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Shannon Foynes
PORT COMPANY

Capacity Extension at Shannon Foynes

Environmental Impact Assessment Report

Volume 1 Main Document

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1 INTRODUCTION

1.1 CONTEXT

This Environmental Impact Assessment Report (EIAR) has been prepared on behalf of Shannon Foynes Port Company (SFPC) for development works at the Port of Foynes, Foynes, Co. Limerick.

SFPC is seeking a 10-year permission to facilitate 'port capacity extension' at the Port of Foynes. This requirement to extend port capacity is responsive to a historic pattern of commercial growth through the Port of Foynes consistent with the projections envisaged in the Port Company's spatial and commercial masterplan – 'Vision 2041' and the resultant fruition of those projections experienced to date.

1.2 PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Environmental Impact Assessment (EIA) is a procedure under the terms of European Directives[1] for the assessment of the effects of development projects on the environment. An Environmental Impact Assessment Report (EIAR) is a statement prepared by the developer, providing information on the significant effects on the environment based on current knowledge and methods of assessment. It is carried out by competent experts, with appropriate expertise to provide informed assessment on their discipline.

The primary objective of the EIAR is to identify the baseline environmental context of the proposed development, predict potential beneficial and/or adverse effects of the development and propose appropriate mitigation measures where necessary. In preparing the EIAR the following regulations and guidelines were considered:

- The requirements of EC Directives and Irish Regulations regarding Environmental Impact Assessment;
- Guidelines on the Information to be Contained in Environmental Impact Statements (Environmental Protection Agency, Draft August 2017);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Draft Advice Notes for Preparing Environmental Impact Statements, (EPA 2015);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of the Environment, Community and Local Government [DoECLG], 2013); and
- In addition, specialist disciplines have had regard to other relevant guidelines, as noted in the specific chapters of the EIAR.

[1] *EU Directive 85/337/EEC as amended by Directives 2011/92/EU and DIRECTIVE 2014/52/EU*

1.3 FUNCTION OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

This EIAR is a statement of the effects, if any, which the proposed development, if carried out, would have on the environment. It consists of a systematic analysis and assessment of the potential effects of a proposed project on the receiving environment. The function of the EIAR is to:

- Establish the existing environmental characteristics of the proposed site;
- Provide details of the proposed development and associated secondary developments;
- Predict the likely significant effects of the development on the environment;
- Outline the measures considered necessary to avoid, reduce or mitigate the negative impacts identified both individually and cumulatively to an acceptable degree;
- Identify areas requiring reinstatement and on-going monitoring.

The EIAR has been prepared following the logical analysis of the development proposal in relation to the receiving environment. This process of environmental impact 'assessment' and the preparation of this report has been an evolving iterative process. In order to avoid, reduce or negate potential adverse environmental effects, and to ensure holistic consideration of all environmental issues, the EIAR for this project has been cognisant of baseline environmental conditions established and assessed within the existing port estate and more recent permitted developments.

For the avoidance of doubt, all necessary technical information required for the purpose of the EIAR is enclosed within this report. Consideration of this EIAR is not reliant upon consideration of any data contained in a previous EIAR or any other separate assessment.

1.4 TECHNICAL DIFFICULTIES OR LACK OF DATA

The compilation of the information necessary for the EIAR did not present any significant difficulties. However, some assumptions and projections were necessary for certain areas of this assessment, particularly the traffic and noise assessments. Survey work has been undertaken to compliment data from official sources in order to provide up-to-date base line information on which to undertake the environmental assessments. This EIAR has been prepared on the best available information and in accordance with current best practice and guidelines published by the Environmental Protection Agency.

1.5 THE APPLICANT

Shannon Foynes Port Company (SFPC) was established from the merger of the former Shannon Estuary and Foynes port companies as part of the ports rationalisation and modernisation programme undertaken by the Irish government in 2000. SFPC is Ireland's largest bulk port and its second largest port operation currently handling in excess of 11 million tonnes per annum.

SFPC facilitates an international gateway on the Shannon Estuary that is recognised at a national level as being fundamental to Ireland's economic prosperity and global trading links. With port facilities at Foynes, Limerick Docks and Shannon Airport and with commercial jurisdiction over marine activities on a 500km2 area on the Shannon Estuary, SFPC IS Ireland's largest bulk port and second largest port based on tonnage.

The Shannon Estuary extends from Limerick city to the Atlantic Ocean and is Ireland's premium deepwater resource with a channel depth of in excess of 18 metres and connected to all major international shipping lanes. SFPC oversees trade with an annual value of €8.4bn. The existing facilities on the estuary are serviced by the largest vessels entering Irish waters routinely handling large vessels up to 200,000 deadweight tonnes (dwt). The Shannon Estuary has a number of substantial deepwater facilities under the authority of SFPC. In addition to the general cargo ports at Foynes and Limerick Docklands, there are also single user jetties at Moneypoint, Tarbert Island, Aughinsh and Shannon Airport.

SFPC is recognised by the European Commission as one of the three core ports in Ireland under the Trans- European Transport Network (Ten–T). In the Government's 2013 National Ports Policy, it is recognised as one of the three Tier 1 ports of national significance. Importantly, this Government Policy identifies the Tier 1 ports as responsible for providing future national port infrastructural capacity.

Port activities on the Estuary have evolved over time and have made a positive contribution to the historic and economic development of the region. Whilst SFPC seeks to maximise the potential of the Shannon Estuary and its port from a commercial and economic perspective, SFPC also seeks to ensure that port operations are responsive to its settlement location and the surrounding community. In this regard, SFPC contributes to wider community activities and already make significant contributions through hosting the following programmes and initiatives:

- School competitions program;
- School port tour program;
- School placement programme for transition year students;
- Sponsorship of local rugby and GAA club;
- Sponsorship of local community council;
- Sponsorship of the annual Foynes Air Show;
- Foynes National school laptop sponsorship;
- Sponsorship of Foynes Yacht Club; and
- A significant financial contribution to the Askeaton community swimming pool development.

SFPC commits to continued implementation of a programme designed to facilitate greater integration between the Port and the settlement of Foynes.

1.6 THE PROPOSED DEVELOPMENT

This capacity extension is provided in two interrelated ways – increased capacity of the quay wall, and, increased capacity of supporting landside storage facilities and logistics. Consequently, the project includes two specific elements of development and operational activities as follows:

- Jetty Extension - The joining of the existing 'West Quay' and the 'East Jetty'

and;

- Durnish Land Development - To provide for increased port related storage and port-centric logistics

The proposed development, as described in the public notices seeks to provide for Port Capacity Extension that will consist of the following:

(1) Modifications to the existing jetties and quays to include: connection of the existing West Quay to the existing East Jetty for the purpose of extending the length of the existing quay to facilitate the mooring of vessels and Port related operations. Development works consist of; (i) Construction of an open piled jetty structure with suspended 116.5 metre concrete deck connecting the West Quay to the East Jetty; (ii) quayside furniture including quay fenders, mooring bollards, safety ladders, toe rail, and lighting columns, (iii) construction and remedial works to the both existing West Quay and East Jetty ends to facilitate structural 'tie-in' of the proposed new jetty structure, (iv) removal of the existing small craft landing pontoon and walkway from its current position affixed to the shore between the West Quay and the East Jetty, and provision of a new small craft landing pontoon and walkway affixed to the western side of the West Quay wall, and, (v) all associated site development works; and

(2) Phased Expansion of the Port Estate on 33.95 hectares of land immediately adjacent to the east of the existing port estate to provide serviced industrial land, and, to accommodate marine related industry, port centric logistics and associated infrastructure that will be provided in accordance with a development framework programme prepared for the overall 'expansion' area and which is lodged with the planning application. The development includes:

   (I) site development and infrastructure works to the entire expansion lands on a phased basis including (a) raising of ground levels with fill material to a typical height of +4.44m OD Malin; (b) provision of all associated services including storm water infrastructure and, modification to the existing OPW drainage attenuation system; (c) provision of 2.4m high perimeter fencing, (d) landscaping berms and treatments, and (e) all associated site development works; all to be delivered on a phased basis; and

   (II) Implementation and use of 'Phase 1' of port expansion works including: (a) modification and realignment to part of the existing port estate access road including provision of new roundabout and junction arrangements on that road, and associated lighting, and storm water drainage; (b) provision of new internal Port access road (with associated footpath and combined cycle path) including the provision of bridge structures to facilitate access across existing drainage channels; (c) construction of three covered industrial type warehouse units (with typical maximum ridge height of 15.1m above raised ground level) with associated external storage, parking and circulation areas; (d) the provision of separate dedicated uncovered 'open' storage area/ container storage area and associated circulation and service area (with maximum container stacking height of 8m if/when container storage required); (e) provision of Klargester BE model (or similar) package foul water treatment system with polishing filter and discharge to ground to serve the Phase 1a expansion area; (f) modifications to existing 'Foynes Engineering' industrial building which involves the removal of the 'lean-to' structure affixed to the main building and remedial building and site development works; (g) provision of an ESB electrical substation; (h) provision of lighting columns within the 'Phase 1' expansion area; (i) provision of a new security kiosk and access control barrier on the existing Port access road; (j) provision of noise attenuation measures along parts of the southern and western boundary of 'Phase 1' expansion area; (k) fire water storage infrastructure; (l) provision of a 'bus-stop' on the existing Port access road; (m) landscaping; and (n) all associated site development works.

1.7 STATUTORY REQUIREMENT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT

Under the provisions of Section 37B(4)(a) of the Planning & Development Act 2000 (as amended), by notice dated 30th November 2016, An Bord Pleanála (Ref 13.PC0224) determined that,

"having regard to the nature, scale and location of the proposed port related development it is considered that the proposed extension of jetty facilities and the associated extension to the port estate at Foynes Port, County Limerick constitutes development that falls within the definition of transport infrastructure in the Seventh Schedule of the Planning & Development Act 2000 (as amended). Furthermore, the proposed development is considered to satisfy the requirements of Section 37A (2) (a) & (b) of the Act, having regard also to the identified status of the port in National and Regional level policy".

In compliance with Section 37(E)(1) of the Planning & Development Act 2000 (as amended), an application for permission for development in respect of which a notice has been served under section 37B(4)(*a*) shall be accompanied by an environmental impact statement in respect of the proposed development.

In addition, Schedule 5 of the Planning and Development Regulations 2001 (as amended) sets out a comprehensive list of project types and development thresholds that require a mandatory Environmental Impact Assessment. The proposed development also falls within Part 2, Article 10 of the Regulations: Infrastructure Projects. Sub-sections (a) and (b)(iv) apply in this instance and provide that a mandatory EIA is required for developments which provide for:

(a) Industrial estate development projects, where the area would exceed 15 hectares; and

(b)(iv) Urban development which would involve an area greater than 2 hectares in the case of a business district, 10 hectares in the case of other parts of a built-up area and 20 hectares elsewhere.

The proposed development seeks to extend the existing port estate on land comprising 33.95 hectares for marine related industrial uses and which also comprises urban development in excess of 20 hectares. A mandatory EIA is therefore required under the provisions of both Part 2, Article 10(a); and Part 2, Article 10 (b)iv.

Directive EIA 2014/52/EU amends EIA law in several respects, updating the 2011/92/ EU Directive. The amendments include a requirement for an Environmental Impact Assessment Report (EIAR), rather than an Environmental Impact Statement (EIS). The other changes introduced include:

- Refinement of environmental factors to be considered in the assessment;
- Expansion of the information to be contained in the Environmental Impact Assessment Report (EIAR);
- Requirement for developer to have competent experts prepare the EIAR.

Directive 2014/52/EU has not yet been transposed into Irish Planning legislation. Nonetheless, in line with the recommendation of the DoHPCLG Key Issues Consultation Paper, 2017, this report has been prepared in compliance with the requirements of the 2014 Directive.

1.8 STRUCTURE OF THE EIAR

This EIAR is prepared using the 'Grouped Format Structure'. This means that each topic of environmental assessment is considered as a separate section and is drafted by relevant specialists. The EIAR is presented in seven volumes as follows:

- Volume 1 EIAR Main Document
- Volume 2 EIAR Appendices
- Volume 3 EIAR Appendices (A3)
- Volume 4 EIAR Non Technical Summary
- Volume 5 EIAR Non Technical Summary Drawings (A3)
- Volume 6 Natura Impact Statement
- Volume 7 Planning Drawings (A3)
- Volume 8 Appendix 8.2 - GQRA
- Volume 9 Roads and Traffic modelling data and A3 drawings

The project managers and engineers for the proposed development are RPS Group Limited. HRA Planning Limited (HRA Planning) are the Planning consultants.

Production of the EIAR has been coordinated by RPS Group Limited and HRA Planning Limited. The EIAR structure, responsibility and qualified input for each chapter is detailed in Table 1.1.

Chapter of EIAR	Author(s)	Company	Subject Area	Qualification
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Chapter 2	Sinead Henry	RPS	Engineering Aspects	MEng CEng MICE NECReg
Chapter 2	Gary Rowan	HRA Planning	Planning Strategy	BSc(Hons) MSc Applied Science PGDip EIA SEA Mgmt. MIPI MRTPI
Chapter 3	Mary Hughes	HRA Planning	Spatial Planning Policy	BA (Hons) MSc PGDip EIA Mgmt. MIPI
Chapter 4	Mary Hughes	HRA Planning	Project Scoping & Consultation	BA (Hons) MSc PGDip EIA Mgm.t MIPI
Chapter 5	Gary Rowan Mary Hughes	HRA Planning	Examination of Alternatives	BSc(Hons) MSc Applied Science PGDip EIA SEA Mgmt. MIPI MRTPI BA (Hons) MSc PGDip EIA Mgmt. MIPI
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Chapter 7	Gerard Morgan	RPS	Benthic Ecology and Fisheries	BSc (Hons) MSc
Chapter 7	Simon Berrow	RPS	Marine Mammals	BSc (Hons) PhD
Chapter 8	Debbie Nesbitt	RPS	Waste	BSc MSc CEnv MCIWM MIEMA
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Chapter 11	Stephen Cleary	RPS	Terrestrial Noise	BA(Mod) MSc MIEMA MIOA CEnv
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Chapter 12	Adrian Bell	RPS	Coastal Processes	BSc CEng FIAE FIEI MICE MIStructE
Chapter 13	Celine Daly	RPS	Transportation	BSc (Hons) CMILT MCIHT MTPS
Chapter 14	Rex Bangerter	ADCO	Archaeology	BA MA
Chapter 15	Raymond Holbeach	RPS	Landscape and Visual	BSc(Hons) MLA CMLI
Chapter 16	Mary Hughes	HRA Planning	Interactions of the Foregoing	BA (Hons) MSc PGDip EIA Mgmt. MIPI

Table 1.1 List of Contributors to EIAR Chapters

2 PROJECT DESCRIPTION

This chapter sets out a description of the proposed development and information on the project site, the design, size and other relevant features of the project. These details are set out in the following sections in a logical structure so as to adequately describe; the location of the project and the characteristics of the project for which this Environmental assessment has been undertaken.

2.1 THE LOCATION OF THE PROJECT

2.1.1 Site Location

The subject site is located within and adjacent to the settlement of Foynes, Co. Limerick and comprises the existing 'Port of Foynes' and undeveloped lands to the immediate east of the existing Port estate. The northern boundary of the subject site adjoins the Shannon Estuary. Foynes village is situated to the south (behind) the existing port estate and extends along the National Secondary (N69) Limerick – Tarbert Road. Limerick City is located circa 38km to the east (upstream), whilst the mouth of the Shannon Estuary where it meets the Atlantic Ocean (between Loop Head and Kerry Head) is located circa 56km to the west (downstream).

Situated on the Shannon Estuary, the Port of Foynes is a 'Tier 1 Pot' and is the second largest Port in Ireland and is the principle general purpose terminal on the Estuary routinely catering for cargo vessels. Due to its favourable location on the west coast of Ireland and its modern deepwater facilities, Foynes Port is ideally positioned for additional European trading as well as for further increases in ocean energy resources.

The Port of Foynes (including Foynes Island) is one of a number of Port facilities that operate on the estuary. All marine activities generated by the Port and by these other facilities operate within the statutory jurisdiction of Shannon Foynes Port Company (SFPC) which extends over 500km^2 area on the Shannon Estuary, stretching from Kerry/Loop Heads to Limerick City.

The existing Port provides circa 657m length of quay wall catering for vessel sizes of up to 200+ metre in length, 10.5m draught and between 3,000-40,000 deadweight tonnes (dwt). The Port of Foynes is one of 6 main port facilities on the Shannon Estuary that are serviced by Shannon Foynes Port Company (SFPC). In addition to these main facilities, there are 4 other deep-water anchorages on the Shannon Estuary which are situated off Scattery Island.

Figures 2.1 and 2.2 and 2.3 show the location of Foynes Port and the extent of the project boundary and area of proposed development works. The Port is positioned south of Foynes Island in a sheltered channel with a depth of -7.8m CD (Chart Datum) separate from the wider Shannon Estuary.

The channel is dredged to provide access to the estuary for shipping at the western end. A berth depth of -10.5mCD is maintained close to the existing quay walls. A shallower channel is maintained to the East of the island for smaller vessels. There is a tidal range of approximately 5m at spring tides. The harbour area is well sheltered and formed by a channel south of Foynes Island whilst the main navigation channel of the Estuary is located to the north of the island in deeper water.

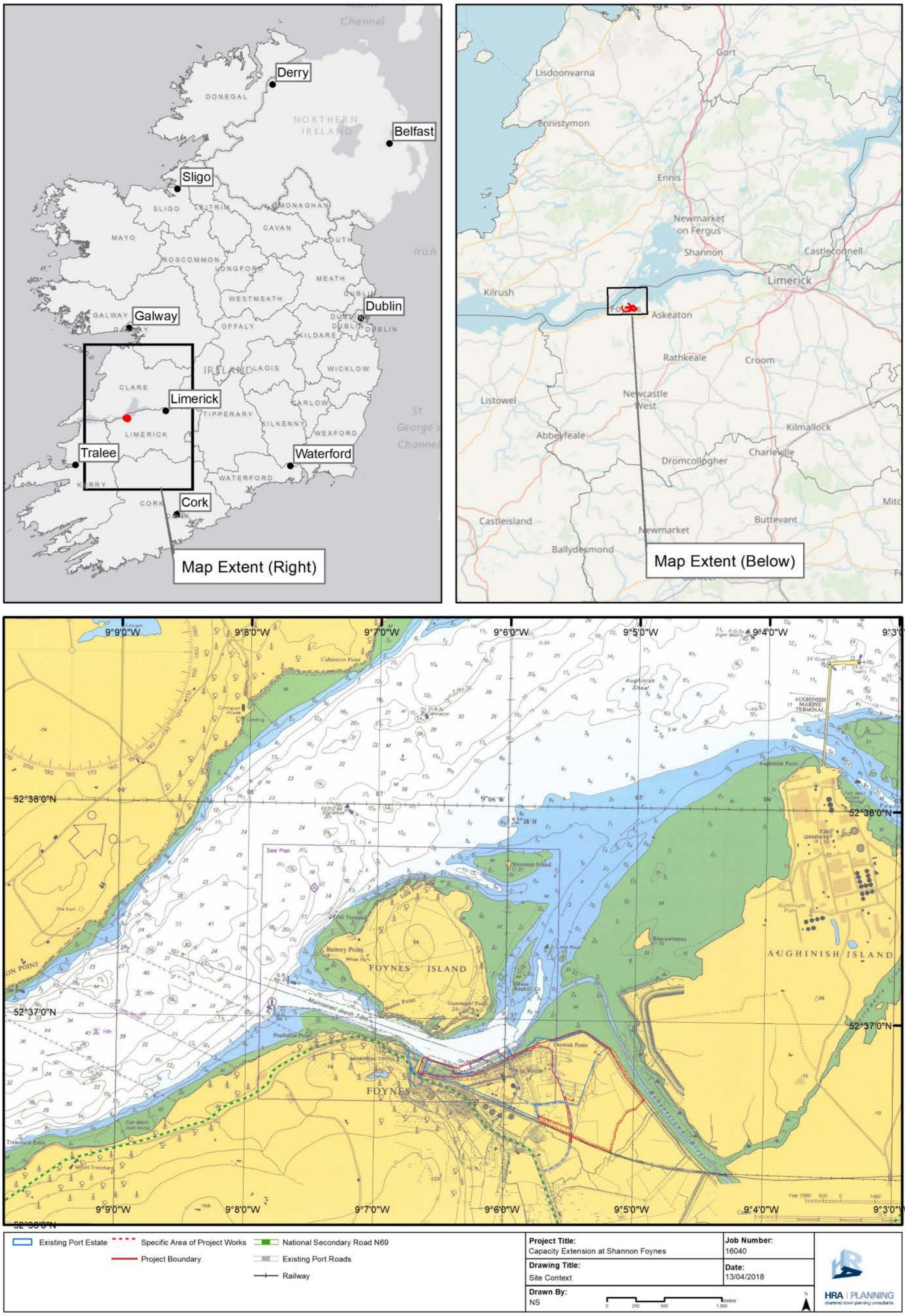


Figure 2.1 Project Location

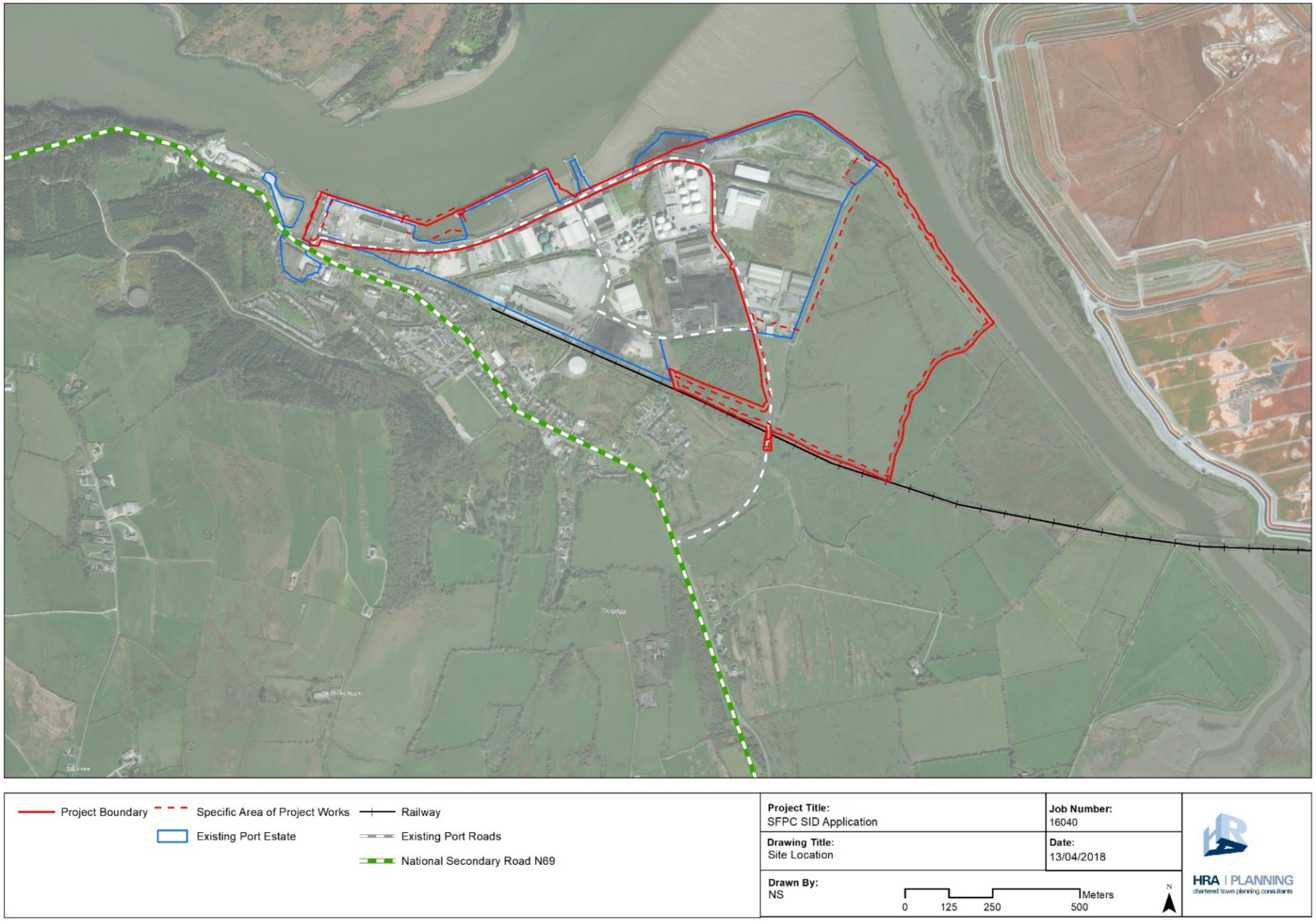


Figure 2.2 Project Boundary – Aerial base

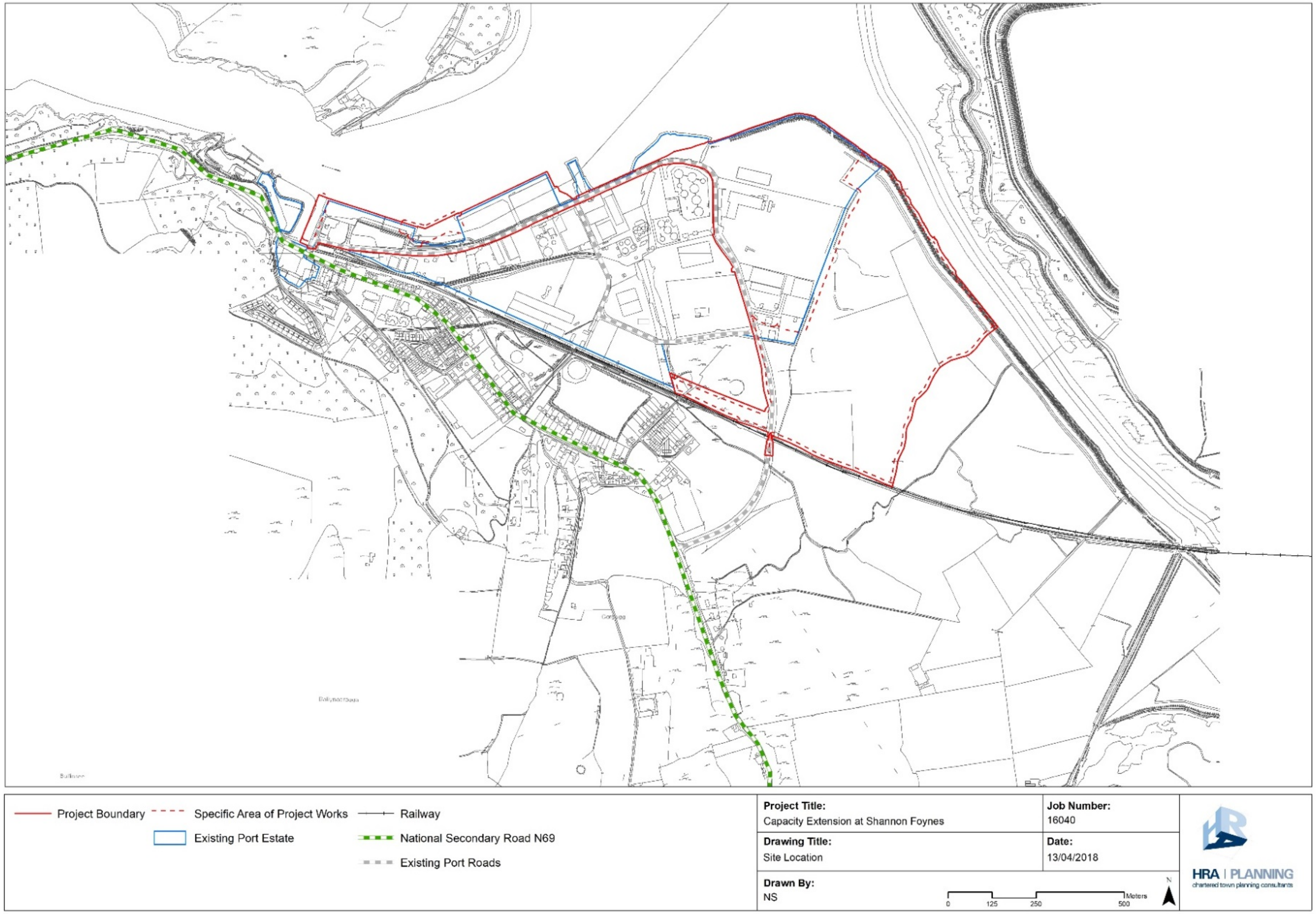


Figure 2.3 Project Boundary – Ordnance Survey base

2.1.2 DEVELOPMENT AREA

The project site for the purpose of this EIAR is defined by the red line planning application site boundary as illustrated on the planning application drawings. This area which measures 62.10 hectares (ha) extends to include specific areas in which the proposed development will occur within the existing Port estate and, on lands directly adjacent to it. The proposed development works are concentrated in two specific locations – (i) adjacent to the existing quay walls within the existing Port estate (measuring 0.51ha or 5,142m^2), and (ii) undeveloped lands adjacent to the east of the exiting port estate referred to for the purpose of this EIAR as 'Durnish' or the 'Durnish lands' as illustrated in Figure 2.4 (measuring 33.95ha or 339,559m^2).

Though physically separated, the proposed development works will, from an operations perspective, be interdependent on each other. For convenience of identification, the planning application drawings which this EIAR relates, seeks to illustrate further, the specific areas of the proposed 'development works' by way of dotted red line within the red line planning application boundary. For the avoidance of doubt, this has no bearing on this EIAR. The EIAR boundary for which this environmental impact assessment has been undertaken is consistent with the planning application boundary and all proposed works have been subject to assessment in this EIAR.

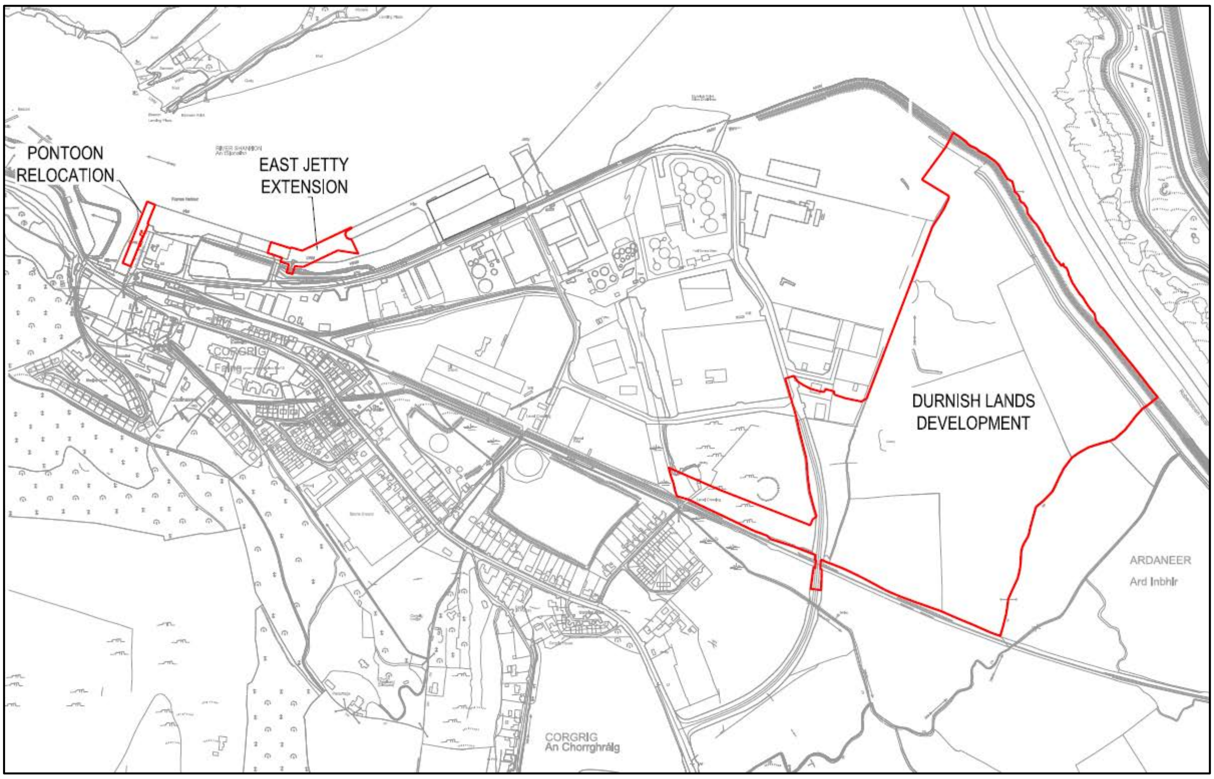


Figure 2.4 Development Areas

The two proposed development areas are described in further detail.

2.1.2.1 Jetty Extension

This 'jetty extension' is located between the two existing quay walls within the Port estate situated adjacent to the Shannon Estuary - 'The West Quay' and, 'The East Jetty'. 'The West Quay' and 'The East Jetty' are the principle mooring berths for which all vessels berth for the purpose of loading/unloading of all shipment bulk goods through the port.

The area between is a residual undeveloped area situated between the two aforementioned quay walls and offers no operational port function or infrastructure. This area does contain a small craft landing pontoon provided by the Port Company to facilitate private access to Foynes Island for a third party. Situated within the existing port estate, this area forms part of the established riverside industrial landscape character defined by existing port operations. The proposed development provides for the relocation of that pontoon and forms part of the development proposal and assessment of this EIAR.

2.1.2.2 Durnish Lands

This area extends to 33.95ha hectares in area (defined by dotted red line on the proposed development drawings) and is situated to the east of the existing Port estate. The northern boundary of this area extends along the Robertstown River where it adjoins the estuary. This northern boundary is defined by existing raised earth embankments which include drainage ditches and streams. The southern boundary of the site adjoins the single track rail line (Limerick-Foynes) which is currently disused. The south-western site boundary adjoins the existing port access road for a distance of circa 280m. That port access road extends for a distance of circa 730 metres between the public road - N69 National Secondary Route (Limerick – Tarbert Road) and the existing port estate.

Though situated within the defined settlement boundary and positioned immediately to the east of the existing port estate, the Durnish Lands are situated outside the existing urban and industrial footprint and are currently undeveloped and retain an agricultural ('greenfield') character. The subject site comprises a number of irregular shaped fields separated and defined by hedgerow and pockets of scrub.

The majority of the Durnish lands comprises of Improved Agricultural Grassland habitat - a highly modified habitat of low ecological value. There are also several natural and semi-natural habitats present which are considered to be locally important including wet grassland, scrub, marsh and a stream. No rare or protected plants were recorded on site and, none of the habitats recorded correspond to any habitats listed on Annex I of the Habitats Directive. Further analysis of the natural environment is presented in Chapter 7.

Ground levels vary across the site ranging from +1.1m OD (Malin) to +3.9m OD. The land is not currently in use and does not benefit from any existing surface water, waste-water infrastructure. The landscape character of these lands is defined by the natural setting of the estuary and associated marine processes, and, industrial activities including the existing Port estate and the adjacent Aughinish Alumini plant on the opposing side of the Robertstown River.

The Durnish lands form part of lands acquired by SFPC by way of compulsorily acquisition in 2016 under the Harbours Act. The acquisition of these lands was based on a demonstrated need for Port expansion based on historical growth patterns, predicted trends, and the absence of any other available and suitable land to facilitate expansion of this Tier 1 Port at Foynes. The 'Durnish lands', which are included in this application, represent a substantial portion of the compulsory acquired land.

2.1.2.3 Adjacent Land Uses

The Shannon Estuary provides a commercial function for SFPC extending over an area encompassing circa 500km2 (between Limerick City and Loop Head / Kerry Head) with its naturally occurring deep-waters, accommodating some of the largest vessels entering Irish Waters. Vessel movements occur along the entirety of the estuary between the Ocean and Limerick City in order to gain access to other port facilities at Moneypoint, Tarbert, Aughnish, Shannon Airport, and Ted Russell Dock at eastern extremity of the estuary at Limerick City. The existing Port estate is positioned to the immediate west and includes industrial activities and uses associated with access to the port.

Lands to the east of the Durnish lands are, similar to the Durnish lands in that they are undeveloped and retain a 'greenfield' agricultural character and are used for some agricultural activity. Aughinish Alumina industrial processing plant is situated on the opposite (north-eastern) side of the Roberstown River with access also to the Estuary.

The settlement of Foynes is situated to the south west and comprises of a relatively small village settlement and population with residential, and local retail commercial activities concentrated primarily along the main street, (The N69 Limerick – Tarbert Road).

An Irish Rail owned single rail line extends from Limerick and terminates at the Port. The rail line extends along the southern boundary of the existing port estate effectively separating the Port estate from the Foynes Village urban area. The line extends and traverses the Durnish lands and at that point, includes at 'at grade' level crossing for which the southern port access road traverses in order to connect the existing Port estate with the N69 National Secondary Route. This rail line is not currently in use.

2.1.2.4 Existing Port Operations

Since initial development of the Port in the 1846, the Port has experienced incremental growth and development through the 20th century. More recent Port development occurred with the existing West quay wall constructed in 1934 and upgraded and extended in 1934 and 1998. The East Jetty dates to 1934 and was extended in 1984 with (planning) consent secured in 2012 for the reclamation and infill of the area located behind (south) of that jetty to facilitate increased quay side storage, port logistics and operations. The existing Port estate comprises 64 hectares much of which is within the ownership of SFPC.

From an operational Ports perspective, the Port of Foynes, specialises in the berthing primarily of commercial cargo vessels (occasional berthing of cruise ships occur), and, the handling and storage of bulk cargoes imported and exported by shipment through the Port. Typical cargo types through the Port of Foynes include; dry bulk fertilisers, animal feeds, salt, coal and alumina hydrate; Break bulk including timber, construction materials, machinery and materials for the offshore industry; Liquids – primarily oils but also chemicals; Project cargoes including materials for the renewable wind energy industry; and, Cruise vessels. The storage demands for these types of cargo are typically greater than container and/or ferry ports because of the sizes of each shipment and the duration that these types of cargos are stored in port.

The landside port operations at Foynes are maintained through a series of jetties, cargo handling equipment and storage facilities. Portside handling equipment includes various mobile harbour cranes and grabs, mobile hoppers, a variety of forklifts and handling equipment, and stevedores. Currently, there are 4 general cargo berths totalling 657m. The West jetty is 271 meters long, the East jetty 295 meters long, and the Tanker jetty is 91 meters long). The current configuration of quay allows the port to manage four 10,000 dwt vessels at any one time or two 50,000 dwt vessels and one 5,000 dwt vessel at any one time. In this configuration, berth occupancy percentage is at 40% on an annualised average and 78% on a peak seasonal average. The length of the existing quaywall and the current berthing provision is proving unsustainable in the context of predicted tonnage growth rates1 as it will inevitably lead to longer wait times for ships, leading predictably, to increased costs to the receiver and a loss of competitiveness for SFPC and the mid-west region.

Shipping movements at the port of Foynes are conducted throughout the day and night, 364 days a year. General cargo operations are usually conducted between 0600 and 2400 7 days a week with the capacity to work 24/7 as required for operational or safety reasons. These operations include quay side handling, and open and closed storage, and associated marine activities and port logistics.

All of the SFPC land is within some operational use or activity either by the Port or by Port users with the latter being under tenancy arrangements through the Port Company.

Land is used for covered (warehouse or tank) and uncovered open storage of liquid, break bulk and dry bulk cargos. The port is serviced by a main internal port estate road that links all storage areas to the quay walls.

The existing Port Estate, in terms of open and covered storage is operating at full operational capacity. No residual or undeveloped property occurs within the estate. Open storage adjacent to the quay wall is restricted to the loading and unloading of goods. Whilst the reclamation of the land behind the East Jetty (currently under construction pursuant to a 2012 planning permission), will provide for increase quay side storage, that uncovered area has been allocated to assist with improved efficiencies in loading and unloading cargos associated with existing port operations. It will not address demand for covered and uncovered storage for future growth and associated dwell times of general cargos.

2.1.3 Existing Port Infrastructure

Vehicular Access - The port is accessed from two points from the N69 National Secondary Route which are accessed by controlled barrier. These access points are situated circa 1.4km apart and at opposite sides of the village and port access is controlled by barrier access.

[1] Established under the Port Company Economic and Spatial Masterplan ‘Vision 2041’

Surface water and foul water arrangements within the existing port estate have been designed and provided on a piecemeal basis as the port has developed. This has resulted in a number of individual and combined on-site waste water treatment solutions.

2.1.4 Planning History

An overview of pertinent developments permitted within the existing Port Estate is set out in Table 2.1 below. There is no history of permitted development occurring on the Durnish lands.

Recent Planning History at Foynes Port			
Company name / location	**Year & Planning reference**	**General Development Description**	**Decision Date**
SFPC Developments			
East Jetty	17/7019	Extension of Permission from Ref No: 12/212	2017
Port	16/730	the installation of an Emergency Alarm system	2016
East Jetty	12/212	2.49 hectares of reclamation at the East Jetty in Foynes Port	2012. Ongoing
Mogul Store	06/709	Erection of a new bulk warehouse with concrete yard and associated site works	10/05/2006 Development completed
Port	04/2226	erection of security fencing, access barriers and gates,	2004
Clinker Store	04/1880	Construction of bulk storage building, access road with street lighting and all ancillary works	2004/1880 Development completed
West Quay	96/ 1960	Extension to existing west jetty, construction of service landing area, office/service building and ancillary works	20/12/1996 Development completed
East Jetty	1965/ 997	New East Jetty and contingent	09/12/1965 Development completed
Recent Third Party Developments			
Irish Cement Ltd.,	15/1059	temporary bulk storage of up to 40,000 tonnes of petcoke	2016
CPL Fuels Ireland Ltd.,	15/818	minor amendments to Phase 1 of a previously approved development under planning reference 14/603	2016
Bord Na Mona Fuels Limited	15/468 PL91.246279	smokeless and bio-mass based solid fuel manufacturing and packaging facility	2016
Atlantic Fuel Supply Company Ltd	15/127	the provision of an above ground steel fire water storage tank of approximately 2,020m3 volume at the A.F.S.C. Terminal	2015
Chemi-floc Ltd	15/34	the construction of 3 no. double containment vertical storage tanks for storage of inorganic chemicals at their existing warehouse/storage facility	2015
Argosea Services Ltd	14/635	the construction of 5 no. covered, adjoining bulk and general storage, warehouses, and adjoining service yard, a weighbridge, boundary fencing with new entrance to Foynes Harbour Road, signage	2014
CPL Fuels Ireland Ltd.,	14/603	alterations and extension to the existing industrial building, erection of new buildings and new hardcore area for external	2015

Recent Planning History at Foynes Port			
		storage, to accommodate the storage, screening, processing, binding and packaging of solid fuel briquettes by CPL and to use the property for purposes associated with the import and export of products through the Port of Foynes	
CPL Fuels Ireland Ltd.,	12/311	the bulk storage and packing of solid fuel for the domestic solid fuel heating market within the island of Ireland with an annual capacity of 30,000 tonnes,	2012
Greenport Environmental	09/737	Change of use of an existing warehouse building from a timber frame construction facility and for permission to extend the existing structure to accommodate a biogas/composting facility. The proposed development includes demolition of ancillary storage structures, changes to an existing entrance to the site and for the upgrade of existing services and waste water treatment system. The development includes for gas/water storage structures and bio filters	11/11/2009 Development not completed
Atlantic Fuels	08/372	a Bulk Liquid Warehouse and Oil Terminal. This application is an amendment to a previous successful application granted under ref. 05/789	2008
Aherlow TRansport	06/3600	erection of 2 no. warehouses for the storage of dry goods and associated site works	2007
Inver Energy Ltd	05/789	Construction of a bulk liquid warehouse and oil terminal consisting of 14 no. oil storage tanks, loading yard area, truck wash facility, truck loading bay, car & truck parking, water storage tank, two storey operations building with proprietary foul water treatment system & outfall to estuary, single storey electrical service building with electrical sub-station and boiler house, perimeter security fence and gating, landscaping, oil pipelines and associated fittings.	19/07/2005 Development completed
Inver Resources Ltd.	03/1194	Facility for the storage and distribution by road of petroleum Class III(1) and Class II (1) that consisted of 14 no oil storage tanks with a total capacity of 44,300 cubic metres within concrete bund area of 0.9 Ha, loading yard area 0.1 Ha, truck wash facility, all with interceptors and outfall to estuary,	21/09/2004 Development completed

Table 2.1 Overview of Pertinent Permitted Developments

The planning history illustrates the diversity of port related development activities and associated uses.

2.1.5 Amenity Designations

The Shannon Estuary is subject to 2 natural amenity sites designated under the EU Habitats Directive[2] 92/43/EEC. These are: *The Lower River Shannon Special Area of Conservation* (SAC) site code 002165 and, *the River Shannon and Fergus Estuaries Special Protection Area* (SPA) site code 004077. The spatial configuration of these amenity areas and relationship with the port and the proposed development is presented and assessed in Chapter 7.

There are no archaeological or features of built heritage occurring with the area of the proposed development. A recorded monument (ref: LI1010-009-) does occur on adjacent lands. This is classified as an 'Enclosure' and is situated outside of the development site and there are no works proposed to this monument. The spatial configuration of these amenity areas and relationship with the port and the proposed development is presented and assessed in this EIAR.

[2] *Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora*

2.2 CHARACTERISTICS OF THE PROJECT

The project includes specific development works, and operational activities. The characteristics of the project are thus presented in the following sections and this information sets out the operational and physical characteristics of the project.

2.2.1 Nature of the Proposed Development

The project is to facilitate capacity extension at Shannon Foynes Port. This requirement to extend Port capacity is responsive to a historic pattern of commercial growth through the Port of Foynes consistent with the projections envisaged in the Port Company's spatial and commercial masterplan – 'Vision 2041' and the resultant fruition of those projections experienced to date.

The significant overall value of the trade handled by SFPC at a regional and National level is presented and discussed in Chapter 6. This includes the servicing of large scale facilities on the Estuary such as Aughinish and Moneypoint, and, the residual handling of main generalised cargos through other terminals including the Port of Foynes. As a general use terminal, The Port of Foynes, serves four primary cargo sectors of the economy – agriculture, construction, energy, and tourism (cruise vessels). Whilst market fluctuations can influence sectoral performance, these sectors continue to perform well and maintain the staple port commodity base.

Historical data demonstrates a relationship between quay length, tonnage throughput and, landside activities. Increased landside storage is directly associated with increased cargo throughput. The Port does not, nor cannot, operate on a direct loading and unloading arrangement from ship to road or *vis-versa*. Cargos entering and leaving the port in most instances require 'dwell time' that is, a period of time that cargos spend within the port prior to export or, prior to onward movement (by road) following importation.

Given that commercial vessels are generally chartered on a time basis, critical to the successful operation of any port is the adequacy of quay facilities that enable vessels to dock, load and/or unload cargos and disembark without delay. Delays can lead to operational inefficiencies including; increased charter costs, which in turn increase the costs for customers trafficking cargos through the port. Port efficiencies and the relationship of this to regional and National competitiveness is discussed in further detail in Chapter 6.

This capacity extension is provided in two interrelated ways – increased capacity of the quay wall, and, increased capacity of supporting landside storage facilities and logistics. Consequently, the project includes two specific elements of development and operational activities as follows:

- JETTY EXTENSION
- The joining of the existing 'West Quay' and the 'East Jetty'

  And;

- DURNISH LAND DEVELOPMENT
  - To provide for increased port related storage and port-centric logistics

These are discussed in further detail in section 2.2.2.

2.2.2 Description of the Proposed Development

Further to the above project objectives, the description of the project for which planning permission is being proposed and which is set out in the formal planning notice seeks;

The proposed development seeks to provide for Port Capacity Extension that will consist of the following:

(1) M**odifications to the existing jetties and quays to include:** connection of the existing West Quay to the existing East Jetty for the purpose of extending the length of the existing quay to facilitate the mooring of vessels and Port related operations. Development works consist of; (i) Construction of an open piled jetty structure with suspended 116.5 metre concrete deck connecting the West Quay to the East Jetty; (ii) quayside furniture including quay fenders, mooring bollards, safety ladders, toe rail, and lighting columns, (iii) construction and remedial works to the both existing West Quay and East Jetty ends to facilitate structural 'tie-in' of the proposed new jetty structure, (iv) removal of the existing small craft landing pontoon and walkway from its current position affixed to the shore between the West Quay and the East Jetty, and provision of a new small craft landing pontoon and walkway affixed to the western side of the West Quay wall, and, (v) all associated site development works; and

(2) **Phased Expansion of the Port Estate** on 33.95 hectares of land immediately adjacent to the east of the existing port estate to provide serviced industrial land, and, to accommodate marine related industry, port centric logistics and associated infrastructure that will be provided in accordance with a development framework programme prepared for the overall 'expansion' area and which is lodged with the planning application. The development includes:

(I) site development and infrastructure works to the entire expansion lands on a phased basis including (a) raising of ground levels with fill material to a typical height of +4.44m OD Malin; (b) provision of all associated services including storm water infrastructure and modification of the existing OPW drainage attenuation system; (c) provision of 2.4m high perimeter fencing, (d) landscaping berms and treatments, and (e) all associated site development works; all to be delivered on a phased basis; and

(II) Implementation and use of 'Phase 1' of port expansion works including: (a) modification and realignment to part of the existing port estate access road including provision of new roundabout and junction arrangements on that road, and associated lighting, and storm water drainage; (b) provision of new internal Port access road (with associated footpath and combined cycle path) including the provision of bridge structures to facilitate access across existing drainage channels; (c) construction of three covered industrial type warehouse units (with typical maximum ridge height of 15.1m above raised ground level) with associated external storage, parking and circulation areas; (d) the provision of separate dedicated uncovered 'open' storage area/ container storage area and associated circulation and service area (with maximum container stacking height of 8m if/when container storage required); (e) provision of Klargester BE model (or similar) package foul water treatment system with polishing filter and discharge to ground to serve the Phase 1a expansion area; (f) modifications to existing 'Foynes Engineering' industrial building which involves the removal of the 'lean-to' structure affixed to the main building and remedial building and site development works; (g) provision of an ESB electrical substation; (h) provision of lighting columns within the 'Phase 1' expansion area; (i) provision of a new security kiosk and access control barrier on the existing Port access road; (j) provision of noise attenuation measures along parts of the southern and western boundary of 'Phase 1' expansion area; (k) fire water storage infrastructure; (l) provision of a 'bus-stop' on the existing Port access road; (m) landscaping; and (n) all associated site development works.

2.2.3 Planning Permission and Environmental Assessment- Clarification

For the avoidance of doubt, all works proposed as part of the planning application for which planning permission is being sought, and described in the statutory notices, have been subject to environmental assessment which is presented in this EIAR. The 'physical characteristics' of these development works are presented and described in further detail in the following section. These characteristics of development present a phased approach to the development (of the Durnish lands) and the proposed phasing approach is described and assessed as part of this EIAR.

However, in order to ensure an effective and conclusive environmental impact assessment consistent with best practise, the assessment of potential effects on the environment examines; the effects arising from the physical characteristics of the proposed scheme (for which planning permission is sought), and also; the collective cumulative effects of the overall development scheme for the Durnish lands if all development phases were implemented.

The examination of the 'all phase' development scenario for Durnish is consistent with best practice in order to examine a 'worst-case' scenario of the project effects.

Examination of this 'worst-case' scenario is based on the likely effects of the proposed development and proposed uses as part of Phase 1, and, the anticipated landuses that will occur from subsequent operational use of Phase 2 and Phase 3 based on the information known and available at this time in respect to those subsequent Phases.

Despite the consideration of those subsequent development phases as part of this environmental assessment, the future uses shall be subject to the necessary and separate planning consent in due course. This approach is applied in the relevant chapters that examine the environmental variables.

2.2.4 Physical Characteristics

The Physical Characteristics of the Project are presented under each of the main physical elements of the project described in Section 2.2.2 above. A copy of the pertinent drawings including site plans, elevations and cross sectional details illustrating the proposed development (which were submitted with the planning application) are appended to this Chapter in Appendix 2.1.

2.2.5 Jetty Extension

The proposed extension to the existing Port berths will facilitate opportunity for the docking of larger vessels (with increased loads) in response to the increasing international trend toward larger vessel sizes. However, the proposed berth extension will also allow the docking of increased smaller vessels at the same time. Under either scenario, tonnage throughput will rise as predicted in the Port Company's strategic masterplan ('Vision 2041').

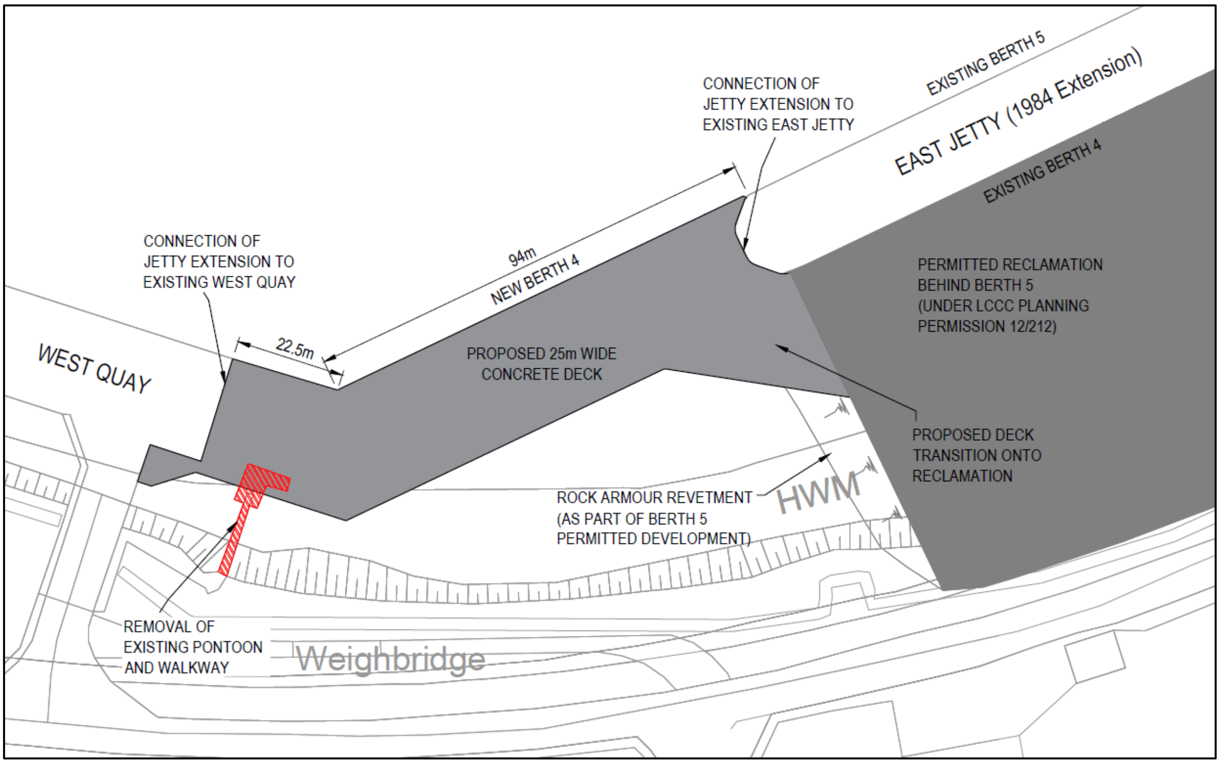


Figure 2.5 Jetty Extension connecting West Quay and East Jetty (removal of existing pontoon also shown)

Connection of the existing West Quay to the existing East Jetty will involve the construction of an open piled jetty structure with suspended reinforced concrete deck tying into; the existing jetty and quay wall structures; and, the land reclaimed to the rear of the East Jetty (and berth Berth 5 of same) being carried out under planning permission reference 12/212 & 17/7019.

As shown in Figure 2.5, a 25m wide suspended reinforced concrete deck will span between the West Quay and the East Jetty, though will be wider at its eastern end to facilitate transition of the proposed deck into the reclaimed land behind the East Jetty. The proposed deck shall extend a distance of 116.5m between the West Quay and the East Wall.

The project does not require dredging and does not involve the filling of the land behind (south) of the proposed jetty structure. The general arrangement of that area and inter-tidal mudflat shall be left open and exposed between the new jetty structure, and the existing port side (save for removal of the small craft landing pontoon from this location and as illustrated). The potential effects to tidal currents and coastal processes will therefore be minimum and these are assessed in detail in Chapter 12 of this EIAR.

Given the different alignments of the existing West Quay and East Jetty, the proposed jetty extension shall extend eastward from the existing West Quay for a distance of circa 22.5m before turning approximately 31^{o} to the northeast and continuing for a further distance of 94 metres where it will connect with the existing East Jetty.

Tubular steel piles will be installed to a depth determined by a combination of factors including; the local bedrock level, condition of the bedrock, the condition of the overlying material, the imposed quay loadings and the final geometry of the selected pile profile. Based on available geotechnical information it is anticipated that the tubular steel piles will be installed to depths ranging between -30mCD (Chart Datum) and -35mCD (i.e. Between circa –33mOD Malin and -38mOD Malin), with the final depths depending on the local ground conditions and proximity to the standard dredge depth. It is envisaged that piles will be driven to provide approximately 3m deep penetration into rock.

Heavy piles such as this will sink several metres when lowered vertically to the seabed. A vibratory pile driver will then be used to drive the piles as far as possible. It is likely however that at least half of the pile driving will require an impact hammer to drive the piles into rock. The total duration of the piling activity will be approximately 10 months, meaning that on average it will take about 3 working days to complete a pile. The pile is lifted into place, aligned and lowered slowly into position. The vibratory driver is then brought into position and begins to vibrate the pile into position. Initially there will be multiple stops for alignment checks. Gradually the pile is secured and vibrated for longer periods. At some point the vibratory driver will cease to be effective and the impact driver will be brought into position. Due to the length of the piles it is likely that the piles will be installed in sections so further time is required to weld extension sections to the pile. Piling will likely be undertaken from a jack-up barge using a single crane, with a change-over in operations.

The construction of the jetty extension may involve some marine traffic transporting materials. This or similar methodology will be equally applicable for the foundation piles that will accommodate the relocated small craft floating pontoon on the western side of the West Quay wall.

The tubular piles shall support pre-cast concrete beams and planks, which will be craned into position. An in-situ concrete deck will be poured over the top to bind all concrete elements together, using a concrete pump or concrete skips suspended from a crane. A typical cross-section through the proposed jetty extension is shown on Figure 2.6 below.

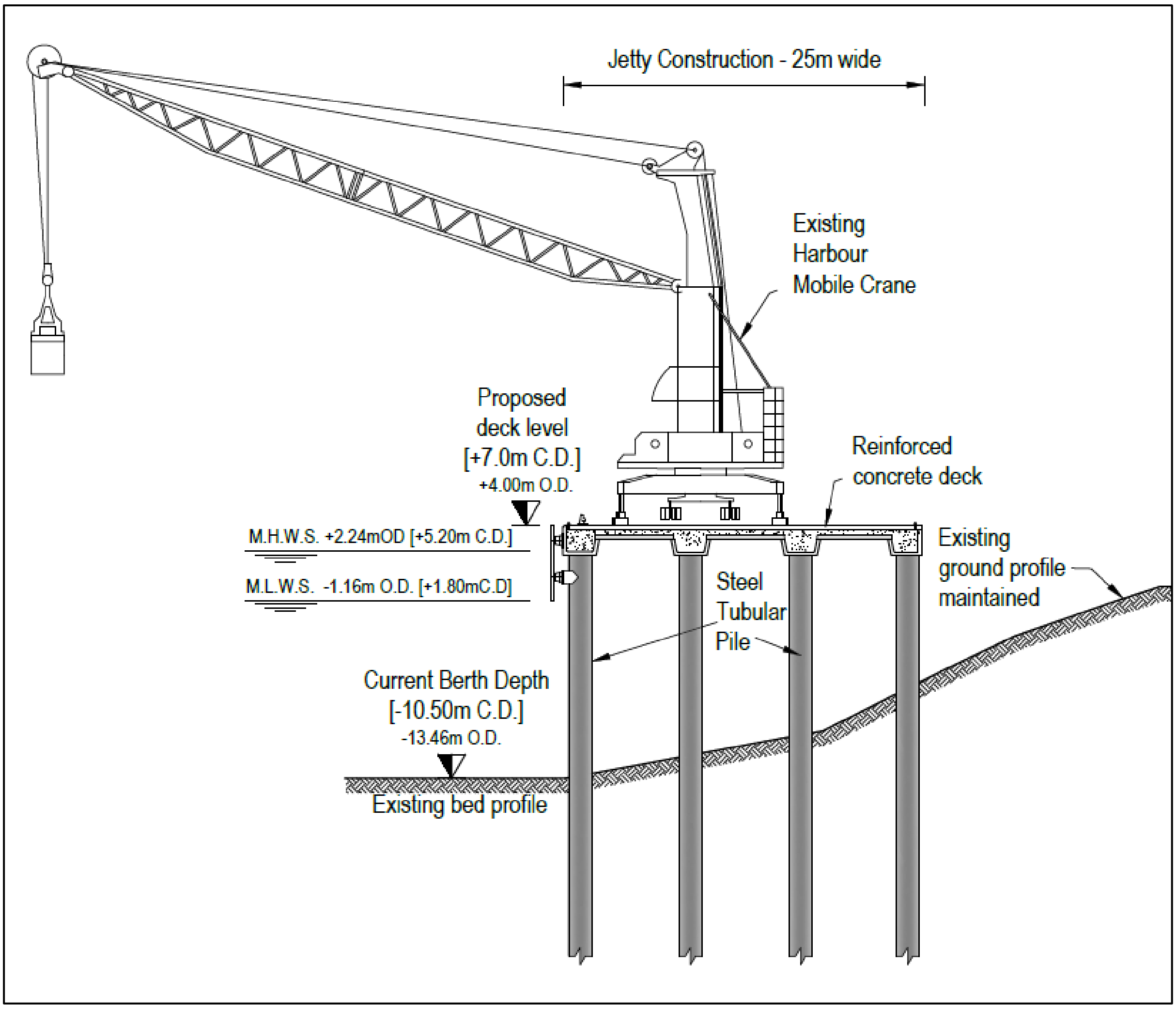


Figure 2.6 Typical Cross Section through Proposed Jetty Extension

A new reinforced concrete capping beam shall be provided to the edge of the new open pile structure to allow re-distribution of loads from bollard pulls and transfer of pile loads into the capping beam. Precast units may be used for external face and soffit of the capping beam (to provide for aesthetics of finish and ease of construction) provided suitable detailing for ladders, connectivity of piles and longitudinal load spread are maintained.

The final top level of the cope beam shall match the existing jetty structures, and shall tie into the existing structures where necessary. The open pile structure shall be sufficiently connected to the existing structures, with a movement joint provided near the connection to the East Jetty.

The jetty connection shall also incorporate a reinforced concrete transition slab to allow hinged movement between the proposed open pile deck structure and the reclaimed area behind existing Berth No.5 (Limerick City and County Council planning permission ref: 12/212 & 17/7019 refers to existing reclaimed area). The plan layout of the proposed jetty extension is illustrated in Figure 2.7.

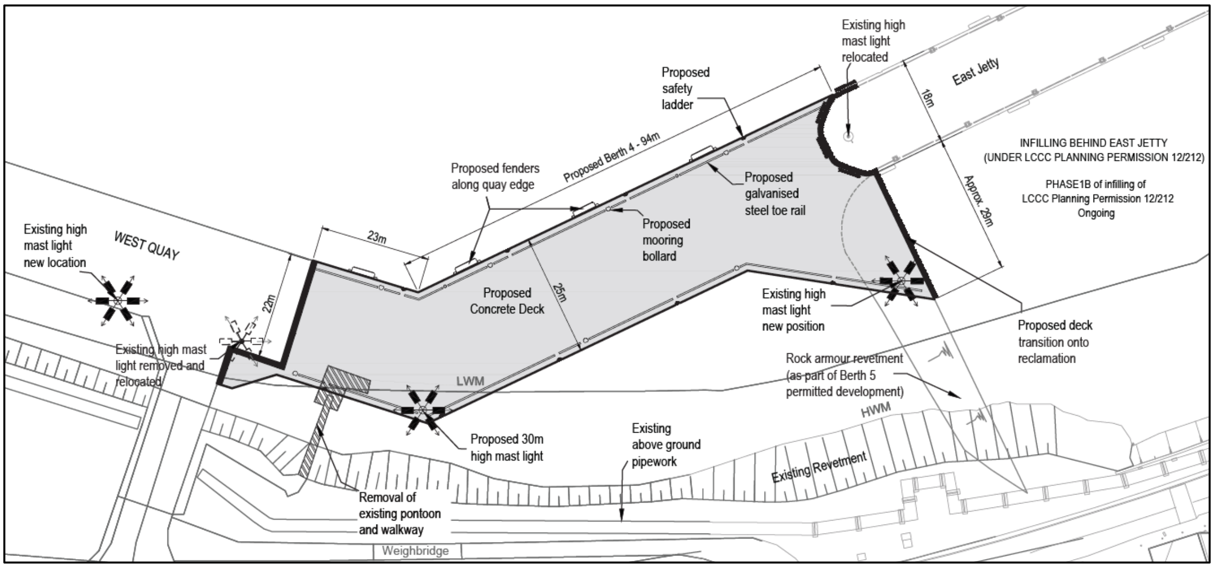


Figure 2.7 Plan layout of proposed jetty

2.2.5.1.1 Drainage

No storm water runoff shall be permitted from the jetty connection structure but shall be collected in a dedicated storm water drainage system. A surface water drainage system will be designed to consist of heavy duty gullies cast into the reinforced concrete deck, with concrete pipes cast into the insitu concrete deck structure. These pipes will carry the storm water to an appropriate full retention interceptor, before being discharged into the harbour waters through a non-return flap valve.

A readily and safely accessible monitoring chamber will be provided on the storm water pipeline to allow for inspection and sampling of the storm water being discharged. Manholes and covers shall be designed to accommodate the proposed operational loads. The finished level of the deck structure shall accommodate drainage falls as required.

2.2.5.1.2 Quay Furniture

The proposed suspended deck will include berthing fenders and mooring bollards placed at regular intervals along the outside (northern) quay edge to accommodate mooring vessels for the purpose of loading and unloading of goods. Mooring bollards will also be placed at regular intervals along the inside (southern) quay edge. The suspended deck will facilitate port traffic and infrastructure which would typically expect to include; loading and unloading vehicles, mobile loading hoppers and craneage, and, associate port traffic and personnel.

100T staghorn bollards shall be provided at regular intervals along both faces of the jetty connection structure. Toe rails will be installed between and in-line with the proposed mooring bollards. Fenders will be installed along the seaward face of the new jetty structure.

Fenders shall be as per the fenders currently used on East Jetty. The fenders will have fender panels typically UHMW-PE 1m x 1.9m x 3.36m, and will be suitable for accommodating the required range of vessels (max 60,000DWT).

All existing jetty structures will be retained during the works and will continue to be used for berthing.

2.2.5.1.3 Safety Equipment

Fire hydrants will be provided at regular intervals along the jetty structure. Access ladders and safety chains shall be provided at regular intervals along both faces of the jetty connection structure.

2.2.5.1.4 Dredging

No capital dredging is required as part of the proposed works. The location of the proposed jetty extension is currently dredged to a declared depth of -10.5mCD as part of SFPC's current maintenance dredging campaign and this depth is illustrated on Admiralty Charts in Figure 2.8.

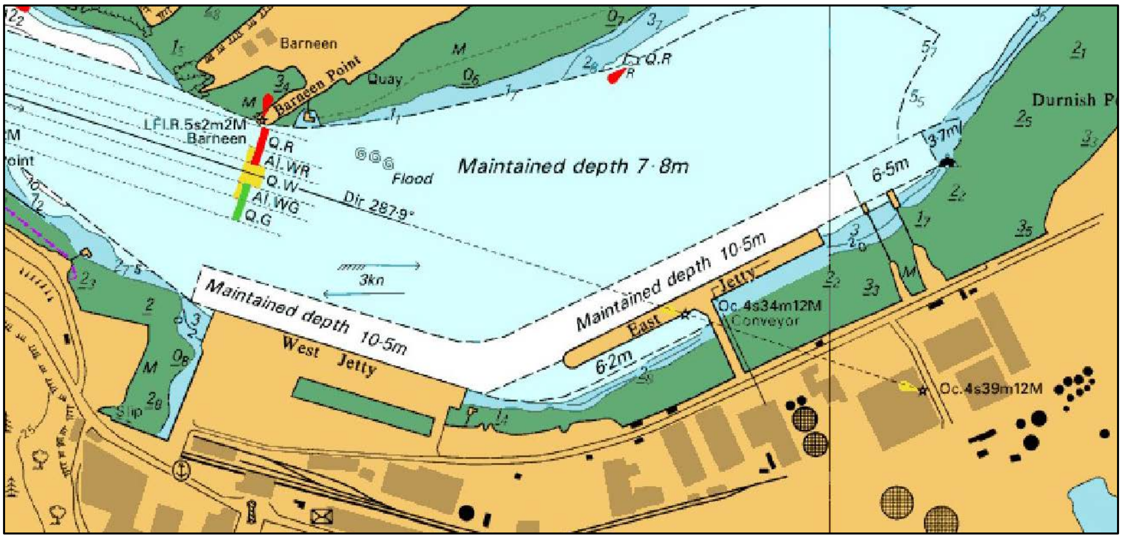


Figure 2.8 Foynes Admiralty Chart Extract

2.2.5.1.5 Mechanical and electrical services

The proposed lighting for the jetty connection working area will comprise 30.0m high; base hinged raising and lowering masts with multiple floodlight arrangements and light cowls for light pollution control. Plate 2.1 shows similar lighting provided on the existing East Jetty.

Plate 2.1 Existing 30m High Lighting Masts on East Jetty

Low energy LED lighting will provide an average lighting level of 30-50 lux for storage and operational areas, and an average of 20 lux in circulation areas. The lighting will be designed to prevent direct glare into surrounding properties and illumination of the night sky.

Power supply will be by connection to the local electricity grid system.

2.2.5.1.6 Water Supply

Water supply will be by connection to the existing water supplies on the existing East and West Jetty structures.

2.2.5.1.7 Fencing and security

The site of the proposed works is wholly contained within the existing port operational (ISPS) area and as such no additional security fencing will be required.

2.2.5.1.8 General Construction Sequence

The general sequence of the construction of the jetty connection works will be as set out below:

1. Removal and relocation of the existing small craft landing pontoon to an area identified at the west side of West Quay. Two locating piles will be installed at the new location to accommodate the relocated landing pontoon
2. Driving of steel tubular piles to the required depth using a vibrating hammer and hydraulic impact hammer to achieve the required toe level (see Plates 2.2 and 2.3 for typical piling

hammers). Piles to support a suspended concrete deck, connecting the existing West Quay to the existing East jetty to create New Berth No. 4.

3. Localised demolition of existing jetty structures and structural connection between new structure and existing jetty structures.
4. Installation of pre-cast concrete deck elements using suitable plant.
5. Pouring of in-situ concrete deck on jetty extension using concrete pump/skip
6. Installation of drainage, services, quay furniture and lighting

Plate 2.2 Typical Piling Hammer for Tubular Pile Installation

Plate 2.3 Piling Hammer in Use for Tubular Pile Installation

2.2.5.1.9 Landing Pontoon Relocation

Prior to commencement of the jetty extension works, the existing small craft landing pontoon located behind the proposed jetty extension (as shown in Plate 2.4 below and illustrated in Figure 2.5 previously) shall be removed and relocated to an area identified at the west side of West Quay as illustrated in Figure 2.9.

Plate 2.4 Existing Pontoon

Two locating piles shall be installed at the new location and a landing platform shall be constructed to tie in with the existing quay structure, along with a landing structure and concrete bankseat to accommodate the pontoon walkway.

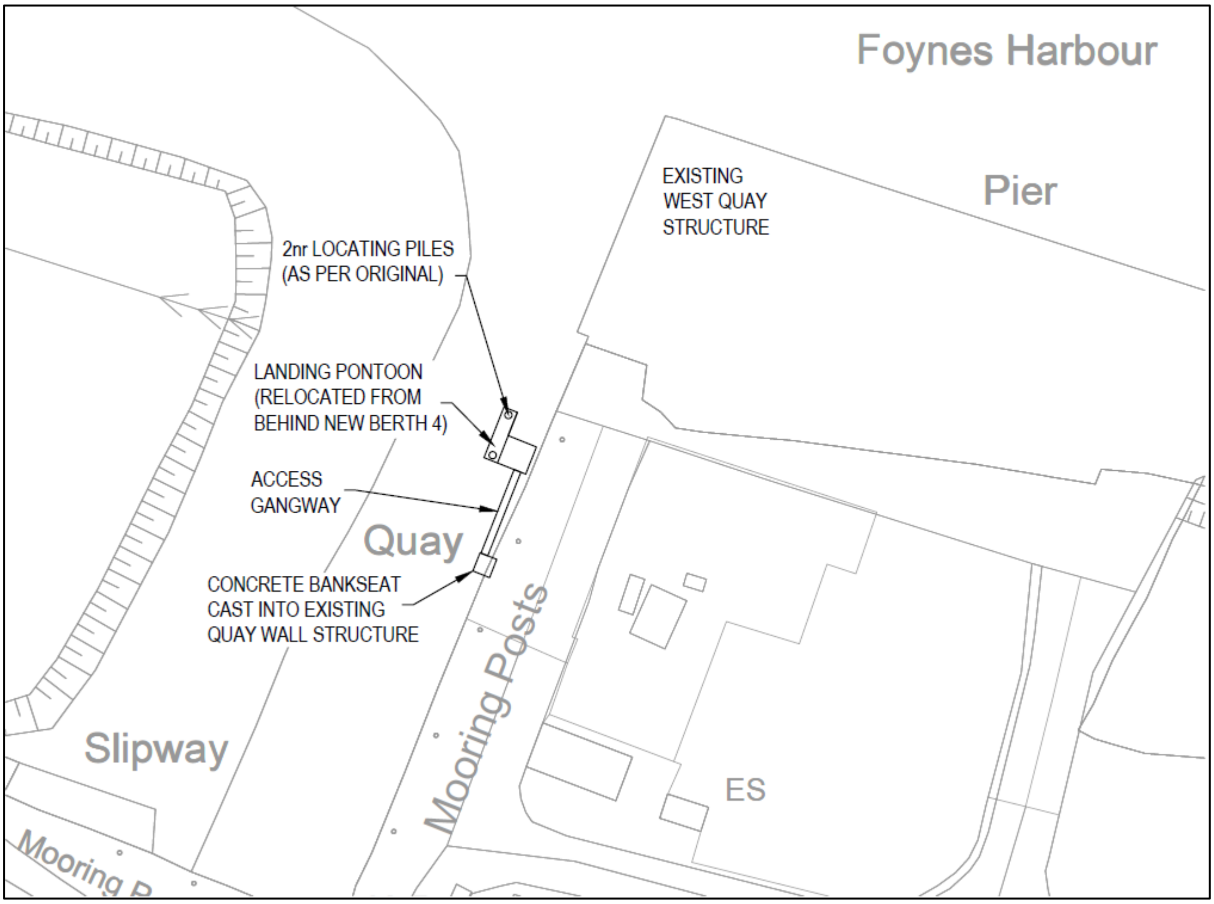


Figure 2.9 Proposed Location of Relocated Pontoon

2.2.5.1.10 Proposed Operations at East Jetty

Port operations on the jetty extension will be as per the existing jetties, and will generally comprise the loading and unloading of vessels using Harbour Mobile Cranes consistent with existing quay operations. Materials handled will vary depending on trade requirements but the following is anticipated;

- Construction materials including timber, steel sections reinforcement etc.
- Project cargoes such as wind turbine components, steel pipes etc.
- All types of dry and liquid bulk cargoes

Shipping movements at the port of Foynes are conducted on a 24/7 basis 364 days a year. In addition, all liquid bulk operations are conducted on a 24/7/364 basis. General cargo operations are usually conducted between 0600 and 2400 7-days a week with the capacity to work 24/7 as required for operational or safety reasons. It is intended that hours of operation on the jetty extension will be the same as the existing.

2.2.5.1.11 Equipment

Handling operations on the existing jetty will continue as is the current practice with vessels generally being loaded or unloaded by the use of the Port's existing harbour mobile cranes. Handling operations on the new jetty extension will be dependent on the type of cargo which is to be accommodated at any given time. However the equipment will likely comprise some or all of those described in the following sections on an "as required" basis.

The details and dimensions of particular types of equipment will vary from manufacturer to manufacturer and final dimensions will only be determined when the supplier of the equipment has been identified. Dimensions considered in preparation of the EIS are based on typical dimensions of equipment currently available in the marketplace. Some variation may occur in the final items of equipment provided.

<u>Mobile Cranes</u>

It is likely that the jetty extension will not be provided with any fixed terminal equipment and that mobile equipment such as the existing harbour mobile cranes will be used for ship to shore operations, with cargo being transferred to mobile hoppers discharging into HGV's for transport to onsite storage facilities or directly offsite.

Plate 2.5 Typical Harbour Mobile Crane

This type of crane is currently in use at the existing East and West Jetties at Foynes and typical cranes are illustrated in Plate 2.5.

<u>Other Handling Equipment</u>

Other types of port handling equipment such as mobile hoppers, mobile cranes, mobile weighbridges, loading shovels, reach stackers, mast lift trucks (as shown on Plate 2.6), or similar will be used as and when required.

Plate 2.6 Typical Mast Lift Truck

2.2.5.1.12 Operational Access

Access to the jetty extension will be via the existing entrances onto the East and West jetty access structures.

2.2.5.2 Durnish Lands Development

The developed lands will be used for open storage and warehousing and will be used primarily for the handling and storage of general cargo. In addition, the lands will also be used for port-centric processing operations such as bulk raw material being graded, mixed or sorted before being bagged or put into tankers. It is intended that hours of operation on the proposed developed lands will be 24/7, 364 days per year. The breakdown of uses across the Durnish lands has been calculated at;

- Covered storage Approx. 5.2ha
- Open storage Approx. 15.5ha

Materials handled will vary depending on trade requirements but the following is anticipated;

- Construction materials including timber, steel sections reinforcement etc.
- Scrap metal
- Project cargoes such as wind turbine components, steel pipes etc.
- All types of dry and liquid bulk cargoes
- Storage of containers

However, the proposed works associated with connection of West Wall and East Jetty, background technical analysis which has informed this EIAR and the planning application, recommends that certain site development and preparatory works are necessary to ensure the proper planning and sustainable development of this previously undeveloped land for Port and marine related industrial uses consistent with current landuse planning provisions and National Planning Guidelines.

Such measures relate namely, to the raising of the ground levels across this greenfield site (to +4.44m OD Malin) to ensure that landuse activities can be provided at a level which has been designed and are responsive to best practice and current flood risk management requirements in order to minimise flood risk to people, property, the economy and the environment.

The design of ground levels adopts a precautionary approach to allow for uncertainties in data and risk assessment procedures taking account of climate change. The basis of this approach including the flood risk assessment of the proposed development is contained in Chapter 9.2.

2.2.5.2.1 Phased Approach and Development Framework

Additional port related storage is an immediate requirement.

Based on mid line forecasts, tonnage throughput at the Port of Foynes is anticipated to reach 2,770,000 tonnes by 2025. This is in line with the medium growth scenario detailed in Vision 2041. The current throughput is 1,778,126 tonnes. Based on this tonnage projection (mid-line growth scenario set out in Vision 2041), it is projected that the tonnage growth at Foynes port over the next 10 years, and the life of this planning permission, will reach 3,280,000 tons by 2029.

If it is a case that the high growth scenario is realised then additional land will be required to accommodate such growth prior to the expiration of planning permission in ten years'.

Having regard to the lifespan of the intended planning permission and the significant increase in tonnage predicted, it is proposed to implement the operational use of the Durnish land in three phases in line with economic growth and customer demand. The proposed phasing regime is illustrated on the appended drawing (also lodged with the planning application) titled: 'Proposed Phasing Plan for Operational Uses'.

However, to ensure the effective and timely availability of the Durnish lands for operational use as the needs arise, the proposed development includes the filling of all of the Durnish land as part of the initial phase of development (Phase 1) to make them serviceable. Phasing is proposed in the following manner:

Phase 1 – Proposed Development and Operational Uses (subject of this planning application)

- Jetty Extension (including relocation of pontoon);
- Filling of entire Durnish lands, provision of infrastructure and landscaping over the entire site (phased over a 10-year period);
- Development and operation use of 8.2 hectares of filled and serviced land for marine related industry to accommodate existing tonnage throughput through the Port of 1,778,126 tonnes.

