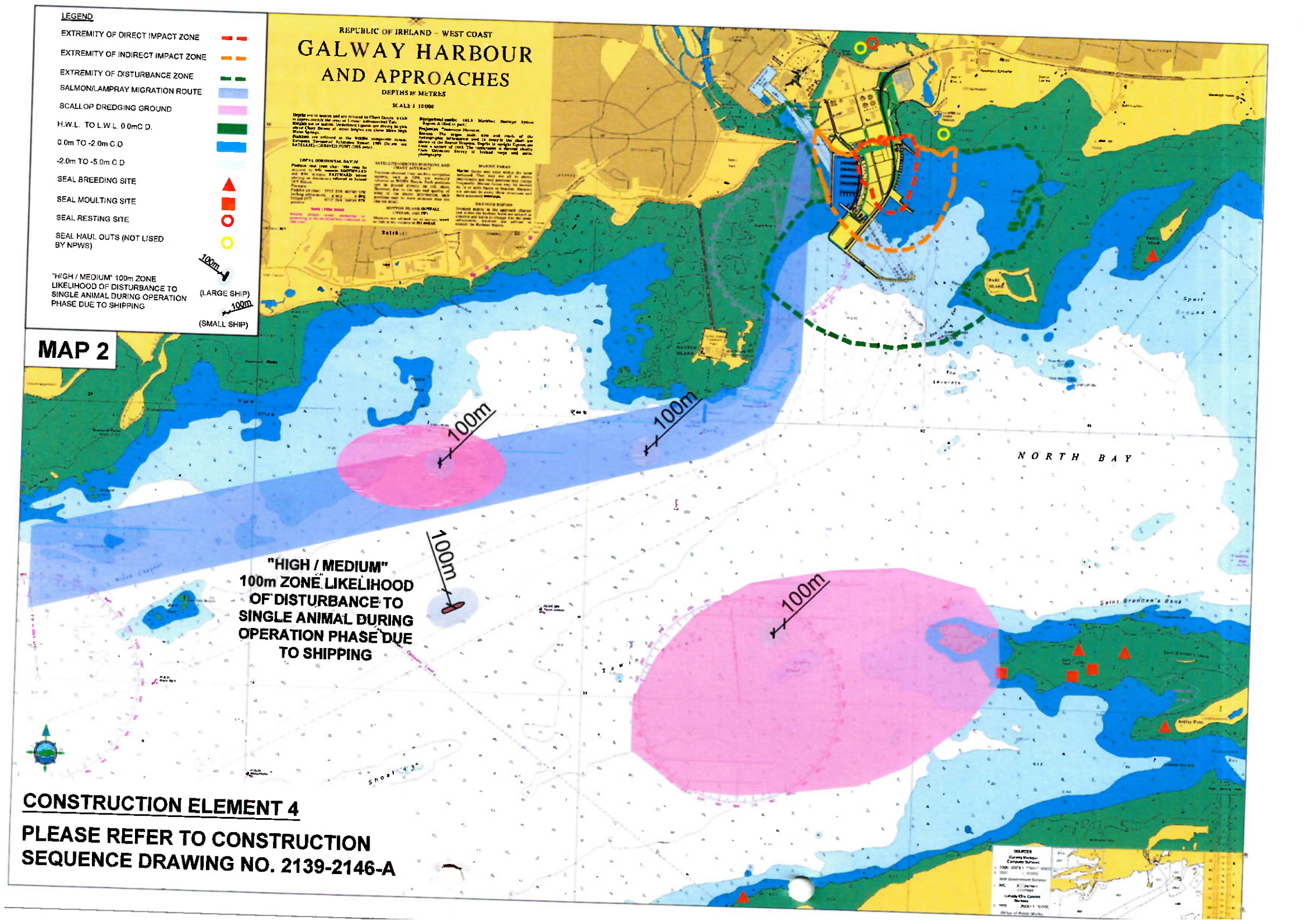
Table 9.27 Estimated Shipping Emissions in Tonnes Do Nothing Scenario 2035											
	Tonnage	Vessels	Hrs in Port	Engine kW		NO_x	SO_2	CO_2	HC	PM	
Liquid Products	250000	68	16	2700		6	0	280	0	0	
Dry Products	278000	75	28	2700		5	0	272	0	0	
Cruise Vessels		3	9	24000		2	0	97	0	0	
Other Vessels		3000	2	75		5	0	224	0	0	
Total	528,000	146				18	1	872	0	1	
Do Nothing Alternative											
Road Transport from Cork								17297			
Road Transport from Foynes								11373			

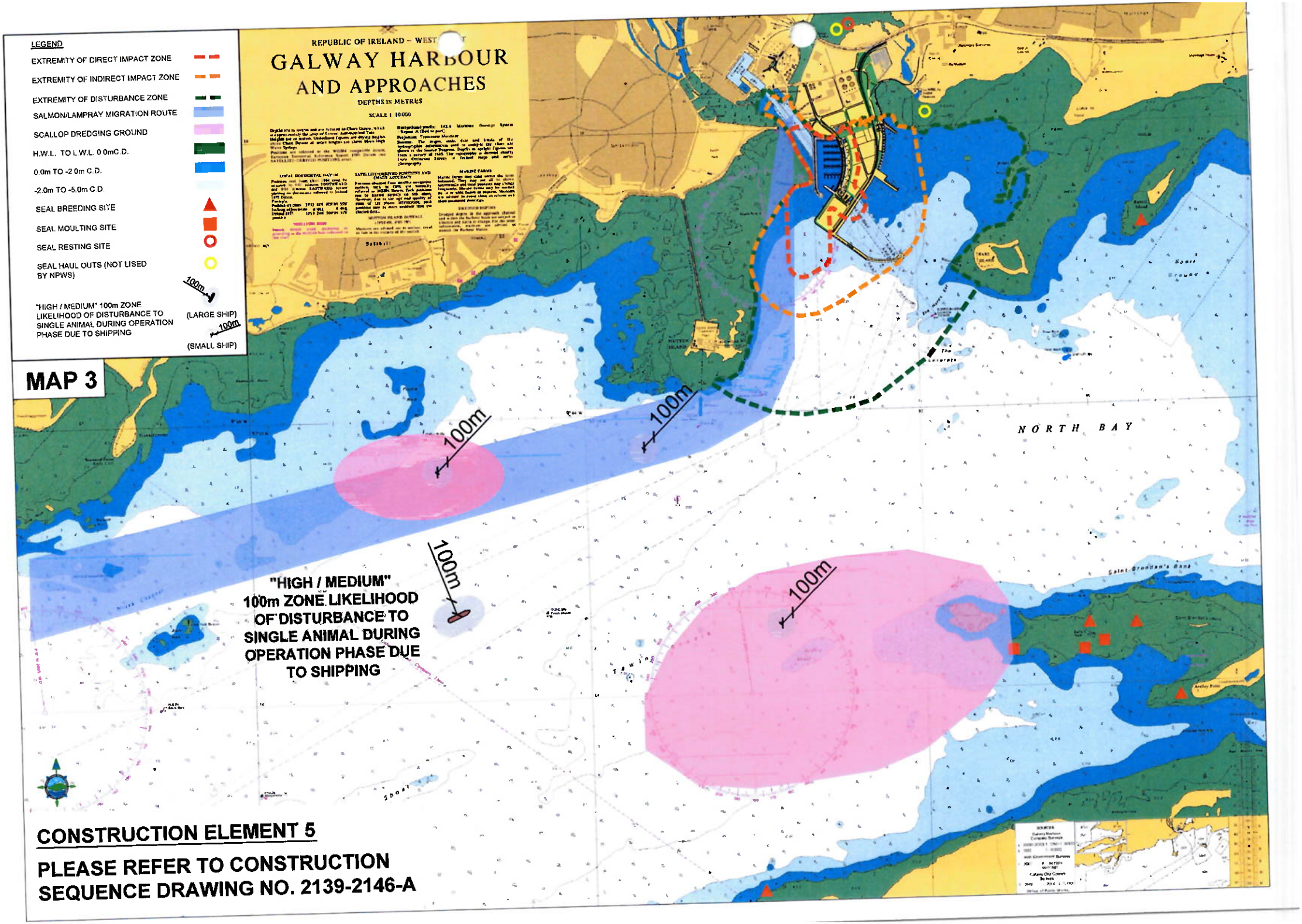
Errata to Chapter 10 Noise and Vibration Appendix 10.3

