

Article 6(3) Appropriate Assessment Screening Report

Burkeway Bearna Strategic
Housing Development



Table of Contents

1.	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Appropriate Assessment.....	1
1.2.1	Screening for Appropriate Assessment.....	1
1.2.2	Statement of Authority.....	2
2.	DESCRIPTION OF THE PROPOSED DEVELOPMENT.....	3
2.1	Site Location.....	3
2.2	Characteristics of the Proposed Development.....	3
2.2.1	Development Description.....	3
2.2.2	Description of the Baseline Ecological Environment.....	4
3.	IDENTIFICATION OF RELEVANT EUROPEAN SITES.....	9
3.1	Identification of the European Sites within the Likely Zone of Impact.....	9
3.2	Galway Bay Assimilative Capacity Assessment.....	10
3.3	European Sites with the Potential to be Significantly Affected by the Proposed Development.....	25
3.4	Likely Cumulative Impact of the Proposed Development on European Sites, in-combination with other plans and projects.....	25
4.	ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS.....	26
4.1	Data Collected to Carry Out Assessment.....	26
4.2	Concluding Statement.....	26
	BIBLIOGRAPHY.....	27

TABLE OF PLATES

<i>Plate 2.1 Scrub, Bracken and Acid Grassland mosaic which characterises much of the proposed development site.</i>	5
<i>Plate 2.2 Spoil and Recolonising Bare Ground over the western sections of the site, together with scrub/bracken/acid grassland mosaic.</i>	6
<i>Plate 2.3 The Trusky Stream, located at the eastern edge of the proposed development site (within the red line boundary but outside the main construction footprint).</i>	7
<i>Plate 2.4 Wet Grassland/Marsh habitat recorded along the margins of the Trusky Stream.</i>	8

TABLE OF TABLES

<i>Table 3.1 Identification of Designated sites within the Likely Zone of Impact.</i>	12
---	----

APPENDICES

Appendix 1 – Galway Bay Assimilative Capacity Modelling Study Report	
--	--

1. INTRODUCTION

1.1 Background

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Stage One Screening for Appropriate Assessment in respect of a proposed strategic housing development (SHD) consisting of 121 no. dwelling houses together with a crèche facility, associated outdoor play areas and car parking; a footpath connectivity link along the L-1321; shared communal and private open space; car and bicycle parking; site landscaping and public lighting; decommissioning of the existing wastewater treatment plant and provision of all services; access from the L-1321 via the Cnoc Fraoigh development and all associated site development works; and a public linear park along the Trusky Stream. The proposed development is located in the townlands of Trusky East, Trusky West, Freeport and Ahaglugger, Bearna, Co. Galway.

Screening for Appropriate Assessment is required pursuant to Article 6(3) of Directive 92/43/EEC (the Habitats Directive) and Part XAB of the Planning and Development Act 2000, as amended (“the 2000 Act”). Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The project is not directly connected with, or necessary for, the management of any European Site and, consequently, the project is subject to the Appropriate Assessment Screening process.

The assessment in this report is based on a desk study and field surveys undertaken in May 2018 and August, September and November 2019. A follow up ecological multi-disciplinary survey was also undertaken on 19 May 2020. It specifically assesses the potential for the proposed development to result in significant effects on European sites in the absence of any best practice, mitigation or preventative measures.

This Appropriate Assessment Screening Report has been prepared in accordance with the European Commission’s Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and Managing Natura 2000 Sites: the provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment’s Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.
2. EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.

1.2 Appropriate Assessment

1.2.1 Screening for Appropriate Assessment

The purpose of a (Stage One) screening exercise for Appropriate Assessment is to determine whether it is necessary to carry out a Stage Two Appropriate Assessment of the implications for a European site of a project. The trigger for the requirement for an Appropriate Assessment is that the project, either individually or in combination with other plans or projects, is “likely to have a significant effect” on the European site.

It is clear that the trigger for an Appropriate Assessment is a very light one, and that the mere probability or a risk that a project might have a significant effect is sufficient to require an Appropriate Assessment to be undertaken. Under Part XAB of the 2000 Act, screening for Appropriate Assessment must be carried out by the competent authority. As per Section 177U, 'A screening for appropriate assessment shall be carried out by the competent authority to assess, in view of best scientific knowledge, if... a proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site'. The competent authority shall determine that an Appropriate Assessment of a proposed development is required if it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.' The competent authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and must be recorded.

Whereupon the carrying out of a Stage One screening, it is determined by the competent authority that a Stage Two Appropriate Assessment is required, an applicant for permission must prepare and submit a Natura Impact Statement to the competent authority.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provisions of section 177U of the 2000 Act.

1.2.2

Statement of Authority

A baseline ecological survey was undertaken on the 31st May 2018, the 30th August 2019 and 19th September 2019 by Pat Roberts (BSc, MCIEEM) of MKO. An additional site visit was conducted on the 29th of November 2019 by Pat Roberts and Sara Fissolo (BSc) of MKO, to carry out kick sampling on the Trusky stream and to obtain aerial imagery of the proposed development site using drone footage.. An additional ecological walkover of the site was undertaken on 19 May 2020, which confirmed the results of the surveys that were previously undertaken. This report has been prepared by Sara Fissolo. The report has been reviewed by Sarah Mullen (BSc, PhD) and by Pat Roberts (BSc, MCIEEM) who has over 14 years' experience in ecological assessment. The following data and information was among that which was considered when carrying out this assessment:

- Review of NPWS Site Synopses, Conservation Objectives for the European Sites
- Review of 2019, 2013 and 2007 EU Habitats Directive (Article 17) Reports.
- Review of ecological information from previous applications on the site.
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA and Water Framework Directive (WFD).
- Review of OS maps and aerial photographs of the site of the proposed development.
- Field visits undertaken by MKO ecologists during May 2018, August, September and November 2019, and May 2020.
- Review of the Galway County Development Plan 2015-2021 and all associated Environmental Reports.
- Review of Variation 2(a) of the Galway County Development Plan 2015-2021 and all associated Environmental Reports.
- Review of the Natura Impact Statement that was prepared for the N6 Galway City Ring Road (Arup 2018)]
- Review of the Galway Transport Strategy (2016)

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed development site is located in the townlands of Trusky East, Trusky West, Freeport and Ahaglugger, Bearna, Co. Galway, approximately 6km to the west of Galway City (I.G. Ref.: M 23388 23615). The site is accessed via an existing residential development at Trusky East called Cnoc Fraoigh, off the Bearna Road. The subject lands measure approximately 5.38 hectares in area.

The site location is shown in Figure 2.1.

2.2 Characteristics of the Proposed Development

2.2.1 Development Description

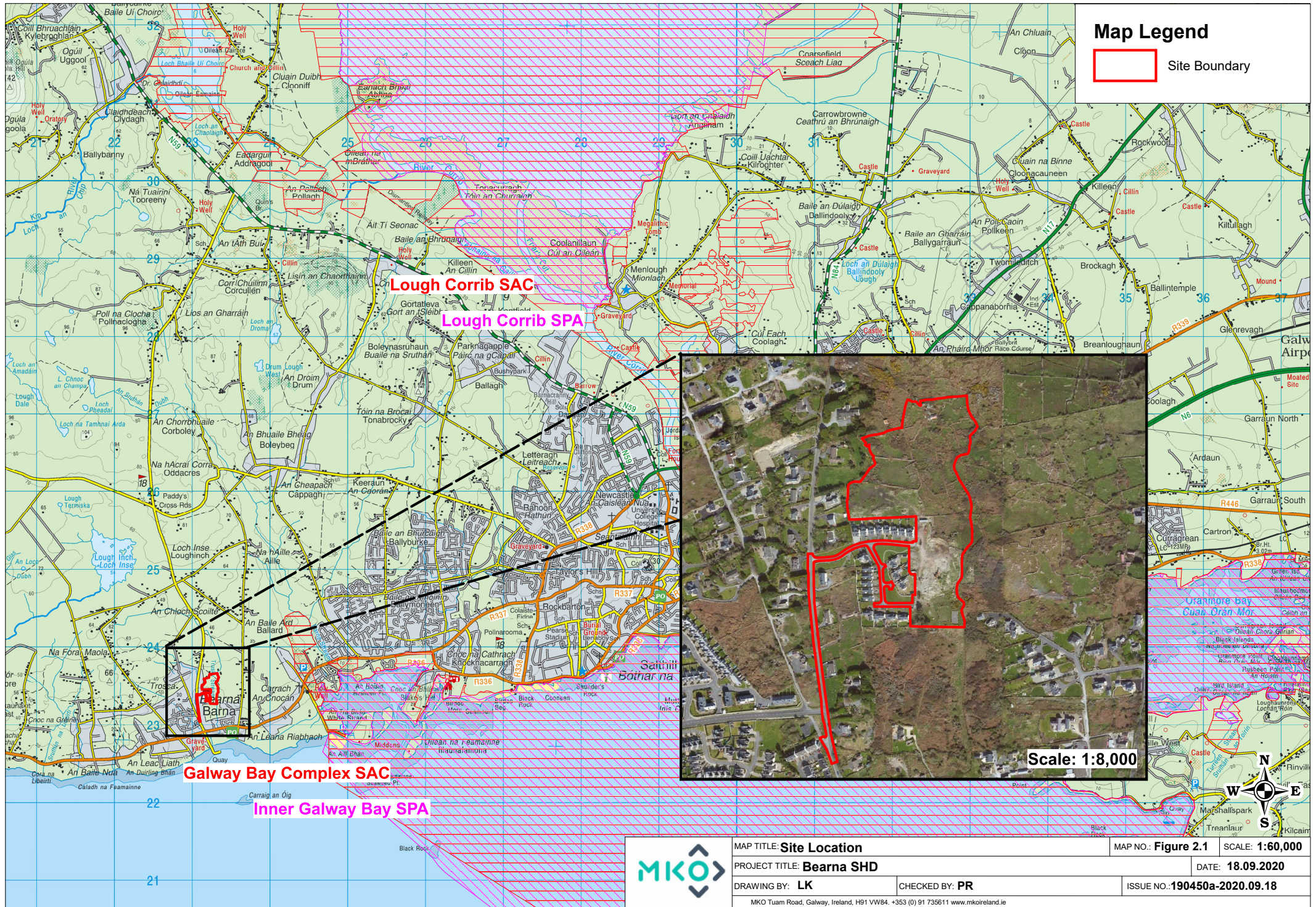
The planning application in respect of the proposed development is made under the Strategic Housing Development (SHD) provisions of the Planning and Development (Housing) and Residential Tenancies Act, 2016.

The proposed development will consist of:

- 1) Demolition of existing outbuildings
- 2) Construction of 121 no. residential units comprising
 - 52 no. houses (37 no. three-beds, 15 no. four-beds)
 - 4 no. duplex units in Duplex Block D1 (2 no. two-beds (ground floor units) and 2 no. three-beds (2 storey units))
 - 8 no. duplex units in Duplex Block D2 (4 no. two-beds (ground floor units) and 4 no. three-beds (2 storey units))
 - 6 no. duplex units in Duplex Block D3 (3 no. two-beds (ground floor units) and 3 no. three-beds (2 storey units))
 - 14 no. duplex units in Duplex Block D4 (7 no. two-beds (ground floor units) and 7 no. three-beds (2 storey units))
 - 4 no. duplex units in Terrace Block T5 (2 no. two-beds (ground floor units) and 2 no. three-beds (2 storey units))
 - 14 no. Apartments in Apartment Block A1 (5 no. one-beds, 9 no. two-beds)
 - 13 no. Apartments in Apartment Block A2 (4 no. one-beds, 9 no. two-beds and a Multipurpose Room)
 - 2 no. Apartments in Apartment Block A3 (2 no. two-beds)
 - 4 no. Apartments in Apartment Block A4 (4 no. two-beds)
- 3) Development of a crèche facility (224.80 sqm), associated outdoor play areas and parking
- 4) Provision of a footpath connectivity link along the L-1321
- 5) Provision of shared communal and private open space, car and bicycle parking, site landscaping and public lighting, decommissioning of the existing wastewater treatment plant and provision of all services, access from the L-1321 via the Cnoc Fraoigh development and all associated site development works

Map Legend

 Site Boundary



Scale: 1:8,000

	MAP TITLE: Site Location	MAP NO.: Figure 2.1	SCALE: 1:60,000	
	PROJECT TITLE: Bearna SHD	DATE: 18.09.2020		
	DRAWING BY: LK	CHECKED BY: PR	ISSUE NO.: 190450a-2020.09.18	
	<small>MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie</small>			



REV	DATE	DESCRIPTION	BY
2	16/04/2020	Revised for Overlooking Distances	AR
3	22/04/2020	Revised for Parking	AR
4	08/05/2020	Revised for A3.4 Apartments, T3, Bin Store & Numbering	AR
5	14/05/2020	Import Landscape MP	AR
6	15/05/2020	Revised for Road Levels	AR
7	21/05/2020	Revised T5 Area, Boundary	AR
8	28/05/2020	Bike & Apartment Blocks Stores	AR
9	05/06/2020	Revised Landscaping	AR
10	23/06/2020	Revised Boundary Line	AR
11	29/06/2020	Revised Bike Storage	AR
12	08/10/2020	Issued for SHD Application	AR

LEGEND	DESCRIPTION
	Site Boundary
	Proposed Ground Floor Level
	Spot Height
	Unit Number
	Unit Type

SHD APPLICATION

NORTH POINT

ONLY FOR REFERENCE WITH EXAMINERS

APPROVED BY *Stewart*

Client: BURKEWAY HOMES LTD

Project: BEARNA RESIDENTIAL DEVELOPMENT

Title: PROPOSED SITE LAYOUT PLAN

Sheet No.: 924-MDO-XX-XX-DR-01101

Scale as: 1:500 (A1) Current Rev: 12 Project No.: 924

MC CAULEY DAYE O'CONNELL
ARCHITECTS

11 Merrion Square, Dublin 2, Ireland
Telephone: +353 (0)1 400 4171
info@mdo.ie | www.mdo.ie

6) Provision of a public linear park along the Trusky Stream.

The proposed site layout (excluding the footpath and services that are proposed in the public road network to the west and assessed as part of this report) is provided in Drawing 924 MDO-XX-XX-DR-01101.

2.2.2

Description of the Baseline Ecological Environment

Assessing the impacts of any project and associated activities requires an understanding of the ecological baseline conditions prior to and at the time of the project proceeding. Ecological baseline conditions are those existing in the absence of proposed activities (CIEEM 2018).

Much of the site is highly modified from its natural condition and is characterised by **Spoil and Bare Ground [ED2]**. The remaining sections primarily consist of a mosaic of **Dry Humid Acid Grassland [GS3]**, **Scrub [WS1]** and **Dense Bracken [HD1]** (**Error! Reference source not found.**) which showed signs of grazing and trampling from cattle. Typical species in the grasslands included fescues (*Festuca spp.*), sweet vernal grass (*Anthoxanthum odoratum*), meadow foxtail (*Alopecurus pratensis*), self heal (*Prunella vulgaris*), tormentil (*Potentilla erecta*). Species indicative of disturbance and improvement such as nettle (*Urtica dioica*), spear thistle (*Cirsium vulgare*) and hogweed (*Heracleum sphondylium*) were also common. The scrub was dominated by bramble (*Rubus fruticosus agg.*) with some blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*) and gorse (*Ulex europeaus*).

Other habitats within the development boundary include **Recolonising Bare Ground [ED3]** (**Error! Reference source not found.**), two derelict sheds at the north-west corner of the site classified as **Buildings and Other Artificial Surfaces [BL3]** and stone walls throughout the site **classified as Stone walls and other stonework (BL1)**. There are some isolated protrusions of granite bedrock within the site with species such as wild thyme (*Thymus praecox*) and English stonecrop (*Sedum anglicum*) present. Where they exist, these features are very small and often associated with old stone walls. Wall pennywort (*Umbilicus rupestris*) was recorded on the old stone walls along with extensive growth of lichens. Typical species in the recolonizing bare ground habitats included coltsfoot (*Tussilago farfara*), ribwort plantain (*Plantago lanceolata*) and black medick (*Medicago lupulina*) with pineapple weed (*Matricaria discoidea*), daisy (*Bellis perennis*) and herb Robert (*Geranium robertianum*).

A large concrete attenuation tank is located at the southern end of the proposed development site, indicating an existing waste water treatment area. A small patch of **Wet Grassland [GS4]** was also recorded in this area. A small, non native **Tree Line (WL2)** (*Pinus sp.*) is located in the south western corner of the site and is adjacent to the existing housing estate and not connected to any other tree line or hedgerow habitat in the wider area.

The connection to the public sewerage network and all road and footpath improvement works between the proposed residential site and Bearna village are located in existing road and path infrastructure classified as **Buildings and artificial surfaces (BL3)**.

A section of the Trusky Stream is located within the proposed development site, however it is located over 10 metres at its nearest point to the east of the main construction footprint and is separated from the construction area by a natural vegetation buffer. The stream is considerably further away than this distance over the majority of the boundary, thus retaining a largely undisturbed riparian zone. The only works that will be undertaken in this area are the construction of two surface water outfalls to the stream and minor landscaping works. It is classified as an **Upland Eroding River [FW1]**. The watercourse was approximately 1-2 metres wide and was typically less than 0.3m deep throughout most of its length within the proposed development site. The stream is vegetated by species including fool's watercress (*Apium nodiflorum*), watercress (*Nasturtium officinale*) and the aquatic moss *Fontinalis antipyretica*, while gorse (*Ulex europeaus*) and bramble (*Rubus fruticosus*) scrub characterised the banks (**Error! Reference source not found.**) **Wet Grassland [GS4]** habitat grading into **Marsh (GM1)** was identified in small patches along the flood plain of the Trusky stream (**Error! Reference source not found.**). The s

pecies in this habitat are dominated by creeping bent (*Agrostis stolonifera*), floating sweet grass (*Glyceria fluitans*), yellow iris (*Iris pseudacorus*), marsh ragwort (*Senecio aquatica*) and meadowsweet (*Filipendula ulmaria*). The stream discharges to Galway Bay approximately 690m downstream of the proposed development, approximately 1.5km to the west of Galway Bay Complex cSAC and Inner Galway Bay SPA.

No Annex I habitats or Annex II plant species associated with any nearby European sites were recorded within or adjacent to the proposed development site. No botanical species listed under the Flora (Protection) Order, 2015, listed in the EU Habitats Directive (92/43/EEC) or the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended were recorded on the site.

No otter resting or breeding sites were identified within the site boundary. However, otter spraint was recorded within the Trusky Stream during a walkover survey on 29 November 2019, and otter are likely to use this watercourse to some extent for foraging and commuting though due to its small size and nature, it does not provide significant habitat for this species. Otter is listed as a Qualifying Interest of Galway Bay Complex cSAC.

No other Annex II species or SCI bird species associated with any nearby European Sites were recorded during the site ecological surveys undertaken. The site did not provide important habitat for any species listed on Annex II of the EU Habitats Directive or Annex I of the EU Birds Directive species or any other bird species that is among the SCIs of any nearby SPA.



Plate 2.1 Scrub, Bracken and Acid Grassland mosaic which characterises much of the proposed development site.



Plate 2.2 Spoil and Recolonising Bare Ground over the western sections of the site, together with scrub/bracken/acid grassland mosaic.



Plate 2.3 The Trusky Stream, located at the eastern edge of the proposed development site (within the red line boundary but outside the main construction footprint).