Phase 1 – Activities

- Covered storage 1.2ha
- Open storage 7ha
  - Warehousing (up to 15m height)
  - Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high)
  - Loose cargoes such as woodchip biomass fuel (stored 6m high)
  - Storage of containers (up to 3nr high) approx. 8m high with handling equipment up to 17m height

Phase 1 – Implementation

The implementation of Phase 1 is envisaged in sub-phases as follows:

- Phase 1A

~ Stripping of Topsoil over entire Durnish Lands and seeding with clover mix
~ Boundary treatment around entire site (South, East and Northern perimeters)
~ Access road improvements and roundabout construction
~ Provision of new port security kiosk
~ Filling of Phase 1 extent of lands to a level of +4.44mOD
~ Provision of security fencing around raised lands
~ Provision of storm drainage infrastructure and attenuation pond extension
~ Removal of existing "lean to" shed
~ Construction of internal road network and drainage channel crossing structures
~ Construction of warehousing and open storage areas
~ Provision of foul water infrastructure
~ Provision of lighting and services

- Phase 1B

~ Filling of "Phase 2" extent of lands
~ Provision of storm drainage system
~ Provision of security fencing

- Phase 1C

~ Filling of "Phase 3" extent of lands
~ Provision of storm drainage system
~ Provision of security fencing

The proposed phasing regime (Phase 1A – 1C) is illustrated on the appended drawing (also lodged with the planning application) titled: 'Proposed Phasing Plan for Construction' and is illustrated in Figure 2.10.

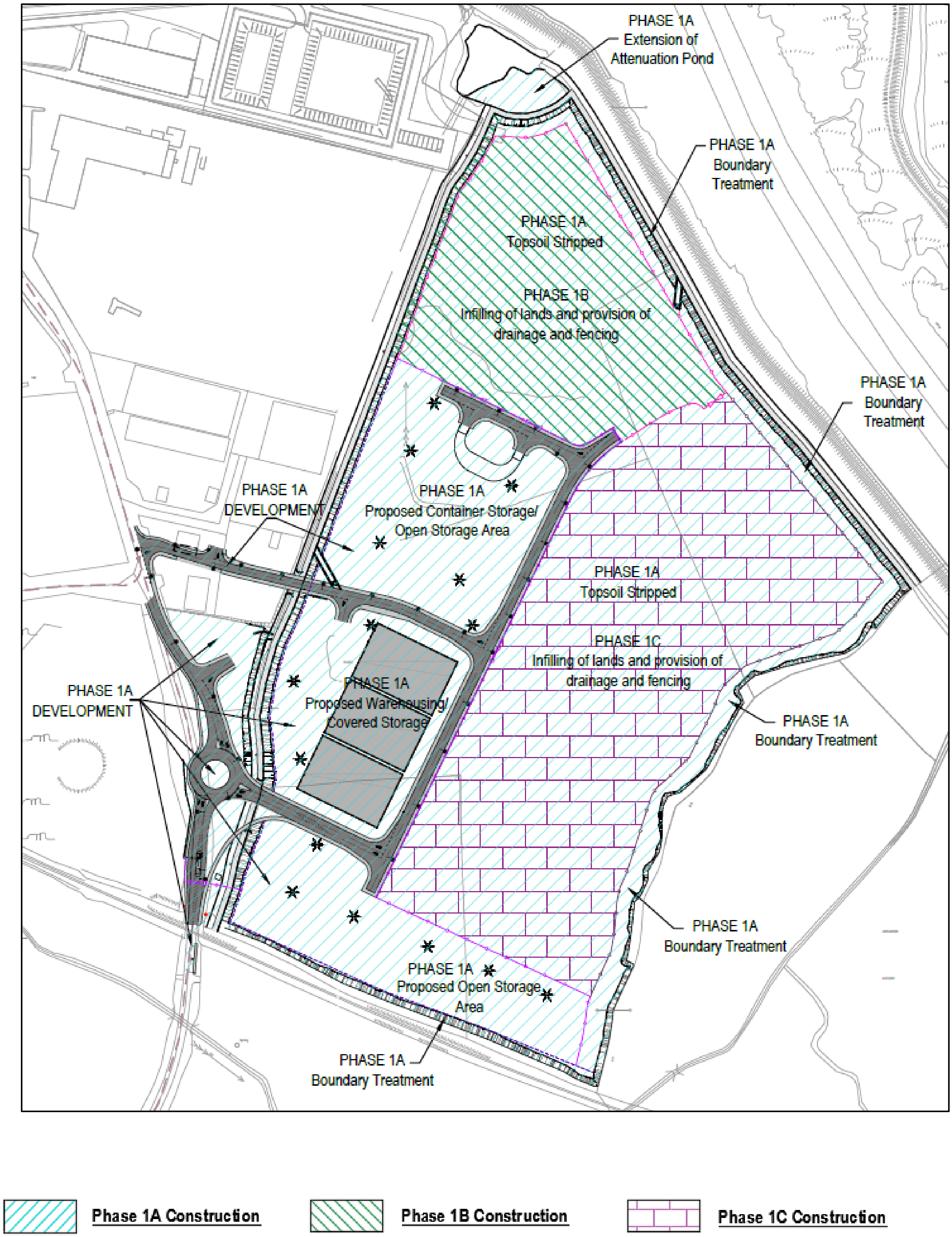


Figure 2.10 Proposed Phasing Plan for Construction

These sub-phases seek to ensure the orderly development of the expansion area. Having said that, the proposed phasing regime does not, nor cannot preclude the possibility of all Phase 1 works being carried out simultaneously if/where market conditions support that.

In the meantime, the upfront capital cost of undertaking site development works and specifically the raising of ground levels across the entire of the Durnish lands is unviable in the absence of supporting market conditions or, one specific user for the lands. Furthermore, the timescale for implementation of that specific measure (raising the ground levels across the entire site prior to any operational use) will delay the opportunity to provide for immediate storage requirements with the potential effects on maintaining Port competitiveness.

Phases 2 and 3

The operational uses of Phase 2 and Phase 3 are unknown at this time and therefore there are no further site-specific details in terms uses that can be provided. However, for the purpose of this assessment and specifically, a cumulative consideration of proposed and likely anticipated uses (based on existing and proposed port uses), the likely operational scenarios for Phase 2 and Phase 3 are as follows;

Phase 2 – Likely Operational Scenario (Subject to future planning consent)

Accommodation of additional (predicted) 991,874 tonnes of cargo throughput to deliver total Port tonnage throughput of 2,770,000 tonnes by 2025. Anticipated delivery consisting of:

- Covered storage of circa 1.2ha
- Open storage of circa 2.4ha
  - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
  - Construction of internal road network
  - Provision of foul water infrastructure
  - Provision of lighting and services

Phase 3 – Likely Operational Scenario (Subject to future planning consent)

Accommodation of additional (predicted) 510,000 tonnes of cargo throughput to deliver total Port tonnage throughput of 3,280,000 tonnes by 2029. Anticipated delivery consisting of:

- Covered storage 2.8ha
- Open storage 6.1ha
  - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
  - Construction of internal road network
  - Provision of foul water infrastructure
  - Provision of lighting and services

Open storage uses (predicted for Phase 2 and 3):

- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high)
- Loose cargoes such as woodchip biomass fuel (stored 6m high)
- Scrap metal (stored 8m high)
- Storage of containers (up to 3nr high) approx. 8m high with handling equipment up to 17m height

Covered storage (predicted for Phase 2 and 3):

- Warehousing (up to 20m height)
- Storage tanks (up to 15m height)

'The Framework Plan'

All phases have been considered and designed for within the context of a 'Framework Plan' for development within the Durnish Lands.

The Framework Plan (which is submitted as part of the planning consent) sets out a development concept arrangement for the entire Durnish lands (Phase 1, 2 and 3) in order to present a holistic and co-ordinated approach toward the orderly and sustainable development of the Durnish Lands. This will guide subsequent developments within subsequent Phase 2 and Phase 3 given that the specific details of uses are not known at this time and assists this assessment process. Specific detailed uses and infrastructure required for Phase 2 and Phase 3 and which are not included in the current planning application will be subject to planning consents as necessary.

The Framework Plan has given consideration to and presents a strategic arrangement of inter-alia; general layout arrangements; the design and implementation of infrastructure including water, energy services, flood risk management, water services, lighting, and site security; the primary internal access roads, building heights and design across the entire site. The proposed first phase of development reflects the 'development framework' for that area given that the immediate requirements are know at this time. The Framework Plan acknowledges that different Port users have different land use requirements and therefore given that the site-specific storage requirements and uses are not yet known for subsequent phases, the Framework Plan retains a degree of flexibility for operational development within the Phase 2 and Phase 3 albeit within certain limitations.

The design of the Framework Plan has derived from an iterative process conducted in parallel to the formulation of the development proposal and the execution of this EIAR.

For the purpose of this EIAR, a cumulative assessment has been undertaken of all development proponents and the EIAR has taken account of and assessed the scope of anticipated end uses and anticipated building types and heights, and landscaping (set out in the Framework Plan).

2.2.5.2.2 Infilling (during Phase 1)

The top 200mm of topsoil shall be stripped across the extents of the Durnish lands, and shall be re-used in the formation of the berm required for the landscaping boundary treatment. The exposed sub-base shall be seeded with a clover mix to bind the material together.

Suitable infill material shall be sourced from authorised quarries, and shall be imported by road to raise the level of the existing Durnish lands to a finish ground level of +4.44mOD (including capping and surfacing). It is anticipated that this material can and will be sourced locally within the region. Figure 2.11 below shows the proximity of active crushed rock quarries in the vicinity of the Durnish Lands. Quarry facilities from which this material will be sourced will be registered with the local authority and will have the necessary planning permission and other consents in place for the winning and haul of such material. Consequently, there is no obligation on this project to secure planning permission or other consent for sourcing that material, or to undertake EIAR in respect to winning the material.

The anticipated volumes and type of fill material required to meet the design ground levels for Durnish lands are set out as follows:

<u>Assuming filling of Phase 1 in a single phase</u>

- Circa 521,000m^3 of imported fill material (equating to circa 937,800T based on a conversion of 1.8T/m^3)
- Circa 71,100m^3 of surfacing (equating to circa 167,100T based on a conversion of 2.35T/m^3)

Or alternatively,
Assuming filling of Phase 1 as sub-phases:

<u>Phase 1A</u>

- Circa 195,500m^3 of imported fill material (equating to circa 351,900T based on a conversion of 1.8T/m^3)
- Circa 28,000m^3 of surfacing (equating to circa 65,800T based on a conversion of 2.35T/m^3)

<u>Phase 1B</u>

- Circa 115,000m^3 of imported fill material (equating to circa 207,000T based on a conversion of 1.8T/m^3)
- Circa 13,600m^3 of surfacing (equating to circa 31,950T based on a conversion of 2.35T/m^3)

<u>Phase 1C</u>

- Circa 210,500m^3 of imported fill material (equating to circa 378,900T based on a conversion of 1.8T/m^3)
- Circa 29,500m^3 of surfacing (equating to circa 69,350T based on a conversion of 2.35T/m^3)

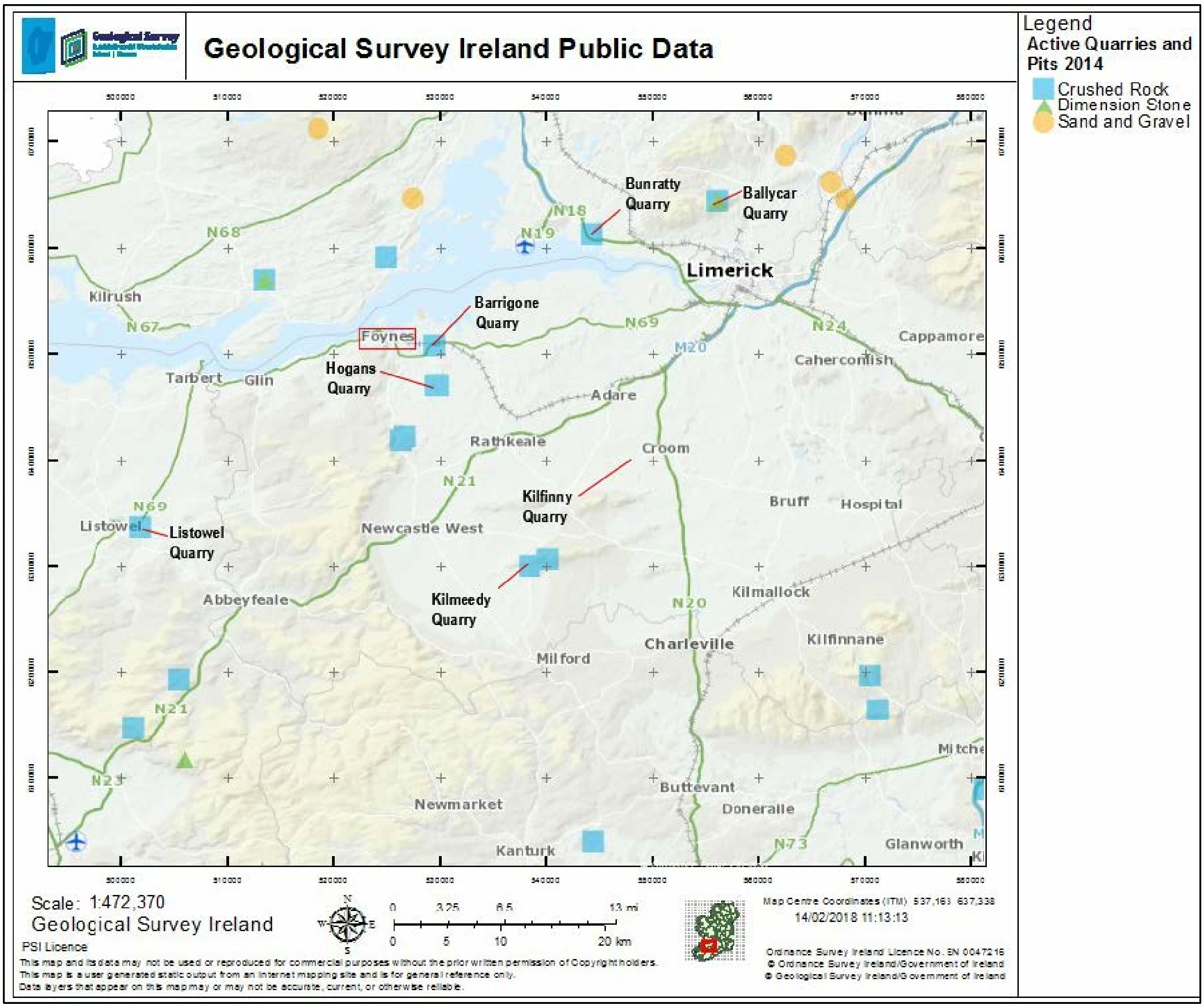


Figure 2.11 Map showing Active Quarries in Vicinity of Foynes (Source: OSi)

Quarry Name	Location	Council Licensed/Registered	Availability to Provide Required Rockfill	Fig2.12 Reference
Joseph Hogan Ltd.	Ballylin, Foynes, Co. Limerick	✓	✓	Hogan's Quarry
Liam Lynch Quarries Ltd.	Kilfinny, Adare, Co. Limerick	✓	✓	Kilfinny Quarry
Roadstone Provinces Ltd.	Bunratty West, Co. Clare	✓	✓	Bunratty Quarry
	Barrigone, Dysert, Co. Limerick			Barrigone Quarry
Kilmeedy Sandstone (William McAuliffe Ltd.)	Kilmeedy, Co. Limerick	✓	✓	Kilmeedy Quarry
O'Connell Quarries Ltd.	Ballycar, Co. Clare	✓	X *(site too far from quarry)*	Ballycar Quarry
Allman Contracts Ltd.	Listowel, Co. Kerry	Contacted - Response Pending		Listowel Quarry

Table 2.2 Confirmation of Available Quarries (non-exhaustive list provided)

2.2.5.2.3 Surfacing

The surfacing shall be heavy duty impermeable surfacing, designed to take account of the proposed operational usage and associated loadings. Details of proposed surfacing are shown on the relevant planning drawings.

2.2.5.2.4 Access to Durnish Lands

Roundabout construction

It is proposed to construct a roundabout on the existing port access road to provide the main access into the developed Durnish Lands. The roundabout has been designed to the Design Manual for Roads and Bridges (DMRB) adoptable standards and assessed as part of Chapter 13. The existing road shall be improved to provide a 12.5m radius roundabout, with two 5m wide lanes (as shown on the relevant planning drawings).

The proposed construction of the road improvements encroaches on an existing sloped grass embankment. In order to facilitate the roundabout construction, a retaining structure is proposed at this location, as shown in Figure 2.12 below.

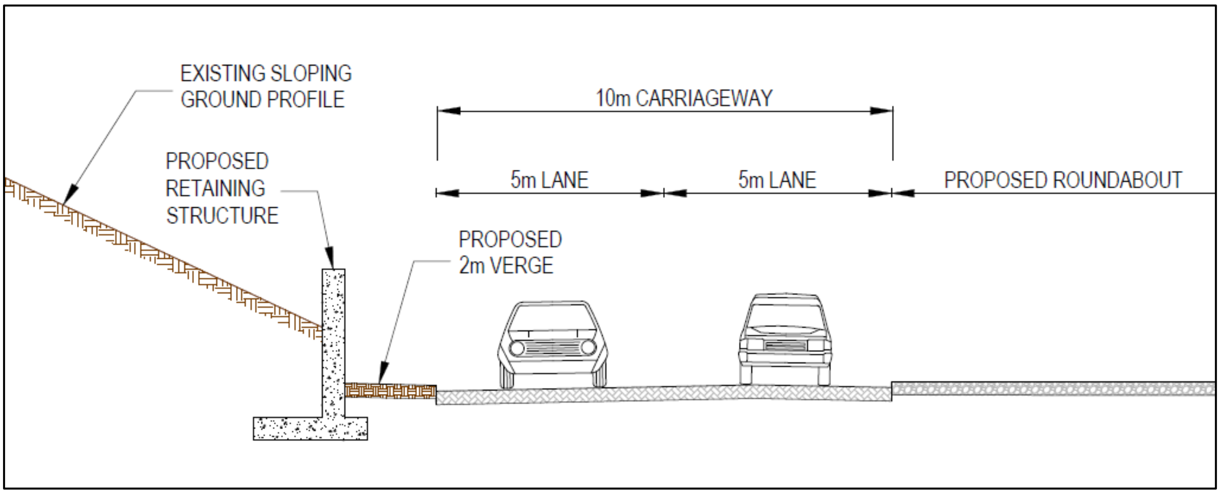


Figure 2.12 Proposed Retaining Structure for Roundabout Construction

Mid-Point Access to Durnish Lands

In order to facilitate the construction of the mid-point access to the Durnish Lands (as shown on the relevant planning drawings), the Foynes Engineering lean to structure must be removed. This structure is a steel frame structure, with single skin steel corrugated sheeting, and measures approximately 6.7m wide by 19.2m long. The extent of the required removal is shown on Figure 2.13 below and is detailed on the relevant planning drawings.

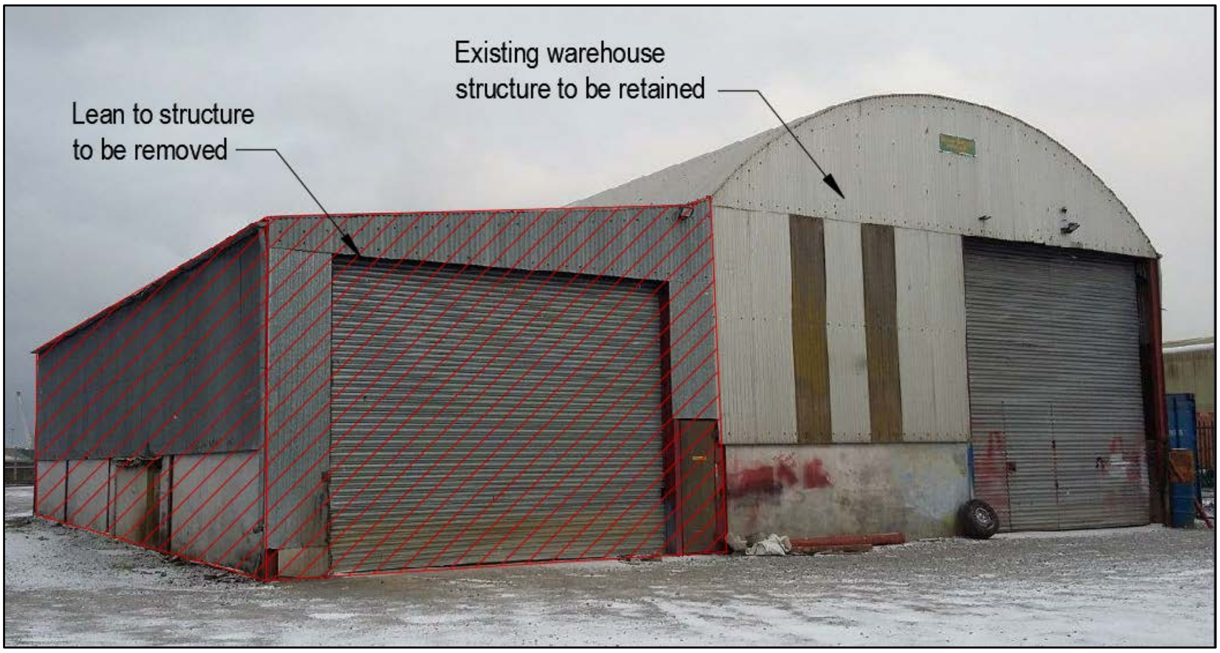


Figure 2.13 Extent of Structure to be Removed

Access to plot from port road

Direct access is to be provided from the existing port access road into the area of the Durnish Lands located to the west of the OPW drainage channel, as shown on the relevant planning drawings.

Access Structures

In order to facilitate access into the Durnish Lands, 2 no. crossing structures are required to provide access across the existing OPW drainage channel.

The locations of these crossing structures are shown on Figure 2.14 below. Details of the proposed crossing structures are shown on the relevant planning drawings.

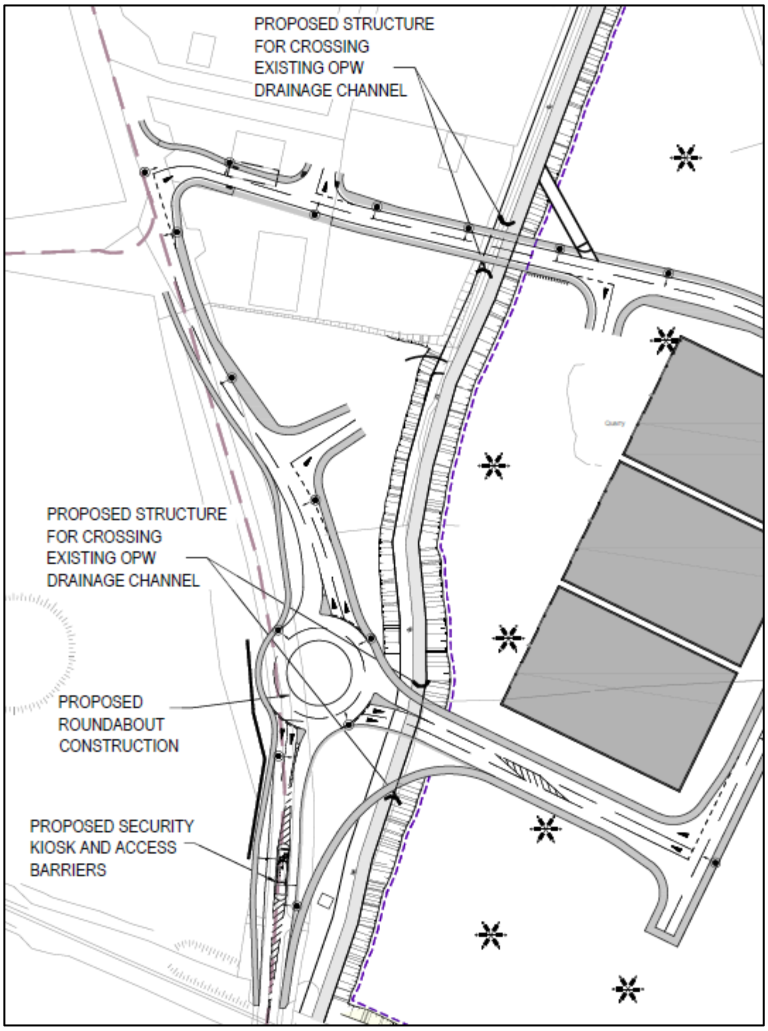


Figure 2.14 Locations of Crossing Structures

At each location, a 1.2m dia. precast concrete pipe shall be installed in the existing OPW drainage channel to facilitate the construction of the proposed access road across the channel, whilst accommodating the existing flow within the channel. Reinforced concrete headwalls shall be constructed, along with Reno mattresses and gabion baskets to support the existing channel side slopes at both ends of the concrete pipe, positioned either side of the road crossing. Trash screens shall also be provided upstream of each crossing structure. This detail is shown in Figure 2.15 below.

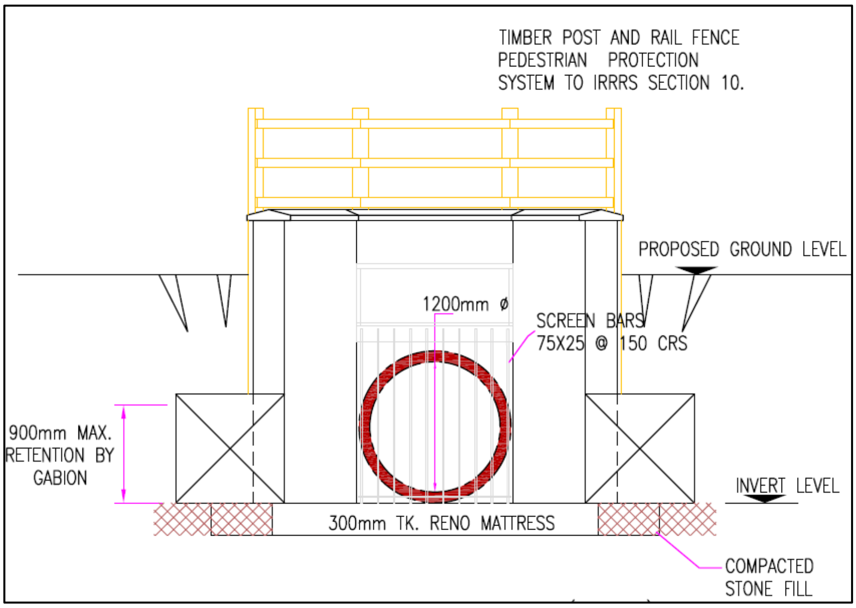


Figure 2.15 Crossing Structure Headwall Detail

2.2.5.2.5 Warehousing

3 No. Warehouse units and an area of open/container storage are proposed as part of Phase 1. Warehouses to be constructed on the Durnish Lands shall be similar to the typical Argosea Foynes Warehouses which are typically approximately 50m wide x 80m long portal frame structures, with a pitch roof height of approximately 15m.

Plate 2.7 below shows an example of similar warehousing to that proposed for the Durnish Lands.

Plate 2.7 Typical Form of Proposed Warehousing

Warehousing shall have a Finished Floor Level of +4.74mOD Malin. Subject to the requirements of the end user, the warehousing may be combined as one integrated building (with dividing walls) or 3 no. individual units with a 2.5m wide gap between them (as shown on Figure 2.16 below). Subsequent warehousing and open stores shall be constructed in subsequent Phases 2 and 3 as the demand dictates.

The layout and plot size and configuration will be responsive to end user or market requirements but will conform generally to the strategic infrastructure layout and assimilate with surrounding buildings, uses and service and general layout arrangements.

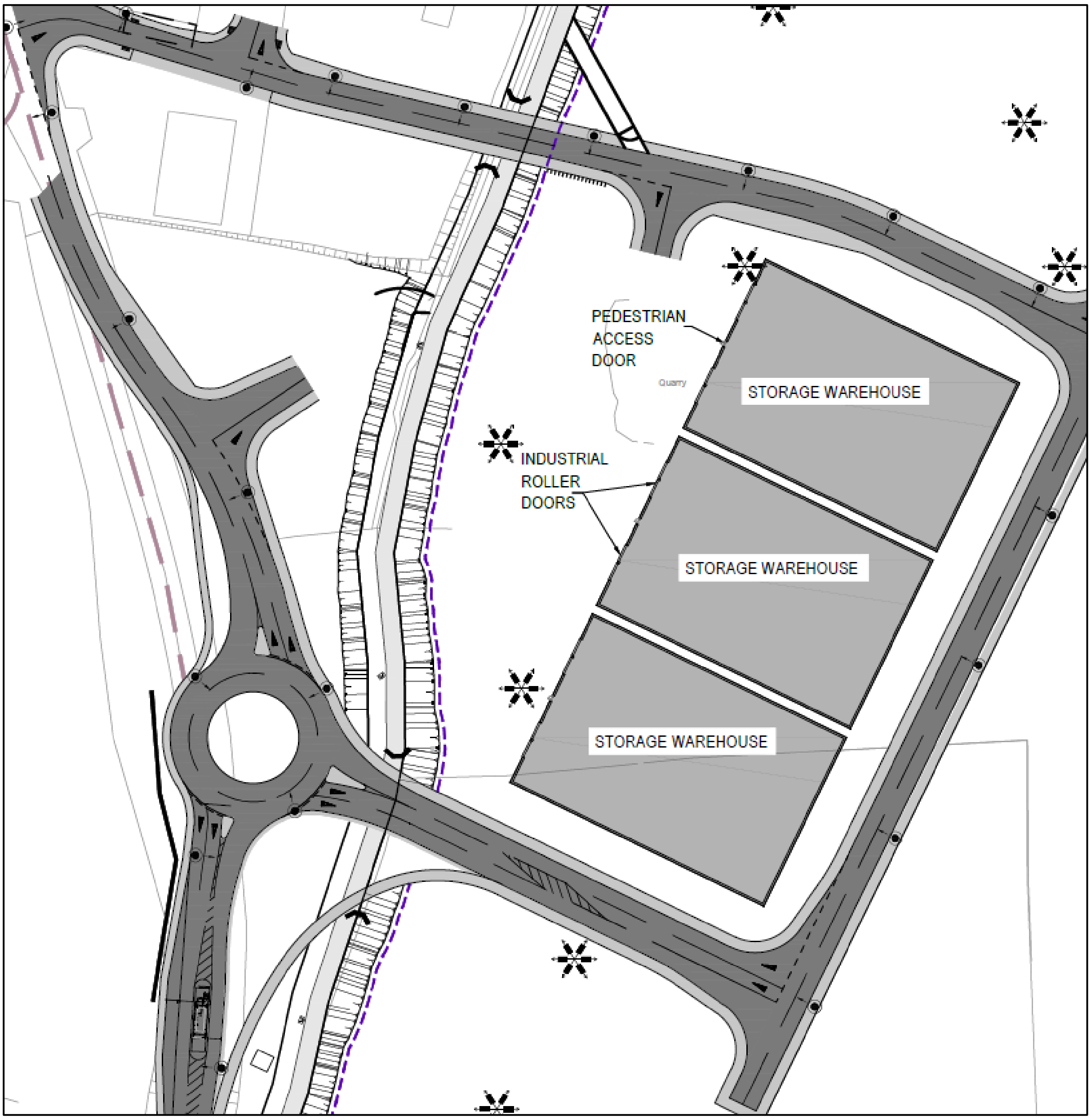


Figure 2.16 Proposed Warehousing Layout

2.2.5.2.6 Provision of New Port Security Kiosk and Barrier

As part of the development works, it is proposed to replace the existing security kiosk and access barriers located at the East Entrance to Foynes Port.

Plate 2.8 below shows the existing infrastructure.

These shall be retained in place, with the security gates and barriers kept open to permit access within the Port.

Plate 2.8 Foynes Port East Entrance Security Kiosk & Barriers

As part of the development works, it is proposed to provide a new port security kiosk and barriers further south along the existing port access road, south of the proposed roundabout, in order to include the roundabout and Phase 1 lands within the secure port lands.

The intention is to provide a new security kiosk with security barriers at the location shown in Figure 2.17 below, and to add an express lane and additional security barrier to facilitate ease of access for port users in possession of security passes.

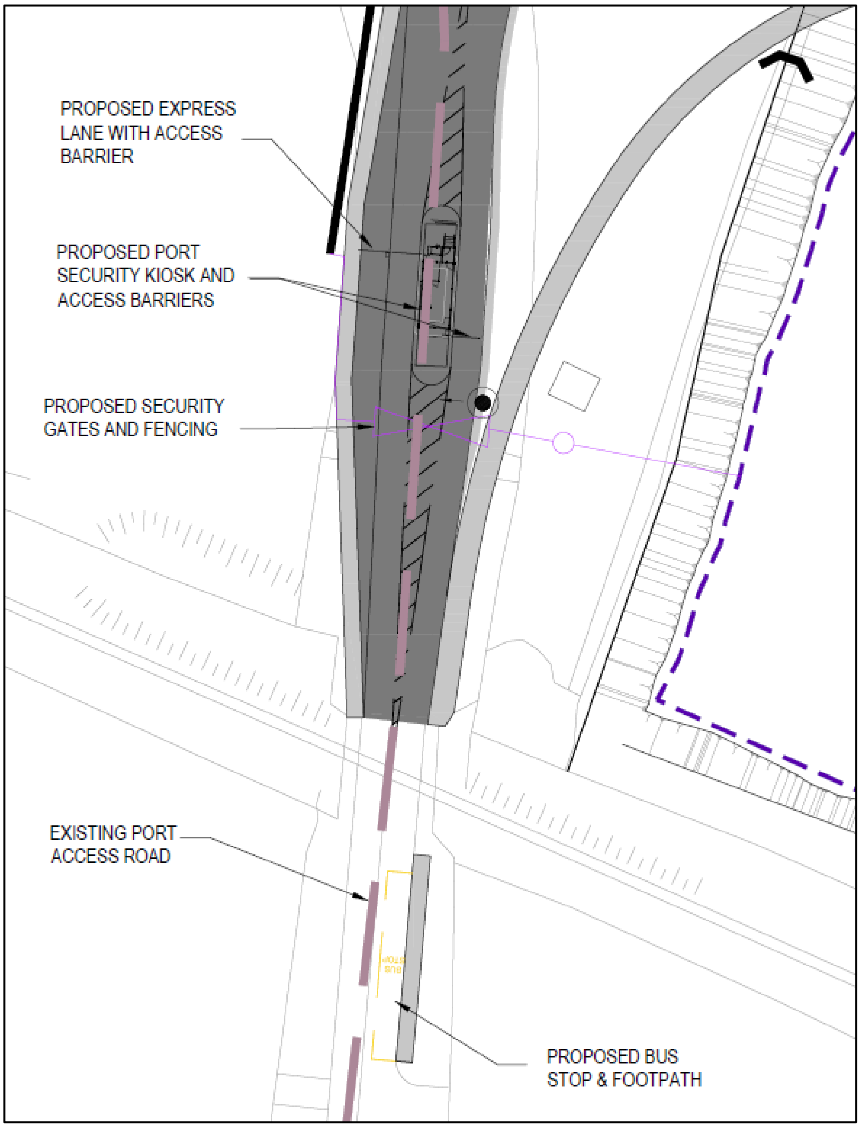


Figure 2.17 Relocation of Port Security Kiosk & Barriers

2.2.5.2.7 Storm and Foul Water Drainage

Storm Water Drainage

The storm water drainage system for the Durnish Lands has been designed in accordance with SuDS principles to avoid putting any further pressure on the existing OPW drainage channels or attenuation pond.

Indeed, the opportunity afforded by the proposed site works has been taken to propose an extension to the size of the attenuation pond by 2,000m^2 as a failsafe measure and contribution towards extended flood protection upstream. This will allow a further storage volume of circa 5,000m^3 of influent stormwater during the upper tidal cycle when the outfall (near low water) is not operational. This represents approximately double the storage capacity in the current attenuation pond.

The stormwater design of the site has been assessed using catchment hydrological analysis and rainfall intensities for varying durations at a 1:100 year return period event as provided by Met Éireann.

The greenfield runoff rate was established as 0.645 $m^3/s/km^2$ based on catchment hydrological analysis (as shown in Table 9.2.7 of Chapter 9. This produces an existing Q_{med} discharge flow rate of $0.164m^3/s$ for the full area of the field.

Based on a conservative assumption of fully impermeable surfacing for the proposed development of the Durnish Lands, each storm duration was analysed to calculate the required storage volume, over and above the existing discharge flow rate of $0.164m^3/s$.

The maximum storage volume requirement was calculated as circa $9{,}200m^3$ based on a fully paved hardstanding surface runoff rate of 590 l/s for a 6 hour duration storm. The 6 hour duration was found to be the worst case to generate the maximum stormwater storage requirement to be accommodated by the stormwater design.

In line with SuDS principles, it is proposed that this storage volume of $9{,}200m^3$ will be accommodated within the permeable imported fill over the site development.

Storm drains will collect all surface water and convey it through full retention interceptors (to collect hydrocarbons and silt) and the stormwater will then be conveyed through perforated pipes to allow percolation into the infilled ground.

Assuming such percolation occurs over only 30% of the site, this generates a storage depth of 121mm of water and then using a conservative assumption of voids ratio in the imported fill material of only 20% generates an additional water table “depth” of 605mm within the circa 2m to 2.5m depth of infilled ground.

Furthermore, it is proposed that hydro-brakes will be installed at the end of each perforated drainage pipe run to ensure the existing discharge rate of $0.164m^3/s$ into the drainage channel is respected in the future development.

An outfall pipe will extend from each hydro-brake chamber, beneath the 5m wayleave, and into the existing drainage channel.

Readily and safely accessible monitoring chambers will be provided on the storm water pipelines to allow for inspection and sampling of the storm water being discharged.

The design approach is to ensure active percolation into the infilled ground is achieved in order to keep the proposed discharge rate below this existing rate of $0.164m^3/s$. This approach is in addition to doubling the size of the existing attenuation pond as a failsafe design approach.

Details of the proposed stormwater system are shown on the relevant planning drawings and on Figure 2.18 below.

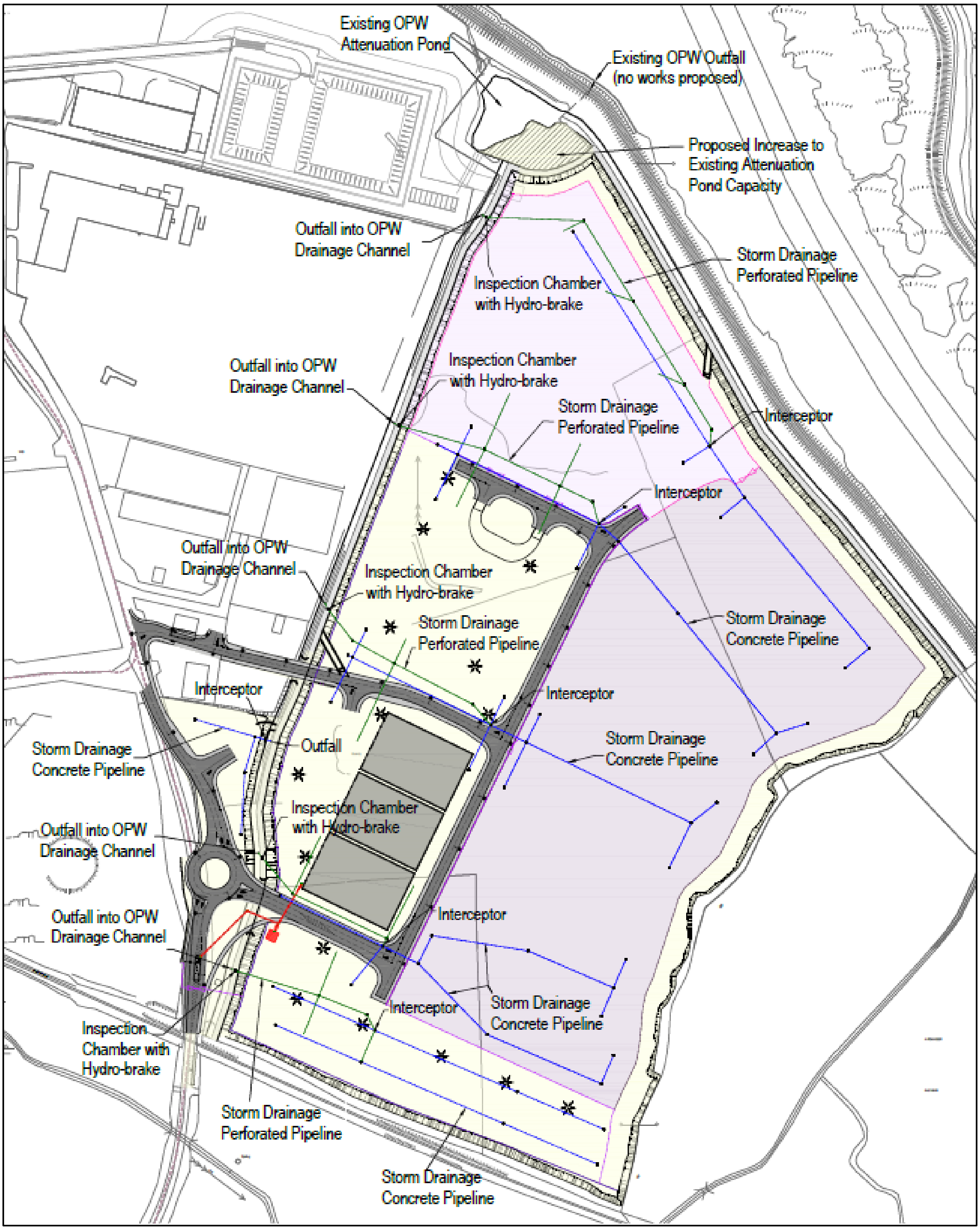


Figure 2.18 Proposed Drainage Layout

Foul Drainage

Foul (sewer) drainage arrangements have been designed and are included as part of this proposal. The foul sewer water arrangement has been designed in the context of the existing infrastructure regime and particularly, the absence of public foul sewer mains servicing the Port and the Port expansion area, the distance and limited capacity of the existing treatment plan serving the town of Foynes, and, the opportunity presented by the size of the Durnish lands to provide for a self-sufficient solution.

The preferred design solution, has derived from consideration of a number of waste-water design options explores as part of the EIAR process and is considered consistent with best practice having regard to the locational and site-specific circumstances. (Consideration of these options is set out further in Chapter 5).

Foul water arrangements will be implemented on a phased basis consistent with each of the planned phases of development. Each phase will involve the implementation of a package treatment system which when implemented collectively, will service the entire Durnish lands, designed with sufficient capacity to accommodate predicted loadings (generated from the 'population equivalent' (PE) of the anticipated number of employees). This approach allows for the foul wastewater treatment system to be individually sized for each development phase to maximise efficiency and afford a level of flexibility for future development given its long programme duration and uncertain land usage requirements of subsequent phases (beyond the immediate known requirements of Phase 1). The table below shows the respective increase in Population Equivalent for each proposed phase of the Durnish Lands development.

	Occupancy	Population Equivalent (PE)
PHASE 1	48	20
PHASE 2	24	10
PHASE 3	48	20
TOTAL	**120**	**50**

Table 2.3 – Phase 1 – Phase 3 Population Equivalent

For the design of the Phase 1 treatment system, a factor of safety of 1.25 was applied to the occupancy figure for Phase 1. Therefore, an occupancy figure of 60 personnel was considered and a design population equivalent of 30 was used in the system design.

The package treatment system proposed for Phase 1 is a Klargester BioDisc BE (or similar), which provides both primary and secondary treatment of foul waters. Preliminary sizing of packaged system for 30pe is approx. 2.45m wide x 3.34m long, x 3.3m deep.

See Figure 2.19 below for typical package treatment system proposed.

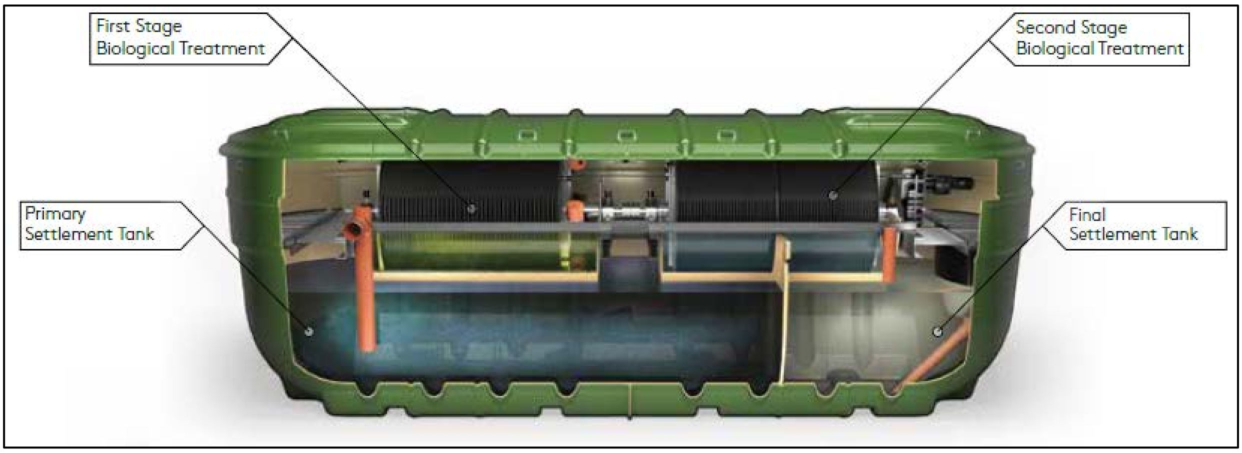


Figure 2.19 Typical Package Treatment Plant (source Kingspan Klargester BioDisc©)

In line with EPA Guidance, the treated effluent will be subjected to tertiary treatment by the means of a polishing filter which also acts as a percolation area to redistribute the treated and polished effluent to the groundwater.

It is proposed to use a stratified sand polishing filter to provide the dual function of polishing the effluent and also infiltrating the treated effluent to the groundwater. The design arrangement is in accordance with EPA Code of Practice guidance and European standards.

This polishing filter shall be a minimum of 0.9m deep, with material graded as specified in EPA Guidance, underlain with imported fill material above the in-situ sub-soil/water table. The base of the proposed polishing filter shall be a minimum of 1.2m above the existing water table/bed rock within the existing ground strata.

See Figure 2.20 below for typical make-up of sand polishing filter.

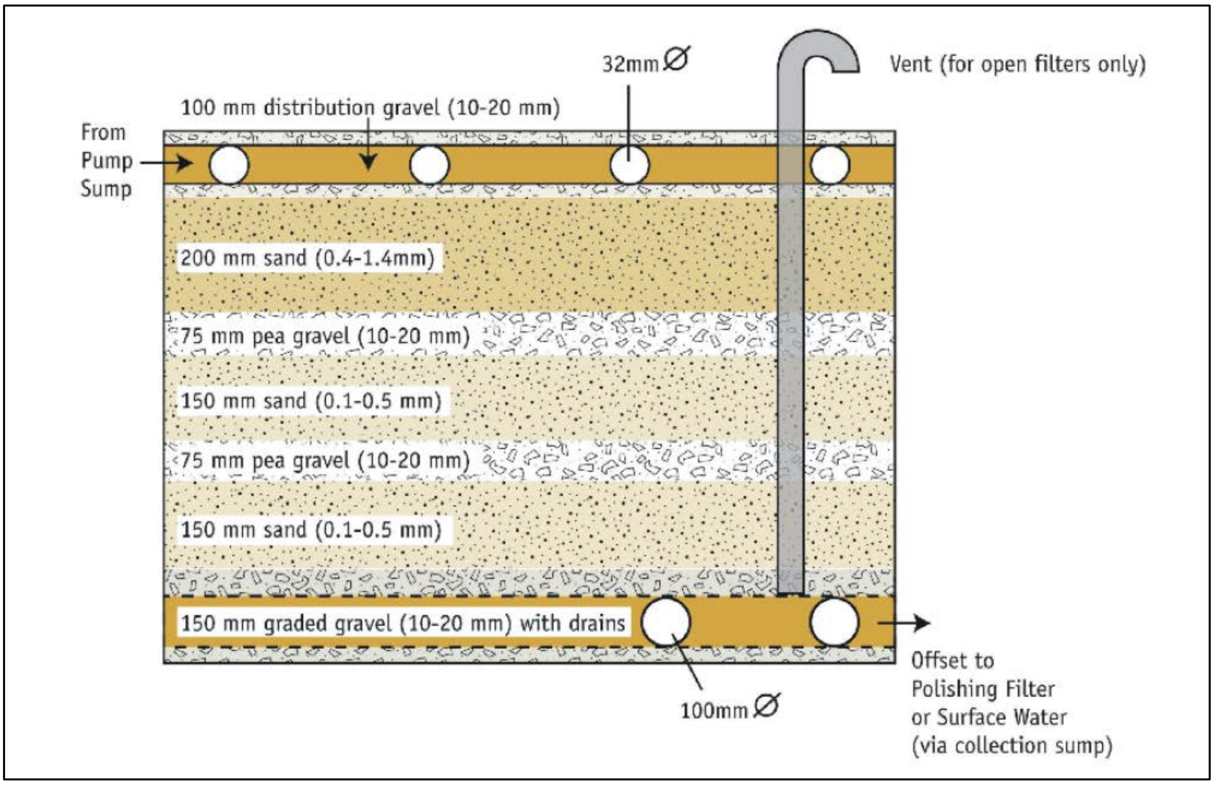


Figure 2.20 Typical Stratified Sand Polishing Filter (Source- EPA Guidance)

This design arrangement has been based on site-specific percolation testing (details of which are appended to Chapter 8 of this EIAR), taking account of land raising and the type of fill material that will be required to provide for appropriate percolation.

Development details are illustrated on drawing number (M0679-RPS-00-PL-DR-C-0123) and are supported by additional technical specifications, including design and manufacturers specifications set out in **Appendix 2.2** .

These design details provide for the warehousing units proposed as part of Phase 1 and design details illustrate the waste water collection points and the wastewater network including treatment system and percolation area.

There is also a requirement to provide foul treatment for the WC which is located within the proposed security kiosk. This will be carried by a foul pipe from the kiosk, via the proposed crossing structure, to the package treatment plant being provided for the warehousing as above.

The locations of the proposed package treatment plant as part of the Phase 1 development is shown in Figure 2.21 below.

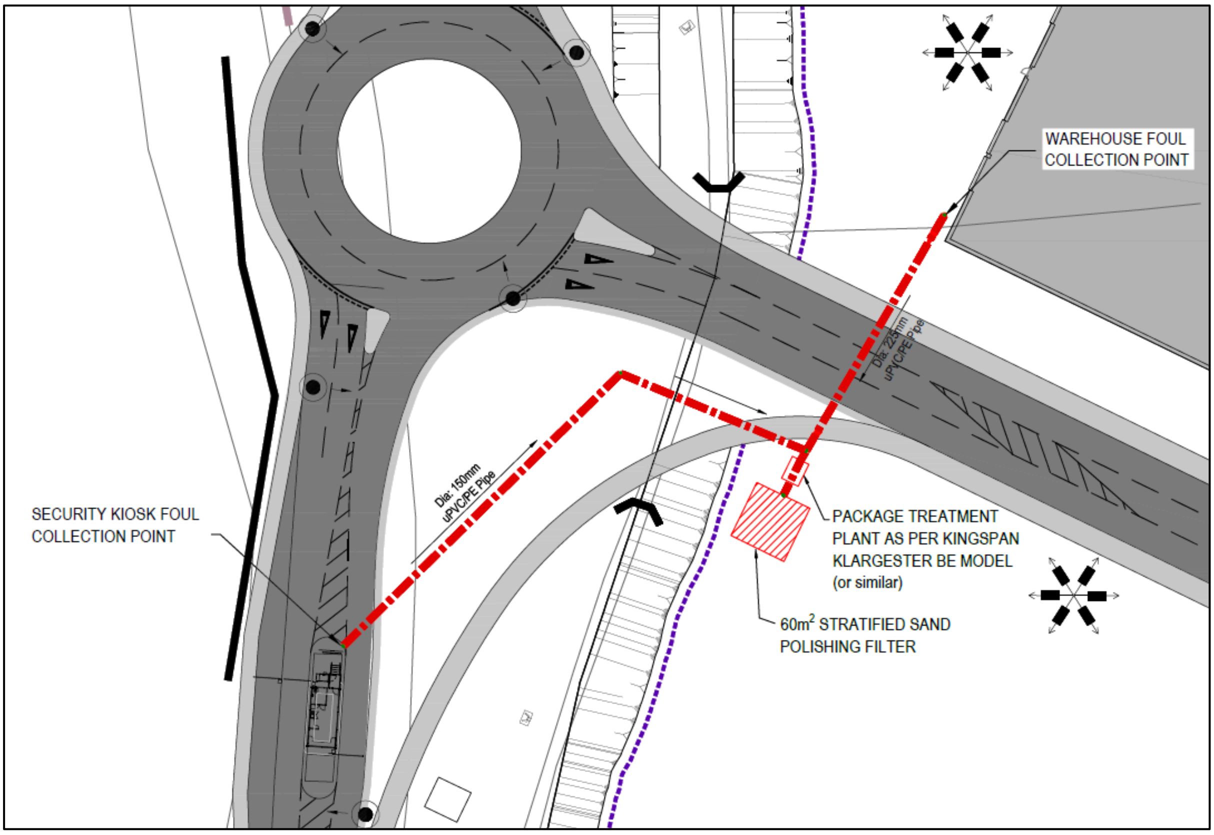


Figure 2.21 Proposed Foul Treatment Layout

2.2.5.2.8 Water Supply

Water supply will be by connection to the local mains system within the existing port area.

2.2.5.2.9 Mechanical and Electrical Services

The proposed lighting for the general working areas/storage area will comprise 30.0m high; base hinged raising and lowering masts with multiple floodlight arrangements units and light cowls for light pollution control. Lighting will be designed to provide an average lighting level of 30-50 lux for storage and operational areas and an average of 20lux for internal access roads. 8m high lighting standards will be provided along internal roads and footpaths. The lighting will be designed to prevent direct glare into surrounding properties and illumination of the night sky.

In accordance with the mitigation measures outlined in Chapter 7 of this EIAR, the positioning of the proposed high mast lights has been refined and light shields added to ensure the lux levels along the Southern and Eastern boundaries of the Durnish lands do not exceed 5lux.

Power supply will be by connection to the local electricity grid system via a proposed ESB substation to be constructed at the South-Western boundary of the Durnish Lands.

2.2.5.2.10 Fencing and Security

Secure fencing will be provided along the perimeter of the developed Phase 1 lands. Fencing shall be in keeping with the panel mounted fencing currently used around the Port lands, and shall be 2.4m high panel fencing with a close mesh profile (5mm dia. steel wire with a 200x25mm mesh aperture), mounted on RHS posts with a bracket fixing system.

A typical photo of the proposed fencing is shown in Plate 2.9 below. The location of the fencing is shown on the relevant planning drawings, and extends along the internal perimeters of Phase 1a.

Plate 2.9 Typical Security Fencing at Foynes

As part of the mitigation measures outlined in Chapter 11, an 800m long, 4m high noise barrier is to be provided along the Southern and Western boundaries of the Phase 1a development area. In this case, the noise barrier also acts to secure the perimeter along these boundaries in lieu of security fencing.

A typical photo of the proposed noise barrier is shown in Plate 2.10 below.

Plate 2.10 Typical 4m High Noise Barrier

Fencing will be implemented in phases commensurate with the phased implementation of the development and provided to securitise each of those areas. This is proposed as follows:

Phase 1A

- Circa 800m of 4m high noise barrier
- Circa 930m of 2.4m high fencing
- 5 No. gates

Phase 1B

- Circa 630m length of 2.4m high fencing
- 2 No. gates

Phase 1C

- Circa 670m length of 2.4m high fencing

2.2.5.2.11 Boundary Treatment

Suitable planting will be provided to the external perimeter of the raised lands to provide a visual barrier between the developed site and the neighbouring lands.

At the beginning of the Phase 1 development, the stripped topsoil will be profiled to form a landscaping berm along the Northern, Eastern, Southern boundaries and part of the Western boundary of the Durnish Lands. The top level of this berm will be +4.44mOD (in keeping with the proposed fill levels across the site).

Planting will be carried out along the slope of the berm, extending to the crest, with the width of proposed planting varying dependent upon the width of the existing boundary planting which is to be retained and “gapped up”.

Due to the exposed coastal nature of the Durnish Lands, tolerant hardy species with deeper planting depths will be planted, allowing for a careful profile of very hardy species at the front, and taller screening trees at the rear. First line of defence will include hardy salt tolerant native shrub species like Hawthorn, Blackthorn, Goat Willow, Gorse with low canopy trees Alder and Mountain Ash. This protects the second line of defence that will include native shrubs like Holly, Broom, Hazel and high canopy trees Oak, Ash, Scots Pine.

This is detailed on planning drawing “1773.5.01-Proposed Boundary Treatments”.

2.2.5.2.12 Safety Equipment

Fire hydrants will be provided at regular intervals in all working and storage areas.

Correspondence received from Irish Water (attached in Appendix 4 Volume 2 of the EIAR) advised that Irish Water cannot guarantee fire flow requirements from the existing mains supply, and therefore the proposed development should include adequate fire storage capacity to guarantee the water flow required to meet the Fire Authority requirements.

To this end, 2nr water storage tanks and a pumping house are proposed as part of the Phase 1 development. Preliminary sizing of the tanks has been undertaken to provide a minimum of 45,000l water storage capacity, and a pumping house with diesel generators shall also be provided.

The proposed location and layout is shown in Figure 2.22 below. Confirmation of the tank sizes, location and layout shall be subject to agreement in writing with Limerick Fire and Rescue Service at detailed design stage.

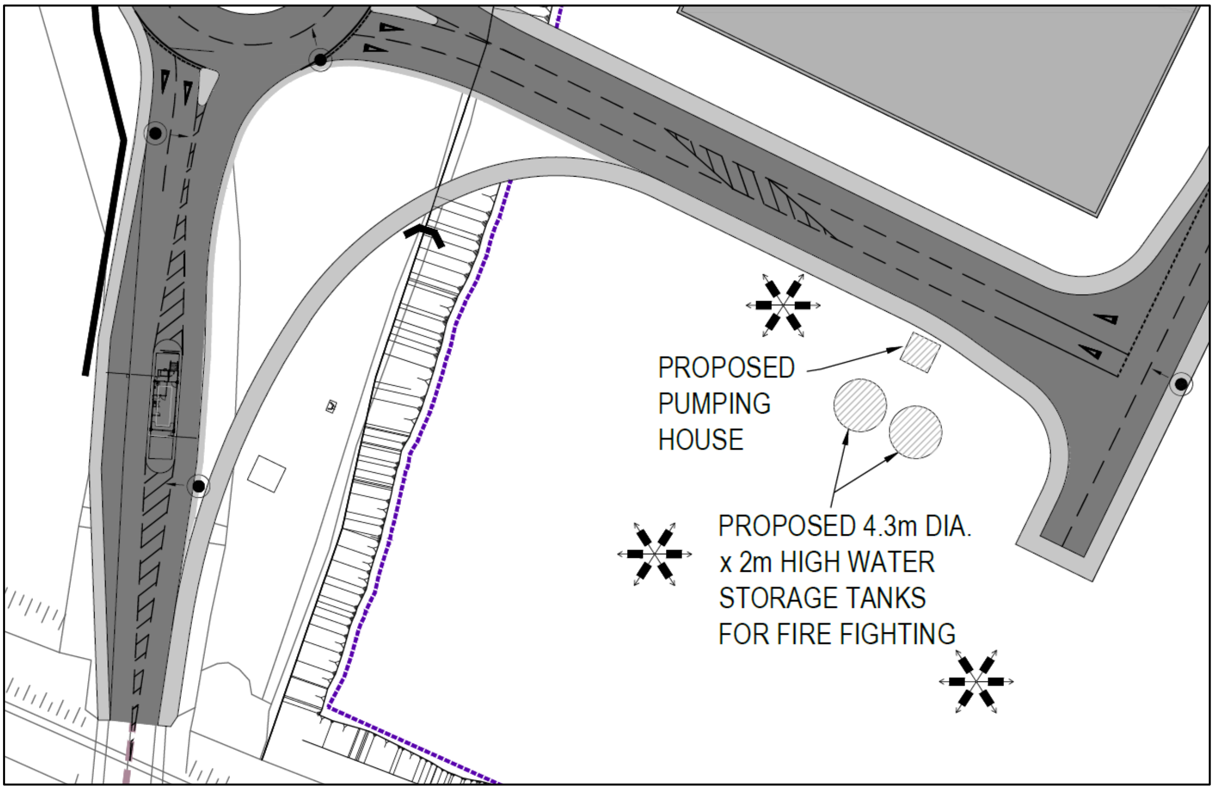


Figure 2.22 Proposed Water Storage Tanks

2.2.5.2.13 Durnish Lands General Construction Sequence

Single phase Construction

The general sequence of the development of the Durnish Lands will be as set out below:

- Stripping of topsoil across the existing site and seeding with clover mix
- Profiling of topsoil to form berm for boundary treatment along perimeter of Durnish Lands and planting of visual buffer
- Raising of existing lands to a level of +4.44mOD using imported fill material (whilst providing 5m wayleave for OPW access to drainage channel)
- Roundabout construction on Port access road and main access road into developed lands
- Construction of new Port Security kiosk and access barriers
- Demolition of existing shed “lean to” to facilitate construction of mid-point access road into developed lands
- Crossing structures over existing OPW drainage channel along Western boundary of developed lands
- Hardstanding construction and appropriate surfacing for open and covered storage
- Internal road and footpath construction
- Provision of secure fencing and services (power supply, water, drainage, lighting, attenuation pond extension)
- Erection of warehousing for covered storage with FFL of +4.74mOD Malin

Indicative Phased Programme

In the event that the development of the Durnish Lands is progressed on a phased basis, then the anticipated phasing is as outlined below and is as shown on Figure 2.10.

Phase 1A (as outlined on Figure 2.10)

- Stripping of topsoil across the existing site and seeding with clover mix
- Profiling of topsoil to form berm for boundary treatment along perimeter of Durnish Lands and planting of visual buffer
- Raising of Phase 1A portion of existing lands to a level of +4.44mOD using imported fill material (whilst providing 5m wayleave for OPW access to drainage channel)
- Demolition of existing shed "lean to" to facilitate construction of mid-point access road into developed lands
- Roundabout construction on Port access road and main access road into site
- Construction of new Port Security kiosk and access barriers
- Crossing structures over OPW drainage channel
- Internal road and footpath construction
- Hardstanding construction and surfacing
- Provision of secure fencing and services (power supply, water, drainage, foul treatment system, lighting)
- Erection of warehousing for covered storage with FFL of +4.74mOD Malin

Phase 1B (as outlined on Figure 2.10)

- Raising of Phase 1B portion of existing lands to a level of +4.44mOD using imported fill material (whilst providing 5m wayleave for OPW access to drainage channel)
- Provision of stormwater drainage and fencing

Phase 1C (as outlined on Figure 2.10)

- Raising of Phase 1c portion of existing lands to a level of +4.44mOD using imported fill material (whilst providing 5m wayleave for OPW access to drainage channel along northern perimeter of site)
- Provision of stormwater drainage and fencing

2.2.5.2.14 Equipment

Handling operations in the developed site will be dependent on the type of cargo which is to be accommodated at any given time. However the equipment will likely comprise some or all of those described in the following sections on an "as required" basis. The details and dimensions of particular types of equipment will vary from manufacturer to manufacturer and final dimensions will only be determined when the supplier of the equipment has been identified.

Dimensions considered in preparation of the EIAR are based on typical dimensions of equipment currently available in the marketplace. Some variation may occur in the final items of equipment provided.

Port handling equipment such as mobile cranes, mobile hoppers, mobile weighbridges, straddle carriers, loading shovels, reach stackers, mast lift trucks, or similar will be used as and when required.

Reach Stacker

Reach stackers are front lifting items of equipment which use telescopic arms to place containers at height in stacks. This type of equipment will be used in the Durnish Lands to handle containers up to 3nr high (8m high). A typical unit is illustrated in Plate 2.11 below.

Plate 2.11 Typical Reach Stacker

Straddle Carrier

Diesel powered straddle carriers are used to lift containers and deposit them in container stacks. They are mounted on rubber tyres and are usually approximately 16.5m in height. They can be used to stack containers up to 4 high (approximately 11m in height). A typical straddle carrier is illustrated in Plate 2.12.

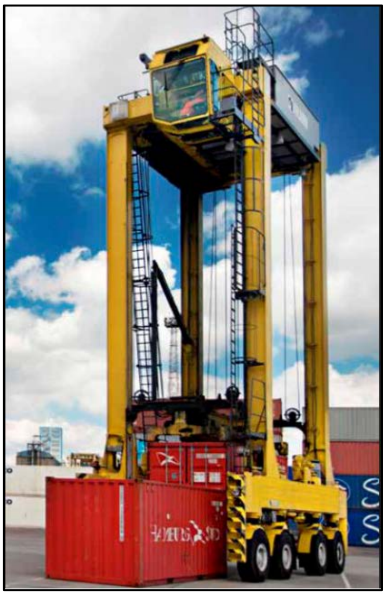


Plate 2.12 Typical Straddle Carrier

2.2.5.2.15 Operational Access

Access to the developed site will primarily be via the newly constructed roundabout on the existing port access road.

An additional point of access is also proposed in the centre of the developed lands, created as a new access point from the existing port access road, as shown on the relevant planning drawings.

2.2.5.2.16 Rail Use

No works are proposed to the existing rail line. The future operational use of the rail line is under constant review but at this time, the operational reuse of the rail line is subject to a specific end user requirements and/or viability of investment in the upgrade in the infrastructure. Despite that, the proposal seeks to retain and safeguard the integrity of that line and infrastructure.

2.2.5.3 Construction Activities

2.2.5.3.1 Jetty Extension

<u>Programme</u>

It is estimated that the proposed construction works will be undertaken during a construction period of approximately 12 months. A draft preliminary programme, showing the duration of the main elements of the construction works is attached in **Appendix 2.3.**

Temporary Site Compound

An area will be required for the establishment of the Contractor's site compound. The site compound will be used for the Contractor's site office accommodation and facilities and will include an area for temporary storage of construction materials.

A suitable area will be made available on existing port lands close to the site of the proposed works.

Site Access

Existing port operations will continue as normal during the construction period.

Access to the site will be via the Foynes Port Access Road (which can be accessed from the adjacent existing port access road off the N69), and along the internal port roads.

In general all construction related traffic will use the port entrance to the east of Foynes village in order to avoid traffic passing through the village.

Suitable traffic management and other systems will be put in place as required to minimise disruption to existing activities during the construction period.

2.2.5.3.2 Durnish Lands Development

Programme

Assuming that the development of the Durnish Lands is undertaken on a single phase basis, it is estimated that the proposed construction works will be undertaken during a construction period of approximately 39 months. A draft preliminary programme is attached in **Appendix 2.3**.

It is envisaged that the development of the Durnish Lands will be commenced whilst the jetty extension works are being undertaken. This is shown in the draft programmes provided. Alternatively, subject to the availability of funding or potential tenant requirements, the development of the Durnish Lands may be undertaken in sub-phases similar to that set out below under the sub heading 'construction employment'.

The anticipated timeline from the overall strategic programme for the sub-phased development of Phase 1 of the Durnish Lands is outlined below:

- Phase 1A Durnish Development (Expected commencement 2019)
- Phase 1B Durnish Development (Expected commencement 2024)
- Phase 1C Durnish Development (Expected commencement 2027)

Temporary Site Compound

A temporary site compound will be required for the proposed works. A suitable area will be made available within the site of the proposed works. In the event that the works are progressed in sub-phases, then the locations of the proposed site compounds will be positioned accordingly.

Site Access

Access to the Durnish Lands development site will be via the existing Foynes Port Access Road which can be accessed from the adjacent N69 road.

In general all construction related traffic will use the port entrance to the east of Foynes village in order to avoid traffic passing through the village.

Suitable traffic management and other systems will be put in place as required to minimise disruption to existing activities during the construction period.

2.2.5.4 Employment

It is anticipated that the total potential for employment during construction phase will range from a minimum 21 no. people to 35 no. people across both the jetty construction works and the port expansion at the Durnish lands during an envisaged 39-month construction period.

On average, 15 no. personnel will be employed for the full duration of the jetty construction works over an anticipated 12 month construction programme.

Construction employment of the Durnish lands development will be more dependent on the implementation of the phasing based on consideration of the following scenarios;

1. Development of Phase 1A lands including site preparation, provision of infrastructure and construction of warehouse units and storage facilities is likely to have a construction period of 18 months and will employ an average of 10 no. people during the entire construction period, with between 6 no. and 20 no. people on site at any one time.

2. Development of Phase1B & 1C lands will occur subsequent to Phase 1a and each other and will include infilling the lands with imported fill material and provision of stormwater drainage. The construction period is envisaged to be 17 months for Phase 1b and 19 months for Phase 1c and will result in the employment of 6 no. people over the construction period.

3. It is possible, subject to market conditions and commercial interests, that the entire Phase 1 lands may be developed in a single phase, in which case the construction period would take in the region of 39 months and employ an average of 10 no. people during the entire construction period, with between 6 no. and 20 no. people on site at any one time.

These details may be subject to change depending on final construction specifications but have been assessed in Chapter 6.

It is anticipated that the operational phase of the project will result in the generation of 120 on-site port related jobs. This calculation is based on the consideration of land area in the context of the existing use, and user types currently operating within the existing Port estate. It does not take account potential residual effects of off-site support services upon which the new operations might require and which might result in off-site employment opportunities.

2.2.5.5 Pollution Control

The construction works will involve Civil and Marine Engineering works and Mechanical and Electrical works.

All machinery used during the construction phase of the works will be required to be in good working order and free from oil and hydraulic fluid leakages.

If machinery maintenance has to take place, it will be carried out at the allocated Contractor's compound which will be located away from the adjacent waters. Fuel for machinery will be required to be stored in a secure and bunded area.

For construction operations such as the infilling of the Durnish Lands, pollution control measures such as wheel wash facilities will be put in place.

2.2.5.6 Site Safety

Safety will be of prime importance during the construction works. The works will be subject to the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations, 2006.

All aspects of design construction will be reviewed with regard to health and safety and a risk assessment will be carried out. A Project Supervisor (design phase) will be appointed to produce a pre-tender Health and Safety Plan for the project.

The Principal Contractor will be responsible for the control and co-ordination of health and safety during the works and will be appointed as the project supervisor (construction stage).

2.2.5.7 Waste Disposal

Contractors working on site during the works will be responsible for the collection, control and disposal of all wastes generated by the works. An indication of the types of waste likely to be generated by the works and the most appropriate method of disposal are presented in Table 2.4.

Activity	Waste Generated	Disposal/Treatment Recommendations
General Construction Waste	Waste oils	Collected by waste recycling contractor.
	Other waste	Collected in skips for disposal by licensed waste contractor.
General Office/Messing	Paper, packaging, canteen etc.	Collected in covered skips/large bins for disposal by a licensed waste contractor.
Temporary Site Toilets	Sewage	Emptied under contract for disposal at an appropriate facility.

Table 2.4 Typical Wastes Generated by the Construction Works

2.2.5.8 Operational Activities

Maintenance

When construction work has been completed, the jetty extension and Durnish lands development will require little by way of maintenance.

Pollution control

Surface water from the new working area on the jetty extension and the developed Durnish Lands will be collected by a system of drainage channels and gullies. The surface water will be discharged via interceptors to ensure that no pollution is released into the surrounding waters.

By 2020, it is the intention of SFPC to retrofit dust suppression hoppers to two of the existing hoppers used in the vicinity of the proposed jetty extension. This will assist with the control of dust from the jetty operations.

2.2.5.9 Duration of the Project

Planning permission in respect to development work is being sought for 10 years to ensure implementation for all of the above works. The duration of the operational element of the project can for the purpose of EIAR, be considered as ‘permanent’.

2.3 DESCRIPTION OF THE RISK OF ACCIDENTS – HAVING REGARD TO SUBSTANCES OR TECHNOLOGIES USED

The risk of accidents can arise during construction and operation phases as part of normal construction measures and port related operations and activities. The risk of accidents and mitigation measures considered necessary to address same, has been considered and is presented under the assessment of the each environmental variable assessed in this EIAR.

2.4 PROJECT CHANGE AND DECOMMISSIONING

There are no plans proposed for the decommissioning of the project given that the nature of the project – i.e. 'port development' can in this instance, be considered as a 'permanent' operation. The decommissioning of specific buildings or layouts is likely to form part of subsequent planning consent procedures and in the unlikely event that specific decommissioning requirements are necessary, appropriate mitigation can be applied to those consents.

2.5 OTHER RELATED PROJECTS AND POTENTIAL FOR EX-SITU EFFECTS

The proposed development does not involve or rely on any other related projects or give rise to significant ex-situ effects that should be considered as part of this EIAR. The applicant is satisfied that all projects are contained within the confines of the development (and EIAR) boundary as presented and assessed in this EIAR. For clarification, the construction of the new access roundabout and realignment of the existing port access road to facilitate access to the 'Phase 1' development involves the works within the ownership of Limerick City and County Council and consent for same has been received from that Authority for the inclusion of their lands to facilitate those works to the road. These works have been considered as part of this EIAR

3 SPATIAL PLANNING TRENDS & POLICY

3.1 INTRODUCTION

There is significant policy at international, national, regional and local level which recognises SFPC as a national asset and supports its continued growth. The policy framework recognises Ireland's ports and SFPC as being vital drivers of Ireland's competitiveness and future prospects.

This chapter of the EIAR provides an overview of international and national policy in support of the proposed development. It then examines statutory planning policy which demonstrates a plan – led approach to development and provides the necessary support to advance the proposed development through the planning process.

3.2 INTERNATIONAL SIGNIFICANCE

3.2.1 EU Trans-European Transport Network (TEN-T)

The EU Trans-European Transport Network (TEN-T) policy has created the basis for Europe to build a modern integrated transport system that can address sustainable, smart and inclusive growth challenges and to strengthen Europe's global competitiveness. SFPC is recognised by the European Commission as one of the three core ports in Ireland under TEN-T. SFPC is a core port on the core network. For inclusion in the core network, ports must enjoy significant volumes of freight and have a high level of international connectivity. Ireland comprises part of the North Sea-Mediterranean (NS-M) Core Network Corridor, as illustrated in Figure 3.1.

Within Ireland, the core corridor alignment extends from Belfast to Dublin and Cork. Presently the core corridor does not extend to include SFPC (see Figure 3.2). SFPC through the Department of Transport has been negotiating a change to the core corridor network at European level. The Department of Transport has recently advised that the European Commission Department for Mobility & Transport (DG Move) is agreeable to extending the core corridor to include SFPC and that Annex II of the Connecting Europe Facility (CEF) Regulations will be amended to reflect this change. The CEF Regulations will be updated in 2020, prior to the next funding period (2021 – 2026). However, DG Move will be publishing its mid-term review later this year and the change to extend the NSM Core Corridor to SFPC will be detailed in this review.

Designation of SFPC as part of this transportation corridor unlocks additional advantages for future port development as well as supporting enhanced external connectivity with Ireland's European partners. Brexit will also place Ireland and SFPC in a unique position to support the further development of this corridor given the long-term withdrawal of the UK from the EU and thus the corridor.

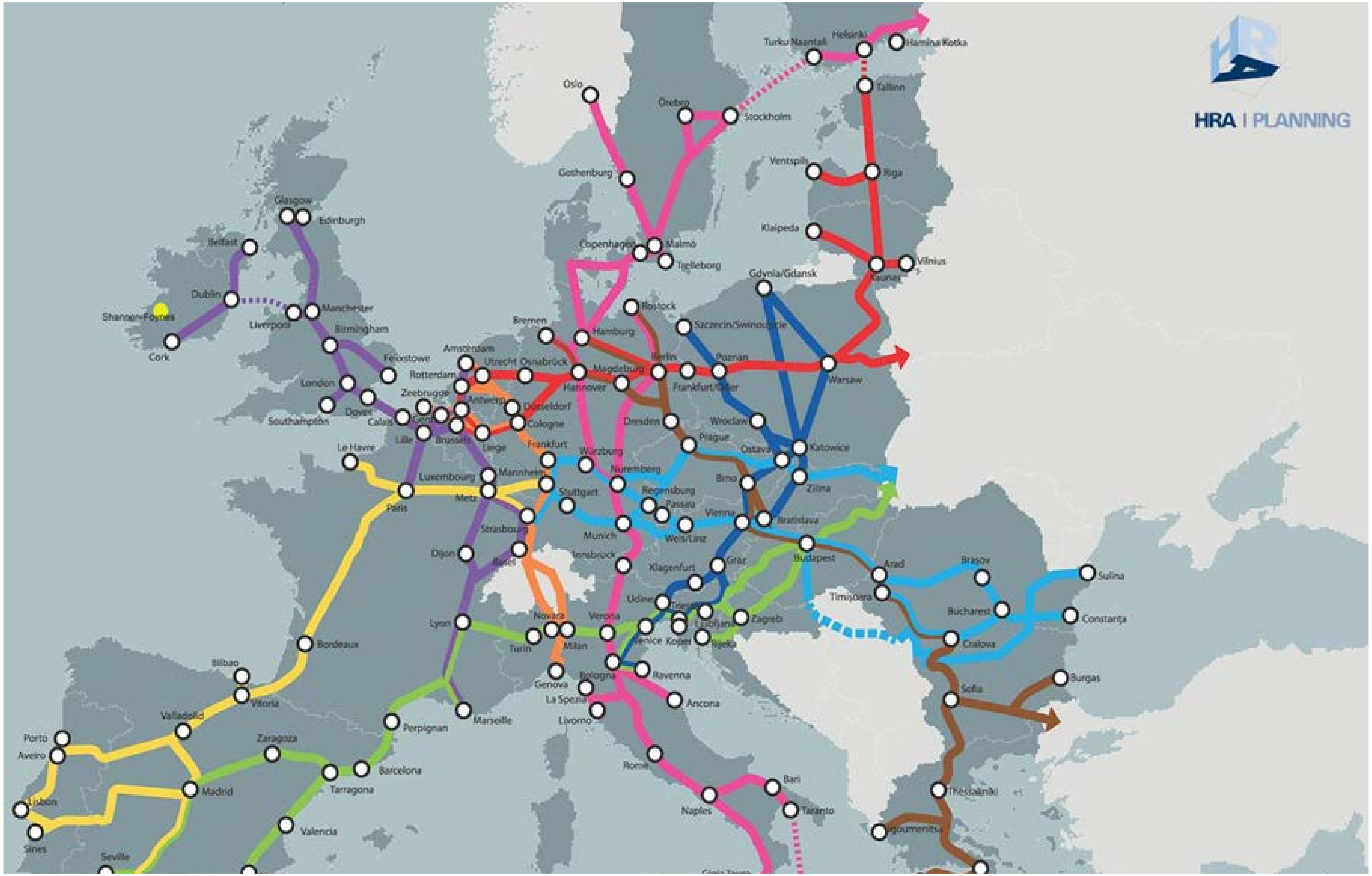


Figure 3.1 Position of Shannon Foynes Port Company (yellow dot) in the context of the existing European Core Network Map Source: EU Commission TEN-T

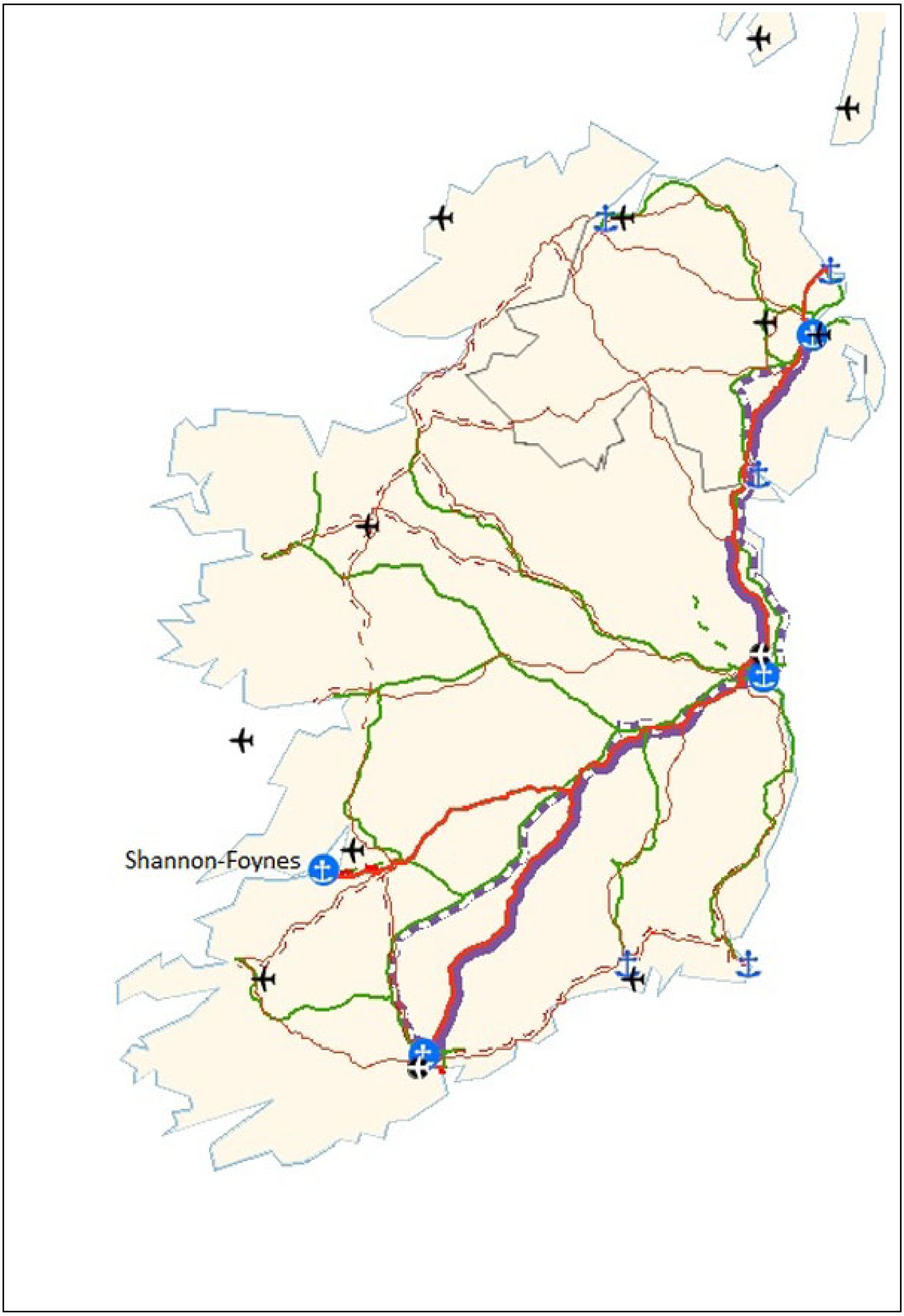


Figure 3.2 Ireland's Core Network including Core Ports Map Source: EU Commission Transport Interactive Mapping

At EU level there is extensive support for the development of Ireland's ports with the three core ports in Ireland, including SFPC, securing EU funding for significant development projects. Funding for the Port of Foynes has been secured under the EU's Connecting Europe Facility (CEF). Specifically, SFPC secured funding in respect of three different but inter-related projects in recent times. It received €800,000 in funding to undertake a study of the potential for reinstating and expanding the rail line connecting the Port of Foynes to the Irish rail network. It also received €2.2 million in the 2014 Call and €4.5m in the 2017 Blended Call for jetty enhancement works, aimed at transforming the Shannon Estuary into a major national and international economic hub.