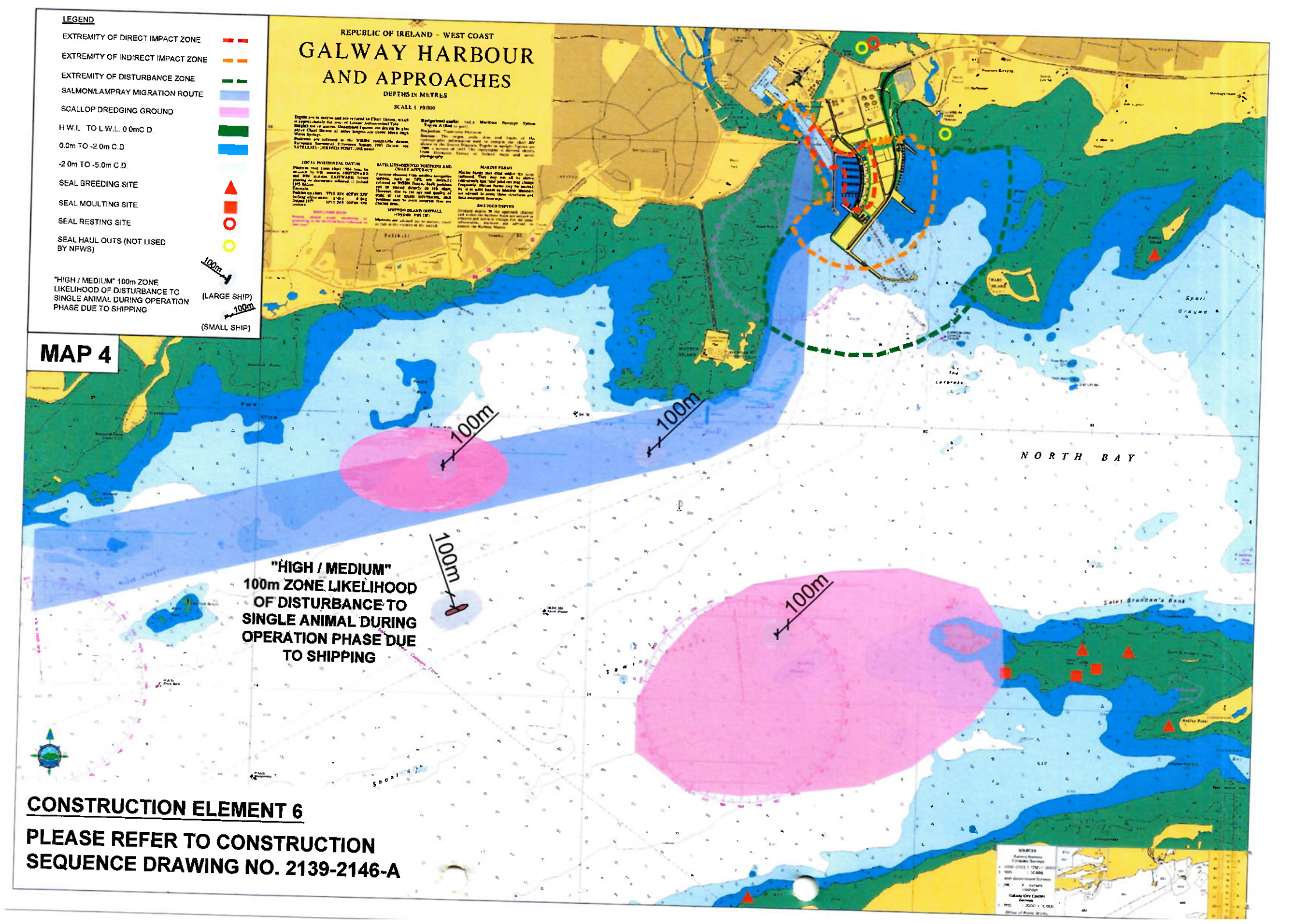


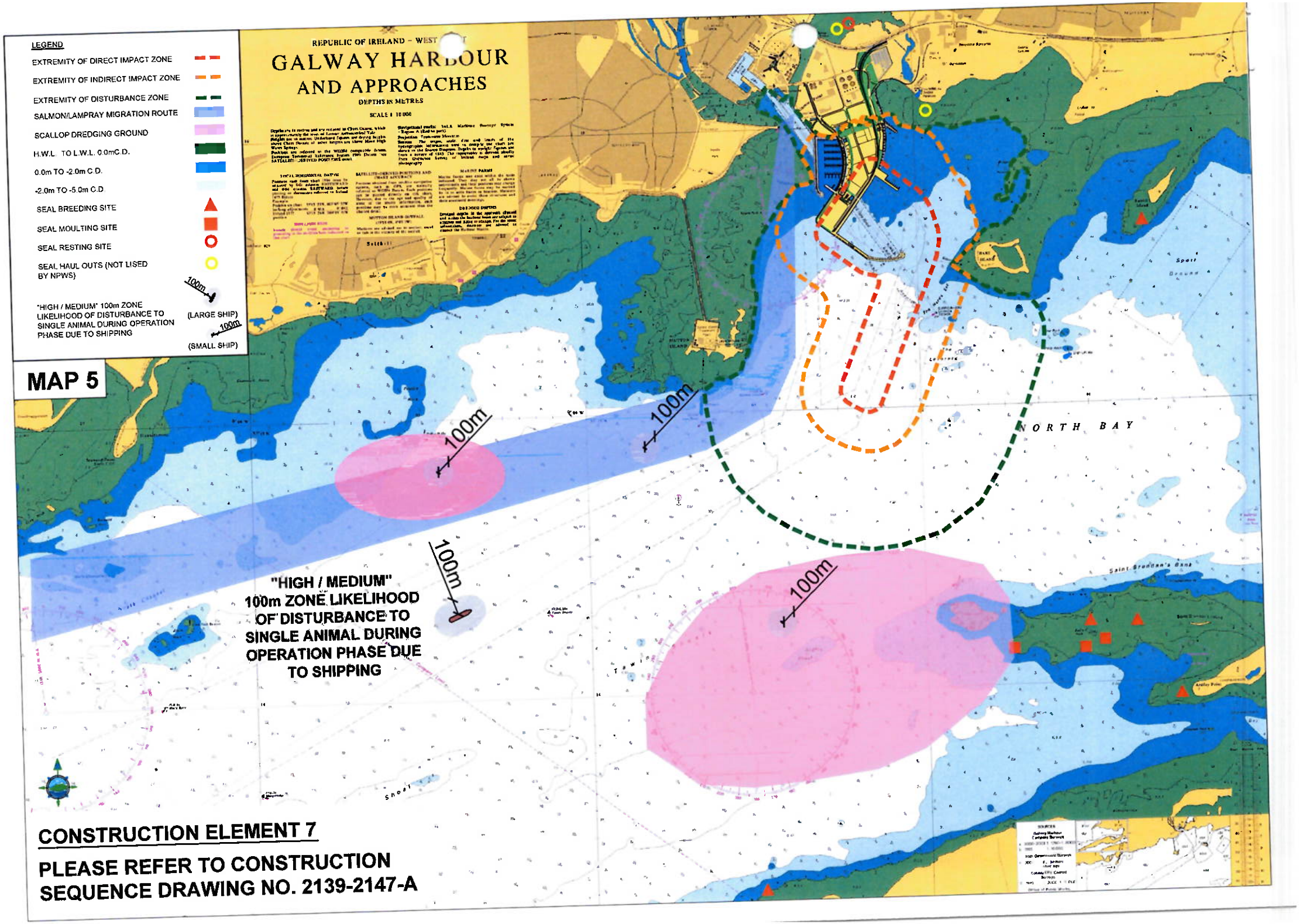
Harbour Seal Sites
Seal Breeding Sites
Seal Moulting Site
Seal Resting Site
Seal Haul outs (Not listed by NPWS)
Port Area Outline
Dredge Area Outline
EXTENT OF CONSTRUCTION NOISE IMPACT ZONE MAPPING - REFER TO MAPS 1-14 NOISE IMPACT RADII
GALWAY Gaillimh
Galway Bay
Cuan na Gaillimhe
Oranmore Bay
Cuan Orán Mór
Salthill
Bothar na Trá
Mutton Isd
Inis Caorach
Hare Isd
Oileán Rois Mhóir
Rabbit Island
Tawin Island
Tamhain
Kilcolgan Point
Ardfry Point
St Brendan's Isd
Illaunafamona
Oileán na Feamainne
ORANMORE
Orán Mór
Claddagh
An Cladach
HARBOUR SEAL SITES IN CONTEXT OF GALWAY BAY - REFER TO SECTION 2.2.7.3 OF NIS FOR DETAILS