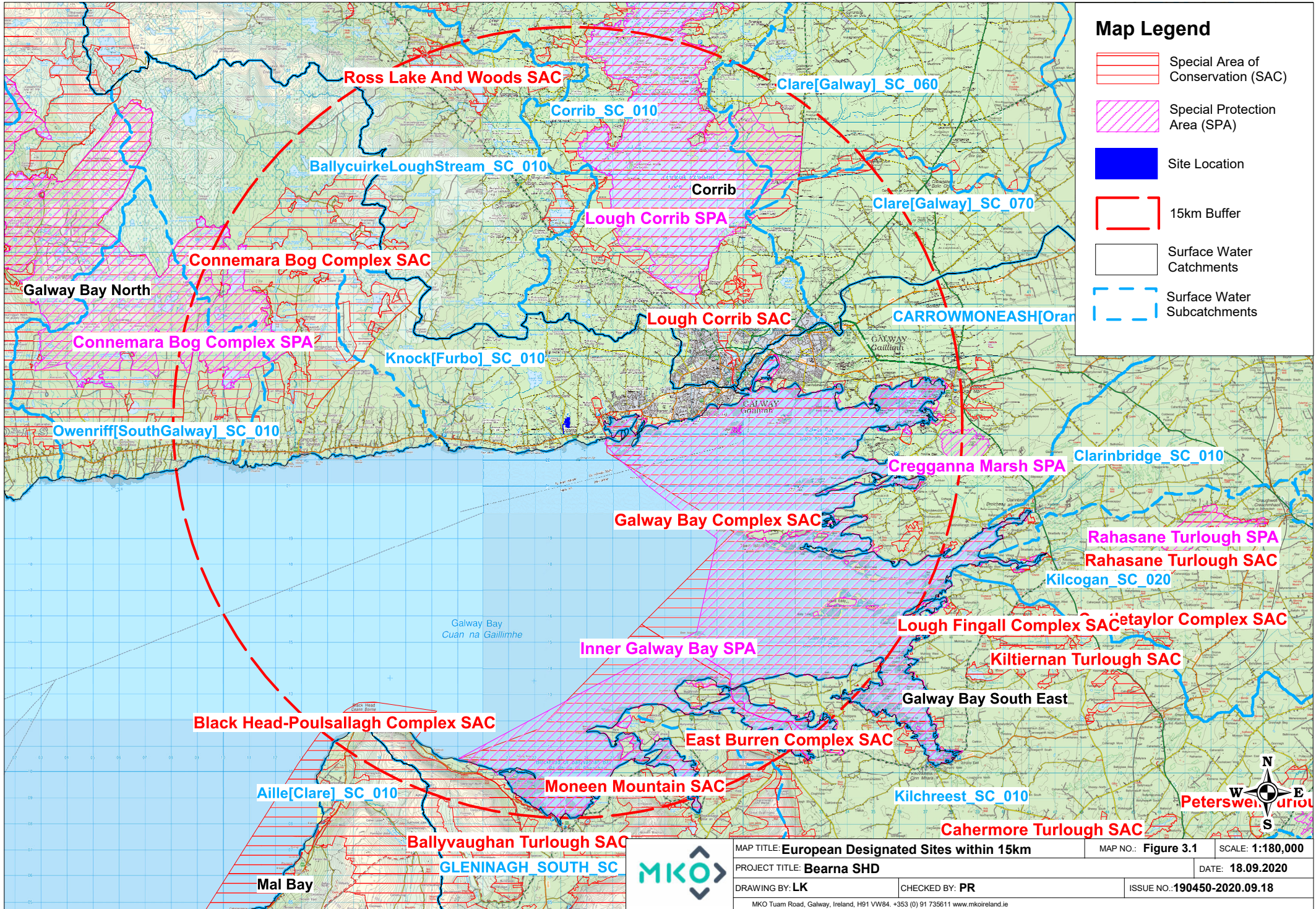
Plate 2.4 Wet Grassland/Marsh habitat recorded along the margins of the Trusky Stream

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the proposed development:

1. Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on 9th October 2020. The datasets were utilized to identify European Sites which could potentially be affected by the proposed development.
2. All European Sites within a distance of 15km surrounding the development site were identified and are shown on Figure 3.1.
3. There is no potential connectivity between the proposed development site and any terrestrially-based European site located at a distance of greater than 15km. No potential habitat connectivity, hydrological connectivity or any other connection that could result in likely significant effects on these sites was identified.
4. In addition, for the reasons set out in detail below, whilst the potential for significant effects on marine-based European sites within Galway Bay located over 15km from the site of the proposed development was considered, likely significant effects may be excluded on the basis of the assimilative capacity of Galway Bay.
5. The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the proposed development and any European Sites. The hydrological catchments are also shown in Figure 3.1.
6. In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the Scottish Natural Heritage (SNH) Guidance, 'Assessing Connectivity with Special Protection Areas (SPA)' (2016) was consulted. This document provides guidance in relation to the identification of connectivity between proposed development and Special Protection Areas. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
7. Table 3.1, provides details of all relevant European Sites as identified in the preceding steps, which are within the likely Zone of Impact. The assessment considers any potential for any direct or indirect impacts of the proposed development, both alone and in combination with other plans and projects, on European Sites by virtue of the following criteria: size and scale, land-take, distance from the European Site or key features of the site, resource requirements, emissions, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this screening assessment
8. The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of finalising this report in October 2020.
9. Figure 3.1 shows the location of the proposed development in relation to all European sites within 15km of the proposed development.
10. Figure 3.2 shows the location of the proposed development in relation to all other European Sites within Galway Bay along with the mapped pollutant distribution from the assimilative capacity study.

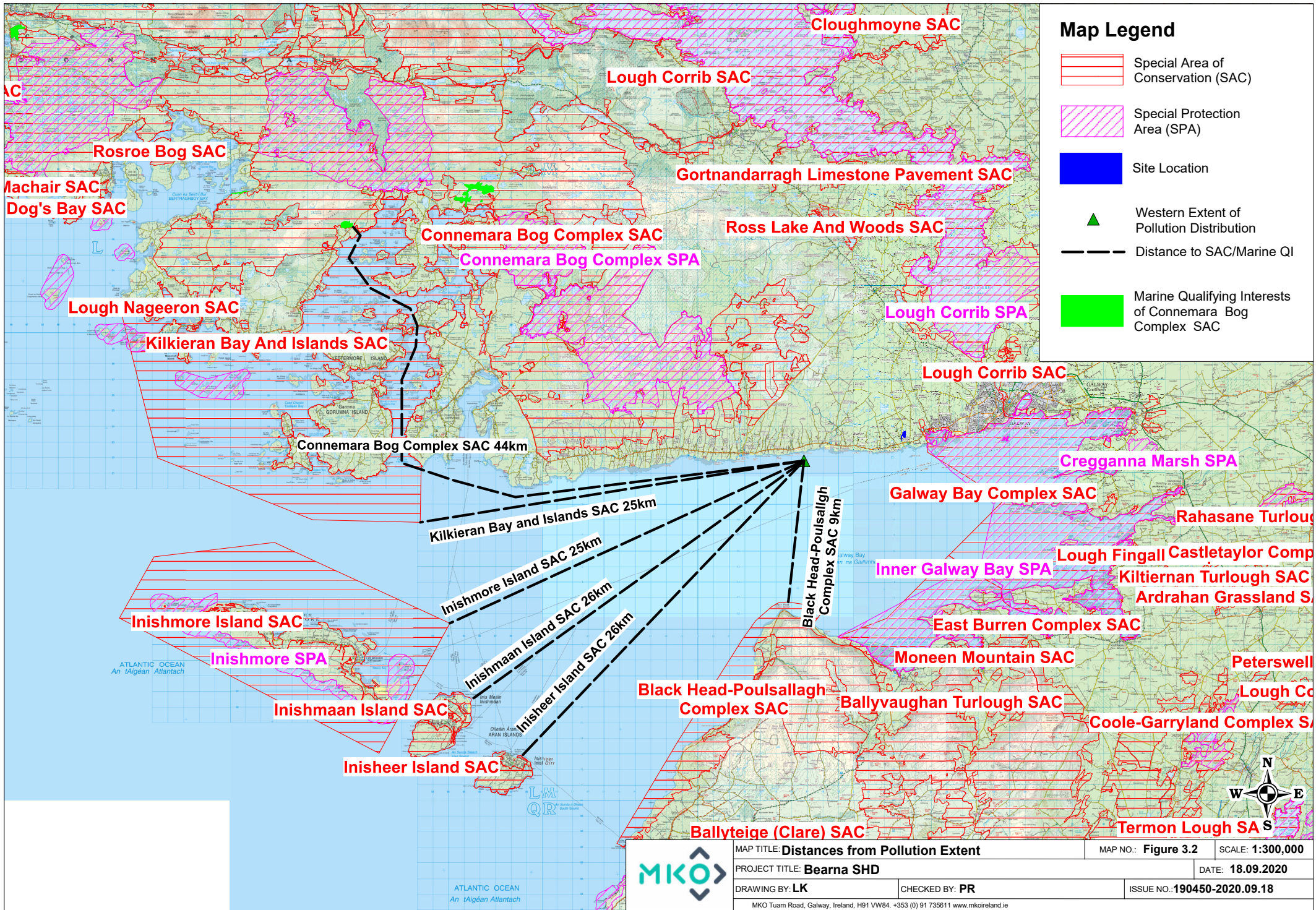


Map Legend

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Site Location
- 15km Buffer
- Surface Water Catchments
- Surface Water Subcatchments

MAP TITLE: European Designated Sites within 15km		MAP NO.: Figure 3.1	SCALE: 1:180,000
PROJECT TITLE: Bearna SHD			
DRAWING BY: LK		CHECKED BY: PR	
DATE: 18.09.2020		ISSUE NO.: 190450-2020.09.18	
MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie			





11. Where potential for any pathways for Significant Effect are identified, the site is included within the Likely Zone of Impact and is further considered as part of the Stage One screening assessment.
12. There is absolutely no reliance placed in this AASR on (a) measures intended to avoid/reduce harmful effects on the European sites, (b) construction management/best practice measures, or (c) any other measures (such as SUDS) which are proposed with no relation to the intention of avoiding or reducing any potentially harmful effect of the development on any European site.

3.2 Galway Bay Assimilative Capacity Assessment

In order to support the assessments carried out in the Appropriate Assessment Screening Report and the Environmental Impact Assessment Report, MSN_HYDRO was commissioned to undertake an Assimilative Capacity Study of Galway Bay. The purpose of this study was to assess the capacity of Galway Bay to assimilate a potential pollutant discharge from the proposed development to the Trusky Stream which drains the proposed SHD lands. The Galway Bay Assimilative Capacity Assessment Report is submitted as Appendix 1 to this AASR.

As set out in the Assimilative Capacity Assessment Report, a hydrodynamic module was used to calculate water circulation patterns (currents) throughout Galway Bay, based on tidal dynamics and River Corrib flows. Using these currents, the pollutant transport module calculated the transport of pollutants around the Bay based on a scenario where pollutant loads from an extreme event are introduced into Galway Bay from the proposed development site, via the Trusky Stream. The Galway Bay model is highly resolved both spatially and temporally. The model resolves all parameters on a 100m x 100m grid throughout the bay at every 40 seconds. The model contains 176 grid points north-south and 290 grid points east-west, giving a total of 51,040 computational cells in the model.

Adopting a precautionary approach, a pollutant discharge scenario was devised for the highly unlikely event of a diesel spill into the Trusky Stream. In this scenario, a potential pollution event was modelled, in the absence of any mitigation measures, involving 300l of diesel, containing 250mg/l of active pollutant, being accidentally spilled and entering the stream during an extreme flood event. The peak of a large flow event will bring the pollutant load to Galway Bay in the shortest time and hence in a highly concentrated mass; this is a conservative approach to specifying the pollutant load.

In order to ensure a robust appraisal of the assimilative capacity of Galway Bay, it was conservatively assumed that the pollutant is not diluted along the stream as it travels from the site to the confluence with Galway Bay. Moreover, conservative pollutant and hydraulic loads were specified to the model and the model was run for 2 full 14-day spring-neap tidal cycles. The results are then analysed and assimilative capacity was assessed.

Time series were included at 10 analysis points in Galway Bay; including the nearest points of three European sites to the discharge location of the Trusky Stream into Galway Bay and other locations in relation to other European sites that are located further west in Galway Bay.

As appears from the conclusions of the Assimilative Capacity Study Report, the study focused on analysing concentrations and dilution factors at 10 points, including:

1. Inner Galway Bay SPA (E124675 N 222655)
2. Galway Bay Complex cSAC (E124755 N222784)
3. Black Head-Poulsallagh Complex cSAC

Other points analysed included the discharge location of the Trusky Stream into Galway Bay (at Bearna Pier) and points plotted to demonstrate where the concentration and dilution of the pollutant are reduced to trace levels to the west of the entry point into Galway Bay. Figure 6 in the Report demonstrated the extent of the spill in the context of the European sites that are located further west in Galway Bay.

The synoptic maps of concentration contours throughout Galway Bay referenced in the Report show:

- The pollutant plume tends to spread out along the northern side of Galway Bay and is not transported widely throughout the domain
- Either no pollutant or very low levels of pollutant are observed in large parts of Galway Bay
- Concentrations reduce rapidly with distance from the discharge location
- Concentrations reduce rapidly with time.

The main conclusions from this analysis are:

- (i) the highest concentration calculated is at the outfall site (at Bearna Pier). At this point the peak concentration is $5\mu\text{g/l}$ once the diesel has mixed within the grid cell where it enters Galway Bay. This is a low value, and after this peak the concentrations fall off rapidly. The dilution factor just after the time of peak concentration is around 2000; dilution rapidly increases to around 17,000 over time.
- (ii) at the nearest point of Inner Galway Bay SPA, peak concentration was approximately $0.0016\mu\text{g/l}$, with dilution factors soon after of 15,000. The dilution factors vary with tidal volume and transport of the pollutant plume.
- (iii) at the nearest point of Galway Bay Complex cSAC, results are very similar to results at the nearest point of Inner Galway Bay SPA, with peak concentration of approximately $0.0016\mu\text{g/l}$, with dilution factors soon after of 15,000. The dilution factors vary with tidal volume and transport of the pollutant plume.
- (iv) the model results confirmed that the pollutant does not get transported to the location of Black Head-Poulsallagh Complex cSAC;
- (v) all other points show concentrations less than at Bearna Pier, and the nearest points of the nearest point of Inner Galway Bay SPA and Galway Bay Complex cSAC; and
- (vi) based on the above analysis, in the absence of any mitigation, Galway Bay has adequate capacity to assimilate the modelled extreme pollution event.

Accordingly, any potential for significant effects on marine-based European Sites located over 15km from the site of the proposed development within Galway Bay may be excluded on the basis of the conclusions of the Assimilative Capacity Modelling Study, which is included as Appendix 1. The Report has clearly demonstrated that the assimilative capacity of Galway Bay is such that there is no potential for any pollution event associated with the proposed development to result in significant effects on any marine-based European Site located at a distance of greater than 15km from the proposed development.