3.2.2 Trans-European Transport Network (Ten-T) Regulations 2014

Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU, came into effect in January 2014.

Paragraph 13 of the preamble notes that appropriate measures should be taken for the development of the Core network by 2030 as a priority. Action will concentrate on those components of the TEN-T network with the highest European added value, in particular cross-border sections, missing links, multimodal connecting points and major bottlenecks serving the objective, set out in the White Paper, of reducing greenhouse gas emissions from transport.

Article 41 of the Regulations states that the maritime ports of the core network shall be connected with the railway and road transport network by 31 December 2030, except where physical constraints prevent such connection. Paragraphs 14 and 15 of the preamble further clarifies that exemptions from the infrastructure requirements of the core network should be possible in duly justified cases, <u>including cases where investment cannot be justified</u> (underline Our Emphasis). The particular situation of isolated or partially isolated rail networks should be recognised by way of exemptions from certain infrastructure requirements.

In the case of SFPC, the Port of Foynes benefits from an existing rail line. SFPC have been actively assessing the viability and feasibility of bringing the rail line back into operational use. A scoping study was carried out by Iarnród Éireann (IE) [1] to establish the broad engineering feasibility of re-opening the Limerick to Foynes railway line to limited freight traffic. This study was followed on by the Foynes Railway Line Preliminary Design Report 2015, which confirmed that the renovation of 40km of rail line would cost in the region of €25m, with annual maintenance costs of circa €350,000 per annum. These figures exclude the capital cost estimates for rolling stock and train operating costs. Accordingly, it is SFPC's position that this line can only be reinstated if commercially viable to do so, arising from the needs of a particular operator and cargo type.

The proposed development seeks to maintain a rail connection to the overall port operation. Nothing within the proposed development will hinder the potential for the future use of rail freight carrying facilities. It is submitted that the maintenance of the rail connection and the safeguarding of the potential for future use of rail freight currently satisfies the requirements of the TEN-T Regulations, as the port can still be connected to the rail network by 2030.

[1] Foynes Railway Scoping Study 2014

3.3 NATIONAL SIGNIFICANCE

3.3.1 National Planning Framework

The Government's National Planning Framework (NPF) includes objectives supporting investment in critical national infrastructure by both the public and private sectors in key areas including transport.

The NPF recognises that Ireland's port and shipping services play an important role as enablers of economic growth. They are recognised as critical infrastructure for international trade, with over 90% of Irish international trade moving by sea. Ports also serve as logistics and distribution hubs. The NPF recognises the long-term trend in the maritime shipping sector towards greater consolidation of resources and increases in vessel sizes. These trends are cited as necessitating further investment in hinterland transport connections, particularly at Ports with deep-water resources of which SFPC is included.

The NPF recognises that *"to maintain economic growth, we must be capable of delivering additional port capacity in a timely and predictable manner".* The document acknowledges that there are major redevelopment projects taking place at Tier 1 ports (i.e. Dublin, Cork and Shannon-Foynes) at present and confirms that these developments will result in a greater concentration of traffic through these ports, with implications for shore-based and marine-based infrastructure.

It further acknowledges the potential associated with naturally occurring deep water at ports in the south and south-west, which are capable of receiving the largest ocean going vessels and offer the potential for industrial development that depends currently, or will depend in the future, on deep water berths. National Policy Objective 40 seeks to *"ensure that the strategic development requirements of Tier 1 and Tier 2 Ports, ports of regional significance and smaller harbours are addressed as part of Regional Spatial and Economic Strategies, metropolitan area and city/county development plans, to ensure the effective growth and sustainable development of the city regions and regional and rural areas".*

The NPF focuses on the strengths of the Mid West region. It acknowledges that the strengths of the Mid West region are *"focused on Limerick City and key employment and infrastructure assets at Shannon and Foynes".* It acknowledges that future growth, amongst other things, will be based on leveraging national and international connectivity. Key future growth enablers for Limerick include, *"enhanced road connectivity to Shannon Foynes Port, including local by-passes".*

Although Objective 40 of the NPF devolves the responsibility of addressing the strategic development requirements of ports to the Regional Spatial and Economic Strategies, the NPF is clearly supportive of delivering additional port capacity at Tier 1 ports such as SFPC and acknowledges that this must be delivered in a timely and predictable manner.

3.3.2 National Development Plan 2018 - 2027

The National Development Plan 2018 – 2027 (NDP) confirms the Government's commitment to investment in public infrastructure as detailed in the National Planning Framework and guides national, regional and local planning and investment decisions in Ireland over the next two decades.

In implementing National Strategic Outcome 6 of the NPF, acknowledges that as an island, continued investment in our port and airport connections to the UK, the EU and the rest of the world, is integral to underpinning international competitiveness. It is also central to responding to the challenges as well as the opportunities arising from Brexit.

The NDP acknowledges the ‘capacity extension works’ at Foynes and recognises is as a major capital infrastructure programme. The NDP recognises that this work, along with other capital infrastructure programmes in Dublin and Cork Ports, “*will enhance national and international connectivity, provide for future increases in trade and national port capacity requirements by facilitating more vessels, larger sized vessels and increased tonnage and throughput”.* [2] It further states that *“strengthening access routes to Ireland’s ports through investment to upgrade and enhance the road transport network to improve journey times is and remains a Government priority”.*[3] Examples of such investments include amongst others the N21/N69 Limerick to Adare to Foynes Road, to improve access to Shannon Foynes Port.

The Foynes – Limerick Road Improvement Scheme is advancing. A route selection report for the scheme, detailing the selection of the preferred route corridor. was published in June 2016. Since then, a provisional 80m wide corridor and provisional junction layouts for the entire scheme were identified in June 2017. Public consultation is ongoing and it is anticipated that an application will be made to An Bord Pleanála this year.

3.3.3 National Ports Policy 2013

The National Ports Policy was published by the Department of Transport, Tourism, and Sport in 2013 and represents a detailed and descriptive policy document outlining the categorisation of Ireland’s ports in the context of the EU TEN-T transportation network as well as corporate governance and environmental issues.

The Ports Policy is not prescriptive regarding location for future port capacity and states that this should be set out in the existing planning and development hierarchy. The Policy seeks to set a framework for the continued development of the commercial port network and emphasises that provision of adequate and efficient capacity into the future is a critical Government strategic objective. This includes addressing new trends such as larger vessels and emerging markets. It states that Ports of National Significance, must be capable of the type of port capacity required to ensure continued access to both regional and global markets for our trading economy.

As Ireland’s second largest port in terms of total throughput/trade handled and its access to deep-water resources, SFPC was designated by the Government in the National Ports Policy as a Tier 1 Port of National Significance. This means that the port must continue to play a key role, both regionally and nationally, in meeting the external trading requirements of the Irish economy, and that the continued successful commercial development of the port represents a key policy objective in this regard.

[2] National Development Plan 2018 – 2027 pp.68 - 69
[3] Ibid

As noted in the National Ports Policy, *"The continued commercial development of Shannon Foynes Port Company is a key strategic objective of National Ports Policy"* and "*It is the Government's position that those ports considered to be of national significance must be capable of the type of port capacity required to ensure continued access to both regional and global markets for our trading economy. Government expects the Ports of National Significance (Tier 1) to lead the response of the State commercial ports sector to future national port capacity requirements"*.

It is submitted that national ports policy effectively mandates SFPC along with the other two Tier 1 ports to expand and grow as demand requires and to ensure investment in ports meets port capacity requirements.

3.4 REGIONAL SIGNIFICANCE

3.4.1 Mid West Regional Planning Guidelines 2010 – 2022

The Mid West Regional Planning Guidelines (MWRPG) recognises the significance of the Shannon Estuary and its ports as providing a major goods transport link for the region. It states that the protection of the capacities of existing ports and improvement of access to them is a regional priority.

The MWRPG directs local authorities to include specific economic development objectives which seek to harness the economic potential of the estuary and capitalise on its deep-water characteristics for enhanced maritime activity. It states that economic growth must be promoted along the shore of the estuary in order to harness the true natural assets of the estuary and its potential economic benefits to the Region.

It is a stated regional objective to facilitate the carrying out of an inter jurisdictional Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary. The purpose of the framework plan is to identify the nature of the development, economic growth and employment that can be sustainably accommodated within the Shannon Estuary and the location of sites that could accommodate specific types of development, while ensuring that designated European sites and other environmentally sensitive sites would not be reduced.

3.4.2 Strategic Integrated Framework Plan for the Shannon Estuary

Perhaps the single most important regional document to be prepared in terms of the Shannon Estuary is the inter-jurisdictional Strategic Integrated Framework Plan for the Shannon Estuary (SIFP), as promoted in the MWRPG. It provides a coherent spatial plan to recognise the economic potential of the Estuary and is significant in that it has 'buy in' from all relevant stakeholders and policy makers.

SIFP aims to support the multifunctional nature of the Shannon Estuary and facilitate diversification of the economy through the promotion of commercial/industrial employment and maritime energy over a thirty-year horizon. It seeks to transform the estuary into an international economic hub by taking advantage of what are among the deepest and sheltered harbours in Europe and the world.

This document is significant in that it has 'buy in' from all relevant stakeholders and policy makers and therefore paves the way for future appropriate development on the Estuary. Furthermore, it was adopted, by means of either a variation or the review of the Clare, Kerry and Limerick Development Plans. In relation to maritime industry the SIFP identifies specific sites which may be suitable to accommodate future growth in the Estuary and specifically concludes that "*all growth should seek to utilise where possible the existing industry connectivity and synergy, as well as the infrastructure to create a more sustainable and attractive network for further investment".* More specifically the SIFP safeguards the role and function of the Port of Foynes "*as a key strategic driver of economic growth and as the premier deepwater bulk port facility offering the greatest economies of scale in Ireland's bulk freight supply chain at a key Gateway in the Mid-West Region"* (SIFP MRI 1.2.5).

The SIFP identifies the application site and additional adjoining land to the east in Foynes, as necessary for future port development. Specifically, it designates most of this land as "Strategic Development Locations (SDL) for Maritime Development". SIFP MRI 1.2.7 seeks "*to support and facilitate the sustainable growth and expansion of Foynes Port, to ensure greater capacity, more competitive trade potential and diversification of trade patterns to meet national and international market demands. Proposals for marine related industry and more specifically sustainable port related uses will be encouraged, along with alternative uses, which complement the existing proposed marine related uses within the site, and that demonstrates compatibility with the level of flood risk, including provision of estuarine buffer areas. Proposals will be subject to compliance with the criteria in Objective SIFP MRI 1.2".*

Section 5.4.4.4 of the document, In the preamble to development objectives SIFP MRI 1.2.6 and 1.2.7, notes under the heading 'Assets' that *"this SDL derives significant benefit from the existing port facilities and access to deep water. SFPC have identified a number of key growth sectors involving new berthing facilities, onshore infrastructure and the ability to accommodate larger vessels to serve wider markets. To complement the growth in maritime infrastructure, a parallel growth in the hinterland available for storage, warehousing and other port related uses is also required. This is a vital opportunity for the Port of Foynes, and a key asset in the growth dynamic and sequential expansion of Port activity, to be safeguarded and maintained as a vital port asset…".*

The SIFP, recognised in other documents as an exemplary approach to integrated maritime planning, affords significant importance to the Port of Foynes and its future expansion plans, in the context of an overall plan for the integrated and sustainable development of the Shannon Estuary.

3.4.3 Mid West Area Strategic Plan 2012 - 2030

Similar to the RPG's the Mid West Area Strategic Plan (MWASP) acknowledges the strength of port activity in the region and recognises that the opportunities presented by the Port of Foynes as an employment hub are substantial.

3.4.4 Southern Regional Assembly Regional Spatial and Economic Strategy – Issues Paper

The Regional Spatial and Economic Strategy (RSES) for the Southern Regional Assembly is currently under preparation. The purpose of the RSES is to support the implementation of the NPF and the economic policies and objectives of the Government by providing a long-term strategic planning and economic framework for the development of the regions.

An Issues Paper, highlighting key issues to be addressed in the RSES was published and placed on public consultation. The Issues Paper acknowledges that all principal ports in the Southern Region including SFPC, play vital economic roles for the region. It acknowledges that the proximity to continental Europe after Brexit will only increase the importance of the location of these ports for the State. It states that the "*RSES gives the Southern Region an opportunity to develop the ports as regional and national assets and to develop a Regional Policy for multi-modal logistics so as to identify regional logistics hubs for freight transfer, in combination with identified improved freight routes to port with reference to the TEN-T Core Network through Ireland".*

The Issues Paper highlights that, "for our national and regional economic competitiveness, investment in the sustainable development of our port and airport assets is essential. This is critical, so our State and region can adjust to the changing international economy, especially important for our region in the context of BREXIT". It recognises that key future growth enablers for metropolitan cities, include improved connectivity to ports and airports.

The Issues Paper confirms that the Maritime Spatial Planning Directive requires a coordinated, integrated and transboundary approach in order to promote the sustainable development and growth of the maritime and coastal economies and the sustainable use of marine and coastal resources. It quotes one example of how this might be achieved and cites the Shannon Integrated Framework Plan as a plan which sets out an innovative approach to sustainable development and environmental protection of the Shannon Estuary.

Although the RSES has not been completed for the Southern Region, the Issues Paper does recognise the importance of key infrastructural assets such as SFPC, the Port of Foynes and its sustainable development.

3.5 LOCAL SIGNIFICANCE

The Limerick County Development Plan 2010 – 2016, as extended is the pertinent planning document guiding development in the area of the development proposal. The Plan was amended in May 2015 (Variation No.3) to incorporate the SIFP. The SIFP was commissioned by the Clare, Kerry, Limerick City and Limerick County Councils and was attached by way of Volume 7 to the Limerick County Development Plan.

3.5.1 Limerick County Development Plan 2010 – 2016, as amended

Chapter 5.0 of the CDP relating to Economic Development recognises the Port of Foynes and the Shannon Estuary as a significant core asset for economic development in the region. It states, *"the Estuary provides a strategic transit gateway whilst the Port facilitates trade from* *many industrial sectors critical to the ongoing sustainability and competitiveness of the region. The existing deep water facility at the Port and existing logistical operations provide a transit hub for a diversity of industries in the region including traditional manufacturing, extractive industries, general cargo, and emerging renewable energies"*[4].

The CDP further states that "*it is likely that the role and function of the Port and Estuary as a transport hub will increase. The location of the Port, its existing rail connection to the national network and the naturally occurring deep water areas of the Shannon estuary directly adjacent to Foynes presents significant opportunity to provide for enhanced maritime activities"*.[5]

Significantly, Policy SE02 of the CDP states that "*the council will support efforts to expand and upgrade the port facilities available in the Foynes Harbour in line with the Strategic Integrated Framework Plan for the Shannon Estuary and the Vision 2041 Shannon Foynes Port Company Masterplan".* This policy acknowledges the importance of the Vision 2041 Masterplan in supporting and guiding future development within SFPC and the Port of Foynes.

The CDP recognises the strategic importance of Foynes in the Shannon Estuary and as a result has zoned suitable lands for development (see Figure 3.3). The subject land is zoned for Marine Related Industry. Objective ED O6 states that, "*land zoned for Marine Related Industry, shall provide for marine related industry and large scale uses that create a synergy with the marine use. Marine related industry shall be taken to include the use of land for industry that, by its nature, requires a location adjacent to estuarine/deep water including a dependency on marine transport, transhipment, bulk cargo or where the industrial process benefit from a location adjacent to the marine area".*[6]

There are a number of objectives in the CDP which seek to safeguard the use of land not only for marine related industry but also specifically for port related uses and other industrial activities. Objective ED04 of the CDP seeks *"to safeguard the Strategic Development Locations at Foynes Port, Foynes Island and Aughinish Island for the sustainable growth and development of marine related industry".*

It is a further objective of the CDP (Objective ED05) to:

(a) ensure that the marine related industrial zoned land in Foynes is safeguarded for the accommodation of port related uses and other industrial activities;

(b) support the expansion of the Port at Foynes and promote the economic and industrial development of the Shannon Estuary as a strategic transport, energy and logistics hub serving the county and wider region; and

(c) support the consideration of new deep water berthage within the estuary to enhance the strategic economic function of the Port.

Objective ED O7 of the CDP seeks to safeguard and promote the use of marine related industrial zoned land for the accommodation of port related uses and other industrial activities and supports the expansion of the Port at Foynes as well as promoting new deep water berthage. Specifically ED07 seeks to ensure that:

[4] Limerick County Development Plan 2010 – 216, as amended pp.5-3
[5] Limerick County Development Plan 2010 – 216, as amended pp5-3
[6] Ibid pp 5 - 11

(a) the marine related industrial zoned land in Foynes is safeguarded for the accommodation of port related uses and other industrial activities (see map A2 in Appendix 1). The lands indicated in the Shannon Integrated Framework Plan are also included in this zoning. The application of appropriate mitigation measures for this zone as detailed in SIFP Vol 2 appendices C and D, the Environmental Report and Natura Impact Report of the variation to this plan to incorporate the SIFP will apply for proposed developments within this zone.

(b) Support the expansion of the Port at Foynes and promote the economic and industrial development of the Shannon Estuary as a strategic transport, energy and logistics Hub serving the County and wider region by utilising naturally occurring deep water characteristics and by identifying and safeguarding existing and future strategic transportation links, subject to fulfilling the requirements of the Habitats Directive and the conservation objectives of the Lower River Shannon SAC site.

(c) Support the consideration of new deep water berthage within the estuary to enhance the strategic economic function of the Port subject to compliance with the ecological objectives of the Lower River Shannon SAC site and other policies of the County Development Plan.

Chapter 9.0 of the CDP focuses on the Shannon Estuary and states that, “the Strategic Integrated Framework Plan (SIFP), which is included as Volume 7 of this Development Plan is an important document concerning the future of the estuary”.[7] This is confirmed in Policy SE 01 which states that it is a policy of Limerick City and County Council “to support and implement the inter-jurisdictional Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary in conjunction with the other relevant local authorities and agencies”. Objective SE O3 states that “the Council will support efforts to expand and upgrade the port facilities available in the Foynes Harbour in line with the Strategic Integrated Framework Plan for the Shannon Estuary and the Vision 2041 Shannon Foynes Port Company Masterplan”.

The Council places strong emphasis on the need to standardise colour schemes within the port area. It encourages the preparation of a design master plan that would serve to coordinate finishes and colours within the port complex and recognises that this is important in any future proposals. In this regard, the Development Framework Plan accompanying the planning application fulfils this requirement and seeks to demonstrate how future development will be delivered on the site.

Other relevant policies and objectives within the CDP, relevant to the proposed development includes Objective SE O4 which seeks, “to safeguard the Limerick-Foynes rail line against encroachment by inappropriate uses that could compromise the long-term development of the rail facility”.

Objective F4 of the CDP acknowledges that, “development of the port, while hugely important for the town and the region as a whole, should be carried out in as sensitive a manner as possible. It will be an objective of the Council to encourage potential applicants to submit a master plan with a view to ensuring that the visual effects of such developments are

[7] Limerick County Development Plan 2010 – 216, as amended pp 9 -2

minimised. Any applications for port activity are to include measures designed to minimise the effects of the proposed development on the residential and visual amenity of the town".[8]

Overall it must be concluded that the proposed development seeks to adopt a plan-led approach to development.

[8] Ibid pp App 1-8

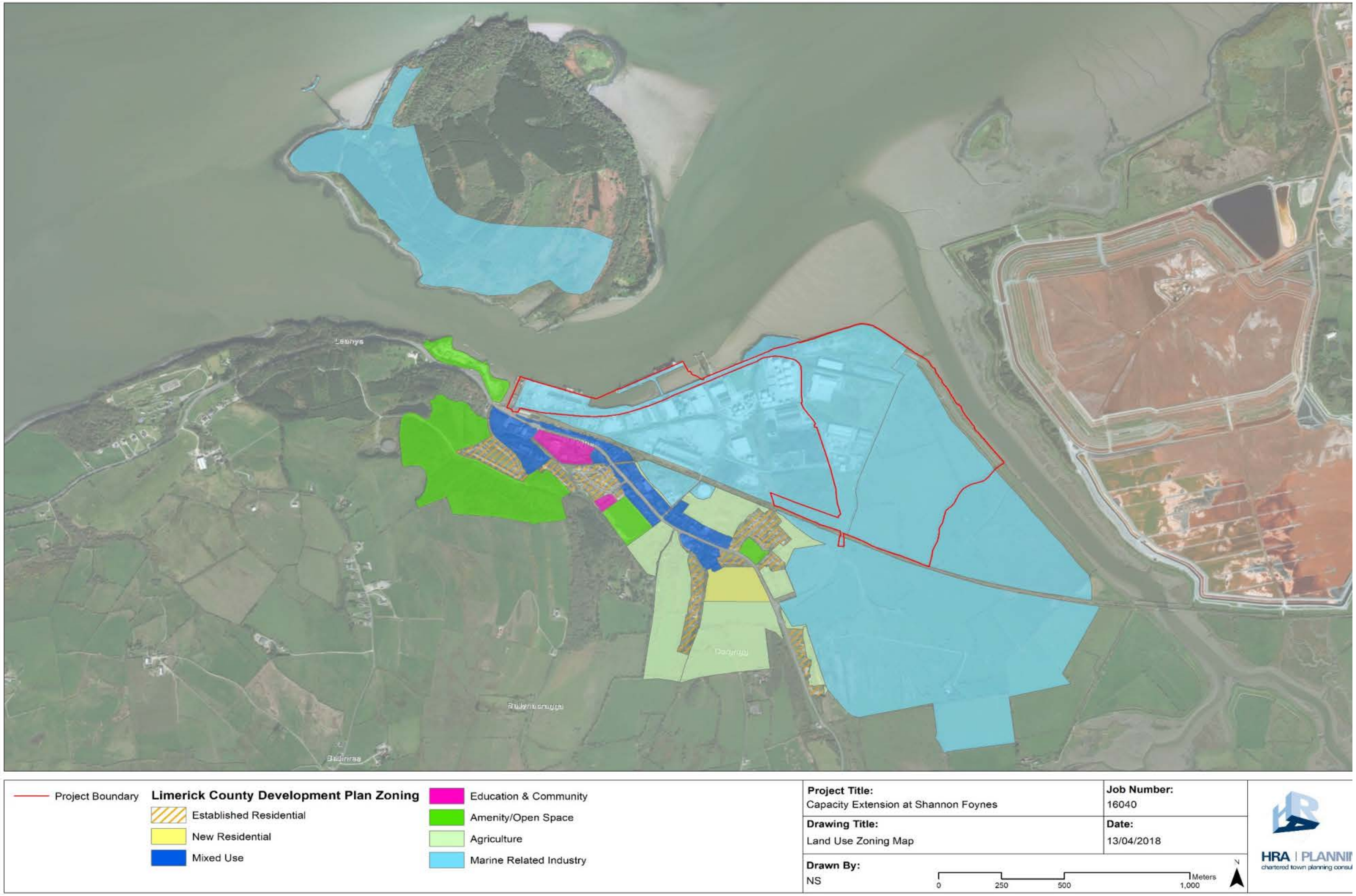


Figure 3.3 Relevant Zoning Provisions (Source: landuse zoning data from Limerick County Development Plan 2010 – 2016)

3.6 SUPPORTING POLICY SUMMARY

Development and future expansion within SFPC and the Port of Foynes has significant support at international, national, regional and local level. Designation of SFPC as part of the TEN-T transportation corridor and a Tier 1 Port unlocks additional advantages for future port development as well as supporting enhanced external connectivity with Ireland's European partners.

At a national level the National Planning Framework (NPF) and the National Development Plan (NDP) recognises that to maintain economic growth, we must be capable of delivering additional port capacity in a timely and predictable manner and acknowledges redevelopment projects taking place at Tier 1 ports including Foynes. The continued commercial development of SFPC is also a key strategic objective of National Ports Policy.

At a regional level the Mid West Regional Planning Guidelines (MWRPG) promotes protection of the capacities of existing ports and improvement of access to them as a regional priority. Enhancing capacities of existing ports is also promoted within the Strategic Integrated Framework Plan for the Shannon Estuary (SIFP). The SIFP seeks to support and facilitate the sustainable growth and expansion of Foynes Port, identifying the Port as a Strategic Development Location. It seeks to ensure greater capacity, more competitive trade potential and diversification of trade patterns by promoting expansion of the Port in an eastern direction.

At a local level, there is significant support for the sustainable expansion of the Port in line with the Port Masterplan Vision 2041. The subject lands are appropriately zoned and safeguarded to provide for marine related development.

The assessment demonstrates how the proposed development is concurrent with land use planning and strategic planning at international, national, regional and local level. The documents confirm that capacity extension works at the Port of Foynes will contributes to the economic and sustainable development of the region. The planning policy assessment brings forth the conclusion that the location, nature and function of the proposed development is in accordance with relevant plans and policies and should as a result be deemed acceptable in principle at the proposed location.

3.7 REFERENCES

- Department of Housing Planning Community & Local Government, National Planning Framework 2018
- Department of Public Expenditure & Reform, National Development Plan 2018
- Department of Transport, Tourism, and Sport, National Ports Policy 2013
- Regional Planning Guidelines Mid West 2010 - 2022
- Strategic Integrated Framework Plan for the Shannon Estuary
- Mid West Area Strategic Plan 2012 – 2030
- Regional Spatial and Economic Strategy – Issues Paper
- Limerick County Development Plan 2010 – 2016

4 PROJECT SCOPING & CONSUTLATION

4.1 INTRODUCTION

Extensive scoping and public consultation has been undertaken to inform the development project. Consultation was undertaken with statutory consultees, Limerick City & County Council and the general public, to draw on their local knowledge and experience of the Shannon Estuary and to identify issues of particular environmental significance.

The purpose of the scoping and public consultation processes was to establish aspects of the environment to be considered in the Environmental Impact Assessment Report (EIAR) and in particular those sensitive aspects requiring more in-depth study. The exercise has resulted in an iterative design process, such that the proposal and design has been modified to address the concerns of statutory consultees and the general public.

4.2 SCOPING

4.2.1 Scoping Approach

Detailed scoping has been undertaken in respect of the proposed development. The purpose of the scoping exercise was to identify issues of environmental significance and which would require detailed consideration within the EIAR.

The project was initially scoped with the applicant and within the design based on the expertise and past experience of the EIAR contributors for similar projects. Existing activities and features on site and similar developments in other locations also informed the process, including the previous planning application made to reclaim 2.49 hectares of land to the rear of the East Jetty (planning reference P12/212, extended under P17/7019).

The scope of the EIAR, conducted in respect of the proposed development, has had regard to the following statutory and guidance documents:

- Statutory requirements of the Planning and Development Act 2000 – 2017 and the Planning and Development Regulations 2001 - 2018;
- Guidelines on the Information to be contained in Environmental Impact Statements and Advice Notes on Current Practice in the Preparation of an EIS both published by the Environmental Protection Agency 2003;
- Draft Revised Guidelines on the Information to be contained in Environmental Impact Statements, September 2015;
- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, August 2017;
- The requirements of Limerick City & Council as detailed in the Limerick County Development Plan 2010 – 2016, as extended; and
- The likely concerns of other third parties.

4.2.2 Written Scoping Requests

Initial scoping by the design team was supplemented by written scoping requests to a number of statutory and non-statutory consultees. A copy of the letter is detailed in Appendix 4.1. Contact was made with 40 no. consultees as detailed in Appendix 4.2. The consultees were issued with a comprehensive overview of the proposed development along with an initial set of drawings, clearly demarcating the site and explaining the overall development approach.

The scoping requests were issued in October 2017 and at that time the development project included reclamation of foreshore to the rear of the proposed new east and west jetty structure, to connect with the shoreline. It was envisaged that this work would be undertaken similar to permitted development on the adjoining site to the east. Since consultation was undertaken, the project works have evolved and have been further developed such that it is no longer proposed to advance with the reclamation element of the development proposal.

Similarly, at the time of consultation with the statutory and non-statutory bodies, it was not envisaged that containers would be stored on site. In the intervening period since consultation was undertaken, market circumstances have changed and there is now a possibility that containers could be potentially stored on site. Accordingly, this possible scenario is now included and is assessed within the EIAR.

Of the 40 no. consultees that were contacted:

- Acknowledgement letters / emails were received from 6 no. consultees;
- Detailed responses were received from 7 no. consultees; and
- No response was received from 27 no. consultees

The detailed responses received from the 7 no. consultees are provided in Appendix 4.3, the information of which has significantly influenced the content and direction of this EIAR.

4.2.3 Written Scoping Responses

4.2.3.1 Commission for Railway Regulation

The Commission for Railway Regulation dated 24th November 2017 seeks to ensure protection of the railway line and seeks to ensure that risks associated with railway trespass are not increased. In this regard it should be noted that perimeter fencing will be provided along the external perimeter of the proposed port expansion area, in accordance with the requirements of the International Ship and Port Facility Security Code (ISPS Code), thereby preventing increased trespass as a result of development on the subject site.

4.2.3.2 Birdwatch Ireland

An email from Birdwatch Ireland dated the 20th December 2017 expressed concerns regarding the proposed reclamation works to the rear of the jetty extension. As previously stated these works do not form part of the planning application at this time. Site specific water bird survey work was recommended by Birdwatch Ireland and extensive surveys have been undertaken as part of this EIAR. This work is detailed in Chapter 7.0 along with an assessment of the impact of increased shipping on the Estuary. In this regard it should be noted that the movement of ships within the Estuary and the frequency of ships is not likely to substantially increase, with the average number of ships per week increasing from 6 no. to 7 no. ships.

4.2.3.3 Clare County Council

The letter from Clare County Council dated the 17th November 2017 advises that detailed consideration must be given to consideration of alternatives. A robust case should be made, with the necessary scientific evidence presented, to support the need for the proposed development. This element of the EIAR is comprehensively addressed in Chapter 5.0.

Clare County Council also recommends that over-arching and site-specific mitigation measures, as set out in the Strategic Integrated Framework Plan for the Shannon Estuary, Natura Impact Report, should also be implemented. These mitigation measures are addressed within the various chapters of the EIAR and are also addressed by virtue of undertaking the EIAR and relevant studies in the first place.

4.2.3.4 Department of Culture Heritage and the Gaeltacht

The Department by letter dated the 20th November 2017 advises on generic archaeological guidelines and recommends that a specific section on underwater cultural heritage should be provided in the EIAR. Chapter 14.0 of the EIAR deals with both terrestrial and marine archaeology in accordance with the requirements of the Department.

4.2.3.5 Bord Iascaigh Mhara

Bord Iascaigh Mhara by letter dated 21st November 2017 welcomes the proposed development and acknowledges the significant benefits that the Port of Foynes beings to the area. It highlights the prominence of aquaculture and fishing sectors in the Estuary and how changes to storm water discharge or freshwater inputs may impact shellfish and fish heath. The control of storm water discharge is dealt with extensively in Chapter 9.0 whilst potential impacts on sea life is dealt with in Chapter 7.0.

4.2.3.6 Transport Infrastructure Ireland

Transport Infrastructure Ireland by letter dated 22nd November 2017 provided best practice guidance in respect of traffic assessment. Chapter 13.0 Material Assets – Roads & Traffic, has regard to such guidance and assesses the impact that the proposed development will have on the existing network now and into the future. A comprehensive Traffic & Transport Assessment is appended to the EIAR.

4.2.3.7 Coillte

Coillte responded by email dated the 13th October 2017. They confirmed that the proposed development does not interfere or infringe on Coillte property and accordingly they have no concerns.

4.3 PRE – PLANNING MEETING

A pre-planning meeting was held with Limerick City and County Council on the 20th February 2018 in respect of the proposed development. Representatives from the Planning, Environment and Roads Departments were present along with a representative from the Mid West Roads Design Office. The nature and extent of the proposed development was presented to the Council along with a set of drawings

A number of issues were raised by the Council in respect of the proposed development and which would need to be addressed in the EIAR, including:

- Flooding and the potential impacts on adjoining lands;
- Filling of land and sources of quarry material;
- Air Quality and any potential impacts arising from the filling of land;
- On site surface water management and run-off management during the filling of land;
- Provision of foul treatment on the site; and
- Traffic and potential impact on the existing and future road network.

The issues raised by Limerick City & County Council have been comprehensively addressed throughout the EIAR. The nature and extent of development including the filling of land are dealt with in Chapter 2.0. The impact of traffic is dealt with in Chapter 13.0; air quality is dealt with in Chapter 10.0; flooding is dealt with in Chapter 9.0; and surface water management and foul water management are dealt with in Chapter 9.0.

A Natura Impact Assessment has been prepared as a separate, stand-alone report and is included within the planning application, assessing the potential impact of the proposed development on the River Shannon and River Fergus Special Protection Area (SPA) and the Lower River Shannon Special Area of Conservation (SAC).

A query was raised by the design team at the pre planning meeting regarding the application of a Development Management Standard relating to industrial / commercial development and detailed in Section 10.6.1 of the Limerick County Development Plan 2010 – 2016. The development management standard seeks to restrict site coverage on a greenfield site to a maximum of 40%. The Council confirmed by email dated the 22nd February 2018 that the standard has not been applied strictly to every site. The Council confirmed that "*it is assessed on a site by site basis and is subject to adequate area being provided for parking, roads, services and any other land requirements within the site. The amount of defined open storage area permitted within a site is subject to the same considerations".* The clarification provided by the Council has influenced the overall Development Framework for the Durnish lands such that the site has been arranged in accordance with good planning principles and design criteria, without necessarily affording the blanket application of a maximum 40% site coverage.

4.4 PUBLIC CONSULTATION

4.4.1 Approach

Two separate public consultation events were held in Foynes on the 22nd November 2017 and on the 14th March 2018. The events were advertised in the Limerick Leader newspaper and a copy of the adverts are provided in Appendix 4.4. The events were also advertised by means of posters displayed in shop windows and in the Community Centre; notices in the parish newsletter, St. Senan's; and a notice, read out at mass services on the weekend before the event. The public consultation events were also publicised on local radio prior to the consultation days.

Both consultations consisted of open sessions from 14.00hrs to 16.00hrs and from 18.00hrs to 20.00hrs. The first event was held in the Community Hall whilst the second event was held in the Harbour Offices. All members of the public were welcome to attend the open sessions where drawings and information pertaining to the project were on display. Engineers and scientists from RPS were available to talk people through the proposals and also to answer any questions on the proposed development. In addition, representatives from SFPC were present at the consultation sessions. A questionnaire was made available to members of the public for completion, to gauge views from the general public on the development as presented. A copy of this questionnaire is provided in Appendix 4.5.

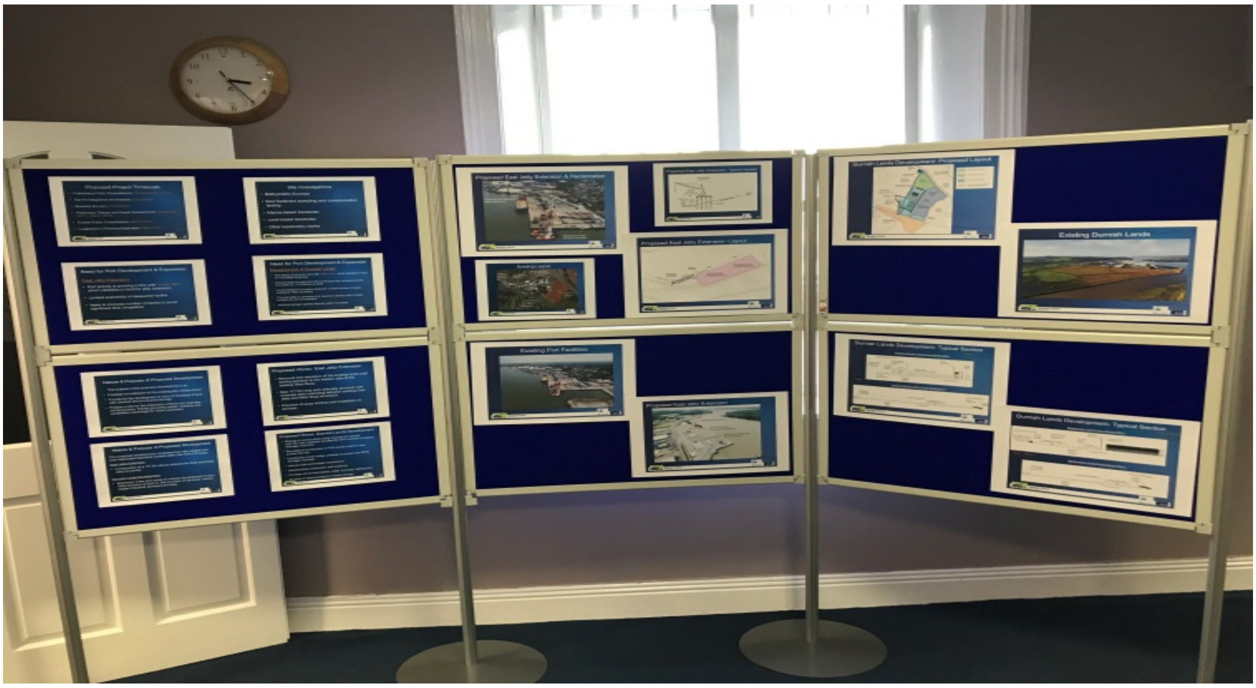


Plate 4.1 Photos from Public Consultation Event in November 2018

4.4.2 First Public Consultation Event

In total approximately 40 no. people attended the first consultation event. There was a broad range of issues raised during the consultation sessions as follows:

1. Impact on siltation within Foynes Harbour;
2. Dust arising from on-loading and off-loading practises at the Port;
3. Flooding - reassurance was requested that the proposed works in the Port would not offset the benefits from the recent flooding/drainage relieve scheme in Foynes Village or cause flooding to neighbouring lands;
4. Request for improved access to the Port, and in particular the public slipway;
5. Impact on traffic and how new road layouts will link with the proposed new road from Limerick; and
6. Employment opportunities arising from the proposed development.

A commitment was made at the event to hold a similar consultation day in March 2018 when the project proposals would be put on display again prior to the application being submitted to An Bord Pleanála for planning approval.

4.4.3 Second Public Consultation Event

In total approximately 12 no. people attended the second consultation event. This event primarily focused on the issues of concerns raised in the first public consultation event. As members of the public reviewed up to date drawings and impact assessments, members of the design team clarified issues regarding dust, flooding, traffic and access and explained how their concerns were being addressed within the EIAR.

4.4.4 Submissions Received from the Public

One submission was received from a landowner in Ardneer, Foynes during the period of public consultation. A copy of the submission is detailed in Appendix 4.6. Concerns were expressed in relation to potential pollution of adjoining lands; destruction of existing flora and fauna; impact on drainage and quality of waters; and financial loss due to devaluation of property.

The issues raised in the submission have been comprehensively addressed in this EIAR. The concern expressed in the submission in relation to pollution of adjoining lands is unclear as the potential source for pollution has not been identified. However, potential pollutants including dust are dealt with in Chapter 10.0 Air Quality; and noise is dealt with in Chapter 11.0 Noise & Vibration. Chapter 9.0 deals with water quality and flood risk and ensures that no adverse impacts arise in relation to drainage and the quality of waters in the area. Chapter 7.0 comprehensively deals with biodiversity whilst Chapter 15.0 deals with the Landscape and introduces measures such as a buffer around the entire perimeter of the development site to ensure protection of the visual and ecological amenities of the area. The EIAR confirms that there will be no long term adverse impacts on the surrounding area.

4.5 EXTENT OF STUDY

Following the scoping process, pre planning meeting with Limerick City & County Council and 2 no. public consultation events, all environmental topics have been comprehensively addressed within this EIAR including:

- Population and Human Health
- Flora & Fauna and Biodiversity
- Land & Soils, Hydrogeology and Waste
- Water Quality & Flood Risk
- Air & Climate
- Noise & Vibration
- Material Assets – Coastal Processes
- Material Assets - Traffic and Transportation
- Archaeology and Cultural Heritage
- The Landscape.

5 NEED FOR THE SCHEME & EXAMINATION OF ALTERNATIVES

5.1 INTRODUCTION

The Environmental Protection Agency's Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) and, the Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017) suggests that ‘alternatives’ to the main reasons for choosing the proposed development, may be described at a number of levels including inter-alia; alternative locations, design/layout, processes and mitigation.

This section of the EIAR details the ‘need’ for the proposed development and, it describes the ‘alternatives’ considered in terms of the ‘do-nothing’ scenario and alternative ‘location’, alternative ‘design’ and alternative ‘processes’.

The ‘need’ for the development will be examined at two levels. Firstly, it is relevant to examine shipping trends and changes at international and national level and how these are influencing the type of port facilities required on the ground. These trends and changes have informed a number of detailed studies on how and why the ports sector must adapt to meet changing demands. The second level then focuses on the needs of SFPC and the Port of Foynes in order to remain competitive in the market place.

This chapter should be read in conjunction with Chapter 3.0 ‘Spatial Planning Policy’ as this provides the statutory and non-statutory support for expansion at the Port of Foynes, having regard to international, national, regional and local policy and objectives.

5.2 NEED FOR THE SCHEME

There is an immediate economic need for the proposed development, to ensure that the Port of Foynes remains competitive and is capable of meeting current day needs and requirements. This requirement to extend port capacity is responsive to a historic pattern of commercial growth through the Port of Foynes consistent with the projections envisaged in the Port Company’s spatial and commercial masterplan – ‘Vision 2041’ and the resultant fruition of those projections experienced to date.

The ‘Durnish lands’ (the area of planned and proposed port expansion described in Chapter 2, section 2.2.1.) was acquired by SFPC by way of compulsory acquisition. During their assessment of that application made to them, An Bord Pleanála (ABP Ref: 13. CQ3001) acknowledged that,

“a supporting case has been made by the SFPC for the need for expansion of the port holding for the purposes of implementation of the scheme of development”.

That assessment by An Bord Pleanála further confirmed that,

“the acquisition of the lands in question by SFPC is necessary for the purpose of ensuring the implementation of the scheme of development of its harbour and without which its implementation would prove impracticable without the lands concerned being included in the scheme”.

Justifying need for the development was a central tenet of the CPO application process. Although it is acknowledged that both the CPO and planning application processes are separate and distinct, it is considered that the case for the 'need' for the scheme of development has previously been established and accepted by An Bord Pleanála. Nonetheless, in the interest of completeness and having regard to the separate codes that exist for the CPO process and planning application process, the need for the scheme will be reaffirmed in this chapter.

5.2.1 Port Trends and Changes

The commercial, technological, and regulatory environment in which Irish ports operate is changing rapidly, both domestically and globally. There are a number of key trends impacting on port operators in Ireland and around the world and in order to maintain competitiveness, it is important that the ports sector and SFPC addresses these challenges, including:

- The continuing trend towards larger ships requiring deep-water ports, and the reduced availability of ships to serve smaller ports;
- Increasing integration of maritime transport into the door to door global logistics and supply chain, blurring the traditional division of tasks within the logistics chain[1];
- The emergence of the concept of port-centric logistics as a key driver for future port development[2];
- Intensified inter-port competition due to improved landside hinterland connections, even among more distant seaports; and
- Growing importance of maintaining a high environmental, security and safety standards in order to comply with regulations and maintain community support for port developments.

The Port of Foynes seeks to maintain its competitiveness and address current shipping trends through the proposed development. It seeks to increase efficiencies and deliver improved port infrastructure through increased berth provision and increased land provision to accommodate port centric logistics.

5.2.2 Growth in Vessel Size

The trend in international shipping has always been towards larger vessels to exploit economies of scale. Analysis of Central Statistics Office (CS0) data[3] indicates that the number of vessels up to 5,000 GT in size calling at Irish ports declined from 6,843 in 2005 to less than half this number by 2016. Even allowing for the general economic downturn, this pattern illustrates the decline in demand for smaller vessels. By the same token, vessel numbers in the 40-80,000 GT category increased by a factor of eight between 1999 and 2010 from 200 vessels to 1600 vessels per annum. In more recent times the trend continues with 1,518 vessels calling to Irish ports in 2005, increasing to 1,668 in 2015.

While the total number of vessels arriving in 2016 (12,880) is 20% lower than the 2007 level, the gross tonnage of all vessels has increased by 5%. Thus, in terms of demand, it is clear that the form of demand in this area in terms or the number of vessel arrivals has changed and the total tonnage of arrivals is above the 2007 level.

[1] InterTrade Ireland 'Freight Transport Report for the Island of Ireland'2008
[2] Ibid
[3] Central Statistics Office, Vessel arrivals by vessel size class

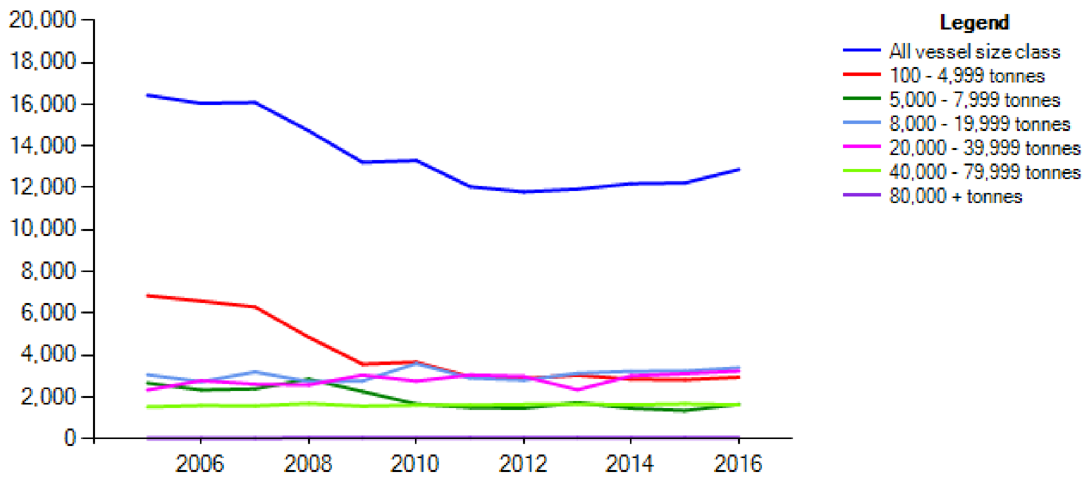


Figure 5.1 Vessel Arrivals by Vessel Size Class in Ireland

The trend is evident worldwide. The largest container vessels on order have more than sextupled since 1975 and is set to expand by at least 13 percent by 2020, according to an IHS Maritime & Trade analysis of the order book[4]. The HIS Maritime & Trade Analysis accounts the rapid rise in ship sizes to a growth of globalization in the last four decades, rise of containerisation at the expense of breakbulk and bulk shipping, and carriers' need for greater economies of scale to compete with each other and gain fuel efficiencies.

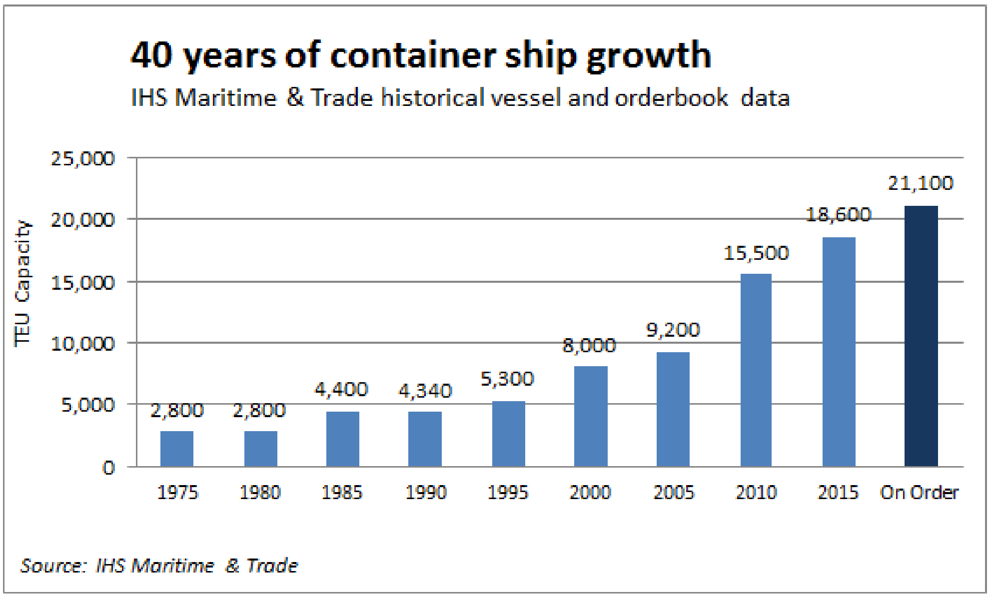


Figure 5.2 Growth in Size of Container Shipping Worldwide

[4] The Journal of Commerce - https://www.joc.com/maritime-news/ships-shipbuilding/average-size-container-ship-order-rise-13-percent-2020_20150707.html

Within Ireland there is already perceived to be a problem for vessel operators to match increasing demand with larger vessels (giving them economies of scale) when terminal operators do not have sufficient service and infrastructure capacity to handle such vessels (800 – 1,000 TEU), in terms of vessel discharge and loading, terminal area and handling capacity and efficient landside collection and delivery systems[5]. Increased vessel size may require that ports spend more on dredging and invest in larger berths, terminals and taller cranes with a longer reach[6]. The Competition Authority Report confirms that "*the increase in vessel size could influence competition between Irish ports in the long-term. Deep water ports like Cork and Shannon Foynes may benefit from their ability to handle larger vessels, particularly for heavy bulk vessels that require comparatively more water depth compared to Lo-Lo and Ro-Ro vessels".*

Table 5.1 below highlights the change in the size of vessels calling to the Port of Foynes over the last five years:

Tonnage range	Up to 10,000	10-20,000	20-30,000	30,000 +	Total Ships
2012	246	41	1	14	302
2013	260	44	5	17	326
2014	215	36	11	21	283
2015	245	38	4	25	312
2016	229	24	18	36	307
2017	246	24	17	36	323

Table 5.1 Change in Size of Vessels to the Port of Foynes

As can be seen from Table 5.1, the number of vessels of over 30,000 dwt calling to the Port of Foynes has more than doubled in the last five years. The port infrastructure must be able to accommodate this growth in vessel size without negatively impacting on the efficiency of the port.

[5] InterTrade Ireland 'Freight Transport Report for the Island of Ireland' 2008 pp.62
[6] The Competition Authority, Competition in the Irish Ports Sector, 2013

5.2.3 Growth in Port Activity

In Ireland, it is acknowledged that the ports and maritime transport services sector has an important role to play in the competitiveness and connectivity of the economy[7]. Companies operating in the ports and maritime transport services area are largely dependent on the wider performance of the Irish economy to drive growth and investment. The growth in this segment can be linked to future domestic GDP forecasts. *The Irish* economy is *growing* three times faster than any other European country with headline *growth* last year estimated to have been 7.3%[8]. This has a knock-on effect on port trade and activity. Transport demand is closely linked to economic growth and the performance of the economy. As the economy expands, the number of commuters and the level of trade tends to increase. Transport activity and demand is growing and would be expected to expand further in future years in line with forecast economic growth rates[9].

Such economic growth is reflected in recent port statistics and trends. The latest IMDO iShip Index indicates growth in shipping and port activity in the Republic of Ireland by 5% in Q3 of 2017 compared to the same period last year. The iShip index is a volume index for all freight traffic moving to and from the Republic of Ireland. There was positive year on year growth across all major cargo markets. Notable however, has been the particularly strong growth the Lift-on/Lift-off (Lo/Lo) sector at 7% overall in laden traffic. The Bulk Traffic segment saw tonnage volumes increase this quarter by 4% (excluding transhipments) in the Republic of Ireland when compared to the same period last year. This was driven primarily by increases in Break Bulk tonnage by 9%. Dry Bulk volumes grew by 2% while Liquid Bulk traffic increased 5% compared to Q3 2016 (excluding transhipments). However, when transhipments are included, Liquid Bulk grew by 13% this quarter compared to 2016.

These national trends are reflected within SFPC. In 2017 the port handled over 11 million tonnes of goods, representing 21.6% of the overall volume of goods moving through Republic of Ireland seaports and placing it next to Dublin Port in terms of throughput. SFPC plays a particularly important role in the bulk trades market, through its handling of liquid, dry and break bulks and accounts for 38.3% of the overall volume of bulk trades handled at Republic of Ireland commercial seaports.

Tonnage throughput in the Port of Foynes has steadily increased since 2011, increasing from 1.3 million tonnes to almost 1.8 million tonnes in 2017. Bulk solid trade remains very strong in the Port of Foynes, growing by over 7% between 2016 and 2017. However, the greatest growth was experienced in break bulk trade, which experienced growth of almost 13% in the same period. This growth reflects the resurgence in the domestic and export economy where, for example, petroleum and construction products were particularly strong. In addition, agri related cargoes grew steadily reflecting expansion in that sector.

SFPC, with increasing tonnage and a record operating profit of €4.7m in 2016, is seeking to roll – out its investment programme in line with its Port Masterplan – Vision 2041, including development of the subject land and port infrastructure.

[7] Harnessing our Ocean Wealth – An Integrated Marine Plan for Ireland Roadmap 2012 pp.29
[8] EU Commission winter interim economic forecast, February 2018
[9] Dept. of Public Expenditure & Reform, Strategic Public Infrastructure: Capacity & Demand Analysis, August 2017 pp.30

5.2.4 Forecasted Growth in Foynes

SFPC's strategic planning reports identify and address the significant capacity issues facing the Port of Foynes. These documents include:

- SFPC Masterplan – Vision 2041 (published in 2011);
- Five year rolling Strategic Plan with Department of Transport, Tourism and Sport review, approved in May 2015; and
- Capital Investment Plan approved in May 2015

Extensive consultations were undertaken by SFPC with port users and customers in the preparation of its Vision 2041 plan. Chapter 5.0 of Vision 2041 examines the likely trends in commodities handled by SFPC and considers various forecasted growth scenarios in relevant sectors over the next thirty years and the demand that these are likely to create for port facilities, principally in Foynes. The projected future trends and growth scenarios set out in Vision 2041 take account of relevant information in policy documents such as TEN-T Guidelines, National Ports Policy 2013; Food Harvest 2020; the Irish Ports Offshore Renewable Energy Services (ISPPORES) review undertaken by the Irish Maritime Development Office and the Shannon Estuary Strategic Integrated Framework Plan (SIFP). Table 5.2 represents the tonnage figures forecasted in Vision 2041[10] for SFPC's general cargo terminals at the Port of Foynes and Limerick Docks. It should be noted that Limerick Docks absorbs approximately 500,000 tonnes per annum of these tonnage forecast figures.

	2011	2025	2041
Base Line	1,663,000	3,094,000	3,208,000
Mid Line	1,663,000	3,270,000	4,142,000
High Line	1,663,000	3,820,000	5,571,000

Table 5.2 Anticipated Growth in Tonnage at General Cargo Ports

SFPC is already on track to achieving the specified growth projections detailed in Table 5.2. Since 2011 tonnage at the Port of Foynes has increased by 30% to 1.778 million tonnes, which is consistent with Vision 2041's mid to high average growth scenario. The average annual growth in tonnages projected in SFPC's Strategic Plan 2015 – 2019 is just over 7% for SFPC's general cargo terminals, which is also consistent with the mid to high growth scenarios presented in Vision 2041.

SFPC has identified several new areas in which it forecasts future growth will be focused. These are focused on the energy and the unitised sectors.

Biomass energy is considered a strong development potential for the Mid-West region as outlined in the Mid-West Area Strategic Plan 2012-2030. SFPC considers the existence of an established port to facilitate inward and outward trade as potentially beneficial in this future industry. Progress has

[10] Vision 2041, Table 5.1 pp.41

been made to date, with Foynes being chosen as the location for the production of biomass based fuel by Bord Na Mona (which has planning permission for a plant) and CPL Fuels.

SFPC is a major facilitator of renewable energy projects into Ireland, especially in the area of wind turbines. Since 2005 the Port has handled a majority of turbine imports primarily due to the relative size of the Port of Foynes when compared with other ports in Ireland and its location on the western seaboard. The Irish Maritime Development Office (IMDO), in its Irish Ports Offshore Renewable Energy Services (IPORES) study, has identified SFPC as a Category 'A' Port which offers a high potential to serve as a regional centre or hub for large-scale developments.

It is considered that the shift towards renewables and co-fuelling for electricity generation, future oil and gas exploration off the west coast of Ireland, together with the changing dynamics within the onshore fuel distribution market in Ireland will generate additional traffic through the Port of Foynes.

In the agri sector, significant growth is anticipated over time with the recent abolition of milk quotas. This is likely to result in an increase in the throughput of inputs such as animal feeds and fertilisers due to the further intensification of farming as restrictions on milk production are lifted. Both of these products are currently trafficked through the Port of Foynes in significant volumes and this sector already experienced significant increases in the last year.

Opportunities are also likely to arise from Brexit. The prospect of a 'hard-Brexit', including the UK's possible withdrawal from the EU Customs Union, would impose economic costs on the utilisation of the handling of goods through the traditional UK 'land-bridge' with continental Europe. This represents an opportunity for SFPC which would benefit from economies of scale in the handling of large vessels, as well as its access to the common market. Specific markets that may benefit from such an arrangement would include the agri-food sector.

5.2.5 Need for Enhanced Capacities

During the period 2015-2016 alone, over €45m was invested in the port estate in Foynes by SFPC and the private sector. Increasing port capacity is dependent on three main elements of water depths, berthage and storage capacity. All three elements are interlinked and a deficit in one area, such as a land shortage, will make it commercially impracticable to carry out jetty improvement works. Expansion of SFPC's storage facilities have already been accepted and recognised in the SIFP and by Limerick City & County Council in their rezoning of land[11] for marine related industrial use.

The need for additional storage space was also acknowledged by the Inspector when adjudicating on the CPO application (ABP Ref: 13. CQ3001). Section 7.25 of the Inspector's report confirms that,

"*on the basis of the submissions made there appears to be a shortage of storage lands within the confines of the existing port lands to accommodate expansion of the ports storage and other related and ancillary uses. I also consider it reasonable to conclude on the basis of the information presented that an enhancement of physical infrastructure as described in the scheme of development as Phases 1 and 2 will necessitate the requirement for additional and related storage lands and port centric uses and without which the implementation of the scheme of development could prove impracticable".*

[11] Variation no.3 of the Limerick County Development Plan 2010 - 2016

Historical growth in cargo traffic through the Port of Foynes and the relationship between cargo tonnage growth and key port infrastructure is highlighted in Table 5.3. This table demonstrates that supporting port infrastructure must grow as tonnage throughput increases.

Date	Tonnage Throughput	Total Quay length /No. of general cargo berths	Actual Foynes Port Estate footprint
1960	123,550 tonnes	110m / 1 berth	5.94 hectares
1970	535,248 tonnes	250m / 2 berths	13.14 hectares
1980	622,114 tonnes	250m / 2 berths	25.5 hectares
1990	1,086,431 tonnes	405m / 3 berths	57.1 hectares
2000	1,227,819 tonnes	566m / 4 berths	59.5 hectares
2011 – Base line year for Vision 2041	1,364,879 tonnes	566m / 4 berths	59.5 hectares
2017	1,778,126 tonnes	566m / 4 berths	64 hectares

Table 5.3 Historical growth in cargo traffic through the Port of Foynes and the relationship between cargo tonnage growth and key port infrastructure

5.2.5.1 Additional Berthage

Vessels are generally chartered on a time basis, critical to the successful operation of any port is the adequacy of quay facilities that enable vessels to dock, load and/or unload cargos and disembark without delay. If delays occur, this leads to increased charter costs, which in turn increase the costs for customers trafficking cargos through the port. It is accepted as a port industry standard[12] that average annual berth occupancy rates of 50% to 60% strike a reasonable balance between free berth time and ship waiting times. It is also accepted that average annual levels of berth occupancy above 60% will lead to an unacceptable increase in waiting times for vessels which can only be solved by the reduction in cargo traffic or the provision of additional berth space/quay facilities.

At present Foynes port consists of four general cargo berths totalling 560m in length. The current configuration of quay allows the port to manage 4 no. 10,000 dwt vessels at any one time or 2 no. 50,000 dwt vessels and 1 no. 5,000 dwt vessel at any one time. This configuration has resulted in a berth occupancy percentage of 40% on an annualised average and 78% on a peak seasonal average. This level of berth occupancy is not sustainable in the medium to long term based on current tonnage growth rates as it will inevitably lead to longer wait times for ships leading to increased costs to the receiver and a loss of competitiveness for SFPC and the Mid West region.

Assuming no change in the existing berth facilities currently in operation, SFPC's projected mid growth rate out to 2025 shows berth occupancy increasing to 60% on an annual average basis (with

[12] Gregory Tsinker – Port Engineering: Planning Construction Maintenance and Security

a seasonal average of 81% and peak occupancy rates reaching 100%) while SFPC's projected mid growth rate out to 2040 shows a berth occupancy of 71% on an annual average basis (with a seasonal average of 99% and peak occupancy rates reaching 100%).

This increased quay length capacity facilitates the trend towards a higher number of larger vessels calling to the Port of Foynes. The proposed quay length extension of 116.5m will allow the Port of Foynes to facilitate up to 5 no. ships of up to 10,000 dwt at any one time or 3 no. ships of 50,000 dwt at any one time thereby facilitating a reduction in berth occupancy percentage to more acceptable levels and to allow a growth in tonnages out to 2030, in line with Vision 2041.

5.2.5.2 Additional Storage

Unlike the other Tier 1 ports in Ireland, the Port of Foynes specialises in dry bulk, break bulk and liquid cargos. The storage demands for these types of cargo are typically greater than container and/or ferry ports because of the sizes of each shipment and the duration that these types of cargos are stored in port.

Historical SFPC data, as detailed in Table 5.3 shows that there is a very close relationship between new quay length, tonnage growth and supporting land requirements. While the tonnage growth between 1980 and 2000 effectively doubled at Foynes port (going from 622,114 tons per annum to 1,227,819 tonnes per annum), the land bank requirements at Foynes port increased by 2.3 times over the same time frame going from 25.5 hectares to 59.5 hectares.

Figure 5.3 highlights the historic and projected relationship between tonnage and land requirements in the Port of Foynes and demonstrates that 41.5 hectares of additional land is required to facilitate storage by 2020. This analysis supports the proposed development and the extension of the port estate by circa 33.75 hectares.

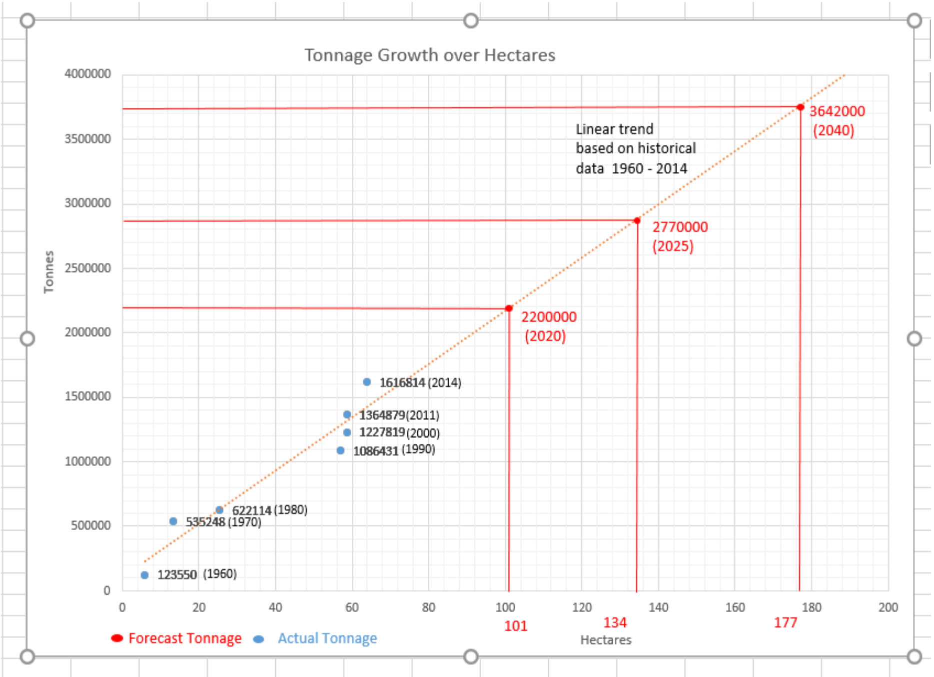


Figure 5.3 Historic and projected relationship between tonnage and land requirements

The projected growth in tonnage and subsequent key port infrastructure requirements are provided in Table 5.4.

Date	Projected Tonnages at the mid line growth rate	Total Quay length /No of general cargo berths	Forecasted Port Estate footprint	Increase in tonnages over base line year 2011	Increase in Foynes Port Estate footprint over the base line year of 2011.
2020	2,200,000 tonnes	686m / 5 berths	101 hectares	835,121 tonnes	41.5 hectares
2025	2,770,000 tonnes	686m / 5 berths	134 hectares	1,405,121 tonnes	74.5 hectares
2040	3,642,000 tonnes	800m / 6 berths	177 hectares	2,277,121 tonnes	117.5 hectares

Table 5.4 Historical growth in cargo traffic through the Port of Foynes and the relationship between cargo tonnage growth and key port infrastructure

As detailed in Chapter 2.0 of the EIAR close to 100% of the Port of Foynes Estate land bank is being utilised (with only minor land available for short turnover cargos). All other sites are either developed, occupied or have been earmarked for a specific future use (with planning consent).

In 2017 the Port of Foynes handled 1,778,126 tonnes within a port estate of circa 64 hectares which is now at 100% capacity. To be in a position to efficiently manage and achieve the projected growth figures as outlined in Vision 2041 document, the Port of Foynes requires additional land. Based on historical data (and projecting that data out to 2025 and beyond) SFPC can reasonably predict its land bank requirements in order to accommodate the projected increase in cargo throughput.

Table 5.4 confirms the requirement for 41.5 hectares of land up to 2020 and the proposed development seeks to satisfy this demand having regard to current economic trends and funding availability.

5.2.6 Economic Significance of SFPC

As a small open economy, Ireland is critically dependent on external trade and investment to support its successful development. This is evidenced by the fact that the overall combined value of merchandise/goods exports and imports represents over 69% of Irish economy Gross Domestic Product (GDP) in 2016, while export sales represent over two-thirds of the overall value of sales within Ireland's manufacturing sector. Ireland's commercial seaports play a vital role in this context, with the volume of maritime trade handled by the ports equating to 84% of the overall volume of Ireland's merchandise trade

An independent Economic Impact Assessment prepared by W2 Consulting[13], examining the activities of SFPC and the wider impact of the commercial trading activity of the port, demonstrates the significance of SFPC to the national economy. Not only are port operations a significant contributor

[13] W2 Consulting Economic Impact Assessment of SFPC 2016

to the region's economy but they represent 1 per cent of Ireland's GDP. The economic impact headlines based on 2014 data, cannot be ignored:

- The economic impact of all SFPC port related activity was €1.9 billion in 2014.
- The regional economic impact of SFPC and associated service providers is €95.8 million,
- The trade activity of SFPC and service providers supports 534 FTEs annually.
- The value of trade handled through SFPC for 2015 was €8.43 billion
- SFPC operations is responsible for 65 FTE's in addition to an employment income effect of €9.4 million for the regional economy.
- The commercial activity of customers of SFPC resulted in €347.2 million of expenditure in the regional economy on non-labour goods and services.
- Projected capital expenditure over the course of Vision 2041 is calculated at €1.8 billion that will support over 22,000 FTE's in the region and stimulate a further €1.09 billion between indirect and induced expenditure.
- Ensuring that the Port of Foynes has appropriate capacity in place to support the future growth in its port trade volumes, will be critical to increasing these economic impacts in the future.

5.3 EXAMINATION OF ALTERNATIVES

5.3.1 The "Do Nothing" Scenario

The current physical constraints in handling some of the larger vessels simultaneously within the Port of Foynes and the critical operational difficulties associated with the projected further increase in number of larger vessels and cargo throughput confirms SFPC view, that there is an urgent need to deliver capacity extension at the Port of Foynes.

A failure to deliver capacity extension at the Port of Foynes, to address the ongoing trend towards larger vessels, would place the Port of Foynes at an operational and competitive disadvantage relative to other large ports. In such a situation, SFPC would start to lose trade and larger freight customers, and over capacity trade would have to be handled at other more distant ports. In this scenario additional socio-economic costs would arise across the Irish economy associated with the internal haulage costs of moving trade, the majority of which would otherwise have an origin / destination catchment that is focussed on the Limerick and Mid West area. These internal freight transport/connectivity costs would include additional journey times and vehicle costs, costs associated with increased traffic congestion along national primary routes and associated environmental/emissions costs.

A failure to provide an extension to the existing port facilities will impact the Port of Foyne's ability to service the needs of the bulks sector and will inevitably lead to further operational difficulties due to berth congestion.

5.3.2 Alternative Location

The proposed development relates to the extension of an existing port facility, which has existed since 1846. The Port of Foynes is designated as a Tier 1 Port and is recognised as a strategic economic driver at international, national, regional and local level, as detailed in Chapter 3.0. The overriding objective of planning policy documents as detailed in Chapter 3.0, is to facilitate the enhancement of strategic economic drivers, subject to normal planning and environmental considerations. The proposal adopts a plan led approach to development and seeks to deliver on port policy at international, national, regional and local level.

In order to inform consideration of alternative locations, a number of important site characteristics were considered in the context of port operations, including:

- The site must provide access to deep water;
- The site must be adequately sheltered from sea and weather conditions;
- The site must be within reasonable distance of existing port locations to ensure effective communications and efficient operations;
- The site must be geographically situated to ensure it is suitable to continue to service effectively the main areas associated with the Port of Foynes current operations and existing customer base;
- The site must be able to be linked to main transportation networks; and
- The site must not represent a fundamental conflict with planning policy or environmentallysensitive designated areas

5.3.2.1 Alternative Locations on the West Coast

SFPC is the only port of significance on the west coast of Ireland, designated as a core port under TEN-T, and a Tier 1 Port under the National Ports Policy 2013. As stated in Chapter 3.0, Tier 1 Ports enjoy significant volumes of freight and have a high level of international connectivity. They have been identified at a European level as having the potential to reinforce a network of modern ports to support maritime freight operations. The other ports[14] on the west coast of Ireland are not recognised as having the qualities or potential of a TEN-T Port, being neither recognised as a Core Port nor a Comprehensive Port.

This position is also reflected in the National Ports Policy 2013. This document recognises that ports in Ireland differ greatly in current capability and future potential. Commercial shipping in Ireland is centered on the five Ports of National Significance, including Tier 1 (SFPC, Cork & Dublin Ports) and Tier 2 (Waterford & Rosslare) Ports. Other ports on the west coast of Ireland, identified in the Ports Policy document, include Bantry Bay, Fenit, Killybegs, Sligo and Galway. These ports have been identified as Tier 3, Ports of Regional Significance.

National Ports Policy 2013 is very clear in its central objective;

> *"that those ports considered to be of national significance must be capable of the type of port capacity required to ensure continued access to both regional and global markets for our trading economy. Government expects the Ports of National Significance (Tier 1) to lead the response of the State commercial ports sector to future national port capacity requirements. There is also a role in this regard for the Ports of National Significance (Tier 2) to develop additional capacity to aid competitive conditions, within the unitised sectors in particular".*[15]

In relation to regional ports, Ports policy states that:

> *"notwithstanding their continuing importance as regional ports, they are not facilities of national significance". In the context of the long-term international trends in ports and shipping, these ports are limited in their future potential as centres of commercial shipping".*[16]

In accordance with European and national ports policy, there is only one port on the west coast of Ireland, namely SFPC, which is designated as a Core Port at European level and as a Tier 1 Port at national level and which can / should be capable of significant expansion.

5.3.2.2 Alternative Locations on the Shannon Estuary

There is no other port facility on the Shannon Estuary capable of accommodating the extent or type of development as proposed and which could be considered as a suitable alternative location to the Port of Foynes.

The only other general cargo port on the Shannon Estuary is located at Ted Russell Dock in Limerick City. However, the distance of the facility upstream from the mouth of the Estuary and limited

[14] Galway Harbour, Fenit, Killybegs, Bantry Bay and Sligo
[15] Ibid Section 4.1 pp.44
[16] National Ports Policy 2013 pp.30

navigational depths will restrict its ability to attract significant increases in bulk solid business comparable with the Port of Foynes.

There are other deep water berths available on the Estuary. However, these are not general cargo facilities. The jetty at Tarbert was commissioned in 1969 to specifically serve the oil-fuelled power station. The Moneypoint terminal was established as a dedicated facility for coal, used to fuel the ESB owned generating station on site. The jetty at Aughinish Island is provided for bauxite and alumina cargoes and was constructed to serve the alumina producing plant, whilst the Shannon Airport facility was constructed to service aviation fuel imports. Whilst these other facilities on the Estuary do comprise of existing jetty facilities, they were constructed to serve a very specific industry and do not have the associated storage, support structures, faclities or connectivity requirements necessary to sustain a general cargo port.

The Shannon Estuary – Strategic Integrated Framework Plan (SIFP) seeks to transform the estuary into an international economic hub by taking advantage of what are among the deepest and sheltered harbours in Europe and the world. It has identified nine strategic development locations (SDL's) adjoining identified sheltered deepwater (>15m depths) sites on the Shannon Estuary. It is intended that these SDLs will attract substantial maritime commerce consistent with the Governments Harnessing our Ocean Wealth, assisting in achieving its economic targets. These nine SDL's have undergone detailed site assessment and selection having regard to an evidence-based approach detailed in Volume 2 of the SIFP. This analysis, detailed in the SIFP, presents a starting point for consideration of alternative sites within the Shannon Estuary. The nine sites are identified in Figure 5.1 and are considered hereunder.

Site A - Inishmurry/Caheracon/Kiladysert: Located outside the village of Kiladysert in Co. Clare on the northern banks of the Shannon Estuary, the site comprises 85.8 hectares. The site is not within reasonable distance of existing port locations to ensure effective communications and efficient operations and the site is not geographically situated to ensure it is suitable to continue to service effectively the main areas associated with the Port of Foynes current operations and existing customer base.

Site B – Moneypoint: Comprising 335.3 hecatres in close proximity to Kilrush town in Co. Clare, the site is owned by the ESB. It is an existing strategically important energy hub. The site is not within reasonable distance of existing port locations to ensure effective communications and efficient operations and the site is not geographically situated to ensure it is suitable to continue to service effectively the main areas associated with the Port of Foynes current operations and existing customer base.

Site C - Foynes Island: Comprising 71.3 hectares the land is in third party ownership and requires significant infrastructure to facilitate access from the existing port. It is considered that this is a more long term ambition, as acknowledged in the SFPC Masterplan – Vision 2041.

Site D - Lands to the rear of Foynes Port: Consisting of 151.8 hectares of land, the proposed port extension located at Durnish, comprises part of these lands. The site derives significant benefit from the existing port facilities, access to deep water and direct access to the N69, key transport corridor.

Site E - Lands at Askeaton: The 111.6 hectares encompasses the entirety of the Shannon Commercial Properties Land Bank, situated in proximity to the village of Askeaton. However, the site is substantially removed from the Estuary, associated deepwater and existing port infrastructure.

Site F - Lands at Aughinish Island: A significant site of 518.6 hectares within the existing industrial complex of Aughinish Alumina UC RUSAL. It is anticipated that the existing he alumina facility will remain as a significant working industrial plant for the foreseeable futur

Site G – Tarbert Power Plant: Comprising a major electricity generating station, the 54.3 hectare site is a strategic energy location, unsuited to the operations of a general port facility. The National Oil Reserves Agency (NORA) has taken a 25 year lease on four underutilised tanks just outside the main island facility and there are moves to diversify away from heavy fuel oil industry into cleaner technologies delivering a sustainable reuse of previously developed land.