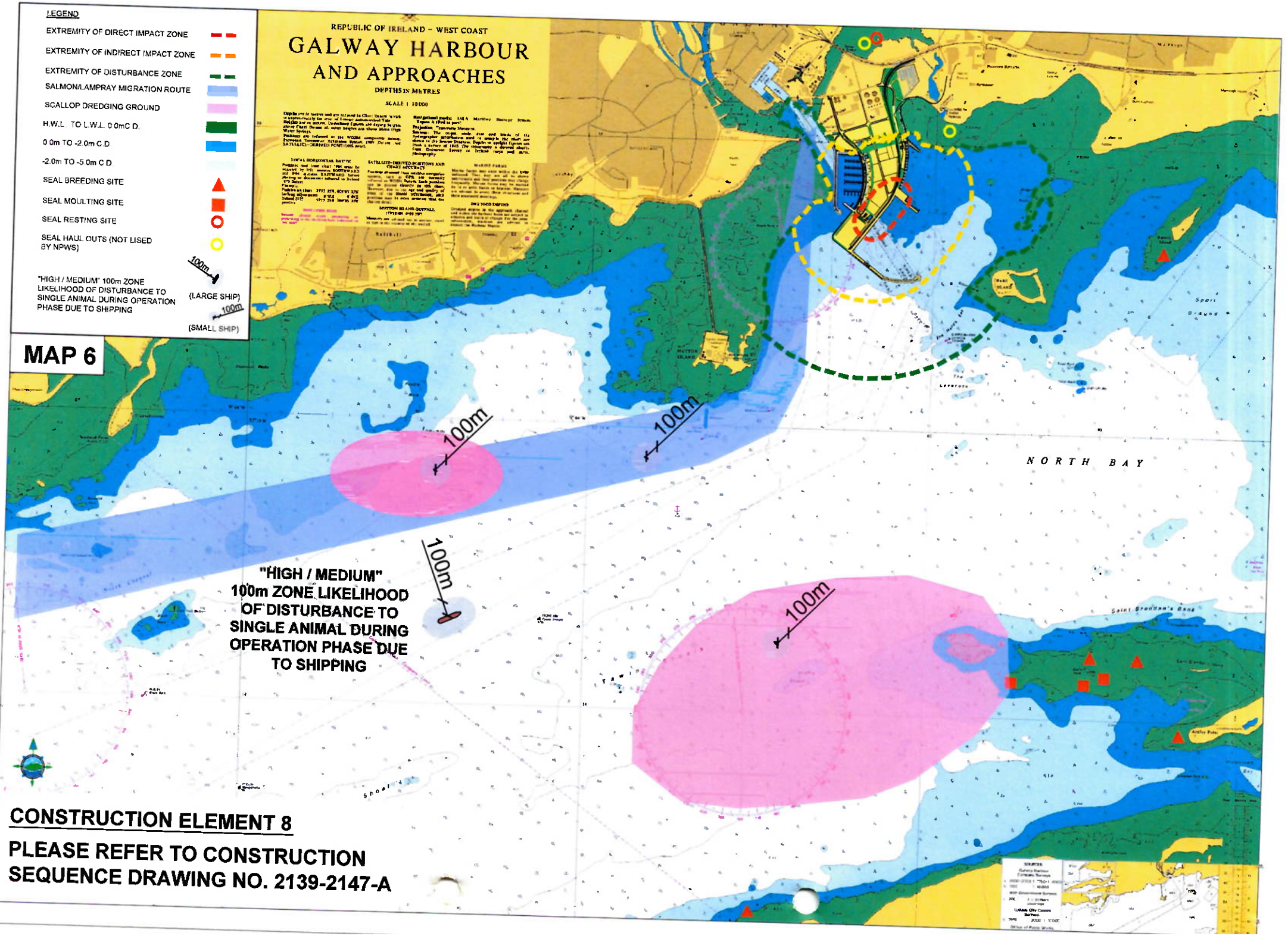

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND – WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 1
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING (LARGE SHIPPING)
NORTH BAY
Saint Brendan's Bank
CONSTRUCTION ELEMENT 3
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2145-A