Table 3.1 Identification of Designated sites within the Likely Zone of Impact

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
Special Areas of Conservation (SAC)/candidate Special Areas of Conservation (cSAC)			
Galway Bay Complex cSAC [000268] Distance: 0.9km (Hydrological distance between the mouth of the Trusky Stream and the cSAC 1.5 km)	<ul style="list-style-type: none"> ➤ [1140] Mudflats and sandflats not covered by seawater at low tide ➤ [1150] Coastal lagoons* ➤ [1160] Large shallow inlets and bays ➤ [1170] Reefs ➤ [1220] Perennial vegetation of stony banks ➤ [1310] <i>Salicornia</i> and other annuals colonising mud and sand ➤ [1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) ➤ [1355] Otter (<i>Lutra lutra</i>) ➤ [1365] Harbour seal (<i>Phoca vitulina</i>) ➤ [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>) ➤ [3180] Turloughs* ➤ [5130] <i>Juniperus communis</i> formations on heaths or calcareous grasslands ➤ [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco Brometalia</i>)(*important orchid sites) ➤ [7210] Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>* ➤ [7230] Alkaline fens 	Detailed conservation objectives for this site, (Version 1, April 2013), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the project site is located entirely outside and approximately 0.9km distant from the European site. There is no potential for indirect effects on the following Qualifying Interests (QIs) as there is no potential link or connectivity between the proposed development and these terrestrially or groundwater dependant habitats: <ul style="list-style-type: none"> ➤ Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] ➤ Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) [6210] ➤ Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210] ➤ Alkaline fens [7230] ➤ Limestone pavements [8240] ➤ Perennial vegetation of stony banks [1220] ➤ Turloughs [3180] ➤ <i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
			<p>The Trusky Stream is located within the proposed development site boundary. The stream is separated from the main construction footprint by over 10m at its nearest point. However, the development also involves the discharge of surface water from the proposed development, to the Trusky Stream. This involves, the installation of two precast headwalls within the banks of the stream at the location of the two surface water outfalls. There will also be some minor landscaping works including the planting of native species and the construction of a boundary fence along the stream banks. The stream discharges to Galway Bay approximately 1.5km to the west of the cSAC.</p> <p>The Assimilative Capacity Modelling Study that is included as Appendix I, demonstrates that even in a highly unlikely pollution event, very low levels of pollutant have the potential to enter this designated site via Galway Bay.</p> <p>However, adopting an extremely precautionary approach, a potential pathway for indirect effects on the following aquatic QIs has been identified via the Trusky Stream in the form of deterioration of surface water quality resulting from potential pollution associated with the construction and operational phases of the development:</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
			<ul style="list-style-type: none"> ➤ [1140] Mudflats and sandflats not covered by seawater at low tide ➤ [1150] Coastal lagoons* ➤ [1160] Large shallow inlets and bays ➤ [1170] Reefs ➤ [1310] <i>Salicornia</i> and other annuals colonising mud and sand ➤ [1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritima</i>) ➤ [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>) ➤ [1355] Otter (<i>Lutra lutra</i>) ➤ [1365] Harbour seal (<i>Phoca vitulina</i>) <p>As there is potential for indirect effects on certain QIs of this European site via the Trusky Stream in the form of deterioration of surface water quality resulting from potential pollution associated with the construction and operational phases of the development, it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is required.</p>
<p>Lough Corrib cSAC [000297]</p> <p>Distance: 5.9km</p>	<ul style="list-style-type: none"> ➤ [1029] Freshwater Pearl Mussel (<i>Margaritifera margaritifera</i>) ➤ [1092] White-clawed Crayfish (<i>Austropotamobius pallipes</i>) 	<p>Detailed conservation objectives for this site, (Version 1, April 2017), were reviewed as part of the assessment and are available at www.npws.ie</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 6km distant from the European site.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
	<ul style="list-style-type: none"> > [1095] Sea Lamprey (<i>Petromyzon marinus</i>) > [1096] Brook Lamprey (<i>Lampetra planeri</i>) > [1106] Salmon (<i>Salmo salar</i>) > [1303] Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) > [1355] Otter (<i>Lutra lutra</i>) > [1393] Slender Green Feather-moss (<i>Drepanocladus vernicosus</i>) > [1833] Slender Naiad (<i>Najas flexilis</i>) > [3110] Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) > [3130] Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or Isoeto-Nanojuncetea > [3140] Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. > [3260] Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and Callitricho-Batrachion vegetation > [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) > [6410] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) > [7110] Active raised bogs* > [7120] Degraded raised bogs still capable of natural regeneration > [7150] Depressions on peat substrates of the <i>Rhynchosporion</i> 		<p>No pathway for indirect effects on the terrestrial QIs for which the cSAC has been designated exists.</p> <p>There is no surface or ground water connectivity between the proposed development and the cSAC, which is located in a separate hydrological catchment. Therefore no potential for indirect effects on the aquatic QIs for which the cSAC has been designated exists.</p> <p>The development site is located outside the 2.5km core foraging range for lesser horseshoe bat as outlined in Map 11 of the Site-Specific Conservation Objectives document. No potential for indirect effects on this species, through disturbance or displacement, exists.</p> <p>No pathway for effect exists and the site is not within the Likely Zone of Impact. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
	<ul style="list-style-type: none"> ➤ [7210] Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davalliana</i>* ➤ [7230] Petrifying springs with tufa formation (Cratoneurion)* ➤ [7220] Alkaline fens ➤ [8240] Limestone pavements* ➤ [91A0] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles ➤ [91D0] Bog woodland* 		
<p>Connemara Bog Complex cSAC [002034]</p> <p>Distance: 7.4km</p> <p>(Hydrological distance between the mouth of the Trusky Stream and the cSAC over 50km)</p>	<ul style="list-style-type: none"> ➤ [1065] Marsh Fritillary (<i>Euphydryas aurinia</i>) ➤ [1106] Salmon (<i>Salmo salar</i>) ➤ [1150] Coastal lagoons* ➤ [1170] Reefs ➤ [1355] Otter (<i>Lutra lutra</i>) ➤ [1833] Slender Naiad (<i>Najas flexiles</i>) ➤ [3110] Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) ➤ [3130] Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetea</i> ➤ [3160] Natural dystrophic lakes and ponds ➤ [3260] Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation ➤ [4010] Northern Atlantic wet heaths with <i>Erica tetralix</i> ➤ [4030] European dry heaths 	<p>Detailed conservation objectives for this site, (Version 1, October 2015), were reviewed as part of the assessment and are available at www.npws.ie</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 7.5km distant from the European site.</p> <p>There is no surface or ground water connectivity between the proposed development and the terrestrial elements of the cSAC.</p> <p>The marine elements of the cSAC are located over 30km in a straight line distance from the site of the proposed development (and over 50km via surface water) and the potential for significant effects on these QIs has been excluded on the basis of the objective information contained in the Assimilative Capacity Modelling Study (Appendix 1), and as set out in Section 3.2 above. No pathways for significant indirect effects on this European Site exists.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
	<ul style="list-style-type: none"> ➤ [6410] <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) ➤ [7130] Blanket bogs (* if active bog) ➤ [7140] Transition mires and quaking bogs ➤ [7150] Depressions on peat substrates of the <i>Rhynchosporion</i> ➤ [7230] Alkaline fens ➤ [91A0] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles 		<p>No pathway for effect exists. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>
<p>Black Head-Poulsallagh Complex cSAC [000020]</p> <p>Distance: 11.7km</p>	<ul style="list-style-type: none"> ➤ [1170] Reefs ➤ [1220] Perennial vegetation of stony banks ➤ [1395] Petalwort (<i>Petalophyllum ralfsii</i>) ➤ [3260] Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation ➤ [4060] Alpine and Boreal heaths ➤ [5130] <i>Juniperus communis</i> formations on heaths or calcareous grasslands ➤ [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco Brometalia</i>)(*important orchid sites) ➤ [6510] Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) ➤ [7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>) ➤ [8240] Limestone pavements* ➤ [8330] Submerged or partially submerged sea caves 	<p>Detailed conservation objectives for this site, (Version 1, May 2014), were reviewed as part of the assessment and are available at www.npws.ie</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 11½km distant from the European site.</p> <p>There is no surface or ground water connectivity between the proposed development and the terrestrial elements of the cSAC. The marine elements of the cSAC are located over 11km from the site of the proposed development and the potential for significant effects on these has been excluded on the basis of the objective information contained in the Assimilative Capacity Modelling Study (Appendix 1), and as set out in Section 3.2 above.. As such, it can be objectively concluded that there is no potential for significant effect on this European Site.</p> <p>No pathway for significant effect exists. It can be excluded, on the basis of objective information,</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
			<p>that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>
<p>Ross Lake and Woods cSAC [001312]</p> <p>Distance: 12.1km</p>	<ul style="list-style-type: none"> ➤ [1303] Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) ➤ [3140] Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. 	<p>Detailed conservation objectives for this site, (Version 1, October 2018), were reviewed as part of the assessment and are available at www.npws.ie</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 12km distant from the European site.</p> <p>The proposed development and the cSAC are located within different hydrological catchments and there is no connectivity between the proposed development and the cSAC. No pathways for indirect effects on the terrestrial or aquatic QIs exist.</p> <p>The development site is located outside of the 2.5km core foraging range for lesser horseshoe bat as detailed in Map 3 of the Site Specific Conservation Objectives. No potential for indirect effects on this species, through disturbance or displacement, exists.</p> <p>No pathway for effect exists. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
<p>East Burren Complex cSAC [001926]</p> <p>Distance: 13.1km</p>	<ul style="list-style-type: none"> ➤ [3140] Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. ➤ [3180] Turloughs ➤ [3260] Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation ➤ [4060] Alpine and Boreal heaths ➤ [5130] <i>Juniperus communis</i> formations on heaths or calcareous grasslands ➤ [6130] Calaminarian grasslands of the <i>Violetalia calaminariae</i> ➤ [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) ➤ [6510] Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) ➤ [7210] Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> ➤ [7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>) ➤ [7230] Alkaline fens ➤ [8240] Limestone pavements ➤ [8310] Caves not open to the public ➤ [91E0] Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) ➤ [1065] <i>Euphydryas aurinia</i> (Marsh Fritillary) ➤ [1303] <i>Rhinolophus hipposideros</i> (Lesser Horseshoe Bat) 	<p>Generic conservation objectives exist for this site (Generic Version 7.0, NPWS 2020):</p> <p>‘To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected’</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 13km distant from the European site.</p> <p>The cSAC and the proposed development are located within different hydrological catchments and there is no connectivity between the development and the cSAC. Therefore no potential for indirect effects on the cSAC exists.</p> <p>The development site is located outside of the core 2.5km foraging range for lesser horseshoe bat. No potential for indirect effects on this species, through disturbance or displacement, exists.</p> <p>No pathway for effect exist. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020)	Conservation Objectives	Likely Zone of Impact Determination
	<ul style="list-style-type: none"> ➤ [1355] <i>Lutra lutra</i> (Otter) 		
<p>Moneen Mountain cSAC [000054]</p> <p>Distance: 13.3km</p>	<ul style="list-style-type: none"> ➤ [3180] Turloughs* ➤ [4060] Alpine and Boreal heaths ➤ [5130] <i>Juniperus communis</i> formations on heaths or calcareous grasslands ➤ [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) ➤ [7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>)* ➤ [8240] Limestone pavements ➤ [1065] Marsh Fritillary (<i>Euphydryas aurinia</i>) ➤ [1303] Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) 	<p>Generic conservation objectives exist for this site (Generic Version 7.0, NPWS 2020):</p> <p>‘To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected’</p>	<p>There will be no direct effects as the project site is located entirely outside and approximately 13km distant from the European site.</p> <p>No pathway for indirect effects on the terrestrial QIs for which the cSAC has been designated exists.</p> <p>The cSAC and the proposed development are located within different hydrological catchments and there is no connectivity between the development and the cSAC. Therefore no potential for indirect effects exists on the cSAC.</p> <p>The development site is located outside of the 2.5km core foraging range for lesser horseshoe bat. No potential for indirect effects on this species, through disturbance or displacement, exists.</p> <p>No pathway for effect exists. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>
<p>Special Protection Area (SPA)</p>			

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
<p>Inner Galway Bay SPA [004031]</p> <p>Distance: 1.3km</p> <p>(Hydrological distance between the mouth of the Trusky Stream and the SPA 1.5 km)</p>	<ul style="list-style-type: none"> > [A003] Great Northern Diver (<i>Gavia immer</i>) > [A017] Cormorant (<i>Phalacrocorax carbo</i>) > [A028] Grey Heron (<i>Ardea cinerea</i>) > [A046] Brent Goose (<i>Branta bernicla hrota</i>) > [A050] Wigeon (<i>Anas penelope</i>) > [A052] Teal (<i>Anas crecca</i>) > [A056] Shoveler (<i>Anas clypeata</i>) > [A069] Red-breasted Merganser (<i>Mergus serrator</i>) > [A137] Ringed Plover (<i>Charadrius hiaticula</i>) > [A140] Golden Plover (<i>Pluvialis apricaria</i>) > [A142] Lapwing (<i>Vanellus vanellus</i>) > [A149] Dunlin (<i>Calidris alpina alpina</i>) > [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) > [A160] Curlew (<i>Numenius arquata</i>) > [A162] Redshank (<i>Tringa tetanus</i>) > [A169] Turnstone (<i>Arenaria interpres</i>) > [A179] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) > [A182] Common Gull (<i>Larus canus</i>) > [A191] Sandwich Tern (<i>Sterna sandvicensis</i>) > [A193] Common Tern (<i>Sterna hirundo</i>) > [A999] Wetlands and Waterbirds 	<p>Detailed conservation objectives for this site, (Version 1, May 2013), were reviewed as part of the assessment and are available at www.npws.ie</p>	<p>The proposed development is located entirely outside the SPA and is separated from it by 1.3 km. There is no potential for direct effects on this European Site.</p> <p>The proposed development site does not provide suitable habitat for the species for which the SPA has been designated. Therefore no pathway for indirect effects as a result of disturbance or displacement have been identified.</p> <p>The Trusky Stream is located within the proposed development site boundary. The stream is separated from the main construction footprint by over 10m at its nearest point. However, the development also involves the discharge of surface water from the proposed development, to the Trusky Stream. This involves, the installation of two precast headwalls within the banks of the stream at the location of the two surface water outfalls. There will also be some minor landscaping works including the planting of native species and the construction of a boundary fence along the stream banks. The stream discharges to Galway Bay approximately 1.5km to the west of the SPA.</p> <p>The Assimilative Capacity Modelling Study that is included as Appendix I, demonstrates that even in a highly unlikely pollution event, very low levels of</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
			<p>pollutant have the potential to enter this designated site via Galway Bay.</p> <p>However, adopting an extremely precautionary, a potential pathway for indirect effects on the supporting wetland habitat for SCI bird species was identified in the form of deterioration of water quality resulting from potential pollution associated with the construction and operational phases of the development. The SCI [A999] Wetlands and Waterbirds is assessed in relation to the wetland habitat for all SCI species.</p> <p>The European site is located within the project Zone of Influence and, as there is potential for indirect effects on certain QIs of this European site via the Trusky Stream in the form of deterioration of surface water quality resulting from potential pollution associated with the construction and operational phases of the development, it cannot be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is required.</p>
<p>Lough Corrib SPA [004042]</p> <p>Distance: 6.3km</p>	<ul style="list-style-type: none"> ➤ [A051] Gadwall (<i>Anas strepera</i>) ➤ [A056] Shoveler (<i>Anas clypeata</i>) ➤ [A059] Pochard (<i>Aythya ferina</i>) ➤ [A061] Tufted Duck (<i>Aythya fuligula</i>) 	<p>Generic conservation objectives exist for this site (Generic Version 7.0, NPWS 2020):</p>	<p>The proposed development is located entirely outside the SPA and is separated from it by over 6km. There is no potential for direct effects on this European Site.</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
	<ul style="list-style-type: none"> > [A065] Common Scoter (<i>Melanitta nigra</i>) > [A082] Hen Harrier (<i>Circus cyaneus</i>) > [A125] Coot (<i>Fulica atra</i>) > [A140] Golden Plover (<i>Pluvialis apricaria</i>) > [A179] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) > [A182] Common Gull (<i>Larus canus</i>) > [A193] Common Tern (<i>Sterna hirundo</i>) > [A194] Arctic Tern (<i>Sterna paradisaea</i>) > [A395] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>) > [A999] Wetland and Waterbirds 	<p>‘To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA’</p> <p>And</p> <p>‘To maintain or restore the favourable conservation condition of the wetland habitat at Lough Corrib SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.’</p>	<p>No surface or ground water connection between the SPA, which is in a different hydrological catchment, and the proposed development site has been identified. Therefore no potential for indirect effects on the supporting wetland habitat [A999] for SCI bird species as a result of deterioration in water quality exists.</p> <p>The proposed development site does not provide suitable habitat for the species for which the SPA has been designated. Therefore no pathway for indirect effects as a result of disturbance or displacement exists.</p> <p>No pathway for effect was identified. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>
<p>Connemara Bog Complex SPA [004181]</p> <p>Distance: 11.0km</p>	<ul style="list-style-type: none"> > [A017] Cormorant (<i>Phalacrocorax carbo</i>) > [A098] Merlin (<i>Falco columbarius</i>) > [A140] Golden Plover (<i>Pluvialis apricaria</i>) > [A182] Common Gull (<i>Larus canus</i>) 	<p>Generic conservation objectives exist for this site (Generic Version 7.0, NPWS 2020):</p> <p>‘To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA’</p>	<p>The proposed development is located entirely outside the SPA and is separated from it by 11km. There is no potential for direct effects on this European Site.</p> <p>There is no surface or ground water connectivity between the proposed development and the SPA. The proposed development site does not support</p>

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie (May 2020))	Conservation Objectives	Likely Zone of Impact Determination
			<p>suitable habitat for the species for which the SPA has been designated. Therefore no pathway for indirect effects as a result of disturbance or displacement has been identified.</p> <p>No pathway for effect exists. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>
<p>Cregganna Marsh SPA</p> <p>Distance: 14.1km</p>	<p>➤ [A395] Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)</p>	<p>Generic conservation objectives exist for this site (Generic Version 7.0, NPWS 2020):</p> <p>‘To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA’</p>	<p>The proposed development is located entirely outside the SPA and is separated from it by over 14km. There is no potential for direct effects on this European Site.</p> <p>The proposed development site does not support suitable habitat for the species for which the SPA has been designated. Therefore no pathway for indirect effects as a result of disturbance or displacement.</p> <p>No pathway for effect exists. It can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on this European site. Accordingly, a Stage Two Appropriate Assessment is not required.</p>

3.3 European Sites with the Potential to be Significantly Affected by the Proposed Development

Adopting a precautionary approach, in the absence of any mitigation measures, best practice/construction measures or any other measures which have no relation to avoiding impacts on European sites, a potential pathway for indirect effect in the form of surface water pollution was identified in relation to the following aquatic QIs associated with Galway Bay Complex cSAC and Inner Galway Bay SPA:

Galway Bay Complex cSAC

- > [1140] Mudflats and sandflats not covered by seawater at low tide
- > [1150] Coastal lagoons*
- > [1160] Large shallow inlets and bays
- > [1170] Reefs
- > [1310] *Salicornia* and other annuals colonising mud and sand
- > [1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- > [1410] Mediterranean salt meadows (*Juncetalia maritimi*)
- > [1355] Otter (*Lutra lutra*)
- > [1365] Harbour seal (*Phoca vitulina*)

Inner Galway Bay SPA

- > [A999] Wetlands and Waterbirds

Following an extremely precautionary approach, these sites are considered to be within the Likely Zone of Impact of the proposed development and further assessment regarding potential for significant impacts thereon is required.

3.4 Likely Cumulative Impact of the Proposed Development on European Sites, in-combination with other plans and projects

In circumstances where it can be excluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a number of European sites identified above, there is no possibility of likely cumulative impacts on those particular European sites arising as between the proposed development and other plans and project.

Where potential pathways for effects have been identified in Table 3.1, then the potential for cumulative effects resulting from the proposed development when considered in combination with other plans and projects, cannot be discounted at the screening stage and the potential cumulative impacts arising as between the proposed development and other plans and projects are required to be considered as part of a Stage Two Appropriate Assessment.

4. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

The findings of this Screening Assessment are presented following the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010).

4.1 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of NPWS Site Synopses, Conservation Objectives for the European Sites
- Review of 2019, 2013 and 2007 EU Habitats Directive (Article 17) Reports.
- Review of ecological information from previous applications on the site.
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA and Water Framework Directive (WFD).
- Review of OS maps and aerial photographs of the site of the proposed development.
- Field visits undertaken by MKO ecologists during May 2018, August, September and November 2019, and May 2020.
- Review of the Galway County Development Plan 2015-2021 and all associated Environmental Reports.
- Review of Variation 2(a) of the Galway County Development Plan 2015-2021 and all associated Environmental Reports.
- Review of the Natura Impact Statement that was prepared for the N6 Galway City Ring Road (Arup 2018)]
- Review of the Galway Transport Strategy (2016)

4.2 Concluding Statement

It cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on the Galway Bay Complex cSAC and the Inner Galway Bay SPA.

It can be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on all other European sites.

As a result, an Appropriate Assessment is required, and a Natura Impact Statement has been prepared in respect of the Galway Bay Complex cSAC and the Inner Galway Bay SPA, and submitted with the planning application for, the proposed development.

BIBLIOGRAPHY

Bailey, M. and Rochford J. (2006) Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. (2013). Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland. BTO Books, Thetford, UK.

Barbour, M.T. and J.B. Stribling. (1991) Use of Habitat Assessment in Evaluating the Biological Integrity of Stream Communities. Biological Criteria: Research and Regulation: 25-38. EPA-440/5-91-005. Washington, DC: Office of Water, US EPA.

Birds Directive (2009/47/EC) – http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive 79/409/EEC as amended) (Birds Directive) – transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011).

DEHLG (2009) Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. DEHLG, Dublin.

DoEHLG (2010). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Revision, February, 2010. Department of the Environment, Heritage and Local Government.

EC (2018) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC.

EC (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2006) Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities, Luxembourg.

EC (2007a) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. Office for Official Publications of the European Communities, Luxembourg. European Commission.

EC (2007b) Interpretation Manual of European Union Habitats. Version EUR 27. European Commission, DG Environment.

European Communities (Conservation of Wild Birds) Regulations, 1985, SI 291/1985 & amendments – <http://www.irishstatutebook.ie>

European Communities (Natural Habitats) Regulations, SI 94/1997, SI 233/1998 & SI 378/2005 – <http://www.irishstatutebook.ie>

Fossitt, J. A. (2000). A Guide to Habitats in Ireland. Dublin: The Heritage Council.

Galway City Council (2016) Galway Transport Strategy

Galway County Council, Galway County Development Plan 2015 -2021 and all associated Environmental Documentation.

Galway County Council, Variation 2(a) to the Galway County Development Plan 2015 -2021 and all associated Environmental Documentation.

Habitats Directive (92/43/EEC).

Hartnett, M. (2020) Trusky East Housing Development. Assimilative Capacity Modelling Study. MSN Hydro.

Hartnett, M. (2009) Mutton Island WWTP Discharge and Residence Times of Galway Bay. Department of Civil Engineering, NUIG.

Murphy, D.F. (2004) Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.

Natural England (March 2007). Draft Guidance: The Assessment of Regional Spatial Strategies and Sub-Regional Strategies Under the Provisions of the Habitats Regulations.

NPWS (2008) The Status of EU Protected Habitats and Species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC.

NPWS of the DEHLG (2008) The Report on Status of Habitats and Species in Ireland: Technical Reports and Forms.

NPWS Protected Site Synopses and maps available on <http://www.npws.ie/en/ProtectedSites/>

NRA (2004) Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority, Dublin.

NRA (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1 ed.). Dublin: National Roads Authority.

NRA (2005) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2006) Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes. Dublin: National Roads Authority.

NRA (2009). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Dublin: National Roads Authority.

NRA (2008). The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads. Dublin: National Roads Authority.

OCSC (2020). Trusky East Stream Flood Study O'Connor Sutton Cronin, Multidisciplinary Consulting Engineers.

Scottish Natural Heritage (SNH) (July 2013) Assessing Connectivity with Special Protection Areas (SPA)

Stace, C. A. (1997). *New Flora of the British Isles*. Cambridge: Cambridge University Press.

Therivel R. (2009) Workshop Material on the Habitats Directive Assessment of Plans Levett-Therivel Sustainability Consultants on behalf of the Heritage Council, Kilkenny.

Therivel, R. (2009) 'Appropriate assessment of plans in England', *Environmental Impact Assessment Review* 29(4), pp. 261-272.