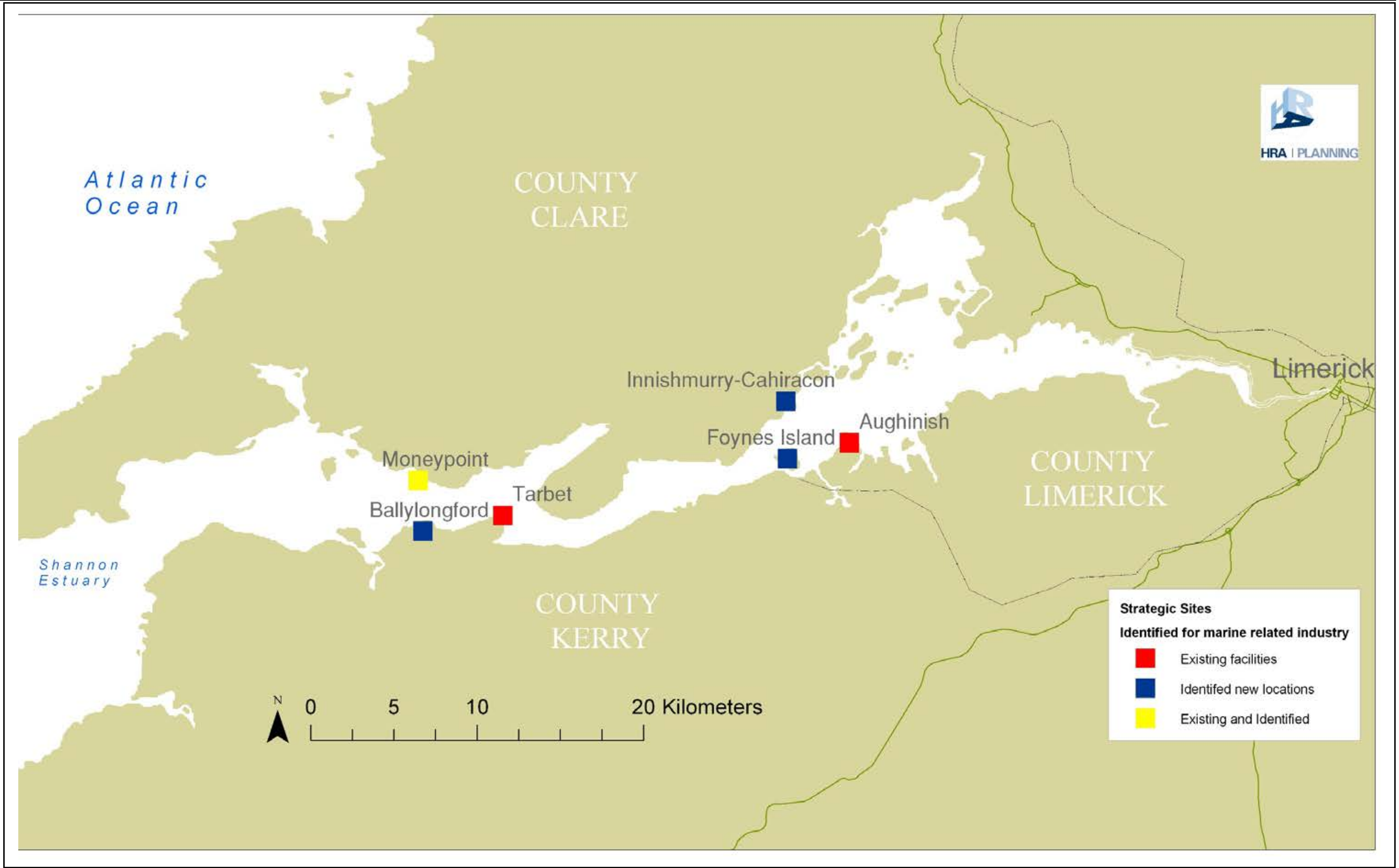


Figure 5.1 Location of Alternative Deepwater Sites

Site H – Ballylongford Landbank: Comprising 592.8 hectares of land, part of the land has planning permission for a proposed LNG importation and storage facility. Although located in proximity to the Port of Foynes, with no existing port infrastructure in place, this land is more suited to industrial development.

Site I – Limerick Docks: Comprising 89.6 hectares the distance of the facility upstream from the mouth of the Estuary and limited navigational depths will restrict its ability to attract significant increases in bulk solid business comparable with the Port of Foynes.

Preferred Site: Site D, which includes the port estate expansion lands at Durnish, adjoins the existing Port of Foynes, within the village of Foynes, which is located on an identified Transport Corridor. The land is suitably zoned for marine related industry within the Limerick County Development Plan 2010 – 2016. The lands access onto the Port Access Road and the N69 National Road Corridor, which is critical for the efficient movement of freight to/from the Port. It straddles the corridor of the existing rail connection between the village of Foynes and Limerick City and provides future opportunities for improved efficiencies in freight movements, when commercially viable to do so. Acquisition of the Durnish lands by SFPC was confirmed under the Harbours Act 1996 - 2015 by An Bord Pleanála (Ref: 13.CQ3001). The site derives significant benefit from the existing port facilities and access to deep water.

- The operation of an efficient and viable port is dependent on three integral elements, namely;
- Sufficient water depths to accommodate actual and projected ship size,
- Sufficient berthage/quay lengths and quay set down areas; and
- Sufficient land available in the vicinity of the port for covered and uncovered storage (to store cargoes being imported or exported through the port) and / or to promote port centric activities and services. Land requirements for a bulk port are directly related to tonnage throughput.

The subject site, in proximity to the Port of Foynes currently benefits from deep water, will benefit from sufficient berthage / quay lengths and will facilitate and ensure that sufficient land is available in the vicinity of the port for storage and/or to promote port centric activities and services and other port related activities.

5.3.2.3 Alternative Locations within Foynes

Consideration of lands to facilitate port expansion adjoining / within proximity to the Port of Foynes has already been considered within the Limerick County Development Plan 2010 - 2016, as amended. Specifically, Variation No. 3, sought to amend the Plan to provide for marine related industrial zoned land adjoining the Port of Foynes, inclusive of the subject lands. The proposed development therefore is adopting a plan-led approach to development.

The existing spatial composition and natural topography of the village of Foynes has dictated the direction of growth within the Port of Foynes. The Port is situated between the Shannon Estuary to the north and the rail line and village to the south. The land surrounding the village rises steeply in a western and south western direction, naturally preventing expansion of the Port in a western direction. The existing settlement structure and Main Street, which runs parallel to the Port Estate, prevents expansion in a southern direction. The, only remaining alternative is to expand in an eastern direction, encompassing the subject lands.

5.3.2.4 Site Suitability

The proposed development adopts a plan led approach to development and seeks to deliver on a number of key objectives at national, regional and local level. Specifically,

- The subject site is zoned for marine related industry use and accordingly its development supports a 'plan led' approach.
- The proposed development is in accordance with SFPC's Masterplan – Vision 2041 and which identified the need for increased berthage and additional land for storage.
- The Port of Foynes already operates successfully at this location and the logic is to expand an existing port operation rather than seek to relocate it.
- The proposed location is positioned adjacent to the national road network with easy access to the from the site to other larger urban and commercial centres.
- The existing rail line adjoins the Port and the expansion lands at Durnish and provides opportunities in the future for rail should it be deemed commercially viable to do so.
- The Port of Foynes and the proposed development including the expansion lands at Durnish are centrally positioned to serve a wide customer catchment.
- The proposed location can contribute to improved transport efficiencies and reduce associated environmental pollution as the proposed development will facilitate the 'proximity principle' whereby customers will use port facilities closest to the destination of their goods.

Section 7.31 of Inspectors report attached to the CPO application in respect of the Durnish land s(ABP Ref: 13. CQ3001) states, *"it would appear that the location of the acquisition lands is plan led to a significant extent having regard to the relevant policy documents referred to above including the SIFP and Development Plan which identifies the lands as part of a Strategic Development Location and imposes relevant marine related industry zoning. Clearly the proximity to the established port, the port access road and indeed the 'straddling' of the railway link into Foynes is also material in regard to the potential suitability of the lands for the purposes for which they are being acquired".*

5.3.3 Alternative Design

Having identified the appropriateness of development within the Port of Foynes and identified the most suitable land to facilitate port expansion, consideration has been given to what alternatives might be considered in the context of the facility layout and boundaries.

5.3.3.1 Berth Expansion

The underlying principle of the proposed development is to make the most efficient use possible of existing and future port lands. The Port of Foynes requires additional quay length. There are four influential factors in guiding the location of quay length including:

- The extent of existing land bank, within the Inner Port proximate to existing berthing and port infrastructure;
- Proximity to deep water;
- Avoidance of impacts on shipping access to existing facilities; and
- Minimal environmental impacts

There is limited land within the inner port area of Foynes capable of accommodating new berthing facilities. The inner port area of Foynes comprises two distinct jetties including the west quay and the eastern jetty. Joining the east jetty with the west quay results in minimum intrusion on existing port configurations and operations and facilitates the provision of 116.5m of additional quay length. Taking the above constraints and considerations into account there is limited opportunity to consider alternative berth positions. The proposed development maintains a practical balance having regard to issues such as dredging and ensuring the most efficient use of existing lands.

In terms of design, a piled suspended deck structure is proposed in preference to the backfilling of land, thereby ensuring minimal interruption to existing coastal processes.

5.3.3.2 Jetty Extension Form of Construction

Several forms of construction were considered for the proposed jetty extension works. A solid steel piled structure with infill between the inner and outer quay faces was considered, however, for geotechnical reasons, an open piled structure was considered more appropriate for this location.

In addition, when considering the wave and sediment transport modelling, the proposed open pile form of construction was preferred to mitigate against any potential impacts on the existing sediment transport within the port. The provision of an open pile structure also retained tidal movements to and from the shore located behind the proposed jetty extension, therefore, avoiding any potential impacts on the existing mudflats in this area.

5.3.3.3 Development Area and Internal Arrangement

With relation to existing port activities within the existing port estate and the CPO Order determined in relation to a very specific area of land, there is very limited scope for consideration of alternative site boundary arrangements.

Access to the port expansion area is influenced by the existing port access road to the east of the port estate. Using this access ensures that port traffic does not have to move through the village of Foynes. A roundabout junction is considered to provide the most appropriate solution for the site, facilitating ease of access to port traffic. Following discussion with Limerick City & County Council, it was agreed that port security should be relocated to the south of the proposed new access arrangement thereby ensuring that the proposed new junction will remain within the overall controlled port estate.

Within the Durnish lands, the proposed internal arrangement and layout has been heavily influenced by the findings of this EIAR. In particular, the location and height of the potential container storage area was originally proposed to the south of the proposed warehouses with stacks of up to 5 no. containers high. Following consideration of visual amenity and noise assessments, the proposed container storage area was relocated north of the proposed warehouses with stacking reduced to 3 no. high. The site has also been modified to provide for a significant landscape and visual buffer extending around the entire northern, southern and eastern site boundaries following detailed landscape and visual appraisal.

5.3.3.4 Flood Risk

Three potential options for flood risk mitigation were considered for the port expansion lands at Durnish:

1. Raising the levels of the lands out of the floodplain to a finished ground level of +4.44mOD

2. Providing hard defences such as an earthen embankment around the lands with localised filling to facilitate drainage

3. Provision of exposed sheet pile wall around the perimeter of the land and an enhanced storage and pumped drainage system.

In consideration of the options, regard was had to the Planning System & Flood Risk Management – Guidelines for Planning Authorities; the zoning of adjoining land to the east for marine related industrial use; and the performance of defences and other infrastructure works which require ongoing operations and maintenance.

Whilst the option of raising the land levels out of the floodplain (Option 1) is likely to be the most expensive, it was considered the only option which is in line with the precautionary approach recommended in paragraph 3.1 of 'The Planning System and Flood Risk Management Guidelines' (DEHLG/OPW, 2009) and detailed in paragraph 5.16 as follows:

> *Where development has to take place in areas at risk of flooding following the application of these Guidelines, the risks should be mitigated and managed through the location, lay-out and design of the development to reduce such risks to an acceptable level. The residual risks to the proposed development should be considered carefully, taking into account the type of development and its vulnerability, how flood risks to the occupants will be managed, insurance provision, scale of the risks and the provision of flood defence works. A precautionary approach would be to set floor levels above the 1% flood level ignoring the moderating effects of flood defences. However, within an existing built-up area the approach above may not produce an appropriate streetscape and therefore for proposed developments with a lower vulnerability, flood resistant and flood resilient construction methods to reduce the impact of flooding would be appropriate. In this situation the flood risk assessment should be thorough and measures to manage these residual risks carefully detailed. More information on flood risk management by design is available in Appendix B. In all cases, a precautionary approach should be taken to allow for uncertainties in data and risk assessment procedures and to enable adaptability to future changes in risk, including the effects of climate change.*

The option of raising the land levels is not reliant on the performance of defences and other infrastructure which require ongoing operation and maintenance. The alternative mitigation options considered would have resulted in, to various degrees, higher levels of residual risk to the development as they are dependent on the performance of flood defence structures. This was considered an unnecessary level of residual risk and not consistent with the precautionary approach set out in the guidelines.

Other factors which were considered in relation to selection of Option 1 as the preferred option as opposed to Options 2 & 3 included:

- The need to ensure continuous inspection and maintenance of the earthen embankment (Option 2) and the risk associated with embankment failure;
- The additional requirement to infill some of the land to ensure drainage of the land can occur by gravity under normal conditions (Option 2);
- The provision of a barrier along the eastern boundary of the site, which would prevent the future holistic and integrated development of adjoining marine related industrial zoned land (Options 2 & 3);
- The adverse visual impacts associated with a sheet pile wall with piles protruding circa 3m above ground level (Option 3);
- The need to construct, operate and maintain a pumped / storage based drainage system to facilitate drainage at times of high coastal water levels and the reliance on this system to prevent flooding of the lands (Option 3). Providing a pumped drainage system for a development at existing ground levels would become more challenging into the future due to sea level rise.

5.3.3.5 Filling of Land

Consideration has been given to the nature and type of fill necessary to raise the level of the existing Durnish lands to a finish ground level of +4.44mOD. Particular regard has been had to the availability and type of fill that would be suitable for the site.

Consideration was given to the use of waste material with an associated application for a Waste authorisation, to fill the land.

An analysis of potential projects in Limerick and the surrounding area, capable of generating sufficient waste to fill the lands was undertaken, with specific regard to projects put forward under Limerick 2030 and under the Limerick Regeneration Framework Implementation Plan. Furthermore figures reported in the Construction and Demolition Waste Soil and Stone Recovery/Disposal Capacity Report would estimate suitable inert waste arisings at 62,000 tonnes per annum in Co. Limerick based on the data reported for 2015.

The fill required for the site is estimated at 937,800 tonnes. Even in securing all suitable waste in Co. Limerick for fill on site, it would take over 15 years to fill the site. Therefore, to rely on waste as a source of fill for the site, would result in an uncontrolled dependence on market conditions and which could adversely impact on the timing of the project.

Accordingly, it was considered that the use of quarry material as a source of fill would be the most appropriate for the site.

5.3.3.6 Foul Treatment System

The construction of a collective holistic foul water treatment system to serve Phases 1, 2 and 3 of the Durnish Lands development was considered. Three options were considered during the design process and these are considered in turn.

Wetland Treatment System - This option comprises a single constructed wetland/reed bed treatment system to treat foul wastewater from the entire site (i.e. Phases 1, 2 and 3). Options for the location of this reed bed system were considered, both within the Durnish Lands (located centrally), and located on a parcel of land to the west of the Durnish Lands, bordering the existing railway line.

Whilst the wetland treatment system would facilitate increased site biodiversity (from planting introduced for wetland system) and would be relatively inexpensive to construct and operate, there are a number of associated disadvantages which are not desirable in the context of the proposed development including:

- Length of pipe network required is in the order of 200-500m (depending on exact routes of foul pipe network and exact location of wetland system); with pipes of this length, accommodating the necessary 1:60 gradient to support a gravity fed system is not achievable given the required level differential. This therefore necessitates the provision of a pumping station. A gravity fed system would be preferred to a pumped system which can be prone to breakdowns due to blockages, mechanical or electrical failure if not maintained correctly. The provision of a pumping station is also considered excessive for the anticipated system loadings from the proposed development.

- A foul sewer serving the entire Durnish Lands could be required to cross OPW drainage channel to reach the treatment system if it was located in the available plot to the West of the Durnish Lands, bordering the existing railway line. This would not be considered a preferable option by the OPW.

- Wetland systems are subject to seasonal system efficiency fluctuations (micro-organism population and efficiency reduce during cold seasons, as vegetation carries out nutrient removal during growing seasons).

- A wetland system must be installed during Phase 1 and be designed to accommodate all future phases - removing the flexibility in subsequent Phases 2 & 3.

- Wetland systems can take a number of years to reach peak performance, as plants typically need a number of seasons to grow and achieve maximum performance- potential that wetland system would not be established in sufficient time to serve Phase 1 warehousing- alternative primary treatment may be needed in the first instance whilst plants become established.

Modular Package Treatment Plant (located centrally in Phase 1) - This option consists of the use of a modular package treatment plant system to service the whole site (i.e. Phase 1, 2 & 3), with proposed upgrades to be applied to the system as the proposed development progresses. The use of a modular package system would be advantageous having regard to the fact that the system can be upgraded to accommodate increased loading as development phases progress, thereby accommodating required design loads of each phase, ensuring efficiency of design and operation. However, there are a number of associated disadvantages which are not desirable in the context of the proposed development including:

- The length of pipe network needed is approx. 200m - 400m; with pipes of this length, accommodating the necessary 1:60 gradient to support a gravity fed system is not achievable given the required level differential. This therefore necessitates the provision of a pumping station. A gravity fed system is preferred to a pumped system which can be prone to breakdowns due to blockages, mechanical or electrical failure if not maintained correctly. A pumping station is also considered excessive for anticipated loadings.

- Excavation and upgrading of the existing treatment facility will be required at each subsequent development stage.

- Package treatment plant is a stand-alone solution and is not capable of being incorporated into any external drainage infrastructure, when and if the WWTW for Foynes village advances.

Package Treatment Plant (Provided on Phased Basis) - This option involves the provision of package treatment plants which are individually sized for the requirements of each phase of development and are constructed as required in each phase. This approach has a number of advantages over and above the other considered options including:

- Phased approach to the construction of the treatment system allows for the most efficient design for each Phase to accommodate the specific requirements;

- Package treatment plants shall be constructed within their required phase – providing flexibility for future land usage and reduced risk of inefficiency in design or system not being required for subsequent phases; and

- Extensive sewer pipe network is not required, as plants can be located in general close proximity to warehousing sources. Therefore, a gravity fed system can be used, negating the requirement for a pumping station (which would be excessive considering anticipated loadings).

Following an analysis of the three options above, it was concluded that a phased approach to the foul treatment design affords a level of flexibility within Phases 2 and 3 of the Durnish development, which is a fundamental requirement for the development given the uncertainty surrounding the exact location and extent of any future storage requirements within these phases.

Construction of a collective holistic foul wastewater treatment system in Phase 1 to service all 3 phases would not be practical considering the level of flexibility SFPC wish to maintain for future development. Should land usage vary to any significant degree in future phases, any foul treatment system provided to service the entire site could be over/under-designed or possibly redundant.

It is noted that this approach to foul treatment has been successfully implemented on sites adjacent to the proposed Durnish lands development. Most notably on the CPL Fuels Site (LCCC Planning ref 14603), where the proposed wastewater treatment plant consisted of a 9.6m3 septic tank for primary settlement, secondary treatment in the form of 16nr Puraflo modules, and tertiary treatment in form of a 225m^2 soil polishing filter to service a site with 61 personnel, operating on a 24/7 basis.

On this basis, the chosen Wastewater Treatment system for Phase 1 of the Durnish Lands was the package treatment developed on a phased basis.

5.3.3.7 Sustainable Transport Measures

A number of options were considered to enhance travel by sustainable means at the site, further advancing and building on existing infrastructure and public transport within the village of Foynes. An existing bus service, Bus Éireann 314 (Limerick – Askeaton – Foynes), runs along the N69.

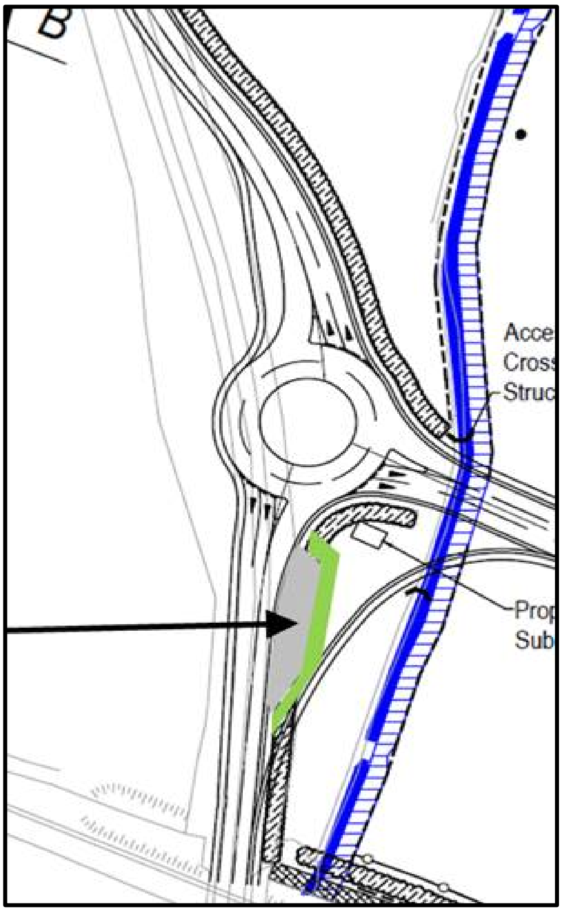


Figure 5.2: Initial Concept Sketch of Possible Bus-Layby

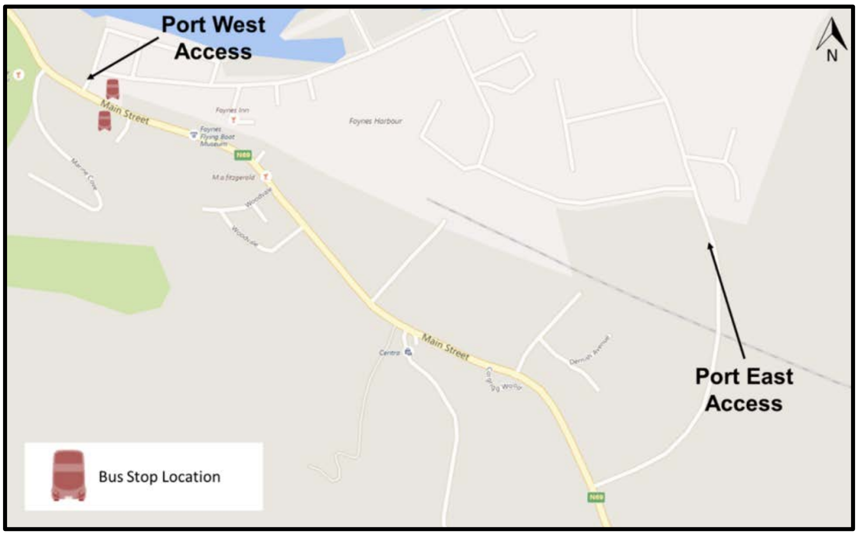
The first option explored the concept of providing a dedicated Bus Stop within the port expansion lands. An initial proposal sought to provide a bus stop within the Durnish Lands thereby extending the No.314 Bus Service from the N69 along the eastern access road and into the Durnish Lands.

It was considered that the area to the right of the proposed access roundabout, which is the overrun area for potential wind turbine blades negotiating the roundabout, could also be used a location for the bus stop. This would consolidate land uses and ensure that the distance of the diversion of the 314 Bus Service was minimised, hence minimising the impact in bus journey times. Figure 5.2 shows the initial concept sketch.

This option was ruled out as there were security issues relating to passengers being able to gain unauthorised access to the Port.

The second option sought to connect the Durnish Lands to the existing bus stops located on the N69 within the village of Foynes, close to the western port access. Figure 5.3 shows the location of the existing bus stops in the village.

The proposal sought to provide of a fleet of bicycles and bicycle stands inside the western port access for employees using the 314 Bus Service to then cycle along the internal port roads to the Durnish Lands. This would necessitate defining an internal cycle route to connect the western port access to the Durnish Lands within the port along the existing road network, a distance of 1.8km. It would also have required the provision of a 3m walkway/cycleway along the roads within the Durnish lands.



A detailed analysis of the proposal followed and it was determined that safety issues could potentially arise from the interaction of on-road cyclists interacting with heavy vehicles within the existing internal port roads.

Figure 5.3 Location of Existing Bus Stop Facilities

However, the provision of the 3m walkway/cycleway along the proposed roads within the Durnish Lands was considered feasible and would future proof the scheme to accommodate a possible future internal cycle connection at the Port. Hence, the proposed 2m footpaths were upgraded to 3m shared cycleway/footways and now form part of the scheme proposals.

The third and final option relooked at the provision of a new bus stop at the eastern port access, but to be located on the southern side of the safety barrier, outside of the existing and proposed port estate close to the locations indicated in Figure 5.4.

This proposal involved extending the proposed footpath from the eastern side of the roundabout to a possible on-road bus stop location on the southbound side of the carriageway just south of the railway line, as indicated on Figure 5.4. An appropriate location was identified for Bus Éireann to provide a bus stop to be an on-road bus stop marked with a flag pole.

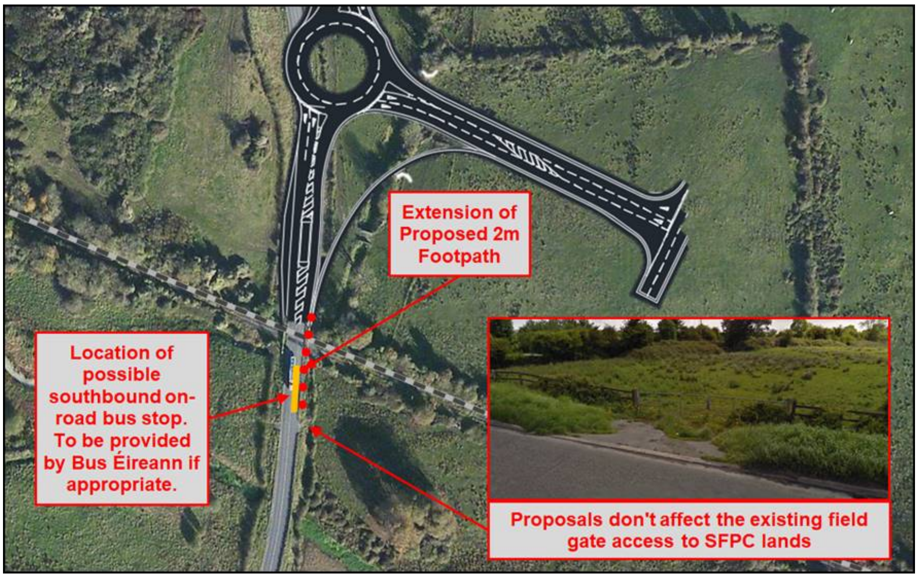


Figure 5.4 Concept of Providing a Bus Stop to the South of the Proposed Security Barrier

This option was considered to be the preferred option as:

- It future proofs the possibility of the extension of the 314 Bus Service from the N69 along the eastern access road to the Port access;
- The bus can approach the barrier without stopping, use the express lane to enter the Port, u-turn at the roundabout without stopping to let anyone get in or off the bus, go through the exit barrier and stop once on the southbound carriageway. The stop is located 70m from the exit barrier to minimise any delay to exiting vehicles; and
- Bus patrons, both those exiting from the Port and those wishing to access the Port, can use the footpath to access between the bus stop and the security area, thereby reducing the need for a northbound and southbound bus stop

This option is now proposed within the development, and has been approved in principle by Bus Éireann at pre-application stage.

5.3.3.8 Delivery & Phasing

A number of alternatives were considered in relation to implementation and delivery of the proposed development in the context of existing port operations and the demand for additional capacity within the port.

Consideration was given to the development of serviced lands only, effectively providing for 33.94 hectares of serviced industrial land to potential investors. However, the upfront cost of delivering such infrastructure in advance of securing a definitive operator/operators was considered to be unviable and failed to deliver additional warehousing and storage facilities, immediately required within the port estate.

A balance needed to be struck whereby some of the land (Phase I) could be developed immediately by SFPC to provide for additional warehousing and storage, with the remainder of the land serviced on a phased basis and retained for the needs of future cargo operators. Accordingly, it was decided to phase development of the land, such that the filling of land and the provision of service infrastructure would occur on a phased basis as and when the need arises, but within the 10 year scope of the planning permission.

It was decided to advance the operational use within Phase I immediately thereby addressing the immediate need for additional warehousing and storage facilities. The remaining two phases would be delivered as serviced industrial land only, thereby affording adequate flexibility to accommodate the needs of future unknown operators. It is acknowledged that the delivery of specific uses and buildings within the serviced Phase 2 and Phase 3I land will need to be advanced separately through the planning consent process, but within the parameters of the Development Framework Programme prepared for the site.

5.3.4 Alternative Processes

The facilities being developed by the Port of Foynes will be required to maintain a degree of flexibility for a number of reasons:

- The occupier / occupiers of the port expansion lands at Durnish are not yet known. The Port of Foynes largely operates on a landlord model whereby SFPC owns and manages the port facilities and infrastructure and leases them to private operators, who provide the superstructure and equipment. SFPC then provides support port service infrastructure;
- Delivery of the phases of development will need to respond to specific market drivers; and
- Variability in customer demands reacting to global shipping and trade trends.

5.3.4.1 Loading and Unloading

As the proposed jetty is a direct extension of the existing cargo handling facilities there is limited opportunity for the consideration of alternative methods of port operations, as operations on this new section would need to be consistent with similar operations on the existing jetties. The loading and unloading of vessels will generally be facilitated using Harbour Mobile Cranes.

Handling operations within the port expansion lands at Durnish will be dependent on the type of cargo which is to be accommodated at any given time. Port handling equipment such as mobile cranes, mobile hoppers, mobile weighbridges, straddle carriers, loading shovels, reach stackers, mast lift trucks, or similar will be used as and when required. SFPC will adopt best practice and will actively review with the receiving companies what other measures might be implemented to control release of dust during unloading operations. In any case, all mitigation measures detailed in Chapter 10.0 will be implemented and a Dust Management Plan prepared for the entire site.

5.3.4.2 Rail Connection

SFPC have been actively assessing the viability and feasibility of bringing the rail line back into operational use. SFPC is identified as a Core Port in the TEN-T network which ports are required to be connected to the road and rail networks by 2030, except where physical constraints prevent such connections.

A scoping study was carried out by Iarnród Éireann (IE) [17] to establish the broad engineering feasibility of re-opening the Limerick to Foynes railway line to limited freight traffic. This study was followed on by the Foynes Railway Line Preliminary Design Report 2015. The Limerick Foynes line is single track rail line of approximately 43km in length. There are 25 no. over bridges and 42 no. under bridges along the Limerick to Foynes line, including 15 no. level crossings along the route, which are manually operated gate crossings. The line was disconnected from the mainline at Limerick in 2004.

The studies confirm that the land required for the project is within IE ownership. However, it has been confirmed that the renovation of 40km of rail line would cost in the region of €25m, with annual maintenance costs of circa €350,000 per annum. These figures exclude the capital cost estimates for rolling stock and train operating costs. Accordingly, it is SFPC's position that this line can only be reinstated if commercially viable to do so, arising from the needs of a particular operator and cargo type.

SFPC made a submission on the National Planning Framework (NPF) and the Review of the Capital Spending Plan seeking inclusion of the Limerick – Foynes Rail line within the infrastructure priorities for the region. Neither the NPF nor the National Development Plan sought to include the rail line in their priorities but they did include the Limerick - Foynes Road Improvement Scheme. Accordingly, it would appear that rail infrastructure and the upgrade of the Limerick – Foynes rail line is not a national priority at this time.

National Ports Policy 2013 recognises that even with a substantial increase in rail freight to and from the ports, most freight will continue to be carried by road. The 2030 Rail Network Strategy Review[18] recognises the limitations to rail freight in Ireland, including:

- The limited long-distance land journeys in Ireland differentiate it from the primary driver of growth in European rail-freight: long distance, international haulage.
- Most transport activity to and from a given port is limited to its immediate regional hinterland.
- Road is generally more competitive in terms of speed and flexibility.
- The small scale of the Irish market results in insufficient volumes of freight.
- Rail transport is best suited to the transport of bulky raw materials over relatively long distances, of which there is less in Ireland.
- There is no financial support mechanism in Ireland.

The National Strategic Investment Framework Investing in Our Transport Future[19] does not provide any clarity on the role of rail transport in Ireland. Action 6 of this document states that *"a new rail policy will be developed by DTTaS to address the future role of rail transport in Ireland".* A recently published document on transport trends in Ireland[20] confirms that levels of road freight activity

[17] Foynes Railway Scoping Study 2014
[18] The 2030 Rail Network Strategy Review - Final Report Iarnród Éireann 2011
[19] Investing in Our Transport Future – Strategic Investment Framework for Land Transport 2015
[20] Transport Trends: An Overview of Ireland's Transport Sector, June 2017

continued to grow by a small amount in 2015, while levels of rail freight activity showed decline. There was a 0.7% increase in the tonne-kms of road freight, and a 3.4% decline in rail freight tonne-kms.

In the Rail Review Report 2016[21], it is stated that "Iarnród Éireann's key strategy for freight is to organically grow the business by focusing on commercially viable niche point to point markets revenue streams. It states that *"any rail lines that could support the development of rail freight in the future, where passenger services do not exist, should be protected in the interim while the business case for that investment is developed".*

The proposed development seeks to maintain a rail connection to the overall port operation. Nothing within the proposed development will hinder the potential for the future use of rail freight carrying facilities as detailed in Figure 5.5. The maintenance of the rail connection and the safeguarding of the potential for future use of rail freight currently satisfies the requirements of the TEN-T Regulations, as the port is connected to the rail network and which could become operational by 2030.

[21] Rail Review Report 2016 pp.24

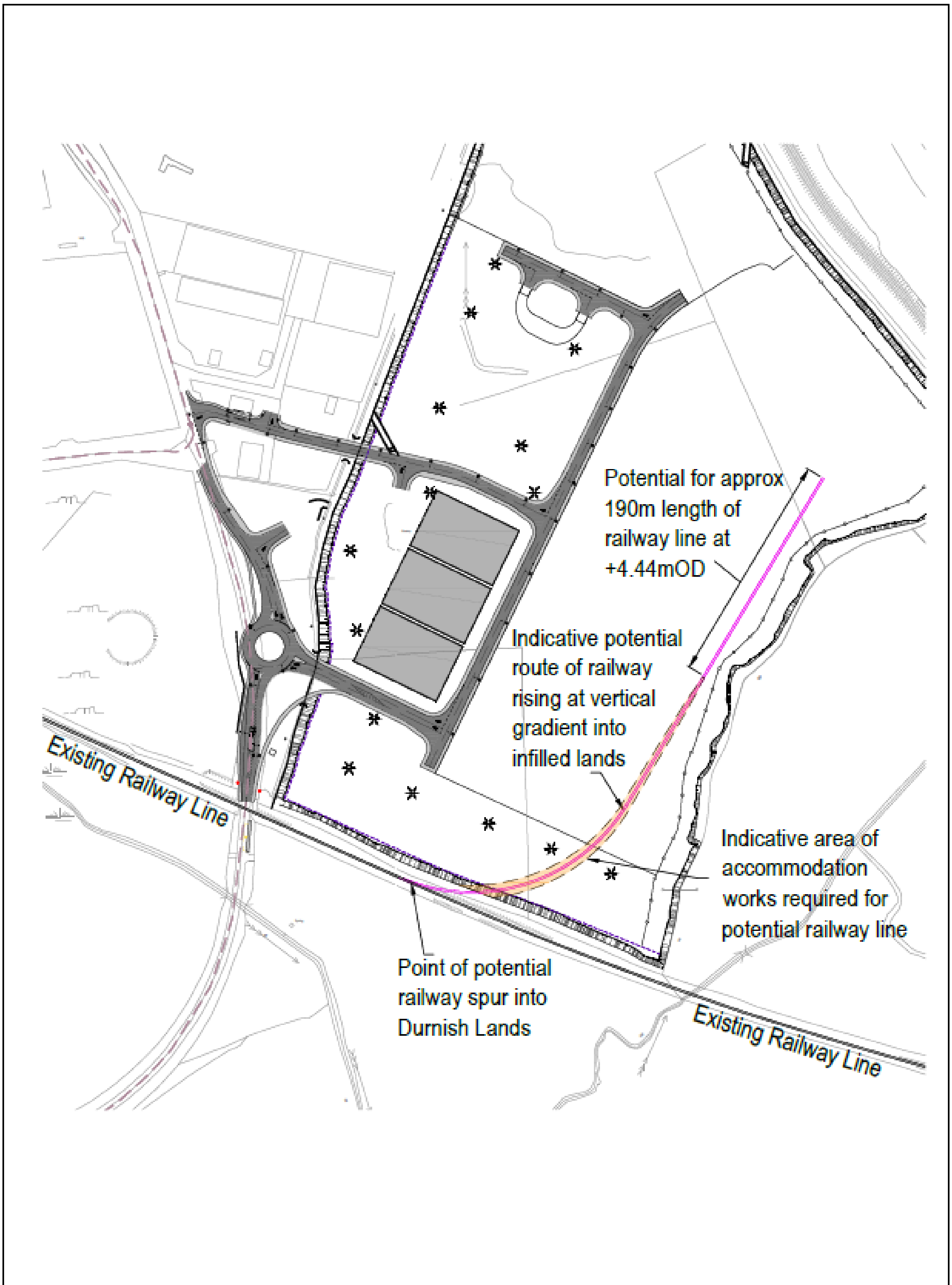


Figure 5.5 Concept demonstrating potential future rail link within the application site

5.4 SUMMATION

This chapter has demonstrated a 'need' for the project and has referenced that this need was accepted by An Bord Pleanála during the consideration of an application by the Port Company for the compulsory acquisition of the 'Durnish' lands in 2016. The circumstances that dictated that need are still applicable and relevant in the context of this proposal. The proposed location and design of this project has derived from detailed consideration of alternative locations, alternative designs and alternative processes and it is on this basis, that the current proposal is the most appropriate design option in the context of environmental impact assessment.

5.5 REFERENCES

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- Transport Trends: An Overview of Ireland's Transport Sector, June 2017
- Rail Review Report 2016
- Sample text, sample text

6 POPULATION & HUMAN HEALTH

6.1 INTRODUCTION

There are a wide range of issues which may impact on population and health. The purpose of this assessment is to identify and assess the potential health and wellbeing effects of the proposed development on the surrounding population, and to deliver evidence-based recommendations that maximise health benefits and reduce or remove potentially negative impacts.

The Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017) suggests that; "*the assessment of impacts on population and human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in this EIAR e.g. under the environmental factors of air, water, soil etc*."

In the application of this approach, consideration of the potential impacts of the Capacity Extension works at the Port of Foynes on population and human health might therefore arise from a number of variables. For example; traffic and transportation, air quality and climate, noise and vibration, townscape and visual (landscape), water quality & flood risk, and the risk of major accidents and/or disasters. These aspects are dealt with in the specific chapters in this EIAR which are dedicated to those topics. In addition, issues such as health and safety and risk of major accident and/or disaster are dealt with in the RPS Seveso Report which has been prepared under separate cover. This Chapter refers to the findings of those assessments included elsewhere in this EIAR which human health effects might occur.

In addition to human health considerations this chapter will assess the impacts the proposed development will have on; (i) Demographics, (ii) Employment, and (iii) Community, with specific regard to economic activity, social considerations, land-use and health & safety.

The principal receptors that may be impacted by the proposed development include residential receptors; direct and indirect economic receptors; social and community facilities; and the transient population.

6.2 ASSESSMENT METHODOLOGY

The baseline information was gathered using desk top analysis of available mapping and aerial images; visits to the site and the surrounding area; analysis census of population data; review of relevant documents; and a review of comments from statutory bodies and the public during the consultation process.

A desk top analysis of current census data from the Central Statistics Office (CSO) was undertaken including an assessment of demographic and employment figures. Census information at settlement and District Electoral Division (DED) was utilised. A land use analysis informed the location of potential receptors, whilst a study of the health and safety element of operations within the existing port contributed to an understanding of the potential risks associated with the proposed development.

Two independent economic studies have been prepared, assessing the economic contribution that SFPC make at local, regional and national level. A study undertaken in 2015 by W2 Consulting[1] examines the activities of the Port Company and wider impact of the commercial trading activity of the port. A further study was undertaken by Indecon[2] on the wider economic impacts of the Foynes to Limerick Road Improvement Scheme. Both these studies provide up to date information on the positive economic impacts arising from the proposed development.

6.3 RECEIVING ENVIRONMENT

This section provides an overview of existing demographics, health status of the area, and the location of potential receptors. It should be noted that the description of the baseline environment of those factors under which human health effects might occur has been addressed elsewhere in this EIAR, under the environmental factors of traffic and transportation, air quality and climate, noise and vibration, townscape and visual (landscape) and water quality & flood risk.

6.3.1 Demographics

An understanding of demography and population is particularly important in the context of the proposed development as it provides an indication of demand and labour supply as it will affect the proposed development and the potential of the development to impact on neighbouring residents.

6.3.1.1 Population and Households

The population of Limerick city and county experienced modest population growth of 1.6% In the five years between the 2011 and the 2016 Census, well below the national average of 3.7%. In contrast, the village of Foynes experienced a population decline of 4.2%, decreasing from a population of 542 persons in 2011 to 520 persons in 2016. The population decline in the village of Foynes is also reflected in the surrounding District Electoral Divisions (DED's) of Shanagolden and Loghill where population fell by 2% and 8.3% respectively. The population decreases in the area are likely explained by the outmigration of economically active people seeking work elsewhere in the State or overseas.

The settlement of Foynes had an average age of 40.4 in 2016 compared with 40.0 in 2011, which was a percentage change of 1.0%. 52% of the population in Foynes is over 40 years of age and this contrasts with a county average of 45%. The age factor along with the number of retirees, demonstrates an aging population in the village.

Analysis of Foynes family cycle data shows that there are 140 no. families in Foynes with 67% of those families with children. Of those families with children 80% have two children or less and 43% have children at or under adolescent stage.

[1] W2 Consulting, Shannon Foynes Port Company Economic Impact Assessment, August 2015
[2] Indecon International Economic Consultants, Assessment of Wider Economic Impacts of Foynes to Limerick Road Improvement Scheme, 2017

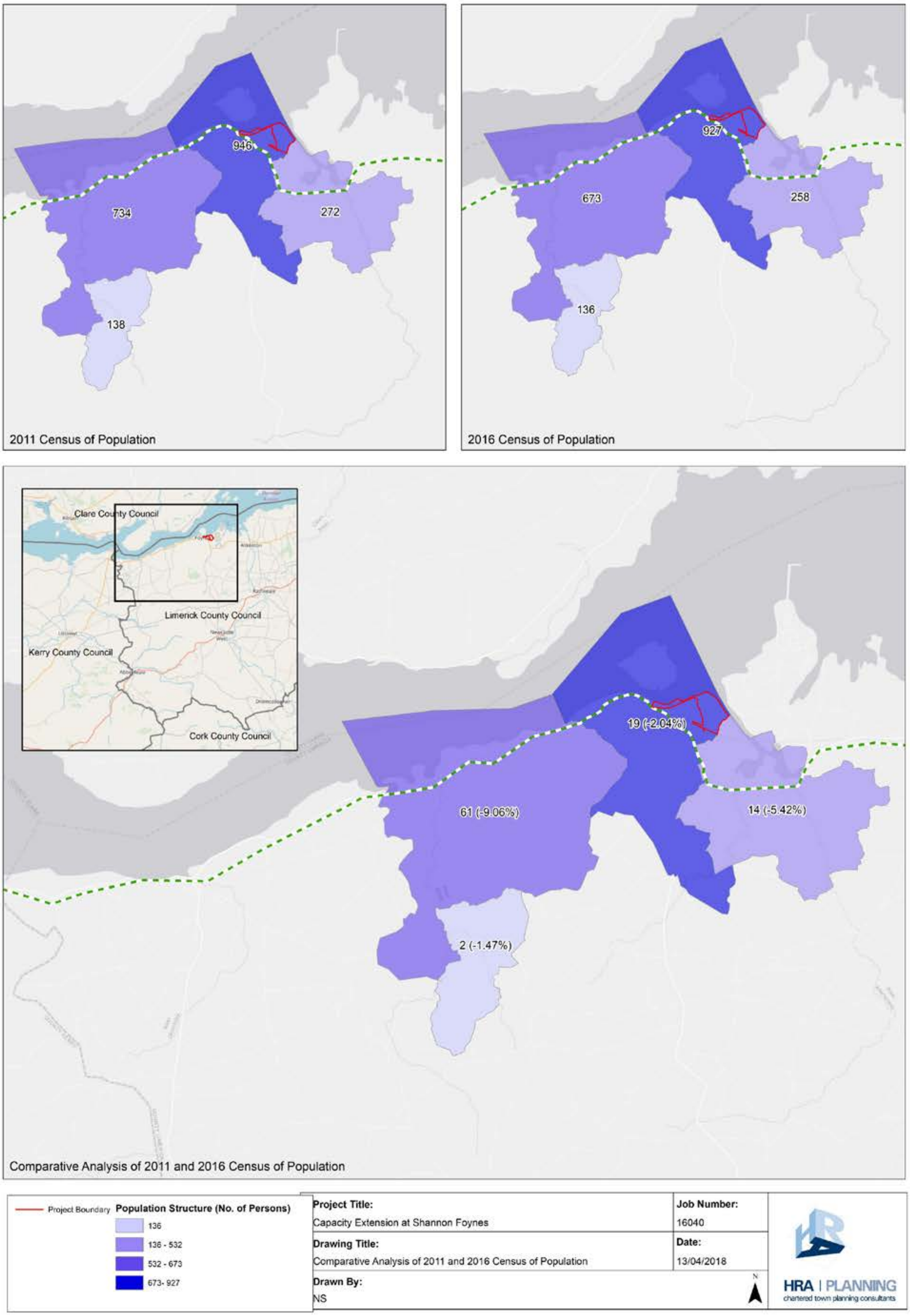


Figure 6.1 Population within the Immediate Surrounding Area

6.3.1.2 Economic Status and Travel to Work Patterns

The economic status of persons aged over 15 in 2016 provides an indication of the available workforce in the area and the overall vitality of economic life in the settlement. The proportion of people at work in Foynes (47%) is somewhat lower than the proportion for Co. Limerick (50%) and lower than the State average of 53%.

The unemployment rate in Foynes was 6% in 2016 which was lower than the county average of 8% and the States average of 7%. The lower than normal percentages of those at work and those unemployed would suggest than there must be a higher than average proportion of student or retirees in the community. The percentage of the community that is retired is significant at 22% and this contrasts to the county average of 15%. The percentage of persons that stay at home to look after family is also higher in Foynes (10%) than the county average of 8%.

Of those that do work in Foynes, a high proportion works outside the settlement. This assumption is supported by the travel to work / school / college data, which indicates that 27% of people in Foynes spend over half an hour travelling to work / school or college. This figure is higher than the county average of 25% but is lower than the national average of 31%. Overall, it highlights the need for people to travel significant distances outside of the settlement to secure work.

6.3.1.3 Housing Stock

Foynes is a small residential settlement with a limited housing stock of 236 no. units, of which 84% were occupied on census night and 12% were deemed to be vacant. The vacancy rate is significant when contrasted with the county and State average of 9%. Such a strong vacancy rate can sometimes indicate the presence of newly built housing which has not been sold (i.e. 'ghost estates'). But this does not appear to be the case in Foynes as the town did not experience any significant residential growth during the development boom years. This suggests that Foynes village does not have a strong housing market in the context of Limerick County.

6.3.1.4 Demographic Summary

In summary, there is a relatively small residential population within Foynes, with evidence of the population declining over the last inter census period. The economic structure related to those in full time employment is weak with a high rate of retirees living in the village. The majority of those that do work appear to travel outside the settlement to secure work. The residential property market in Foynes would appear to be relatively weak, with a high vacancy rate and some dereliction evident within the housing stock.

6.3.2 Health Status

There is little health information available at county level and so there is a reliance on information at national level to inform on the general health of the Limerick and Foynes area. The Department of Health's report '*Health in Ireland, Key Trends 2016*' (Department of Health, 2016) provides summary statistics on health and health care in Ireland over the past ten years.

According to the key trends, life expectancy in Ireland has increased by 2.4 years since 2005 and is now above the average for the EU. The greatest gains in life expectancy have been achieved in the older age groups reflecting decreasing mortality rates from major diseases. The proportion of life expectancy at age 65 to be lived in good health is higher for both men and women in Ireland compared with the EU-28 average.

In recent decades, Ireland has consistently recorded high rates of self-evaluated good health. Population health at the national level presents a clear picture of rapid decreases in mortality rates accompanied by a rapid rise in life expectancy during the past ten years. In the areas of self-reported chronic illness and limitations in activities, Ireland continues to compare favourably with the EU average. Mortality rates from circulatory system diseases fell by 28% between 2006 and 2015 and cancer death rates decreased by 13% over the same period. Transport accident mortality rates have fallen by 51% in the past decade, infant mortality rates by 19%, and suicide rates by 6%. For diseases of the circulatory system, mortality in Ireland was 9% below the EU average.

At county level, the creation of County Health Profiles is one of the key actions from the Healthy Ireland strategy which is our national framework for action to improve the health and wellbeing of the people of Ireland. The County Health Profile for Limerick County confirms that Limerick has a higher than national incidence of female colorectal cancer but is average or below average for all other cancers (City and County data). Limerick also has above average mortality rates for all causes and for the four major causes of death (City and County data).

The results of the Census in 2016 include information on self-reported health. The vast majority of people in Limerick county and city (86%) reported that their health was good or very good, almost 9 per cent stated that their health was fair and just 1.8 per cent reported bad or very bad health.

6.3.3 Employment & Trade

Nationally, the seasonally adjusted unemployment rate for January 2018 was 6.1%[3], down from the rate of 6.2% in December 2017. The seasonally adjusted number of persons unemployed was 143,700 in January 2018.

In January 2016 there were 236,268 people recorded on the live register nationally and in the Mid West region there were 19,643 persons recorded. Significantly there was a drop of almost 3,695 people on the live register between 2016 and 2017 which represents a reduction of almost 16%. This is above the national average of 14.5% per cent which would indicate that the region is recovering well through the provision of jobs in industry and commerce. The scale of the improvement in the labour market over the past year, in the general area surrounding the subject site, was secured from the Social Welfare Office at Newcastle West. Newcastle West was chosen as a representative office for the local catchment area due to its location in West Limerick. The Social Welfare Office at Newcastle West confirms that employment within the local catchment decreased by over 19%.

The Census of Population 2016 confirms that almost 16% of the workforce in Foynes are employed as ‘process, plant and machine operatives’. This reflects the nature of employment on offer in the locality including the Port of Foynes and Rusal – Aughinish Alumina. This is followed by the ‘skilled trades occupation’ and ‘administrative and secretarial occupations’ each comprising 13% o the workforce.

Shannon Foynes Port Company (SFPC) directly employs 20 people, while port service providers employ a further 186 no. persons in Foynes[4]. Table 6.1 presents a summary of Indecon’s estimates

[3] Monthly Unemployment Figures, 30th January 2018

of the value of trade handled and the employment supported directly and indirectly by the operations of SFPC. Based on full-year figures available for 2015, Indecon estimates the overall value of the trade handled by SFPC at €8.43 billion. Indecon have also estimated that this trade, in addition to the direct and indirect impacts of port-related activities, supports a total of 104,447 full-time equivalent jobs directly and indirectly across the Irish economy. This includes employment within SFPC and in port service providers, in addition to the employment across the Irish economy that is associated with the trade volumes moving through the port.

The contribution of SFPC to not only Foynes and the surrounding area, but also the wider regional and national economy, is significant. The nature of occupations within the workforce would suggest that local employment opportunities are dependent on industry in the area, including SFPC and the Port of Foynes.

Port trade-related impacts	**2015 Figures**
Shannon Foynes Port - Total Shannon Estuary Trade - Millions of Tonnes	11.1
Estimated Value of Trade - € Million*	€8,430.2
Estimated Direct and Indirect Employment Supported - No. of Full-Time Equivalents**	104,447
Of which:	
SFPC and Port Service Providers	537
Economy-wide Employment supported by Trade Handled by Port	103,910

Source: Indecon analysis based on data supplied by SFPC, W2 (2015) and Indecon Assessment of the Economic Impact of Exports on the Irish Economy (2015)
* Value of trade estimated based on updated mid-range estimate of value per tonne of trade estimated in W2 (2015).[6]
** Includes direct and indirect employment supported within Shannon Foynes Port Company and port service providers, in addition to direct and indirect employment within port customers which use the port to transport freight.

Table 6.1 Estimated Value of Trade and Employment Supported by SFPC Source: Table 4.3 Indecon Report pp.21

6.3.4 Land Use

6.3.4.1 Settlement Pattern

Foynes has a population of 520 people[5]. The N69 runs through the village in an east west direction, functioning as the Main Street for the village as well as a coastal route with links to / from the Wild Atlantic Way. The disused Limerick – Foynes rail line also follows this route, effectively separating port activities from the village. The Port of Foynes occupies land to the north of the existing rail line, with village development largely occurring on lands to the south, as detailed in Figure 6.2.

The settlement is dominated by the Port of Foynes and associated marine related industry, with little residential or recreational uses apparent. It is noted that the Limerick County Development Plan

[4] Indecon International Economic Consultants, Assessment of Wider Economic Impacts of Foynes to Limerick Road Improvement Scheme, 2017 pp.15 plus additional personnel (56 no.) employed by CPL
[5] Census of Population 2016

2010 – 2016 recognises that development of the port, while hugely important for the town and the region as a whole, should be carried out in as sensitive a manner as possible (Objective F4).

The area surrounding Foynes hosts a number of major industry sites and major employers. These include major multinationals as well as indigenous Irish businesses operating in the food, electronics and commodities areas. Major firms include Rusal/Aughinish Alumina, Wyeth Nutritions and Shannon Foynes Port Company.

6.3.4.2 Port of Foynes Landuse

The Port Estate comprises 64 hectares with 53.3 hectares of land in the ownership of SFPC and 10.7 hectares in third party ownership. All land within the Port is currently utilised or committed with planning consent and there is no remaining available space to accommodate development / future expansion. The Port is accessed via one of two dedicated port entrances. One via the port slip road off the N69 and the second at the western extremity of the port/village thereby ensuring that traffic travelling from and to either direction, does not go through the village.

There are two identified Seveso sites[6] within the Port of Foynes. One of these sites is operated by Inter Terminals Shannon Ltd. (formerly Irish Bulk Liquid Storage Ltd.) and the other is operated by Atlantic Fuel Supply Company Ltd. Both sites have a consultation distances of 300m and 400m respectively, meaning that the Health and Safety Authority will be consulted in respect to new proposals to ensure compliance with the Major Accidents Directive and to ensure good practise risk minimisation. A detailed Seveso Report has been prepared by RPS to accompany the planning application.

[6] A Seveso site is an industrial premise that has notified the Health and Safety Authority (HSA) that it meets a specific threshold for quantities of hazardous substances as outlined in the EC (Control of Major Accident Hazards Involving Dangerous Substances) Regulations. These Regulations give effect to Council Directives 96/82/EC and 2003/105/EC, which aim to limit the consequences for human beings and the environment of major accidents involving dangerous substances.

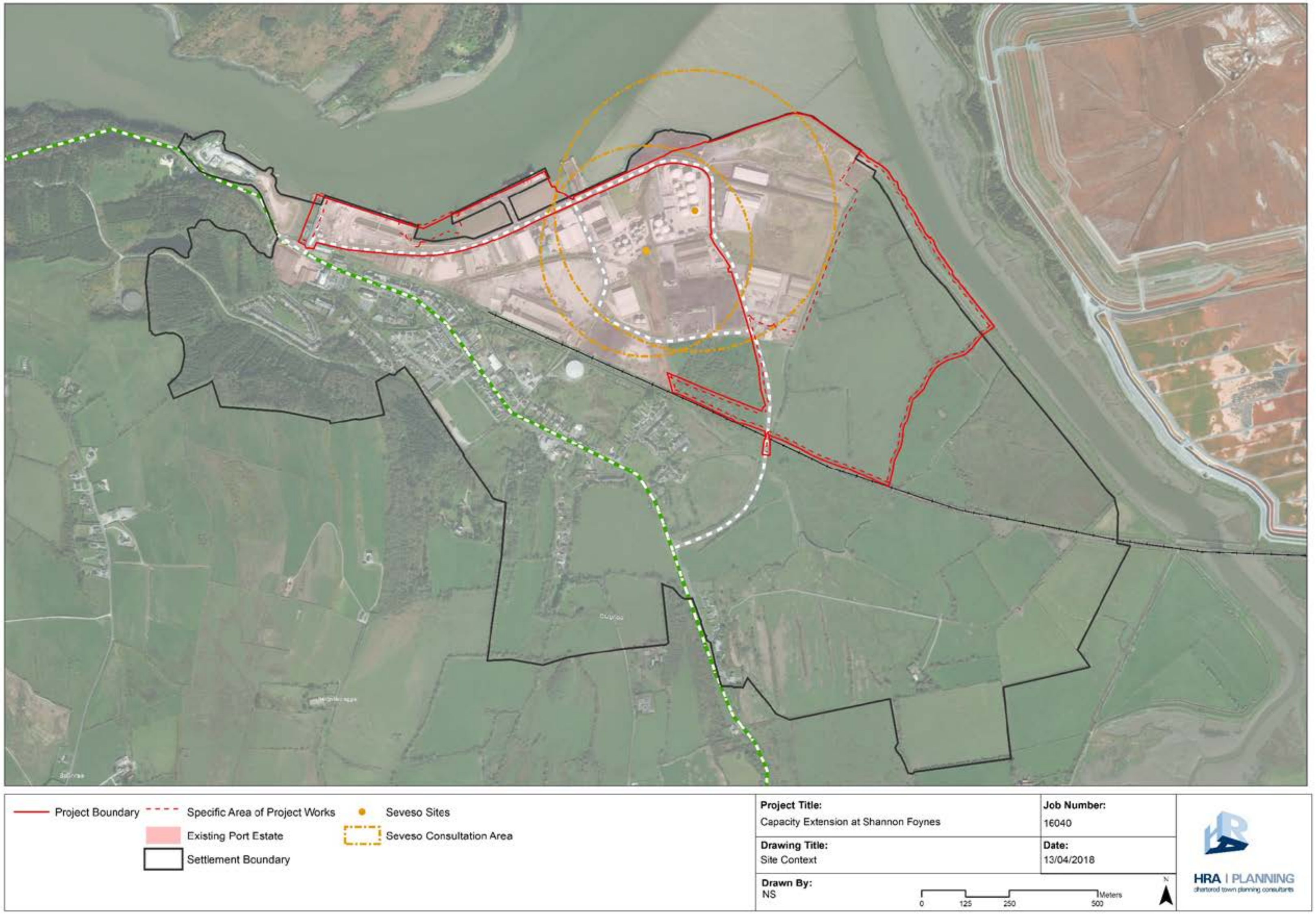


Figure 6.2 Port of Foynes – landuse & context

6.3.4.3 Potential Receptors

Key potential receptors, to be assessed in this chapter, are identified in Figure 6.3 including residential development at Dernish Avenue, future identified residential development off Corgrigg Wood Road, community development and tourist facilities such as the Flying Boat Museum.

<u>Residential Receptors</u>

The majority of the population as expressed within the settlement of Foynes and the surrounding DED's reside proximate to existing port operations, separated by the existing rail line. The closest residential development to the site is located 230m south west of the Durnish lands within the residential development of Dernish Avenue. These houses are the closest as they are set well back from the N69 in the direction of the Port. There are a significant number of other one off houses, infill and streetscape developments all within the settlement of Foynes and proximate to existing and future Port operations. Outside of the settlement and within 500m east of the existing port access road, there are a further 5 no. one off houses fronting onto the N69. There are two residential properties located on Foynes Island.

There is limited zoned residential land in the village of Foynes save for one plot of 3.5 hectares located between the N69 and Corgrigg Wood Road. Assuming an average density of 22 units per hectare[7] this land has the potential to generate an additional 77 residential units in proximity to the Port.

The N69 National Secondary Route, notwithstanding planning restrictions limiting direct access, has a number of one off houses, proximate to and fronting onto the road.

<u>Commercial Receptors</u>

There is a limited number of commercial service companies located within Foynes. Mainly comprising of small convenience shops, public houses, restaurants, petrol filling stations and a motor factor outlet, all of these services are located on the Main Street. A significant tourist attraction, namely the Flying Boat Museum is located at the western end of the village.

The closest existing industry to the Port lands is that if Rusal – Aughinish Alumina which employs 450 people, located on a significant site to the east of the Port.

Whilst the Limerick County Development Plan affords mixed use zoning along the Main Street of Foynes, the only other economic zoning in the settlement is that of Marine Related Industry. Objective ED06 states that, *"land zoned for Marine Related Industry, shall provide for marine related industry and large scale uses that create a synergy with the marine use. Marine related industry shall be taken to include the use of land for industry that, by its nature, requires a location adjacent to estuarine/deep water including a dependency on marine transport, transhipment, bulk cargo or where the industrial process benefit from a location adjacent to the marine area".* Furthermore, it is an objective of the Council, Objective ED04, to safeguard the Strategic Development Locations at Foynes Port, Foynes Island and Aughinish Island for the sustainable growth and development of marine related industry.

[7] Limerick County Development Plan 2010 – 2016, as extended - Densities as set out in core strategy

The primary commercial activities located within the Shannon Estuary are directly Port related activities and fishing. SFPC confirms that 875 commercial ships entered the Estuary in 2017. There is also a range of commercial fishing activity in and near the Estuary. There are approximately 8 licensed local boats which work mainly pots (crab, lobster and shrimp) gillnets, and tanglenets. Shrimp fishing takes place within the Estuary during the late Autumn and Winter months. Consultation with BIM Regional Fisheries Development officers whose operational area includes the Port of Foynes area, confirmed that there are no licensed commercial fishing activities in the immediate vicinity of the proposed development. The Estuary is recognised as being an important area for the commercial aquaculture, and the current licensed operations are focused on the cultivation of shellfish. The majority of oyster cultivation are focused on areas in/near Rinevella, Carrigaholt, Poulnasherry Bay, Ballylongford Bay, Bunnaclugga Bay and near Aughinish Island. Chapter 7.0, Flora & Fauna and Biodiversity of this EIAR provides a more detailed description of fishing activities within the harbour.

A number of indirect economic receptors have also been identified to include suppliers of construction materials required to complete the proposed development. It is not possible to identify these suppliers at planning stage as use of these suppliers will be dependent on detailed construction drawings and requirements. There are proposals to fill the land to +4.44mOD necessitating the importation of substantial volumes of quarry fill. This fill will be sourced from a network of local quarries, as detailed in Chapter 2.0, with direct positive economic impacts.

Tourism & Recreation Receptors

The Shannon Estuary provides for a number of marine based leisure activities including fishing, sailing, rowing, angling, bird watching and swimming, which support the tourism industry in the area. Marine based leisure activities are also widely used by residents of the County. Foynes Yacht Club located at Cooleen Point has over 130 members, providing pontoon berths and swinging moorings.

SFPC promotes the Shannon Estuary as a Cruise Gateway and provides support and assistance in the development of call schedules and programmes to cruise liners, as well as operational execution while in port. While cruise liners do call occasionally to the Port of Foynes, the numbers have been modest and are at the smaller end of the cruise vessel size range – less than 1,000 passengers.

Marine tourism is also noted on the Estuary with the only known resident group of bottlenose dolphins in Ireland, making them a unique tourism product. Currently, several vessels operate wildlife watching trips to see the dolphins, to inform tourists of the conservation and protection of these and other marine species. The Shannon Car Ferry provides an important tourism connection between the N69 and N67 across the Estuary between Tarbert in Co. Kerry and Killimer in Co. Kerry.

The Flying Boat and Maritime Museum in Foynes village attracts significant visitors throughout the year. In association with the community it also hosts the Foynes Irish Coffee Festival every Summer and the annual Foynes Air Show.

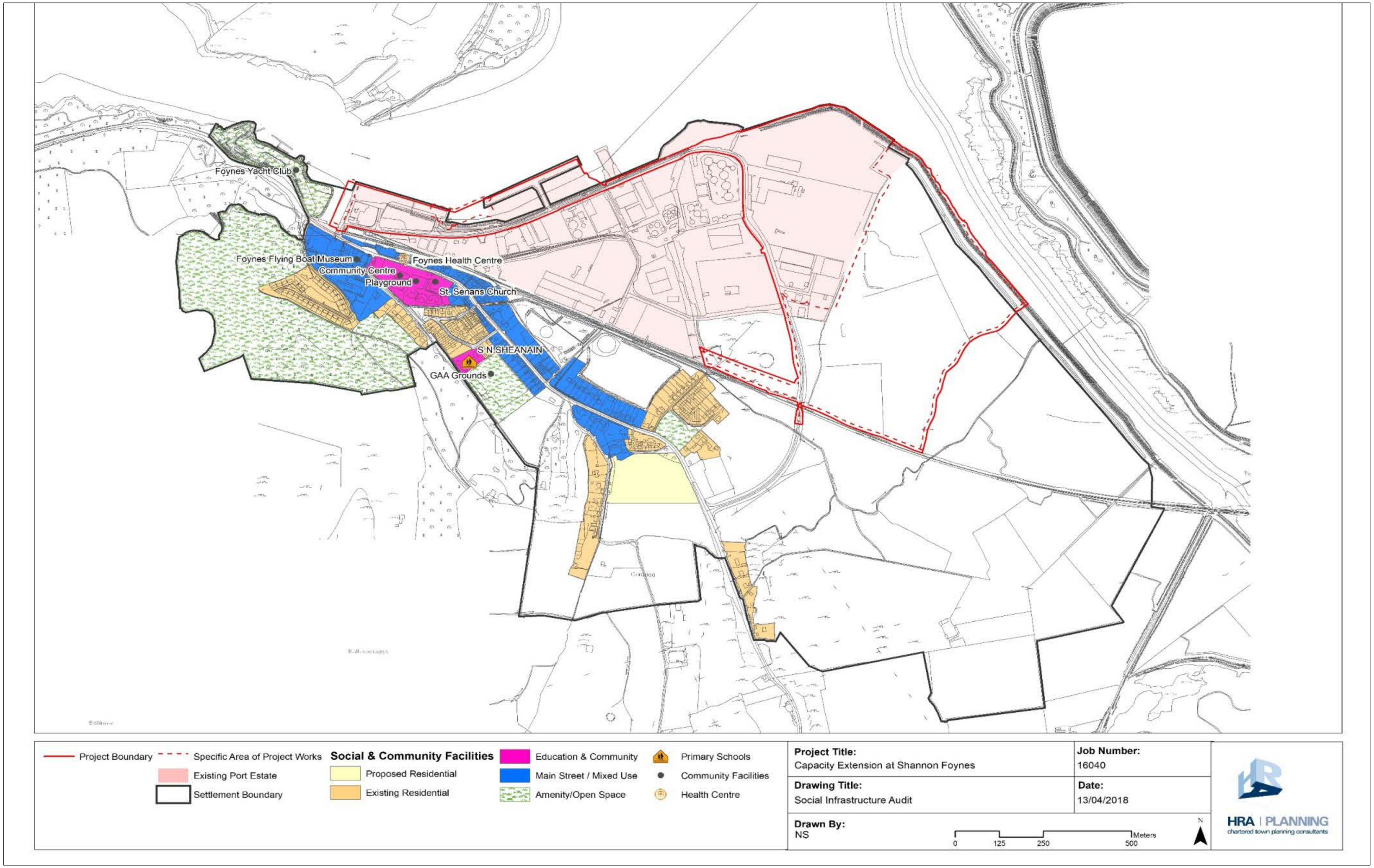


Figure 6.2 Port of Foynes – Situation & Context as per Landuse Zoning

Social and Community Facilities

St. Senan's National School, located in Woodvale in the centre of the village, is a mixed school with an enrolment of 93 no. students. There is no secondary school in the village. Colaiste Mhuire in Askeaton is the closest secondary school, located 11km to the east the village. There are no registered childcare facilities in the village or immediate surrounding area.

Other social and community facilities in the area include the GAA grounds located to the rear of the school, the Community Centre located off the Main Street and community playground and the local Catholic Church There is significant land identified in the County Development Plan and zoned for amenity / open space provision to the west of the village, along the shorefront between the Port and Foynes Yacht Club and on elevated land to the rear of Marine Cove residential development. These lands although identified for recreational purposes, have not yet been developed.

Future Receptors

To identify potential future receptors a review was undertaken of permitted development in Foynes and its environs over the last five years (including extension of duration of previous permissions). The details of this research are included in Appendix 6.1.

6.3.5 Health & Safety

SFPC operates and maintains quality management systems to comply with internationally recognised standards OHSAS 18001 & ISO9001. Successful maintenance of international standards enables the organisation to maintain a level of control over, and knowledge of, relevant hazards resulting from normal operations and abnormal situations with an overall objective to improving performance and preventing accidents and/or incidents in the workplace

SFPC and the Port of Foynes operates to the International Ship and Port Facility Security Code (ISPS Code), which provides a comprehensive set of measures to enhance the security of ships and port facilities. Strict security procedures are already in place on site to deal with all access on a 24 hour basis. These procedures require all vehicles and personnel visiting the site to be logged and will continue in place once construction commences and has been completed.

The company currently holds NASI Certification for Quality (ISO 9001: 2008) and for Occupational Health & Safety Management (OHSAS 18001:2007) relating to the provision of a safe haven for shipping in the Shannon Estuary by traffic management within the port limits, the maintenance and development of terminal and shore-side facilities and the operation of cargo handling and logistic services. The activities, products and services of the port authority have a Certificate of Verification and is ECOPORTS Pers Certified.

In addition to the Health & Safety Statement there are other additional procedures in place, which combine to ensure that the business operation is and will be conducted in accordance with best practice and relevant legislation, including:

- Environmental Policy Procedures
- Corporate Social Responsibility
- Quality Customer Service
- Emergency Response Procedure
- Training Procedure

6.4 LIKELIHOOD OF IMPACTS

This section provides an assessment of all of the potential and predicted impacts of the proposed development on population and human health. As outlined in Section 6.1, in accordance with the draft EPA guidelines, the assessment of impacts on population and human health refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in this EIAR.

A number of the likely impacts have already been 'designed out' of the development proposal. These measures have been dealt with comprehensively in respective chapters including Chapter 15.0 The Landscape; Chapter 11.0 Noise & Vibration; Chapter 9.0 Water Quality & Flood Risk; Chapter 7.0 Flora, Fauna & Biodiversity; and Chapter 13.0 Material Assets: Roads & Traffic.

A 10 year permission is sought to deliver Phase 1 of the capacity extension works at Foynes. Phase 1 is likely to comprise a number of sub phases as detailed in Chapter 2.0 of this EIAR primarily relating to the filling of land and the delivery of on-site infrastructure to accommodate future phases of development. It is of course, also possible that Phase I could be delivered without sub phasing, subject to the specific requirements of one client / operator. The phased delivery of Phase 1 is not likely to result in isolated impacts on population and human health and so consideration is given to the delivery of Phase 1 in its entirety.

In order to ensure an effective and conclusive environmental assessment consistent with best practise, the assessment of potential effects on the environment also examines the collective cumulative effects of the overall development scheme for the Durnish lands if all three development phases, as detailed in Chapter 2.0, were implemented. The examination of the 'all phase' development scenario for Durnish is consistent with best practice in order to examine a 'worst-case' scenario of the project effects. Examination of this 'worst-case' scenario is based on the likely effects of the proposed development and proposed uses as part of Phase 1, and, the anticipated landuses that will occur from subsequent Phase 2 and Phase 3 based on the information known and available at this time in respect to those subsequent phases.

6.4.1 'Do-Nothing' Scenario

The consequence of a 'Do Nothing' scenario would be that the Port of Foynes would continue to operate from its existing location, handling freight and cargo on a commercial basis. In the short term Port activities at existing locations would intensify to respond to economic demands, within the parameters of existing relevant Harbour Works Orders and planning permissions. This intensification of activity would result in a growth in throughput of all trades and a consequential increase in traffic flows, albeit at a lower trajectory than could be facilitated by the proposed development.

While in the short term some intensification and economic growth would be achievable in the 'Do Nothing' scenario, there would be significant long term and wide reaching negative impacts related to competitiveness; regional economic growth; sustainable transport patterns (discussed in Chapter 13.0); and strategic spatial development objectives (discussed in Chapter 3.0).

6.4.2 Construction Impacts

Potential construction impacts arise from a range of issues discussed elsewhere in this EIAR: Traffic & Transportation (Chapter 13.0); Noise and Vibration (Chapter 11.0); Air Quality and Climate (Chapter 10.0); and Flora, Fauna & Biodiversity (Chapter 7.0). Construction impacts are generally temporary in nature.

Potential impacts on economic activity not discussed elsewhere relate to the direct employment of construction workers and indirect economic activity generated by the construction process. The proposed development will sustain and support indirect employment within local quarry operations who will provide the quarry material to fill the land. These quarry operators have the benefit of planning permission having gone through a separate consent process in their own right.

Potential impacts could occur as a result of inadequate site management or accidental spillage during construction, which would reach the waters of the Shannon Estuary and potentially affect recreational and commercial activities on the Estuary. However, the likelihood of this happening is low given the design measures introduced as part of the development and detail included in the Construction Environment Management Plan prepared in support of the development.

The visual landscape will change once construction commences and it will take time for the proposed landscaping treatment within the buffer zones to mature. These impacts are likely to be temporary and short term in nature.

6.4.3 Operational Impacts

Potential operational impacts arise from a range of issues discussed elsewhere in this EIAR including Landscape & Visual (Chapter 15.0); Traffic & Transportation (Chapter 13.0); Noise & Vibration (Chapter 11.0); and Air Quality & Climate (Chapter 10.0).

The proposed development is likely to have direct employment impacts with the operation of Phase 1 and the future operation of Phase 2 and Phase 3. An increase in employment in the area will have positive, long term impacts resulting in positive benefits to the surrounding community and will result in an indirect positive impact on services and facilities.

The proposed development will likely result in an increase in tonnage and shipping movements in the Estuary with larger and more frequent ships to and from the port. This could have an impact on the recreational benefits of the Estuary and other commercial operations on the waters.

Whilst the visual appearance of the existing Port is not likely to change substantially as a result of the proposed jetty extension, the appearance of the Durnish lands will substantially change, from that of a greenfield site to an industrial / commercial site effectively linked to the existing Port. The physical and perceptual dominance of the Port within the settlement of Foynes will increase.

The impact of the development on traffic & transportation is likely to be significant with a direct correlation between tonnage throughout and traffic volumes. The worst-case scenario will ultimately be dependent on the occupiers and users of the Phase 2 and 3 lands, which will be subject to a separate and independent consent process. Whilst the potential future use of the rail line has been accommodated within the development proposal, the actual use of the rail line and associated impacts thereon will be triggered by a specific user and product type, sometime in the future and which are currently unknown. Although such potential use has not been identified at this stage in the development process, the potential for rail use can / will be evaluated as future uses independently advance through the development consent process.

6.4.4 Cumulative Impacts

A planning history review was undertaken to identify any recently approved or pending developments which may have a cumulative impact with the proposed development. These developments are mapped and listed in Appendix 6.1. The significant developments in terms of impacts on population and human health are noted and assessed below.

Planning consent was granted to SFPC to undertake reclamation at the East Jetty in Foynes (PL Ref: 12/212 extend under PL Ref: 17/7019). Phase I of these works have been completed but it is likely that Phase II works will commence at the same time as the proposed development employing up to 15 no. people during construction but with no additional personnel employed during operations.

Planning consent granted to Bord na Mona for a smokeless and biomass based solid fuel manufacturing and packaging facility (PL Ref: 15/468). This permission is located within the grounds of the existing Port of Foynes. This development has not yet been constructed and is stated to potentially employ 140 no. people during construction. An additional 46 no. people will be employed during its operation[8]. It is possible that this development may advance on site at the same time as the proposed development.

Other significant industrial developments have been granted to RUSAL Aughinish Alumina in recent times as detailed in Appendix 6.1 but these are not likely to result in cumulative impacts having regard to their location removed from the Port estate and the settlement of Foynes. Furthermore, the applications primarily relate to operational improvements rather than the expansion of operations on site.

Other small-scale developments, including the expansion of existing commercial operations in the village, the change of use of applications from commercial to residential and the construction of new one-off houses within and outside of the settlement, further consolidate the function and position of Foynes as an employment hub.

6.5 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

6.5.1 Human Health

6.5.1.1 Do Nothing Scenario

In a ‘Do Nothing’ scenario there may be some intensification of existing permitted activities within the existing Port of Foynes. Any intensification of activities will be controlled by the port’s existing health and safety procedures and regulated by existing standards within relevant consents and authorisations.

[8] Sourced from Environmental Impact Statement prepared in support of development proposal

6.5.1.2 Construction Phase

The proposed development is predominantly industrial in character and it is considered that the greatest health and safety risks[9] will be posed during the construction phase of the proposed development. As with any construction site, there will be potential risks to the health and safety in terms of injury or death of construction personnel on-site due to the usage of large, mobile machinery as well as heavy equipment and materials. These issues along with integrated design and procedural measures to limit risks are dealt with in detail later in this chapter under Section 6.5.6 Health & Safety.

6.5.1.3 Operational Phase

Human health may be impacted in a variety of ways and by several environmental receptors including water, biodiversity, climate, flooding, air and major accidents. Exposure to contaminants or pollutants can have serious implications for human health. Potential impacts on pollution and human health include inadequate water and wastewater infrastructure, contamination of soils, excessive noise, flooding, poor air quality in areas where there are large volumes of traffic and the health impacts associated with storage of materials, although it should be noted that the proposed development does not propose any hazardous materials on site.

These issues are addressed within the relevant discipline of the EIAR as summarised in Table 6.3.

[9] A risk is defined by the HSA as 'the likelihood that a person may be harmed or suffers adverse health impacts if exposed to a hazard.' Source: http://www.hsa.ie/eng/Topics/Hazards/

Environmental Factor	Relevant Chapter	Predicted Impacts	Human Health Risk	Proposed Mitigation
Population & Human Health	Chapter 6.0 Population & Human Health	Construction & Operational Risks associated with personnel and equipment	Accident at work during construction and / or operation	Compliance with Health & Safety at Work Regulations
Biodiversity	Chapter 7.0 Flora, Fauna & Biodiversity	None	None	None
Soils & Geology	Chapter 8.0 Land & Soils and Waste	Potential pollutant linkages Contamination of Lands Change to water supply to springs and wells and river baseflow.	Risk to construction workers from contaminants during the earthworks	Clean fill material will be imported to raise site levels.
Water Quality	Chapter 9.0 Water Quality & Flood Risk	Pollution of surface waters and drinking waters	Surface water run off pollution Pollution from oils, chemicals and contaminants Foul water pollution	Implementation of Environmental Management Plan Provision of oil interceptors and sediment traps Adequate bunding and regular inspection of facilities
Flooding	Chapter 9.0 Water Quality & Flood Risk	Potential for increased flooding with risk to life	Uncertainty of existing defence system (embankments) could give rise to risk of flooding	Filling of lands to 4.44mOD thereby lifting the site from Flood Zone A to Flood Zone C Setting finished floor levels at a minimum of 4.74m OD Malin
Dust	Chapter 10. Air & Climate	According to the EPA report 'Air Quality in Ireland 2015' (EPA, 2016), air pollution is the single largest environmental health risk in Europe. The road traffic from the proposed development on top of the background levels are not predicted to breach the air quality limits and/or WHO guidelines.	Increased dust emission during construction and operation	Construction compound is located away from southern site boundary which is in proximity to housing. Dust Minimisation 7 Control Plan currently operated by SFPC to be supplemented with additional measures
Noise	Chapter 11.0 Noise & Vibration	According to the 2015 European Commission report 'Noise Impacts on Health' (European Commission, 2015), the most common effects of noise on the vulnerable identified include annoyance, sleep disturbance, heart and circulation problems and quality of life	Increase in noise levels	Construction of a noise barrier along southern and parts of the western site boundary

Discipline	Relevant Chapter	Predicted Impacts	Human Health Risk	Proposed Mitigation
Tidal Flows & Coastal Processes	Chapter 12.0 Material Assets – Coastal Processes	Altering of tidal flows and possibility of increased erosion	None	None
Traffic & Transport	Chapter 13.0 Material Assets – Roads & Traffic	Traffic-related air pollution, noise, crashes and social effects combine to generate a wide range of negative health consequences	None	None
Archaeology & Cultural Heritage	Chapter 14.0 Archaeology & Cultural Heritage	None	None	None
Landscape & Visual	Chapter 15.0 The Landscape	None	None	None

Table 6.3 Summary of Risks to Human Health – refer to individual chapters for detailed assessment

6.5.2 Economic Activity

6.5.2.1 Do Nothing Scenario

Maintaining competitiveness and preventing loss of trade to other ports in Ireland and Europe are significant drivers of the proposed development. Supporting the expansion and future development of SFPC and the Port of Foynes is heavily supported by international, national, regional and local policy, as detailed in Chapter 3.0

A failure to expand the Port now would compromise future expansion plans within the Port as set out in Vision 2041 and would stymie medium and long term projected growth. Overall, if this and future projects do not proceed, the Indecon Report[10] estimates that under a mid-growth scenario, a failure to develop the Port would result in an estimated loss of trade from the Port of Foynes of up to 1.3 million tonnes annually, or 37% relative to projected port traffic in 2041. This potential loss in future trade would be equivalent to €5.5 billion in present value terms when the annual losses are cumulated over a 20-year period.

6.5.2.2 Construction Impacts

The proposed jetty connection has an envisaged construction period of 12 months and it is assumed that an average 15 no. personnel will be employed for the full duration of the jetty construction works.

Expansion of the port facility to the Durnish lands (Phase 1) is likely to occur over three sub phases 1a – 1c.