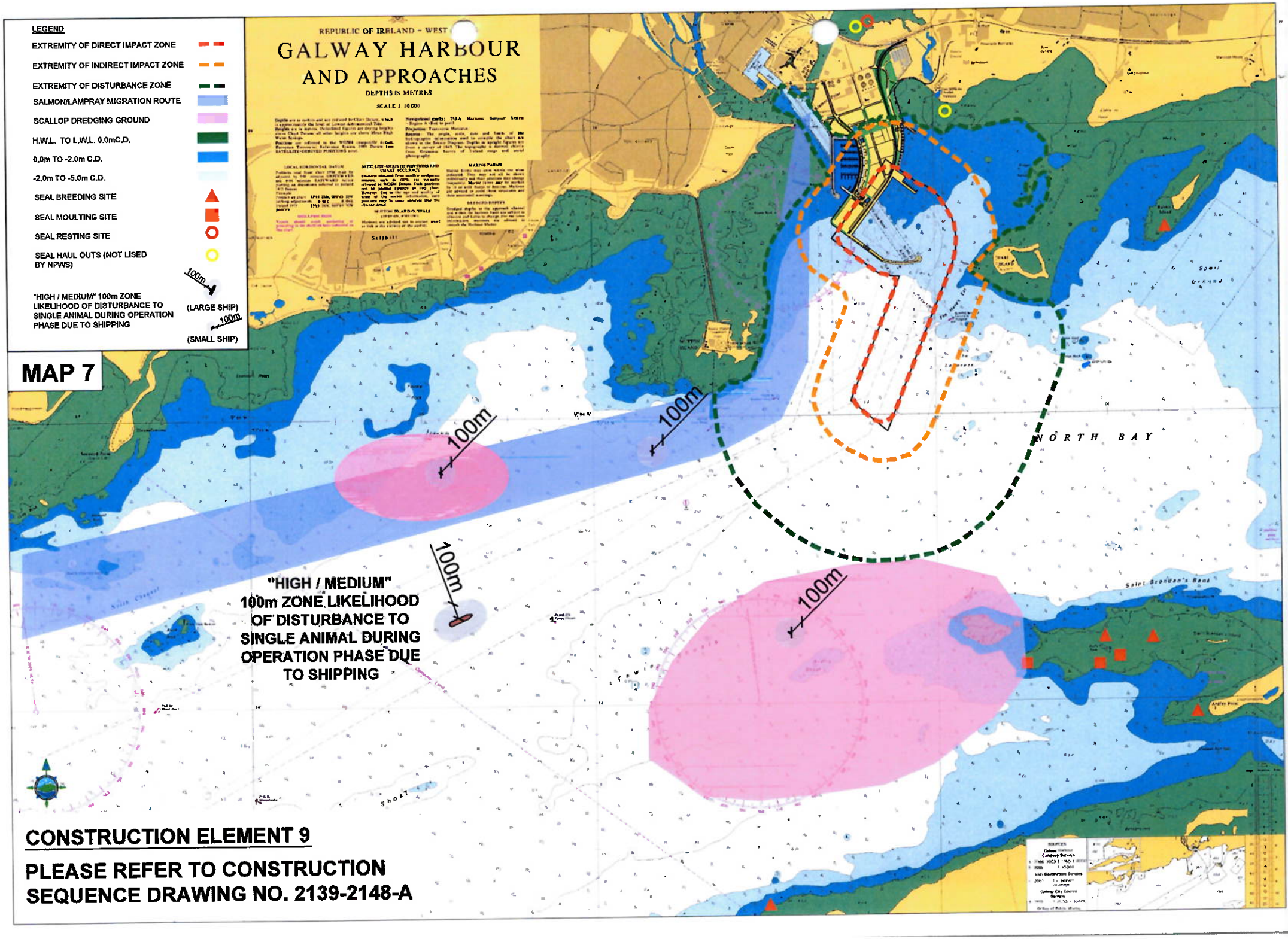

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D
-2.0m TO -5.0m C.D
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 2
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
CONSTRUCTION ELEMENT 4
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2146-A

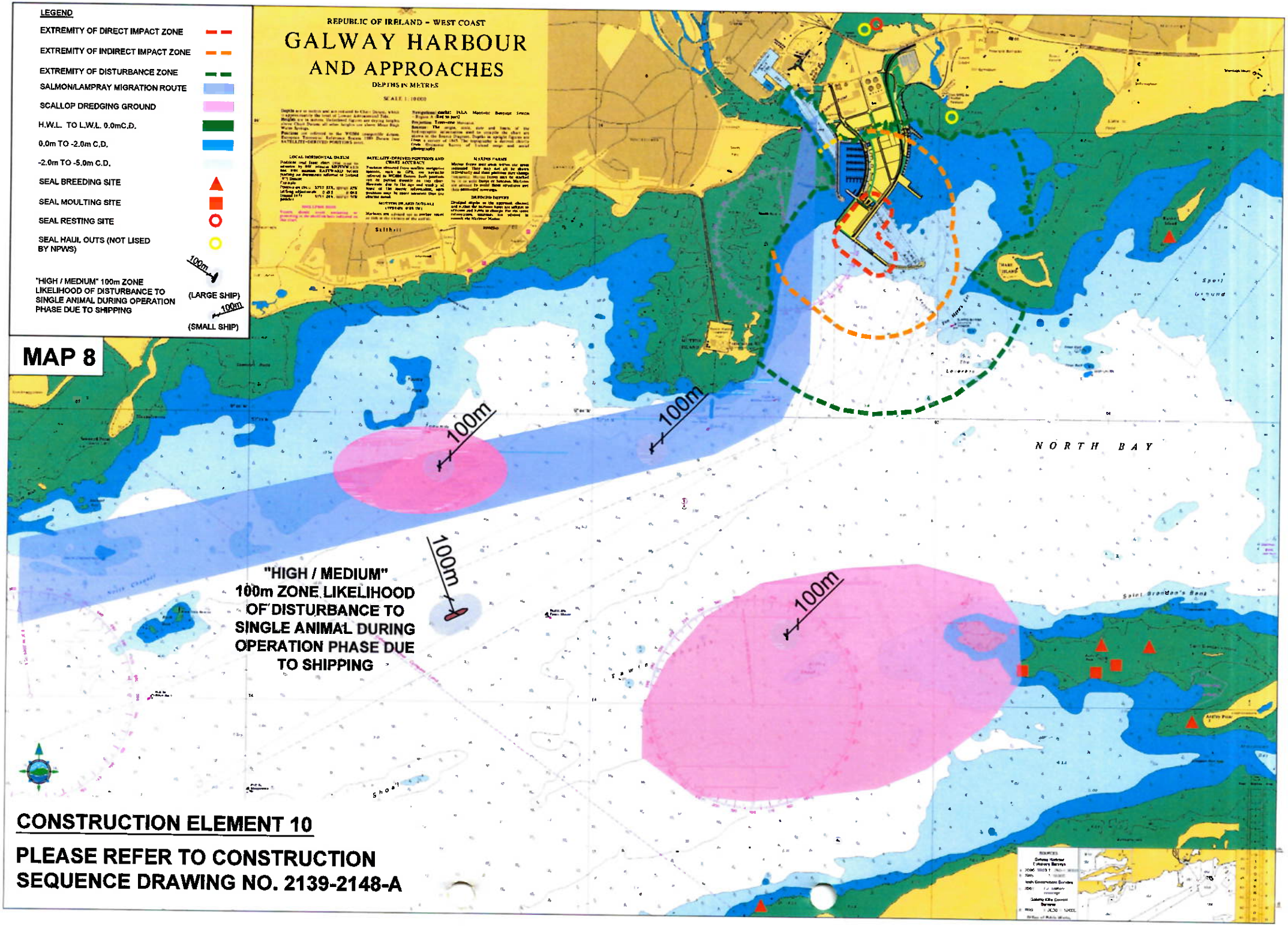

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT USED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m (LARGE SHIP)
100m (SMALL SHIP)
REPUBLIC OF IRELAND – WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1 : 10000
MAP 3
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
Saint Brendan's Bank
CONSTRUCTION ELEMENT 5
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2146-A