APPENDIX 1

ASSIMILATIVE CAPACITY MODELLING STUDY

TRUSKY EAST HOUSING DEVELOPMENT

Assimilative Capacity Modelling Study

September 2020

MSN Hydro

Hydro-Environmental Engineering Consultants

<u>Section</u>	<u>Content</u>	<u>Page</u>
1.	Introduction	1
2.	Methodology	2
3.	Results	6
4.	Summary and Conclusions	22
	Appendix	25

Disclaimer

Model results in this report are based on the inherent assumptions and formulations under which the models have been developed. Any decisions made based on these results must be informed by an understanding of the model assumptions and formulations.

MSN_HYDRO Ltd. is a registered company with offices in Galway, Ireland.

Company no. 625253 VAT no. 3652174DH

1. Introduction

Burkeway Homes Ltd. is in the process of preparing an application to An Bord Pleanála (ABP) for permission in respect of a strategic housing scheme [SHD] on lands located in the townlands of Trusky East, Trusky West, Freeport and Ahaglugger, Bearna, Co. Galway.

The subject lands are located to the north of Bearna, approximately 7 km west of Galway City. The entire site drains to the Trusky East Stream. At the downstream end of the subject site, the Trusky East Stream has a catchment of 1.79km².

In the context of preparing the Appropriate Assessment Screening Report [AASR] and Environmental Impact Assessment Report [EIAR] in respect of the proposed development, it was considered that an Assimilative Capacity study of Galway Bay should be carried out, and that results from the study should be submitted with AASR and EIAR which will accompany the planning application.

Burkeway Homes Ltd. commissioned MSN_HYDRO to undertake the Assimilative Capacity Study. The purpose of this study is to determine the capacity of Galway Bay to assimilate a pollutant discharge from the Trusky East Stream that drains the proposed SHD lands.

2. Methodology

MSN_HYDRO staff have considerable experience in modelling many bay and estuaries around Ireland. As part of this study, an existing model of Galway Bay has been used to undertake an assessment of the capacity of Galway Bay to assimilate flood runoff and associated potential pollutant loads.

The computational model which has been used in this study is the DIVAST model; this model has been used on over 100 water quality studies around the world. An existing hydrodynamic model of Galway Bay has been adapted for the prediction of water quality in Galway Bay after a potential discharge from the proposed SHD into the Trusky East Stream. A module has been integrated within the existing model that will enable the concentration of potential pollutants to be predicted throughout Galway Bay in a scenario where pollutant loads from an extreme event enter Galway Bay from the Trusky East Stream.

The extent of the existing detailed Galway Bay model is shown in Figure 1. Figure 1 also shows the bathymetry contours used to develop the computational model.

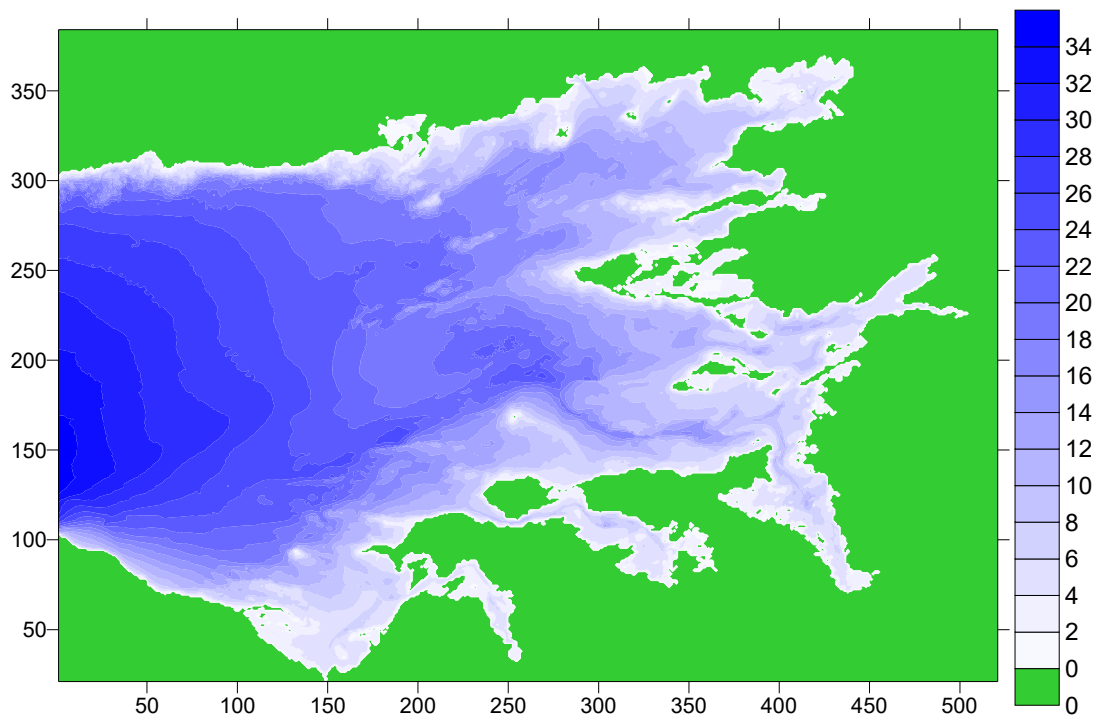


Figure 1: Contour map showing model extents and depths relative to high tide.

The Galway Bay model is composed of 2 modules:

- Hydrodynamic module (HM) – based on the 2D Navier-Stokes equations
- Pollutants transport module (PTM) – based on the advection diffusion equation

The hydrodynamic module is used to calculate water circulation patterns (currents) throughout Galway Bay, based on tidal dynamics and River Corrib flows. Using these currents, the pollutant transport module calculates the transport of pollutants around the bay based on a scenario where pollutant loads from an extreme event are introduced into Galway Bay from the site, through the Trusky East Stream from the SHD site, see Figure 2. The Galway Bay model is highly resolved both spatially and temporally. The model resolves all parameters on a 100m x 100m grid throughout the bay at every 40 seconds. The model contains 176 grid points north-south and 290 grid points east-west, giving a total of 51,040 computational cells in the model.

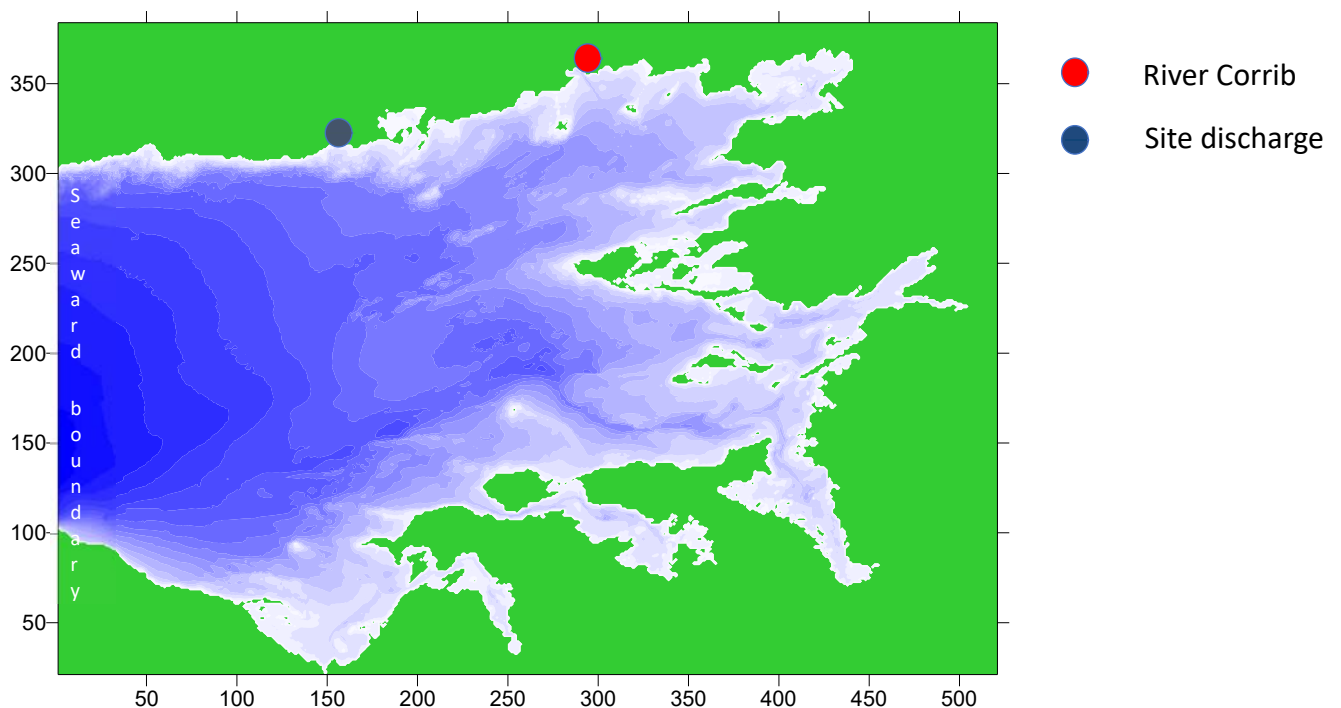


Figure 2: Galway Bay location map

The following tasks were completed as part of this study:

- Galway Bay hydrodynamic model developed based on:
 - River Corrib annual flows of $104.8\text{m}^3/\text{s}$ - this flow is based on OPW data
 - Tidal dynamics specified at the seaward model boundary. The tidal dynamics varied between neap tidal amplitude of 1m to spring tidal amplitude of 2.2m
- The hydrodynamic module was run and a comparison was made between model output and current measurements taken in the middle of Galway Bay to assess model performance.
- The Trusky East Stream enters Galway Bay at Bearna Pier. This location was specified to the model.

Adopting a precautionary approach, a pollutant discharge scenario was devised for the highly unlikely event of a diesel spill into the Trusky East Stream. In this scenario, a potential pollution event has been modelled, in the absence of any mitigation measures, involving 300l of diesel, containing 250mg/l of active pollutant, is accidentally spilled and enters the stream during an extreme flood event. The peak of a large flow event will bring the pollutant load to Galway Bay in the shortest time and hence in a highly concentrated mass; this is a conservative approach to specifying the pollutant load.

- During the flood event the stream flow hydrograph shown in Figure 3 was used.

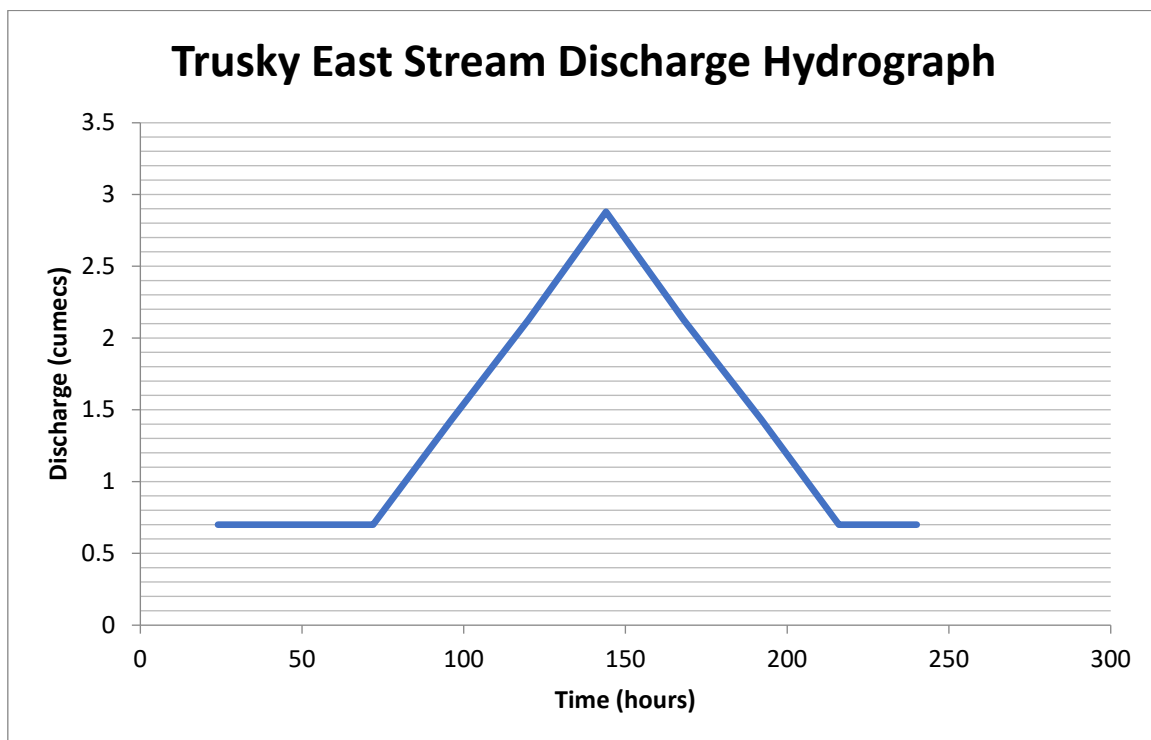


Figure 3: Discharge hydrograph

The above hydrograph presents river discharge, $Q(\text{m}^3/\text{s})$, as a function of time. The baseflow of the stream is $0.7\text{m}^3/\text{s}$. It is considered that the diesel spill occurs during a flood event with a 0.1% AEP (Annual Exceedence Probability). This flood event is considered to rise linearly from the baseflow to a peak of $2.88\text{m}^3/\text{s}$ over a 72-hour period, and to recede to baseflow over a further 72-hour period. For this study it was assumed that the spill occurred over a short duration of an hour around the peak of the discharge hydrograph. The peak of a large flow event will bring the pollutant load to Galway Bay in the shortest time and hence in a highly concentrated mass; this is a conservative approach to specifying the pollutant load.

It has been conservatively assumed that the pollutant is not diluted along the stream as it travels from the site to the confluence with Galway Bay.

These pollutant and hydraulic loads were specified to the model and the model was run for 2 full 14-day spring-neap tidal cycles.

- Model outputs are presented in four graphical forms:
 - time series graphs at 6 locations throughout Galway Bay illustrating how the pollutant concentration changes with time at each location
 - time series graphs at 6 locations throughout Galway Bay illustrating how the dilution values changes with time at each location
 - synoptic charts of pollutant contours throughout Galway Bay for 6 times during the model simulations
 - synoptic charts of dilution contours throughout Galway Bay for 6 times during the model simulations

- Results are then analysed and assimilative capacity is assessed.

3. Results

Comparison between model calculated hydrodynamics and data

Prior to using the model for detailed salinity scenario modelling, the performance of the hydrodynamic was assessed.

The hydrodynamic model was compared against measured velocities collected by an Acoustic Doppler Current Profiler (ADCP). The ADCP recorded water levels, magnitudes of water velocities (m/s) and direction of water velocities. Data was recorded in the centre of Inner Galway Bay during November 2013. The ADCP, being located in the middle of Galway Bay, provided a very good indicator of how the overall Galway/Kinvara Bay hydrodynamic model is working. The hydrodynamic model was run for the period of ADCP data collection. Figure 4 presents comparisons between ADCP data and calibrated model results for water level, magnitudes of water velocities (m/s) and direction of water velocities.

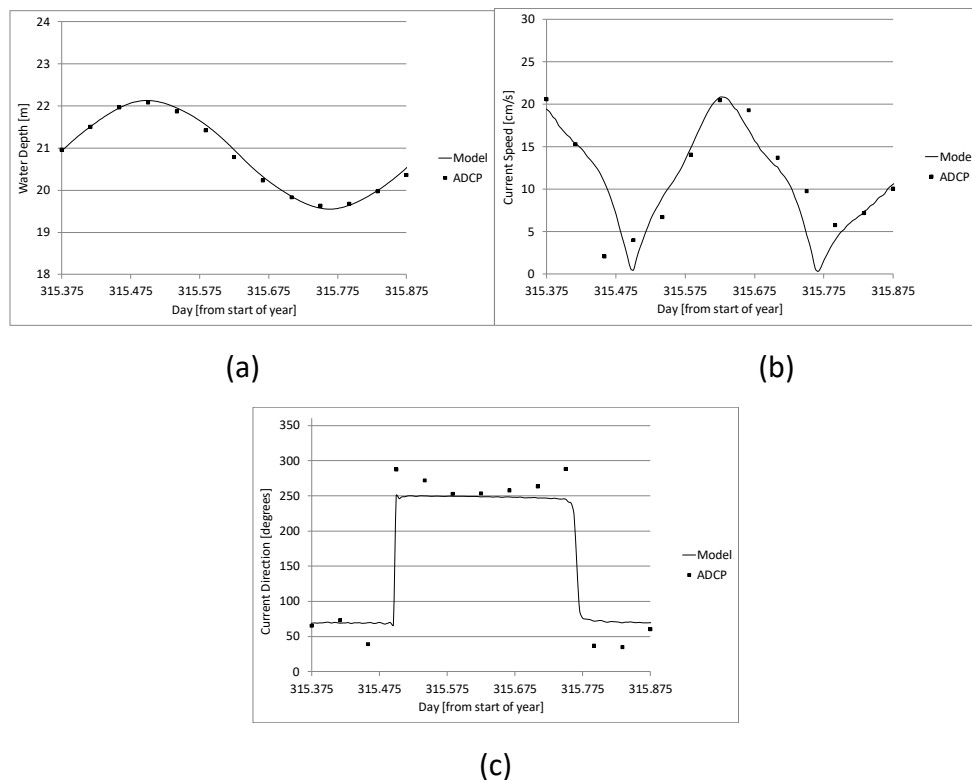


Figure 4: Comparison of model (a) water levels; (b) current speeds and (c) current directions between model results and ADCP data for period 09:43–21:43 on 11/11/2013

Results of concentrations and dilution factors

Once the hydrodynamic model was shown to be well-behaved, the model was then set to perform the diesel spill transport scenario as detailed in Section 2 above. The model was set to begin at low spring tide, this represents the most conservative tidal phase as the volume of the bay is at it lowest and, therefore, so is dilution. Further, by beginning the simulation at low spring tide the next flood tide will transport the pollutant towards Inner Galway Bay SPA and Galway Bay Complex cSAC with high velocity currents. Plots of water circulation patterns in Galway Bay are presented in the Appendix. Figure A1 shows circulation patterns throughout Galway Bay; Figures 2-5 show circulation patterns local to the discharge point at 4 stages of the tide.

Time series have been included at 10 analysis points in Galway Bay; these 10 points include the three specific points that are the nearest points of three European Sites as shown in Figure 5 - locations marked by green stars. In addition, Figure 6 shows the modelled area in relation to other European Sites that are located further west in Galway Bay.