- Development of Phase 1a lands including site preparation, provision of infrastructure and construction of warehouse units and storage facilities is likely to have a construction period of 18 months and will employ an average of 10 no. people during the entire construction period, with between 6 no. and 20 no. people on site at any one time.
- Development of Phase1b & 1c lands will occur subsequent to Phase 1a and each other and will include infilling the lands with imported material and provision of stormwater drainage. The construction period is envisaged to be 17 months for Phase 1b and 19 months for Phase 1c and will result in the employment of 6 no. people over the construction period.

The total potential for employment during construction will range from a minimum 21 no. people to 35 no. people across both the jetty construction works and the port expansion at the Durnish lands over a 39 month construction period.

As well as providing direct employment, albeit on a temporary long-term basis, the proposed development will result in increased revenue for the services sector, as a result of spending by construction workers within the settlement of Foynes. It will also result in further indirect benefits to the construction industry in terms of materials and supplies during construction and which is likely to impact further afield, including local quarries engaged to supply fill for the land. The

[10] Indecon International Economic Consultants, Assessment of Wider Economic Impacts of Foynes to Limerick Road Improvement Scheme, 2017 pp.28

proposed development is likely to have a significant multiplier resulting in increased economic benefits to the wider Limerick area.

The proposed development will therefore have a moderate, positive, medium-term impact on direct and indirect construction employment; construction suppliers and associated economic activity.

The likely construction impacts arising from the development and use of Phase 2 and Phase 3 lands are unknown at this stage and are likely to be assessed in the future when a separate consent process is undertaken for their the exact use.

6.5.2.3 Operational Impacts

The proposed jetty extension and expansion of port facilities into the Durnish lands (Phase 1) are interdependent and must be holistically considered in terms of future employment opportunities.

SFPC directly employs 20 people within the Port of Foynes, while port service providers currently employ a further 166 persons in Foynes[11]. As port trades grows there will be a related growth in employment linked to the port's activities. Although actual employment figures will be dependent on each specific end user, based on current employment trends within the Port of Foynes[12] it is estimated that Phase 1 of the proposed development is likely to result in additional employment for 48 no. people. Total employment within the Port of Foynes is likely to be in the region of 214 persons once Phase 1 is completed and operational.

Although the future operators for Phase 2 and Phase 3 lands are unknown at this stage, an estimate of likely future employment can be made based on current employment trends within the Port of Foynes. It is anticipated that the employment figure of 48 no. persons for Phase 1 will increase to 120 no. people once Phase 2 and Phase 3 lands become operational, thereby increasing overall employment within the Port of Foynes to 306 no. persons.

The operational phase of the proposed redevelopment (Phase 1) is therefore considered to have a slight, positive, medium term impact on direct port related employment; growing to a moderate positive long-term impact as trade activity grows and Phase 2 and 3 become operational.

In terms of indirect economic activity, the proposed redevelopment is essential to support the growth of the local and regional economy. Economic development policy (as detailed in Chapter 3.0) emphasises that the provision of excellent port infrastructure is essential to develop and maintain economic growth and national competitiveness.

Whilst there is no economic impact study specifically relating to the Port of Foynes, an economic impact assessment on the wider SFPC operations was undertaken based on 2014 expenditure figures. This Economic Impact Assessment[13] evaluates the indirect contribution of SFPC's activities as a whole on the regional economy and whilst not specifically relating to the Port of Foynes, it must be remembered that the Port of Foynes is SFPC's largest terminal on the Estuary. As detailed in Table 6.2 below, a total of 289 FTEs are supported as a result of all port activity resulting in an overall

[11] Indecon International Economic Consultants, Assessment of Wider Economic Impacts of Foynes to Limerick Road Improvement Scheme, 2017 pp.15 plus additional employment offered by CPL
[12] 186 no. people are employed across a site measuring 64 hectares
[13] Economic Impact Assessment – Shannon Foynes Port Company, 2015 pp.28

employment impact of 534 FTE's. The downstream value of SFPC and service providers is further demonstrated by the €94 million impact as a result of operational expenditures of €51.1 million. This includes indirect expenditure of €29.1 million in addition to €14.3 million of induced expenditure in the economy as a result of the trading activities of SFPC and service providers.

	Expenditure Impact (€ millions)	Employment Impact (FTE's)
Direct Expenditure	€51.1	289
Indirect Expenditure	€29.1	150
Induced Expenditure	€14.3	95
Overall Expenditure Impact	€94.4	534

Table 6.2 Economic Impact of SFPC & Service Providers Operational Expenditures 2014 Source: Table 10: W2 Consulting Economic Impact Assessment pp.29

The indirect regional economic impact of all SFPC activities and associated services providers is significant at €94.4m. Based on such data, it is anticipated that the regional impact of the proposed development and the Port of Foynes, as the main deepwater facility on the Estuary, is likely to be significant.

Foynes village is designated as a Tier 3 Centre on a Transport Corridor in the Limerick County Development Plan. These centres are promoted as secondary development centres for significant future development and have an important regional employment function within their surrounding catchment areas. The County Development Plan identified limited growth within the village of Foynes between 2006 and 2022 and predicted that an additional 54 no. housing units would be required to facilitate population growth. However, population within the village has actually fallen. Analysis of the existing demographics has indicated that there is a relatively small existing residential population in Foynes (520 persons) and that the housing market is relatively weak, with a high vacancy rate and some dereliction evident within the existing stock.

The proposed development (Phase 1) is likely to result in an additional 48 no. people working in the village, increasing to 120 no. people working within the Port of Foynes when Phase 2 & 3 become operational. This is a relatively small number of employees and it is considered unlikely that all will live within the village, or surrounding settlements, as commuting times from Limerick City to Foynes are relatively short (20 to 30 minutes). It is anticipated, therefore, that the proposed development will have no significant impact on population change within Foynes village or surrounding settlements.

Consequently, the operational phase will have a significant, positive, permanent impact on the economic activity of the region.

6.5.3 Landuse

The existing and proposed development is on lands currently zoned as 'marine related industry' within the Limerick County Development Plan 2010 – 2016 as extended. It is the objective (ED 07a) of the Council to ensure that the marine related industrial zoned land in Foynes is safeguarded for the accommodation of port related uses and other industrial activities. The existing uses on the lands consist of current port and port related activities; access roads; and associated infrastructure. There are no known way-leaves or rights of way within the proposed expansion lands at Durnish or within the jetty extension area.

6.5.3.1 Do Nothing Scenario

Section 3.4 of the County Development Plan recognises that the Port of Foynes will play an important role in the future development of the County and the region as a whole. The County Development Plan, Objective ED 07b) seeks to support the expansion of the Port at Foynes and promote the economic and industrial development of the Shannon Estuary as a strategic transport, energy and logistics hub serving the County and wider region.

The 'Do Nothing' scenario would, result in stifling the strategic spatial development objectives for the county and the region. The 'Do Nothing' scenario would therefore result in a significant, negative, long-term impact on land use.

6.5.3.2 Construction Impacts

Construction access to the site will be via the existing port access road with a new roundabout provided to access the Durnish lands. There will be no change to existing land use to accommodate construction access with no resultant impact on land use.

The construction site for the jetty extension works will occur within an already modified, industrial setting and will have no resultant impact on land use.

The construction site establishment within the Durnish lands expansion area will include site office; secure compound for storage of materials and plant; temporary vehicle parking area; and storage for excavated materials, prior to off-site disposal. It will be located on land currently undeveloped and used as temporary open storage, with no existing way-leave; right of way or amenity use. The construction site establishment will therefore have a moderate, neutral short-term impact on land use.

6.5.3.3 Operational Impacts

The operational phase of the proposed development will incorporate intensification of the existing port area and an extension of Port activities to the east, into existing greenfield land.

The jetty extension works will result in a change to the physical structure of the area. While there is a physical change, the use of the area will remain 'port operations'. New mobile cranes will be read with existing cranes. The predicted magnitude of change in landuse is small and it is assessed that there is a significant neutral permanent impact in relation to 'land' use.

The extension of port facilities to the east will result in a long term change of land use, from the existing undeveloped greenfield land, to active port related use. Delivery of the proposed development (Phase 1) will occur over three sub phases such that it is only Phase 1 land that will become operational. Phase 2 and Phase 3 land, although benefitting from site infrastructure works, including the filling of land, will not accommodate an immediate user. Phase 2 and Phase 3 land will remain as serviced port land, shovel ready to accommodate new port users, subject to a separate consent process.

In relation to the zoning provision of the land and the objective within the County Development Plan to accommodate marine related uses, the proposed development provides for a more intensive and appropriate land use and is therefore a moderate positive long term impact.

From a perceptual and visual impact, the significance of a change in landuse will be major to substantial negative without mitigation and this potential impact is dealt with in Chapter 15.0 Landscape & Visual. There are limited dwellings in the immediate proximity of the proposal given its location within an existing industrial setting but for the nearest properties at Dernish Avenue and along the N69. In relation to these closest receptors, no significant visual effects have been predicted due to the limited visibility of the proposed development in conjunction with retention of existing hedgerows and significant buffer landscape planting. At locations further from the proposed development the low-lying nature of the site of the proposed development, intervening features, separation distances and orientation of distance combine to ensure there are no residential dwellings that are significantly affected.

6.5.4 Social & Recreational

Social considerations relate to whether the development will change patterns and types of activity and land use. In this context it is necessary to consider potential impacts on recreation and amenity; and on non-commercial activities that may be affected by the proposed redevelopment. Potential social and community receptors have been identified as being: residential population; schools; community facilities; churches and cemeteries; land zoned for recreation or amenity uses.

6.5.4.1 Do Nothing Scenario

In a ‘Do Nothing’ scenario there will be some intensification of existing permitted activities within the boundary of the site. However, it is considered that any intensification of existing activities would have no impacts on social considerations.

6.5.4.2 Construction Impacts

Potential construction impacts relating to traffic; noise & vibration; and dust are assessed in chapters 13.0, 10.0 and 11.0 respectively.

6.5.4.3 Operational Impacts

The movement of ships within the Estuary and the frequency of ships is not likely to substantially increase. The annual average number of vessels calling to the Port of Foynes in the last five years equates to a weekly average of six vessels per week. The proposed development may not necessarily result in an increase in the number of ships on the Estuary but it may result in a larger number of ships carrying greater tonnage. Thus, whilst the proposed development will result in increased tonnage, the number of ships may not grow. Based on a simple calculation of average ships calling to Foynes port and projected tonnage growth, it is projected that the number of vessels may increase to seven vessels per week. The increase is likely to have a negligible impact on existing activities in the Estuary including existing recreational and other commercial activities, including fishing.

The projected new employment arising from the proposed development is not likely to result in significant additional pressures on existing facilities and services in the settlement of Foynes.

Tourism is a significant sector and employer in the wider Mid-West region. However, the sector is relatively underdeveloped in West Limerick compared to other coastal locations, due to poor access coupled with the impacts of the major draw of tourism centres in Kerry and in Clare. The proposed development involves the Port extending in an eastern direction away from the village with all port traffic arriving from the east, north and south using the Port access road, located well removed from the village centre. The proposed development is therefore unlikely to directly impact on the tourism potential of Foynes, or the immediate surrounding area.

The proposed development will further support and justify the need for delivery of the Limerick - Foynes Road Improvement Scheme. This scheme, once developed, will enhance access to the Port and the surrounding area thereby significantly improving access to areas with significant tourism potential and indirectly enhancing tourism in the area.

The proposed development is therefore likely to have a neutral long-term impact on recreation and social activities and services in the area.

6.5.5 Transportation

6.5.6 Do Nothing Scenario

In a 'Do Nothing' scenario there may be some intensification of existing permitted activities within the boundary of the site resulting in increased tonnage and associated road and sea traffic flows. As the capacity to increase tonnage within the existing Port is low, growth in tonnage and associated increase in road and sea traffic movements is likely to be minimal. The 'Do Nothing' Scenario will therefore have a negligible, neutral permanent impact on traffic & transportation.

6.5.7 Construction Impacts

An increase in traffic volumes to and from the development is likely during the construction period and this is comprehensively dealt with in Chapter 13.0 Traffic & Transportation. It is proposed that construction traffic will enter the site by means of the Port access road, east of the village of Foynes. Use of this access will ensure that traffic continues to be diverted away from the Main Street and village centre, thereby ensuring a neutral impact on the residents living within the village. Those residents living east of the Port access road, off the N69, will experience an increase in the level of traffic to and from the port during construction. Having regard to findings of Chapter 13.0 and confirmation of existing capacity in the road network to accommodate the proposed development, there is likely to be a moderate, temporary impact on traffic and transportation.

6.5.7.1 Operational Impacts

The proposed development will give rise to an increase in road and sea freight traffic. Chapter 13.0 considers traffic volumes to and from the site in detail and concludes that there will be no significant impact on the highway network.

The proposed development does not envisage use of the existing rail network at this stage. It is possible that future uses within Phase 2 and Phase 3 of the expansion lands at Durnish, may necessitate and justify the use of rail from a commercial perspective. Should this eventuality arise, it is important to note that such future uses will be subject to a separate planning consent process, which, in itself, will assess any potential impacts arising from reuse of the rail network. The important consideration in this development proposal, is that the potential future use of rail infrastructure is not compromised by the proposed development and is maintained free from development, should the need for such infrastructure arise in the future.

The development is located adjoining the main urban settlement of Foynes, with the proposed port expansion at Durnish on greenfield land. There are no footpaths in the area of the Port Access Road with existing footpaths in Foynes terminating at the junction of the N69 and Dernish Avenue at the eastern end of the village. The potential for pedestrian access to the proposed port expansion area at Durnish is therefore limited. At the western end of the village, a footpath extends from the village to the western Port access thereby facilitating pedestrian access to the Port.

Having regard to the evidential decline in population numbers in west Limerick over the last decade and trends amongst existing employees within the Port, it is likely that many of those employed will travel from other centres within the county to the subject site. Whilst public transport is limited, Bus Eireann Service number 314 does operate between Limerick, Askeaton, Foynes, Tarbert and Ballybunion, and could potentially become a feasible form of transport for some employees. Coming from Limerick City Centre the first bus leaves Limerick at 07:45hrs. For the return trip at the end of the day buses leave Foynes at 15:20hrs and 19:00hrs. Provision has been made for a bus stop at the entrance to the Durnish lands. It is clear that changes to the current bus timetable and improvements with respect to pedestrian facilities in Foynes would be required before buses would be an attractive mode of travel for employees. A Mobility Management Plan is included as an Appendix to Chapter 13.0 in order to maximise travel by employees to/from the site for all sustainable modes of travel.

The design of the proposed development and implementation of existing road and sea traffic management operational procedures will ensure that increased traffic has no negative impact on the residential and recreational amenities of the area. Consequently, in relation to sea and road traffic, the operational phase of the proposed development will have a neutral permanent impact on the residential amenities of the area

6.5.8 Health & Safety

6.5.8.1 Do Nothing Scenario

In a 'Do Nothing' scenario there may be some intensification of existing permitted activities within the existing port operation. Any intensification of activities will be controlled by the port's existing health and safety procedures and no negative impacts are predicted in relation to land based activities.

6.5.8.2 Construction Impacts

The proposed development is designed to be operated to best industry standards, with emphasis on the health and safety of employees, local residents and the community at large. A Project Supervisor, Design Process (PSDP), will be appointed at tender stage to coordinate the design effort and to address and minimise construction risks during the detailed design period. Notification of this appointment will be sent to the HSA by means of their Approved Form 1 (AF1).

As design advances and before construction commences, a Preliminary Health and Safety Plan will be drawn up by the PSDP and reviewed by the project team. This ultimately will be passed on to the appointed Project Supervisor Construction Stage (PSCS) to be developed into a Construction Health and Safety Plan, prior to construction commencing. Notification of this appointment and the commencement date of construction will be sent to the HSA by means of their Approved Form 2 (AF2).

It is intended that construction of the jetty extension, will occur simultaneously with ongoing Port operations. Prior to commencement of the jetty extension works, the existing small craft landing pontoon located behind the proposed jetty extension shall be removed and relocated to an area identified at the west side of West Quay. The construction site will be made secure and the Construction Environment Management Plan will ensure the necessary procedures are in place to provide for the safe and efficient movement of construction traffic within the Port. The potential for construction and operational conflict to arise on the Durnish lands is more limited as the works comprise an extension to the eastern end of the Port, separated from the existing Port by the Port access road. The works proposed to the Durnish lands are more self-contained and the potential for conflict to arise is limited.

A Seveso Report prepared by RPS accompanies the planning application. The report concludes that neither the proposed jetty extension area or the Durnish lands extension are located within the consultation distance of the Lower Tier Inter Terminals Shannon Ltd. site. As such, there is negligible change in risk predicted for this site. The Atlantic Fuel Supply Company Upper Tier facility may pose a slight increased risk and this should be taken into consideration in the Safety Report and Major Accident Prevention Policy (MAPP) prepared by the Atlantic Fuel Supply Company site and regulated by the HSA. With Health & Safety procedures in place, construction activities will have a negligible, neutral, short term impact on health and safety.

6.5.8.3 Operational Impacts

The company currently holds NASI Certification for Quality (ISO 9001: 2008) and for Occupational Health & Safety Management (OHSAS 18001:2007). The existing company's Health & Safety

Statement and Risk Register will need to be updated once operations commence on the application site.

The site of the jetty works is wholly contained within the existing port operational (ISPS) area and as such no additional security fencing will be required. However, security fencing will be provided along the external perimeter of the Phase 1 proposed port expansion area.

Fire hydrants will be provided at regular intervals along the jetty structure. Access ladders and safety chains shall be provided at regular intervals along both faces of the jetty connection structure. Within the Durnish lands, fire hydrants will be provided to serve Phase 1 with future uses within Phase 2 and 3 subject to their own planning consent applications and associated health & safety requirements.

In terms of the Seveso sites and as detailed in the Seveso Report, it is anticipated that the proposed new developments will have no direct impact on the two COMAH establishments in the area and will not alter the risk profile of these operations. The 400m consultation distance associated with the Atlantic Fuel Supply Company Upper Tier facility, slightly extends into the Durnish lands on the western site boundary. However, this part of the land has been identified for infrastructural works and will not contain any buildings.

With Health & Safety procedures in place as detailed in Section 6.3.4 of this chapter, operational activities will have a negligible, neutral impact on health and safety.

6.5.9 Cumulative Impacts

Section 6.4.4 of this chapter has listed the potential developments granted planning permission and which could give rise to cumulative impacts. Whilst other environmental impacts have been considered in respective chapters within this EIAR, including traffic, noise, air quality and landscape, the consideration in this chapter concentrates on the socio-economic impacts.

6.5.9.1 Construction Impacts

The Bord na Mona development within the existing port will give rise to significant employment on a temporary basis during construction, stated to be in the region of 140 personnel. Whilst the reclamation of the East Jetty within the Port of Foynes is likely to result in the employment of 15 no. persons during construction when advanced as a project in its own right, it is likely that the construction personnel will be absorbed into the proposed jetty extension works, such that total construction relating to the jetty within the existing Port will be 15 no. persons. When considered with the average number of workers to be engaged during construction of the Port expansion lands at Durnish, the figure increases to 25 no. persons.

Should all three projects advance simultaneously then the total number of people employed during construction will be in the order of 165 no. persons. Whilst employment opportunities may be afforded to the local population the greatest impact is likely to be increased revenue for the services sector as a result of spending by construction workers.

6.5.9.2 Operational Impacts

Should all phases (Phase 1 – 3) of development proceed as planned, the potential for new employment opportunities within the settlement of Foynes will be substantial with the proposed development potentially generating a total of 120 no. jobs with 48 no. jobs in Phase 1. In addition, the Bord na Mona development has the potential to generate an additional 46 no. jobs, resulting in excess of 94 no. jobs in the short to medium term and 166 no. jobs in the long-term once all phases of the Durnish lands have been completed.

Such additional employment levels in the village, could create additional need for houses as previously discussed, and for associated services and facilities. However overall, the permitted applications for extension to existing commercial and industrial facilities in the area will consolidate the role of Foynes as a strategic employment location. Cumulatively the continuing development of commercial, industrial and port activities will have a significant positive impact on the economic vitality of rural County Limerick.

6.6 REMEDIAL AND MITIGATION MEASURES

A Construction Environment Management Plan (CeMP) has been developed which collates all mitigation measures contained within this EIAR. The CeMP will be modified upon securing consent for the proposed development such that all conditions applied by An Bord Pleánala will be included. The development of the CeMP will include continued consultation with statutory bodies, interested parties and the local communities.

The CEMP will form part of the Specification for the Construction Works, thereby contractually binding Contractors to adhere to the mitigation measures as well as providing Contractors with the opportunity to price for the inclusion of the mitigation measures.

6.6.1 Economic Activity

The proposed development will play a key role in providing the necessary infrastructure required for continued growth within the port. It will therefore provide an overall beneficial socio-economic impact. No negative impacts on economic activity have been identified. Accordingly, no mitigation measures are required.

6.6.2 Landuse

No other significant negative impacts on social considerations have been identified. Accordingly, no mitigation measures are required.

6.6.3 Social & Recreational

No negative impacts have been identified in relation to land use. Accordingly, no mitigation measures are required.

6.6.4 Health & Safety

During construction all areas will be delineated and will be under the control of the Project Supervisor Construction Stage (PSCS) who will coordinate and supervise all safety aspects of the project. A Safety File will be complied and maintained on site for the duration of the project and the implementation of the Plan will be subject to regular audits. No negative impacts on Health & Safety have been identified by the operational phase of the proposed redevelopment. No further mitigation measures are required.

6.7 RESIDUAL IMPACTS

The proposed development will provide an overall positive socio-economic benefit through direct and indirect employment opportunities associated with the predicted growth in trade.

No negative residual impacts have been identified as a result of the proposed development.

6.8 MONITORING

No monitoring is required.

6.9 REFERENCES

- W2 Consulting, Shannon Foynes Port Company Economic Impact Assessment, August 2015
- Indecon International Economic Consultants, Assessment of Wider Economic Impacts of Foynes to Limerick Road Improvement Scheme, 2017
- Central Statistics Office website *www.cso.ie*
- Galway County *Development Plan 2010, as amended*
- Health & Safety Authority website *www.hsa.ie*

7. BIODIVERSITY

7.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses in an appropriate manner, the direct and indirect significant effects of the proposed development on biodiversity, with particular attention to species and habitats protected under European Council Directives 92/43/EEC and 2009/147/EC.

Ecological Impact Assessment (EcIA) is a process of identifying, quantifying and evaluating the potential and likely significant effects of a proposed project on ecological features, where ecological features are the species, habitats and biodiversity components of ecosystems that have the potential to be affected by the proposed development.

As all biodiversity comprises an enormous amount of species and habitats, ecological assessment is typically divided into specialist subject areas. The biodiversity chapter of this EIAR contains a description of the terrestrial, marine and avian biodiversity features and designated sites within a zone of influence (ZoI) of the proposed development, followed by an assessment of the potential and likely significant effects of the proposed development on terrestrial, marine and avian biodiversity features and designated sites.

This chapter contains information on different specialist subject areas of ecology, and has been written by a number of authors. Avian biodiversity features are present in both the marine and terrestrial environments, and a decision was taken to present the assessment on avian biodiversity separately rather than split avian biodiversity into two sub-assessments.

This chapter has been broken down into the following sub-sections:

- 7.2: Terrestrial Biodiversity
- 7.3: Benthic Biodiversity and Fisheries
- 7.4: Marine Mammals
- 7.5: Avian Biodiversity
- 7.6: Designated Sites

Each specialist sub-section discusses terrestrial, marine and avian biodiversity features and designated sites in turn under each of the sub-headings of:

- Methodology
- Receiving Environment
- Impact Assessment
- Remedial and Mitigation Measures
- Residual Impacts
- Monitoring

'Methodology' describes the survey and assessment methodology used by each specialist in compiling their component part of the chapter.

'Receiving Environment' describes the receiving environment and comprises a description of the relevant biodiversity features within the zone of influence of the proposed development.

'Impact Assessment' outlines the potential for impacts upon relevant biodiversity features as a result of the construction and operation of the proposed development at each phase and cumulatively, and determines whether or not those potential impacts which have been identified are likely. This section then predicts the magnitude of likely potential effects on relevant biodiversity features and determines whether or not they are significant in the absence of mitigation.

'Remedial and Mitigation Measures' describes measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on relevant biodiversity features within the zone of influence of the proposed development.

'Residual Impacts' predicts the residual impact upon relevant biodiversity features within the zone of influence of the proposed development, after having taken avoidance, remedial or counterbalancing mitigation measures into account.

'Monitoring' concludes the sub-divided assessments by describing, where relevant and applicable, any proposals for monitoring. Monitoring provides a mechanism to detect unexpected mitigation failures, and verify that the proposed development is being constructed and/or operated as intended. Monitoring can result in actions, activities or operations being adapted or adjusted to ensure continued compliance with conditions of consent.

Section 7.7 then presents an overall conclusion to the Biodiversity chapter.

A Natura Impact Statement (NIS) has been prepared on behalf of the applicant to document a shadow appropriate assessment exercise conducted in support of an application for consent to a competent authority (and/or a public authority) in respect of conducting an appropriate assessment prior to consenting proposed development. The NIS contained at Volume 6 of the EIAR, and is intended to assist An Bord Pleanála in fulfilling its duties in accordance with Part XAB of the Planning and Development Act 2000; and the Marine Planning and Foreshore Section of the Department of Housing, Planning, Community and Local Government in fulfilling its duties in accordance with Part V of the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

This chapter should be read alongside appendices and technical reports not included in the EIAR main text. Appendices and technical reports are presented in the EIAR as follows:

<u>EIAR Volume 2</u>

- Appendix 7.1 Terrestrial Biodiversity Data Tables
- Appendix 7.2 Bat Survey Report
- Appendix 7.3 Proposed NHA Site Synopsis

<u>EIAR Volume 6</u>

- Natura Impact Statement

7.2 TERRESTRIAL BIODIVERSITY

7.2.1 Methodology

7.2.1.1 Desktop Review

The National Biodiversity Data Centre (NBDC) is a national organisation that collates, manages, analyses and disseminates data on Ireland's biodiversity. It is funded by the Heritage Council and the Department of Culture, Heritage and the Gaeltacht. The NBDC provides access to all validated biodiversity data through Biodiversity Maps, the on-line biodiversity data portal.

Biodiversity records and full species accounts can be viewed and scrutinised through an interactive Biodiversity Maps portal. This is a tool that can be used to help make a preliminary assessment of biodiversity issues when considering site-specific proposed development. The chosen search area using the NBDC search tool was customised in order to capture all records within a minimum 5km distance of the proposed development site. The principal purpose of this task is to capture any records of protected species or species of natural heritage importance in close proximity to the site boundary. The zone of influence of the proposed development does not extend further than this.

A National Parks and Wildlife Service (NPWS) data set of Annex I habitats and Flora Protection Order (2015) plant species was reviewed to check for any records at the site of proposed development.

Formal consultations were undertaken to inform the assessment with the following organisations, which were felt to be of particular relevance to terrestrial ecology and nature conservation:

- Bat Conservation Ireland (BCI): a data request consultation was issued in June 2017 and a response received in July 2017.
- National Parks & Wildlife Service: Consultation meeting in SFPC offices in November 2017 with the NPWS Divisional Ecologist, District Conservation Officer and District Ranger.

Informal consultations were carried out with people familiar with the natural history of Foynes area, including Mr.Liam Dundon, wildlife representative at the nearby Aughinish Alumina.

7.2.1.2 Flora and Habitat Survey

Habitat Survey was conducted at Durnish on the 19th July and 16th August 2016, and habitat survey of Durnish and the East Jetty extension area was conducted on the 4th July 2017.

Surveys were undertaken in accordance with the Heritage Council's *Best Practice Guidance for Habitat Survey and Mapping* (Smyth *et al.*, 2011).

The survey was also extended to include further information on the potential of the habitats identified to support species by law or of natural heritage importance. All habitats were mapped and categorised in accordance with the Heritage Council's *Guide to Habitats in Ireland* (Fossitt, 2000). A search was undertaken for protected and invasive flora species. Georeferenced aerial photographs were used as an aid to mapping habitats.

7.2.1.3 Species

Terrestrial Mammals

A survey for protected species was conducted at the Durnish site on the 15th & 16th August 2016. A further survey of Durnish and the East Jetty extension area was conducted on the 4th July 2017. Surveys were conducted with regard to best practice guidelines, in particular the National Roads Authority guidance on *Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes* (NRA, 2008).

All visible signs of mammals were recorded, and the site visually assessed, in particular for potential breeding or resting areas for protected mammal species. Two camera traps were also deployed at various locations at the Durnish site in August 2016. Notes were taken on tracks and signs of protected species during the surveys.

Furthermore, as part of allied monthly ornithological surveys at the site of proposed development over the course of two years (as described in Section 7.4), the Durnish and East Jetty extension sites were regularly traversed and the surveyor was always looking for mammal sightings or signs until the ornithological survey location had been reached. Where these observations have yielded information, that has also been incorporated into this assessment.

The suitability of habitats for protected species was also assessed using expert judgement in combination with the survey results and desktop assessment.

Bats

Bat surveys were conducted primarily in accordance with the Bat Conservation Trust *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd Ed) (Collins, 2016). Further guidance on survey and impact assessment was taken from the NPWS *Bat Mitigation Guidelines for Ireland* (Irish Wildlife Manual No.25) (Kelleher & Marnell, 2006). Information on population trends, distribution and threats was taken primarily from the Bat Conservation Ireland publication *Irish Bats in the 21st Century* (Roche *et al.*, 2014).

The initial desktop review and habitat surveys identified a potential for usage of the site by bats. The desktop review also included an assessment of habitat connectivity of landscape features such as hedgerows, woodland, and waterways from aerial photography and historic maps (e.g. Google Earth and Bing maps and Ordnance Survey Ireland historic 6-inch maps dating from c. 1829-41).

The entire site (Durnish area, jetty area and road) was subsequently surveyed out of season, by walkover survey on 15/11/2016. Surveyors were bat specialist Dr. Isobel Abbott, and Ciarán Cronin. That survey resulted in a preliminary identification and assessment of a number of potential roost features (PRF's) for bats in trees on site, as well as features suitable for bat commuting and foraging. Particular note was made of hedgerows, treelines, trees and wetlands/waterways on site. Hedgerows were assessed for bat usage in terms of their age, structure, species composition and connectivity with other site features and the wider landscape. All potential roost features were identified, photographed and their positions recorded. That bat assessment was undertaken outside the optimal timeframe for active bat surveys (May to September), and as such relied on daytime visual habitat assessment only.

Further targeted bat surveys were then conducted monthly between April and June 2017. Two separate survey methods were employed at the site – Activity surveys and Roost surveys. Given the nature of the landscape (very wet, near deep water, evidence of drinking/antisocial behaviour, livestock often present) it was required to have two surveyors per visit for safety reasons. Surveyors worked separately in some areas and together in higher risk areas, and were in contact throughout.

Activity Surveys

Bat activity surveys were conducted using a mixture of manual transect surveys and static detector surveys in order to comprehensively assess usage of the site by bats.

Manual activity surveys were conducted across the site on one dusk period per month (April – June 2017). These consisted of a series of 3 minute spot counts, covering a total of 42 pre-determined spots per survey, along a walked transect. Transect Spot Counts generally took place from sunset to 3 hours after sunset, although on some particularly bright evenings start times were delayed until light levels were sufficiently faded that there was a likelihood of encountering bats.

Spots were placed strategically around the site, at targeted locations to cover the full range of habitats present. Start points along the route were staggered between surveys to offset any biases due to timing of activity. Surveying continued while transiting between spots to increase the chances of recording rarer species, although only spot counts were analysed and presented. Surveys were conducted using broadband detectors, with presence or absence of species and feeding activity recorded at each spot. The use of spot counts to record bat activity was primarily chosen on Health & Safety grounds as ground conditions on site were predominantly rough and it allowed surveyors to pay attention to their footing whilst moving between spots. It also allowed for the potential for individual spots to be omitted for safety reasons (e.g. antisocial behaviour or animal presence), without necessarily losing a whole transect. It was thus deemed the safest approach at this particular site.

Some bat species are difficult to detect and others may only use the site on occasion. Therefore, in order to supplement the manual activity surveys, 2 or 3 static bat detectors were also deployed at strategic locations on site each month (April – July 2017), for periods ranging from 3 to 16 nights. These allowed for further detection of species not present or not detected on transect surveys. Static detectors are particularly useful for detection of species which only visit the site occasionally, and for species which are otherwise difficult to detect, in particular Lesser Horseshoe Bat, which was identified from desktop surveys as potentially occurring on site. Deployment locations were chosen to cover the main parts of the site where bat activity was likely and to maximise the possibility of detection of target species. The detectors used were two SM4 (Wildlife Acoustics) and an Anabat Express (Titley Scientific).

Roost Surveys

A number of potential bat roost features in trees on the site were identified in the initial site survey in November 2016. Tree roosts of bats are notoriously difficult to identify and assess, are very variable in usage rates as roost features can be used by bats in a number of different ways, some bats can move roosts very regularly, or utilise different roosts at different times, both within the same night or through the season.

Also, and importantly, most mature boundary vegetation at the site of proposed development is to be retained and supplemented. Therefore, in order to provide information on trees that could possibly contain roosts identified in the 2016 survey, visual and acoustic surveys were conducted on individual trees or close clusters of trees at least once between April and June 2017, either at dawn or dusk to provide information on whether or not bat activity and calls were occurring in proximity to trees at emergence or re-entry times. Dawn re-entry surveys were conducted from 2 hours before sunrise, to

15 mins after, while dusk emergence surveys were conducted from 15 mins before sunset to 2 hours after.

An extension to an industrial unit which is to be demolished for a mid-point access road into the site was visually inspected both internally and externally.

Bat surveys were not conducted at the site of the proposed jetty extension between the existing East Jetty and West Quay. It was determined that there are no features present here of value to the local population of bats.

7.2.1.4 **Ecological Valuation and Assessment**

Likely significant effects are predicted on the basis of the proposed Project as described in EIAR Chapter 2 *Project Description*. The information gathered from consultation, scoping and stakeholder feedback; the desk study and suite of targeted ecological field surveys has been used to prepare an EcIA of the proposed development upon the identified terrestrial biodiversity features. The EcIA was undertaken in accordance with the following guidelines which were used to derive valuation and assessment criteria as set out in Table 7.2.1 and Table 7.2.2.

Section 3.7.3 of the draft Environmental Protection Agency's *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2017) note under Figure 3.5 therein that "*where more specific definitions exist within a specialised factor or topic e.g. biodiversity, these should be used in preference to these generalised definitions*".

The valuation and impact assessment for terrestrial biodiversity has been undertaken following the methodology set out in the Chartered Institute of Ecology and Environmental Management's *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (2^{nd} Ed) (CIEEM, 2016); and with reference to Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009); EPA (2017); and BS 42020:2013 Biodiversity: Code of practice for planning and development (BSI, 2013).

CIEEM (2016) guidelines are complementary to EPA (2017) guidelines when describing the nature of effects on biodiversity features:

Positive or negative:	Positive and negative impacts/effects are determined according to whether the change is in accordance with nature conservation objectives and policy e.g. improves the quality of the environment or reduces the quality of the environment (*Quality of Effects*, EPA 2017);
Extent:	The spatial or geographical area over which the impact/effect may occur (*Extent and Context of Effects*, EPA 2017);
Magnitude:	'Magnitude' refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms (*Duration and Frequency of Effects*, EPA, 2017);
Duration:	'Duration' is defined in relation to ecological characteristics as well as human timeframes. Five years, which might seem short-term in the human context or that of other long-lived species, would span at least five generations of some invertebrate species. The duration of an activity may differ from the duration of the resulting effect caused by the activity.

	Effects may be described as short, medium or long-term and permanent or temporary. Short, medium, long-term and temporary will need to be defined in months/years (*Duration and Frequency of Effects*, EPA, 2017);
Frequency and timing:	The number of times an activity occurs will influence the resulting effect. The timing of an activity or change may result in an impact if it coincides with critical life-stages or seasons (*Duration and Frequency of Effects*, EPA, 2017), and
Reversibility:	An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation. In some cases, the same activity can cause both reversible and irreversible effects (*Duration and Frequency of Effects*, EPA, 2017).

EcIA is based upon a source-pathway-receptor model, where the source is defined as the individual elements of the proposed Project that have the potential to affect identified ecological features. The pathway is defined as the means or route by which a source can affect the ecological features. An ecological receptor is the feature of interest, being a species, habitat or ecologically functioning unit of natural heritage importance. Each element can exist independently however an effect is created where there is a linkage between the source, pathway and feature. A significant effect is defined in CIEEM (2016) as –:

"an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' [...] or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local.";

and

"an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. A significant effect is a positive or negative ecological effect that should be given weight in judging whether to authorise a project: it can influence whether permission is given or refused and, if given, whether the effect is important enough to warrant conditions, restrictions or further requirements such as monitoring".

BS 42020:2013 states that if an effect is sufficiently important to be given weight in the planning balance or to warrant the imposition of a planning condition, e.g. to provide or guarantee necessary mitigation measures, it is likely to be "significant" in that context at the level under consideration. The converse is also true: insignificant effects would not warrant a refusal of permission or the imposition of conditions.

Table 7.2.1 sets out a geographic frame of reference and criteria for valuing ecological features. Table 7.2.2 sets out criteria for predicting magnitudes of effect. These tables have been prepared with due regard to CIEEM, EPA and NRA guidelines described above.

Significant impacts are moderate or major effects which require avoidance, reduction or counterbalancing measures to mitigate or offset their adverse effects. Beneficial effects do not require mitigation measures as their effects are welcomed.

Table 7.2.1 Valuation Criteria for Biodiversity Features

Value	*Criteria*
International	• 'European Sites' including Special Areas of Conservation (SAC) & Special Protection Areas (SPA) • Sites that satisfy the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive) • Features essential to maintaining the coherence of the Natura 2000 Network • Sites containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive • Resident or regularly occurring populations (assessed to be important at the international level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Ramsar Sites • World Heritage Sites • Sites hosting significant populations of species under the Bonn Convention • Sites hosting significant populations of species under the Berne Convention
National	• Wildlife Refuge for species protected under the Wildlife Acts • Resident or regularly occurring populations (assessed to be important at the national level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Natural Heritage Areas (NHA) or proposed NHA • National Nature Reserves (NNR) • Marine Nature Reserve (MNR)
County	• Sites listed as part of the Ecological Network in the County Development Plan (CDP) • Areas subject to a Tree Preservation Order in a CDP • Resident or regularly occurring populations (assessed to be important at the County level) of the following • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Species protected under the Wildlife (Northern Ireland) Order 1985 (as amended); and/or • Species listed on the relevant Red Data list • Sites containing areas of the habitat types listed in Annex I of the Habitats Directive that do not satisfy the criteria for valuation as of International or National importance • Regionally important populations of species or viable areas of semi-natural habitats or natural heritage features identified in a Biodiversity Action Plan (BAP) or County Development Plan (CDP) prepared for an administrative area • Sites containing natural habitat types with high biodiversity in a regional context and a high degree of naturalness, or populations of species that are uncommon within the County
Local (Higher)	• Locally important populations of priority species or habitats or features of natural heritage importance identified in a BAP, if this has been prepared • Key features of local value, e.g.: o sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality

Value	*Criteria*
	o Sites or features containing common or lower value habitats that maintain links and function as ecological corridors between key features of local value
Local (Lower) / Site	• Sites containing small areas of semi-natural habitats that are of limited local importance • sites containing areas of highly modified habitats • sites containing local populations of species that are common and not of conservation value • Sites that are used by protected species or species of conservation value as part of their territories but which do not contain the breeding or resting places of these species • Sites that do not maintain links or do not function as ecological corridors between key features of local value

Table 7.2.2 Magnitudes of Effect upon Biodiversity Features

Magnitude of Effect	*Criteria*
Major adverse	• Adverse Effect upon Integrity of a European site • Loss of or permanent damage to any part of a site of international or national importance • Loss of a key component or key feature of a site of regional importance • Decline in favourable conservation status (FCS) or condition (FCC) of a legally protected species at County value • Causing of an offence under European Directives or domestic transposing legislation
Moderate adverse	• Temporary impacts to key features of a site of international or national importance, but no permanent damage or loss of FCS/FCC • Permanent impacts to any part of a site of County value • Permanent loss of a key feature of local importance (higher value) where a feature is important for and supports other features • Causing of an offence under domestic legislation
Minor adverse	• Temporary impacts to any part of a site of County value • Temporary loss of a feature of local importance (higher value) • Permanent loss of a feature of local importance (lower value)
Negligible	• No impacts above a *de minimis* threshold on identified biodiversity features • Beneficial and adverse impacts balance such that resulting impact has no overall affect upon feature.
Minor beneficial	• A small but clear and measurable gain in general wildlife interest, e.g. small-scale new habitats of wildlife value created where none existed before or where the new habitats exceed in area the habitats lost.
Moderate beneficial	• Larger new scale habitats (e.g. net gains > 1 ha in area) created leading to significant measurable gains helping to achieve relevant objectives of a BAP or CDP
Major beneficial	• Major gains in new habitats (net gains > 10 ha) of high significance for biodiversity helping to achieve relevant objectives of a BAP or CDP and underpinning government policy

7.2.2 RECEIVING ENVIRONMENT

7.2.2.1 Flora & Habitats

Sixteen habitat types were identified on or adjacent to the site of proposed development, although habitats are mapped across a much greater area than only the lands proposed for development. Habitats are illustrated in Figure 7.2.1 *Terrestrial Habitat Map*.

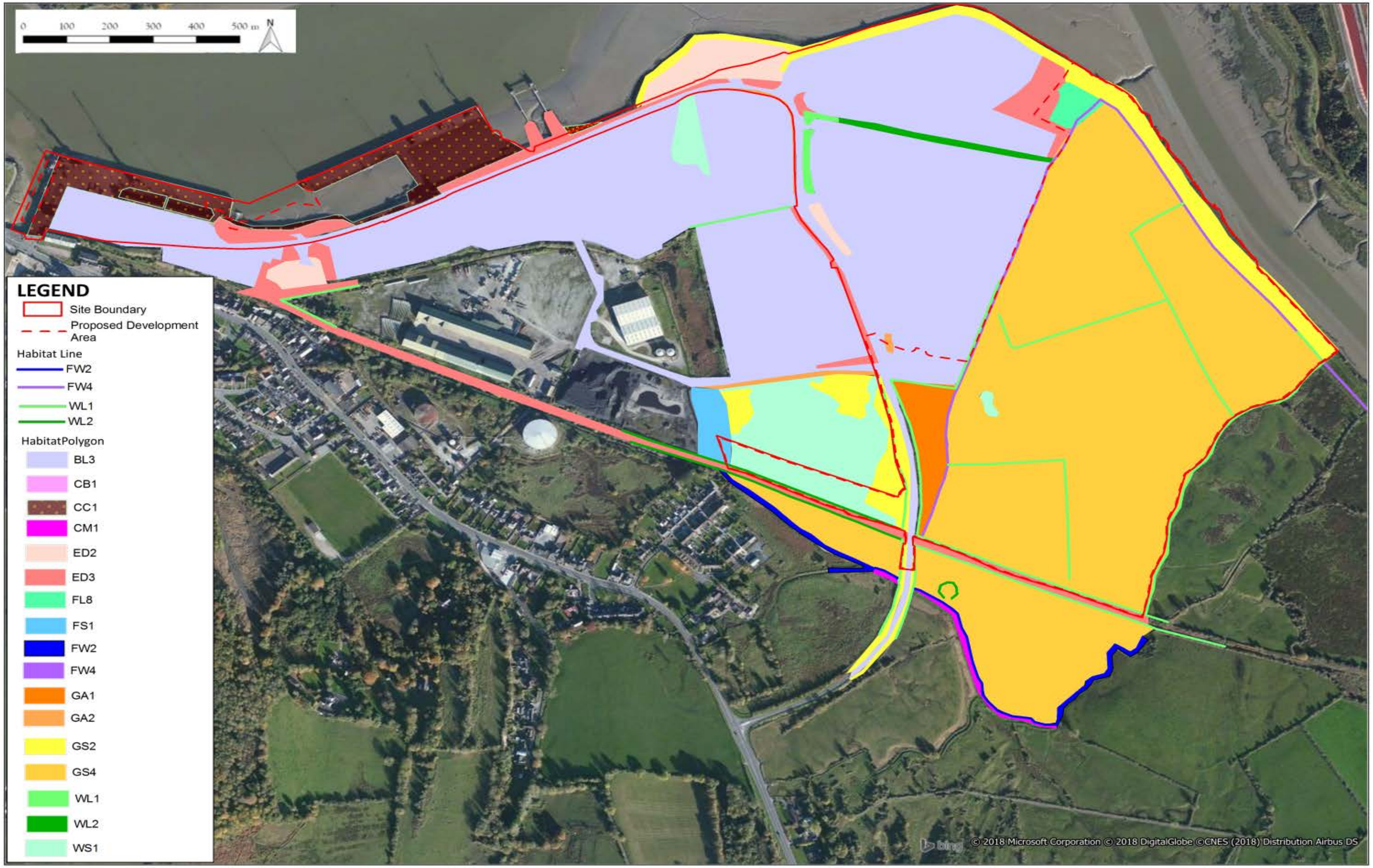
Most habitats on site were of local (lower) value, although some were of local (higher) value as they function as wildlife habitats and linking corridors at the local level. No rare or protected plants were recorded on site, despite some occurring nearby at Aughinish Island.

The port area consists primarily of highly modified Built Land (BL3) and Sea Walls, Piers & Jetties (CC1) of local (lower) value. Some of the hedgerows on site are quite old townland boundaries and of some ecological significance. The majority of the Durnish site is primarily Wet Grassland (GS4) albeit a highly modified habitat, previously managed and grazed and of local (lower) value, although one section in the south-east is given a local (higher) value.

There are also several other semi-natural habitats present which are considered to be of local value including, scrub, swamp and a stream. There are several linear habitats on site or adjacent; drainage ditches, hedgerows, treelines and the disused railway, which provide connectivity between the habitats in the wider area and are therefore also locally important. None of the habitats on site correspond to any habitats listed on Annex I of the Habitats Directive. The habitats are described further below. The scientific names of species listed in the text that follows are listed in Table A7.1 of Appendix 7.1.

Habitat value is not solely assessed in regard to habitat quality or status, but incorporates other ecological features of note (e.g. the presence of bat roosts in a hedgerow will increase the assessed ecological value of that hedgerow beyond its intrinsic quality as a habitat).

Figure 7.2.1 Terrestrial Habitat Map



Other Artificial Lakes and Ponds FL8

There is an OPW maintained attenuation pond to the north-west of the site (Plate 7.2.10) of approximately 0.33ha in area. The drainage ditches on site drain to this pond and it is connected to the estuary via a concrete sluice, which appears to be poorly functional. It contains abundant Sea Club-rush and the water surface has abundant algal mats. False Oat Grass, Nettles, Bramble and Traveller's Joy are abundant on the sloping sides with occasional Willow.

This is an artificial habitat with low diversity and assessed to be of local (lower) value.

Depositing/ Lowland Rivers FW2

There is a small river running along the entire southern border of the site, varying between approximately one and four metres in width and approximately 650m in length (Plate 7.2.1, 7.2.7 & 7.2.8). This slow moving and heavily vegetated stream contains abundant Duckweeds, Watercress, Fool's Watercress and Reed Canary-grass, with occasional Common Spike Rush along the margins. There are no embankments and the adjacent grassland is mostly at a low elevation above the river edge. There are some wetter 'channels' extending from the river into the adjacent grassland. It is therefore likely that this stream overflows and inundates the adjacent wet grassland habitats during wet periods, but was dry during surveys. The stream flows eastwards along the southern end of the site, turns north-eastwards at the south east corner of the site, flows outside the site boundary and discharges to the Robertstown River to the east of the site. In the south-western sector it is heavily vegetated with Fool's Watercress, Watercress, Bulrush and Reed Canary-grass, and runs under a stone bridge near the housing estate and into the Reed Swamp.

The stream is a suitable habitat for European Eel, but otherwise not likely to be of significant value to any protected species, apart from potential occasional use by otters and bats. Despite a low flow rate, congested flora, likely polluted nature and low diversity it is nonetheless a natural feature providing a pathway for movement of wildlife and a source of fresh water. This feature does not link sites of higher value. It is assessed to be of local (lower) value.

Drainage Ditches FW4

OPW drainage channels run adjacent to the western and northern boundaries of the Durnish site, totalling approximately 1,377m in length (Plate 7.2.9). The ditch running north-east to south-west along the west side of the site is 2 - 3m deep and contains abundant algae, Sea Club-rush and Bulrush, indicating a brackish nature. This is likely a result of the poor functioning of the associated sluice, allowing some backflow of saline water at high tides. The steep sides of the ditch support Ragwort, Great Willowherb, Water Figwort, Hawthorn, Bramble, Buddleia, Willow, Wild Angelica, Creeping Thistle, Cock's-foot, False Oat Grass, Bittersweet and Bush Vetch. This ditch runs along the site boundary and then internally as it extends southwards. A deep ditch runs along the inner side of the northern embankment which contained Common Reed. The sides of the ditch are vegetated and include Large Bindweed, Hart's-tongue Fern, Meadowsweet, Willowherbs, Nettle, Wild Carrot, and Wild Angelica.

Some hedgerows have shallow ephemeral ditches associated, which flood in wetter periods in winter, but were dry through most of the year. These are not mapped. Where the ditches pass near hedgerows and treelines there is a high potential for bat foraging, and bats may indeed forage anywhere along the length of the ditches. The larger ditches are likely suitable habitat for European Eel.

This habitat is artificial and species poor, but does provide some connectivity between other habitats in the wider area. Those other features that the ditches connect are not key features of local importance. The habitat is assessed to be of local (lower) value.

Plate 7.2.1 River looking west to port access road

Reed and Large Sedge Swamps FS1

An area of 0.47ha of swamp is located >200m from the site of proposed development (Plate 7.2.2). It is dominated by Bulrush and Sea Club Rush. Great Willowherb, Hard Rush and scattered Hawthorn are also present. This habitat is linked to the site via the stream and the drainage ditch network. This is likely a remnant portion of the marshland/wetland visible on older maps of the area (OSI 6" maps from early 19th century), prior to the historical development of the port, although it now has limited connectivity to other aquatic habitats.

A natural but degraded habitat, it is assessed to be of local (lower) value.

Plate 7.2.2 Reed Swamp, looking north from railway

Improved Agricultural Grassland GA1

There is an area of approximately 11.6ha of improved agricultural grassland in a field where the main access road and roundabout to the Durnish lands is to be located. This habitat is dominated by Perennial Rye-Grass and Rushes with frequent Docks, Ragwort and Creeping Thistle (Plate 7.2.3).

This habitat is significantly modified and species poor, and it is assessed to be of local (lower) value.

Plate 7.2.3 Grassland (GA1 on left) viewed from port access road looking north-east

Amenity Grassland GA2

There are some very small sections of Amenity Grassland within the port alongside some sections of road. This grassland is species poor and is cut regularly.

This habitat is significantly modified and it is assessed to be of local (lower) value.

Dry Meadows and Grassy Verges GS2

This habitat occurs at two locations - (i) in an area of grassland north of the railway west of and outside of the areas of proposed development; and (ii) along the flood embankment at the northeastern boundary of the Durnish site between it and the Robertstown River. The high flood embankment runs along the northeastern boundary of the site, continuing west to the port boundary, and south-east along the Robertstown River. It is dominated by grasses along most of its length. False Oat-grass, Wild Carrot, Spear Thistle, Sea Mayweed, Creeping Thistle, Knapweed, Curled Dock, Yorkshire Fog, Hawk's Beard and Red Bartsia all occur here. The invasive species Winter Heliotrope is present in patches.

The grassland in the south-west of the site contains abundant False-Oat Grass, Yorkshire Fog, Knapweed and Hard Rush and frequent Ragwort, Creeping Thistle, Docks, Wild Carrot, Silverweed and Sweet Vernal Grass. Other parts of the field have transitioned to scrub. A similar range of species grow on the lower trackway adjacent to the embankment at the north of the site with the addition of Red Bartsia, False Fox Sedge, Black Medick, Common Vetch, Red Clover, White Clover, Yellow Rattle, Tormentil and Meadow Vetchling.

This habitat occurs outside of the site of proposed development on both occasions. Due to its relatively small extent and relatively low species richness this grassland is assessed to be of local (lower) value.

Wet Grassland GS4

This grassland is present throughout much of the site, and totals approximately 36.27ha. Within the fields to the east of the Durnish site and north of the railway (Plate 7.2.4) the wet grassland appears to have been reseeded and/or fertilised in the past but has not been intensively managed for some time. It covers an area of approximately 29.96ha. It is being invaded by scrub consisting of Bramble, Nettle, False Oat Grass and Hawthorn due to low levels of grazing and cutting. The ground is shallowly undulating and species that were observed are often more typical of dry grassland occur commonly on the ridges.

Dry, overgrown ditches occur throughout the fields also. Yorkshire Fog, Creeping Bent, and Hard Rush are abundant. Smooth Rush, Docks, Creeping Buttercup, Red and White Clover, Crested Dog's-tail, Sorrel, Meadow Vetchling and Perennial Rye-grass are frequent. Typical wet grassland species such as Meadowsweet, Marsh Thistle, Marsh Foxtail, Fool's Water Cress, Tufted Forget-me-not, Water Horsetail and Silverweed are occasional. Sedges occur rarely. Small patches of drier grassland within this habitat contain Meadow Buttercup and Ladies Bedstraw.

The south-east of the site (below the railway and east of the Port entrance road) is also wet grassland but is more diverse than the fields north of the railway. No development is proposed here. It covers an area of approximately 5ha. Like the fields to the north the ground was undulating and some species typical of drier grassland were present. This field is lightly grazed with Yorkshire Fog, Creeping Bent, Smooth Rush and Hard Rush abundant.

Sweet Vernal Grass, Red Fescue, Selfheal, Red and White Clover, Meadow Buttercup, Ribwort Plantain, Perennial Rye Grass, Cat's Ear, Creeping Buttercup, Creeping Thistle, Crested Dog's-tail, and Meadow Vetchling occur frequently. Hogweed, Curled Dock and Nettle are occasional. Meadowsweet, Marsh Thistle, Marsh Bedstraw, Marsh Cinquefoil, are also present with Glaucous Sedge, False Fox Sedge, Water Mint, Fool's Watercress, Sharp-flowered Rush and Tufted Forget-me-not growing adjacent to the stream and drainage ditches. Knapweed is occasional and Ox-eye Daisy, Common Spotted Orchid, Pyramidal Orchid, Ladies Bedstraw, Bird's-foot Trefoil, Cowslip and Yarrow are rare, occurring only on the drier patches of ground. Due to low levels of grazing small patches of scrub with False Oat Grass, Bramble, Willow and Hawthorn are also present.

The grassland to the south of the railway in the south-west of the site is rank, with patches of scrub developing and clearly has not been cut or grazed for many years. Covering an area of approximately 1.27ha it is characterised by abundant False Oat Grass, Hard Rush and Large Bindweed with frequent Rosebay Willowherb, Great Willowherb, Meadowsweet, Meadow Vetchling, Creeping Thistle, Yorkshire Fog, Docks, Greater Birdsfoot Trefoil, Water Mint, Bush Vetch, Marsh Woundwort, Ribwort Plantain and Red Clover. There are also occasional Rusty Willows and Hawthorn.

The wet grassland areas to the north of the railway is assessed to be of local (lower) value. The wet grassland area to the south of the railway and west of the Port entrance road is assessed to be of local (lower) value. The wet grassland area to the south of the railway and east of the Port entrance road is assessed to be of local (higher) value due to its greater diversity of species in a local context.

Plate 7.2.4 Wet Grassland (GS4) and hedgerow from railway looking north

Hedgerows WL1

There are hedgerows bordering the site of proposed development at Durnish, forming internal field boundaries and also along the railway corridor. For ease of reference Hedgerows (H) and Treelines (T) are numbered in Figure 7.2.2 *Linear Habitats and Point Features* and described and assessed individually in the following text. Lengths correspond to those shown in Figure 7.2.1 *Terrestrial Habitat Map*. For ease of reference in the descriptive text, linear habitat features are given a reference number, as shown in Figure 7.2.2.

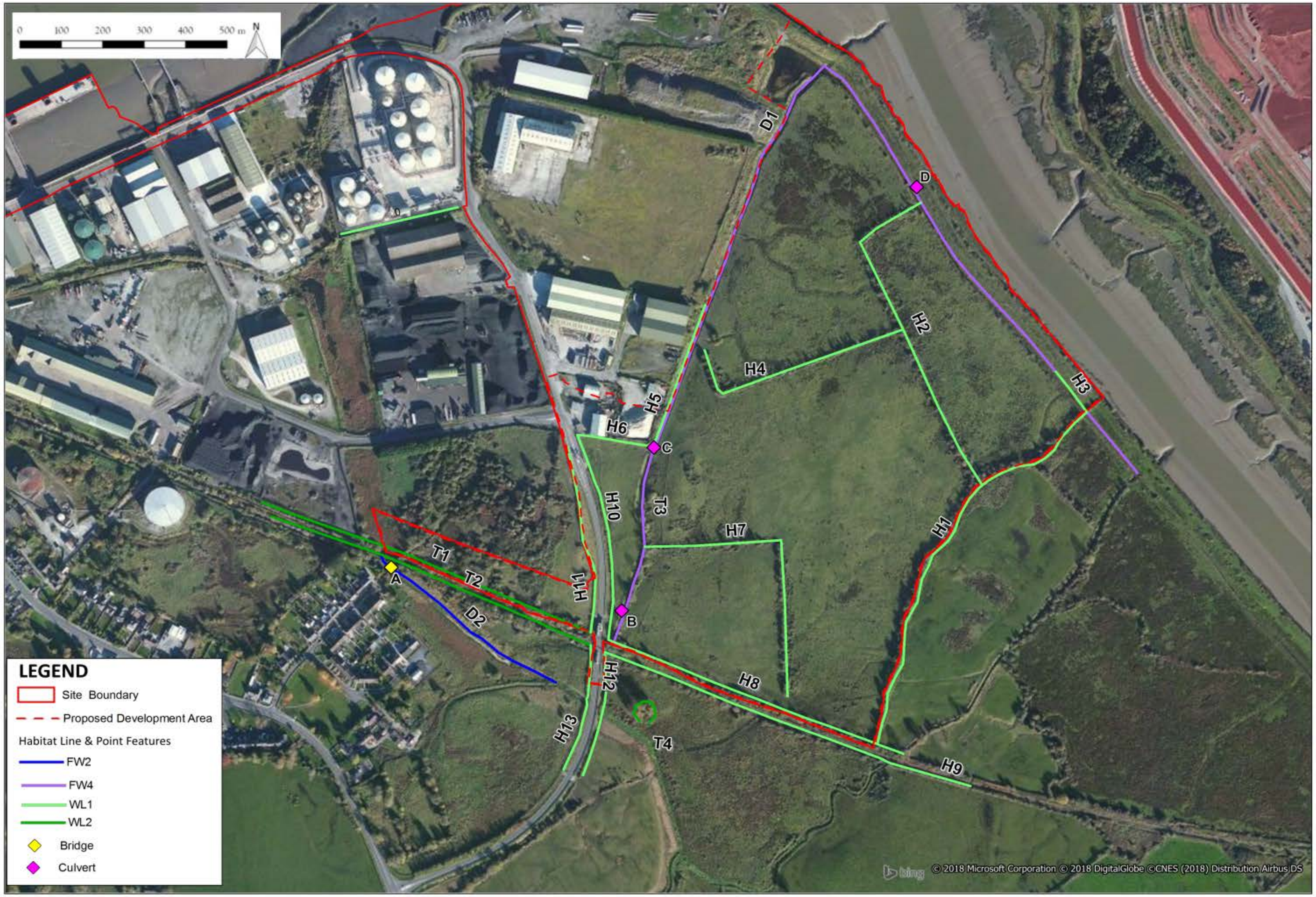
Many of the existing field boundaries are long-established, as they appear on 1st Edition Ordnance Survey Ireland historic 6-inch maps of the site dating from c. 1829 - 1841. Others appear on 2nd Edition maps (1897 – 1913).

Hedgerows on site are generally up to 5m tall and dominated by Hawthorn with Bramble, Alder, Sycamore, Elder and Willow also present. Overall the hedgerows along the field boundaries are relatively species poor with little ground flora and with numerous gaps caused by lack of management and movement of cattle. The gaps are often filled by Bramble.

The hedgerows adjacent to the railway are much more diverse. Hedgerow species here include Hawthorn, Ash, Blackthorn, Honeysuckle and Roses.

The invasive species Traveller's Joy is abundant in places.

Figure 7.2.2 Linear Habitats and Point Features



H1 (575m)

This hedgerow appears on the 1st edition Ordnance Survey map and is a townland boundary. The hedgerow consists of a earth and stone bank (to 2m high in places), with an associated shallow ditch to the west of the bank. The ditch was dry during the habitat survey but unvegetated and appeared to flood at times. The northern section of this hedgerow consists of a double row as it also has a low bank to the west of the ditch.

The hedgerow is dominated by Hawthorns, some of which have diameters of up to 1m indicating considerable age. The hedgerow has been unmanaged for a long time and is quite open at the base and often gappy, with the gaps mostly filled with Bramble. Some deadwood is present, including a fallen and decaying elm with abundant Jelly-Ear fungus.

This habitat has a minor role in connecting valuable ecological habitats in the wider area, is not particularly diverse and is in relatively poor condition. Despite these factors, the habitat still has considerable ecological value given its age and maturity and the value of the high bank as a habitat for rodents and other mammals.

A number of possible bat roost features are present and the hedgerow was used by foraging and commuting bats. Occasional detections of Pine Marten, Badger, Irish Stoat and Irish Hare were made here, and a likely Otter track was noted at the north end.

According to the guidelines set out in the Heritage Council's *Hedgerow Appraisal System: Best Practise Guidance on Hedgerow Surveying, Data Collation and Appraisal* (Foulkes *et al.* 2013) this is a 'Heritage Hedgerow' due to being an old townland boundary. Furthermore, such mature habitats are scarce in a local context and it is thus assessed to be of local (higher) value. It will be retained as part of boundary vegetation surrounding the proposed development.

H2 (448m)

A field boundary hedgerow, with a large gap for cattle to cross. This is an unmanaged hedgerow, with the open base and numerous gaps often filled by Bramble. It varies from a single to a double hedgerow, with a shallow ephemeral drain underneath the eastern half, which is often water filled. The eastern section contains some larger trees to c. 15m tall, including Hornbeam, Sycamore and Ash, however it is dominated by Hawthorn. This hedgerow was noted to be used by foraging bats on one occasion in June 2017 and Pine Marten scat was found once at the eastern end.

Its maturity lends this hedgerow an ecological value, which is significantly diminished by its poor condition with gaps and erosion created by cattle. It does have a minor connecting function within the local landscape but does not function as an ecological corridor linking key features of local value. It is assessed to be of local (lower) value. It will be removed as part of the proposed development.

H3 (77m)

A very small and very gappy hedgerow of immature Hawthorn and Bramble, following the fence-line above the main drainage channel. It is assessed to be of local (lower) value. It will be retained as part of boundary vegetation surrounding the proposed development.

H4 (306m)

An old field boundary, most of which is on the first edition OS map. It has been unmanaged for a long time and is very open and gappy at the base throughout its length as well as eroded by cattle. To about 5m tall, it is dominated by Hawthorn and also contains some Ash. A large dead elm is present in the south western corner but this is considered not to contain any likely bat roost features. Badger was noted passing through here on 2 occasions and Irish Hare was observed in the vicinity of this hedgerow. Its maturity lends this hedgerow an ecological value, which is significantly diminished by its poor condition. It does have a minor connecting function within the local landscape but does not function as an ecological corridor linking key features of local value. It is assessed to be of local (lower) value. It will be removed as part of the proposed development.

H5 (194m)

This hedgerow is not on the site of proposed development, but is on a sloping bank on the western side of the deep main drainage channel which forms the western site boundary of the Durnish lands. Some trees are present in the southern part. Its lack of maturity, poor condition and generally low profile detracts from this hedgerows ecological value, although it does have a minor connecting function within the local landscape. It does not function as an ecological corridor linking key features of local value. It is assessed to be of local (lower) value. It will be retained as part of the proposed development.

H6 (94m)

A small hedgerow bordering the developed area to the north, containing some Hawthorn and abundant Bramble. It does not function as an ecological corridor linking key features of local value. It is assessed to be of local (lower) value. It will be removed as part of the proposed development.

H7 (375m)

A small section of his field boundary hedgerow appears on the first edition OS map. The rest is not on the first edition map but is over 100 years old as the boundary appears on the 2nd edition map. It is long-term unmanaged and is very gappy at the base and with numerous cattle crossing points and some gaps filled by Bramble. It measures 4 - 5m in height and is dominated by Hawthorn with some larger trees present including Ash and Hornbeam. It was used by small numbers of foraging bats on a regular basis. Its maturity lends this hedgerow an ecological value, but which is significantly diminished by its poor condition. It does have a minor connecting function within the local landscape but does not function as an ecological corridor linking key features of local value. Despite its age it is in very poor condition and it is assessed to be of local (lower) value. It will be removed as part of the proposed development.

H8 (403m)

A well-established hedgerow bordering the railway line (Plate 7.2.5). In parts there is a substantial sod and stone ditch underneath, to about 1m in height, although this is missing for large sections. An overgrown and unconnected drainage ditch is present in parts on the railway side, which is occasionally wet. There are a number of potential bat roost features here and it was consistently used by foraging and commuting bats of a range of species. This included Lesser Horseshoe Bat on occasion. This hedgerow functions as an ecological corridor for key features of local value, acting as a wildlife corridor and passing through a number of habitat types along the entirety of its length. It is assessed to be of local (higher) value. It will be retained as part of the proposed development.

H9 (497m)

A well-established hedgerow with numerous trees bordering the southern side of the railway tracks (Plate 7.2.5). It is often gappy and Bramble filled and has no drainage ditch. This hedgerow qualifies as a Heritage Hedgerow due to its historical significance, the presence of a ditch and its diversity. As with H8 above it is a significant wildlife corridor, contains a number of potential bat roosts and was consistently used by foraging and commuting bats. This included Lesser Horseshoe Bat on occasion. It is assessed to be of local (higher) value. It will be retained as part of the proposed development.

Plate 7.2.5 Railway looking east from port access road (Hedgerows H8 and H9 partly visible)

H10 (275m)

This is a recent and immature gappy hedgerow composed mainly of small Hawthorn, along a fence-line adjacent to the access road. It is assessed to be of local (lower) value. It will be removed as part of the proposed development.

H11 (247m)

This is a recently planted gappy hedgerow composed mainly of small Hawthorn, along a fence-line adjacent to the access road. It is assessed to be of local (lower) value. It will be retained as part of the proposed development.

H12 (165m)

A continuation of H10. A small new gappy hedgerow composed mainly of small Hawthorn, along a fence-line adjacent to the Port access road. It is assessed to be of local (lower) value. It will be retained as part of the proposed development.

H13 (168m)

A continuation of H11. A small new gappy hedgerow composed mainly of small Hawthorn, along a fence-line adjacent to the Port access road. It is assessed to be of local (lower) value. Parts of this length of hedgerow will be removed to facilitate a footpath to a bus stop as part of the proposed development.

Treelines WL2

For ease of reference Hedgerows (H) and Treelines (T) are numbered in Figure 7.2.2 above and described and assessed individually. Lengths correspond to the features as shown in the habitat map in Figure 7.2.1. The treelines are generally not diverse but they do contain mature native trees and have potential for both foraging and roosting bats. A further treeline of tall conifers is present within the port but at a distance from the proposed development, and not described further here.

T1 (452m)

This is a treeline of mature Ash, Sycamore, Willow and Hawthorn up to approximately 8m tall adjacent to the railway on the western side of the road, north side of the tracks (Plate 7.2.6). A deep but overgrown and unconnected old drainage ditch is present between treeline and tracks in places. There is limited ground flora associated with the treelines; Bramble, Creeping Thistle and the invasive Winter Heliotrope were recorded. Ivy is often dense on the trunks and lower branches. Given its age and maturity this treeline gains a high ecological value. It does however have a significant role as a wildlife corridor being a long hedgerow and passing through a large number of habitats along the entirety of its length, in association with adjacent hedgerows. In conjunction with T2 (as well as H8 and H9) the double treeline also provides significant shelter. It contains a number of likely bat roost features and was consistently used by a range of foraging and commuting bat species. This included Lesser Horseshoe Bat on occasion. Its value is distinctly reduced from lack of management, being in relatively poor condition with limited regeneration and not particularly diverse. Nonetheless, such treelines are scarce in the wider area and primarily as a wildlife corridor. It is assessed to be of local (higher) value. It will be retained as part of the proposed development.

T2 (440m)

As T1, but without the associated drainage ditch (Plate 7.2.6). For the same reasons it is assessed to be of local (higher) value. It will be retained as part of the proposed development.

T3 (206m)

This short treeline borders the deep drainage ditch. It is composed mostly of mature Ash trees, some with dense Ivy cover, although many trees are dead or dying and the hedgerow is in relatively poor condition, being gappy at the base (Plate 7.2.3). This treeline consistently had a range of bat species foraging and commuting, including Natterers Bat and Lesser Horseshoe Bat. There is one tree with potential to accommodate roosting bats. This is a remnant part of a field boundary shown on the first edition OS map. For its historical significance and associated wet drain this treeline is considered to be a Heritage Hedgerow. Due primarily to its maturity it is assessed to be of local (higher) value. It will be removed as part of the proposed development.

T4 (75m)

This is a tree circle of Sycamores in the south-west of the site. The trees are about 12m tall and mature. There is almost no ground flora below but Lords-and-ladies grows here. Tree circles are usually associated with demesnes however this feature is not shown on the historic Ordnance Survey maps. As a non-native species, the ecological value of Sycamore is limited, although it does provide shelter for invertebrates and other animals. Two of these trees are considered to have low potential for roosting bats. Nonetheless, this small area has no significant understory and no significant connectivity. It is assessed to be of local (lower) value. It will be retained as part of the proposed

development.

Plate 7.2.6 Railway looking west from port access road (Treelines T1 and T2 visible)

Scrub WS1

There is a small area of approximately 3.8ha of scrub within the Port to the west of and far removed from the site of proposed development at Durnish. A portion of this habitat has been cleared of vegetation. Species include Bracken, Bramble, Hawthorn, immature Sycamore, False Oat Grass, Large Bindweed, Wild Angelica, Great Willowherb, Creeping Thistle, Nettle, Common Fleabane and Elder.

There are also small patches of scrub within the wet grassland but most of these are too small to map independently. One larger patch of scrub (approximately 0.07ha) occurs on an area of rock outcrop within the site of proposed development at Durnish and contains Bramble, Hawthorn, Nettles and an Ash sapling. Further small areas of scrub exist within the port estate but outside the boundary of the site of proposed development.

Scrub is a very widespread habitat and although it is likely to be of value to a range of local wildlife, this habitat does not contain a high diversity of plant species, does not provide a significant linking function between other habitats and the range of species using it are likely to be common and widespread. The small area of scrub to be removed as part of the proposed development is assessed to be of local (lower) value.

Recolonising Bare Ground ED3

This habitat occurs along the disused railway track far removed from the site of proposed development at Durnish and closer to the proposed Jetty extension area. It occurs also in smaller pockets throughout the port estate, again outside of the site of proposed development.

The railway corridor is generally very species rich, supporting Rosebay Willowherb, Hoary and Great Willowherbs, Pineappleweed, Ivy, Dandelion, Bramble, False Oat Grass, Silverweed, Imperforate St. John’s Wort, Perennial, Smooth and Prickly Sow Thistles, Greater Plantain, Annual Meadowgrass, Black Medick, Ribwort Plantain, Wild Carrot, Scarlet Pimpernel, Daisy, Meadowsweet, Spear Thistle, Ladies Bedstraw, Greater Burnet Saxifrage, Upright Hedge Parsley, Fumitory, Knapweed, Hogweed, Wild Angelica, Common Fleabane, Nipplewort, Bracken, Herb Robert, Marsh Woundwort, Eyebright, Common Spotted-Orchid and Horsetail. There is also Buddleia, Traveller’s Joy, Large Bindweed and some small patches of Japanese Knotweed. Scrub is starting to invade the railway with Blackthorn, Hawthorn, Ash and Sycamore saplings present.

There are various patches of recolonising bare ground elsewhere within the port; along the verges of roads, under the pipeline and in unused/lightly used storage yards. Frequently occurring plant species in this habitat at the port include Redshank (or Lady's thumb), Pineappleweed, Groundsel, Docks, Long-headed Poppy, Nettle, Willowherbs, Annual Meadow Grass, Ragwort, Creeping Thistle, Scarlet Pimpernel, Lesser Trefoil, Shepherd’s Purse, Charlock, Turnip, Hedge Mustard, Lesser Swine Cress, False Oat-grass, Cock’s Foot and Yorkshire Fog. Buddleia, Traveller’s Joy and Willows occurred occasionally on recolonising bare ground. Black Nightshade, Thorn Apple and Narrow-leaved Ragwort also occurred (albeit occasionally to rarely) in this habitat.

Recolonising bare ground along the railway corridor has a diverse range of plant species and is likely to be an important habitat for invertebrates. It is used by foraging bats and has the potential to act as a corridor for movement of many species. This habitat functions as an ecological corridor for key features of local value. It is assessed to be of local (higher) value. It will be retained as part of the proposed development.

Recolonising bare ground elsewhere within the port consists of ruderal species and is outside of the site of proposed development. It is assessed to be of local (lower) value.

Spoil and Bare Ground ED2

In places within the Port the recolonising bare ground had been sprayed with weed killer and is thus better classified as bare ground. This habitat does not occur within the site of proposed development. It is assessed to be of local (lower) value.

Sea Walls, Piers and Jetties CC1

The rock armour and various other structures at the site of proposed construction of a jetty extension between the existing East Jetty and West Quay corresponds to this habitat category (CC1). It covers an area of approximately 0.77 ha within the site boundary but is present throughout the port estate at its interface with the estuary. The lower portions of many of the structures are covered at high tide and have been colonised by *Fucus* seaweeds. These coastal constructions are mainly unvegetated above the high tide line; Willowherbs occur occasionally, Tree Mallow and Sea Mayweed are the only typical coastal species. This is an artificial habitat and above the Mean High Water Mark (i.e. terrestrial habitats) it is assessed to be of local (lower) value.

Buildings and Artificial Surfaces BL3

Much of the port and the roadway correspond to this habitat category. Plant species such as Willowherbs and Buddleia occur occasionally. This habitat is assessed to be of local (lower) value.

7.2.2.2 Invasive Plant Species

Sycamore, Buddleia, Japanese Knotweed, Common Cord Grass, Winter Heliotrope and Traveller's Joy were noted as described within the habitat descriptions at Section 7.2.2.1 above.

Sycamore is commonly found in the hedgerows on site.

Buddleia was found in a number of waste ground areas within the port but outside the site boundary.

Japanese Knotweed was noted on the railway track approximately 200m northwest of the site of proposed development.

In the north-east of the site, at the banks of the Robertstown River there is a small area of mudflat, entirely covered in Common Cord-grass. It is adjacent to but outside the site boundary.

Winter Heliotrope was recorded in the grassland on the embankment at the north of the site.

Travellers Joy is abundant on the hedgerows and treelines along the railway track and occasional in hedgerows elsewhere on site.

A number of other invasive species are known from the 10km square R25 but were not recorded on site, including Himalayan Honeysuckle, Rhododendron and Field Penny-cress.

7.2.2.3 Flora Protection Order (FPO) & Rare Plants

Five plant species listed under the Flora Protection Order (2015) have been recorded in the wider area around the development site (See Table A7.2 in Appendix 7.1 for further information):

- Hairy Violet
- Round Prickly-headed Poppy
- Meadow Barley
- Great Burnet
- Cornflower

Cornflower has previously been declared Regionally Extinct in the Irish Red Data Book (No.1 Vascular Plants) (Curtis & McGough, 1988), but in the latest Red List (Wyse-Jackson *et al.*, 2016) has been moved to a 'waiting list' due to uncertainty over the provenance of some recent records. An arable weed, it is not likely to occur on site.

Round-headed Prickly Poppy and Hairy Violet are from very old records, although the Violet has been recorded more recently (1988) at Poulaweala River at the east side of Aughinish Island (>2 km east). Both species prefer drier habitats and are unlikely to occur on site. Round-headed Prickly Poppy has been declared Regionally Extinct (Wyse-Jackson et al, 2016).

Both Meadow Barley and Great Burnet are present at Aughinish Island (2017), to the east of the site, and continue to grow in the area following translocation projects there. The previously improved nature of the soils and grazing regime suggest that both species are unlikely to occur on site. Through consultation, NPWS requested that surveys take account of the possibility of these species being present. Surveyors were alert to the possibility of these species being present on site, but none were located during surveys undertaken in the months of July and August despite extensive searching.

Other nationally rare and scarce vascular plant species noted in the SAC documentation as being present in the general area are:

Triangular Club-rush (river Shannon estuary is only site in Ireland, at River borders in inner estuary)

- Lesser Bulrush
- Summer Snowflake
- Opposite leaved Pondweed (Limerick City)
- Golden Dock (River Fergus Estuary)

Triangular Club Rush is known from further east, upriver on the River Shannon, with the nearest known locations being the Rivers Maigue and Owenagarney, which are approximately 20km east of the site. Some suitable habitat exists on site. Suitable habitat also exists on site for the other species mentioned above.

The generally improved nature of much of the site, and low diversity of plants recorded would indicate that the likelihood of those species occurring is low.

Surveyors were alert to the possibility of these species being present on site, but none were located during surveys despite extensive searching.

The following charophytes also occur within the SAC:

- Bearded Stonewort (brackish water specialist)
- Convergent Stonewort (Shannon airport lagoon)

Again, the generally improved nature of much of the site and generally improved nature of the farmland suggests that the likelihood of these species occurring is very low. Both species prefer clear water, with low nutrient inputs, and low levels of competition.

Waterways on site are likely to contain high levels of nutrient input, and are generally congested with aquatic plants. Nonetheless, surveyors were alert to the possibility of these species being present on site, but neither species was observed during surveys.

7.2.2.4 Terrestrial Mammals

Summary

The site in general is not of very high quality for mammals, although the more substantial, long established hedgerows bordering the east of the site and the railway line provide a high quality foraging, commuting and dispersal habitat.

Otter and Badger are not likely to breed on site, but both species were found to use the site on occasion. Otters were limited to north of the Durnish area, adjacent to the Robertstown River and drainage channel, whilst Badgers were located crossing the eastern hedgerow and in the north of the site.

Pine Marten was recorded from droppings in the eastern hedgerow in November 2016, but not at other times, indicating a low level of usage of the site, probably by a wandering individual.

Irish Stoat was found around the Durnish site, and may breed in the area.

Irish Hare is the most regularly detected mammal on site, and was regularly detected on camera moving across the eastern boundary. Numbers on site do not appear to be high, although records are common, and the species may breed on site.

Red Fox occurs commonly.

Domestic Dog and Cat were recorded and rodents are known to be present in the drier banks of the eastern hedgerow, the railway hedgerow and internal hedgerows.

Table A7.3 in Appendix 7.1 and Figure 7.2.3 show details of camera trap deployments and species captured, while Figures 7.2.4 and 7.2.5 show the locations of all protected mammal records (sightings, signs, tracks, trails and camera).