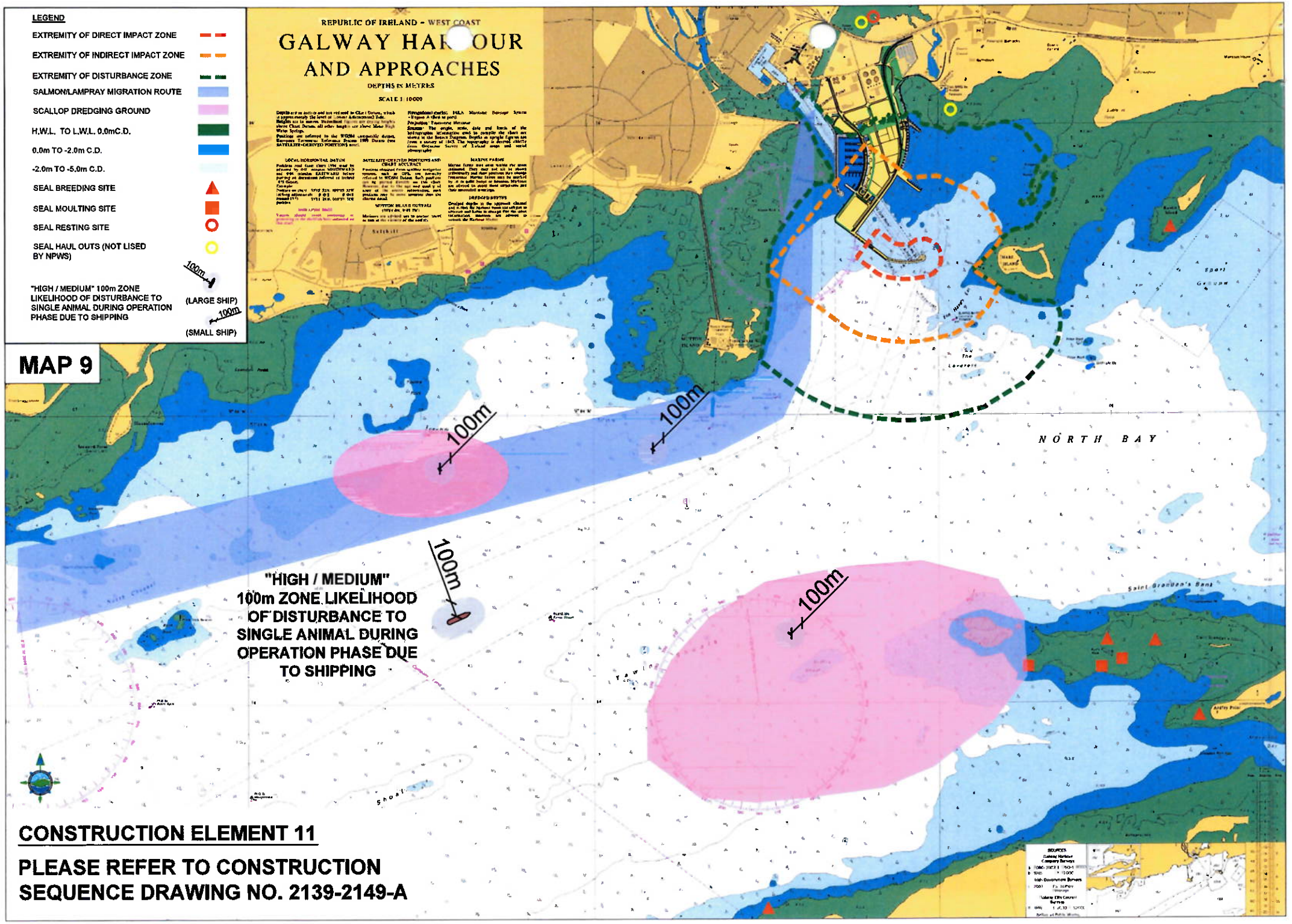

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D
0.0m TO -2.0m C.D
-2.0m TO -5.0m C.D
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
100m
(LARGE SHIP)
100m
(SMALL SHIP)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1 : 10000
MAP 4
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
CONSTRUCTION ELEMENT 6
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2146-A

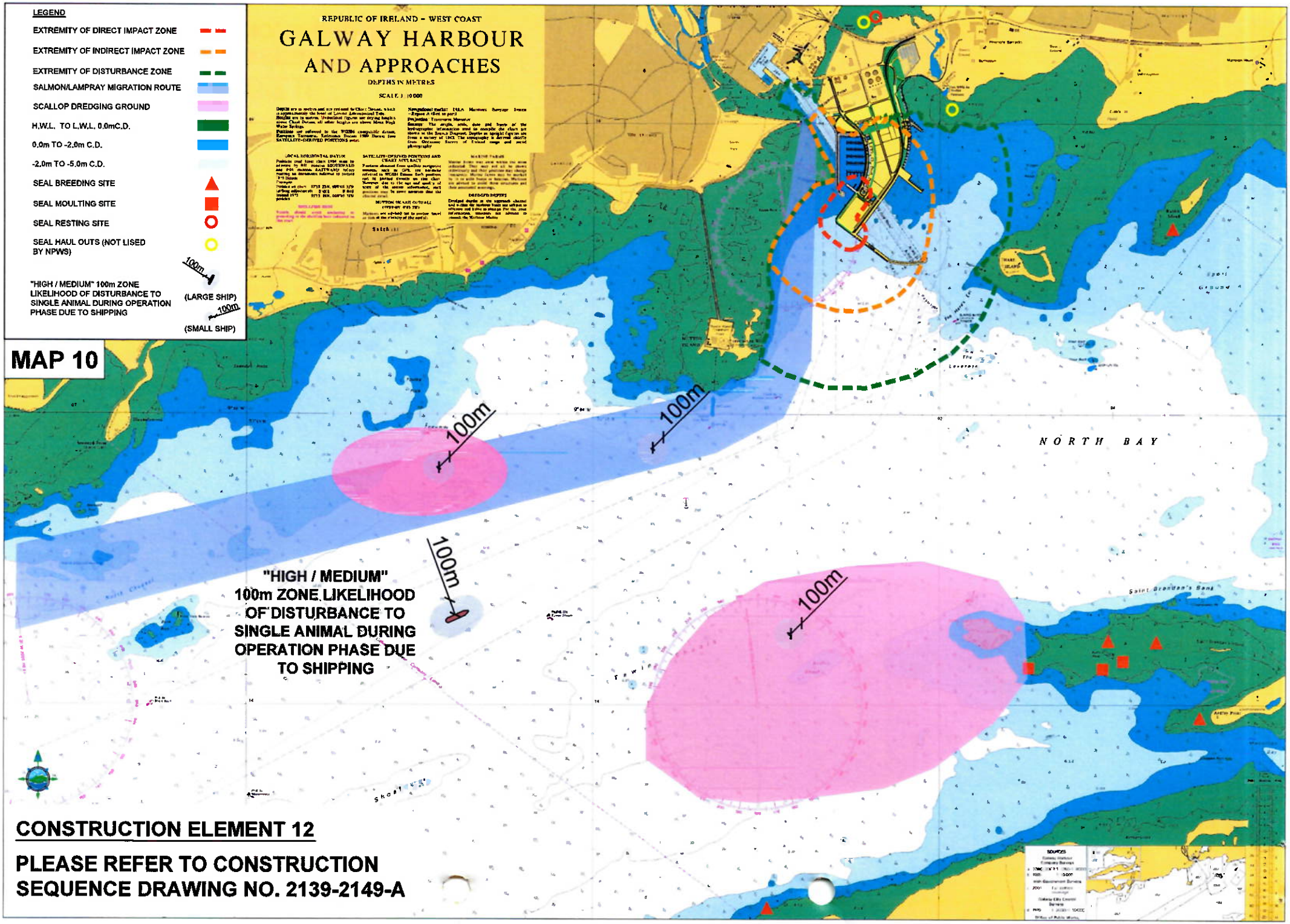

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m (LARGE SHIP)
100m (SMALL SHIP)
REPUBLIC OF IRELAND - WEST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1 10 000
MAP 5
100m
100m
100m
100m
NORTH BAY
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
CONSTRUCTION ELEMENT 7
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2147-A