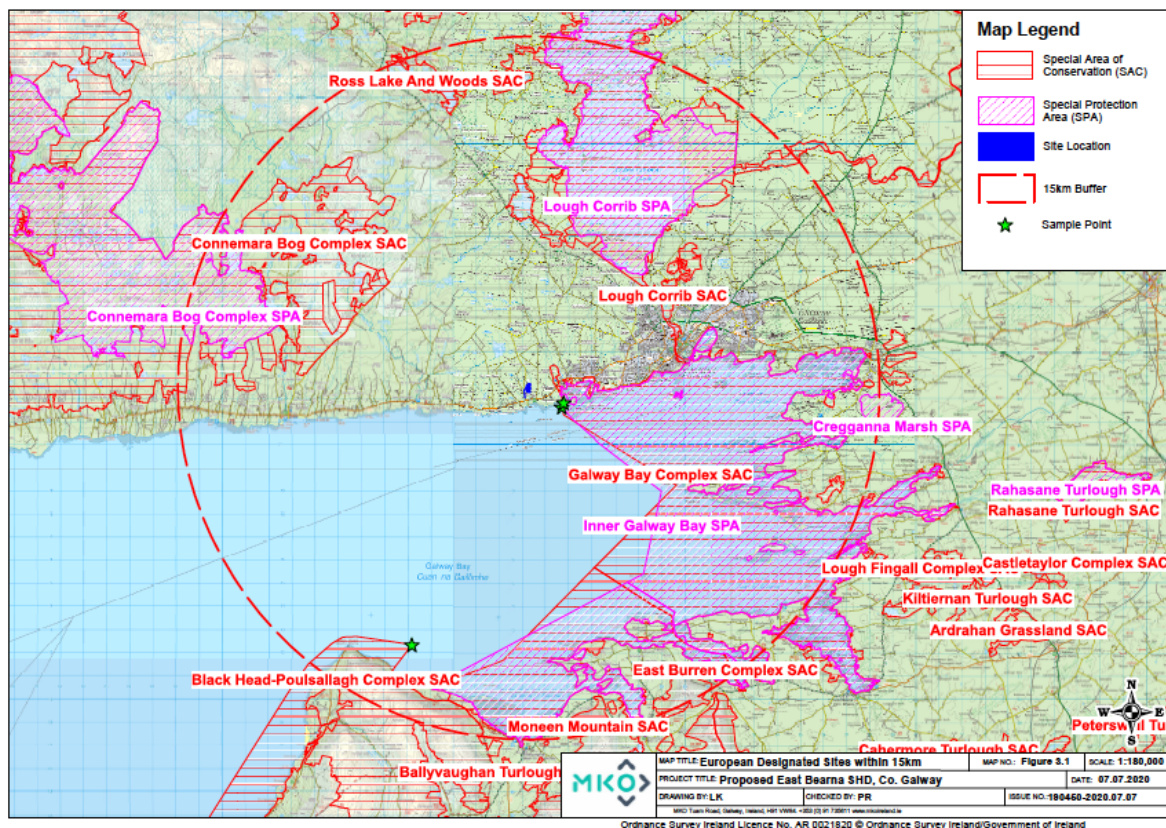


Figure 5: Locations of analysis points and designated sites within 15km

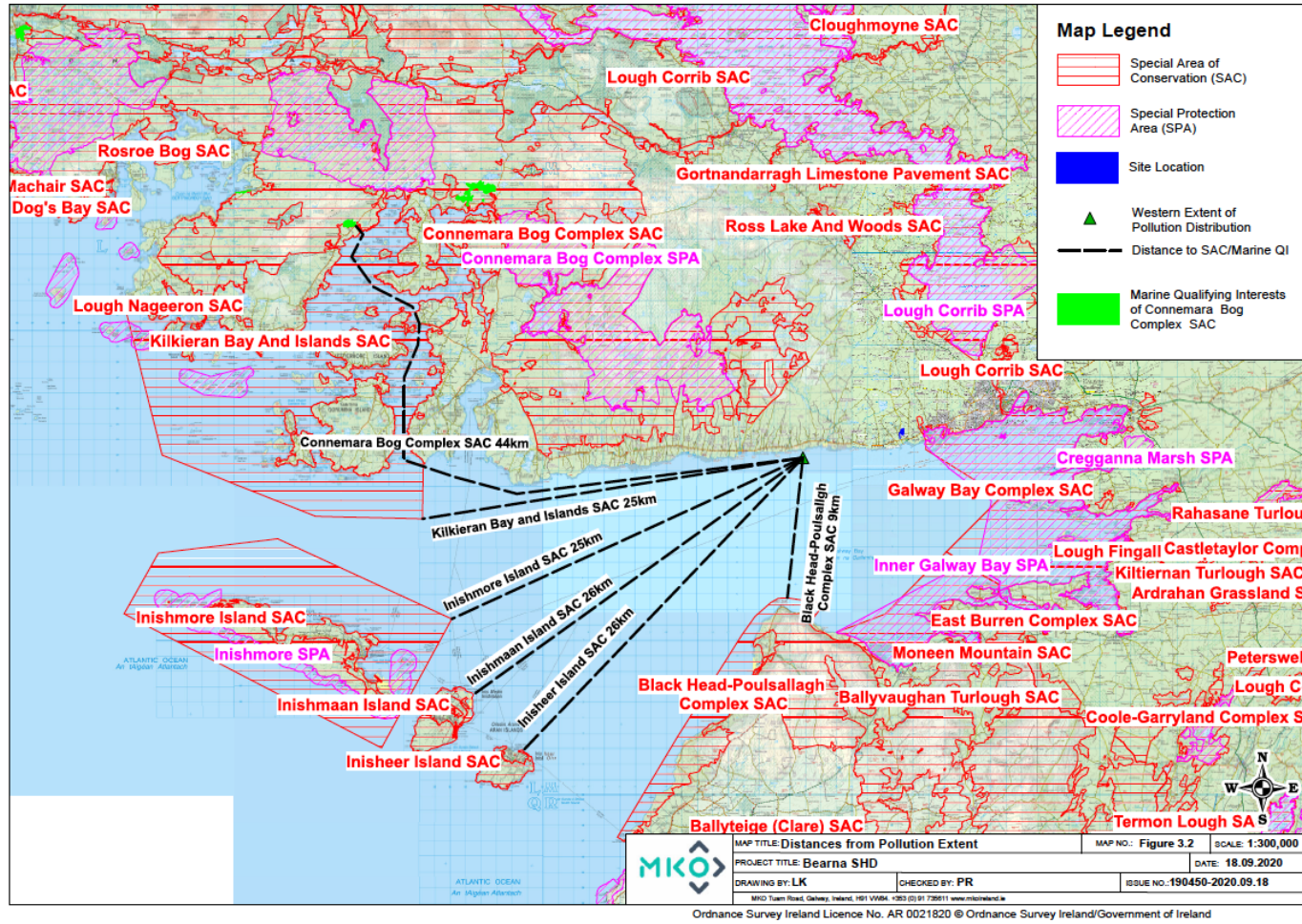


Figure 6: Modelled area in relation to other European Sites located further west

The 3 locations shown in Figure 5 above are:

1. Inner Galway Bay SPA (E124675 N 222655) (approx. 1.4km east of Trusky Stream mouth)
2. Galway Bay Complex cSAC (E124755 N222784) (approx. 1.5km east of Trusky Stream mouth)
3. Black Head-Poulsallagh Complex cSAC (E118193 N212362) (approx. 11.5km south west of Trusky Stream mouth)

In addition to the above, Figure 6 shows a fourth point at the location where the pollutant was reduced to trace levels in terms of both concentration and dilution (as described below). This shows the context of the potential pollutant dispersal in relation to European Sites that are located to the west within Galway Bay.

In order to provide further information on the transport of the diesel spillage throughout Galway Bay additional analysis points were included. All points are shown in Figure 7.

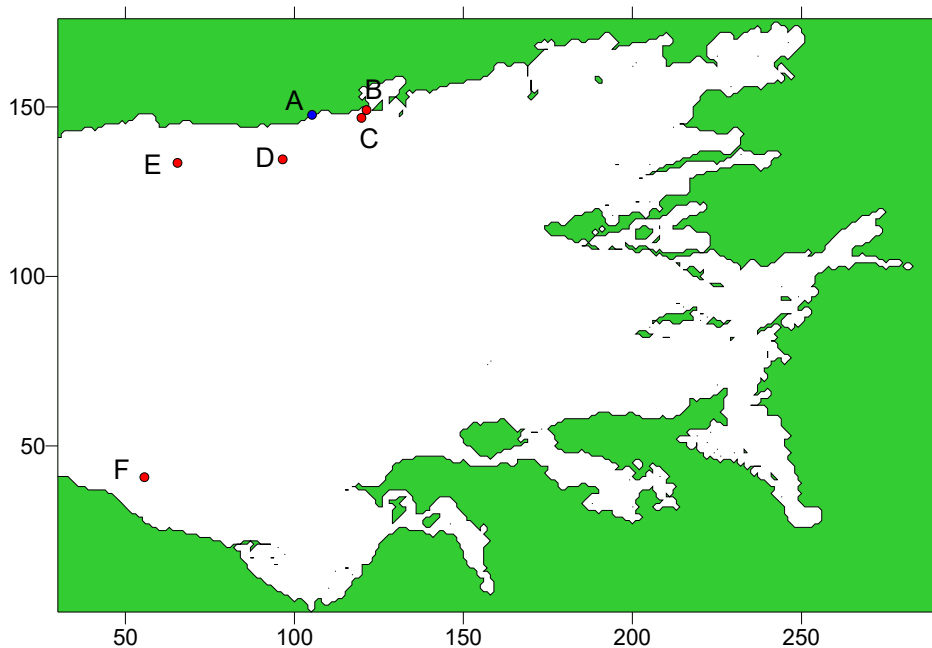


Figure 7: Location of all model output points

The most significant points in Figure 7 are:

- Point A - the point where the discharge enters Galway Bay.
- Point B - Inner Galway Bay SPA (E124675 N 222655)
- Point C - Galway Bay Complex cSAC (E124755 N222784)
- Point F - Black Head-Poulsallagh Complex cSAC (E118193 N212362)

Points D and E have been included to illustrate the levels of pollutants within the discharge plume.

In the Figures 8-12 below, time series of both pollutant concentrations ($\mu\text{g/l}$) and dilutions as a function of time (hours) are presented for each analysis point where a pollutant concentration is detected. No pollutant was detected at analysis point 'F', so no results are presented for this point.

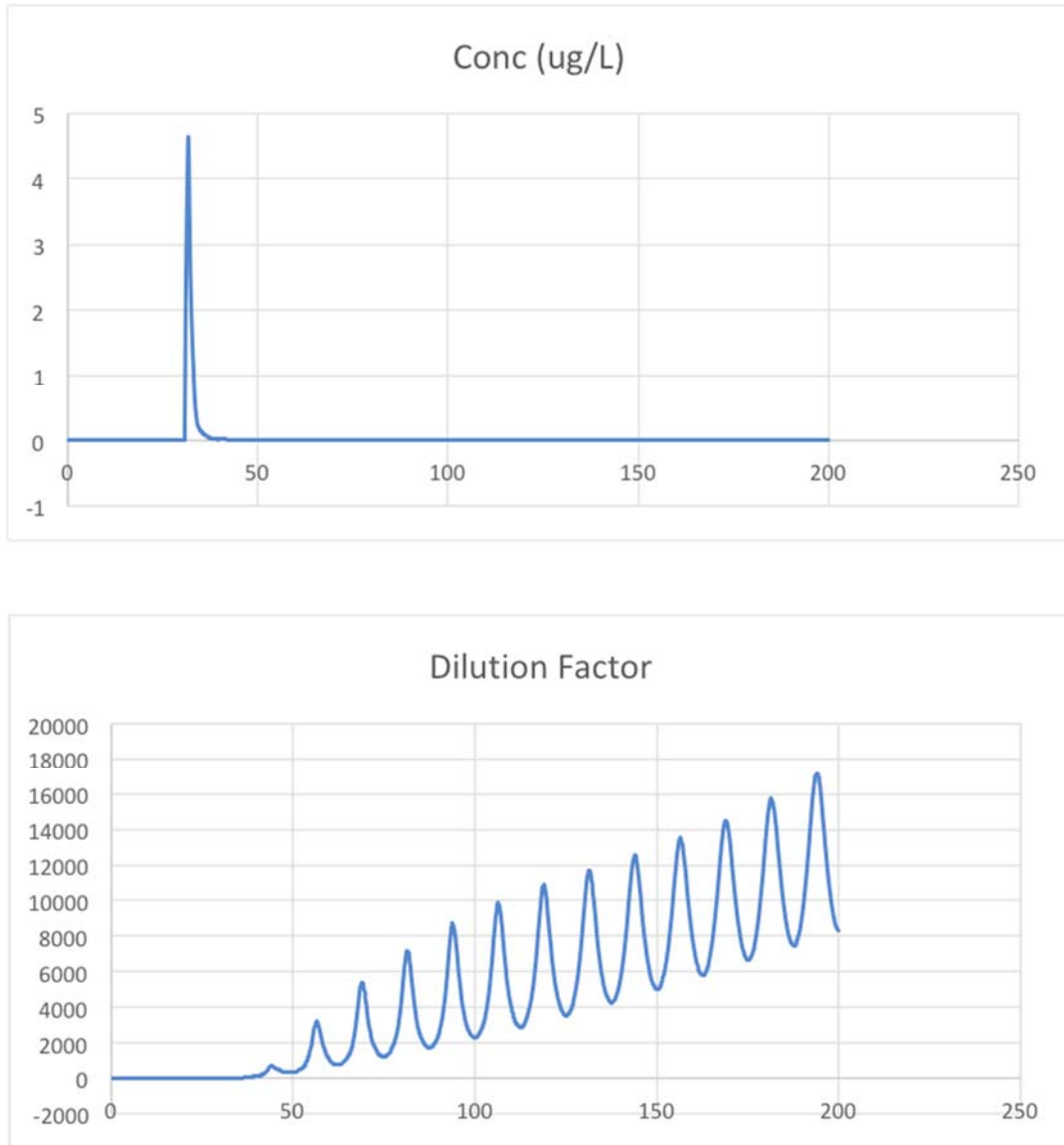


Figure 8: Concentration and Dilution at 'A'

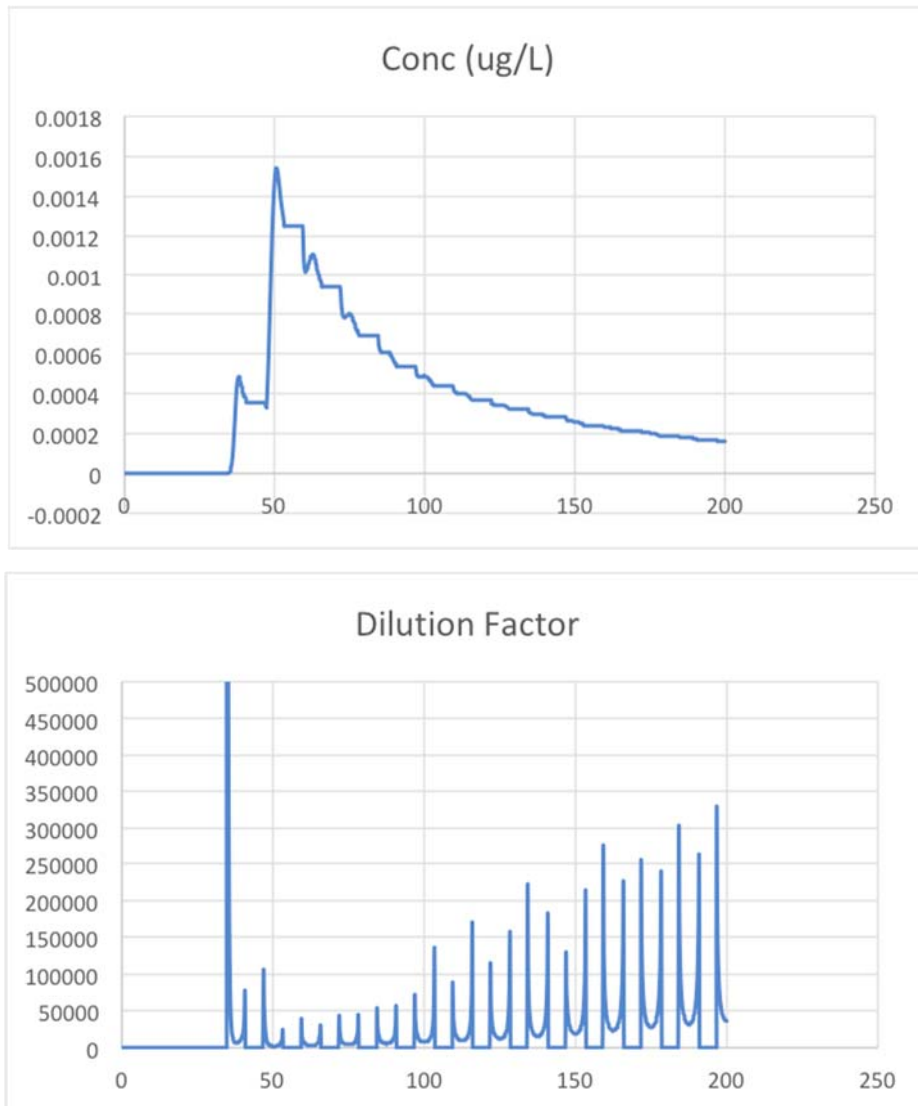


Figure 9: Concentration and Dilution at 'B'

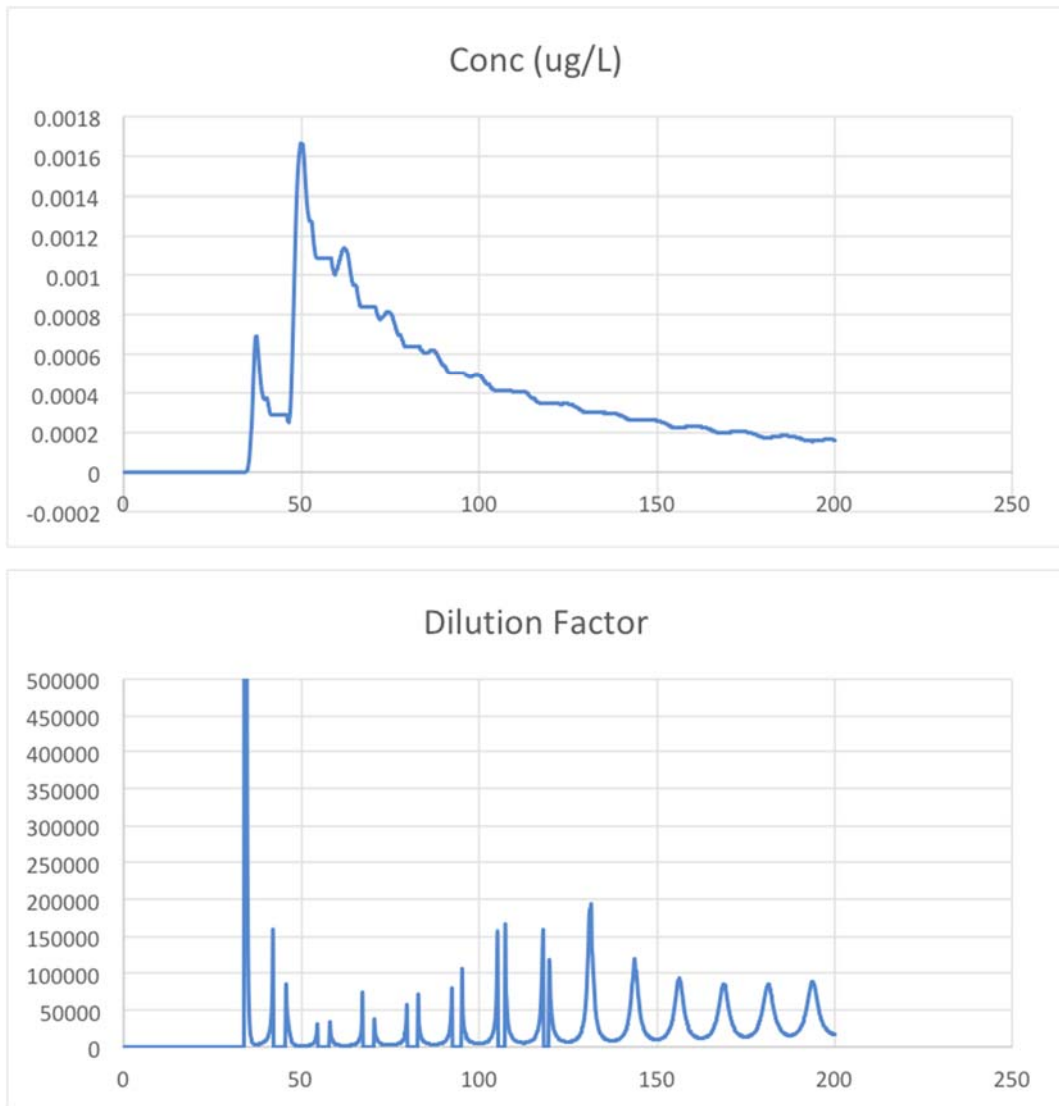


Figure 10: Concentration and Dilution 'C'