Figure 7.2.3 Camera Trap Locations

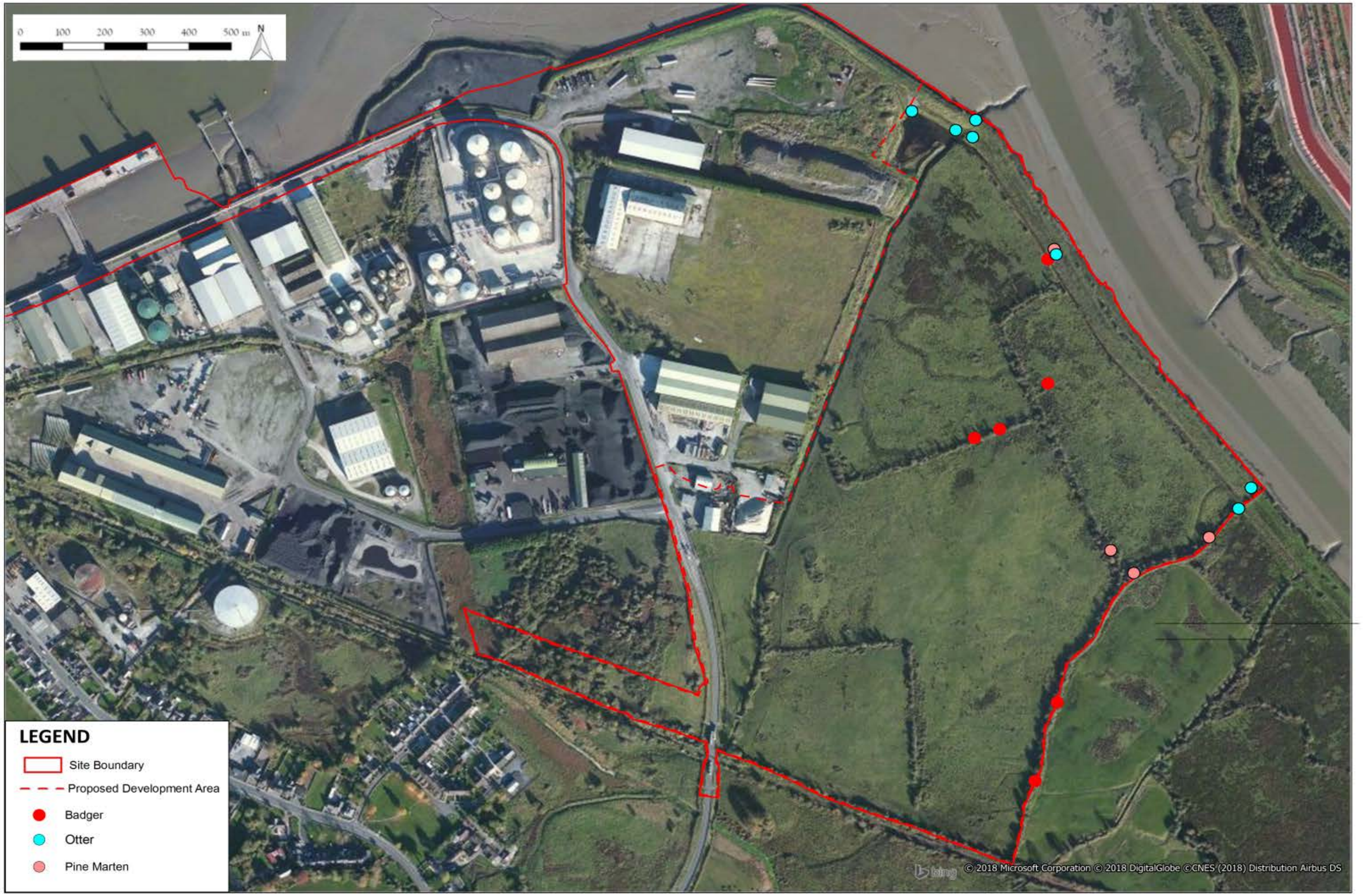


Figure 7.2.4 Records of Badger, Otter and Pine Martin

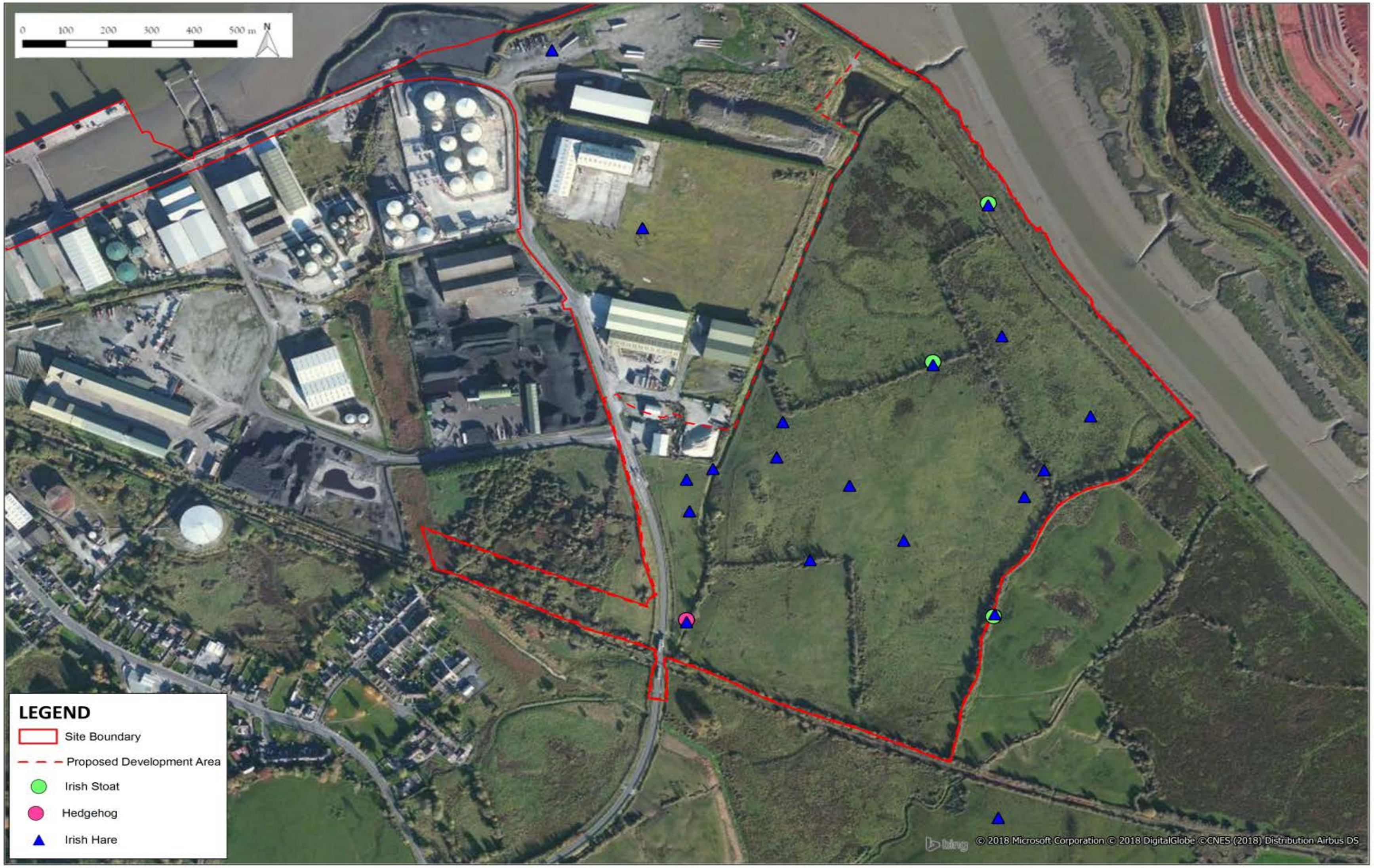


Figure 7.2.5 Records of Irish Stoat, Hedgehog and Irish Hare

Figure 7.2.6 Records of other mammals

Badger

There were 10 records of Badger on the site: 3 prints, 1 set of scratch marks and 6 camera records. Locations of all records are shown in Figure 7.2.4.

Badgers are nocturnal. Widespread in Ireland, they thrive in mosaic habitats of woodland, hedgerow and farmland. They excavate complex underground tunnel systems, called setts, and avoid building setts in areas prone to flooding. The Atlas of Mammals in Ireland (2010-2015) notes that hedgerows are favoured sites for setts sites (Lysaght & Marnell, 2016). Badgers are omnivorous, taking a wide variety of foods, both animal and plant, with earthworms being a favourite. Territories vary from 60 – 200 hectares. Cubs are born in the early spring.

Badger records included a print and scratch marks in H1 in November 2016, and prints at Bridge D and H4 in April 2017. Camera records came from Hedgerows H1 in March and April 2017, Hedge H4 in May 2017 and Bridge D in June 2016. A mammal trail leading towards the small ring of Sycamores in the south, from the railway, was probably made by Badgers. There was no evidence of use of port areas beyond the Durnish site by Badgers and nor is this likely given the absence of semi-natural habitats, high levels of human movement, port lighting and restricted prey availability.

Given the high level of survey effort and very low number of detections at the Durnish site, it is concluded that use of the site of proposed development by Badgers is irregular to occasional. Badgers are likely to use the Durnish site for occasional foraging, and may use the railway corridor while moving throughout the wider area.

No evidence at all of Badger sett activity was observed at the Durnish site.

Badger is widespread in Ireland and is a protected species under the Wildlife Acts. There is a general lack of suitable habitat for setts on site and the species is an irregular visitor in small numbers. As a biodiversity feature at this site of proposed development, it is assessed to be of local (lower) value.

Otter

There were 7 records attributed to Otter from the site, 1 trail, 2 prey remains and 4 droppings. There were no sight or camera records. Locations of all records are shown in Figure 7.2.4. Note that not all trail records are included on the map but they are discussed below, and that many prey remains (eg crabs) could not be attributed to any species of predator as it could not be determined if they were the result of mammal or bird activity.

Otters are widespread in Ireland and found in a variety of aquatic habitats, both freshwater and marine, but always requiring access to fresh water. Their territorial nature results in frequent marking of territories with droppings (‘spraints’), which can usually be readily identified and are often placed in conspicuous locations. Otters breed in burrows, called ‘holts’, and also use safe places to rest above ground during the day (‘couches’). Holts are often found under tree root systems near water, but can be located some distance from water. Otters are primarily nocturnal, and feed on a variety of prey, usually fish and crustaceans, but occasionally also taking birds and small mammals.

Otter activity was confined to the northern part of the site, around the drainage channel and larger drainage pool. Activity was recorded throughout the survey period, but was pronounced in the November 2016 - January 2017 period (6 of the 7 records). Most activity consisted of both old and fresh spraint and prey remains found at the edge of the drainage pool (mostly crab). In all winter months, multiple trails from the pool leading up over the embankment were noted, indicating a regular transit between the pool and the Robertstown River. Fewer tracks were noted in the north-east of the site, but occasional prey remains (crabs) were found as well as tracks leading over the embankment, and a worn path leading from the drainage channel into the eastern hedgerow, which was probably made by Otter.

Fewer tracks over the embankment were noted from March 2017 and those that did exist appeared less well used. In June and July 2017 a large amount of crab remains were noted in the vicinity of Bridge D in the north of the site. At least one of these showed beak mark consistent with crow, and a camera trap at this location detected crows eating a prey item which may have been crab. Nonetheless these prey items are also consistent with Otter activity and are mapped in Figure 7.2.4, although they may not relate to any mammal species.

Mammal survey in November 2016 and July 2017 specifically checked the rock armour, jetties and shorelines of the port sectors but no evidence of Otter was found. These areas were checked again during monthly bird surveys until March 2017 and during habitat surveys and again no evidence of Otters was found.

Relatively low quality habitat and low potential for otter holts exist on site, particularly in the embankment along the Robertstown River, the northern part of the eastern hedgerow, and the rock armour in the port sections.

No evidence of the existence of Otter holts or couches was recorded on or adjacent to the site of proposed development. It is thus considered that Otters do not breed at the site, but visit the edge of the site occasionally to forage in the drainage channels and pool. Otters are known to be relatively abundant across the Robertstown River in both the western and eastern parts of Aughinish Island, and breed in both areas (Liam Dundon, wildlife specialist Aughinish, *pers.comm*). This is only 300m across the river. Otter activity at Durnish and Foynes is thus considered most likely to be a result of animals visiting the site occasionally from the Aughinish area.

Otter is widespread in aquatic habitats in Ireland but a protected species under the Wildlife Acts, and under Annexes II and IV to the Habitats Directive. There is a general lack of suitable habitat for holts or couches but the species is a regular visitor to the Durnish site, albeit limited to the northern edge at the estuary. As a biodiversity feature at this site of proposed development, it is assessed to be of local (lower) value.

Pine Marten

There were 3 records attributed to Pine Marten from the site, all droppings in a limited area recorded in November 2016 (Figure 7.2.4).

Pine Marten are usually found in deciduous woodland or scrub, but being an opportunist can also regularly be found in other habitats. Territories can be marked with usually distinctive droppings. Nest sites can be found in *"a variety of locations such as hollow trees, clefts in rocks, abandoned squirrel nests or outbuildings"* (Hayden & Harrington, 2000). Formerly found primarily north of the Shannon, it has been increasing its range in recent years.

Multiple Pine Marten scat was found on trees in a hedgerow (H1) on the eastern boundary of the Durnish site during mammal survey in November 2016. These areas were searched thoroughly during subsequent site visits, and camera traps were deployed in the vicinity, but no further signs of activity were noted. Pine Marten are likely to occur in the deciduous woodlands to the south and west of Foynes (also Red Squirrel records exist for there in 2012). The location of sightings in the Durnish lands is sub-optimal habitat, not directly connected to likely Pine Marten habitat in the wider vicinity. It is considered that the activity noted was a result of a wandering individual, and the site is not likely to be used for any purposes by Pine Marten on a regular basis.

Pine Marten is limited in distribution in Ireland, although expanding its range. It is protected under the Wildlife Acts and under Annex V of the European Habitats Directive. There is a general lack of suitable habitat for breeding and the species is not likely to be a regular visitor to the site. As a biodiversity feature at this site of proposed development, it is assessed to be of local (lower) value.

Irish Stoat

There were 20 records attributed to Stoat from the site, all camera detections, from 3 locations (Figure 7.2.5). Widespread across Ireland, the Irish Stoat is an endemic subspecies of the European Stoat, limited in occurrence to Ireland and the Isle of Man (Hayden & Harrington, 2000). It thus has an added ecological value in terms of genetic diversity. Being extremely adaptable, it is found in a wide variety of habitats, but usually near woodland, scrub and hedgerows. Food is diverse animal prey, from rabbits to rodents, but can also include birds and invertebrates. Stoats are extremely territorial and males are usually only tolerated in a females territory for mating, which takes place from March to June. Kits are born in April or May and litters are usually large (6 – 9 on average) and are sexually mature and often mated at 2 – 3 weeks of age (i.e. whilst still unweaned).

This species was captured on camera three times in the eastern hedgerow, twice on 27/03/2017 and once on 05/04/2017. Between 11th and 18th May there were 13 detections in hedgerow H4 including two detections of two animals together and 5 detections of an animal climbing a tree. On 14th and 15th June 2017 there were 4 detections of Stoat near Culvert D in the north of the site. All records may relate to the same individuals.

It appears likely that Stoat forages on site. No evidence of a breeding location was observed. Stoats are widespread in Ireland but a protected species under the Wildlife Acts. The Irish subspecies is genetically distinct in a European context, adding to its ecological value. The species is a regular visitor to the site and suitable breeding habitat does exist on site but no evidence of a breeding site was observed. As a biodiversity feature at this site of proposed development, it is assessed to be of local (lower) value.

Hedgehog

There were 2 records of Hedgehog from the site, both camera detections (Figure 7.2.5). Both detections occurred near Culvert B on the night of the 7th May 2017.

Hedgehogs appear to be widespread and reasonably common in Ireland, having been introduced in Medieval times (Lysaght & Marnell, 2016), although the precise status is unclear due to lack of standardised survey.

Although a protected species under the Wildlife Acts, Hedgehog appears to be only an occasional visitor to the site. As a biodiversity feature at this site of proposed development, it is assessed to be of local (lower) value.

Irish Hare

There were 216 records attributed to Hare from the site, by far the highest of any species. 203 of these were camera detections and 13 were sightings, from widespread locations (Figure 7.2.5). Almost all records were in the Durnish lands, with a small number in wasteland within the port estate. A number of records on camera in the eastern hedgerow (H1) indicate a movement of animals across this boundary. No signs of a Hare form were observed.

Widespread across Ireland, this species is mostly found in open grassland habitats, often with associated hedgerows and other cover. They breed above ground and are largely nocturnal. The Irish form is considered a subspecies of the Mountain Hare, differing primarily in not attaining a white winter coat.

Irish Hares are widespread and abundant in Ireland but a protected species under the Wildlife Acts and under Annex V of the European Habitats Directive (Annex V references animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures).

The species was commonly observed on the site and suitable breeding habitat does exist on site although no forms (resting places) were observed. Given its regular occurrence at Durnish lands, Irish Hare may breed at the site of proposed development. The Durnish site is evaluated as forming part of a wider territory of a local population of a protected species and as a biodiversity feature; Irish Hare is assessed to be of local (higher) value.

Other Mammals

A number of other mammal species were found to occur on site (Figure 7.2.6), or are known to occur in the wider area (within 10km). None of those known to occur in the wider area are protected species. Pygmy Shrew, although undetected in the suite of surveys conducted, could occur in the hedgerow habitats on site. This species is protected under the Wildlife Acts. The majority of mature boundary vegetation at the site of proposed development is to be retained and supplemented.

National Biodiversity Data Centre records show that Red Squirrel has been recorded in the woodland south of Foynes Town in 2012, approximately 1km from the site. Habitats on site are not generally suitable for Red Squirrel and the site provides no connectivity between habitats which may be suitable. They may occasionally occur in the larger hedgerow and treelines adjoining the railway line when dispersing.

Red Fox is regular visitor to the site of proposed development at Durnish (signs and trails), and was noted to move across the eastern boundary regularly along with Irish Hare, although no evidence of breeding was noted at the site of proposed development. A single adult was noted carrying prey (woodpigeon) southwards on 15th June 2017 at the northern Culvert D.

A number of captures of small mammals (probably Wood Mouse) were made on camera in the eastern hedgerow (H1), with another in hedgerow H7. The species is likely to be widespread and common around the site, and the eastern hedgerow (H1) and the southern hedgerow (H8) provide high banks where small mammals have excavated tunnels. Similarly, Brown Rat was detected in H1 and by Culvert D in the north. Likewise this species is likely to be widespread through the site (and also in the already developed port area).

The recently introduced invasive species Greater White-toothed Shrew has been recorded within 1.1km of the site of proposed development (just west of Foynes) in 2010, but was not observed at the site of proposed development.

Another introduced species, the Bank Vole, has been recorded in 2011 within 700m of the west of the site (10 trapped) and although it may occur at the site of proposed development, it was not detected during the suite of surveys conducted.

Table A7.4 in Appendix 7.1 summarises mammal species recorded at or which could occur at the site of proposed development.

7.2.2.5 **Bats**

All Irish bats are protected under Annex IV to the Habitats Directive (*"Animal and plant species of community interest in need of strict protection requiring strict protection"*), and Lesser Horseshoe Bat has additional protection under Annex II (*"Animal and plant species of community interest whose conservation requires the designation of special areas of conservation")*. All Irish bat species are also afforded protection under the Irish Wildlife Acts, which makes it an offence to wilfully interfere with, or destroy, the breeding or resting place of these species.

Bat Activity

Seven bat species were recorded on site, showing that the site of proposed development generally and particularly the linear railway corridor to the south of the site of proposed development, has a diverse range of bat species. Full results of bat survey are presented as a Bat Survey Report in Appendix 7.2.

Common and Soprano Pipistrelle and Leisler's Bat were the most frequently encountered species, reflecting their range and distribution, and they were regularly encountered foraging and commuting on site.

Activity was centred along the disused railway corridor, with high levels of Pipistrelle activity. Pipistrelle presence was also consistently noted on the eastern hedgerow (H1), and at lower levels, activity was detected in almost all parts of the site. Activity was generally low over the main body of the Durnish lands proposed for development, save for one period of high bat foraging activity detected along hedgerow H2 in June. There were indications of possible roosting of these species in trees along the railway corridor outside of the site of proposed development, although it is likely that many (if not all) of these bats are roosting in nearby buildings at Foynes.

Brown Long-eared Bat was detected regularly at the site of proposed development, again with records focused on the railway corridor and adjacent hedgerows.

Myotis Bats were also recorded regularly at the site of proposed development, in particular Natterers Bats, but Whiskered Bat also on one night. Daubentons Bat was not recorded and is unlikely to forage on site. Natterers Bat activity focused on the grassland adjacent to the river and along the railway corridor.

Lesser Horseshoe Bat was recorded occasionally at the site of proposed development, with records distinctly focused on the railway corridor, although one period of activity was detected at Treeline T3 between the site of proposed development and the Port access road. It is not likely to occur elsewhere on site. The nearest known roost is over 3km away and although there is no likelihood of the species roosting at the site of proposed development, the presence of an undetected roost closer to the railway corridor cannot be discounted, most likely in the deciduous woodland to the south and west of Foynes town.

Pipistrelles

Three Pipistrelle species occur in Ireland. Common and Soprano Pipistrelles are two of the most abundant bat species, while Nathusius' Pipistrelle is scarcer and more localised, with some resident individuals and others assumed to be migrants. Common and Soprano Pipistrelles were the most commonly encountered bat species at the Durnish site of proposed development. Nathusius' Pipistrelle was not recorded and is not known from the wider area (nearest known record is 16km away in 2014). Records from surveys are shown in Figure 5 of the Bat Survey Report in Appendix 7.2.

Although transect records show a wide distribution of Common and Soprano Pipistrelles at the site of proposed development at Durnish, it was clear that numbers of registrations in the northern parts were far fewer than in the southern section, with activity particularly pronounced around the railway corridor and eastern hedgerow. However, the static detectors showed a distinctly and anomalously high number of registrations, including feeding buzzes and some social calls, in June at location E on Hedgerow H2 (refer Figure 7.2.2 for location of hedgerow H2 and Figure 4 of the Bat Survey Report in Appendix 7.2 for static device location E) in the north of the site of proposed development at Durnish. There was also a high level of activity noted south of and outside of the site of proposed development at the river. Registrations of Soprano Pipistrelles averaged somewhat higher than Commons.

There was no Pipistrelle activity noted within the existing port section of the site.

Summer roosts have been found primarily in buildings and they are assumed to hibernate in buildings and trees but hibernacula have been seldom recorded in Ireland. Foraging habitat appears to be primarily associated with tree lines, hedgerows and woodland (NPWS, 2009), although Soprano Pipistrelles are often found closer to water.

No roosts were detected at the site of proposed development. However, activity strongly indicative of the presence of a Common Pipistrelle roost was noted along the western section of the railway corridor outside of the site of proposed development, in the vicinity of Potential Roost Features (PRF's) 1 & 3, and 6/7 (Refer Section 3.3 of the Bat Survey Report in Appendix 7.2. for discussion on PRFs and Figure 10 for PRF locations). Bats were seen circling and foraging actively around suitable trees, very early in the evening, and were possibly seen entering and exiting PRFs 1 and 3. Although Soprano Pipistrelles were also noted later, these appeared to be mostly coming in from the west (Foynes town).

At the eastern section of railway, behaviour was also noted around PRF 25 to the south of the proposed open storage area which was suggestive of roost activity (early emergence, lots foraging) of both Pipistrelle species, although this was not certain.

In addition, a lot of late morning commuting and foraging of both Pipistrelle species was noted along the eastern Hedgerow H1 (refer Figure 7.2.2), although most bats were seen to fly off to the north or south at the last minute.

Common and Soprano Pipistrelles are the most common bat species in Ireland and widespread through the country (NPWS, 2009). They are classified as Least Concern in the Irish Red List of Terrestrial Mammals (Marnell et al, 2009), both in Ireland and Europe, and are given a Favourable

Conservation Status in the most recent reports on the Status of EU Protected Habitats and Species in Ireland (NPWS, 2013). As with all Irish bat species, these species are protected species under the Wildlife Acts and Annex IV of the Habitats Directive.

Due primarily to their protected status and their widespread and common status in Ireland, these two species as biodiversity features at this site of proposed development, are assessed to be of local (higher) value.

Myotis Bats

Identifying Myotis bats from acoustic data is extremely difficult and usually not possible, and these species are treated as a group here for that reason, despite having differing ecologies. Of all the species, Natterer's Bat has the widest range of vocalisation frequency and can sometimes be identified as a result of this, as at this site. Records of individually identified Myotis species, based solely on acoustic data, should always be treated with a degree of caution however. Myotis bat activity was recorded at the site of proposed development in small amounts but in widespread locations (Figure 6 of the Bat Survey Report in Appendix 7.2.) although very few were recorded north of the railway in the actual site of proposed development. Myotis bats showed a clear preference for habitat features to the south of the site, in particular near the stream and along the railway corridor, with lower activity on the eastern hedgerow and even less within the site of proposed development. The highest amount of activity was recorded near the stream to the south of the site by static detector in June.

A Natterer's Bat was seen and recorded feeding near this location during spot counts in June, and many of the static recordings were strongly suggestive or characteristic of this species, showing the characteristic steep and short broadband frequency sweep (see Appendix II of the Bat Survey Report in Appendix 7.2.). Natterer's Bats were identified from acoustic data along the railway on 5 of 24 nights in May, with unidentified Myotis on an additional 11 of 24 nights.

The high level of Natterer's Bat activity near the stream in the south was concentrated over two nights (20 of the 23 records), although activity was recorded on 4 out of 5 nights here. Almost all activity was recorded between 0100 and 0230 hours (21 of 23 records).

Whiskered Bat was identified from acoustic static detector data along the eastern hedgerow, giving 3 recordings on the night of 11/12 May (see Appendix II of the Bat Survey Report in Appendix 7.2.), two close together at 2321/2322 hours, and another at 0506 hours. The extremely similar Brandt's Bat has been recorded on a very few occasions in Ireland, and while that species cannot be entirely excluded here, on current knowledge it is much more likely that records refer to Whiskered Bat, and they are treated as such. A consultation response from Bat Conservation Ireland shows that this species has also been recorded within approximately 1km south of the site boundary. As a primarily woodland species it is considered to be an occasional visitor to the site due to low amount of suitable foraging habitat.

Daubenton's Bat was not identified at the site of proposed development. Although some waterbodies exist close to or on the site, these are generally small and congested with plant life, thus of reduced suitability for this species. A consultation response from Bat Conservation Ireland shows that this species has been recorded within approximately 1km south of the site boundary. It is considered unlikely to regularly occur on site due to lack of habitat.

There was no activity of Myotis Bats noted from within the port section of the site.

Myotis bats are the some of the least studied or recorded resident bat species in Ireland. Foraging habitat of Whiskered Bats appears centred on grassland surrounded by hedgerows, or woodland, while Natterer's prefers to glean prey from broad leaved woodland, and tree lined river corridors, ponds and grassland. Daubenton's are primarily associated with slow moving waterbodies. Nonetheless, all species can be found in hedgerow and woodland habitats (NPWS, 2009).

Summer and nursery roosts of Whiskered and Natterer's have been found primarily in buildings, with roosts usually consisting of small numbers of individuals, although both species have also regularly been found roosting in bridges. Daubenton's has been found primarily roosting in bridges, although is often also found in buildings in summer (probably prefers older buildings near water). All have been recorded roosting in trees, and Daubenton's has also been recorded in bat boxes (Schwegler type) in Ireland (NPWS, 2009).

Whiskered hibernate in a range of underground sites, while Natterer's have been primarily found in caves or underground sites, but with some records from ruined buildings and bridges. Hibernacula of Daubenton's bats are rarely found, but it is likely that they commonly use underground sites (NPWS, 2009).

No activity suggestive of roosting on site was detected for any Myotis bats, although these species can enter and leave roosts late and our level of roost work was unlikely to detect roosting Myotis bats especially in the small numbers likely to be present on site.

Whiskered, Natterer's and Daubenton's appear to occur in widespread locations throughout the country, but only Daubenton's appears to be common (NPWS, 2009). Both Whiskered and Natterer's appear to be scarce, although both species can be found in small numbers in the right habitats. They are all classified as Least Concern in the Irish Red List of Terrestrial Mammals (Marnell et al, 2009), both in Ireland and Europe, and all are given a Favourable Conservation Status in the most recent reports on the Status of EU Protected Habitats and Species in Ireland (NPWS, 2013). As with all Irish bat species, these species are all protected species under the Wildlife Acts and Annex IV of the Habitats Directive.

Natterer's Bat appears to be the most regularly occurring Myotis Bat at the site of proposed development, particularly along the railway corridor and over grassland adjacent to the stream to the south of the site of proposed development. Given its general scarcity on a national level, and the apparently regular occurrence on site the species, as a biodiversity feature at this site of proposed development, is assessed to be of County value.

Whiskered Bat appears to be only an occasional visitor on site. However, given its general scarcity on a national level and known occurrences nearby the species, as a biodiversity feature at this site of proposed development, is assessed to be of local (higher) value.

Daubenton's Bat is not known to occur on site, and there are only poor quality foraging habitats for the species on site. Nonetheless it is known from the vicinity, and many of the Myotis registrations were not identified to species level. It may occur as a foraging species along the railway corridor or may commute along the same. Due primarily to its widespread and common status in Ireland, general lack of records on site and generally low site suitability, Daubenton's Bat is assessed to have a low local value.

Leisler's Bat

Leisler's Bats were commonly recorded throughout the site of proposed development during all survey types (Figure 7 of the Bat Survey Report in Appendix 7.2.). As with Pipistrelles, a significant amount of feeding activity was noted in June in the north of the site (static deployment site E), which was similarly somewhat anomalous to the results from other surveys, when Leisler's Bat was more rarely recorded in the northern parts of the site. Otherwise records show some concentration to the south and south-west outside of the site. Bats were occasionally noted foraging high above the railway line area.

Leisler's Bat was the only bat species recorded within the existing port boundary, when a single individual was heard and seen flying in at dusk from the direction of Foynes Island, and on through the port. This individual almost certainly roosted on Foynes Island, outside the site boundary.

Foraging has been recorded over a wide variety of habitats, although there are some indications that pasture may be preferred, along with drainage canals and lakes. Leisler's Bats are strong fliers, and have been recorded foraging up to 13.4km from roosts (NPWS, 2009).

Summer roosts have been found primarily in buildings in Ireland, although some have been found in trees (beech, oak and ash), and elsewhere in Europe trees are the preferred roost locations (NPWS, 2009). Small numbers are known to roost in bat boxes (Schwegler type). This species is known to exhibit regular roost switching behaviour. Day roosts in buildings and hollow trees have been recorded, and these have also been used as night roosts on occasion.

There are few data regarding hibernation roosts for this species, although bats have been found both in old buildings and in tree roosts (with large trees such as oak and beech seemingly preferred).

No roost locations were detected on or near the site during our surveys. On a number of occasions bats were seen flying in the direction of Foynes town, often at high altitude (30 – 100m), early in the morning before sunrise. As with Pipistrelles, buildings around Foynes town would appear to have a high suitability for roosting bats. In June, bats were noted foraging high above the ring of sycamores (PRF 23-24) only 10 minutes after sunset. Although no roosts were detected, the sycamore ring may be a roost for small numbers of bats.

Leisler's Bat is one of the most common bat species in Ireland and widespread through the country (NPWS, 2009). It is classified as Near Threatened in the Irish Red List of Terrestrial Mammals (Marnell et al, 2009), but of Least Concern in Europe. It is given a Favourable Conservation Status in the most recent reports on the Status of EU Protected Habitats and Species in Ireland (NPWS, 2013). As with all Irish bat species, these species are protected species under the Wildlife Acts and Annex IV of the Habitats Directive.

Ireland is the European stronghold for this species, and it is estimated to account for 20-25% of the European population. Unlike elsewhere in Europe there is no other large bat species competing for the ecological niche in Ireland. Due primarily to its widespread and common status in Ireland, combined with the importance of Ireland on a European scale this species, as a biodiversity feature at this site of proposed development, is assessed to be of local (higher) value.

Brown Long-eared Bat

Brown Long-eared bats have very quiet echolocation calls, and often don't call very much, relying on their large ears to detect movement of prey items. As such they are difficult to detect acoustically, and as with our surveys, are more often detected using static detectors. A single bat was located visually and acoustically in April – the only bat recorded on the April transect surveys – at the eastern end of the railway. Otherwise, records almost all came from static detectors, with a concentration of records in the central portion of the site, along the railway line and nearby hedgerows. The largest concentration of records is illustrated in Figure 8 of the Bat Survey Report in Appendix 7.2., just north of the railway (near the old ash tree), and is primarily due to records from a single night, when 6 of the 7 records were obtained.

Brown Long-eared Bat is another of the most common and widespread bat species in Ireland (NPWS, 2009). It is classified as Least Concern in the Irish Red List of Terrestrial Mammals (Marnell et al, 2009), both in Ireland and Europe. It is given a Favourable Conservation Status in the most recent reports on the Status of EU Protected Habitats and Species in Ireland (NPWS, 2013). As with all Irish bat species, it is protected under the Wildlife Acts and Annex IV of the Habitats Directive.

The species requires large open spaces for roosting, where it can fly around prior to emergence. Summer nursery roosts have been found primarily in buildings in Ireland, in large open attics, although tree holes and farm buildings are sometimes used as temporary roosts. The species shows a high degree of roost fidelity (NPWS, 2009). Small numbers are known to roost in bat boxes (Schwegler type).

There are few data regarding hibernation roosts for this species, although bats have been found both in old buildings and caves (NPWS, 2009).

No indications of roosting on site were observed during all surveys. Foraging has been recorded over a wide variety of habitats, although there are indications that it is closely associated with some degree of tree cover (NPWS, 2009), which might include woodland, parks and gardens, hedgerows and scrub etc.

Due primarily to its regular occurrence on site, this species as a biodiversity feature at this site of proposed development, is assessed to be of local (higher) value.

Lesser Horse Shoe Bat

This species echo-locates at much higher frequencies than other Irish bats, and can be very difficult to detect on heterodyne detectors. There were no records of this species from transect counts, but a small number of records from static detectors in the vicinity of the railway corridor (Figure 9 of the Bat Survey Report in Appendix 7.2).

The species was recorded on 5 nights out of 24 on the railway and 1 night out of 8 immediately north of the railway in Treeline T3, as shown in Table 4 of the Bat Survey Report in Appendix 7.2. There were no detections elsewhere on site, despite a further 34 nights of detector deployment. It is likely, given the highly clustered nature of the records, that all 5 records on 15/6/2017 refer to the same individual spending 10 minutes in the vicinity. Similarly, the two records on 27/04/2017 may also refer to a single bat.

Given that the species is easily overlooked, activity of Lesser Horseshoe bats along the railway line is likely to be somewhat more regular than indicated by our results, although it is unlikely that the species occurs commonly. The railway area thus represents a regularly used resource by this species, for foraging or commuting.

The species requires open spaces for roosting and hibernating, which it can easily fly into. Summer nursery roosts have been found primarily in old or derelict buildings in Ireland, and the species shows a high degree of roost fidelity (Marnell et al, 2009). There is a single Irish record of roosting in a very large tree hollow (McAney et al, 2013). Hibernacula are generally well known in Ireland and are typically underground, in structures such as caves, cellars, souterrains etc. (Marnell et al, 2009).

Lesser Horseshoe bats typically forage in deciduous woodland and riparian vegetation, normally within a few km of their roosts. Bontandina et al (2002) found one bat foraging up to 4.2km from a nursery roost, but noted that most spent over 50% of their foraging time within 600m of it. Similarly, Motte and Libois (2002) also noted most activity within 500m of a nursery roost. Both authors suggest that conservation management of this species should concentrate on areas within 1.0 km - 2.5 km of the nursery roost. Many studies indicate heavy reliance on connectivity between roost and foraging areas, with bats relying on linear landscape features such as treeline, stonewalls and hedgerows to navigate and commute (Marnell et al, 2009).

There are no likely roost sites of any type on the site of proposed development. In Limerick, the population of Lesser Horseshoe bats appears to be small and centred on the Curraghchase area, approximately 14km east of the site (Roche *et al*, 2015). Consultation has revealed three known Lesser Horseshoe Bat roosts within 10km of the proposed development site. The closest is in the Mount Trenchard area, approximately 3km west of the site. This is towards the upper end of commuting distance to the site, but it may be that this is the source of the bats occurring on site.

The other known roosts are in the Kiladysert area, across the River Shannon to the north, and separated from the site by a minimum 2km of water. Lesser Horseshoe bats are known to be averse to crossing even relatively short open spaces on land, and it can be said with a degree of confidence that bats from this area will therefore not occur on site. Another known roost is 10km to the south near Rathkeale, and again this area is too distant for bats from that roost to occur on site.

A review of aerial imagery reveals that potential suitable foraging habitat also exists around the southern and western boundaries of Foynes town, and there is potential for undetected Lesser Horseshoe Bat roosts in this area. Given that the species often emerges late from roosts (Collins, 2016), the presence of individuals 80 minutes after sunset in April might suggest the presence of a closer roost, although given the generally colder weather in April bats may have emerged earlier and travelled longer distances on suitable nights.

Similarly, apparently suitable foraging habitat exists to the south-east of the site at Barrigone, which may also have suitable undetected roost areas. This is a minimum of 2.5km from the site, but significantly longer for bats avoiding open water areas, and connectivity between the sites is poor, being mostly agricultural farmland with some hedgerow. As such, there is unlikely to be significant commuting of bats from this area, should they exist.

Given the open nature of the habitats within the port, the general unsuitability of the building types and the high level of lighting through the night, it is not likely that Lesser Horseshoe Bats roost within the port boundary.

A widespread decline in this species across Europe was evident in the late 20th Century, although there are increasing signs of a stabilisation or partial recovery (McAney et al, 2013). The most recent population estimate in Ireland is 14,010 individuals, although the Irish population shows increasing trends in both the short and long-term (NPWS, 2013). Loss of roosting sites due to deterioration or renovation of old buildings, loss of commuting routes linking roosts to foraging sites and unsympathetic management of foraging sites are the major threats to this species (NPWS, 2013).

Lesser Horseshoe Bat has a restricted range in Ireland, being confined primarily to the six western seaboard counties of Cork, Kerry, Clare, Limerick, Galway and Mayo. It is classified as Least Concern in the Irish Red List of Terrestrial Mammals, but Near Threatened in Europe (Marnell et al, 2009). It is given a Favourable Conservation Status in the most recent reports on the Status of EU Protected Habitats and Species in Ireland (NPWS, 2013). As with all Irish bat species, it is protected under the Wildlife Acts and Annex IV of the Habitats Directive, but is the only Irish bat species afforded additional protection under Annex II of the Habitats Directive (with 41 Special Areas of Conservation designated). Roche et al, (2015) note that overall, the Lesser Horseshoe Bat population in Limerick is very small and the considerable distance to Kerry sites to the south and even south Clare sites to the north means that there is an ongoing risk of inbreeding or even extinction.

The species was only recorded occasionally on site, and there are no suitable nursery or hibernation roosts on site. Nonetheless, due primarily to its restricted range in Ireland, scarcity in the county and declining status in Europe, this species as a biodiversity feature at this site of proposed development, is assessed to be of County value.

Commuting and Foraging Habitat

Habitats at the site of proposed development which are of the highest potential value to bat species are the hedgerows, treelines and aquatic habitats - in particular where these are adjacent to each other or inter-connect. There is ample foraging habitat for a variety of bat species in the field areas. The port area does not provide a roosting, foraging or commuting resource for bats.

Old Tree-lined Railway Line

The disused railway line bordering the site of proposed development to the south is bound on both sides by mature treelines and hedgerows, with Ash and Hawthorn being the main mature tree species. At the west of the survey area, a relatively wide waterway, c. 4 m, runs to the south of the railway. There is wet marshy land to the south, and scrub to the north along the section of railway lying west of the road crossing the road to Foynes port. In the Durnish farmland (east of access road), there is grassland on both sides of the tree-lined railway corridor. There is currently no artificial lighting along the railway line, and this lack of light spill would be beneficial to all Irish bat species with the possible exception of Leisler's bat (Mathews *et al.* 2015). The tree-lined railway corridor is likely to provide relatively high quality foraging and commuting habitat for the full range of bat species recorded in the area. Potential bat roost features were also noted in trees and a bridge along the railway, as outlined in section 3.3 of the Bat Survey Report at Appendix 7.2. Common and Soprano Pipistrelles were frequently noted foraging and commuting in this area in May and June and Leisler's Bat was recorded regularly. Brown Long-eared Bat was recorded occasionally although is likely more frequent than records suggest as it is difficult to detect, while Natterer's Bat also showed a cluster of records in this area. In particular, Lesser Horseshoe Bat was recorded occasionally along the railway corridor and clearly uses the area on an occasional basis, although probably in small numbers.

This area is considered to be the most important area on the site for bat foraging and commuting, both in terms of activity levels, species diversity and roost potential.

River

There is a natural river channel to the south of the railway line and beyond the site if proposed development. It is a tributary of the Robertsown River which runs parallel to the north-east perimeter of the site of proposed development at Durnish. Rivers are generally highly productive foraging grounds for all Irish bat species because of the productivity of emergent aquatic insects on which many bat species feed. Daubenton's Bat and Soprano Pipistrelle are particularly associated with foraging along rivers in Ireland, but all bat species will take aquatic insects on occasion. Daubenton's Bat is a so-called 'trawling' bat species, which hunts at low heights above water, often <50 cm, capturing insects directly from or close to the smooth surface of slow-moving rivers. It also hunts at lakes and other habitats such as woodland and hedgerow on occasion. This river on site is slow-moving, but it is unlikely to be particularly favourable to foraging Daubenton's Bat, because its surface is covered in aquatic vegetation for much of its length (Plates 1 – 2 of the Bat Survey Report at Appendix 7.2). This vegetation would create 'acoustic clutter', inhibiting the effectiveness of the bats' echolocation in pinpointing insects floating on, or emerging from, the surface. The river channel is also generally too narrow along the majority of its length to facilitate the typical foraging flight behaviour of Daubenton's Bat, i.e. wide figure-of-eight loops and turns close to the surface. Furthermore, the riverbank lacks cover of tall vegetation, generally favoured by bat species. The river is not sheltered by steep banks, and it is almost completely lacking in cover or riparian trees, except for a few immature willows in places (Plates 1 – 2 of the Bat Survey Report at Appendix 7.2). It is also noteworthy that the river as shown in Plate 2 was significantly more flooded during the winter (when photo was taken) compared to the summer period, and as such is of even lower value during the drier main flight period for Irish bats due to more constricted flow and denser plant cover. Nonetheless, the river provides limited foraging opportunities, via emergent aquatic insects, to a range of bat species in the area. It may also provide a source of freshwater drinking water for bats in the area. No Daubenton’s Bats were recorded on site, although activity of Natterer’s Bat was highest in the vicinity of the river. Pipistrelle activity was also generally high in the area, as was Leisler’s Bat.

To the north of the site of proposed development, the larger Robertstown River flows adjacent to the site boundary. This is brackish water, with almost no cover of hedgerow or tree along the western bank (the site boundary). Two bat transect spots were located over the embankment adjacent to this river but no bats were recorded there (a small number of Soprano Pipistrelle registrations referred to bats commuting on the inner side of the embankment, towards the drainage channels). It is not considered likely that the Robertstown River provides a significant foraging resource for bats at this site.

Drainage Channels and Artificial Pond

There are drainage channels, which are man-made and maintained by OPW, running along the western edge of the site of proposed development at Durnish from near the railway crossing to the artificial pond in the north-west cormer of the site (Plates 3 - 4 of the Bat Survey Report at Appendix 7.2), and from the pond along the north-eastern site perimeter to the north-eastern edge of the site and beyond (Plate 4 of the Bat Survey Report at Appendix 7.2). These waterways are c. 2 - 4 m wide with a smooth water surface. As mentioned, Daubenton's Bat generally prefers wider water channels where it can perform wide looping flights, searching for emerging aquatic insects using its echolocation. The channels are lacking bankside tree/hedgerow cover along the majority of their length (Plate 4 of the Bat Survey Report at Appendix 7.2), and this relative lack of shelter for both bats and insects would likely reduce the value of the channels as bat foraging habitats. Duckweed (*Lemna* sp.) which covers the surface in some sections, , in particular the larger pool, also reduces the foraging efficiency of Daubenton's Bat (Boonman *et al.* 1998).

These areas are also subject to a rather high level of lighting throughout the night, due to light spill from the floodlit adjacent port areas, although some of the deeper channels in the western section remain quite dark. As such their suitability for bats is reduced, as many species are quite light averse, including Daubenton’s Bat. Notwithstanding this, the drainage channels and artificial pond are likely to provide aquatic insect prey, albeit limited, to Daubenton's Bat, Leisler's Bat as well as Common and Soprano Pipistrelles, and may also provide a source of drinking water to bats. There were small numbers of Pipistrelles, primarily Soprano Pipistrelles, recorded along the drainage channel in the west of Durnish. In the southernmost part of the drainage channel, where there is less light spill, and significant tree cover adjacent to the drainage ditch there were small numbers of Myotis bats recorded, along with Brown Long-eared and Lesser Horseshoe bats.

Hedgerows/Treelines of Field Boundaries

Many field boundary hedgerows at the site of proposed development are mature, composed mainly of old Hawthorn trees, with other mixed deciduous species including Ash, Sycamore, Willow and Hornbeam. Where they are mature, they have not been subject to hedgerow management such as strimming, cutting or ivy removal, and although often gappy, most sections have areas of thick bramble cover at the base (e.g. Plate 5 of the Bat Survey Report at Appendix 7.2), often filling gaps. Some sections of hedgerow have drainage ditches and earthen banks or old stone walls embedded in earthen banks. These features are attractive for bat foraging and commuting due to the shelter and source of insect prey they provide. Furthermore, the old drainage ditches/streams along some sections (e.g. Plate 6 of the Bat Survey Report at Appendix 7.2) would provide aquatic prey, and hence foraging opportunities for bats. The Hawthorn trees are remarkable for their maturity and the old-growth ivy cover (Plate 7 of the Bat Survey Report at Appendix 7.2), and this is discussed in relation to potential roosting opportunities in Section 3.3 of the Bat Survey Report at Appendix 7.2. The eastern hedgerow (H1) is the best example on site, being a well-established old townland boundary.

The internal hedgerows, especially in the northern half of the Durnish site, are subject to a rather high level of lighting throughout the night, due to light spill from the floodlit port areas to the west, although most are of course somewhat darker on the shaded side. The hedgerows on site are potentially used for foraging or commuting by all bat species known from the site.

Indeed, both Pipistrelle species were regularly recorded on the eastern hedgerow both foraging and commuting. They were recorded generally less often, although still regularly in small numbers on the internal hedgerow network, although a period of intense Pipistrelle and Leisler’s Bat activity was somewhat anomalously recorded at the western side of hedgerow H2 over a few days in June. Leisler’s Bat was recorded at a generally low level of activity, but often related to hedgerows.

Myotis bats were very infrequently recorded on the internal hedgerow network, although both Whiskered and Natterer’s bats were recorded on the eastern hedgerow on one occasion. Brown Long-eared Bat was closely associated with hedgerows, usually near the railway corridor and adjacent hedgerows (including the eastern hedgerow H1).

Port Areas

The site of proposed development at the existing port, comprises rock armour along the shoreline, with existing concrete jetties in brackish water. The jetties are adjacent to the built-up, industrial footprint of the existing port. The jetties and their immediate surroundings are considered unlikely to provide foraging or roosting opportunities to bats, as they are in an exposed setting without cover of tall vegetation to provide shelter or insect prey to bats.

The entire port area is very strongly floodlit throughout the night, which would repel all bat species at such intensity. Indeed, only one bat was recorded within the port area – a single Leisler's Bat which flew over the shoreline and port area from Foynes Island at dusk. This bat did not stop to forage within the area.

Connectivity with Wider Landscape

Hedgerows and waterways form vital connective corridors in the Irish landscape for bats, as well as other wildlife. Most bat species generally forage and commute along sheltered linear features such as hedgerows, waterways and woodland edge and often move between different patches of roosting and foraging habitat along such habitat corridors. The hedgerows, treelines and waterways on site not only provide foraging habitats in themselves, but are likely to be used by bats travelling between roosts and foraging grounds.

The existing Foynes port estate is almost devoid of trees and other natural vegetation, and very brightly lit and hence generally unfavourable to bats. Futhermore, the modern industrial-type buildings on site would generally not be those typically used by bat species for roosting. The Robertstown River at the northern boundary of the site is not considered to provide a significant foraging resource and at approximately 120m wide is more likely to form a barrier to commuting by many bat species.

Given therefore that both the western and norther parts of the site form barriers to movement of most bat species, the site in its broader context forms something of a 'dead-end' for bats, and the hedgerows are therefore not likely to be a significant commuting route for bats. The exceptions to this are the densely vegetated linear railway corridor which is clearly used by commuting bats, and the eastern hedgerow H1 which provides a somewhat less important, but nonetheless clear connective role.

It is likely that the majority of bats which use the Durnish farmland for commuting and foraging would originate in roosts in buildings south of the existing port footprint, as well as south or south-west of the Durnish lands (e.g. Foynes town).

Bat Roosts

A corrugated lean-to extension of a building occurs within the footprint of proposed development and that extension must be demolished to facilitate an access road. The original building will remain. All other buildings within the existing footprint of Foynes port will not be affected by the proposed development. This one building extension, along with bridges and trees were visually assessed regarding their potential to support potential roost features (PRF's) for bats, and their locations are illustrated in Figure 10 of the Bat Survey Report at Appendix 7.2. Five structures (four bridges and one building) are described and assessed in Table 6 of the Bat Survey Report at Appendix 7.2. Twenty nine trees are described and assessed in Table 7 of the Bat Survey Report at Appendix 7.2, and their locations are also illustrated in Figure 10 of the Bat Survey Report. Such features include holes, cracks, crevices, split boughs, peeling bark and thick ivy-cover on trees and cracks/crevices in bridges for example. Close-focusing binoculars and a high powered torch were used to search for potential bat roost features, while also searching for evidence of bat roosting. The locations of trees with potential roost features were recorded using a GPS unit. The surveys were preliminary ground-based surveys, and did not include close-up or invasive physical inspection of all potential bat roost features.

These trees and structures were categorised for their potential suitability for bats in accordance with Collins (2016) guidance, which is aligned also with the system of categorisation in BS 8569:2015

Surveying for bats in trees and woodland (BSI, 2015). In accordance with Section 6.2.9 of Collins (2016) guidance, where moderate or high suitability roosting habitat has been established and where impacts on roosting habitat or features are possible, then further surveys are required. Conversely, where low or negligible suitability has been assigned then no further survey is required.

Structures A and E have been assigned a low suitability of features for roosting bats as described in Section 3.3 and Table 6 of the Bat Survey Report at Appendix 7.2. No bat droppings or cadavers were observed within Building E. Structures B, C and D have been assigned a negligible suitability of features for roosting bats. No further action is required.

Tree No's. 9, 10, 11 and 12 occur within the site of proposed development at Durnish and will be felled to facilitate the proposed development. They have been assigned a negligible suitability of features for roosting bats as described in Section 3.3 and Table 7 of the Bat Survey Report at Appendix 7.2, and no further action is required. All other trees either occur beyond the site of proposed development or on the boundary of the site of proposed development, are to be retained. Tree No.8 to be retained is the only tree with moderate suitability of features for roosting bats in the boundary vegetation of the site of proposed development, in the southwest corner of the covered storage / warehousing area.

7.2.2.6 **Invertebrates**

Desktop review determined that the site was not likely to contain many species of invertebrate of conservation significance. Notes were made during all surveys of butterflies and dragonflies detected on site. Records of butterflies (lepidoptera) and dragonflies (odonata) made during this survey include:

Dragonflies

- Brown Hawker, Four-spotted Chaser, Variable Damselfly, Blue-tailed Damselfly, Common Darter.

Butterflies

- Common Blue, Speckled Wood, Peacock, Meadow Brown, Ringlet, Small White, Large White and Green-veined White

Suitable habitat exists on site for Small Heath, Wall and Wood White species, although none were recorded despite numerous visits at a suitable time of year. No habitat suitable for Marsh Fritillary was noted during the habitat assessment and the sole larval food plant, Devils' Bit Scabious, was not recorded.

Although there is some suitable habitat in the stream and drainage ditch areas for Scarce Blue-tailed Damselfly, the habitat is small in extent, and it is considered that the likelihood of this species occurring is negligible. The species was searched out during surveys which occurred during its flight period, without success.

All butterfly (lepidoptera) and dragonfly (odonata) species recorded on site are thus assessed to have a local (lower) value.

7.2.3 LIKELIHOOD OF IMPACTS

7.2.3.1 Flora and Habitats

As outlined above, the valuation and impact assessment for terrestrial biodiversity has been undertaken following the methodology set out in the Chartered Institute of Ecology and Environmental Management's *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (2nd Ed) (CIEEM, 2016); and with reference to Transport Infrastructure Ireland's *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009); EPA (2017); and BS 42020:2013 Biodiversity: Code of practice for planning and development (BSI, 2013). Table 7.2.1 sets out a geographic frame of reference and criteria for valuing ecological features. Table 7.2.2 sets out criteria for predicting magnitudes of effect. These tables have been prepared with due regard to CIEEM, EPA and NRA guidelines.

To determine likely significant effects of the proposed development on the identified terrestrial biodiversity receptors, the potential for impacts upon these features as a result of the construction and operation of the proposed development must firstly be considered, and then it must be determined whether or not those potential impacts which have been identified are likely. The predicted magnitude of likely potential effects on biodiversity features is based on the criteria set out in Table 7.2.2 and determines whether or not impacts are significant in the absence of mitigation.

Significant impacts are moderate or major effects which require avoidance, reduction or counterbalancing measures to mitigate or offset their adverse effects. Beneficial effects do not require mitigation measures as their effects are welcomed.

Table 7.2.3 outlines the terrestrial biodiversity features recorded at the site of proposed development and their value at a geographic scale in accordance with criteria in Table 7.2.1. Sixteen habitat types were identified on or adjacent to the site of proposed development. Seven species of bats were recorded. Seven species of ground mammal were also recorded.

Table 7.2.3 Terrestrial biodiversity features recorded and their value at a geographic scale

Value	***Feature***
County value	Lesser Horseshoe Bat
	Natterers Bat
local (higher) value	Whiskered Bat
	Common Pipistrelle Bat
	Soprano Pipistrelle Bat
	Leisler's Bat
	Brown Long-eared Bat
	Irish Hare
Ranging from local (lower) value to local (higher) value	Hedgerows WL1
	Treelines WL2
	Recolonising Bare Ground ED3
	Wet Grassland GS4
local (lower) value	Other Artificial Lakes and Ponds FL8
	Depositing / Lowland Rivers FW2
	Drainage Ditches FW4
	Reed and Large Sedge Swamps FS1

Value	***Feature***
	Improved Agricultural Grassland GA1
	Amenity Grassland GA2
	Dry Meadows and Grassy Verges GS2
	Scrub WS1
	Spoil and Bare Ground ED2
	Sea Walls, Piers and Jetties CC1
	Buildings and Artificial Surfaces BL3
	Otter
	Badger
	Pine Marten
	Irish Stoat
	Red Fox
	Hedgehog

Proposed East Jetty Extension

The relocation of the landing pontoon to an area identified at the west side of West Quay, and a new open pile structure and quay furniture constructed to connect the existing West Quay to the existing East Jetty, creating a new Berth No.4, shall result in the addition of new Sea Walls, Piers and Jetties (CC1) habitat. The proposed construction works will be undertaken during a construction period of approximately 12 months. Existing port operations will continue as normal during the construction period. Access to the site will be via the Foynes Port Access Road (which can be accessed from the adjacent N69 trunk road), and along the internal port roads.

No terrestrial habitats of value shall be lost as a result of the construction or operation of these elements of the proposed development. No significant effects upon terrestrial biodiversity habitat or flora features are predicted at construction or operational stage.

Proposed Development at Durnish

Imported fill material shall be brought to the site of proposed development at Durnish to raise the level of the existing lands. A roundabout, roads and access structures crossing the OPW drain shall be constructed. The raised area shall be surfaced, internal roads shall be constructed and services shall be provided. The intended use is for warehousing, covered and open storage areas.

Internal trees and hedgerows shall be removed along H2, H4 and H7. Much of treeline T3 shall be retained where it occurs along a 5m wayleave to be retained for access to the drainage channel for OPW. Topsoil shall be stripped and all other habitats at the Durnish site shall be covered by imported fill material. External boundary vegetation shall be retained along H1, H3 and H8. Existing boundary vegetation shall be augmented where retained and strengthened by additional planting along H8 and H1. A wide landscaped belt shall be planted along the north-eastern site boundary between the site and the Robertstown River.

The top 200mm of topsoil shall be stripped across the extents of the Durnish lands, and shall be stockpiled for re-use in the formation of the berm required for the landscaping boundary treatment. The exposed sub-base shall be seeded with clover to bind the material together.

Secure fencing will be provided along the external perimeter of the developed lands at Durnish. Fencing shall be 2.4m high panel fencing with a close mesh profile.

It is anticipated that the development of the Durnish Lands will be commenced whilst the jetty extension works are being undertaken. It is intended that hours of operation on the proposed developed lands will be 24/7, 364 days per year.

The site may be developed in one construction campaign of approximately 39 months, or development may be progressed on a phased basis across 18 months in years 1 and 2; 18 months in years 6 and 7; and 18 months in years 9 and 10, as explained further in Chapter 2.

The principal potential adverse effect on habitats and flora is habitat loss as a direct consequence of the infilling and development of the Durnish site.

In addition to this principal effect, there is the potential for suspended sediments or polluting substances to enter watercourses at construction or operational stages, degrading the water quality of these habitats. These watercourses drain to the Robertstown River and onwards to the Shannon Estuary.

Chapter 9 describes predicted effects upon water quality. Chapter 8 describes predicted effects of the proposed development on the underlying hydrogeological features.

Japanese knotweed occurs approximately 200m from the site of proposed development as described in Section 7.2.2.1. There is no likelihood that this species could be spread to other areas of the site or off-site during construction phase.

7.2.3.2 Protected Species

Proposed East Jetty Extension

As described in EIAR Chapter 2, the relocation of the landing pontoon to an area identified at the west side of West Quay, and a new open pile structure and quay furniture constructed to connect the existing West Quay to the existing East Jetty, creating a new Berth No.4, shall result in the addition of new Sea Walls, Piers and Jetties (CC1) habitat. The proposed construction works will be undertaken during a construction period of approximately 12 months. Existing port operations will continue as normal during the construction period. Access to the site will be via the Foynes Port Access Road (which can be accessed from the adjacent N69 trunk road), and along the internal port roads.

Only a single Leisler's Bat was recorded commuting high over this area of the proposed development, and it did not stop to forage. No other protected species was recorded here. The area comprising this element of the proposed development is considered unimportant for the protected species recorded..

No significant effects upon terrestrial biodiversity protected species features are predicted at construction or operational stage.

Proposed Development at Durnish

As described in EIAR Chapter 2, imported fill material shall be brought to the site of proposed development at Durnish to raise the level of the existing lands. A roundabout, roads and access structures crossing the OPW drain shall be constructed. The raised area shall be surfaced, internal roads shall be constructed and services shall be provided. The intended use is for warehousing, covered and open storage areas.

Secure fencing will be provided along the external perimeter of the developed lands at Durnish. Fencing shall be 2.4m high panel fencing with a close mesh profile.

The site may be developed in one construction campaign of approximately 39 months, or development may be progressed on a phased basis as outlined above and explained further in Chapter 2. If developed in phases, construction activity would likely occur for periods of 18 months across a ten year programme. If all three phases are developed in one campaign, whilst construction activity will only occur for an anticipated 39 months commencing in year 1, operational phase activity may well occur thereafter from year three onwards. In the long term, operational phase activity is anticipated to be 24/7, 364 days per year.

It is anticipated that the development of the Durnish Lands will be commenced whilst the jetty extension works are being undertaken.

The sequence of construction activities anticipated to occur at Durnish is described in Chapter 2 of the EIAR. Construction of an access structure across the drainage channel is required, followed by roundabout construction and road improvements. Each subsequent phase of construction requires a construction compound and topsoil stripping and storage, followed by lorries delivering imported fill to the site. Imported material will be spread across the site throughout the bulk of the construction period. This activity is followed by hardstanding construction and surfacing. The infill and surfacing activities for phased construction are anticipated to last for between 14 and 17 months per phase, or 36 months for an un-phased build out. Provision of services (foul and stormwater drainage), internal road construction, installation of high mast lighting columns and the erection of warehousing completes construction phase (or phases).

Proposed operations at Durnish are described in Chapter 2 of the EIAR. In general terms, the development will be used for open storage and warehousing, and for the handling and storage of general cargo. In addition, the lands will also be used for port-centric processing operations such as bulk raw material being graded, mixed or sorted before being bagged or put into tankers.

Warehousing is anticipated in all phases. Break bulk and project cargo is anticipated to be stored on site. Containers are anticipated to be stacked 5 high. Storage tanks are anticipated in later phases. High mast lighting columns will be 30m high.

Normal port-related traffic including cars, HGVs, reach stackers and straddle carriers shall move across the site at operational phase, as will people.

The potential adverse effects on protected species as a direct consequence of the infilling and development of the Durnish site are:

- loss of breeding or resting areas,
- habitat loss causing displacement of species to alternative areas or fragmentation of territories
- noise, visual or lighting disturbance at construction stage causing displacement of species to alternative areas
- noise, visual or lighting disturbance at operational stage causing displacement of species to alternative areas

In addition to these potential effects, there is also the potential for suspended sediments or polluting substances to enter watercourses at construction or operational stages, degrading the water quality of these habitats which may be used by protected species.

7.2.4 DESCRIPTION OF SIGNIFICANCE OF IMPACTS

7.2.4.1 Flora & Habitats

Proposed East Jetty Extension

As noted in Section 7.2.3.2, no habitats of value shall be lost as a result of the construction or operation of these elements of the proposed development. No significant effects upon terrestrial biodiversity habitat or flora features are predicted at construction or operational stage.

Proposed development at Durnish

Habitat Loss

As noted in Section 7.1.3, internal trees and hedgerows shall be removed along H2, H4 and H7. Topsoil shall be stripped and all other habitats at the Durnish site shall be covered by imported fill material.

- 1,130m of local (lower) value hedgerow (WL1) habitat will be lost within the Durnish site (H2, H4, H7).
- 30ha of local (lower) value wet grassland (GS4) shall be lost within the Durnish site. Remaining higher value GS4 habitat to the south of the railway line will remain intact.
- 11,6ha of local (lower) value improved agricultural grassland (GA1) habitat will be lost within the Durnish site.

In accordance with Table 7.1.2, permanent loss of a feature of local (lower) importance is predicted to result in a minor adverse magnitude of effect.

The Limerick County Development Plan 2010-2016 is the prevailing area plan for this site. It contains an objective (EH O3) to seek the conservation and protection of features of natural interest such as appropriate woodlands and hedgerows, wetlands and uplands and places of high biodiversity interest.

The design and layout of the proposed development at Durnish has sought to retain as much external boundary vegetation as possible, and enhance it with supplemental planting to offset visual effects (refer to Chapter 15). Much of treeline T3 shall be retained where it occurs along a 5m wayleave to be retained for access to the drainage channel for OPW. External boundary vegetation shall be retained along H1, H3 and H8. Existing boundary vegetation shall be augmented where retained and strengthened by additional planting along H8 and H1. A wide landscaped belt shall be planted along the north-eastern site boundary between the site and the Robertstown River. Drawing 1773.5.01 *Proposed Boundary Treatments* illustrates the landscaping proposals. These are not mitigation measures proposed to offset adverse effects upon biodiversity loss of habitats, as the predicted effect of development is minor adverse and does not require mitigation. These measures do however result in beneficial effects and result in almost 2ha of native planting. These measures are therefore predicted to result in a moderate beneficial magnitude of effect, and counterbalance the loss of habitats noted above.

Water Quality and Habitat Degradation

In addition to loss of habitats, there is the potential for suspended sediments or polluting substances to enter watercourses at construction or operational stages, degrading the water quality of these habitats.

There is potential for construction activities (removal of topsoil and importation of fill material) to result in elevated concentrations of suspended solids or polluting substances to escape to surface waters bordering the site. During the operational stage, there is also potential for leakage of fuel or other stored materials, pollution of watercourses due to accidental spillages of unspecified materials to watercourses.

Chapter 9 of the EIAR describes predicted effects upon water quality. EIAR Chapter 8 describes predicted effects of the proposed development ton the underlying hydrogeological features.

Other Artificial Lakes and Ponds (FL8), Depositing / Lowland Rivers (FW2) and Drainage Ditches (FW4) are assessed as being biodiversity features of local (lower) value at this site of proposed development. Temporary degradation of water quality is assessed as resulting in a minor adverse magnitude of effect on these receptors.

Downstream effects on designated sites are discussed separately.

Spread of Invasive Plant Species

As noted in Section 7.3.2.2, Japanese Knotweed was noted on the railway track outside of and at some distance from the site of proposed development. There is no possibility that construction activities could cause the spread of Japanese Knotweed from its recorded location.

7.2.4.2 Protected Species

Proposed East Jetty Extension

This area is considered unimportant for the protected species. No disturbance or displacement of protected species will occur. No significant effects upon terrestrial biodiversity protected species features are predicted at construction or operational stage.

Proposed development at Durnish

As described previously, the potential adverse effects on protected species as a direct consequence of the infilling and development of the Durnish site are:

- loss of breeding or resting areas,
- habitat loss causing displacement of species to alternative areas or fragmentation of territories
- noise, visual or lighting disturbance at construction stage causing displacement of species to alternative areas
- noise, visual or lighting disturbance at operational stage causing displacement of species to alternative areas

These effects are due to the activities associated both with the construction of the lands at Durnish as described in Chapter 2 of the EIAR, and also the ongoing use of the port lands at operational phase also described in Chapter 2 of the EIAR.

Habitat Loss

Loss of the open grassland habitats within the Durnish site will result in loss of possible breeding habitat, loss of territories and loss of foraging habitat for Irish Hare, a species of local (higher) value; loss of foraging habitat for Natterers Bat, a species of County importance; and loss of foraging habitat for Badger and Red Fox, species of local (lower) value.

The effect of the loss of these grassland habitats will be temporary, as the species concerned will be displaced, once the grasslands no longer exist, to proximate areas of grassland. Whilst the loss of grassland is permanent, the wider landscape between the Robertstown River in the north and Ardineer in the south, and between Durnish in the west and Churchfield in the east; is dominated by grasslands enveloped by hedgerows and treelines. In that sense, the effect of the habitat loss is temporary as once displaced, the species concerned will permanently relocate to another suitable area nearby.

Temporary impacts upon features of County and local value are assigned a minor adverse magnitude of effect in accordance with criteria set out in Table 7.1.2.

Loss of the internal hedgerows within the Durnish site will result in loss of commuting and foraging corridors for the following species of local (higher) value:

- Common Pipistrelle
- Soprano Pipistrelle
- Whiskered Bat
- Leisler's Bat
- Brown Long-eared Bat

And the following species of local (lower) value:

- Irish Stoat
- Pine Marten
- Hedgehog

The effect of the loss of the internal hedgerow habitats will be temporary, as the species concerned will divert, once the internal hedgerows no longer exist, to proximate areas of hedgerows around the boundary of the site which will be retained and augmented. The effect is removal of an amount of linear vegetated habitat that bats fly along and ground mammals travel through, but not the removal of all such habitat within the territories of those species. The removal of these internal hedgerows do not fragment a territory or part of a territory, or render a portion of a territory isolated and unconnected.

Permanent and temporary impacts upon features of local value (but not key features of local importance) are assigned a minor adverse magnitude of effect in accordance with criteria set out in Table 7.1.2.

In accordance with Section 6.2.9 of Collins (2016) guidance, where moderate or high suitability roosting habitat has been established and where impacts on roosting habitat or features are possible, then further surveys are required. Conversely, where low or negligible suitability has been assigned then no further survey is required.

Structures A and E have been assigned a low suitability of features for roosting bats. No bat droppings or cadavers were observed within Building E. Structures B, C and D have been assigned a negligible suitability of features for roosting bats. No mitigation measures are required.

Tree No's. 9, 10, 11 and 12 occur within the site of proposed development at Durnish and will be felled to facilitate the proposed development. No bat roosts or features suitable for bat roosts were observed in these internal hedgerows H2, H4 or H7 to be removed. They have been assigned a negligible suitability of features for roosting bats and no further action is required. All other trees either occur beyond the site of proposed development or on the boundary of the site of proposed development, are to be retained.

Tree No.8 to be retained is the only tree with moderate suitability of features for roosting bats in the boundary vegetation of the site of proposed development, in the southwest corner of the covered storage / warehousing area. If bats were to occupy this tree, in the absence of any precautionary protective measures being taken, construction works could accidently result in an injury or disturbance to individual bats; or destruction or disturbance of their resting place (roost). Such an action would be an offence under wildlife law if a bat or bats were roosting in the tree. Wildlife offences are assigned a moderate adverse magnitude of effect in accordance with criteria set out in Table 7.1.2. Mitigation is required.

Otter was assigned a local (lower) value for this site of proposed development, and Lesser Horseshore bat was assigned a County value. The habitats they were observed to use are to be retained, being the waterways (for Otter) and the vegetated railway corridor (for Lesser Horseshoe bat).

This will not result in a significant loss of foraging habitat for Otter, which primarily occurred in conjunction with waterways on site (these are retained), or for Lesser Horseshoe Bat which was primarily recorded along the railway (also retained).

Noise, visual or lighting causing disturbance to protected species is considered separately below.

Lighting Disturbance

During both the construction and operational phases there will be a significant increase in the distribution and intensity of lighting at the site during the hours of darkness. Light spill from on-site lighting can extend over a wide area outside the site boundary, depending on location, direction and intensity.

All mammal species identified on the site are primarily active at night and will be less inclined to enter areas which have light spill, effectively resulting in indirect loss of foraging and breeding habitats, or an interruption of commuting routes, and particularly for bats.

The *Durnish Lands General Arrangement drawing,* accompanying Chapter 2 of the EIAR has been reviewed as part of this assessment. The drawing shows high mast lighting columns across the site of proposed development at Durnish, including lights located approximately 40m north of the southern boundary (H8) of the Durnish lands, approximately 60m west of the eastern boundary (H1), and approximately 70m east of Tree no.8 (a PRF of moderate suitability being retained). These tall column lighting masts will emit light from a height of 30m above ground.

Artificial night lighting during the construction and/or operational phases of the proposed development has the potential to negatively impact bat species by impeding their ability to forage successfully and to move efficiently through the landscape. While some species, such as Leisler's Bat, exploit insects which accumulate around lights on occasion, most Irish bat species are too sensitive to light to benefit from such prey accumulations, and their foraging opportunities and commuting movements are generally negatively affected by lighting (Carden *et al*, 2010). In addition, studies to date have focused on the effects of standard roadside street lighting, and not the extremely bright and intense floodlighting likely to be experienced at the site. Some bat species which are recorded in the area are highly averse to artificial light, including Brown Long-eared Bat, Lesser Horseshoe Bat and Myotis species (Rowse *et al.* 2016). Bat roosting opportunities are also negatively affected by lighting, as some cases of roost abandonment, delayed emergence, or reduced growth of bat pups in response to light spill near roosts have been reported (Boldogh *et al*, 2007).

Lighting associated with the development has the potential for long-term negative impacts on bats, depending on the lighting design. This could result in a potential loss or reduction of foraging habitat, or an interruption in commuting routes for the following species of County value:

- Lesser Horseshoe Bat
- Natterer's Bat

This could result in a potential loss or reduction of foraging, breeding or resting habitat, or an interruption in commuting routes for the following species of local (higher) value:

- Common Pipistrelle
- Soprano Pipistrelle
- Whiskered Bat
- Leisler's Bat
- Brown Long-eared Bat

Long term effects of light spill, if not designed appropriately may effectively result in indirect loss of foraging and breeding habitats of bats, or an interruption of commuting routes of bats. This would equate to a permanent loss of a key feature of local importance if light spill rendered the railway corridor or eastern boundary hedgerow unavailable to bats. This would also equate to disturbance under wildlife law. Permanent impacts upon key features of local value and wildlife offences are assigned a moderate adverse magnitude of effect in accordance with criteria set out in Table 7.1.2. A proposed noise barrier located along the southern boundary (refer to Drawing 1773.5.01 *Proposed Boundary Treatments*) will help ameliorate the effect of light spill at low level and ground level, but mitigation is required.

Noise and Visual Disturbance

During construction phase, there will be much more noise, traffic movements and human presence than exists today, and concentrated for periods of key construction activities, both at daytime and potentially also at night-time. During operational phase, the will also be more noise, traffic movements and human presence than exists today, both at daytime and at night-time. All mammal species identified on the site are primarily active at night and will be less inclined to visit areas which have significant noise or activity.

The effect of noise or visual disturbance on ground mammals acts in a similar way as does light pollution for foraging and commuting bats. Significant noise or visual disturbance effectively result in indirect loss of foraging and commuting habitat for ground mammals as they would be deterred from using the retained hedgerows and railway corridor. The construction stage effects are temporary, lasting for an anticipated 39 months. Operational stage noise or visual disturbance effects are not predicted to be constant or significant. An amount of habituation by ground mammal species holding territories adjacent to the Port is predicted to dilute the adverse effect of any regular lower level noise or visual stimuli that may cause disturbance.

The predicted effect is that noise or visual stimuli that may cause disturbance will deter ground mammals from using the railway corridor and eastern hedgerow corridors for short periods, but not permanently. Such an effect amounts to a temporary loss of a key feature of local importance, and a proposed noise barrier located along the southern boundary (refer to Drawing 1773.5.01 *Proposed Boundary Treatments*) will help ameliorate the effect of noise and disturbance at low level and ground level. A minor adverse magnitude of effect is predicted, in accordance with criteria set out in Table 7.1.2.

7.2.4.3 **Cumulative Effects**

Future phases of the proposed development

Having regard to the 10 year lifespan of the intended planning permission and the predicted increase in tonnage presented in Chapter 2, it is proposed to implement the operational use of the Durnish land in three phases in line with economic growth and customer demand and as illustrated in EIAR Figure 2.10. However, to ensure the effective and timely availability of the Durnish lands for operational use as the needs arise, the proposed development includes the filling of all of the Durnish land as part of the initial phase of development.

The development strategy has pursued a phased approach to the development of the Durnish lands, and, within the context of a defined 'development framework'. The proposed first phase of development reflects the 'development framework' for that area given that the immediate requirements are know at this time. A Framework Plan (which is submitted as part of the planning application) sets out a development concept arrangement for the entire Durnish lands (Phase 1, 2 and 3) in order to present a holistic and co-ordinated approach toward the orderly and sustainable development of the Durnish Lands. Proposed and likely anticipated uses for future development in Phases 2 and 3 (based on existing and proposed port uses) are:

<u>Phase 2 – Likely Operational Scenario</u> *(Subject to future planning consent)*

Accommodation of additional (predicted) 991,874 tonnes of cargo throughput to deliver total Port tonnage throughput of 2,770,000 tonnes by 2025. Anticipated delivery consisting of:

- Covered storage of circa 1.2ha
- Open storage of circa 2.4ha
  - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
  - Construction of internal road network

- Provision of foul water infrastructure
- Provision of lighting and services

Phase 3 – Likely Operational Scenario *(Subject to future planning consent)*

Accommodation of additional (predicted) 510,000 tonnes of cargo throughput to deliver total Port tonnage throughput of 3,280,000 tonnes by 2030. Anticipated delivery consisting of:

- Covered storage 2.8ha
- Open storage 6.1ha
    - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
    - Construction of internal road network
    - Provision of foul water infrastructure
    - Provision of lighting and services

Open storage uses (predicted for Phase 2 and 3):

- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high)
- Loose cargoes such as woodchip biomass fuel (stored 6m high)
- Scrap metal (stored 8m high)
- Storage of containers (up to 3nr high) approx. 8m high with handling equipment up to 17m height

Covered storage (predicted for Phase 2 and 3):

- Warehousing (up to 20m height)
- Storage tanks (up to 15m height)

The Framework Plan has been reviewed and the strategic plans of general layout arrangements; the design and implementation of infrastructure including water, energy services, flood risk management, water services, lighting, and site security; internal access roads, building heights and design across the entire site have been taken into account in making the cumulative assessment.

Mitigation has been proposed in Section 7.7.5 of this chapter which mirrors mitigation proposed in other chapters of this EIAR dealing with water quality and ground contamination impact pathways. Mitigation has been proposed also in Section 7.2.4.2 to avoid significant adverse noise and visual disturbance effects on protected species.

The assessment of the initial phase has considered the raising of the lands by infilling, provision of infrastructure and landscaping across a ten year window as shown in EIAR Figure 2.10. No new land-take is required for later phases. Column lighting arrangements for later phases have been reviewed and adjusted. Lighting disturbance is not predicted to adversely affect protected species foraging within and commuting along the existing vegetated corridors outside of the site of proposed development along the railway line to the south or the townland boundary to the east.

Operational noise and visual disturbance is not predicted to be significant as a result of the set-back distance of the proposed later phase uses and physical screen provided by both the landscaping to be planted and the flood berm of the Robertstown River in the north of the site.

Operational uses in later phases are not considered to act cumulatively to increase the magnitudes of predicted effect on the flora, habitats and protected species comprising the terrestrial biodiversity features in the area surrounding the site of proposed development.

Other permitted development

A number of other consented developments were reviewed, as outlined in Table 7.6.1, to take account of any likely significant adverse effects on terrestrial biodiversity features.

The consented planning permission (Planning Reg. Ref.: 12/212) to reclaim the foreshore behind the existing East Jetty does not result in any significant adverse effects upon biodiversity features. This proposed development equally does not result in any significant adverse effects upon biodiversity features at the site of the proposed East Jetty extension. As a result, there is no significant adverse cumulative effect on terrestrial biodiversity features as a result of the proposed development and the extant (12/212) Planning Permission.

The remaining projects considered in Table 7.6.1 do not result in significant adverse ecological effects upon terrestrial biodiversity features. With the mitigation proposed in this application applied to the proposed development, there is no significant adverse ecological effect upon the terrestrial biodiversity features identified in the assessment. There is no significant adverse cumulative effect of the proposed development and the other projects listed in Table 7.6.1.

7.2.5 REMEDIAL AND MITIGATION MEASURES

7.2.5.1 Flora & Habitats

Proposed East Jetty Extension

No significant adverse effects on terrestrial biodiversity features are predicted as a result of the construction or operation of the proposed East Jetty extension and pontoon relocation, and no remedial or mitigation measures are required.

Proposed development at Durnish

Habitat Loss

Minor adverse effects as a result of habitat loss are predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required.

A moderate beneficial effect is predicted as a result of existing boundary vegetation being augmented where retained and strengthened by additional planting along H8 and H1, and provision of a wide landscaped belt planted along the north-eastern site boundary between the site and the Robertstown River.

Drawing 1773.5.01 *Proposed Boundary Treatments* details locations, cross sections and species of screen buffer planting and augmentation planting amounting to a little under 2ha of native species landscape planting.

Water Quality and Habitat Degradation

Minor adverse effects as a result of temporary degradation of water quality in surface waters (FL8, FW2, FW4) is predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required. However Chapter 9 describes predicted effects upon water quality. EIAR Chapter 8 describes predicted effects of the proposed development on the underlying hydrogeological features. Those topics have proposed mitigation to prevent the degradation of water quality and have been reviewed and considered in making this assessment.

Spread of Invasive Plant Species

No adverse effects as a result of the spread of invasive plant species are predicted due to the proposed development, and no remedial or mitigation measures are required.

7.2.5.2 Protected Species

Proposed East Jetty Extension

No significant adverse effects on flora and habitats are predicted as a result of the construction or operation of the proposed East Jetty extension and no remedial or mitigation measures are required.

Proposed development at Durnish

Habitat Loss

Minor adverse effects as a result of loss of grassland breeding habitat, loss of territories and loss of foraging habitat for protected species are predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required.

Minor adverse effects as a result of loss of hedgerow breeding habitat, loss of territories and loss of foraging habitat for protected species are predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required.

Tree No.8 has features of moderate suitability for roosting bats. It shall be retained and shall be protected from root damage in accordance with BS 5837:2012 Trees in relation to design, demolition and construction as part of the construction contract.

Lighting Disturbance

Moderate adverse effects as a result of light spill on hedgerows and vegetated corridors causing disturbance to and indirect loss of foraging and breeding habitats of bats, or an interruption of commuting routes of bat species, are predicted due to the proposed development at Durnish, and remedial or mitigation measures are required.

High mast column lighting at the site of proposed development as illustrated in Drawing M0679-RPS-00-PL-R-C-0145 *Proposed Lux Levels at Durnish Lands* has been designed and directed so as to not illuminate existing the Robertstown River or other hedgerows and vegetated corridors outside of the site of proposed development at levels above 5 lux.

Noise and Visual Disturbance

Minor adverse effects as a result of noise or visual stimuli that may cause disturbance to ground mammals using the railway corridor and eastern hedgerow corridors are predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required.

7.2.6 RESIDUAL IMPACTS

7.2.6.1 Flora & Habitats

Proposed East Jetty Extension

There is no likely significant residual impact predicted upon terrestrial biodiversity features as a result of the construction and operation of the proposed East Jetty extension.

Proposed development at Durnish

Likely significant effects were predicted as a result of habitat loss and degradation of water quality. Mitigation has been proposed and vegetation to be retained shall be protected from root damage.

7.2.6.2 Protected Species

Proposed East Jetty Extension

There is no likely significant residual impact predicted upon terrestrial biodiversity protected species features as a result of the construction and operation of the proposed East Jetty extension.