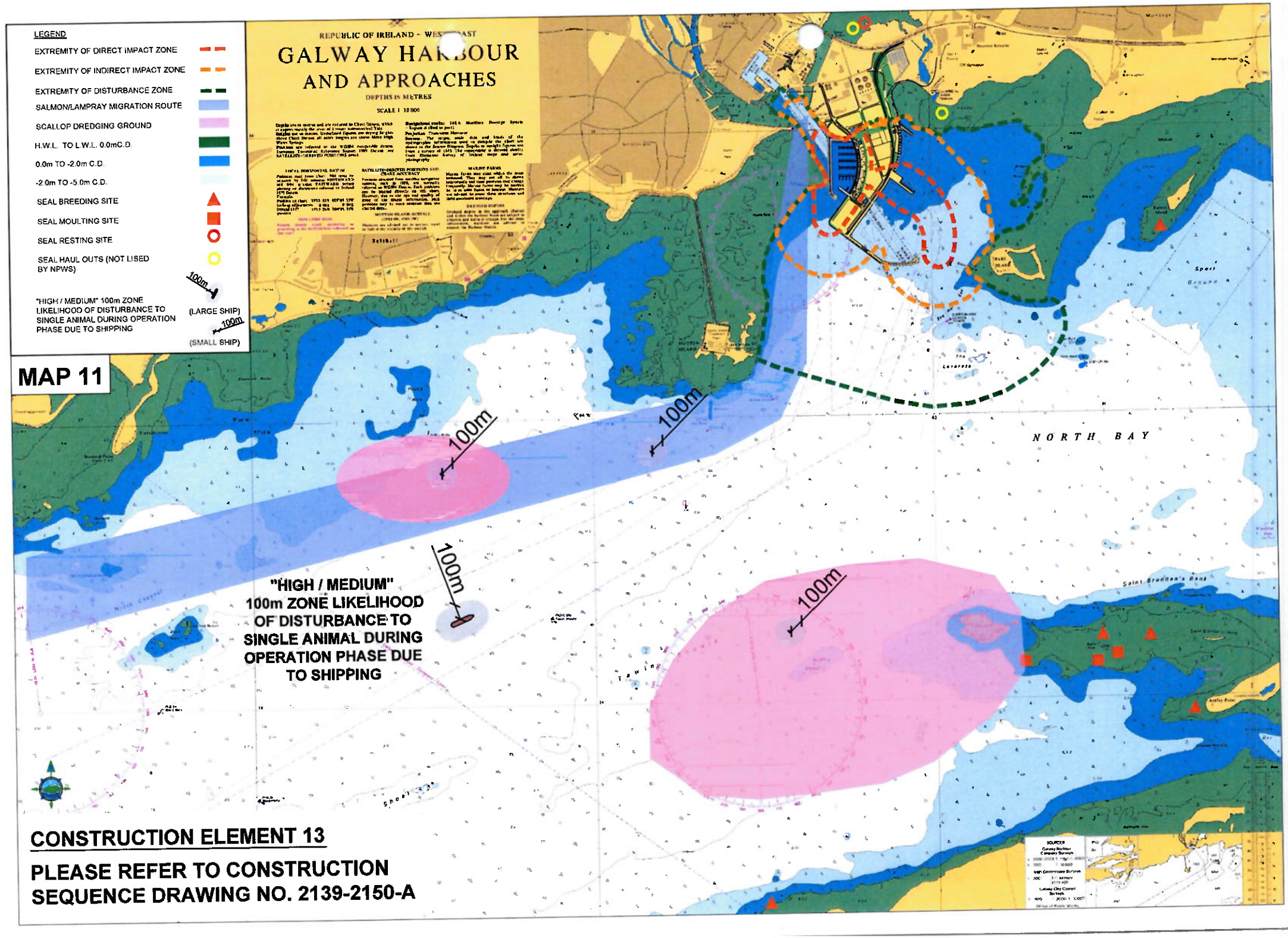

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D
-2.0m TO -5.0m C.D
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1 10000
MAP 6
100m
100m
100m
100m
NORTH BAY
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
CONSTRUCTION ELEMENT 8
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2147-A

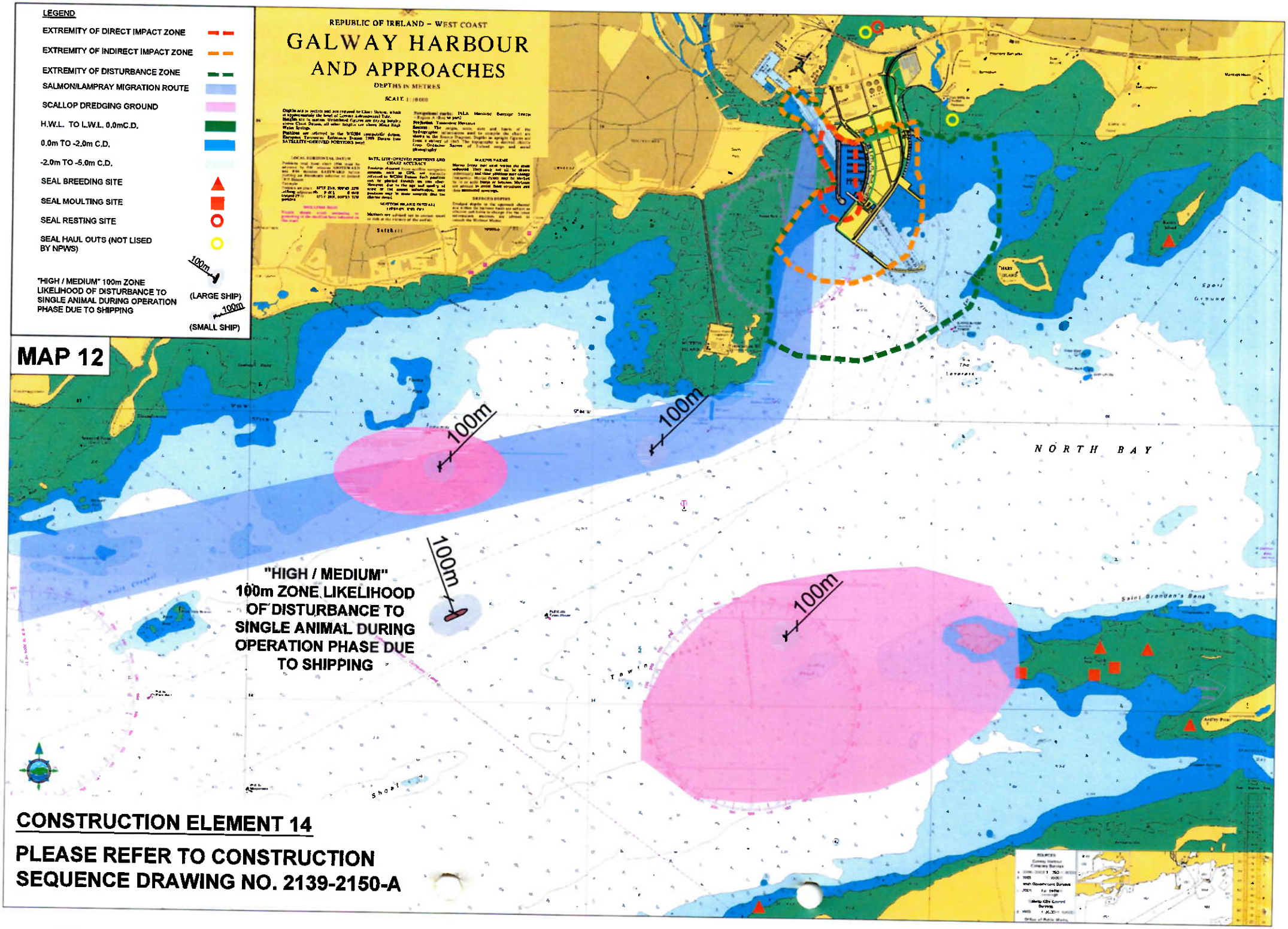

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 7
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
Saint Brendan's Bank
CONSTRUCTION ELEMENT 9
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2148-A