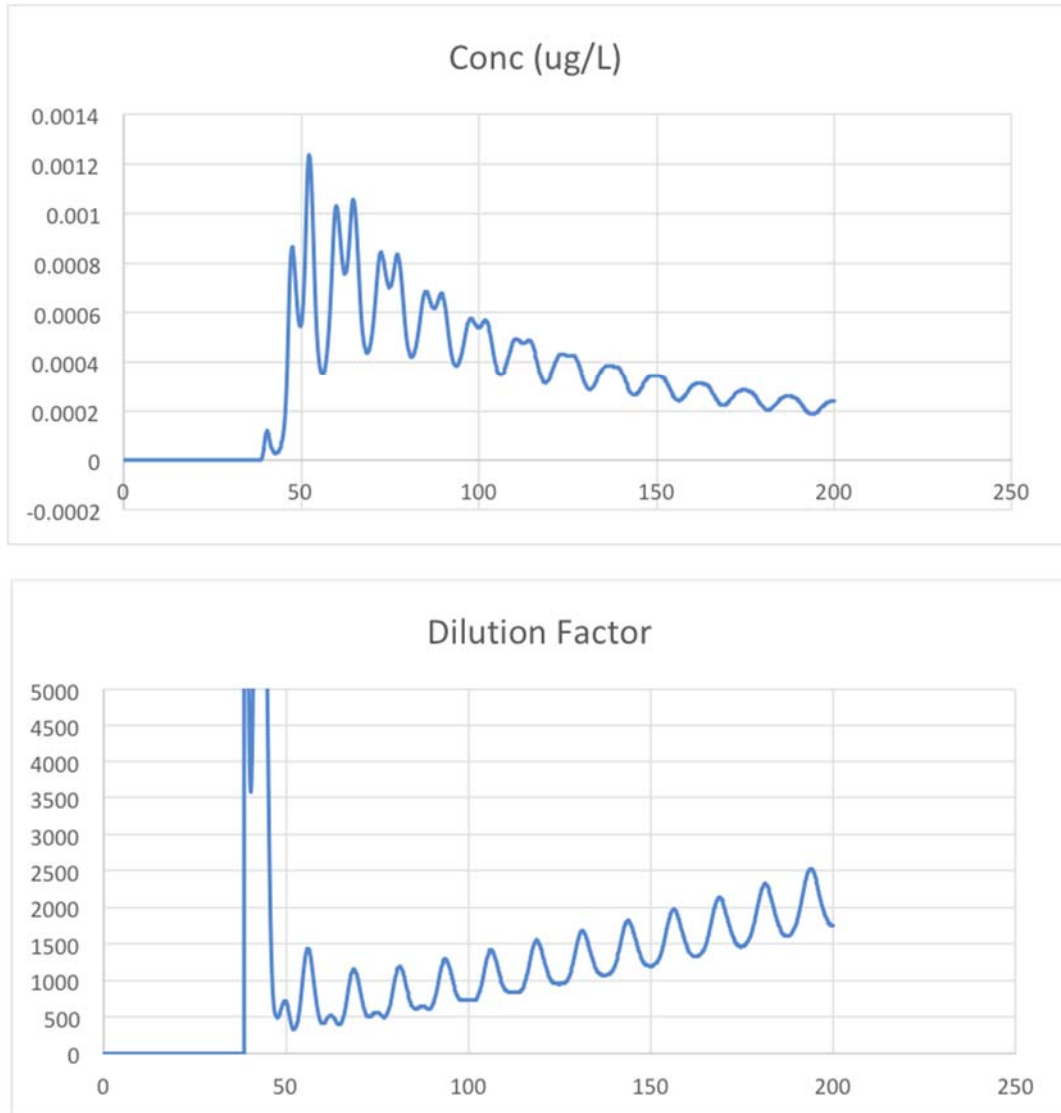


Figure 11: Concentration and Dilution 'D'

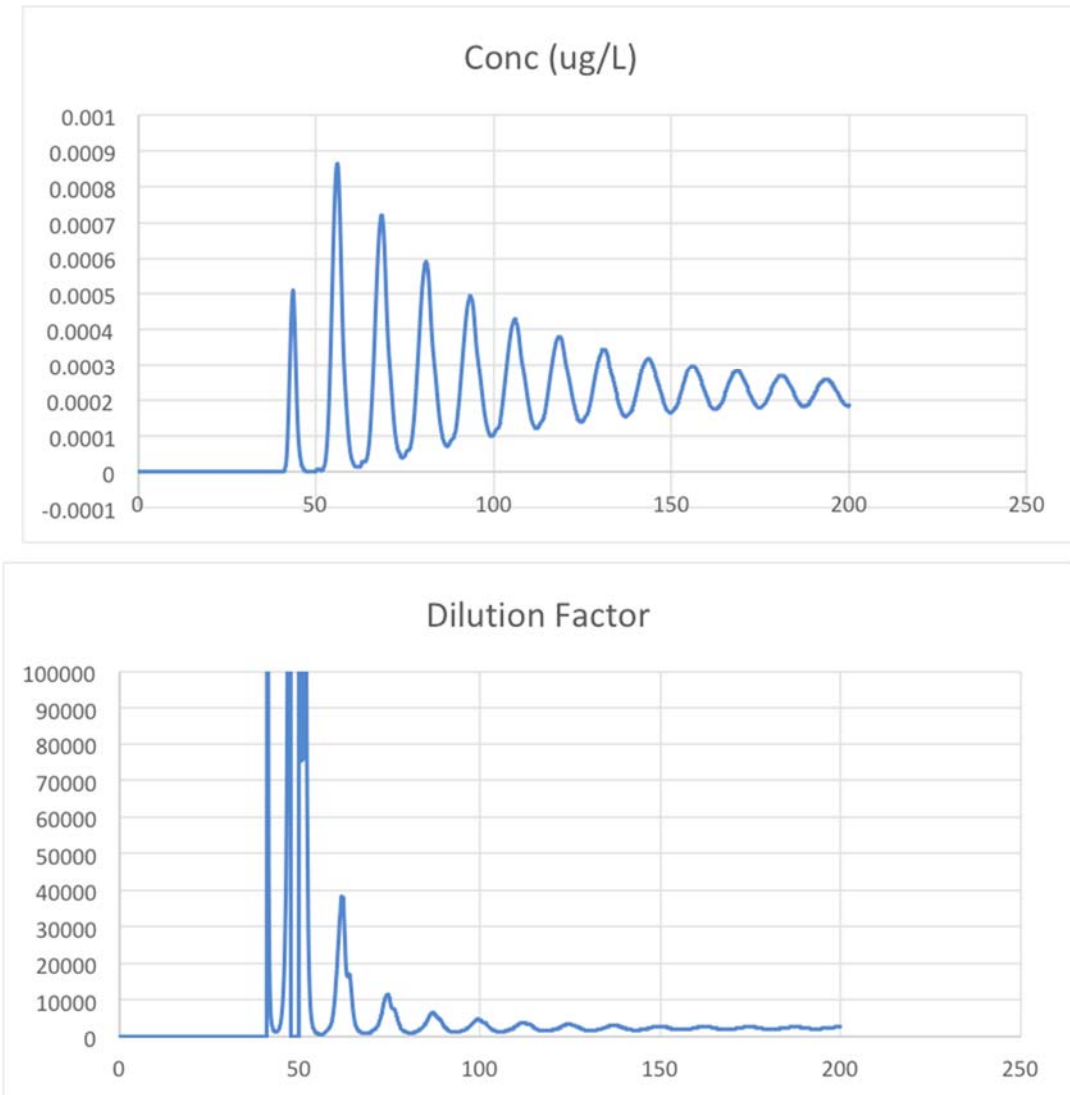


Figure 12: Concentration and Dilution 'E'

In the Figures 13-18 below synoptic maps of pollutant concentrations ($\mu\text{g/l}$) are presented for the following times after the diesel spill: 12.5 hours; 25 hours; 31.25 hours; 37.5 hours; 43.75 hours; 62.5 hours.