Proposed development at Durnish

Likely significant effects were predicted as a result of habitat loss, lighting disturbance or noise and visual disturbance. Mitigation has been proposed and the lighting design has been revised to ensure light spill into habitats beyond the site of proposed development at Durnish does not exceed 5 lux.

There is no likely significant residual impact predicted upon terrestrial biodiversity features as a result of the construction and operation of the proposed development at Durnish.

7.3 BENTHIC BIODIVERSITY AND FISHERIES

7.3.1 METHODOLOGY

7.3.1.1 Benthic Ecology

An assessment was made of the potential impacts associated with the proposed development on the seabed within the intertidal and subtidal areas in and adjacent to the new quay extension. This involved the collection of core samples in the intertidal area and grab samples in the subtidal area. Samples were processed and identified to allow for the assigning of biological communities based on the same system used by NPWS in the classification of these habitats within the SAC. These include Annex I listed habitats listed in the conservation objectives of the Lower Shannon SAC, namely Estuaries (Code 1130), Mudflats and Sandflats not covered by seawater at low tide (Code 1140) and Large Shallow inlets and bays (Code 1160).

Granulometric and Loss on Ignition Analysis

Granulometric analysis was carried out on oven-dried sediment samples from each benthic sampling station using the protocols described by Holme & McIntyre (1984). After appropriate pre-treatment, the sediment was passed through a series of nested brass test sieves with the aid of a mechanical shaker. The sieves chosen had the following mesh sizes 4mm, 2mm, 1mm, 500µm, 250µm, 125µm and 63µm. The resultant weights were then summed into three broader fractions: % Gravel (>2mm), % Sand (<2.0mm >63µm) and % Silt-Clay (<63µm). Further analysis of the sediment data was undertaken using the Gradistat package (Blott & Pye, 2001) which provides broad descriptive categories of granulometry results. Organic matter was estimated using the Loss on Ignition (LOI) method. One gram of dried sediment was ashed at 450˚C for 6 hours and organic carbon was calculated as % sediment weight loss.

Benthic Survey

Sample locations to assess impacts on the marine intertidal and subtidal habitats directly impacted by the proposed development were chosen within and adjacent to the footprint of the proposed new quay extension. Potential indirect impacts on the benthos associated with sediment loss from drainage of development of land at Durnish site was not investigated as the mitigations measures proposed in Chapter 9 of the EIAR are considered more than adequate to prevent any adverse impact on the benthos.

Field assessments were made during the Spring Tide cycle of 31st January 2017, which had a tidal range of 0.6m CD to 5.1m CD. Intertidal samples were collected at Low Water during this sampling period.

Sub-tidal Soft Benthos Survey

A total of 4 sub-tidal sites were sampled within the study area using a 0.028m^2 stainless steel Van-Veen Grab. The selected sampling positions were navigated to using a Trimble Geo-XM GPS system. Once on site, the actual location of each grab sampling station was recorded. A full list of the positions of the sampled stations is presented in Table 7.3.1 and displayed in Figure 7.3.1.

At each subtidal grab station:

- 2 x 0.1m^2 Van-Veen grab taken for benthic faunal analysis (4 Stations).

- 1 x 0.1m^2 Van-Veen grab from which a small amount of sediment was retained for granulometry and Loss on Ignition Analysis (4 stations).

Intertidal Survey

A total of 4 intertidal stations were sampled for benthic faunal analysis, granulometric analysis and organic carbon analysis (Table 7.3.1 and Figure 7.3.1). Sampling methodology followed the methods outlined in the Marine Monitoring Handbook (Davies *et al*., 2001)

At each station:

- 5 x 0.01m^2 cores were taken to a depth of 20cm for benthic faunal analysis.
- 1 x 1m^2 quadrat was marked out and all physical and biological characteristics were recorded for that area.
- 1 x 0.25m^2 (0.5m x 0.5m) quadrat was marked out and excavated to a depth of 20cm. Sediment was manually examined to pick out larger fauna.
- 1 x surface scrape of sediment was taken and stored in a labelled, plastic bag for granulometric and organic carbon analysis.

Figure 7.3.1: Map showing the positions of sub-tidal grab samples (Red Circles Dots) and Intertidal soft sediment samples (Green Circles).

Table 7.3.1 Positions of sub-tidal and intertidal soft sediment sampling stations. All positions are provided in Irish Map Grid.

Sample	*Easting (m)*	*Northing (m)*	*Sample*	*Easting (m)*	*Northing (m)*
Intertidal 01	125165	151805	Subtidal 01	125130	151803
Intertidal 02	125286	151829	Subtidal 02	125195	151832
Intertidal 03	125650	152104	Subtidal 03	125148	151861
Intertidal 04	125869	152395	Subtidal 04	125633	152139

Sample Processing

All benthic samples were processed within 24 hours of collection. Samples were sieved through a 1mm mesh sieve and preserved in 4% formalin (buffered with sea water). All fauna were identified to the lowest taxonomic level possible using standard keys to north-west European fauna by specialist taxonomists.

A number of biotic indices were calculated from the species / abundance matrix from the grab samples. These indices included Simpson's Dominance Index (where values range from low dominance [0] to high dominance [1]), Shannon-Wiener Diversity Index (Values ranging from low diversity [0] to high diversity [4]) and Pielou's Evenness Index (values ranging from low i.e. dominated by a few species [0] to high evenness i.e. a more even spread of species [1]).

7.3.1.2 **Fisheries**

The Shannon Estuary is one of the most important in the country as the gateway to the largest river catchment in Ireland. It coincides also with the Lower Shannon SAC and has a diverse population of resident and migratory fish species. Moreover it is the site of commercial, recreational fisheries and has a thriving shellfish aquaculture sector. The fisheries section of this assessment was undertaken using a combination of desktop review, literature search and direct consultation. Data sources for establishing the current state of wild and commercial fisheries included:

- National Parks and Wildlife Website – Lower Shannon SAC Documentation
- Inland Fisheries Ireland Website – Salmonid & eel management and statistical publications, WDF fisheries survey reports, sea angling information
- Sea Fisheries Protection Authority Website – Shellfish Health and Growing Areas
- ESB Fisheries Conservation Unit for salmon and eel data for the River Shannon
- ECOFACT Website: for data on eel and lamprey in particular

In addition, consultation and data requests were made to BIM, SFPA and DAFF in relation to ongoing and proposed aquaculture activity in the Shannon Estuary and commercial fishing activity there.

Extensive review of relevant peer-reviewed scientific literature in particular on salmon, eel, lamprey and smelt in order to assess the potential impacts of the proposal on certain key species that occur in the study area.

7.3.2 RECEIVING ENVIRONMENT

7.3.2.1 Designated Sites

The site is located within the Lower River Shannon SAC (Site Code: 002165). The Annex I listed marine habitats in this SAC as Features of Interest are

- Estuaries [1130]
- Mudflats and sandflats not covered by sweater at low tide [1140]
- Large shallow inlets and bays [1160]
- Reefs [1170]

The two communities identified in this survey, correspond to the findings of NPWS. The subtidal sand to mixed sediment with *Nephtys* spp. community complex covers 9,431ha. The intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex covers 466ha (NPWS 2012).

7.3.2.2 Benthic Ecology

Physical Environment

Results from the granulometric assessment indicates the presence of muddy sands and sandy muds sediments across large parts of the survey area (Table 7.3.2 and Figure 7.3.2).

Table 7.3.2 Granulometric and Loss on Ignition results from samples taken the Foynes survey area.

	Subtidal 01	***Subtidal 02***	***Subtidal 03***	***Subtidal 04***
% Gravel	0.0%	0.0%	0.0%	0.0%
% Sand	55.2%	61.6%	57.0%	47.6%
% Mud	44.8%	38.4%	43.0%	52.4%
% LOI	5.85%	5.85%	5.95%	4.77%
Textural Group	Muddy Sand	Muddy Sand	Muddy Sand	Sandy Mud
	Intertidal 01	***Intertidal 02***	***Intertidal 03***	***Intertidal 04***
% Gravel	0.0%	0.0%	0.00%	0.0%
% Sand	24.9%	52.4%	54.9%	56.2%
% Mud	75.1%	47.6%	45.1%	43.8%
% LOI	6.67%	5.25%	4.38%	4.18%
Textural Group	Sandy Mud	Muddy Sand	Muddy Sand	Muddy Sand

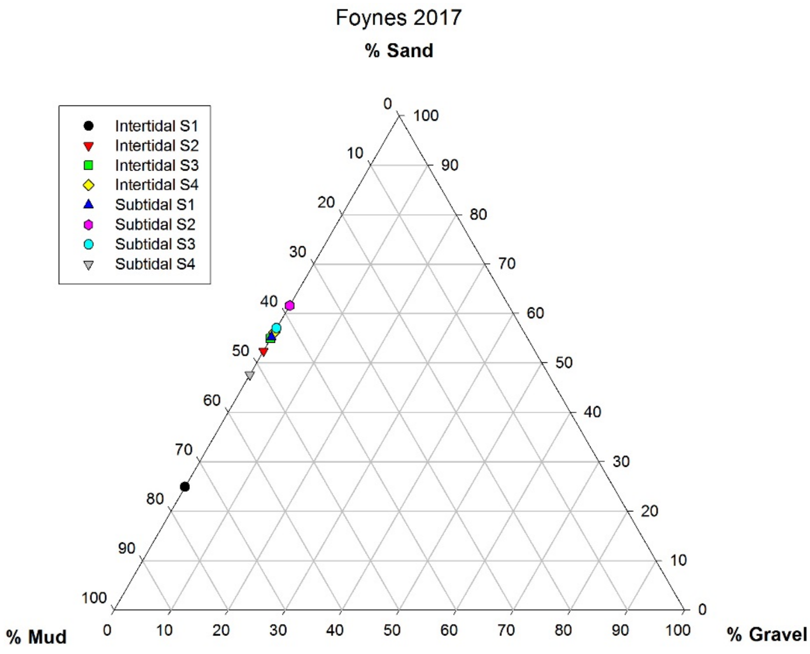


Figure 7.3.2 Ternary Plot of granulometric results from Foynes,

Biological Environment

Subtidal

Subtidal diversity and abundances were low across the survey area. A total of 7 taxa were recorded in the subtidal grab collected (Tables 7.3.3 & 7.3.4). The highest number of species and abundances was recorded at Site 4, located approximately 480m from the proposed open pile jetty extension. At this site, seven taxa were identified, comprising 52 individuals across three replicate grab samples. Sites 1, 2 and 3 are located in the area adjacent to the proposed open pile jetty structure, and all sites returned low taxa numbers (4, 5 and 4 respectively) and low abundances (6, 12 and 7 respectively).

Table 7.3.3 Diversity indices derived from the subtidal grabs collected from the survey area in Foynes.

	1A	1B	1C	2A	2B	2C	3A	3B	3C	4A	4B	4C
No. of Species	3	1	1	3	3	0	0	2	3	3	5	3
No. of Individuals	4	1	1	6	6	0	0	3	4	15	15	22
Shannon-Wiener	1.040	0.000	0.000	0.868	1.010	****	****	0.637	1.040	0.970	1.490	0.896
Pielou's Evenness	0.946	****	****	0.790	0.921	****	****	0.918	0.946	0.883	0.926	0.816
Simpson's Dominance	0.375	1.000	1.000	0.500	0.389	****	****	0.556	0.375	0.413	0.244	0.475

Table 7.3.4 Faunal results from the replicate subtidal grab samples collected at Foynes.

	1A	1B	1C	2A	2B	2C
Nereis diversicolor	-	-	-	-	1	-
Nephtys hombergii	1	-	1	4	2	-
Scoloplos armiger	1	-	-	1	-	-
Capitella capitata	-	1	-	1	-	-
Tubificoides benedii	-	-	-	-	-	-
Macoma balthica	2	-	-	-	3	-
Mytilus edulis	-	-	-	-	-	-

	3A	3B	3C	4A	4B	4C
Nereis diversicolor	-	-	-	-	1	-
Nephtys hombergii	-	1	-	8	5	14
Scoloplos armiger	-	-	-	-	-	3
Capitella capitata	-	-	1	-	4	-
Tubificoides benedii	-	-	1	2	-	-
Macoma balthica	-	2	2	5	3	5
Mytilus edulis	-	-	-	-	2	-

All species identified in the subtidal area are common in Irish coastal waters and are typical of shallow muddy sand communities.

Intertidal

Intertidal infaunal diversity and abundance was low in core samples within the intertidal the survey area and no large macrofauna were identified in the dig samples. A total of 12 taxa were recorded in the samples collected (Tables 7.3.5 & 7.3.6). The highest number of species and abundances were recorded at Site 4, located approximately 900m from the proposed open pile jetty extension. At this site, 8 taxa were identified, comprising of 43 individuals across five replicate cores. The lowest number of individuals and diversity of species was recorded at Site 1, located immediately adjacent to the proposed works, where only 2 taxa and 3 individuals were recorded.

Table 7.3.5 Diversity indices derived from the intertidal cores collected from the survey area in Foynes.

	1A	1B	1C	1D	1E	2A	2B	2C	2D	2E
No. of Species	0	2	1	0	0	3	1	5	4	4
No. of Individuals	0	2	1	0	0	4	1	10	8	12
Shannon-Wiener	****	0.693	0.000	****	****	1.040	0.000	1.360	1.210	1.330
Pielou's Evenness	****	1.000	****	****	****	0.946	****	0.845	0.875	0.959
Simpson's Dominance	****	0.500	1.000	****	****	0.375	1.000	0.320	0.344	0.278

	3A	3B	3C	3D	3E	4A	4B	4C	4D	4E
No. of Species	3	2	2	4	0	4	6	6	4	4
No. of Individuals	6	5	3	5	0	7	11	9	10	6
Shannon-Wiener	1.010	0.673	0.637	1.330	****	1.150	1.540	1.580	1.370	1.330
Pielou's Evenness	0.921	0.971	0.918	0.961	****	0.832	0.860	0.882	0.985	0.959
Simpson's Dominance	0.389	0.520	0.556	0.280	****	0.388	0.273	0.259	0.260	0.278

The species identified in the present survey are typical of intertidal, sandy mud communities, with all species identified in the area being common in Irish coastal waters. The polychaete, *Nephtys hombergii*, and the bivalve mollusc *Macoma balthica*, were present at all sites (but not all cores at these sites).

Table 7.3.6 Faunal results from the intertidal core samples collected at Foynes.

	1A	*1B*	*1C*	*1D*	*1E*	*2A*	*2B*	*2C*	*2D*	*2E*
Eteone longa	-	-	-	-	-	-	-	-	-	-
Phyllodoce mucosa	-	-	-	-	-	-	-	-	-	-
Nereis diversicolor	-	-	-	-	-	-	-	-	-	-
Nephtys hombergii	-	1	1	-	-	1	1	2	4	2
Scoloplos armiger	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	-	-	-	-	2	-	5	1	2
Tharyx killariensis	-	-	-	-	-	-	-	1	-	-
Tubificoides benedii	-	-	-	-	-	-	-	-	-	-
Peringia ulvae	-	-	-	-	-	-	-	1	2	4
Macoma balthica	-	1	-	-	-	1	-	1	-	4
Abra nitida	-	-	-	-	-	-	-	-	-	-
Corophium sp.	-	-	-	-	-	-	-	-	1	-

	3A	*3B*	*3C*	*3D*	*3E*	*4A*	*4B*	*4C*	*4D*	*4E*
Eteone longa	-	-	-	-	-	-	1	-	-	-
Phyllodoce mucosa	-	-	-	1	-	-	-	-	-	-
Nereis diversicolor	1	-	-	1	-	-	-	-	-	-
Nephtys hombergii	2	3	2	2	-	1	5	1	3	2
Scoloplos armiger	-	-	-	-	-	-	1	1	3	1
Pygospio elegans	-	-	-	-	-	4	2	4	2	2
Tharyx killariensis	-	-	-	-	-	1	1	-	-	-
Tubificoides benedii	-	-	-	-	-	-	-	1	-	-
Peringia ulvae	-	-	-	-	-	-	-	-	-	-
Macoma balthica	3	2	1	1	-	1	1	1	2	1
Abra nitida	-	-	-	-	-	-	-	1	-	-
Corophium sp.	-	-	-	-	-	-	-	-	-	-

Community Assessment

Results from the intertidal survey indicate the presence of a single community in the vicinity of the proposed development. This community is similar to that identified in the subtidal community, dominated by the polychaete *Nephtys hombergii* and the mollusc *Macoma balthica*, and broadly corresponds with the biological communities identified by NPWS for this location – '*Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex*' (NPWS, 2012). Species diversity and abundances were low across the survey area, with all species typical of muddy, estuarine environments and common in Irish coastal waters.

Results from the subtidal samples indicate the presence of a single community type across the survey area. This was dominated by the polychaete *Nephtys hombergii* and the bivalve mollusc *Macoma balthica*. This corresponds broadly with the biological communities identified by NPWS for this location within the Lower River Shannon SAC, namely '*Subtidal sand to mixed sediment with* Nephtys *spp. community complex*'. Species diversity and abundances were low across the subtidal habitat, with all species present typical of muddy, estuarine environments and common in Irish coastal waters.

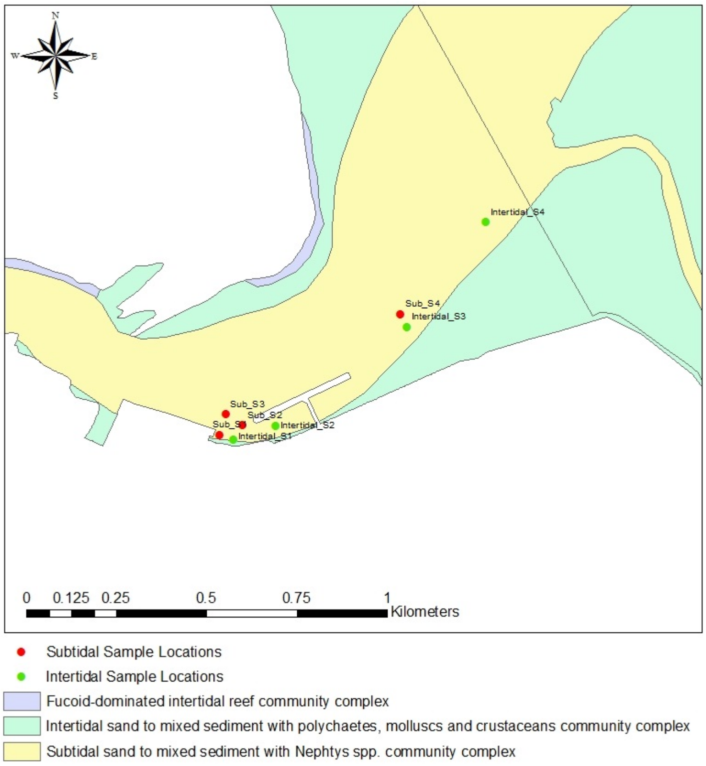


Figure 7.3.3: Extent of communities identified by NPWS for the Shannon Estuary SAC with sample locations overlain.

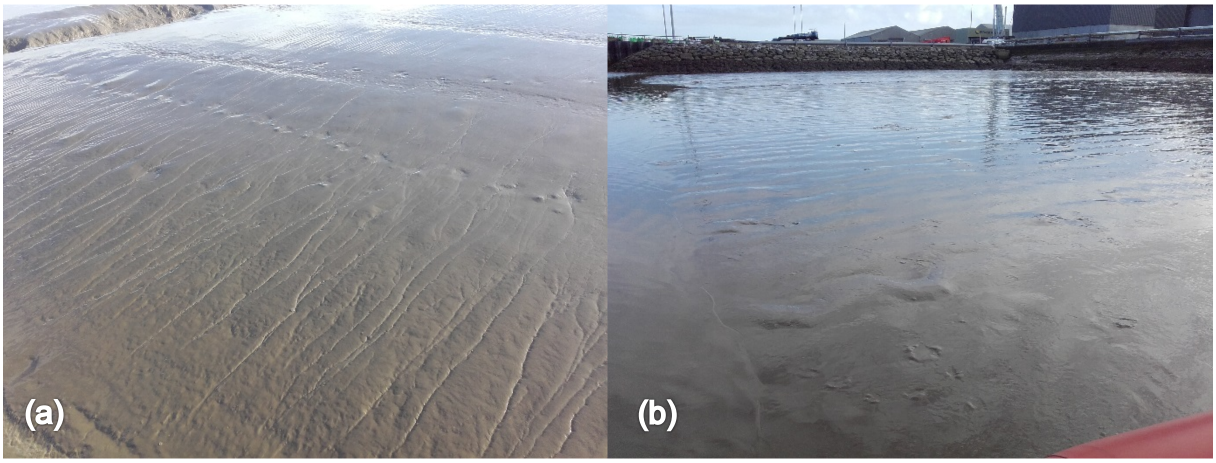


Figure 7.3.4 Intertidal soft sediment from the intertidal areas immediately adjacent to the proposed development. (a) Intertidal 1, (b) Intertidal 2.

Figure 7.3.5 Intertidal soft sediment from the intertidal areas immediately adjacent to the proposed development. (a) Subtidal 1, (b) Subtidal 2.

Sedimentary Chemistry

As part of the baseline assessment in the area samples of sediment were obtained and analysed at 12 sampling sites throughout the study area. The sediment was analysed for a range of contaminants in line with the normal requirements of the Marine Institute and the Environmental Protection Agency when a Dumping at Sea (DAS) permit is being applied for. In this particular instance however the data is being collected in line with a request from the National Parks and Wildlife Service as part of the baseline assessment and not for a DAS permit application. The summarised results from these analyses are presented in Table 7.3.7 along with the sediment contaminant standards which are among the items that the EPA refer use to inform their decisions in relation to DAS applications. The 'Lower Level' is derived from background levels in uncontaminated Irish sediment and corresponds fairly closely with concentrations considered internationally not to cause any adverse biological impacts. The 'Upper Level' is derived from international research on the impacts of these contaminants on biological communities in sediment and equate to levels at or above which adverse biological impacts can be expected. Full results are available in Appendix 7.4 along with a map showing the sampling site locations.

An examination of the results in Table 7.3.7 clearly indicate that in most cases the contaminant levels recorded are at or below the Lower Level and therefore very unlikely to be having any adverse biological influence on the benthic soft sediment community. These results are consistent with the results of similar surveys at Foynes in both 2011 and 2012.

Table 7.3.7 Summary sediment chemistry results from 12 sampling sites in Foynes.

2017	*Average*	*Max*	*Min*	*Number of Samples*	*Lower Level*	*Upper Level*
As mg kg-1	10.2	12.2	7.1	12	**9**	**70**
Hg mg kg-1	0.06	0.16	0.03	12	**0.20**	**0.70**
Cd mg kg-1	0.32	0.46	0.27	12	**0.7**	**4.2**
Cr mg kg-1	43.4	48.2	34.9	12	**120**	**370**
Cu mg kg-1	9.3	11.0	6.5	12	**40**	**110**
Pb mg kg-1	21.9	25.0	15.4	12	**60**	**218**
Ni mg kg-1	21.2	23.8	16.1	12	**21**	**60**
Zn mg kg-1	70.1	77.8	55.8	12	**160**	**410**
∑TBT & DBT mg kg-1	<0.1	<0.017	<0.007	12	**0.1**	**0.5**
PCB S7 PCB ug kg-1	4.2	4.5	3.1	12	**7**	**1260**
HCB (kg dry wt) ug kg-1	<0.9	<0.9	<0.9	12	**0.3**	**1**
g-HCH (kg dry wt) ug kg-1	<0.4	<0.4	<0.4	12	**0.3**	**1**
PAH S 16 ug kg-1	313	526	208	12	**4000**	**-**

7.3.2.3 Fisheries

Lower Shannon SAC

The site of the proposed project is within the Lower Shannon SAC. The Conservation Objectives for the SAC list the following aquatic species that could be encountered within Lower Shannon Estuary where the proposed development is situated: Sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and [1]Atlantic salmon (*Salmo salar*) – only in freshwater. In addition, the Site Synopsis refers to Twaite shad (*Alosa falax fallax*) and to smelt (*Osmerus eperlanus*). The latter is listed as a Red Data Book species in Ireland and is known to occur in the estuary. However, there are no corroborated reports of Twait shad ever having spawned in the Shannon or any of its tributaries or ever having been caught in the Shannon estuary and therefore the species isn't considered further in this assessment. Another species, not specifically listed within the SAC supporting documentation but which is of conservation concern in its wider range is the European eel (*Anguilla anguilla*) for which the Shannon and its tributaries is a recognised stronghold.

Wild Fisheries and Aquaculture

Apart from the species of conservation importance listed above the Shannon Estuary is temporary or permanent home to a wide range of marine and estuarine species which are currently not of conservation concern and many of which have an economic value for the commercial fishing industry. Some of these are also targeted by recreational anglers within the estuary. Finally, the estuary is the site of current and proposed shellfish aquaculture licensed areas mainly for the production of pacific oysters (*Crassostrea gigas*) but also for bottom grown blue mussels (*Mytilus edulis*).

Atlantic Salmon

Although salmon is a listed species only for the freshwater reaches of the Lower Shannon SAC, the fact that it passes by or possibly through the proposed project area, is nevertheless of relevance.

The Shannon Estuary leads to the by far the largest river basin in Ireland, namely the Shannon River. The Salmon Conservation Standing Committee estimate that the Conservation Limit for salmon for the Shannon upstream of Parteen Weir and Ardnacrusha Hydrostation is 49,683 adult salmon based on the wetted area of habitat within the Shannon and its tributaries e.g. the Rivers Suck, Inny and Brosna etc. In reality however, because of the Ardnacrusha dam, the actual number of returning adults is less than 5% of that total, all of which are ultimately sustained by the hatchery rearing programme at Parteen. Instead, the bulk of salmon returning to the Shannon Estuary are from the tributary rivers that join the river downstream of the dam including the Kilmastula, Mulkear, Fergus, Deel, Maigue and Feale rivers and that part of the main river that lies downstream of the dam, i.e. the so called Old Channel e.g. around Castleconnell Co. Limerick. Of those listed, all bar the River Feale discharge to the Lower Shannon upstream of the Foynes Port.

Table 7.3.8 presents estimates of the adult salmon runs into some of these rivers based on IFI-operated fish counters that have been operating on them for several years. The data for the Maigue and Fergus is limited because those counters haven't been operating very long. The table also includes numbers for the Upper Shannon based on data provided by ESB Fisheries Conservation section and

[1] Freshwater only

includes fish that pass upstream via Ardnacrusha dam and Parteen Weir using mechanical trapping and lifting mechanisms at each of these barriers. The tables also include the Standing Scientific Committee's Conservation Limits (CL) for each river as a guide to what should be passing up to allow for self-sustaining populations.

Table 7.3.8 Adult salmon runs into the River Shannon tributaries from published IFI fish counter returns and ESB Fisheries data. The conservation limit (CL) for each tributary is also presented.

	Upper Shannon	Mulkear	Fergus	Maigue	Deel
CL	***49,638***	***4,214***	***1,188***	***4,632***	***2,823***
2016	1,749	7,193	493	807	ND
2015	1,314	2,460	564	1,218	ND
2014	1,206	3,279	ND	ND	ND
2013	2,132	4,665	ND	ND	ND
2012	2,061	ND	ND	ND	ND
2011	3,844	ND	ND	ND	ND
2010	1,237	7,079	ND	ND	ND
Average	**1,935**	**4,935**	**529**	**1,013**	**ND**
Total Average					**8,411**

(ND = no data)

If we assume that the Deel produces on average around 800 salmon per annum and the lower Shannon about 1500, then we're probably looking at about 8000-12000 adults currently entering this part of the Shannon on an annual basis. These figures are very low compared to historical figures which can be largely explained by the very poor sea survival of the species since the 1960's which has been documented in river basins throughout the southern sector of the North Eastern Atlantic, including Ireland. It is estimated that on average, in recent years, only around 5% or less of the smolts that go to sea return as adult salmon. Thus, based on the number of adults presented above that would suggest that around 160,000 to 240,000 smolts leave the Shannon system every year via the estuary.

Fish counter data for the Mulkear, the Feale and the Fergus for 2015 and 2016 have been averaged to show that fish returning to those tributaries, do so throughout much the year with spring, summer and late summer peaks (Figure 7.3.6).

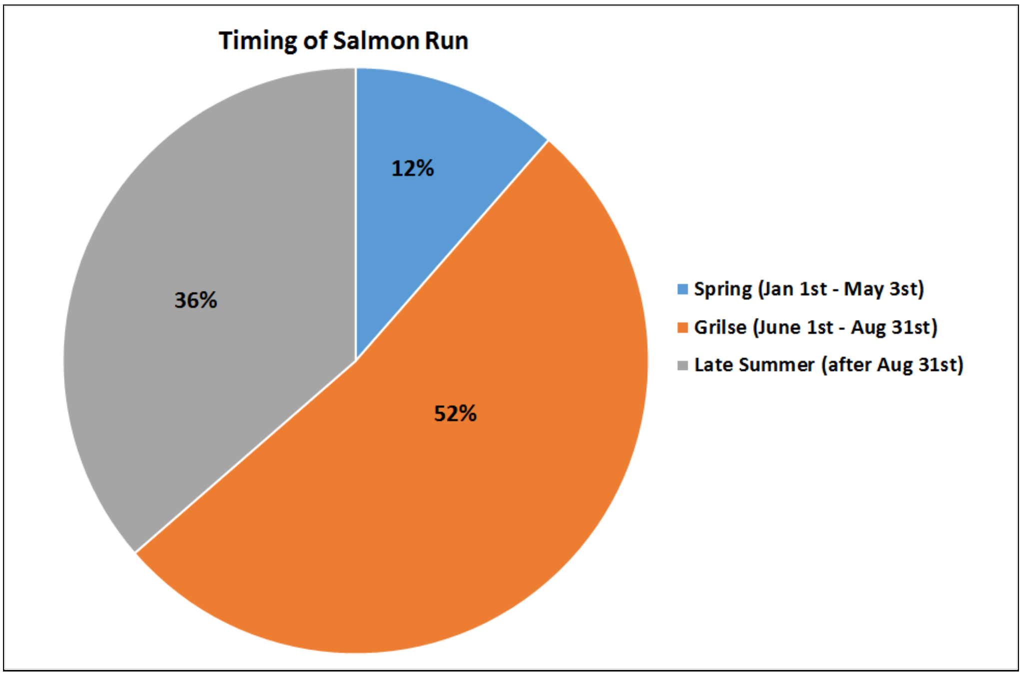


Figure 7.3.6 Pie chart indicating the seasonality of salmon movement into the Shannon Estuary based on average figures for the Mulkear, the Fergus and the Feale.

Lampreys

Lampreys spawn in freshwater in habitats very similar to salmonid fish. After hatching out, the larvae move downstream to slower flowing reaches to marginal and slow velocity areas where there is a build-up of fine sediments into which they burrow and where they remain for several years as ammocoetes. Both river and sea lamprey ammocoetes metamorphose into a sub-adult stages known as transformers or macrophthalmia, when they acquire the external adult features over a period of the summer-autumn months and begin their migration downstream into the estuary and on into the marine environment where they are parasitic on a wide range of fish.

The Lower Shannon is a stronghold for both Sea lamprey (*Petromyzon marinus*) and River Lamprey (*Lampetra fluviatilis*). Sea lamprey are known to spawn in May-July in the lower River Shannon e.g. at Castleconnell and in the lower Mulkear River. River lampreys spawn in the same rivers in the spring and are also know from the Owenagarney River (Bunratty) and the Rine River both discharging to the upper Shannon Estuary. A study on glass eels in the Upper Shannon Estuary (O'Connor, 2003a) collected river lamprey transformers as a by-catch in the Owenagarney, Rine and also in the Ballincurra Creek, the Maigue and the Meelick Creek all discharging into the Upper Shannon Estuary. Although this doesn't prove that the latter rivers have river lamprey runs, there's a good chance that they do.

Lampreys use estuaries both as a feeding ground for adults (particularly river lamprey) and transformers and as a route for spawning migrations for adults. As sea lamprey spawn in the Lower Shannon mainly from May to July they can be expected to migrate up the estuary in spring and early summer. River lamprey spawn in spring in March and April but their spawning migration tends to me much more extended than for sea lamprey stretching from autumn to spring.

There is limited data on the distribution of the transformer stage within estuaries however in the case of sea lamprey, there is an indication that they are more likely to occur in sheltered areas, such as ports, river mouths and small inlets etc. (Silva *et al*., 2013) which is to some extent supported by the recovery of river lamprey transformers as a by-catch in the estuarine areas of small tributary rivers of the Upper Shannon Estuary (as mentioned above) by O'Conner (2003b). The upper Shannon and Fergus Estuaries are very well supplied with such locations. Clearly while feeding both river and sea lampreys will be carried around by their fish hosts and both species are known to attack a wide variety of fully marine and anadromous fish and so the distribution of actively feeding adult river lamprey may well be fairly random within the estuary, although adult sea lamprey are probably less likely to be within the estuary as adults except when migrating to spawn.

Eel

Eel are a protected species which are in serious decline throughout their Atlantic range for several decades and consequently all commercial exploitation of the species has ceased for several years in Ireland. The Shannon Estuary is one of the most important areas for the species and they are known to occur in all the main and many of the small tributaries. Adult eels migrate as silver eels to the south western Sargasso Sea where they spawn and the larvae are brought by currents back across the Atlantic into Irish and European estuaries arriving as unpigmented glass eels. These move into the lower areas of rivers where they grow into pigmented juveniles known as elvers and then proceed to migrate upstream into the wider catchment's watercourses. Eels grow into adults in rivers where they can remain for up to 20 years as yellow eels before migrating downstream on spawning migrations as silver eel. Yellow eel also live in estuaries where they are the stage most frequently caught in the IFI WFD surveys of estuaries.

The ESB at Parteen operate a trap and transport system entailing fishing the eel weir at Killaloe and directed fyke net fishing in several locations in the middle to upper catchment to capture silver eels which are then transported and released downstream of Ardnacrusha. In 2015 this resulted in ~20 tons of silver eel being released below the dam. In addition about 45.8 tons escaped down through the dam and over Parteen weir, bringing the total escapement to 65.8 tons that year. The ESB also operate several elver traps below the dam and Parteen weir and in 2015 they captured between 300kg and 400kg of juvenile eels which were released upstream. Most adult silver eels migrate from the Shannon in the period October to February in a series of waves triggered by a combination of factors including riverine discharge, falling water temperatures, wind speed and direction and lunar luminosity (see Cullen and McCarthy 2003).

A detailed study into glass eels in the Shannon over a 3-year period in the late 1990's (O'Connor, 2003a) showed that these entered the Upper Shannon Estuary tributary estuaries in great numbers from December to April especially in the months of February and March during those years. Their peak movements occurred during spring tide cycles and during the hours of darkness. The estuaries in question included those of the Rine, the Owenagarney, Meelick Creek, Ballinacurra Creek and the Maigue, all in the Upper Shannon Estuary and all upstream of Foynes.

Smelt

Smelt are known to spawn at the head of the tide in Limerick City just below Ardnacrusha Hydropower Station and in the Owenagarney River that enters the Upper Shannon Estuary at Bunratty. In a survey of the distribution of the species in the Shannon Estuary undertaken by salmon fishermen operating at the time, smelt were found to be most abundant in the upper estuary and in the Fergus Estuary, none being taken around Foynes and only a few in the lower estuary in general (Quigley *et al.,* 2004). O'Connor (2003b) reporting on a pilot glass eel survey undertaken over three years in 1997, 1998 and 1999 recorded juvenile smelt as on average constituting 8.4% of the by-catch in the eel nets which was dominated by 3-spined stickleback. For these surveys O'Connor sampled at 6 estuarine sites including the Owenagraney, Rine, Ballincurra Creek, Meelick Creek, Maigue and Feale and with the Owengraney accounting for by far the highest absolute numbers over the 3 years of the survey i.e. 5,759 individuals and 23% of the bycatch. Most smelt were recorded between February and April inclusive and most were juveniles. IFI have also taken smelt in their WDF fish monitoring surveys in the estuary (see Table 7.3.8). These observations would suggest that there's a fairly healthy population of the species in the Shannon Estuary.

General Fish Community – Shannon Estuary

In 2008 and 2014 Inland Fisheries Ireland undertook an extensive survey of the fish community in the inner and outer Shannon Estuary as part of their WFD Fish Monitoring Programme. They also surveyed the Limerick Docs and the Fergus Estuary. Table 7.3.9 list the species recorded in numbers greater than 10 in either the 2008 or 2014 surveys.

The most abundant species included sprat, gobies, flounder, sand smelt, 3-spined stickleback, grey mullet, eel and 5-bearded rockling. Certain species were only taken in appreciable numbers in the Lower Estuary e.g. thick-lipped grey mullet, cod, pollack, poor cod, plaice, Ballan wrasse etc., which probably reflects their more marine distribution within the estuary, whereas in the much lower salinity waters of Limerick Docks, freshwater and brackish species including 3-spined stickleback, roach, dace and perch were also recorded.

Recreational Fishing

Foynes is listed as one of about 16 angling marks around the Shannon Estuary where it is reported that thornback ray, conger, dogfish and codling can be caught in the deeper waters of the shipping channel which is accessible to the west of Foynes village between 300m and 600m from the proposed new jetty extension. Cod, whiting and flounder have been reported from the main piers but these sites may no longer be accessible. There is no fishing permitted within the port area. Night fishing is best for taking conger. The area of the proposed development is unlikely to be a suitable area for the main bait (soft peeler crab - *Carcinus maenas*) due to a lack of the required intertidal habitat for the species.

Commercial Fisheries

In response to initial consultations about the proposed development BIM provided the following details for the region: '*fishing activities within the area include mackerel and scad fishing off the coast of Loop Head, white fish trawlers operate from Fenit, Doonbeg and Rossaveal. V-notching lobster schemes operate in North Kerry and West Clare*. They further indicated that '*a number of local licensed boats operate from piers and slips within the Shannon Estuary working with mainly pots for crab, lobster and shrimp as well as gillnets and tanglenets. The gillnets are used to catch white Pollock, haddock, dogfish, black Pollock, cod and ling. During the summer tanglenet fisheries mainly catch monkfish, turbot and ray. Approximately ten vessels fish from Carrigaholt, Kilbaha, Cashen, Ballylongford and Tarbert ports. From late summer to early spring shrimp are fished within the Estuary. Numerous fish buyers also operate in the area to varying extents (Cashen, Kerry and Carrigaholt)'*.

In follow-up consultation with BIM Regional Fisheries Development officers whose operational area includes the Foynes Port area of the Shannon Estuary they confirmed that there are no licensed commercial fishing activities in the immediate vicinity of the proposed development and further confirmed much of what was conveyed by BIM in their initial response to the proposal.

Table 7.3.9 Numbers of the most numerous species taken by IFI in the WDF Fish Monitoring surveys in the Shannon Estuary in 2008 and 2014 (September & October).

Species	Lower Estuary		Upper Estuary		Limerick Docks		Fergus Estuary	
	2014	2008	2014	2008	2014	2008	2014	2008
Sprat	22860	16727	185	777	25		829	3076
Sand goby	257	1	130		10		133	
Common goby		2164		105		34		673
Thick-lipped grey mullet	138	13						
Sand smelt	128	161					1	10
5-bearded rockling	21	13	10	4			20	9
Flounder	20	23	199	75	274	42	68	76
Corkwing wrasse	1	6						
15-spined stickleback	18	1						
Pollack	14	6						
Poor cod	14	14						
Plaice	12	25						
Saithe	6							
Three-spined stickleback			68	33	51	8		
Eel			28	3	30	21	23	6
Nilsson's pipefish			27				1	10
Smelt			22		138		10	3
Roach				18	38	29		
Dace					15			
Perch					11			
Pogge							26	
Greater pipefish				172				73
European sea bass							1	10
Lesser spotted dogfish	2	19						
Ballan wrasse	1	14						
Common sole	1	10						
Cod		43						

Aquaculture

In response to consultation about the development BIM indicated that there were a number of licensed aquaculture sites within the Shannon Estuary growing oysters (*Crassostrea gigas*) and bottom-grown blue mussels (*Mytilus edulis*). In follow up consultation the BIM Regional Aquaculture Officer responsible for that part of the Shannon Estuary was contacted and they provided details of various aquaculture concerns around the estuary, including contact details for growers. In addition, the Aquaculture & Foreshore Management Division of the Department of Agriculture, Food and the Marine provided maps showing the locations of all of current licensed growing sites and all applications for potential future sites as well as the coordinates of one application which hadn't as yet been mapped. They also provided maps of the locations of oyster orders within the estuary (see Appendix 7.5).

These included 2 licensed areas and 8 license applications to the west of Foynes Port at Ballylongford. These are mainly for oysters with 1 existing license and 1 application also for mussels and 1 for seaweed. The nearest of these sites is 20km west of Foynes. To the east of Foynes there is one active oyster farm and 2 applications, also for oysters. The nearest of these is just over 5km east of the proposed development to the east of Aughinish Island. This latter farm has been in operation for 10 years on the site of a previous farm that had operated for 25 years. The farm produces under 10 tons of finished oysters per annum, which are harvested either as half grown or at full market size depending on the market demand at the time. Half-grown oysters take between 12 and 18 months to reach size, while fully grown product require between 24 and 36 months to grow to size. This farm employs the bag and trestle method where oyster seed are laid in plastic mesh bags on trestles in the lower intertidal where they are spilt, re-bagged, maintained and managed throughout the growing period. Seed are generally laid in the autumn and harvesting of mature oysters takes place between autumn and April / May. In the past, maturing oysters have been on-laid for finishing within the shallow subtidal area of the nearby oyster order, at Loughill. However, this practice hasn't been undertaken in recent times. Loughill is 6km west along the coast from the proposed development area.

The Foynes/Askeaton growing area has a B classification which means that oysters from this growing area may only be sold or supplied for human consumption after treatment in a purification centre or after re-laying to meet the required health standards. They may also be sold for human consumption if subjected to appropriate heat treatment.

7.3.3 LIKELIHOOD OF IMPACT

7.3.3.1 Benthic Ecology

Construction Phase

The aspects of the works considered potentially harmful during the construction phase are: (i) habitat loss associated with the installation of 69 piles, (ii) habitat disturbance during piling for the new quay, (iv) spillages of hydrocarbons and liquid concrete from the construction site and (iv) increased silt input from groundworks on the Durnish site.

Oil Leaks and Spills

There is a possibility of hydrocarbon leaks and spills associated with poorly maintained construction vehicles or during re-fuelling of plant on-site. Considering the volumes of fuel involved, and taking into consideration that a good environmental management plan will be in place, the likelihood of this happening is considered very low.

Cement Spills

Pre-cast concrete beams and planks will be used for the construction of the jetty, and liquid concrete will be poured over the top to bind all concrete elements together using concrete pumps or concrete skips suspended from a crane. Cement spills are unlikely to occur on well designed, maintained and supervised construction sites and can be readily protected against. The likelihood of cement spills is therefore considered very low.

Habitat Disturbance

The construction of the jetty requires the placement of 69 tubular steel piles driven into the seabed between the West Quay and East Jetty. The placement of these piles will require the use of a jack-up barge, which will need to be manoeuvred within the footprint of the development to facilitate the installation of piles. The use of the jack-up barge will result in the temporary displacement of soft sediment subtidal when the legs from the barge are deployed. Impacts associated with the temporary habitat disturbance during the deployment of the barge will be limited to the footprint of the legs, and its immediate vicinity. Once jack up barge has completed its work, recovery of the sediment will be rapid (< 6 months). The likelihood of these very localised impacts occurring is high.

Habitat Loss

The suspended deck structure will require the installation of 69 piles to support it, which will result in the permanent loss of 81m^2 of soft sediment subtidal habitat. Alternative designs were investigated (Chapter 5), and the use of a floating pile structure was deemed preferable to protect the benthic habitats than infilling of the whole structure footprint, which was a feature of the alternative design option for the new quay.

The existing pontoon will be moved from its current location between the proposed quay extension and existing quay wall to an area west of the proposed development (Chapter 2). This will result in the re-instatement of circa 0.5m^2 of subtidal habitat in the area of the existing pontoon and the removal of 0.5m^2 of subtidal habitat at the new location.

Increased silt input from groundworks

Groundworks undertaken on the terrestrial element of the project, as well as the development of the lands at Durnish, have the potential to result in increased silt input into the system through site run-off and drainage through land drains. The likelihood of large amounts of sediment entering the system through the land drains from terrestrial works is low however on properly monitored, well maintained sites fitted with appropriate levels of silt control.

Herbicide control

Vegetation spaying with herbicide in advance of topsoil stripping may be required. The herbicides for potential use are Gallup Biograde Amenity or Roundup Pro Bioactive. Careless storage, handling or use of pesticides, or improper disposal of empty pesticide containers, can easily cause breaches of the legal limit for pesticides in water.

The water quality assessment in EIAR Chapter 9 considers that the magnitude of the potential impacts arising from herbicides entering the aquatic environment are predicted to be moderate adverse with regard to water quality, given the scale of the works proposed, the distances to the aquatic zone and the fact that there are no drinking water resources likely to be impacted. Based on the matrix of environmental impact as present in EIAR Table 9.2 the rating of the impact is considered to be potentially severe in the extremely sensitive water bodies hydrologically connected to the development, in the absence of any mitigation.

Operational Phase

Habitat Disturbance from Propeller Wash

Construction of a new suspended deck structure will result in the subtidal benthos immediately adjacent to the quay being subjected to regular prop wash from cargo vessels. This will reduce the abundances of fauna present immediately adjacent to the quay, although it won’t change the habitat type. The likelihood of this localised impact occurring is considered high.

7.3.3.2 Fisheries

Overview

The construction of the 117m jetty requiring the installation of 69 x 1.2m tubular steel piles is the only aspect of the proposed development potentially likely to impact on fisheries and it is to this particular portion of the project that likely fisheries impacts will be addressed. The development of terrestrial lands at Durnish could result in the discharge of sediment laden drainage from the site during the earth moving stage of the construction. However, basic silt control mitigation measures will remove this as a potential adverse impact and so this aspect of the development will not be addressed further in the fisheries assessment.

Construction Phase

The construction phase of the project is considered the only one that could give rise to impacts on fisheries within the study area. Those aspects of the works considered noteworthy in this regard are (i) noise output from impact pile-driving and (ii) spillages of liquid concrete and hydrocarbons from the construction site.

Noise

Extensive research has been done on the potential impacts of high noise levels in the aquatic environment on fish. However, there are no standards governing anthropogenic noise levels set for the protection of fish in Irish or European environmental legislation. Accordingly, for this assessment the guideline limit values for various thresholds in terms of fish impacts drawn up by the world's leading research group on the impacts of anthropogenic noise on fish have been used in order to determine the potential risks to species of conservation value in particular. In this regard Chapter 11 presents the outcome of noise modelling which has determined the distance from the active pile at which fish mortality or recoverable fish injury is likely to take place. These outputs are presented in Section 11.2 and indicate that the high impact zone i.e. where mortality or recoverable injury can be expected is confined to within 7m of the active pile. In this regard it is worth noting that piles will only be driven one at a time, during normal construction working hours each day, with no piling taking place on Sundays. It is estimated that it will take 10 months to complete the piling i.e. more than 3.5 days available on average for installing each pile. This means in effect that the pile driving process is not a continuous one but usually entails a more stop – start progression. The potential impact of noise is addressed in relation to key species and groups in the following paragraphs.

Salmon

The movement of adult salmon through estuaries and up into the non-tidal sections of rivers, has been reported as being quite variable and dependent on a range of factors including distance from the head of the tide, freshwater flow, and topography of the estuary. Aphrahamian (1998) suggests that adult salmon rely mainly on passive landward displacement on flood tides, followed by a dropping back during ebb tides that gradually bring the salmon closer to its freshwater destination. Milner *et al*, (2012) show this in a generalised figure and suggests that to stem seaward movement during the ebb salmon will drop vertically or horizontally to slacker flows. What isn't entirely clear is whether the adults actively swim or not during the estuarine phase of their migration. During the 6-8 months of inward adult salmon migration up the Shannon Estuary, there are times during parts of the ebb tide when some salmon may stem back down into the 350m wide channel fronting the Foynes Port area and in theory at least some of these fish might be exposed to dangerously high noise levels from the pile driving, i.e. if they end up within 6 to 7m of the actively driven pile. However, although salmon are considered poor hearing specialists, they are known to be diverted by very loud sound levels and for this reason they are extremely unlikely to come sufficiently close to the active pile to be at risk of injury or death (i.e. within 6-7m). When it is further considered that piles will only be driven for half of each day and not on Sundays and moreover, that even during the day, there are likely to be interruptions in the piling process, it is considered that the possibility of a significant adverse impact on the salmon population using the estuary is extremely remote and therefore any impact is considered not significant.

On their outward journey salmon smolts appear to follow a similar strategy as adults moving into the fastest flows toward the centre of the channel during ebb tides and moving toward the margins during flood tides in order to stem landward displacement during the flood. There is strong evidence that smolts actively swim during their outmigration in order to reach the open sea as quickly as possible, and have also been shown to swim faster in the lower parts of estuaries where the salinities are higher and in these reaches also are likely to make seaward progress, albeit slower, during the flood tide. In research on the subject in the River Test and Southampton Water smolts were also seen in to hold station for periods of 10-20 minutes on parts of the flood tides, again in order to stem landward displacement, although this activity was more in evidence in the upper part of the estuary (Moore et al, 1998)). There is also a suggestion that smolts are more likely to emigrate faster in estuaries with less complex typographies and current systems which is the case in the Lower Shannon Estuary. What is clear is that smolts do not hang about and are generally seen to make rapid seaward progress.

In the Shannon at Foynes, we can expect that during most if not all of the ebb tide that smolts will be concentrated in the main channel of the Lower Shannon where the highest current speeds are to be found, i.e. outside the Foynes side-channel. During the flood, some of smolts passing that part of the estuary at that stage of the tide may enter the side channel where the currents will be slacker in order to stem their landward progress potentially bringing them into the higher noise energy zone by the pile driving rig. Even if this occurs during the periods of daytime when pile-driving is ongoing, smolts are known to be diverted by loud noises and being active swimmers during migration are likely to avoid the areas close to the active pile (6-7m) where exposure could result in recoverable injury or death. Moreover, given that the Foynes channel is approximately 350m wide there will be adequate channel width for the smolts to travel downstream without injury and it is considered likely that at most a very small number of the many thousand smolts emigrating from the Upper Shannon Estuary are likely to be adversely impacted by the piling, with no significant adverse impact predicted to occur at the population level of the species in the Lower Shannon SAC.

Lamprey

Spawning migration behaviour of adult river lamprey and adult sea lamprey in estuaries seems to be very little studied. For example, it isn't known if the species uses selective tidal stream transport like for example salmon and eel to progress upstream. However, given that they are relatively poor swimmers and require a significant amount of energy to undertake the strenuous task of upriver migration and redd building when they arrive at their spawning grounds, it would make energetic sense to avail of the strength of the flooding tide at its strongest i.e. in the main channel of the estuary, to carry them upstream and to stem downstream displacement during the ebb by moving to the margins and bottom. Furthermore, there is a good chance that a greater number will migrate at night than during the day as is the case with lamprey migrating in freshwater, although daytime movement certainly cannot be ruled out in the estuary. In these scenarios, on spawning migrations, it is likely that the bulk of the migrating adults will be found in the 2 km wide main channel at any given time but especially during flood tides with perhaps a smaller fraction found in the narrower, 350m wide Foynes side-channel, mainly during ebb tides. Very little is known about sound detection in lamprey but as they do not possess a swim bladder it is thought that they respond to particle motion rather than sound pressure and are therefore less sensitive to sound. However, given that piling will produce very high noise levels these will also be detectable as particle motion and is likely to generate an avoidance response that would keep the lamprey away from the 6-7m radius around the active pile where the sound levels could result in injury or death. Overall, it is considered very unlikely that any adult lamprey of either migrating species will be adversely impacted by the piling at Foynes due to the very confined area over which potentially dangerous sound levels will extend in comparison to the width of the Foynes channel and the main Lower Estuary Channel in this part of the estuary.

Very little is known about the behaviour of outwardly migrating sea lamprey or river lamprey transformers. However, the fact that they may be more likely to be found in sheltered areas (Silva et al, 2013) would suggest that they might be more vulnerable to piling noise impacts if they were to occur in the immediate area of the proposed Foynes jetty extension during piling. However, compared to many sheltered areas along the northern and southern coasts of the mid to upper estuary, the habitat at Foynes is very inferior and small in extent and for this reason it is considered very unlikely that any significant number of transformers of either river or sea lamprey occur there and so the risk to either species from the proposed piling is expected to be negligible and not significant.

Eels

Glass eels are poor swimmers and rely on tidal transport to bring them progressively up through estuaries to the head of the tide. On flood tides they tend to be well distributed throughout the water column but particularly in the main tidal flow, whereas at early ebb they move toward the margins and during full ebb they move toward the bed of the estuary in order to bury into sediment or to remain in slacker flows so as to stem their seaward displacement (Harrison *et al.,* 2014). This oscillating cycle of a big step upstream on the flood and a shorter backward stem during ebb is the mechanism whereby glass eels eventually arrive at the tidal limits where undergo physiological changes to enable them to migrate further upstream into rivers and streams. The fact that glass eel have the ability to move up and down in the water column would suggest that they may have some limited ability to move away from the inner higher noise impact zones around active piles. Nevertheless, the possibility that some migrating glass eels may for a short period of each ebb be displaced into the higher impact zones of the pile being driven at the time cannot be ruled out. If this occurs then some at least of these eels will either suffer recoverable injury or if closer to the pile (within 6m) be killed. It is likely however that the proportion of the glass eel population which will be adversely affected in this way is likely to be very small for a number of reasons as follows: (i) the mortality impact zone is spatially extremely small i.e. 6m in diameter, whereas the length of the coast from the mouth of the estuary at say Kinconly Point to Foynes is more than 40km in length and the main channel in 1.5 - 2km wide at Foynes. (ii) While we cannot rule out some daytime migration in this part of the estuary, there is a good chance based on previous data collected at nearby estuaries that a significant portion of the glass eel run will occur at night while piling is stopped. (iii) During the day, the piling process will not be continuous with substantial gaps related to the management of the installation of individual piles. (iv) The migration will be spread over a relatively long time-scale of 3 – 4 months. Finally, (v) eels do not home to natal rivers, so that a minor reduction in recruitment in the Shannon (even though this isn’t predicted in this case) would have an imperceptible impact on the potential for future glass eel recruitment to the same river in the future.

Details of outwardly migrating adult silver eel are quite variable in the published literature which appears to be more a reflection of the variability in the hydromorphology and water quality in estuaries as much as anything associated with eel behaviour itself. A number of features are apparently common to most studies as follows: (i) silver eel have a propensity to migrate at night or at dusk both in rivers and in estuaries. However, in very turbid estuaries, they will also spend some time travelling by day. (ii) Eels are drawn toward the areas of fastest current speed in a channel, (iii) migration speeds can be slower and more variable at the head of the tide but faster and more direct (seaward) closer to the estuary mouth. Although selective tidal stream transport in the European eel has rarely been demonstrated (McCleave and Arnold, 1999) by virtue of the nature of the experimental set-up used, it has been clearly demonstrated in the closely related American eel (*A. rostrata*) (Parker and McCleave, 1997) and for ecological reasons is probably the norm for European silver eel also. If that is the case, the likelihood is that the bulk of silver eels migrating down the estuary past Foynes will be present in the main channel with few if any using the side channel close to the proposed development. Furthermore, it is likely that more than 50% of migrating eel will only migrate at dusk or at night and for both these reasons the likelihood is that very few will come close to the active pile thereby avoiding any chance of noise induced injury. Even though eel do not have good hearing, loud noise mediated through particle motion rather than sound pressure does invoke an avoidance reaction in the species, it is likely therefore that any eel moving through the side channel at Foynes will avoid the area of an actively driven pile. For the reasons listed, it is expected that pile driving noise will have no significant adverse impact on migrating silver eel.

Smelt

There is the potential for smelt to occur in Foynes Port area they would therefore be at risk if they come into close proximity to the piles. However, they are active swimmers and are more likely in the main to avoid the area around the active pile rather than move close enough to it to be killed or injured, i.e. within around 6-7 metres, especially as they have a swim bladder and are likely to have a keen sense of hearing. That said, smelt larvae or very small fish with poorer swimming ability may have less ability of avoid the immediate area if tides and or strong winds are carrying them toward the piling area. In the latter cases fish may be killed or injured. However, the footprint of this impact zone is exceptionally small in the overall context of the Shannon Estuary. Furthermore, what we can deduce about the distribution of the species based on the available published data would suggest that the species is more concentrated in the upper estuary and within the estuarine areas of tributary rivers and streams and therefore very likely to be present in the Foynes area in much lower densities than in these other locations. For these reasons the impact on the species from pile-driving noise is likely to be imperceptible and not significant at a population level.

Resident/ Transient Fish Community

There is the potential for many of the resident or seasonally transient fish community of non-conservation importance within the Shannon Estuary, especially most of the common ones, to occur as residents or frequent visitors to the Foynes Port area and all will therefore be at risk if they come into close proximity to the actively driven pile. However, all are active swimmers and are more likely in the main to avoid the area around the active pile rather than move close enough to it to be killed or injured, i.e. within around 6-7 metres. That said, fish larvae or very small fish with poorer swimming ability may have less ability to avoid the immediate area if tides or strong winds are carrying them toward the piling area. In the latter cases fish may be killed or injured. However, the footprint of this impact zone is exceptionally small compared to the overall area of the Shannon Estuary, such that this impact is likely to be imperceptible and not significant.

Recreational Fishing

Piling could potentially reduce catches of cod and whiting for recreational anglers due to avoidance of the area during piling by these species which are likely to be sound – sensitive. Other species such as ray, conger and dogfish are likely to be less sound sensitive and therefore less impacted by piling noise. The fact that piling will not be undertaken on Sundays or in the late evening and night during the week and on Saturday afternoons will allow unaffected activity at these times.

Commercial Fisheries

It is clear from correspondences and consultation with BIM that all active commercial fishing within the Shannon Estuary is permitted at a considerable remove from Foynes Port and the proposed development. Therefore there will be no sound-related adverse impacts on commercial fishing or commercial fish stocks.

Cement Spills

Fisheries

Liquid cement will be used in the construction of the decking for the proposed jetty extension and spills during the pouring or failure of form work could give rise to fish mortalities of any species depending on the amounts involved and the timing of a spill. In a well-managed construction site, however, such occurrences can readily be avoided using good construction practice.

Aquaculture

In theory the nearest aquaculture site some 5km east of the proposed development could be adversely impacted by a cement spill. However, unless it was a very substantial spill this is probably very unlikely. In any case, such an eventuality can readily be avoided using good construction practice.

Hydrocarbon Spills

Reports of adult and juvenile fish kills due to oil spills in the marine environment are rare. Fish are known to be able to detect the presence of hydrocarbons in very low concentrations and it is believed that they can avoid oil-contaminated water as a result. Fish eggs and larvae however would not have that ability and would therefore be susceptible either to direct mortality or development defects as a result of contamination. Oil spills can also give rise to tainting of fish and shellfish flesh which would have the effect of making fisheries or aquaculture products unmarketable and even a potential risk to human health. In general, however, most of the research on oil spills relates to very large ones. In the context of the proposed project, the most likely form of hydrocarbon contamination were it to occur would be associated with leaks from poorly maintained construction vehicles and plant or spills from fuel storage areas. However, such leaks and spills can be readily avoided by good construction practice and site management, thereby minimising greatly the likelihood of any significant impact from hydrocarbons during the construction phase.

7.3.4 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

7.3.4.1 Benthic Ecology

In assessing the significance of the impacts associated with the proposed development, the Guidelines on the information to be contained in Environmental Impact Assessment reports (EPA, 2017) was followed. In addition, cumulative impacts were assessed using reports which indicated a direct impact on the marine environment.

- Planning Ref. 12212: RPS (2011) Shannon Foynes Port Company Land Reclamation Project, Environmental Impact Statement. IBE0215.00/September 2015.

Construction Phase

Oil Leaks and Spills

The release of hydrocarbons into the environment would have adverse effects on the benthos in the vicinity of the proposed development, resulting in the temporary removal of benthic fauna from the impacted area. Due to the volumes involved, and considering the implementation of an environmental monitoring plan and suitable mitigation, the likely extent of the effects of hydrocarbon leaks on the benthos would be localised and considered temporary and slight. Such impacts can be readily avoided however through basic mitigation.

Cement Spills

Cement spilled into the environment would have adverse effects on the benthos in the vicinity of the proposed development, resulting in the removal of biological communities within the footprint of the affected area. The extent of this would be expected to be localised due to the low likelihood of large volumes of cement being lost in a supervised site. The impact of cement spills on the benthos has the capacity to be significant with the benthos suffering temporary to short-term effects.

Habitat Disturbance

Habitat disturbance as a result of the placement of the anchor legs from the jack-up barge will result in the temporary disturbance of soft sediment benthic habitat in the immediate vicinity of the legs. These impacts would be considered localised with slight adverse effects on the benthos. The impacts will be temporary, with recovery occurring rapidly following the completion of all construction works requiring the use of a jack-up barge. These impacts have been characterised as not significant.

Habitat Removal

The construction of the jetty will result in the permanent loss of approximately 81m^2 of soft sediment subtidal in areas where the tubular piles will be placed. The loss of this soft sediment habitat would be considered permanent. However, considering the extremely small extent of the area to be removed, in relation to the extent of similar habitat throughout the SAC, the impact is assessed as negligible (a net loss of <0.0001% of this habitat type from the Lower River Shannon SAC). An assessment of negligible is considered because of the following reasons

1. The area to be permanently removed habitat (0.0081ha) is very small when compared to the extent of similar habitat within the Lower River Shannon SAC (9,431ha). This will not have any impact on the ecological functioning of the habitat with Lower River Shannon SAC.
2. The area to be removed doesn't result in the fragmentation of the habitat.
3. The loss of the habitat will cause a change in the character of the habitat within the direct footprint of the development (i.e. it will be removed), but without significant consequences.

The repositioning of the existing small craft pontoon from its current location to a new one immediately west of the proposed development will result in no net loss of benthic habitat, and as such the impact is considered to be neutral.

Increased silt input from groundworks

Depending on the volumes of silt released into the system, these impacts would be considered temporary in nature, and unlikely to cause significant impact on the benthos as the benthos in close proximity to the proposed development consists of soft sediment habitats which already contain significant levels of silt.

Operational Phase

Sediment disturbance from propeller wash

The area immediately adjacent to the new quay will be subjected to episodic disturbance from propeller wash from shipping berthing and manoeuvring in the area. This will result in reduced faunal abundance within the affected area. However, this localised impact, which will not lead to habitat fragmentation or and wider impacts on the ecological functioning of the estuarine habitat within the SAC is considered to be negligible.

Cumulative Impact

The existing approved development at Foynes Port (Planning Ref. 12212) includes the reclamation of 1.5ha intertidal and 1 ha subtidal of the same type of soft habitat that will be impacted by the current proposal. The current proposal will result in the loss of just 0.0081 ha subtidal habitat. Therefore the cumulative impact associated with this additional habitat loss is considered negligible and not significant as it will not result in any loss of ecological function or any fragmentation of the habitat affected.

7.3.4.2 **Fisheries**

The potential noise-related impacts are only anticipated to be relevant for the construction phase of the project.

Noise

The nature and significance of potential piling noise-related impacts on fish in the Shannon Estuary is presented in Table 7.3.10.

Table 7.3.10 Nature and significance of potential piling noise-related impacts on fish in the Shannon Estuary

Fish Species or Life Stage	*Nature of Impact & Significance*	*Explanation*
Adult salmon	Possible localised avoidance of immediate piling area during spawning migration. Impact not significant at the population level	The bulk of salmon will use the main channel to migrate, migration is stretched out over at least 6 months, salmon are known to avoid loud sounds
Salmon smolt	Possible localised avoidance of immediate piling area during spawning migration. Impact not significant at the population level	The bulk of smolts will use the main channel to migrate, migration is stretched out over at least 3-4 months, smolts are known to avoid loud sounds
Adult lamprey	Possible localised avoidance of immediate piling area during	On their spawning migrations the bulk of both lamprey species would be expected within the main channel of the estuary to avail of selective tidal stream transport,

Fish Species or Life Stage	*Nature of Impact & Significance*	*Explanation*
	spawning migration in both sea and river lamprey. Impact not significant at the population level	both species are likely to avoid the immediate piling area due to the presence of loud piling noise
Lamprey transformers	Possible localised avoidance of immediate piling area of both sea and river lamprey transformers Impact not significant at the population level	Compared to many other areas within the upper and middle parts of the estuary, the habitat for transformers is the proposed development area at Foynes would be considered inferior, so their presence there would be expected to be at very low densities if at all.
Glass eel	Possible localised mortality or injury due in ability to avoid active pile at certain stages of the tide. Impact not significant at the population level	The vast bulk of glass eels are likely to progress up stream through the main channel of the estuary where the currents are strongest or within the Foynes channel outside the high impact zone. The area of the high impact sound zone (~40m^2) is negligible in comparison to the total area over which the glass eels travel and are spread during their upstream migration. The bulk of glass eel may migrate at night
Silver eels	Possible localised avoidance of immediate piling area during outward spawning migration. Impact not significant at the population level	The bulk of silver eel are likely to use selective tidal stream transport in the main estuarine channel to migrate. Eel are known to avoid loud sounds. A higher proportion of eel may migrate at night.
Smelt	Possible localised avoidance of immediate piling area. Impact not significant at the population level	Higher densities of juveniles in brackish and freshwater areas, probably lower densities in the Foynes Port area. Likely to have reasonable hearing as they have a swim bladder. Appears to be a healthy population in the Shannon Estuary.
General fish community	Possible localised mortality of fish larvae due to inability to avoid high impact sound area of active pile. Avoidance of immediate area by adult fish during active piling. Impact not significant at the population level	None of the commercially important fish species in the estuary spawn in the immediate area of the proposed development.

Hydrocarbons

Hydrocarbon spills during the construction phase of the project have the potential to cause tainting of fisheries and aquaculture products. Furthermore they could also cause mortality of fish larvae. However, it is expected that this will not be a significant impact because of how readily hydrocarbon pollution can be avoided and prevented using standard construction good practice methods (see Chapter 9).

Cement

Cement spills during the construction phase of the project have the potential to cause serious localised fish kills, depending on the quantities spilled and the tidal conditions at the time. However, such impacts can be readily avoided and prevented by standard good construction practice methods (Chapter 9). It is expected therefore that cement associated pollution will not give rise to any significant adverse impacts.

Cumulative Impacts

The existing approved development at Foynes Port (Planning Ref. 12212) includes the provision of 138 tubular piles. If these are being driven at the same time as the 69 proposed for the current proposal, there is the possibility for cumulative impacts. The significance of these impacts will depend to some extent on the number of piles which will be driven at the same time and the size of those piles as this will determine the cumulative area of high impact sound i.e. the area in which fish might be injured or killed. For most adult and juvenile fish this isn't expected to be significant, as these fish will have the ability to avoid these areas. Migrating glass eel however will be more susceptible due to the fact that they are poor swimmers and are likely to have only a limited ability to avoid the high impact zones if the tide is carrying into these areas. For this to happen the overlap in the piling between the two projects would have to occur in the months of November to April, but in particularly January to April which is the main migratory period for glass eels. Even were this overlap to occur, the adverse impact on the recruitment of eel to the Upper Shannon Estuary tributaries is likely to be not significant because of the small spatial footprint of the impact area relative to where the bulk of the glass eel population are likely to be found at any one time within the estuary during their upstream migration.

7.3.5 REMEDIAL AND MITIGATION MEASURES

Construction Phase

It is not considered that there should be any requirement to compensate for the loss of 81m^2 of soft sediment subtidal habitat given the overwhelming larger amount of this habitat within the SAC and because the change will not result in any diminution of the ecological functioning of the habitat or give rise to habitat fragmentation.

All plant and construction vehicles should be inspected for oil leaks on a daily basis and a full service record of all plant and machinery used should be maintained. (see Chapter 9 for details).

Measures should be made in the Environmental Management Plan prior to commencement of the project with regard the storage of fuel and lubricants for all plant and construction vehicles. All fuels, oils and lubricants should be stored in a fully bunded area in the construction site compound. (see Chapter 9 for details).

Spill kits should be made available across the site works during the course of all construction works, including on the jack-up barge during piling operations. (see Chapter 9 for details)

Vehicles and plant should be refuelled off site where possible. Where re-fuelling on-site is necessary, precautions on the re-fuelling will need to be made to ensure that no fuel is released into the environment. (see Chapter 9 for details)

Standing plant and machinery should be placed on drip-trays. (see Chapter 9 for details)

All surface run-off from the construction site should be directed into a hydrocarbon interceptor before discharge. (see Chapter 9 for details)

All shuttering works must be securely installed and inspected for leaks prior to cement being poured. All pouring operations should be supervised monitored for spills and leaks at all times. (see Chapter 9 for details)

Silt protection works should be installed in the vicinity of all drains in close proximity to the terrestrial works to prevent the loss of silt from the site into the drainage system. (see Chapter 9 for details).

The application of Herbicides will only be undertaken by trained operators who are registered under the European Communities (Sustainable Use of Pesticides) Regulations 2012. The use of trained professionals to apply the herbicides in accordance with the Sustainable Use of Pesticides Directive will ensure that the potential impact from the application of herbicides during site preparation will be minimised.

Operation Phase

All surface run-off from the new quay should be directed into hydrocarbon interceptors before discharge to the environment. These should be maintained in good working order and regularly inspected and de-sludged.

7.3.6 RESIDUAL IMPACTS

Structure/ Construction Phase

The proposed development will result in the permanent loss of a very small area (0.0081ha) of soft sediment subtidal habitat where the steel piles for the new quay will be installed. This is considered a negligible impact given the very large area of the same type of habitat within the SAC, as well as the absence of habitat fragmentation and ecological function that will result. In addition, a reduction in abundances on the subtidal benthos immediately adjacent to the new quay structure is expected as a result in increased sediment disturbance from propeller wash. However, the impact is considered negligible, due to the very localised nature of the impact and the low abundance and diversity already in this area. Moreover, no residual impacts are anticipated for fisheries, commercial or non-commercial or aquaculture.

7.4 MARINE MAMMALS

7.4.1 METHODOLOGY

To date, 25 species of cetacean (whales, dolphins and porpoises) has been recorded in Irish waters (Berrow and Rogan 1997; Berrow 2001; de Boer et al. 2017). Some of these species are widespread and occur throughout the year while others are only present seasonally or while on migration. In 1991, to highlight the importance of Ireland's Exclusive Economic Zone (EEZ) for cetaceans, the Irish government declared all Irish waters as a whale and dolphin Sanctuary (Rogan and Berrow 1995). Legal obligations for the conservation and protection of cetaceans includes the Wildlife Acts (1976, Amended 2000), which prohibits the hunting, injury, wilful interference of cetaceans and the destruction of cetacean and seal resting and breeding areas up to 12 nautical miles (nm) from the coast. The EC Habitats Directive (92/43/EEC), requires that all cetacean species are afforded strict protection within Ireland's EEZ and are maintained at Favourable Conservation Status. Under the Habitats Directive, Ireland is also required to designate Special Areas of Conservation (SACs) for the harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*) and both species of breeding seal (grey (*Halichoerus grypus*) and common (*Phoca vitulina).* There are currently two SACs with bottlenose dolphin as a qualifying interest; the Lower River Shannon SAC and the West Connacht Coast SAC. The proposed jetty construction lies entirely within the Lower River Shannon SAC.

A number of marine mammal species have been recorded in the Shannon Estuary including grey (*Halichoerus grypus*) and common seals (*Phoca vitulina*) and bottlenose dolphins. Although not strictly a marine mammal, otter (*Lutra lutra*) also occur along the shores of the estuary and forage within the estuary. The Lower River Shannon SAC (Site Code 002165) includes bottlenose dolphins and otter as qualifying interests.

Plate 7.4.1 Bottlenose dolphins in the Shannon Estuary

7.4.1.1 Grey and Common seals

Common and Grey seals are regularly observed hauled out near Foynes Island e.g. Sturamis Island, east of Foynes, and Beeves Rock upriver of Foynes port. Although both species only occur in small numbers these seals are part of a much wider population including individuals travelling from France, as revealed by satellite telemetry.

Plate 7.4.2 Grey seal

7.4.1.2 Bottlenose dolphins

The Shannon Estuary is one of the most extensively studied sites for bottlenose dolphins in Europe. Studies have been ongoing since 1993 (Berrow et al. 1996) including extensive use of passive acoustic monitoring since 2001 (Berrow 2001). Bottlenose dolphins are found throughout the estuary but regular concentrations occur off Kilcredaun Head in the outer estuary and Tarbert-Killimer (Berrow et al. 1996; Ingram 2000), which is associated with foraging behaviour (Ingram and Rogan 2002). Most research and monitoring work has been carried out in the outer estuary as far upriver as Tarbert-Killimer with relatively less up river of Tarbert. Foynes Port is situated in the middle to inner part of the estuary, which despite less survey effort research has shown is still used extensively by bottlenose dolphins. Berrow (2009) carried out a series of transects from Kilrush to Shannon airport in the inner estuary between November and March and found the sighting rate was as high as that published for the mid and outer estuary although dolphin abundance was less. Most sightings during this period were off Tarbert and east as far as Foynes Island with no sightings in the inner estuary.

Static Acoustic Monitoring (SAM) provides a very useful tool for assessing the use of a site by bottlenose dolphins in the Shannon. SAM equipment such as C-PODS log the echolocation clicks of odontocetes and record peak frequency and inter-click-intervals to assist in species identification and behaviour. The detection distance of CPODs to bottlenose dolphins in the Shannon estuary is estimated at around 800m (O'Brien et al. 2012). Only bottlenose dolphins have been recorded west of the mouth of the estuary at Kilcredaun Head confirming that all detections up river are from bottlenose dolphins. O'Brien and Berrow (2012) deployed a C-POD off the north side of Foynes Island during a two year acoustic monitoring study. Bottlenose dolphins were present on 40% of days. This compares to 25% of days off Aughinish and 155 of days off Shannon Airport upriver of Foynes and 80% of days off Moneypoint and Tarvert, down river of Foynes (O'Brien et al. 2015).

A more detailed analysis of the data by Carmen (2016), showed that although the detection positive days were less upriver compared to well-studied sites such as Moneypoint, the proportion of time spent foraging was higher suggesting that the inner estuary is an important foraging area. Analysis using General Linear Mixed Models (GLMM) showed that season had a significant effect on the presence of dolphins at the site (Fig. 7.4.1). A significant peak in detections was recorded during the spring (χ^2= 82.5, p<0.0001) and at night (χ^2= 82.5, p<0.0001). Tidal cycle and tidal phase were not found to be significant factors influencing dolphin presence at the site (O'Brien and Berrow, 2012).

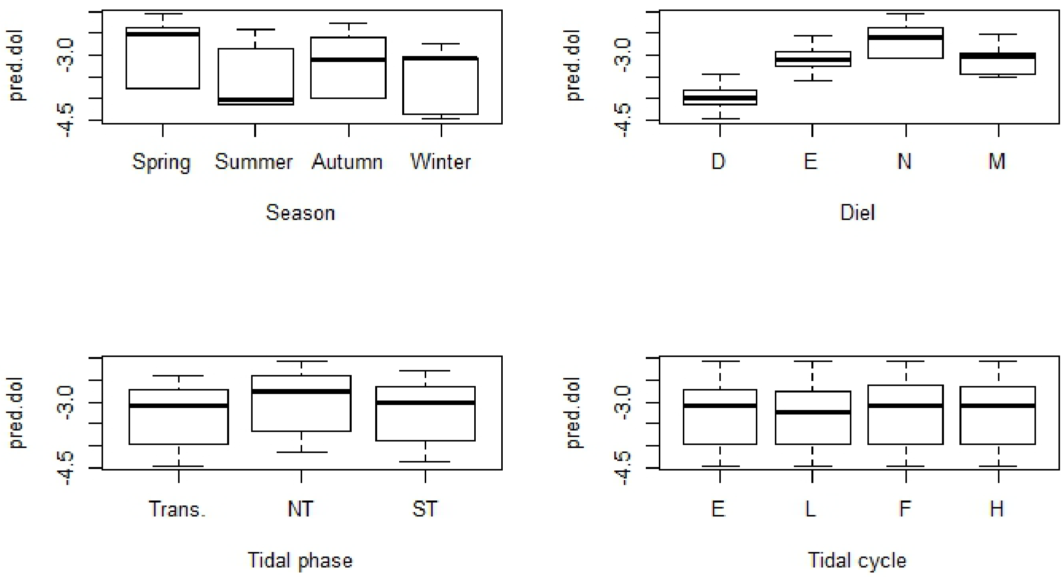


Figure 7.4.1 Predicted proportion of porpoise detection positive hours, in the narrow band high frequency channel from Foynes across season, diel (where D = day, E = evening, M = morning and N = night), tidal phase (where Trans. = transitional phase, NT = neap tide and ST = spring tide) and tidal cycle (where E = ebb, L = slack low, F = flood and H = slack high) (from O'Brien and Berrow 2012).

Berrow and O'Brien (2011) deployed a C-POD for a total of 176 days off the Quay Wall at Foynes Jetty. Dolphins were detected from 27% to 47% of days (mean = 34% of days), with a total of 162 Detection Positive Minutes (DPM) were recorded with a mean on 0.87 DPM per day. When detected, there was only one encounter per day and the duration of encounters were very short with only 6 (3.4%) greater than 4 minutes (Figure 7.4.2). C-POD data were divided into day and night-time which showed that 76% of detections were at night, with only 24% during daylight hours. This suggests that dolphins are using Foynes more frequently at night, maybe as there is less human activity and thus are rarely observed.

Plate 7.4.3 Bottlenose dolphins observed at the Port of Foynes on 10 May, 2001

Plate 7.4.4 SAM monitoring site off north side of Foynes Island Photo: Simon Berrow/IWDG

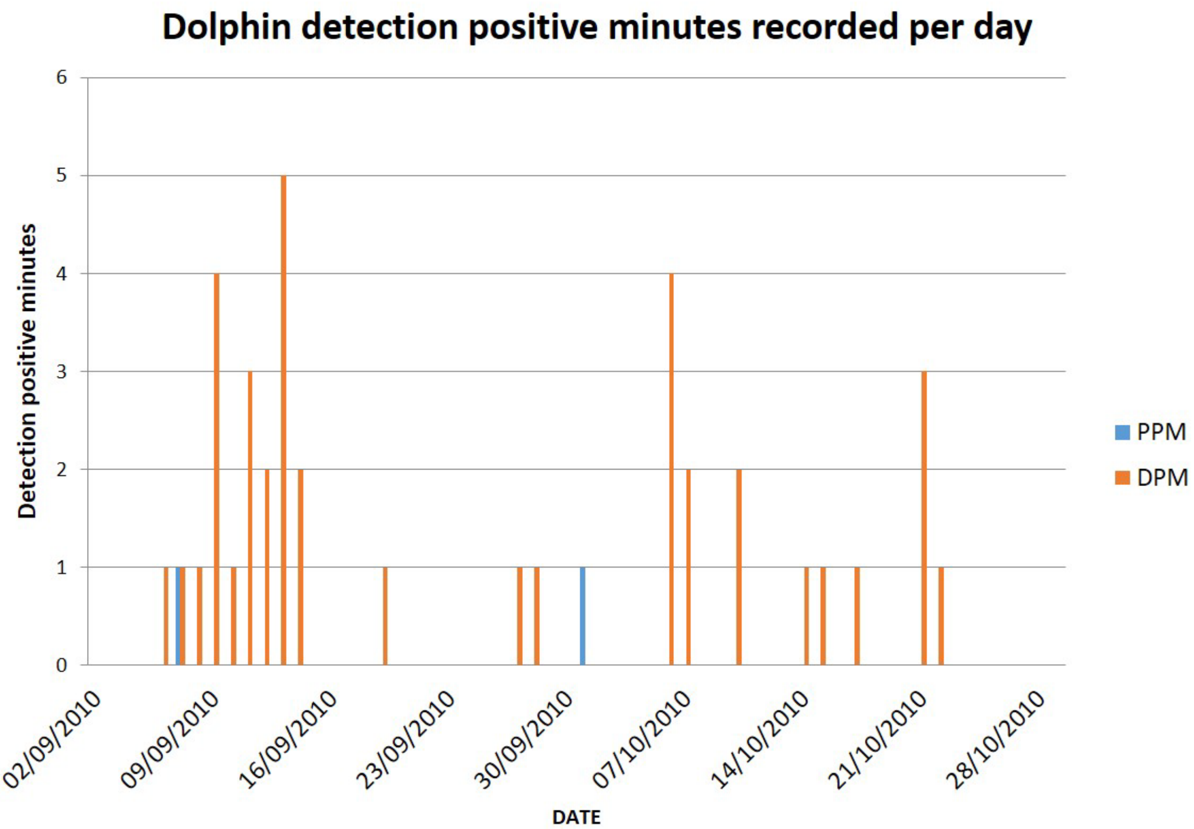


Figure 7.4.2. Number of Detection Positive Minutes (DPMs) per day recorded by a single C-POD from the Quay Wall, Foynes between February and October 2010 (from Berrow O'Brien 2011). PPM refer to narrow band high frequency clicks normally associated with harbour porpoise but here are attributed to dolphins.