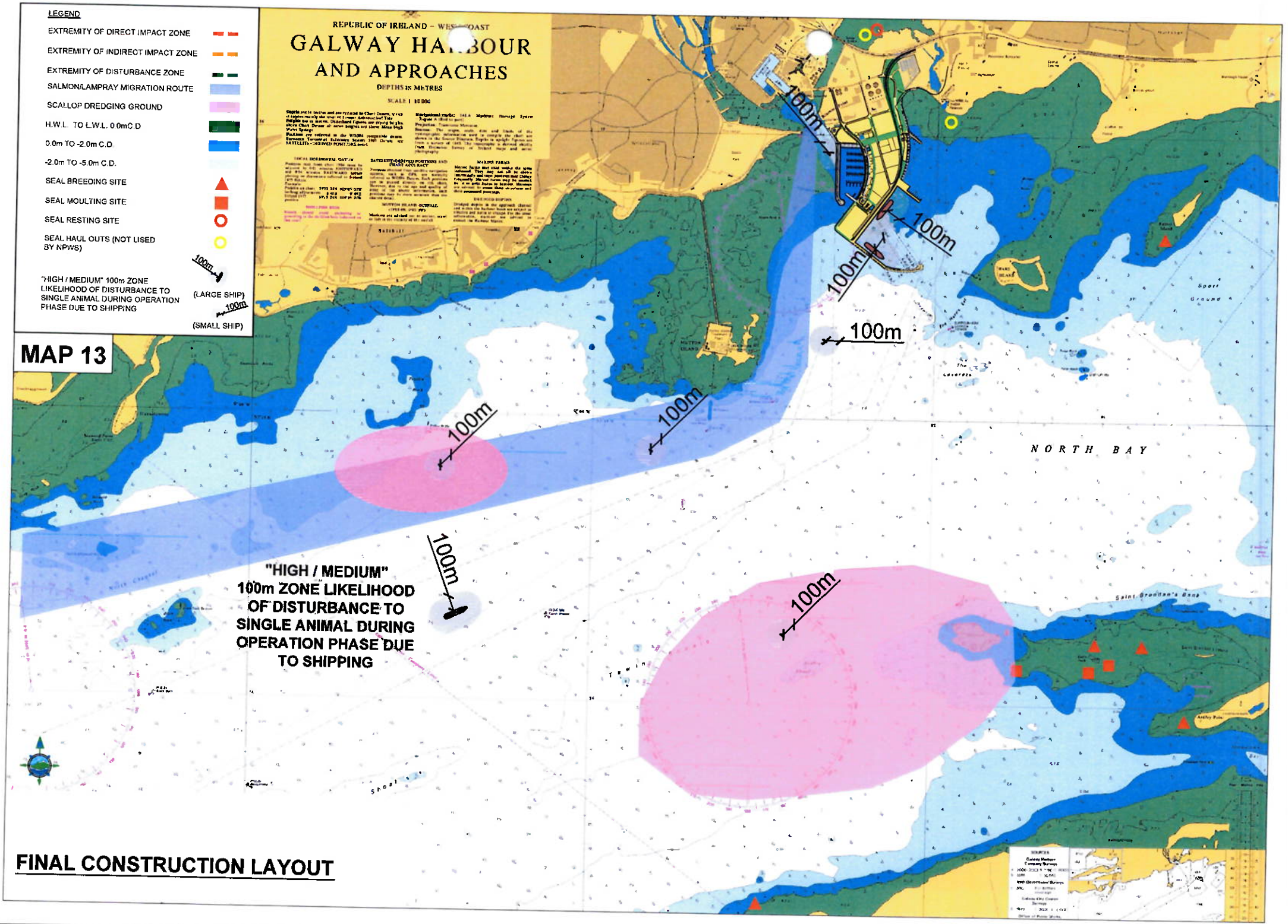

LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
MAP 8
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
CONSTRUCTION ELEMENT 10
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2148-A


LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 9
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
Saint Brendan's Bank
CONSTRUCTION ELEMENT 11
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2149-A


LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR
AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 10
100m
100m
100m
100m
"HIGH / MEDIUM"
100m ZONE LIKELIHOOD
OF DISTURBANCE TO
SINGLE ANIMAL DURING
OPERATION PHASE DUE
TO SHIPPING
NORTH BAY
CONSTRUCTION ELEMENT 12
PLEASE REFER TO CONSTRUCTION
SEQUENCE DRAWING NO. 2139-2149-A


LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
100m
(LARGE SHIP)
100m
(SMALL SHIP)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR
AND APPROACHES
DEPTHS IN METRES
SCALE 1 10 000
MAP 11
100m
100m
100m
100m
NORTH BAY
"HIGH / MEDIUM"
100m ZONE LIKELIHOOD
OF DISTURBANCE TO
SINGLE ANIMAL DURING
OPERATION PHASE DUE
TO SHIPPING
CONSTRUCTION ELEMENT 13
PLEASE REFER TO CONSTRUCTION
SEQUENCE DRAWING NO. 2139-2150-A


LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D.
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
100m
(LARGE SHIP)
100m
(SMALL SHIP)
REPUBLIC OF IRELAND - WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1:10000
MAP 12
100m
100m
100m
100m
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
NORTH BAY
Spiddal
CONSTRUCTION ELEMENT 14
PLEASE REFER TO CONSTRUCTION SEQUENCE DRAWING NO. 2139-2150-A


LEGEND
EXTREMITY OF DIRECT IMPACT ZONE
EXTREMITY OF INDIRECT IMPACT ZONE
EXTREMITY OF DISTURBANCE ZONE
SALMON/LAMPRAY MIGRATION ROUTE
SCALLOP DREDGING GROUND
H.W.L. TO L.W.L. 0.0mC.D
0.0m TO -2.0m C.D.
-2.0m TO -5.0m C.D.
SEAL BREEDING SITE
SEAL MOULTING SITE
SEAL RESTING SITE
SEAL HAUL OUTS (NOT LISED BY NPWS)
100m
(LARGE SHIP)
100m
(SMALL SHIP)
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
REPUBLIC OF IRELAND – WEST COAST
GALWAY HARBOUR AND APPROACHES
DEPTHS IN METRES
SCALE 1 : 10 000
MAP 13
100m
100m
100m
100m
100m
100m
100m
NORTH BAY
"HIGH / MEDIUM" 100m ZONE LIKELIHOOD OF DISTURBANCE TO SINGLE ANIMAL DURING OPERATION PHASE DUE TO SHIPPING
Saint Brendan's Bank
FINAL CONSTRUCTION LAYOUT

JULIANNA ODONOGHUE
ARCHAEOLOGICAL SERVICES

Project: Galway Harbour Extension

Title: Addendum to Archaeological Chapter 13.2 of EIS

Written by: Julianna O'Donoghue

Date: December 2014

Address: Julianna O'Donoghue Archaeological Services, 61 Lady's Cross, Clonakilty, Co. Cork.
Web: www.jodas.ie **Email:** info@jodas.ie **Phone:** (023) 8858707 / (086)3844831

Contents

1 Introduction

This report is an addendum to the Galway Harbour Extension EIS produced by Tobin Consulting Engineers on behalf of Galway Harbour Company. The archaeological section of the EIS was undertaken by Laurence Dunne Archaeology (Dunne & O'Donoghue, 2011) and included the results of a desktop study, and geophysical and dive surveys. This document details the recent discovery of potential shipwreck material within the proposed development.

2 Discovery of Potential Wreck Site

Following the completion and submission of the EIS potential wreck material was discovered by divers in Galway Harbour. It was located close to mooring buoy D1 at 53° 15'.38N, 09° 02'.42W (Figure 1). The material was incidentally uncovered when an air dredge was used to excavate sediment in order to release the keel of a modern yacht from the seabed. The divers noted that their excavation revealed the remains of a possible wooden vessel at a depth of 1m below the existing seabed. They encountered timber possibly belonging to a vessels' frame, several sods of turf, and bone. A sample of the timber and bone was recovered from the site.

3 Analysis of Material

The two recovered objects were inspected by the author. The timber is provisionally identified as Quercus Sp. It comprises a heavily eroded and terredo infested amorphous fragment of timber measuring 480mm by 120mm by 90mm. None of the original surfaces survive. A disintegrated fixing is represented by beads of oxidisation on the narrow face.

The bone sample is identified by Osteo-archaeologist Margaret McCarthy as an adult cow's left scapula.

4 Discussion

Section *13.2.4.1.* of the EIS contains a comprehensive description of the shipwrecks of Galway Harbour. The Shipwreck Inventory compiled by the National Monuments Service lists six wreckings which occurred in proximity to the proposed development site;

- *Friendship* a Dublin ship was en route from Norway to Galway, when she went ashore in 1750 in the Galway River.
- *Royal Charlotte* was en route from Quebec to London in 1762 when she sprung a leak at sea, and while going into Galway River ran ashore and filled with water.