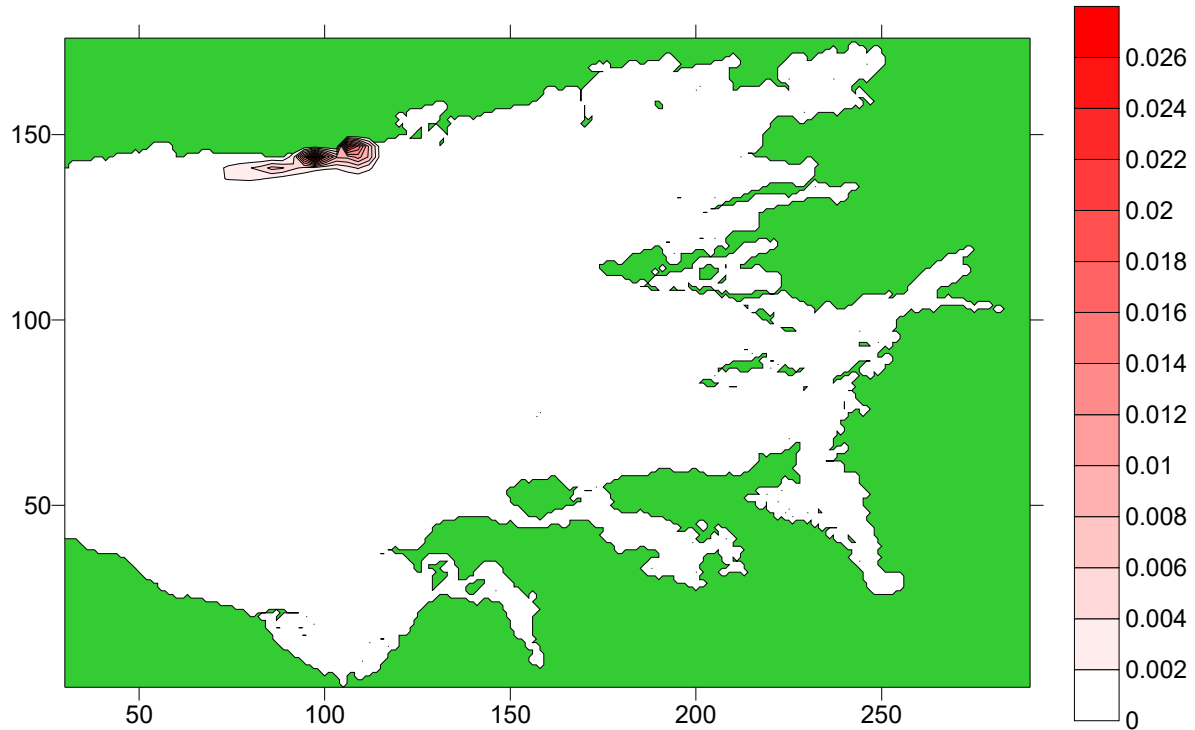


Figure 13: Concentration map 12.5 hours after spill – low tide

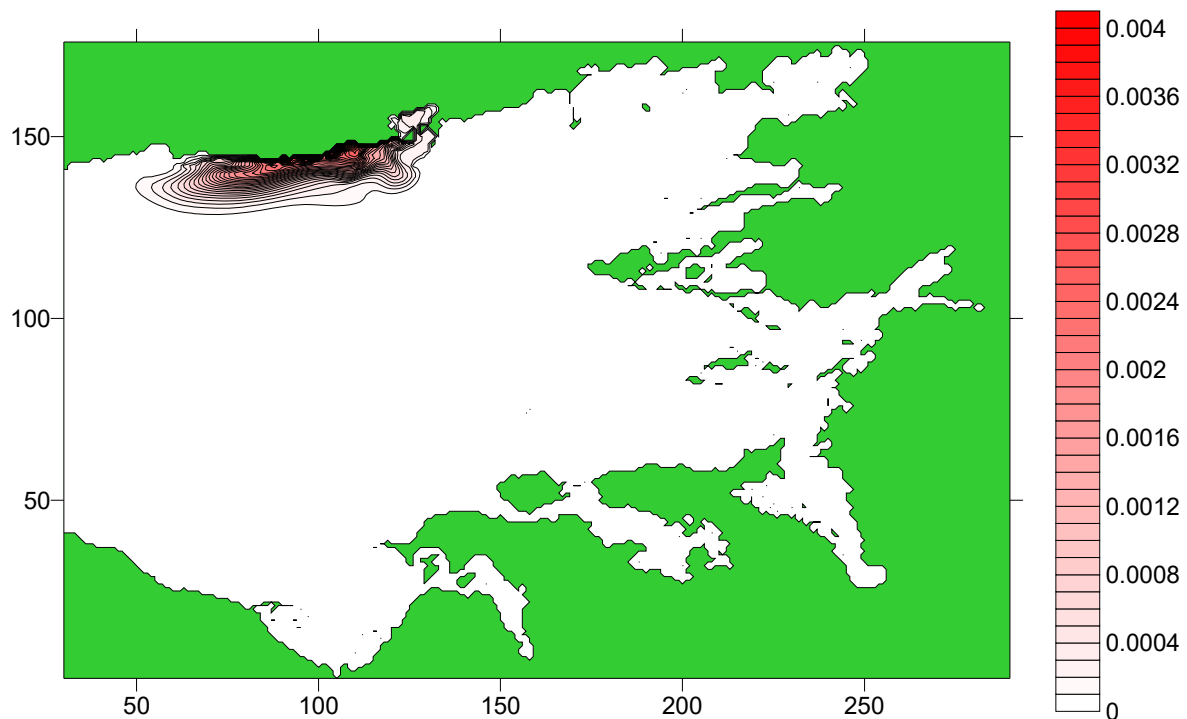


Figure 14: Concentration map 25 hours after spill – low tide

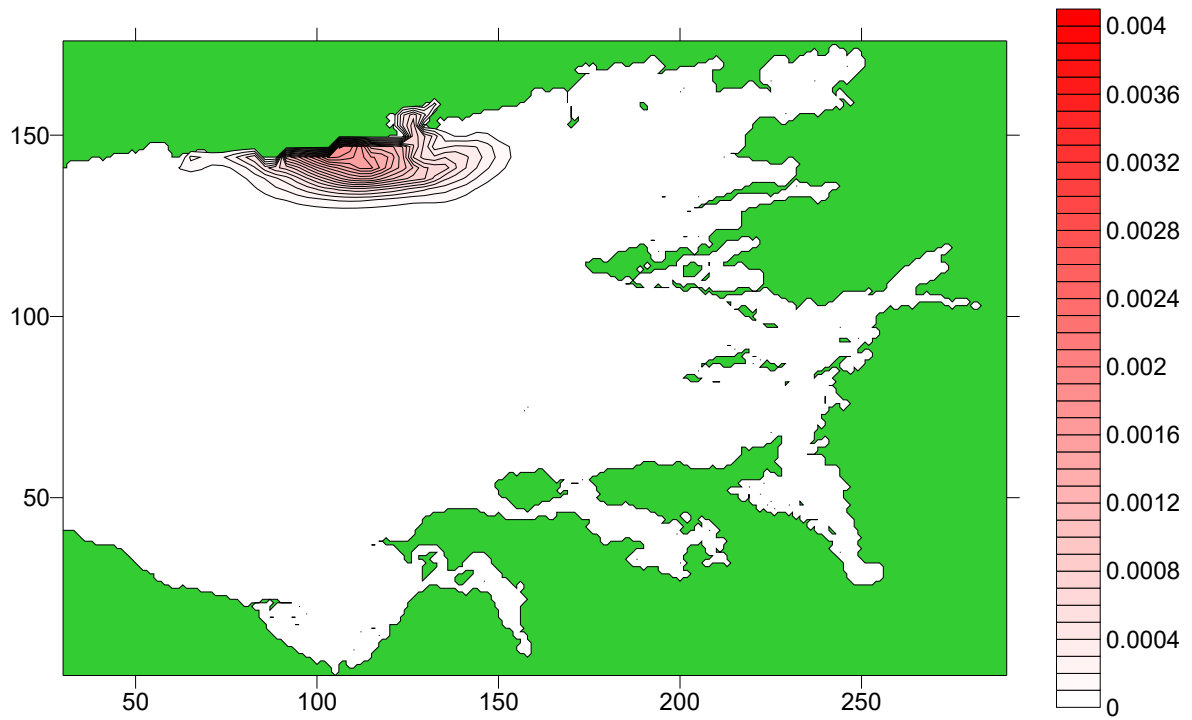


Figure 15: Concentration map 31.25 hours after spill – high tide

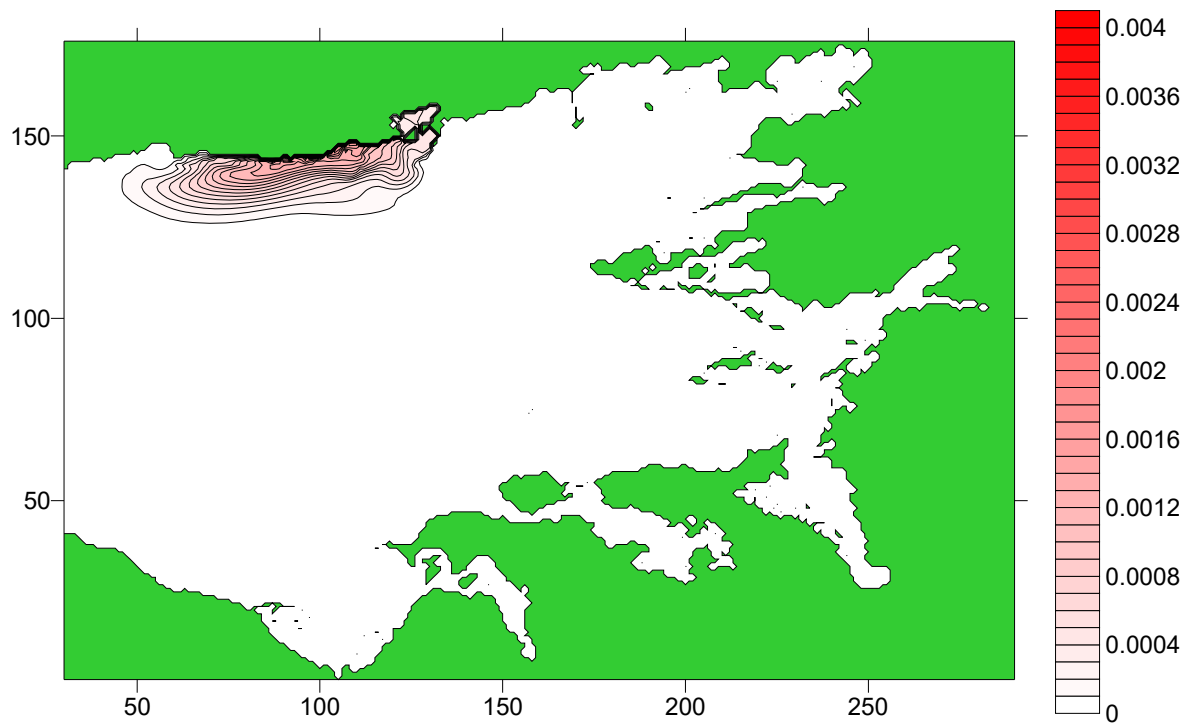


Figure 16: Concentration map 37.5 hours after spill – low tide

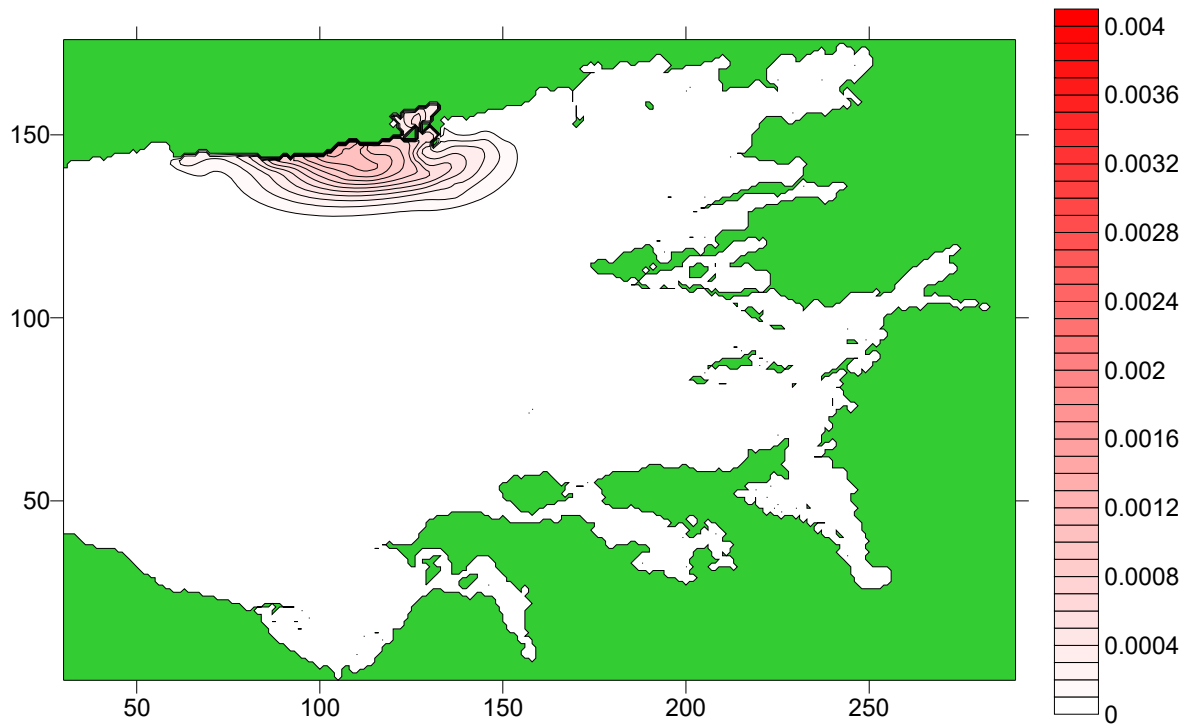


Figure 17: Concentration map 43.75 hours after spill – high tide

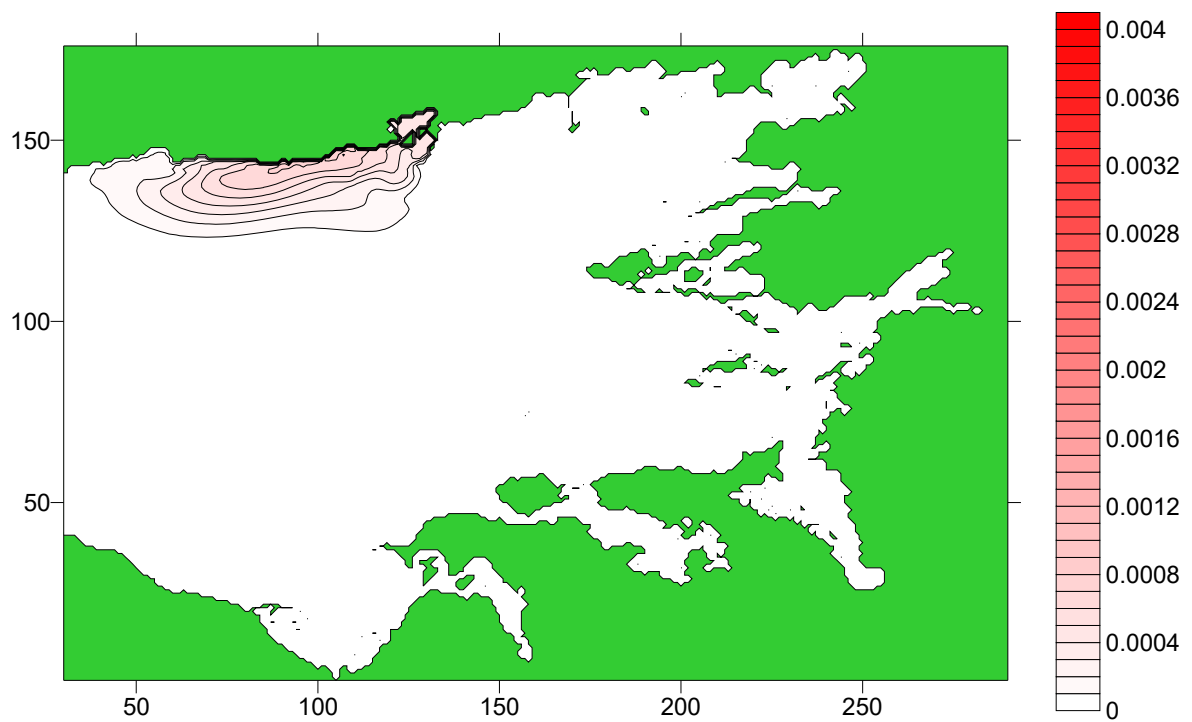


Figure 18: Concentration map 62.5 hours after spill – low tide

In the Figures 19-24 below synoptic maps of dilution factors are presented for 6 times during the diesel spill scenario.

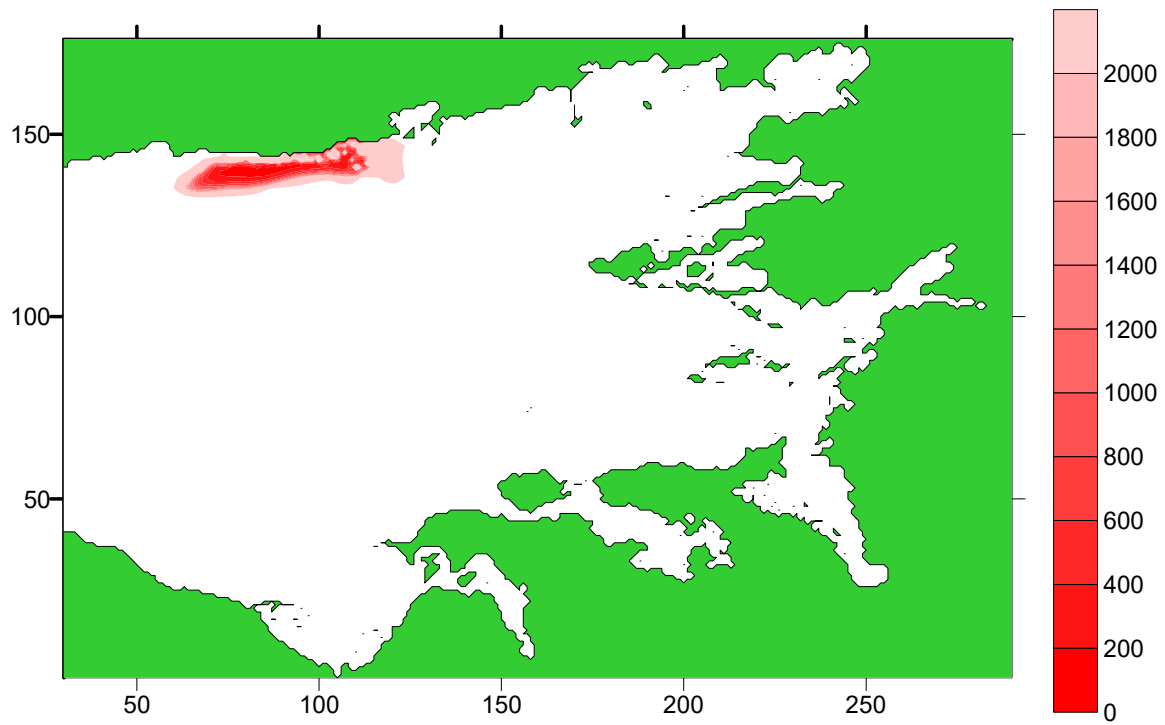


Figure 19: Dilutions map 12.5 hours after spill – low tide

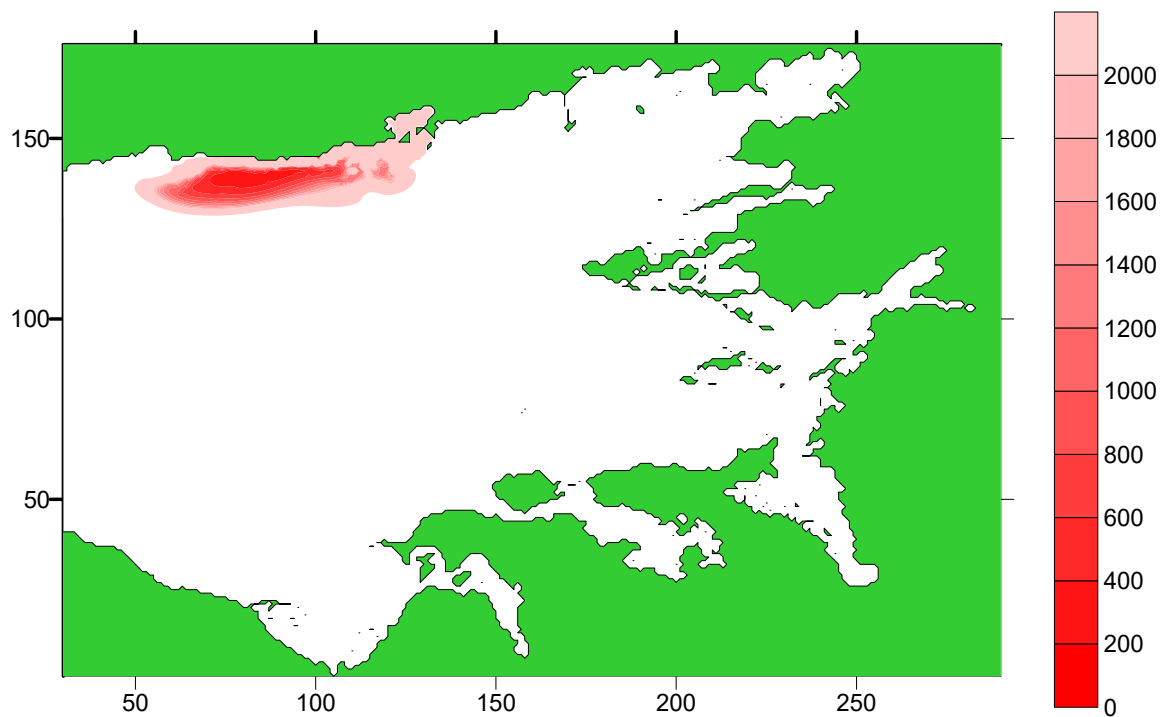


Figure 20: Dilutions map 25 hours after spill – low tide

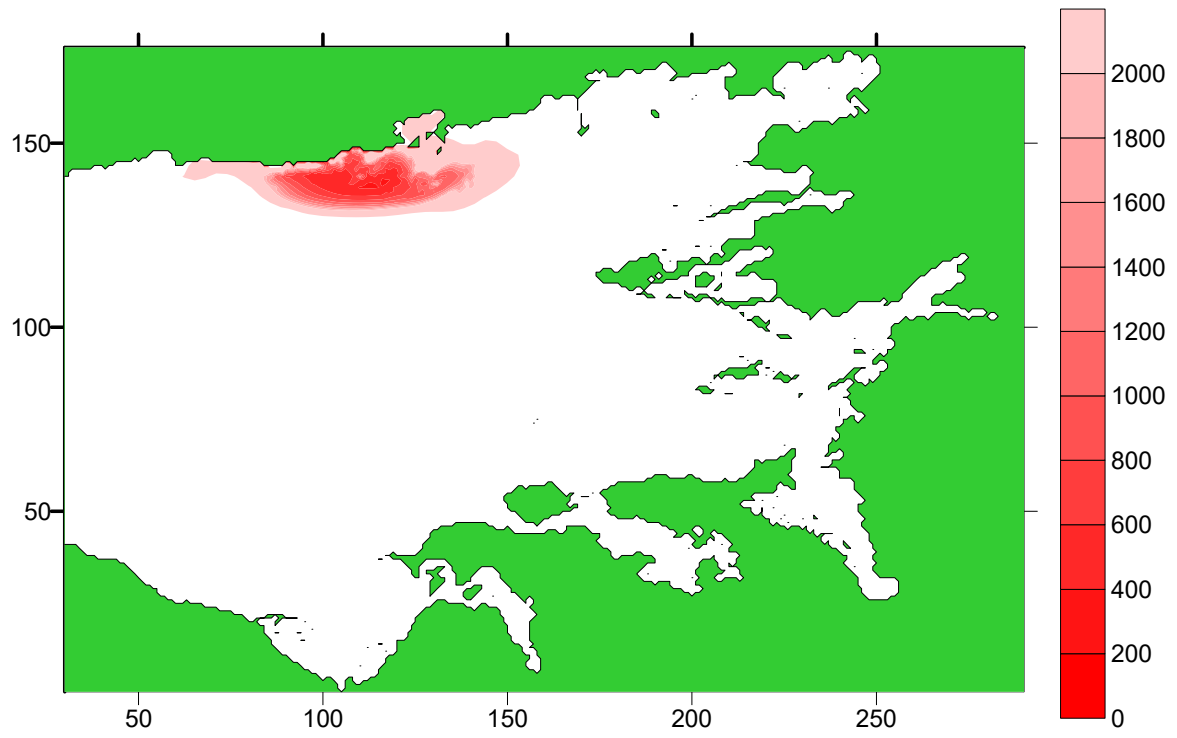


Figure 21: Dilutions map 31.25 hours after spill – high tide

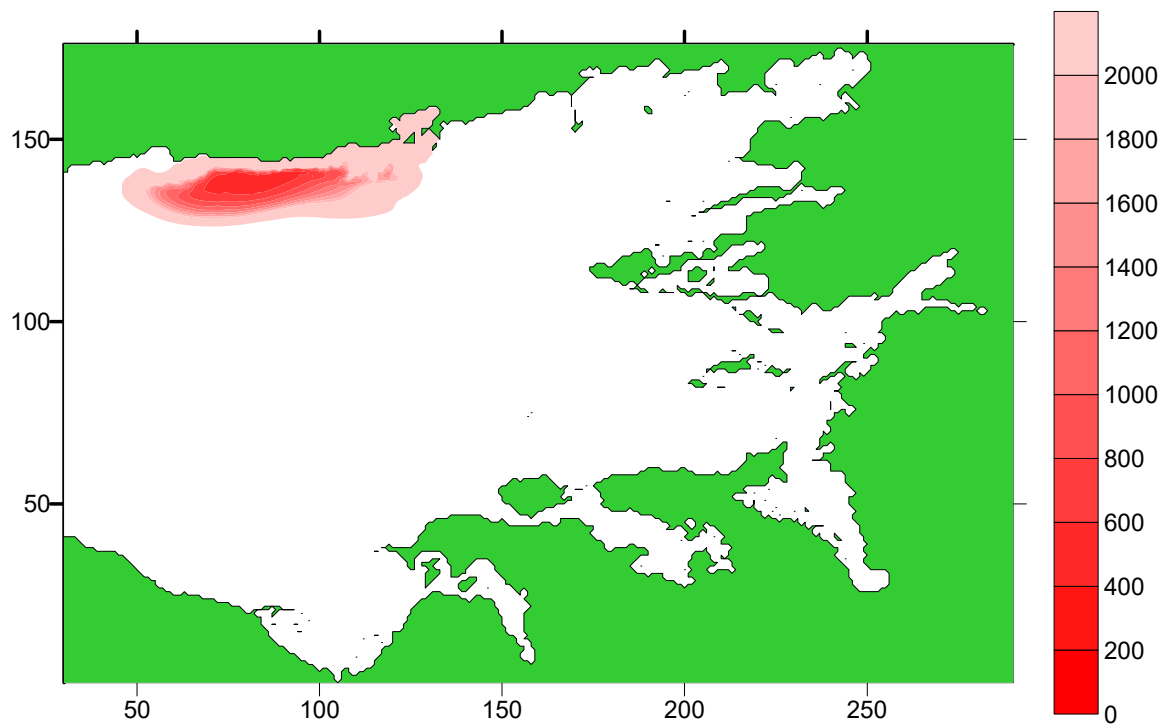


Figure 22: Dilutions map 37.5 hours after spill – low tide

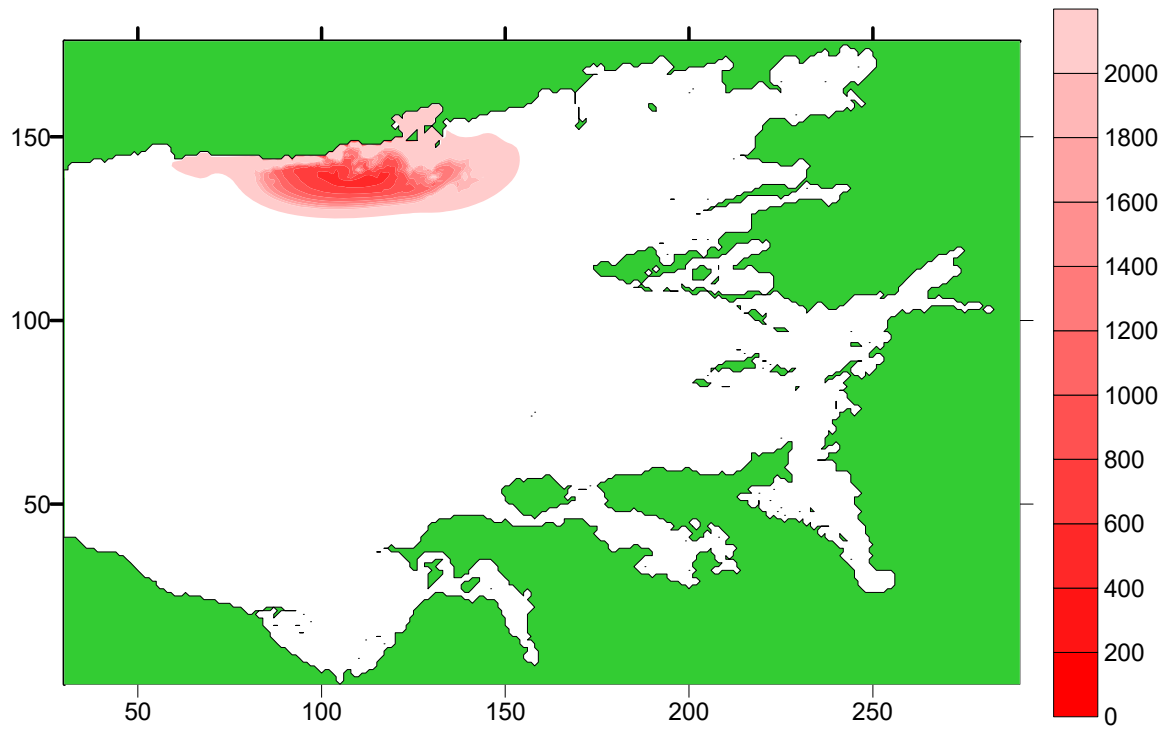


Figure 23: Dilutions map 43.75 hours after spill – high tide

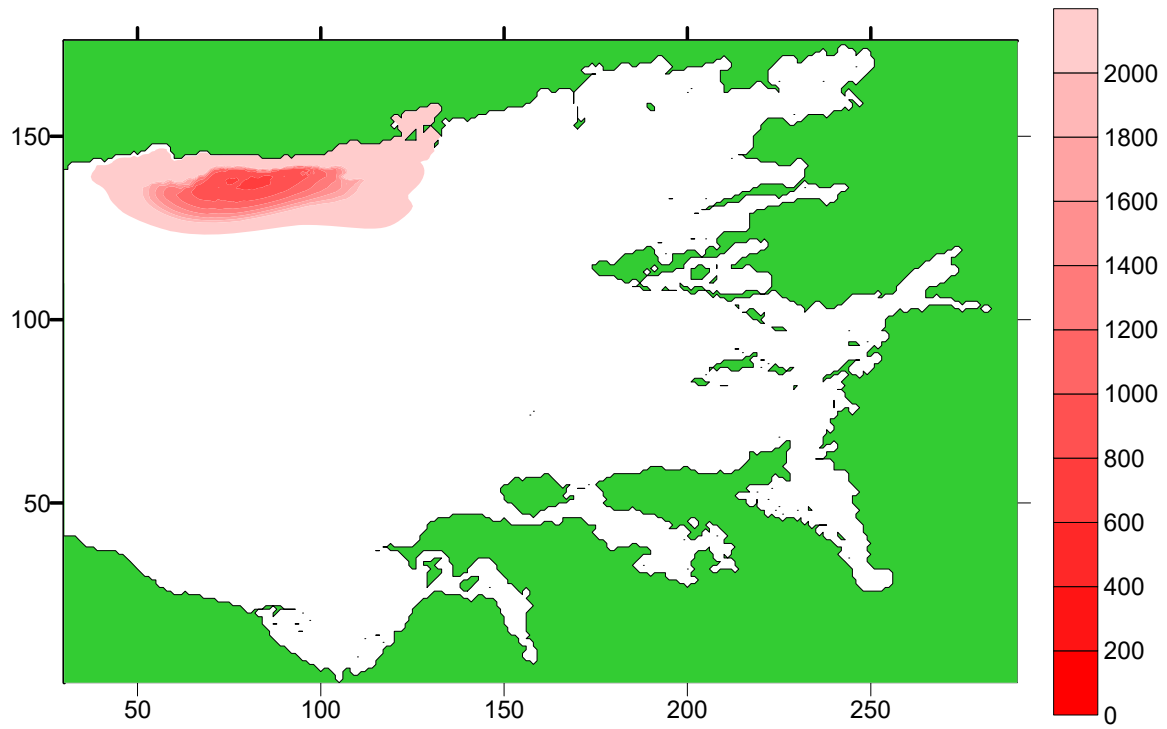


Figure 24: Dilutions map 62.5 hours after spill – low tide

4. Summary and Conclusions:

This study undertook a detailed analysis of a potential pollution event, namely, the transport of diesel spilled into Trusky East Stream and thence to Galway Bay, without any consideration of mitigation measures. The scenario considered was a spill of 300l of diesel, containing 250mg/l of active pollutant, into the stream during a 0.1% AEP flood event.

A hydrodynamic model of Galway Bay was run for 200 hours to simulate water circulation patterns on a 100m x 100m rectangular grid every 40 seconds. The reason the simulation duration was 200 hours is because after 200 hours concentrations of diesel in Galway Bay waters dropped off to very low levels. The model contains 176 grid points north-south and 290 grid points east-west, giving a total of 51,040 computational cells in the model. A pollutant transport model then used these hydrodynamics to transport the pollutant about Galway Bay; this model calculated pollutant concentrations and dilution factors at each grid point every 40 seconds.

In particular, this study focused on analysing concentrations and dilution factors at 3 points:

1. Inner Galway Bay SPA (E124675 N 222655) - Point B
2. Galway Bay Complex cSAC (E124755 N222784) - Point C
3. Black Head-Poulsallagh Complex cSAC - Point D

In addition, a point was plotted to show where the concentration and dilution of the pollutant are reduced to trace levels to the west of the entry point into the bay. Figure 6 above, shows the spill in the context of the European Sites that are located further west in Galway Bay.

The model results are shown in Section 3, and water circulation patterns presented in the Appendix. The time series plots, Figure 8-12, show how concentrations and dilutions vary at each analysis point based on the transport of pollutant and on the stage of the tide. From

these figures we see that the values oscillate with a regular frequency; these oscillations are tidally induced. During high tides lower concentrations and higher dilutions are observed due to the larger volume of water in the bay; we observe the converse at low tides. Over time concentrations die off, or remain very low, and dilutions increase.

Figures 13-18 present synoptic maps of concentration contours throughout Galway Bay. These figures show:

- The pollutant plume tends to spread out along the northern side of Galway Bay and is not transported widely throughout the domain
- Either no pollutant or very low levels of pollutant are observed in large parts of Galway Bay
- Concentrations reduce rapidly with distance from the discharge location
- Concentrations reduce rapidly with time

Figures 19-24 present synoptic maps of dilution contours throughout Galway Bay. These figures show similar features to the concentration contour figures. Dilutions increase with time and distance from the discharge point.

The main conclusions from this analysis are:

- The highest concentration calculated is at point A, the outfall site. At this point the peak concentration is $5\mu\text{g/l}$ once the diesel has mixed within the grid cell where it enters Galway Bay. This is a low value, and after this peak the concentrations fall off rapidly. The dilution factor just after the time of peak concentration is around 2000; dilution rapidly increases to around 17,000 over time.
- At point B peak concentration was approximately $0.0016\mu\text{g/l}$, with dilution factors soon after of 15,000. The dilution factors vary with tidal volume and transport of the pollutant plume.

- At point C results are very similar to results at point B, peak concentration was approximately 0.0016 µg/l, with dilution factors soon after of 15,000. The dilution factors vary with tidal volume and transport of the pollutant plume.
- At point D the model results indicate that the pollutant does not get transported to this location.
- All other points show concentrations less than at points A, B and C.
- Based on the above analysis it appears that Galway Bay has adequate capacity to assimilate the diesel spillage specified above.

APPENDIX

GALWAY BAY WATER CIRCULATION PATTERNS

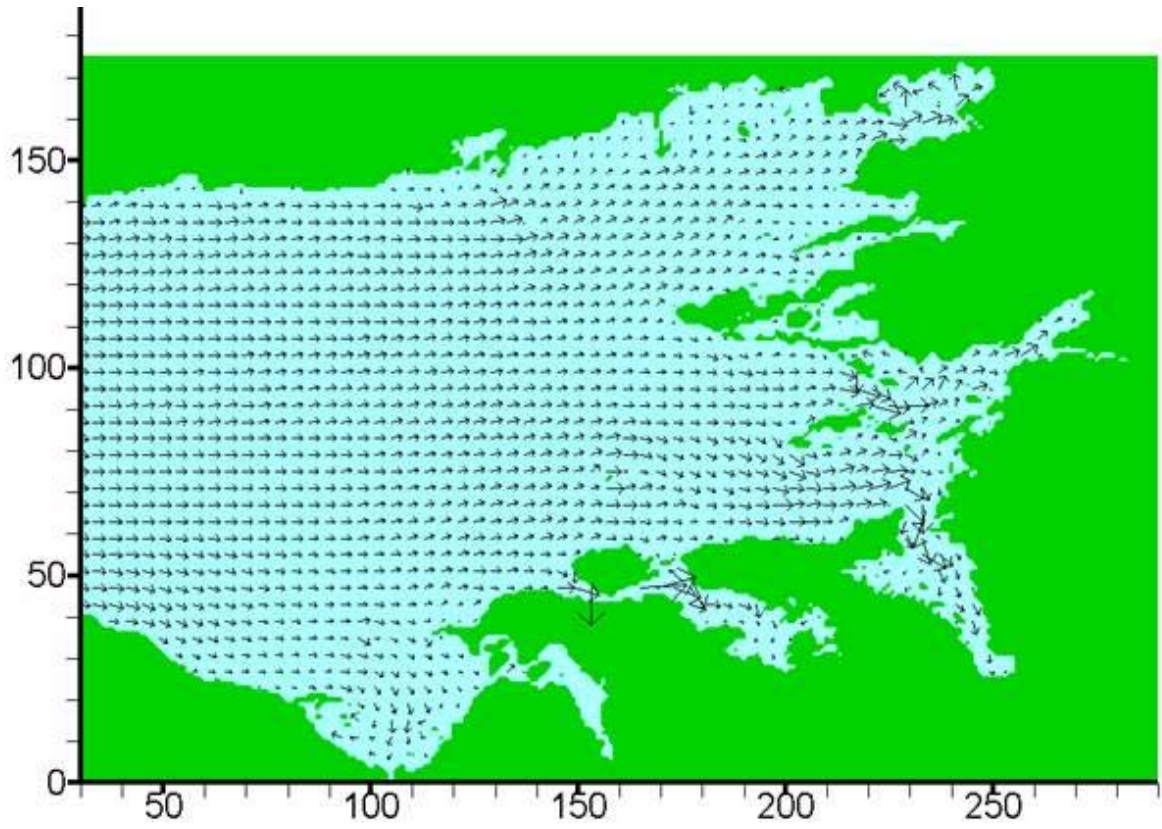


Figure A1: Large scale synoptic circulation map – mid flood tide

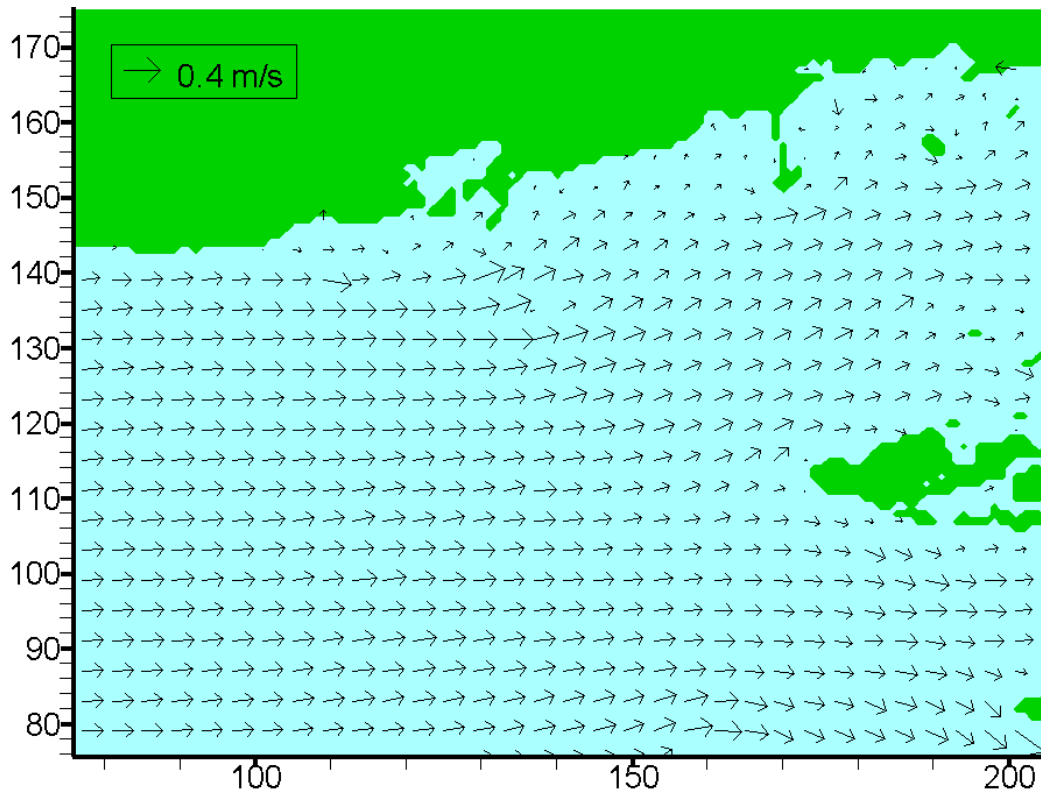


Figure A2: Local scale synoptic circulation map – spring tide, mid flood

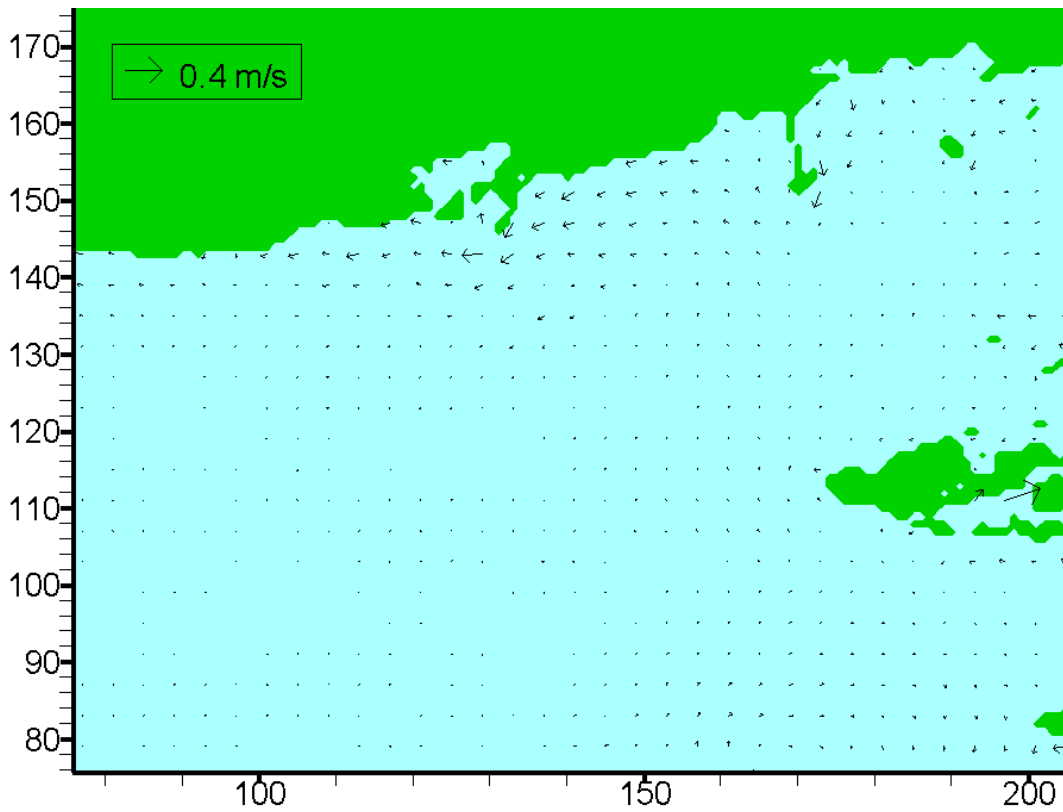


Figure A3: Local scale synoptic circulation map – spring tide, high water

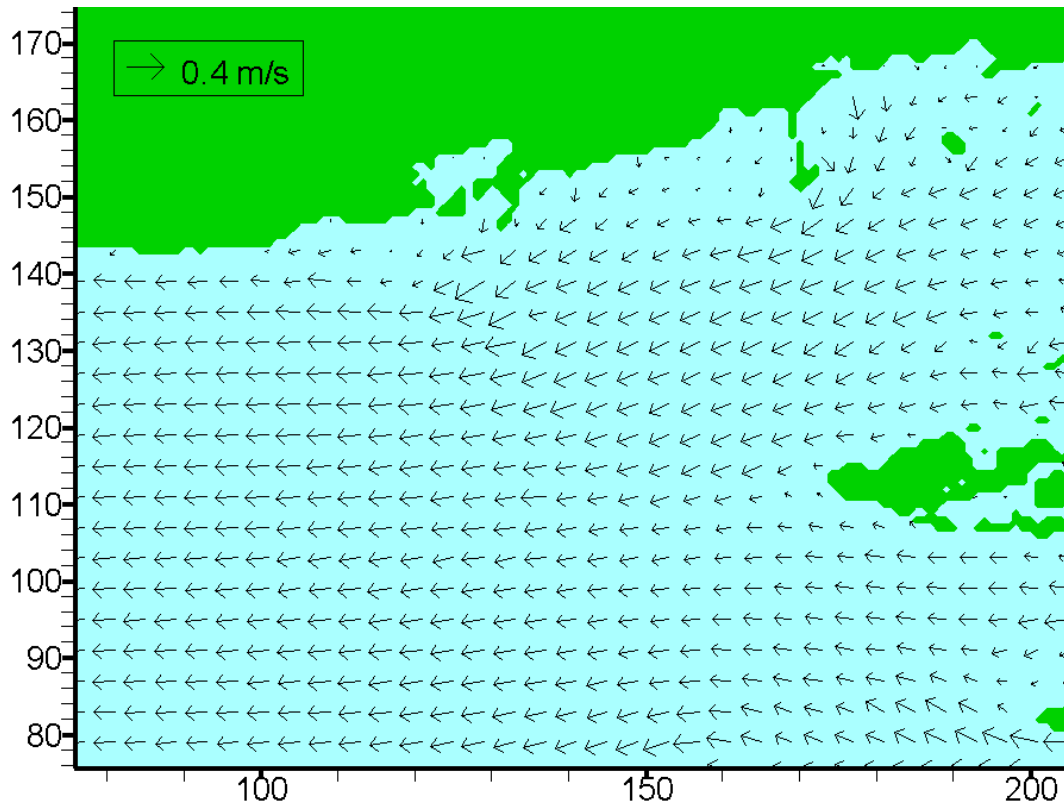


Figure A4: Local scale synoptic circulation map – spring tide, mid ebb

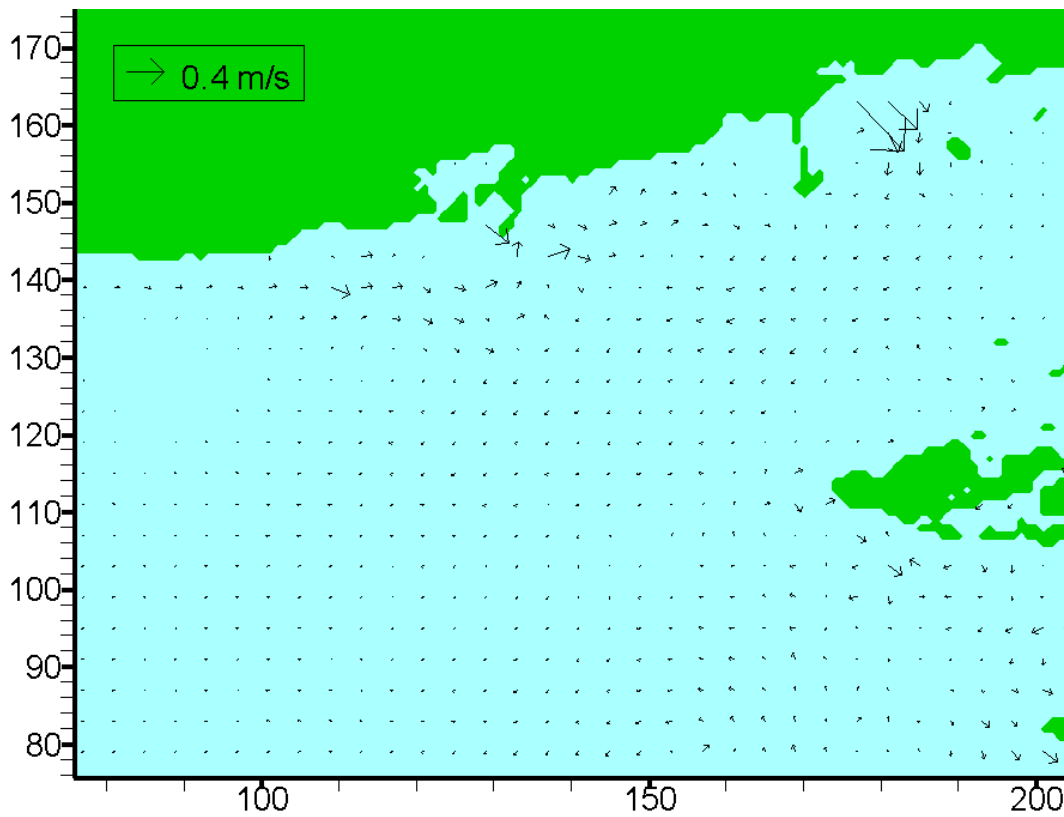


Figure A5: Local scale synoptic circulation map – spring tide, low water