- St. Patrick, a barque was carrying a valuable cargo was blown out the dock and driven onto the shore in1839.
- *Curbat*, a Dublin smack of 32 ton was fishing in Galway Bay in 1882 when she became stranded at Renmore Point.
- *Ocean Queen*, wooden fishing hooker weighing 12 tons was moored in the new dock, in ballast, when she was involved in a collision with the steam tug Conqueror, of Glasgow, and became a total loss. 1887.
- *The Blackstone*, an unspecified wooden sailing vessel, was stranded at the entrance to Lough Atalia in 1830.

There are at least eighty two shipwrecks recorded in the Shipwreck Inventory of Wrecks for Galway Bay (listed in Appendix 13.2.4 of the EIS). These wrecks date to between 1750 and 1938 of which the vast majority are from the 19th century. Most were lost during stormy weather conditions, with the vessel being driven ashore. There are of course a much greater number of wrecking events in Galway Bay which were never documented.

Presently, the amorphous nature of the recent finds recovered by the divers represents potential or anecdotal evidence that warrants an underwater archaeological investigation. In the absence of archaeological testing it is not possible to determine what type of vessel the wood sample represents.

5 Mitigation Measures

Following consultation with Ms. Connie Kelleher of the Underwater Archaeological Unit of the National Monuments Service, it is recommended that underwater targeted test trenches be excavated in the area that the timbers were noted by the divers. All of the archaeological mitigation measures associated with the underwater component of the Galway Harbour Extension are listed below.

5.1 Underwater Archaeological Testing of Wreck Material

The location of the recovered material identified by the divers shall be subjected to a targeted test excavation licensed by the National Monuments Service in order to establish the precise nature, and context of the material. Should coherent remains of a historic vessel be uncovered during the archaeological testing further mitigation measures may be necessary including full excavation of the wreck.

5.2 Archaeological Monitoring

All dredging works in the proposed development site shall be archaeologically monitored under licence by experienced maritime archaeologists with a proven track record in equivalent, similar type work. A detailed monitoring strategy will be agreed between the appointed archaeologist, the underwater archaeological unit of the National Monuments Service and the National Museum of Ireland. This will include agreement on an appropriate finds retrieval strategy, the number of personnel, communication policy and reporting of potential finds. An archaeological dive team shall remain on stand-by for the duration of the dredging operations.

5.3 Archaeological Testing of Lagoons

The seabed deepening will be undertaken by a trailer suction hopper dredger and a back-hoe dredger that will redeposit the dredged sediment in constructed lagoons within the proposed development site where it will be left to dry. These dried lagoons shall be archaeologically tested to recover any potential archaeological artefacts in the sediment. The archaeological testing shall involve a program of artefact sieving and licensed metal detection thus maximising artefact recovery. A detailed testing methodology will be agreed between the appointed archaeologist, the underwater archaeological unit of the National Monuments Service and the National Museum of Ireland.

5.4 Discovery of Archaeological Material

In the event of archaeological material, wreckage, timbers or other artefacts being recorded in the course of the monitoring, the dredging will cease in the immediate area to allow the archaeologist to recover and record any such material. The recovered items shall be placed in temporary wet storage tanks provided on the dredger.

In the event that the dredging operations impacts on a possible archaeological site, then the dredger will be moved to a different area while the standby archaeological dive team is mobilised to undertake an initial assessment of the material. This initial assessment will determine the nature, extent and significance of the archaeological remains. Based on the results of the initial assessment, further archaeological mitigation measures will be agreed upon with the National Monuments Service and the National Museum of Ireland. These

mitigation measures may involve further investigative, targeted excavations and / or potentially full excavation.

Suitable artefact storage facilities shall be in place prior to the commencement of dredging operations. This will include the placement of small tanks on board the dredging vessel and a larger storage facility nearby on land for the storage and processing of artefacts retrieved during the dredging operations. Provision will be place for the full recording, analysis and long term conservation of artefacts recovered during the project.

6 Figures

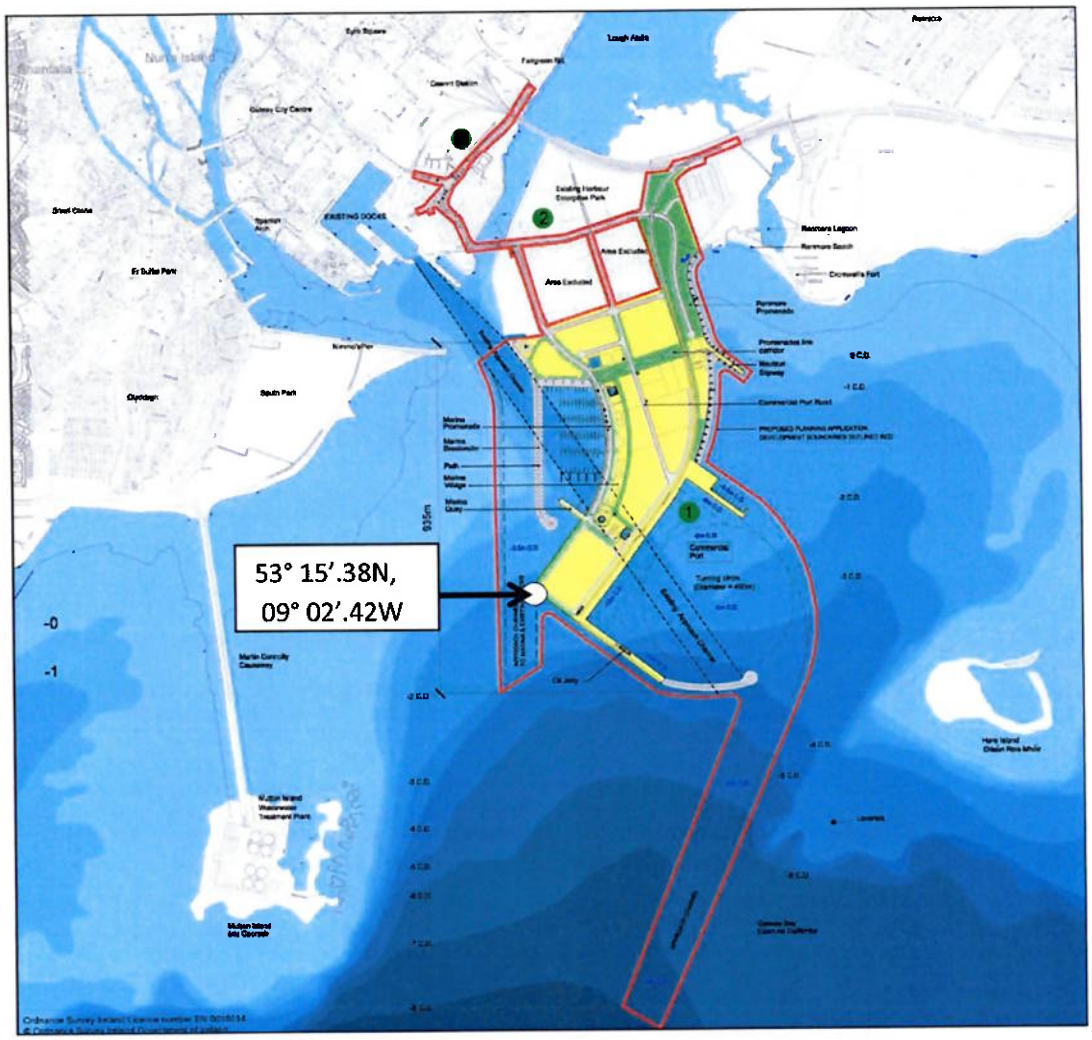


Figure 1: Site location plan showing location of recovered timber and bone fragments

7 Plates

Plate 1: View of recovered fragment of timber.

Plate 2: View of recovered animal bone