Clearly bottlenose dolphins within the Lower River Shannon SAC use the waters adjacent to Foynes Harbour and occasionally enter the port. Any activities which may impact on marine mammals must be considered fully. However in the longer term given the proposed expansion of the port activities at a mid to long term average growth scenario of 3% per annum (Vision 2041) consideration must be given to the impact of this increased vessel traffic on the wider Shannon dolphin habitat.

7.4.2 RECEIVING ENVIRONMENT

The construction site is limited to the immediate area of Foynes harbour and adjacent Durnish landbank which is also within the greater port area. However we have considered the potential impacts of increased shipping activity outside the harbour and its approaches in the wider Shannon Estuary likely to be associated with the upgraded infrastructure in the port.

The only marine mammals likely to be exposed to site construction works are bottlenose dolphins. There was no evidence of otter presence during a survey carried out of the site in 2010.

The receiving environment regarding impacts on marine mammals is mainly restricted to the port area. Impacts in the wider estuary are also considered including the approaches to the port and shipping channels. Disturbance or habitat degradation including pulsed acoustic impacts, associated with the port extension activities is restricted to the immediate port area. Shipping is a known continuous noise source and has been reported as the dominant source of anthropogenic sound in a broadband range from 5 to 300 Hz. Bottlenose dolphins auditory range is as low as 150Hz but they are not very sensitive at these low frequencies

One of the more important impacts to consider are acoustic impacts, both on the auditory functions of marine mammals, including Temporary Threshold Shift (TTS) and from masking. Both dolphins and seals are sensitive but at different frequency ranges with seals estimated auditory bandwidth of 75 Hz to 75 kHz and bottlenose dolphins at 150 Hz to 160 kHz (Southall et al. 2007). However noise associated with this proposed construction are not of high intensity and will attenuate within a short distance. The underwater noise environment within the Foynes harbour area was established through field measurements detailed in Section 11.8 of this EIAR and was used to support the marine mammal impact assessment reported herein.

Bottlenose dolphins occur all year round as they are resident so there is not a particular time of the year where exposure might be less. Seals too have been recorded in all seasons, though are likely to be more abundant in the autumn, but only occur sporadically around Foynes Harbour.

7.4.3 LIKELIHOOD OF IMPACTS

It is estimated that the proposed jetty construction works will be undertaken during a construction period of approximately 12 months. A ‘worst case’ assessment has been carried out whereby the jetty construction may potentially take place at the same time with other permitted development comprising reclamation behind the Eastern Jetty.

7.4.3.1 Construction Phase

Piling

A proposed 25m wide open pile structure will be constructed to connect the existing West Quay to the existing East Jetty. Piling of tubular steel piles, circa 1,219mm diameter x 25.4mm thick, will be driven to provide approximately 3m deep penetration into rock. A vibrating hammer will be craned onto the pile head to drive the pile as much as possible. At this point, a hydraulic impact hammer will used to drive the pile to the required toe level (or until refusal).

Sound pressure from piling activities may have a negative impact on bottlenose dolphins. If a marine mammal's received sound exposures, irrespective of the anthropogenic source, exceed the relevant criterion, auditory injury (PTS) is assumed to be likely. Pile driving is classed as a multi pulse source of impulsive sound. Its measured effects on marine mammals are largely based on work by Southall *et al.* (2007), who proposed a dual criterion based on peak sound pressure level (SPL) and sound exposure level (SEL), where the level that is exceeded first is what should be used as the working injury criterion (i.e. the precautionary of the two measures). The potential impacts on marine mammals from piling activity include Permanent Threshold Shift (PTS), Temporary Threshold Shift (TTS) and behavioural disturbance; each of which have varying degrees of severity for exposed individuals. As all marine mammals do not hear equally across all frequencies, the use of frequency weightings is applied to compensate for differential frequency responses of their sensory systems (M-weighting).

Bailey *et al.* (2010) estimated the effect of pile driving on coastal cetaceans in the Moray Firth (42m water depth), within 25km from the sound source. They found that based on the broadband peak to peak sound level, PTS onset would have occurred within 5m of the pile-driving operation for cetaceans and within 20m for pinnipeds. The level for TTS onset would have been exceeded within 10m and 40m of the pile-driving for cetaceans and pinnipeds respectively. They found that the closest measurement of the pile-driving noise recorded at 100m, had an M-weighted SEL of 166 dB re 1 µPa2 –s which was less than the PTS and TTS SEL criteria for cetaceans and pinnipeds. They suggest that this indicated that no form of injury or hearing impairment should have occurred at ranges greater than 100m from the pile-driving operation.

Demolition

Localised demolition will be necessary at the western end of the existing East Jetty to allow for connection of the jetty extension to the existing jetty's rounded end. Similar localised demolition will also be required at the existing West Quay. No blasting will be carried out. Demolition will be of the existing concrete deck structures and will likely be a combination of high pressure water jetting (hydro-demolition) and localised breaking out of concrete using a rock breaker mounted on an excavator.

Dredging

No capital dredging is required as part of the proposed works.

7.4.3.2 Operation Phase

Ongoing potential impacts during construction are limited to increased shipping traffic. Shipping movements at Foynes port take place throughout the day and night, 364 days a year. General cargo operations are usually conducted between 0600 and 2400 7 days a week with the capacity to work 24/7 as required for operational or safety reasons. It is intended that hours of operation on the jetty extension will be the same.

With respect to shipping traffic entering the port via the Shannon estuary, at present, an average of 6 vessels per week call to Foynes Port. The proposed port extension is not thought to lead to an increase in the number of ships, but rather allow larger ships carrying more tonnage. Improved facilities at Foynes Port, and the projected tonnage, could result in an increase of 7 vessels per week but it should be noted that this will be highly dependent upon the average tonnage of each vessel. Thus whilst the tonnages are expected to grow, the number of ships may not.

Plate 7.4.5 Juvenile bottlenose dolphin in the Shannon Estuary

7.4.4 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

Potential impacts on marine mammals may include localised disturbance, habitat degradation (e.g. decline in availability of potential prey) or increased ambient noise due to increased shipping

Significance may be quantified at population or individual level, short or long-term, chronic or acute. Bottlenose dolphins, the most likely marine mammal to be affected have highly developed acoustically but are resident in the Shannon and thus have been exposed to shipping and marine industry for many years. Seals although present are small in number, only present for short periods and occur at great distances from the port area.

A matrix of possible effects at the individual and population level is presented in Table 7.4.1. Changes in habitat include acoustic effects.

Table 7.4.1. Definitions used to assess likely effects of the proposed port development on marine mammals

Significance	Level	Definition
Significant	**Severe**	Change in habitat leading to long term (>10 years) damage and poor potential for recovery to a normal state.
		Likely effect on population status
		Chronic long-term effect on population health
Significant	**Major**	Change in habitat over a wide area leading to medium term (>2 years) impacts but with a likelihood of recovery within 10 years.
		Possible effect on population status
		Chronic short-term effect on population health
Significant	**Moderate**	Change in habitat in a localised area for a short time, with good recovery potential. Similar scale of effect to existing variability but may have cumulative implications.
		Possible effect on population status
		Acute effect on population health
Insignificant	**Minor**	Change which is within the scope of existing variability but can be monitored.
		May affect population status or health
Insignificant	**Negligible**	Changes which are unlikely to be noticed or measurable against background activities.
Insignificant	**None**	No interaction and hence no change expected.
Insignificant	**Beneficial**	Likely to cause some enhancement to habitat
		May improve population status or health

Potential effects on individual bottlenose dolphins may occur if close to piling on initial start-up. Impacts of demolition are considered negligible as the individuals would need to be adjacent to the demolition site at start up, which is extremely unlikely. Impacts of shipping on ambient noise levels are likely to occur but would be "*within the scope of existing variability but can be monitored*" (Table 7.4.2) and thus considered negligible.

Table 7.4.2 An ENVIID of potential impacts on bottlenose dolphins arising from the proposed port development

Receptors	**Bottlenose dolphin**				
	Individuals	Population	Habitat	Disturbance	Acoustic
Pressures					
Piling	**Significant**	**None**	**None**	**Significant**	**Significant**
Demolition	**Negligible**	**None**	**None**	**Negligible**	**Negligible**
Dredging	**None**	**None**	**None**	**None**	**None**
Shipping	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**

With respect to other marine mammals than dolphins, only potential impacts occur for otters if they occur at the construction site (Table 7.4.3).

Table 7.4.3 An ENVIID of potential impacts on seals and otters arising from the proposed port development

Receptors	Seals	Otters
Pressures		
Piling	**Negligible**	**Significant**
Demolition	**Negligible**	**Significant**
Dredging	**None**	**None**
Shipping	**None**	**None**

7.4.4.1 Cumulative Effects

Relevant activities which may result in cumulative effects have been considered, including reclamation works at East Jetty that have already been given permission. There is no cumulative impact as the impacts of both construction activities, even if they coincided within time and space are minimal and not significant in isolation, or together.

7.4.5 REMEDIAL AND MITIGATION MEASURES

7.4.5.1 Piling

Recommended mitigation measures for piling are limited to the implementation of the NPWS (2014) guidelines which requires a Marine Mammal Observer (MMO) to ensure the area is clear of marine mammals and a soft start procedure where the equipment is ramped up slowly to full power. The buffer zone to be monitored should be agreed with NPWS but we recommend 500-1000m, which is in line with current NPWS guidance “Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters”. Visual mitigation measures require daylight and favourable sea conditions in order to be implemented effectively. Bottlenose dolphins are quite easily detected in good to moderate sea-states and the port area is quite sheltered from all wind directions. The MMO can work effectively from land, with a suitable Vantage Point. This is consistent with existing mitigation measures implemented as part of the Shannon Foynes East Jetty Reclamation Project.

These mitigation measures have been widely used in the Shannon Estuary and elsewhere to mitigate any effects on marine mammals. These include during reclamation works behind the East Jetty in Foynes Port, dredging at Aughinish Alumina, Kilrush Marina and Endesa Power Plant at Tarbert and more recently during piling for the wind turbines at Moneypoint. This mitigation measure is consistent with recommendations contained within the 12/212 assessment.

7.4.5.2 Demolition

Impacts from demolition will be very local and no mitigation is proposed.

7.4.5.3 Vessel activity

Impacts from increased vessel traffic are restricted to the shipping channel and adjacent water and not significant in relation to existing marine traffic activity and no mitigation is proposed. However the long-term impacts of shipping traffic and any increases predicted in the future are of concern. Under the EU Marine Strategy Framework Directive (Directive 2008/56/EC) (MSFD) all seas in each Member State must achieve good environmental status by 2020. Descriptor 11 addresses noise/energy in the marine environment and Indicator 11.2 on continuous low frequency sound (ambient noise) requires trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) to be measured by observation stations and/or with the use of models if appropriate (Dekeling et al. 2014). O'Brien et al (2016) made the first attempts to measure shipping noise in the Shannon Estuary and showed all noise was broadband (5 Hz to 20 kHz) rms values, with a mean noise level for the Shannon Estuary of 100 ± 7.5 dB re 1 µPa. They also recorded a negative effect of shipping noise on the acoustic activity of bottlenose dolphins in the estuary but the significance of this is not known. It is recommended that Shannon Foynes Port Company consider establishing a monitoring programme for ambient/shipping noise to address the issue of long term trends in ocean noise in the future, in view of likely increases in shipping activity.

7.4.6 RESIDUAL IMPACTS

With recommended mitigation there will be no residual impacts on marine mammals.

7.5 AVIAN BIODIVERSITY

7.5.1 METHODOLOGY

7.5.1.1 Breeding Birds

A breeding bird survey was carried out on the proposed development site at Foynes Port between March and July 2017. This survey was undertaken following the broad methodology of the Breeding Bird Survey (Gregory *et al.* 1997). This involved an ornithologist walking a transect route through the site within 250m of all suitable breeding habitat. The visit was undertaken during the breeding season in the early morning within 3 hours of dawn, when bird song is at maximum. All birds present on the ground, in vegetation or on water were recorded using a standard set of codes (Balmer *et al*. 2013, Gilbert *et al*. 1998). Birds flying over the site were not recorded. Registrations of all bird species present were based on sightings or identification of bird song. The species present were allocated to breeding status using a series of standard indicators that were developed for the *Bird Atlas 2007-11* (Balmer *et al.* 2013). Survey areas are shown in Figure 7.5.1 and described below:

Jetty Extension Area

This area is heavily developed, conforming closely to the habitat types 'BL3 – Built Land' and 'CC1 – Coastal Construction' (Fossitt 2000). Concrete piers and jetties are fronted by rock armour in some parts, and all are backed onto a large area of warehouses, offices and other buildings and associated infrastructure and road. There is very little bird breeding habitat or vegetation present apart from small areas of revegetating ground and isolated bushes or small areas of neglected scrub. Exposed mud shores (LS4) occur between the jetties at low tide.

Proposed Development on Durnish Lands

This site is effectively split into quadrants by the main access road running in a North/South direction, and an abandoned railway line crossing from East to West. The railway line is revegetating and is bordered on both sides by well-developed treeline and hedgerow, thus providing a well-established wildlife corridor and bird breeding habitat. The north-west quadrant is primarily scrub, while the other quadrants are primarily wet grassland of varying quality. A well-vegetated, slow moving river borders most of the southern section. The main body of this site is the north-east quadrant and this is subject to seasonal waterlogging and grazing in recent years, with a network of internal and boundary hedgerows of varying quality.

The eastern boundary of this sector is an old townland boundary with well-established hedgerow. Significant drainage channels border the north and west of this section, with areas under many of the hedgerows containing smaller, ephemeral channels. A grassy flood embankment forms the northern boundary against the Robertstown Creek.

Figure 7.5.1 Survey area for breeding bird survey

7.5.1.2 Non-breeding Water Birds

Waterbirds are those species which are fully or partly dependent on water, either tidal or freshwater habitats. This includes swans, geese, ducks, waders, grebes, divers, herons and allied groups. These are species which are largely present in the area only in the non-breeding period, peaking in the winter months. Surveys of the entire study area were carried out within approximately 3 hours of low tide on 17 separate dates, monthly between November 2015 and March 2017. In this period the majority of waterbirds were dispersed in their foraging areas. Sub-site 2 (Foynes Island shores and Sturamus Island) was surveyed by boat up to November 2016 while all other areas were surveyed from land. All waterbirds in this area were mapped and counted using 10x binoculars and a 20-60x telescope. Survey areas are shown in Figure 7.5.2.

The majority of the shoreline is formed by a sea wall/embankment that protects the Port and the western shore of Robertstown Creek.There are extensive mudflats to the east of the Port and in the sheltered parts of Robertstown Creek. The coastline of Foynes Island is relatively natural with some rocky shores, gravel and mudflats.

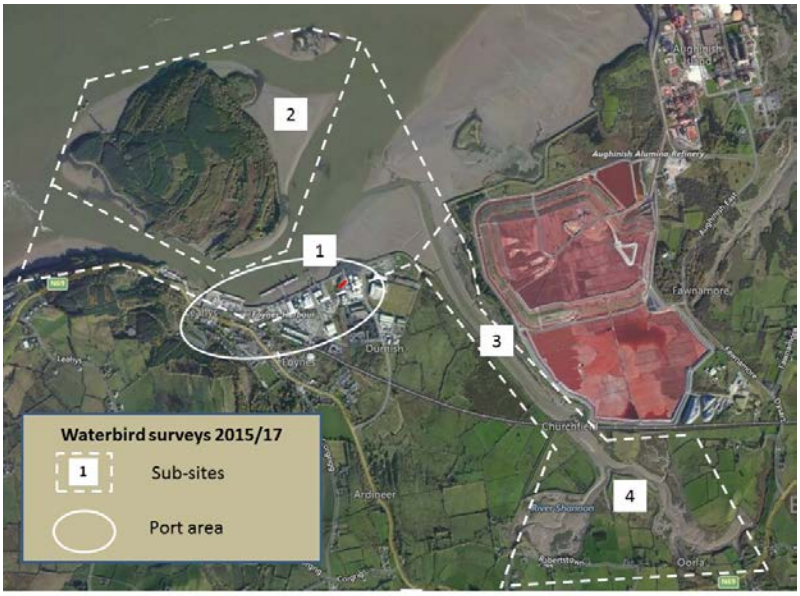


Figure 7.5.2 Survey areas and sub-sites for waterbird surveys in the Foynes Port area.

7.5.2 RECEIVING ENVIRONMENT

7.5.2.1 Breeding Birds

The bird species recorded on the Durnish lands during the breeding season (March to July 2017) are listed in Table 7.5.1. A number of these species were not breeding in the area but are recorded here for completeness.

Table 7.5.1 Birds recorded during the breeding season at proposed Foynes Port extension on Durnish lands

Species	*Scientific Name*	*Breeding status*[1]	*Frequency*[2]	*Habitats*[3]	*Conservation Concern*[4]
Cormorant	*Phalacrocorax carbo*	Non-breeding	Occasional		Amber
Little Egret	*Egretta garzetta*	Non-breeding	Occasional		
Grey Heron	*Ardea cinerea*	Non-breeding	Occasional		
Mallard	*Anas platyrhynchos*	Confirmed breeding	Common	Grassland	
Teal	*Anas crecca*	Possible breeding	Occasional	Grassland	Amber
Sparrowhawk	*Accipiter nisus*	Probable breeding	Occasional	Hedgerow	Amber
Pheasant	*Phasianus colchicus*	Probable breeding	Occasional	Grassland	
Snipe	*Gallinago gallinago*	Possible breeding	Occasional	Grassland	Amber
Rock Dove / Feral Pigeon	*Columba livia*	Non-breeding	Occasional		
Stock Dove	*Columba oenas*	Possible breeding	Occasional	Hedgerow	Amber
Woodpigeon	*Columba palumbus*	Confirmed breeding	Very common	Hedgerow	
Cuckoo	*Cuculus canorus*	Possible breeding	Occasional	Scrub	
Long-eared Owl	*Asio otus*	Possible breeding	Occasional	Treeline	
Skylark	*Alauda arvensis*	Possible breeding	Occasional	Grassland	Amber

Species	***Scientific Name***	***Breeding status***[1]	***Frequency***[2]	***Habitats***[3]	***Conservation Concern***[4]
Swallow	*Hirundo rustica*	Non-breeding	Occasional		Amber
Meadow Pipit	*Anthus pratensis*	Confirmed breeding	Very common	Grassland	Red
Pied Wagtail	*Motacilla alba*	Probable breeding	Occasional	Hedgerow	
Grey Wagtail	*Motacilla cinerea*	Confirmed breeding	Occasional	Grassland	Red
Wren	*Troglodytes troglodytes*	Probable breeding	Very common	Hedgerow	
Dunnock	*Prunella modularis*	Probable breeding	Common	Hedgerow	
Robin	*Erithacus rubecula*	Confirmed breeding	Very common	Hedgerow	Amber
Stonechat	*Saxicola torquata*	Confirmed breeding	Common	Scrub	Amber
Song Thrush	*Turdus philomelos*	Confirmed breeding	Common	Hedgerow	
Blackbird	*Turdus merula*	Confirmed breeding	Very common	Hedgerow	
Blackcap	*Sylvia atricapilla*	Probable breeding	Common	Scrub	
Whitethroat	*Sylvia communis*	Probable breeding	Occasional	Scrub	
Sedge Warbler	*Acrocephalus schoenobaenus*	Probable breeding	Common	Hedgerow	
Willow Warbler	*Phylloscopus trochilus*	Probable breeding	Common	Hedgerow	
Chiffchaff	*Phylloscopus collybita*	Confirmed breeding	Common	Hedgerow	
Treecreeper	*Certhia familiaris*	Possible breeding	Occasional	Hedgerow	
Goldcrest	*Regulus regulus*	Probable breeding	Common	Hedgerow	Amber
Great Tit	*Parus major*	Probable breeding	Occasional	Hedgerow	
Blue Tit	*Parus caeruleus*	Probable breeding	Common	Hedgerow	
Long Tailed Tit	*Aegithalos caudatus*	Confirmed breeding	Occasional	Scrub	
Magpie	*Pica pica*	Probable breeding	Common	Hedgerow	
Jackdaw	*Corvus monedula*	Non-breeding	Occasional		
Rook	*Corvus frugilegus*	Non-breeding	Common		
Hooded Crow	*Corvus cornix*	Confirmed breeding	Common	Hedgerow	
Starling	*Sturnus vulgaris*	Confirmed breeding	Occasional	Hedgerow	Amber
House Sparrow	*Passer domesticus*	Probable breeding	Occasional	Hedgerow	Amber
Chaffinch	*Fringilla coelebs*	Confirmed breeding	Common	Hedgerow	
Linnet	*Carduelis cannabina*	Probable breeding	Common	Scrub	Amber
Lesser Redpoll	*Carduelis cabaret*	Non-breeding	Occasional		
Goldfinch	*Carduelis carduelis*	Probable breeding	Common	Hedgerow	
Greenfinch	*Carduelis chloris*	Probable breeding	Common	Hedgerow	Amber
Bullfinch	*Pyrrhula pyrrhula*	Probable breeding	Occasional	Hedgerow	
Reed Bunting	*Emberiza schoeniclus*	Confirmed breeding	Occasional	Hedgerow	

1. Breeding status as in *Bird Atlas 2007-11* (Balmer *et al.* 2013) – non-breeding, possible, probable, confirmed.
2. Frequency on site – occasional, common, very common.
3. Principal habitats as described by Fossitt (2000).
4. Birds of Conservation Concern (Colhoun and Cummins 2014) – green, amber, red.
5. Records are from within c.50m buffer of boundary and road to security gate

The breeding bird community within the site of the proposed port extension at Durnish lands is typical of grassland and hedgerow in Ireland (Lysaght 1989, Nairn and O'Halloran 2012). All possible, probable or confirmed breeding species are common and widespread in Ireland. Two species, Meadow Pipit and Grey Wagtail, are Red-listed in Ireland because they have suffered a short-term population decline of 59% in Ireland. Fourteen further species are Amber-listed mainly because they have suffered a significant population decline in Ireland in the period 1998-2011 (Colhoun & Cummins 2013). Eight additional non-breeding species were recorded on the lands.

The birds recorded during the breeding season in the area of the proposed jetty extension are given in Table 7.5.2. Records are from within a 50m buffer of boundary and road to security gate Of these species, only five species were confirmed breeding with a further 13 species probably breeding in the area. The breeding species are found exclusively in the buildings and built land and are will not be affected by the proposed jetty extension. Several species were not breeding in the area but are recorded here for completeness. For example, a Peregrine was recorded in the port area, probably foraging on feral pigeons.

Table 7.5.2 Birds recorded during the breeding season at proposed Foynes Port jetty extension

Species	*Scientific name*	*Breeding status*[1]	*Frequency*[2]	*Habitats*[3]	*Conservation Concern*[4]
Mallard	*Anas platyrhynchos*	Probable breeding	Occasional	Built Land	
Peregrine	*Falco peregrinus*	Non-breeding	Occasional	Buildings	
Oystercatcher	*Haematopus ostralegus*	Non-breeding	Occasional		Amber
Black Headed Gull	*Larus ridibundus*	Non-breeding	Occasional		Red
Rock Dove / Feral Pigeon	*Columba livia*	Confirmed breeding	Very common	Buildings	
Stock Dove	*Columba oenas*	Non-breeding	Occasional		Amber
Woodpigeon	*Columba palumbus*	Non-breeding	Occasional		
Swallow	*Hirundo rustica*	Probable breeding	Common	Buildings	Amber
Rock Pipit	*Anthus petrosus*	Confirmed breeding	Occasional	Built Land	
Meadow Pipit	*Anthus pratensis*	Probable breeding	Occasional	Grassland	Red
Pied Wagtail	*Motacilla alba*	Confirmed breeding	Occasional	Buildings	
Wren	*Troglodytes troglodytes*	Probable breeding	Occasional	Scrub	
Dunnock	*Prunella modularis*	Probable breeding	Occasional	Scrub	
Robin	*Erithacus rubecula*	Probable breeding	Occasional	Scrub	Amber
Blackbird	*Turdus merula*	Probable breeding	Occasional	Scrub	
Jackdaw	*Corvus monedula*	Probable breeding	Common	Buildings	
Rook	*Corvus frugilegus*	Non-breeding	Common		
Hooded Crow	*Corvus cornix*	Probable breeding	Occasional	Scrub	
Starling	*Sturnus vulgaris*	Confirmed breeding	Very common	Buildings	Amber
House Sparrow	*Passer domesticus*	Confirmed breeding	Occasional	Buildings	Amber
Chaffinch	*Fringilla coelebs*	Probable breeding	Occasional	Scrub	
Linnet	*Carduelis cannabina*	Probable breeding	Occasional	Scrub	Amber
Lesser Redpoll	*Carduelis cabaret*				
Goldfinch	*Carduelis carduelis*	Probable breeding	Occasional	Scrub	
Greenfinch	*Carduelis chloris*	Probable breeding	Occasional	Scrub	Amber

1. Breeding status as in *Bird Atlas 2007-11* (Balmer *et al.* 2013) – non-breeding, possible, probable, confirmed.

2. Frequency on site – occasional, common, very common.
3. Principal habitats as described by Fossitt (2000).
4. Birds of Conservation Concern (Colhoun and Cummins 2014) – green, amber, red.
5. Records are from within c.50m buffer of boundary and road to security gate

7.5.2.2 Non-breeding Waterbirds

The total populations of waterbirds (all species combined) recorded in the area around Foynes Port are given in Table 7.5.3. The greatest proportion (55%) was recorded consistently in sub-site 4 (the southern end of Robertstown Creek) (see Figure 7.5.2 above for subsite boundaries). Sub-sites 1 (the Port area) and 2 (Foynes Island) held about one fifth of the total each.

Table 7.5.3 Total populations of non-breeding waterbirds in the area of Foynes Port, November 2015 to March 2017.

	Subsites				
Month	***1***	***2***	***3***	***4***	***Total***
Nov-15	214	271	106	255	846
Dec-15	124	316	32	1564	2036
Jan-16	873	379	57	698	2007
Feb-16	154	369	74	265	862
Mar-16	48	87	96	71	302
Apr-16	55	62	18	6	141
May-16	19	40	10	3	72
Jun-16	2	23	6	0	31
Jul-16	29	48	4	128	209
Aug-16	138	66	24	30	258
Sep-16	144	105	26	254	529
Oct-16	136	297	55	563	1051
Nov-16	137	226	86	237	686
Dec-16	492	140	125	2150	2907
Jan-17	499	52	122	1898	2571
Feb-17	168	345	43	706	1262
Mar-17	61	320	12	286	679
Mean	**194**	**185**	**53**	**536**	**968**
Percentage of total	**20**	**19**	**5**	**55**	

Figure 7.5.3 shows the seasonal changes in total number of waterbirds. Peak numbers occurred in December and January in both winters. Numbers were significantly lower in March to August with a minor peak in October during the migration period when migrant birds pass through the area. This a normal pattern of occurrence for non-breeding waterbirds in Ireland (Crowe 2005).

Table 7.5.4 gives the peak numbers of waterbirds of each species recorded in the area of Foynes Port and the mean of 17 counts covering two winter periods and the intervening summer. A total of 38 species were recorded in this period. The most abundant species were Golden Plover, Dunlin and Lapwing. Wigeon and Teal were the most numerous ducks and Black-headed Gull the most abundant gull.

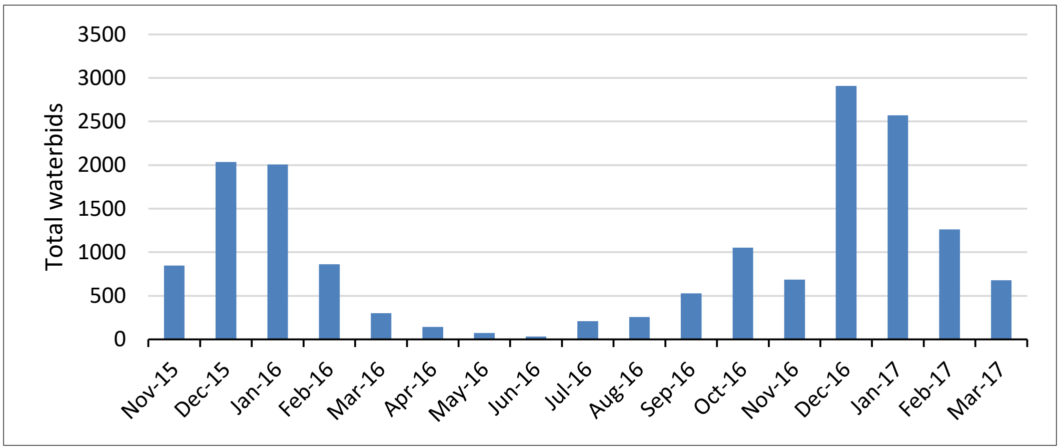


Figure 7.5.3 Monthly totals of waterbirds in the area of Foynes Port 2015-2017

Table 7.5.4 Peak and mean number of each species of non-breeding waterbirds in the area of Foynes Port, November 2015 to March 2017. Qualifying interests of the River Shannon and River Fergus Estuaries SPA are indicated by their reference number.

Species	*Scientific name*	*Qualifying interest of SPA*	*Peak*	*Mean*
Mute Swan	*Cygnus olor*	-	2	0
Whooper Swan	*Cygnus cygnus*	A038	2	0
Shelduck	*Tadorna tadorna*	A048	57	13
Mallard	*Anas platyrhynchos*	-	77	20
Gadwall	*Anas strepera*	-	4	0
Pintail	*Anas acuta*	A054	7	1
Shoveler	*Anas clypeata*	A056	15	1
Wigeon	*Anas penelope*	A050	130	44
Teal	*Anas crecca*	A052	162	70
Great Northern Diver	*Gavia immer*	-	1	0
Little Grebe	*Tachybaptus ruficollus*	-	2	0
Great Crested Grebe	*Podiceps cristatus*	-	9	2
Cormorant	*Phalacrocorax carbo*	A017	47	6
Little Egret	*Egretta garzetta*	-	16	5
Grey Heron	*Ardea cinerea*	-	11	3
Moorhen	*Gallinula chloropus*	-	0	0
Oystercatcher	*Haematopus ostralegus*	-	27	11
Ringed Plover	*Charidrius hiaticula*	A137	114	17
Grey Plover	*Pluvialis squatarola*	A141	2	0

Species	***Scientific name***	***Qualifying interest of SPA***	***Peak***	***Mean***
Golden Plover	*Pluvialis apricaria*	A140	1570	221
Lapwing	*Vanessa vanessa*	A142	495	107
Knot	*Calidris canutus*	A143	3	0
Dunlin	*Calidris alpina*	A149	710	106
Common Sandpiper	*Actitis hypoleucos*	-	3	1
Redshank	*Tringa totanus*	A162	114	45
Spotted Redshank	*Tringa erythropus*	-	1	0
Greenshank	*Tringa nebularia*	A164	26	7
Black-tailed Godwit	*Limosa limosa*	A156	188	35
Curlew	*Numenius arquata*	A160	151	58
Whimbrel	*Numenius phaeopus*	-	37	2
Snipe	*Gallinago gallinago*	-	36	3
Black-headed Gull	*Chroicocephalus ridibundus*	A179	410	153
Common Gull	*Larus canus*	-	75	24
Great Black-backed Gull	*Larus marinus*	-	12	2
Lesser Black-backed Gull	*Larus fuscus*	-	36	5
Herring Gull	*Larus argentatus*	-	17	3
Common Tern	*Sterna hirundo*	-	4	0
Other species		-	1	0

The distribution of several key species by sub-site are shown in Figures 7.5.4 to 7.5.6. These are representative species of ducks (Wigeon), waders (Redshank) and gulls (Black-headed Gull). It is clear that Wigeon were less numerous in sub-site 2 (Foynes Island) in the second winter 2016/17 and appeared to prefer sub-site 4 (south end of Robertstown Creek). Numbers of Redshank and Black-headed gull were higher in the second winter 2016/17 and more numerous in subsite 4. This illustrates that there can be considerable interannual variation in numbers and distribution of waterbirds.

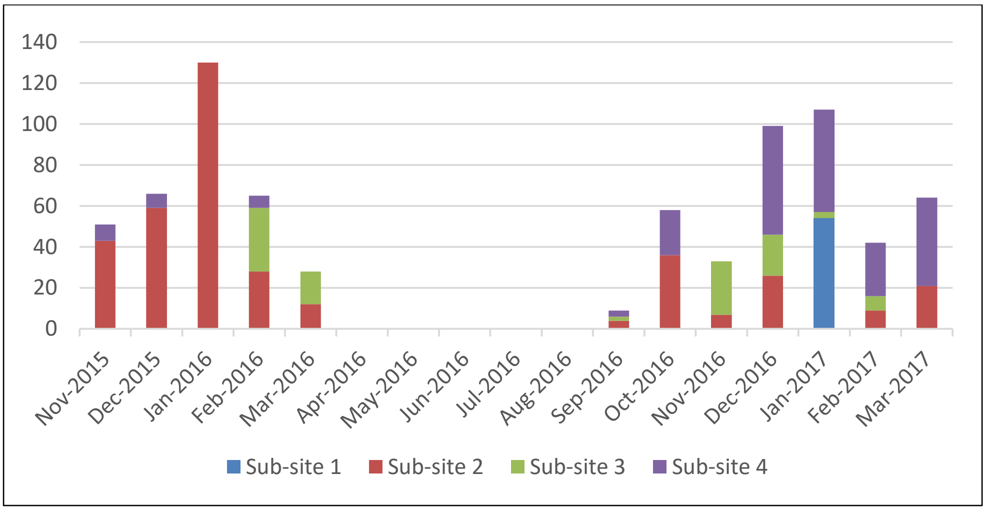


Figure 7.5.4 Monthly counts of Wigeon by sub-site in the area of Foynes Port 2015-2017

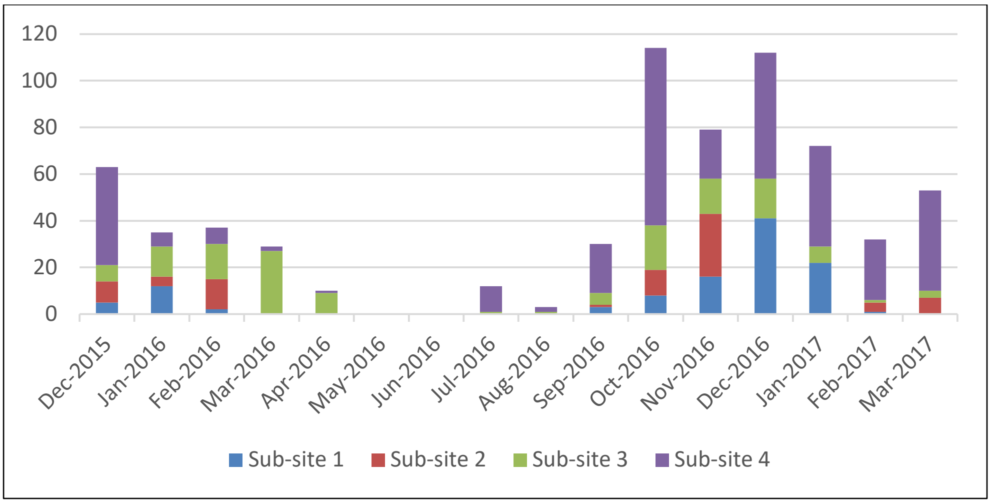


Figure 7.5.5 Monthly counts of Redshank by sub-site in the area of Foynes Port 2015-2017

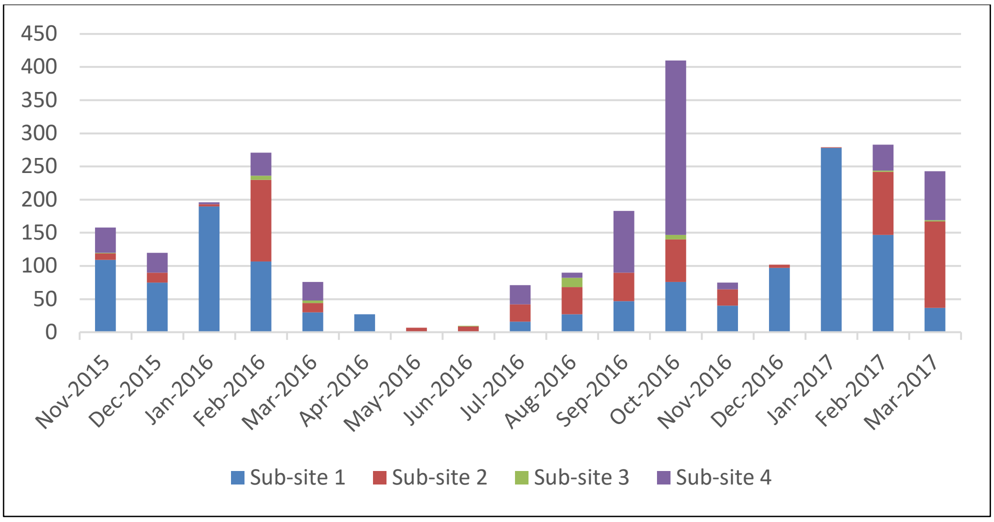


Figure 7.5.6 Monthly counts of Black-headed Gull by sub-site in the area of Foynes Port 2015-2017

7.5.3 LIKELIHOOD OF IMPACTS

7.5.3.1 Construction Impacts

Proposed East Jetty Expansion

The construction of the proposed jetty extension will likely cause some disturbance to waterbirds in the immediate area of the development. Disturbance often implies a short-term or temporary effect that is unlikely to impact upon the individuals or populations of waterbirds concerned. However, it is a term that covers a wide range of responses in waterbirds. Disturbance can be defined as any relatively discrete event in time that disrupts ecosystems, communities or populations, where disruption refers to a change in behaviour, physiology, numbers or survival (Cayford 1993). Disturbance to birds may be caused by human activities which cause a bird to behave differently from the behaviour it would be reasonably expected to exhibit without the presence of that activity.

In the estuarine environment disturbance can manifest in a number of forms of varying severity depending on the nature, duration and intensity of the disturbance source:

- Birds looking up or heads raised, temporarily stopping feeding or roosting;
- Birds moving away from the cause of the disturbance by walking or swimming before resuming previous activity;
- Birds taking flight and landing somewhere in the same feeding area or mudflat;
- Birds taking flight and leaving the target area completely.

The resulting effects of disturbance episodes for estuarine birds are variable. In general, each subsequent level of severity will result in a greater reduction in feeding time, and greater energy expenditure. Flushing is an energetically expensive activity that increases energy expenditure and can result in decreases in the overall fitness of a population, which in turn can lead to reduced breeding success and increased mortality. Birds that are more tolerant than other individuals and remain in an area affected by disturbance may not forage efficiently and if there are additional pressures on the birds (for example cold weather) then this may impact upon the survival of individual birds or their ability to breed later in the year. The term habituation is used to describe birds that have become accustomed to particular sources of disturbance.

A range of literature to assist with the analysis and assessment has been consulted for estuarine and marine environment (see for example, Davidson and Rothwell 1993). The sounds that birds hear can be divided into threatening sounds and non-threatening sounds, to which birds may be habituated. Examples of non-threatening sounds are constant background traffic noise or regular recurring operational port noise. Threatening sounds include impulsive sounds such as rock breaking or piling. A study on the Humber estuary (IECS, 2009) concluded that birds become habituated to regular noise below 70dB. Wright *et al.* (2010) investigated the effects of impulsive noise on water birds and reported that disturbance at levels above 65.5dB(A) are more likely to result in behavioural response of some kind rather than no response. At above 72.25dB(A) flight with abandonment of the site becomes the most likely outcome of the disturbance.

Cutts *et al*. (2009) summarised the general thresholds due to the potential effects of construction disturbance on birds. Noise up to 50dB(A) is found to have no effect whereas noise between 50dB(A) and 85dB(A) causes head turning, scanning behaviour, reduced feeding and movement to nearby areas. Above 85dB(A), response includes preparing to fly away, flying away and possibly leaving the area (Figure 7.5.7).

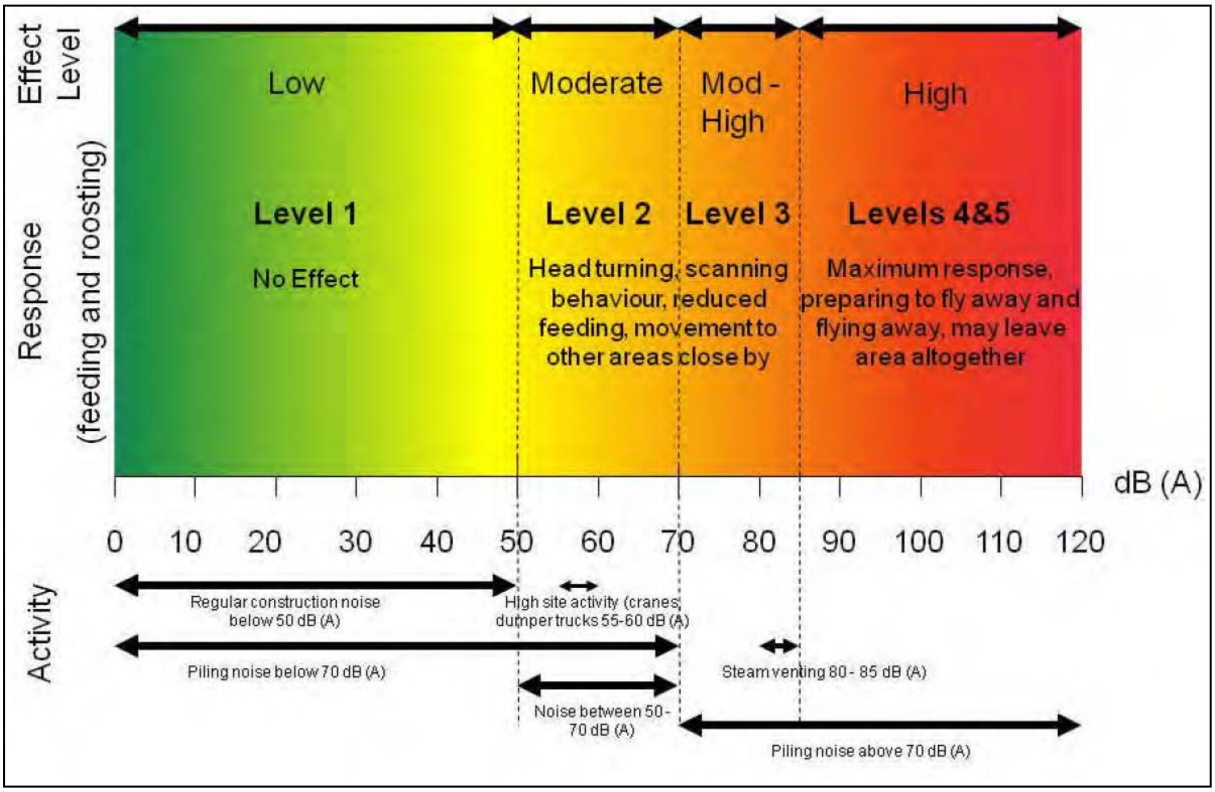


Figure 7.5.7 Waterbird response to construction disturbance (from Cutts et al., 2009)

The authors of that paper recommend that ambient construction noise levels should be restricted to below 70dB(A) as birds will habituate to regular noise below this level (Cutts *et al.* 2009).

IECS (2007) showed that birds were found in general, to accept a wide range of steady state noise level from 55dB(A), up to 85dB(A), therefore complete exclusion within up to 250 m was considered very unlikely. Evidence presented by Cutts et al. (2009) from repair work to a pipeline in the Humber Estuary has shown that disturbed birds (within 100m) are likely to return within a short time frame once disturbance ceases, potentially within 30 minutes, and with no evidence of effects on numbers during surveys the following week, emphasising the short-term nature of any impacts.

Waterbirds in the area of the existing Foynes Port are habituated to construction noise. This is common in estuarine areas close to urban conurbations. For example, waders using a high tide roost within 150-200m of the construction site for a major sewage treatment works in Galway Bay showed no negative effects of disturbance during construction which involved blasting and pile-driving (Nairn 2005).

Proposed Development at Durnish

Similar potential exists for disturbance to birds in the Durnish lands. The potential adverse effects of construction on breeding birds as a direct consequence of the infilling and development of the Durnish site are:

- loss of breeding habitats in the hedgerows, treelines and grasslands
- habitat loss causing displacement of species to alternative areas or fragmentation of territories
- noise or visual disturbance due to personnel and vehicles at construction stage causing displacement of species to alternative areas.

7.5.3.2 Operational Impacts

Operational impacts on birds of the proposed development are likely to be similar to those of the existing port. However, birds in the immediate vicinity of the present port are habituated to normal port activity and are unlikely to be adversely disturbed by it (see discussion above).

7.5.4 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

7.5.4.1 Construction Impacts

Proposed East Jetty Expansion

As described in Chapter 2, the construction works comprise the relocation of the landing pontoon to an area identified at the west side of West Quay, and a new open pile structure and quay furniture constructed to connect the existing West Quay to the existing East Jetty, creating a new Berth No.4. The proposed construction works will be undertaken during a construction period of approximately 12 months. Existing port operations will continue as normal during the construction period.

No breeding birds occur in the footprint of the proposed East Jetty Extension hence the impact of construction here on avian biodiversity will be imperceptible. The breeding birds listed in Table 7.5.2 are all associated with existing buildings and will not be affected by construction disturbance as they are habituated to vehicle and personnel movements. Less than 10 individual non-breeding birds occurred in the area of the jetty extension during the period 2015 to 2017. Oystercatcher and Black-headed Gull were the only waterbird species present here. Habitat loss beneath the new open pile jetty will be negligible and the mudflats that currently exist here will be retained behind the jetty. The waterbirds present are already habituated to vehicle and personnel movements around the existing jetties and will not be affected by additional noise or disturbance during construction. A separate study found that waders using a high tide roost within 150-200m of the construction site for a major sewage treatment works in Galway Bay showed no negative effects of disturbance during construction which involved blasting and pile-driving (Nairn 2005).

Proposed Development at Durnish

The potential adverse effects of construction on breeding birds as a direct consequence of the infilling and development of the Durnish site are:

- loss of breeding habitats in the hedgerows, treelines and grasslands
- habitat loss causing displacement of species to alternative areas or fragmentation of territories
- noise or visual disturbance due to personnel and vehicles at construction stage causing displacement of species to alternative areas.

The species most affected are likely to be affected are listed in Table 7.5.5

Table 7.5.5 Bird species likely to be affected by construction on the Durnish lands.

Species	*Breeding status*[1]	*Frequency*[2]	*Habitats*[3]	*Conservation Concern*[4]
Mallard	Confirmed breeding	Common	Grassland	
Teal	Possible breeding	Occasional	Grassland	Amber
Sparrowhawk	Probable breeding	Occasional	Hedgerow	Amber
Pheasant	Probable breeding	Occasional	Grassland	
Snipe	Possible breeding	Occasional	Grassland	Amber
Stock Dove	Possible breeding	Occasional	Hedgerow	Amber
Woodpigeon	Confirmed breeding	Very common	Hedgerow	
Cuckoo	Possible breeding	Occasional	Scrub	
Long-eared Owl	Possible breeding	Occasional	Treeline	
Skylark	Possible breeding	Occasional	Grassland	Amber
Meadow Pipit	Confirmed breeding	Very common	Grassland	Red
Pied Wagtail	Probable breeding	Occasional	Hedgerow	
Grey Wagtail	Confirmed breeding	Occasional	Grassland	Red
Wren	Probable breeding	Very common	Hedgerow	
Dunnock	Probable breeding	Common	Hedgerow	
Robin	Confirmed breeding	Very common	Hedgerow	Amber
Stonechat	Confirmed breeding	Common	Scrub	Amber
Song Thrush	Confirmed breeding	Common	Hedgerow	
Blackbird	Confirmed breeding	Very common	Hedgerow	
Blackcap	Probable breeding	Common	Scrub	
Whitethroat	Probable breeding	Occasional	Scrub	
Sedge Warbler	Probable breeding	Common	Hedgerow	
Willow Warbler	Probable breeding	Common	Hedgerow	
Chiffchaff	Confirmed breeding	Common	Hedgerow	
Treecreeper	Possible breeding	Occasional	Hedgerow	
Goldcrest	Probable breeding	Common	Hedgerow	Amber
Great Tit	Probable breeding	Occasional	Hedgerow	
Blue Tit	Probable breeding	Common	Hedgerow	
Long Tailed Tit	Confirmed breeding	Occasional	Scrub	
Magpie	Probable breeding	Common	Hedgerow	
Hooded Crow	Confirmed breeding	Common	Hedgerow	
Starling	Confirmed breeding	Occasional	Hedgerow	Amber
House Sparrow	Probable breeding	Occasional	Hedgerow	Amber
Chaffinch	Confirmed breeding	Common	Hedgerow	
Linnet	Probable breeding	Common	Scrub	Amber
Goldfinch	Probable breeding	Common	Hedgerow	
Greenfinch	Probable breeding	Common	Hedgerow	Amber
Bullfinch	Probable breeding	Occasional	Hedgerow	
Reed Bunting	Confirmed breeding	Occasional	Hedgerow	

Of these species, two (Meadow Pipit and Grey Wagtail) are considered to be of high conservation concern (red list) while a further 12 species are of moderate conservation concern (amber list) (Colhoun and Cummins 2013).

7.5.4.2 Operational Impacts

Proposed East Jetty Expansion

Normal port operations will continue during and after construction. This will involve berthing of ships, vehicle and personnel movements around the site. The waterbirds present are already habituated to vehicle and personnel movements around the existing jetties and will not be affected by additional noise or disturbance during operation of the port.

Proposed Development at Durish

The potential adverse effects of port operations on breeding birds in the Durnish site are noise and visual disturbance by personnel and vehicles. Many of the species listed in Table 7.5.5 above are habituated to vehicle and personnel movements as they occur widely in farmland, urban areas and even industrial sites where suitable habitat exists (Nairn & O'Halloran 2012).

7.5.5 REMEDIAL AND MITIGATION MEASURES

7.5.5.1 Proposed East Jetty Expansion

No significant adverse effects on breeding or non-breeding birds are predicted as a result of the construction or operation of the proposed East Jetty extension, and no remedial or mitigation measures are required.

7.5.5.2 Proposed Development at Durnish

Minor adverse effects on breeding birds as a result of habitat loss are predicted due to the proposed development at Durnish, and no remedial or mitigation measures are required, except to restrict site clearance work (especially trees and other vegetation) to the period 1st September to 28th February to avoid adverse impacts on breeding birds.

A moderate beneficial effect is predicted as a result of existing boundary vegetation being augmented where retained and strengthened by additional planting along H8 and H1, and provision of a wide landscaped belt planted along the north-eastern site boundary between the site and the Robertstown Creek as shown in Drawing 1773.5.01 *Proposed Boundary Treatments*. This will help to screen port activities from the intertidal area at Robertsown Creek and prevent disturbance to non-breeding birds in this area.

7.5.6 RESIDUAL IMPACTS

7.5.6.1 Proposed Jetty Expansion

There is no likely significant residual impact predicted upon avian biodiversity as a result of the construction and operation of the proposed East Jetty extension.

7.5.6.2 Proposed Development at Durnish

Likely significant effects on birds were predicted as a result of habitat loss within the Durnish lands. Mitigation was proposed where necessary. As a result there is no likely significant residual impact predicted upon avian biodiversity as a result of the construction and operation of the proposed development at Durnish.

7.5.7 DESIGNATED SITES

7.5.8 METHODOLOGY

A key protection mechanism in the Habitats Directive is the requirement to subject plans and projects to Appropriate Assessment (AA) in line with the requirements of Articles 6(3) and 6(4) of the Habitats Directive. AA considers the implications of any plan or project on the Natura 2000 site network of European sites before any decision is made to allow the plan or project to proceed. European sites are designated under European Council Directives 92/43/EEC and 2009/147/EC Such an assessment must take into consideration the possible effects a plan or project may have in combination with other plans and projects –

> ***Article 6(3)****: Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and if appropriate, after having obtained the opinion of the general public.*

> ***Article 6(4)****: If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of the Natura 2000 site is protected. It shall inform the Commission of the compensatory measures adopted.*

7.5.8.1 Published guidance on Appropriate Assessment

Appropriate Assessment Guidelines for Planning Authorities have been published by the Department of the Environment Heritage and Local Government (DEHLG, 2010a). In addition to the advice available from the Department, the European Commission has published a number of documents which provide a significant body of guidance on the requirements of Appropriate Assessment, most notably including, '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' (EC, 2001), which sets out the principles of how to approach decision making during the process. These principal national and European guidelines have been followed in the preparation this report. The following list identifies these and other pertinent guidance documents:

- Communication from the Commission on the Precautionary Principle, Office for Official Publications of the European Communities, Luxembourg (EC, 2000a);
- 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 (EC, 2000b);
- 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. Office for Official Publications of the European Communities, Brussels (EC, 2001);

- 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; (EC, 2007);
- Estuaries and Coastal Zones within the Context of the Birds and Habitats Directives - Technical Supporting Document on their Dual Roles as Natura 2000 Sites and as Waterways and Locations for Ports. European Commission (EC, 2009);
- Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities. Department of the Environment, Heritage and Local Government, Dublin (DEHLG, 2010a);
- Department of Environment Heritage and Local Government Circular NPW 1/10 and PSSP 2/10 on Appropriate Assessment under Article 6 of the Habitats Directive – Guidance for Planning Authorities (DEHLG, 2010b);
- Guidance document on the implementation of the birds and habitats directive in estuaries and coastal zones with particular attention to port development and dredging. European Commission (EC, 2011a);
- European Commission Staff Working Document 'Integrating biodiversity and nature protection into port development' (EC, 2011b);
- Marine Natura Impact Statements in Irish Special Areas of Conservation: A working document, National Parks and Wildlife Service, Dublin (NPWS, 2012); and
- Interpretation Manual of European Union Habitats. Version EUR 28. European Commission (EC, 2013).

7.5.8.2 Likely Significant Effect

The threshold for a likely significant effect is treated in the screening exercise as being above a de minimis level. A de minimis effect is a level of risk that is too small to be concerned with when considering ecological requirements of an Annex I habitat or a population of Annex II species present on a European site necessary to ensure their favourable conservation condition. If low level effects on habitats or individuals of species are judged to be in this order of magnitude and that judgment has been made in the absence of reasonable scientific doubt, then those effects are not considered to be likely significant effects.

> *"the requirement that the effect in question be 'significant' exists in order to lay down a* de minimis *threshold. Plans or projects that have no appreciable effect on a European site are thereby excluded. If all plans or projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill".*
>
> [Paragraphs 46-50 of the Opinion of the Advocate General in CJEU case C-258/11]

7.5.9 RECEIVING ENVIRONMENT

The site of proposed development is in two parts. The site of the proposed East Jetty extension works, and removal and relocation of the existing small craft landing pontoon to an area identified at the west side of the existing West Quay is located within the Lower River Shannon SAC (Site Code 002165) and the River Shannon and River Fergus Estuaries SPA (Site Code 004077).

The site of the proposed Durnish Lands development is located just over 1km to the east of the Jetty extension works, and the coastal boundary of this site has a flood berm on the bank of the Robertstown River. This berm feature forms the boundary of the Lower River Shannon SAC and the

River Shannon and River Fergus Estuaries SPA. The site of proposed development at Durnish adjoins the boundary with these European sites for approximately 550m.

7.5.9.1 Lower River Shannon SAC

The Lower River Shannon SAC is a European site designated for 14 habitat types and 7 species annexed to the Habitats Directive 92/43/EEC. Qualifying Interests and Conservation Objectives of Lower River Shannon SAC are described below. The SAC is illustrated in Figure 7.6.1.

Qualifying Interests

Annex I Habitats

- Sandbanks which are slightly covered by sea water all the time [1110]
- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- *Coastal lagoons [1150] (a priority habitat)
- Large shallow inlets and bays [1160]
- Reefs [1170]
- Perennial vegetation of stony banks [1220]
- Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]
- Salicornia and other annuals colonising mud and sand [1310]
- Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]
- Mediterranean salt meadows (Juncetalia maritimi) [1410]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation [3260]
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410]
- *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0] (a priority habitat)

Annex II Species

- *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029]
- *Petromyzon marinus* (Sea Lamprey) [1095]
- *Lampetra planeri* (Brook Lamprey) [1096]
- *Lampetra fluviatilis* (River Lamprey) [1099]
- *Salmo salar* (Salmon) [1106]
- *Tursiops truncatus* (Common Bottlenose Dolphin) [1349]
- *Lutra lutra* (Otter) [1355]

Conservation Objectives

To restore or maintain (as applicable, set out below) the favourable conservation condition of the following Annex I habitat types and populations of Annex II species in the SAC, as defined by a range of attributes and targets set out in the published site specific Conservation Objectives, Version 1.0 (published 07/08/2012) for the Lower River Shannon SAC:

Restore

Annex I Habitats

- To restore the favourable conservation condition of *Coastal lagoons in the SAC, as defined by 12 no. attributes and targets.

- To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) in the SAC, as defined by 10 no. attributes and targets.
- To restore the favourable conservation condition of Mediterranean salt meadows (*Juncetalia maritimi*) in the SAC, as defined by 10 no. attributes and targets.
- To restore the favourable conservation condition of *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) in the SAC, as defined by 13 no. attributes and targets.

<u>Annex II Species</u>

- To restore the favourable conservation condition of Freshwater Pearl Mussel in the SAC, as defined by 11 no. attributes and targets.
- To restore the favourable conservation condition of Sea Lamprey in the SAC, as defined by 5 no. attributes and targets.
- To restore the favourable conservation condition of Atlantic Salmon in the SAC, as defined by 6 no. attributes and targets.
- To restore the favourable conservation condition of Otter in the SAC, as defined by 8 no. attributes and targets.

Maintain

<u>Annex I Habitats</u>

- To maintain the favourable conservation condition of Sandbanks which are slightly covered by sea water all the time in the SAC, as defined by 3 no. attributes and targets.
- To maintain the favourable conservation condition of Estuaries in the SAC, as defined by 2 no. attributes and targets.
- To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in the SAC, as defined by 2 no. attributes and targets.
- To maintain the favourable conservation condition of Large shallow inlets and bays in the SAC, as defined by 2 no. attributes and targets.
- To maintain the favourable conservation condition of Reefs in the SAC, as defined by 3 no. attributes and targets.
- To maintain the favourable conservation condition of Perennial vegetation of stony banks in the SAC, as defined by 6 no. attributes and targets.
- To maintain the favourable conservation condition of Vegetated sea cliffs of the Atlantic and Baltic coasts in the SAC, as defined by 8 no. attributes and targets.
- To maintain the favourable conservation condition of Salicornia and other annuals colonizing mud and sand in the SAC, as defined by 10 no. attributes and targets.
- To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the SAC, as defined by 10 no. attributes and targets.
- To maintain the favourable conservation condition of *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) in the SAC, as defined by 10 no. attributes and targets.

<u>Annex II Species</u>

- To maintain the favourable conservation condition of Bottlenose Dolphin in the SAC, as defined by 3 no. attributes and targets.

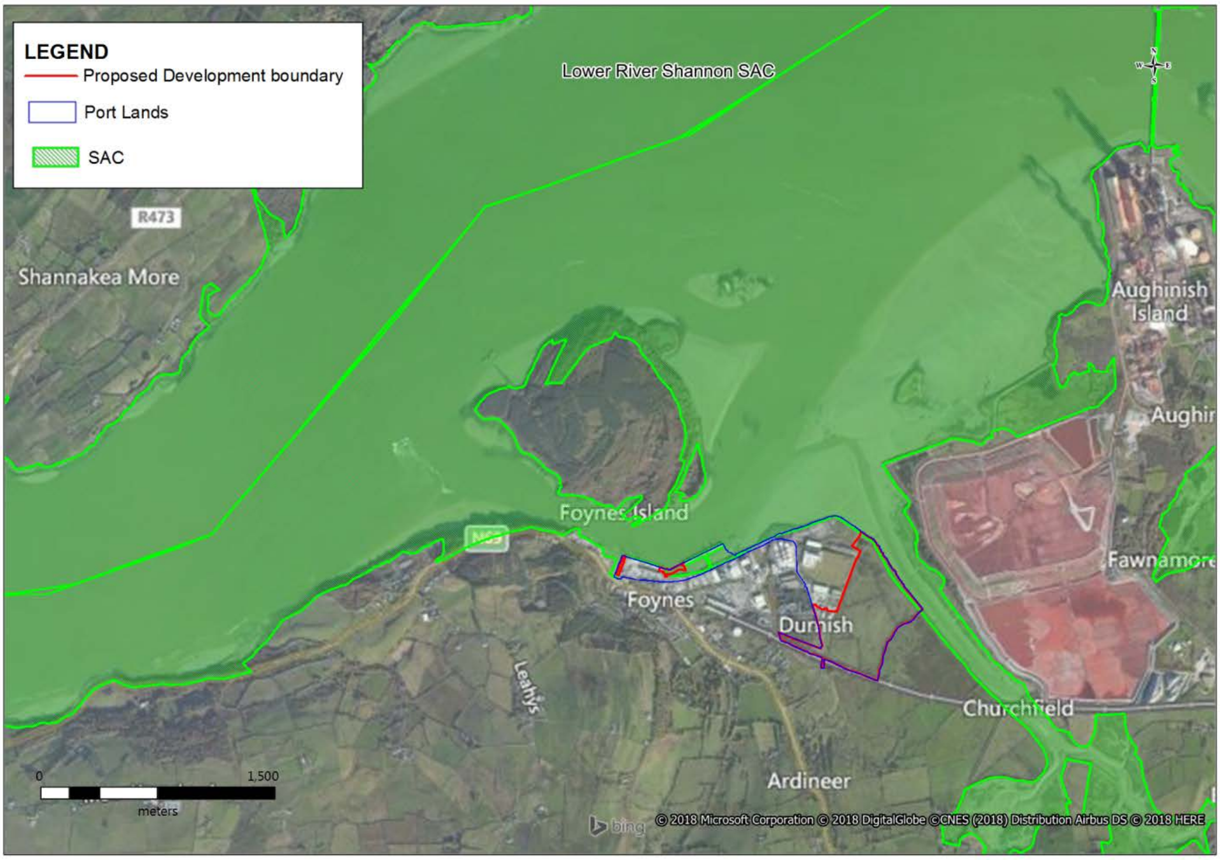


Figure 7.6.1: Lower River Shannon SAC

7.5.9.2 River Shannon and River Fergus Estuaries SPA

The River Shannon and River Fergus Estuaries SPA is a European site designated for 21 species of wading or waterbird, and as a wetland site of international importance under the Birds Directive 2009/147/EC. Qualifying Interests and Conservation Objectives of River Shannon and River Fergus Estuaries SPA are described below. The SPA is illustrated in Figure 7.6.2.

Qualifying Interests

- Cormorant (*Phalacrocorax carbo*) [A017] (breeding + wintering)
- Whooper Swan (*Cygnus cygnus*) [A038] (wintering)
- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] (wintering)
- Shelduck (*Tadorna tadorna*) [A048] (wintering)
- Wigeon (*Anas penelope*) [A050] (wintering)
- Teal (*Anas crecca*) [A052] (wintering)
- Pintail (*Anas acuta*) [A054] (wintering)
- Shoveler (*Anas clypeata*) [A056] (wintering)
- Scaup (*Aythya marila*) [A062] (wintering)
- Ringed Plover (*Charadrius hiaticula*) [A137] (wintering)
- Golden Plover (*Pluvialis apricaria*) [A140] (wintering)
- Grey Plover (*Pluvialis squatarola*) [A141] (wintering)
- Lapwing (*Vanellus vanellus*) [A142] (wintering)
- Knot (*Calidris canutus*) [A143] (wintering)

- Dunlin (*Calidris alpina*) [A149] (wintering)
- Black-tailed Godwit (*Limosa limosa*) [A156] (wintering)
- Bar-tailed Godwit (*Limosa lapponica*) [A157] (wintering)
- Curlew (*Numenius arquata*) [A160] (wintering)
- Redshank (*Tringa totanus*) [A162] (wintering)
- Greenshank (*Tringa nebularia*) [A164] (wintering)
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179] (wintering)
- Wetland and Waterbirds [A999]

Conservation Objectives

To maintain the favourable conservation condition of the populations of species listed above in the SPA, as defined by attributes and targets set out in the published site specific Conservation Objectives, Version 1.0 (published 17/09/2012) for the River Shannon and River Fergus Estuaries SPA.

- The conservation objectives for the breeding and wintering population of Cormorant is defined and measured by 8 no. attributes and targets.
- The conservation objectives for each of the remaining 20 no. wintering populations of qualifying interest species are defined and measured by the same two attributes and targets.
- The conservation objective for wetland habitat is to maintain its favourable conservation condition in the SPA as a resource for the regularly-occurring migratory waterbirds that utilise it, defined and measured by 1 no. attribute and target.

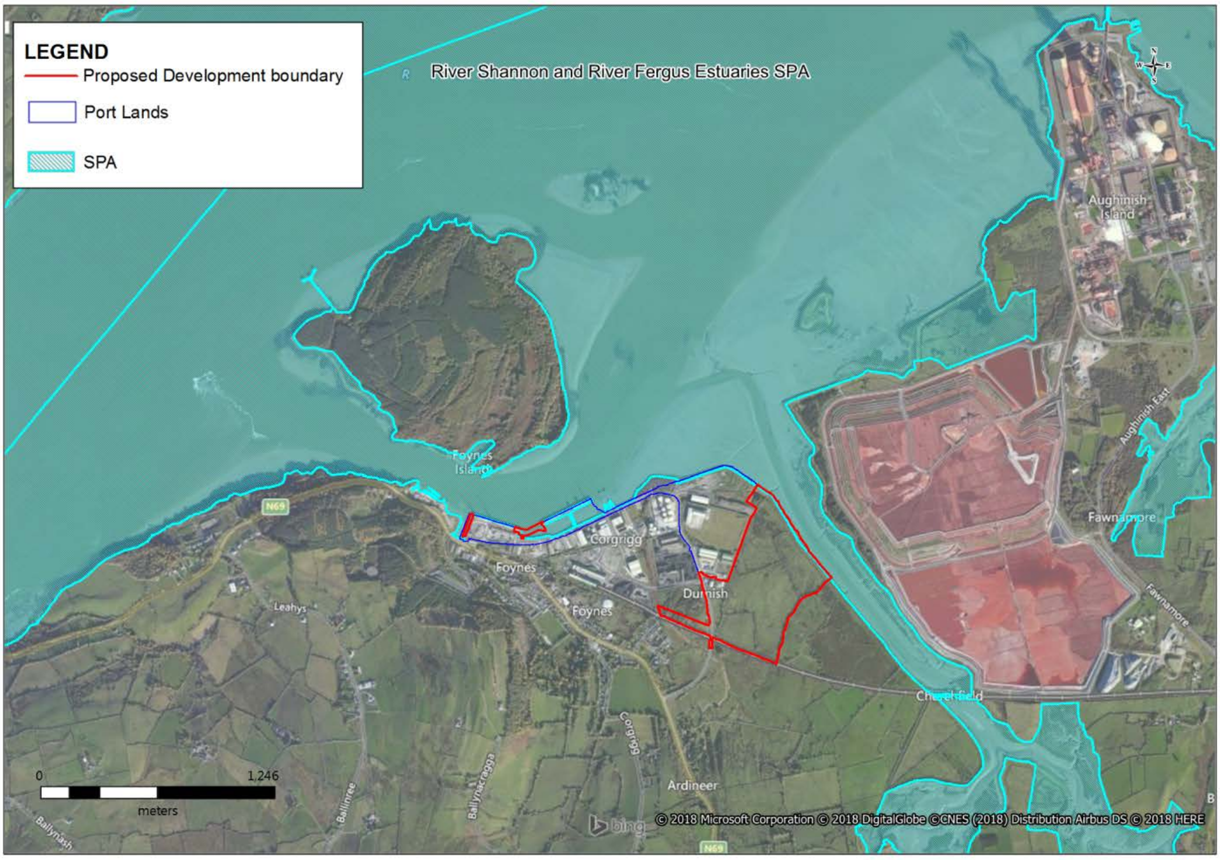


Figure 7.6.2: River Shannon and River Fergus Estuaries SPA

7.5.9.3 Description of the European sites

The Lower River Shannon SAC site synopsis (NPWS, 2013) notes that this SAC is a very large site stretching along the Shannon valley from Killaloe in Co. Clare to Loop Head/Kerry Head, a distance of approximately 120km. The SAC includes the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The River Shannon and River Fergus SPA site synopsis (NPWS, 2015) notes that this SPA comprising the estuaries of the River Shannon and River Fergus, form the largest estuarine complex in Ireland. The SPA comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in Co. Clare and Dooneen Point in Co. Kerry. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River estuary.

Habitats of the European sites

Both the Fergus and inner Shannon Estuaries contain vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics.

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Other coastal habitats that occur within the site include stony beaches and bedrock shores, shingle beaches, sandbanks which are slightly covered by sea water at all times and sand dunes.

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon is broad, generally slow flowing and naturally eutrophic; the Fergus is smaller and alkaline; while the narrow, fast flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth.

Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, but improved grassland is the most common habitat type. One grassland type of particular conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Floating river vegetation characterised by species of water-crowfoot and the moss *Fontinalius antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to Co. Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The herbaceous layer consists of tall perennial herbs. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. The ground flora is species-rich.

There is a small area of actively regenerating cut-away raised bog at Ballyrorheen. It is situated approximately 5 km north-west of Cappamore in Co. Limerick. The bog contains some wet areas with good cover of bog mosses, but the site is being invaded by Downy Birch scrub woodland. Both commercial forestry and the spread of Rhododendron has greatly reduced the overall value of the site.

A number of plant species that are listed in the Irish Red Data Book occur within the site, and several of these are protected under the Flora (Protection) Order, 2015. These are discussed further in Section 7.3.2.3.

Marine Biodiversity

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary. This is the only known resident population of this Annex II species in Ireland. The population was estimated to be 140 ± 12 individuals in 2006.

Otter, a species also listed on Annex II of this Directive, is commonly found in the SAC.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon, while the Mulkear catchment excels as a grilse fishery, though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of lamprey.

Two additional fish species of note, listed in the Irish Red Data Book, also occur, namely Smelt (Osmerus eperlanus) and Pollan (Coregonus autumnalis pollan). Only the former has been observed spawning in the Shannon. Freshwater Pearl Mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

The marine biodiversity of the Shannon Estuary and more specifically at the site of proposed development is described further in subsequent sections of this chapter.

Avifauna

The site is designated a SPA of special conservation interest for 21 species and for holding an assemblage of over 20,000 wintering waterbirds. Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland, and this SPA is the most important coastal wetland site in the country, regularly supporting in excess of 50,000 wintering waterfowl (57,133) - a concentration of international importance.

The site has internationally important populations of:

- Light-bellied Brent Goose (494)
- Dunlin (15,131)
- Black-tailed Godwit (2,035)
- Redshank (2,645)

A further 17 species have populations of national importance:

- Cormorant (245)
- Whooper Swan (118)
- Shelduck (1,025)
- Wigeon (3,761)
- Teal (2,260)
- Pintail (62)
- Shoveler (107)
- Scaup (102)
- Ringed Plover (223)
- Golden Plover (5,664)
- Grey Plover (558)
- Lapwing (15,126)
- Knot (2,015)
- Bar-tailed Godwit (460)
- Curlew (2,396)
- Greenshank (61)
- Black-headed Gull (2,681)

These figures are five year mean peak counts for the period 1995/96 to 1999/2000. The site is among the most important in the country for several of these species, notably Dunlin (13% of national total), Lapwing (6% of national total) and Redshank (9% of national total).

The site also supports a nationally important breeding population of Cormorant (93 pairs in 2010), and other species that occur include:

- Mute Swan (103)
- Mallard (441)
- Red-breasted Merganser (20)
- Great Crested Grebe (50)
- Grey Heron (38)
- Oystercatcher (551)
- Turnstone (124)
- Common Gull (445)

A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn. The site provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I to the Birds Directive breed within the site, but are not qualifying species. These include:

- Peregine Falcon (2-3 pairs)
- Sandwich Tern (34 pairs on Rat Island, 1995)
- Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995)
- Chough (14-41 pairs, 1992)
- Kingfisher

Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4,010 individuals at Loop Head, 1987).

Quoted SPA population figures are five year mean peak counts for the period 1995/96 to 1999/2000. The avifauna of the Shannon Estuary and more specifically at the site of proposed development is described further in Section 7.3.3.

Threats and pressures within the European sites

There is a wide range of land uses within the site. The most common use of the terrestrial parts is grazing by cattle, and some areas have been damaged through over-grazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus estuary). Further, reclamation continues to pose a threat, as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory, except in the upper estuary where it reflects the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences of industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of angler associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

Summary of the value of the European sites

The Lower River Shannon SAC is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II to the Habitats Directive, including the priority habitats coastal lagoons and alluvial woodlands. It contains the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush.

The River Shannon and River Fergus Estuaries SPA is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of four species, and 17 species that have wintering populations of national importance. The site also supports a nationally important breeding population of Cormorant. Of particular note is that three of the species which occur regularly are listed on Annex I of the Birds Directive. Parts of the River Shannon and River Fergus Estuaries SPA are Wildfowl Sanctuaries.

The proposed East Jetty extension is located within the estuarine habitat of the Lower River Shannon SAC and the intertidal wetland habitat of the River Shannon and River Fergus Estuaries SPA. The site of proposed development at Durnish contains land within the SAC and SPA for approximately 550m along a flood berm between the site of proposed development and the Robertstown River, although no development is proposed within the European sites. This is illustrated in Figure 7.6.3.

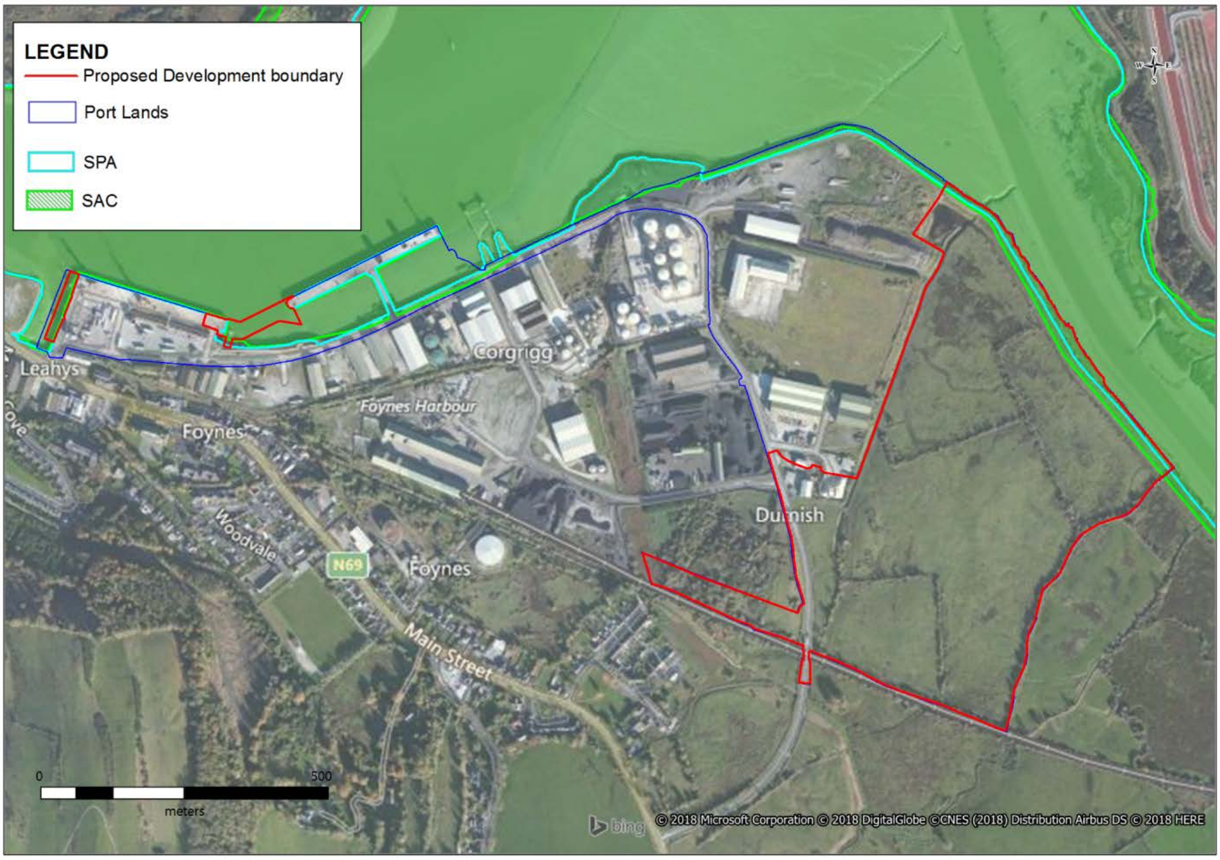


Figure 7.6.3: Proposed development within the European sites

7.5.9.4 Proposed Natural Heritage Areas

Proposed Natural Heritage Areas (pNHAs) are illustrated in Figure 7.6.4. One proposed Natural Heritage Area (pNHA) site occurs at the site of proposed development. This is the Inner Shannon Estuary - South Shore pNHA [Site Code 000435]. The pNHA runs along the southern shore of the Shannon Estuary from Foynes Port to Limerick City. At the Port, the pNHA occurs behind the East Jetty and the proposed East Jetty extension location and contains much of the built fabric of the Port. Note that boundary lines of pNHAs were drawn against older 6 inch maps.

A Site Synopsis for the Inner Shannon Estuary - South Shore pNHA was prepared in 1995 by Dúchas, the predecessor of NPWS. It is included in this EIAR at Appendix 7.3, and notes that the site is a large tidal system with intertidal mudflats, fringing reedbeds, swamps, polders, salt marsh and wet marsh habitats. It is noted as being one of Europe's most important sites for wintering and migrating waterfowl and one of Ireland's most important sites for wintering and migrating waders as the extensive mudflats of the Shannon Estuary are rich in with invertebrate food, supporting many thousands of wading birds and duck.

The Shannon Foynes Port Company - Vision 2041 Masterplan tells us that Foynes Harbour was first identified and surveyed in 1837 as a potential port. Construction works commenced in 1846 and significant expansion continued through to the 20th Century. The inner port area of Foynes comprises the Western Quay and the Eastern Jetty. The Eastern Jetty was originally constructed in 1968, and extended in 1984. Planning permission was granted in 2012 for land reclamation behind the jetty. The Western Quay was constructed in 1934 and then completely upgraded and extended in 1998.

This account confirms that all historical port expansion at the Inner Shannon Estuary - South Shore pNHA occurred before the designation of the site. Consultation with the NPWS Divisional Ecologist and NPWS Seabird specialist has confirmed that there are no defined avian conservation objectives specifically for this pNHA and noted that survey information should be interrogated to see if there are species present and which might be adversely affected, beyond those species which are special conservation interests of the River Shannon and River Fergus Estuaries SPA.

The assessment of implications of the proposed development on the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA is sufficient to determine whether or not adverse effects on the Inner Shannon Estuary - South Shore pNHA are predicted. This is to be found in the Natura Impact Statement in EIAR Volume 6. Where any additional wintering and migrating waders or waterfowl which are not features of the SPA might be significantly affected, the assessment of those features is to be found in this chapter, in Section 7.5 Avian Biodiversity.

A complementary pNHA is also designated on the northern side of the Shannon Estuary (Fergus Estuary and Inner Shannon, North Shore pNHA [Site Code 002048]). That site is located 3.4km NNE of the site of proposed development.

Sturamus Island pNHA [Site Code 001436] occurs to the northeast of Foynes Island, 1.5km NNE of the proposed East Jetty extension.

Cahiracon Wood pNHA [Site Code 001000] occurs 2.9km NW of the site of proposed development.

Barrigone pNHA [Site Code 000432] occurs 2.4km SE of the site of proposed Development

Site Synopses for these pNHAs are not included in the archive of pNHA Site Synopses available on the NPWS website. The County Development Plan does not specify their features of interest. These pNHAs have in many respects been superceded by the designation of the European sites (Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA and Barrigone SAC).

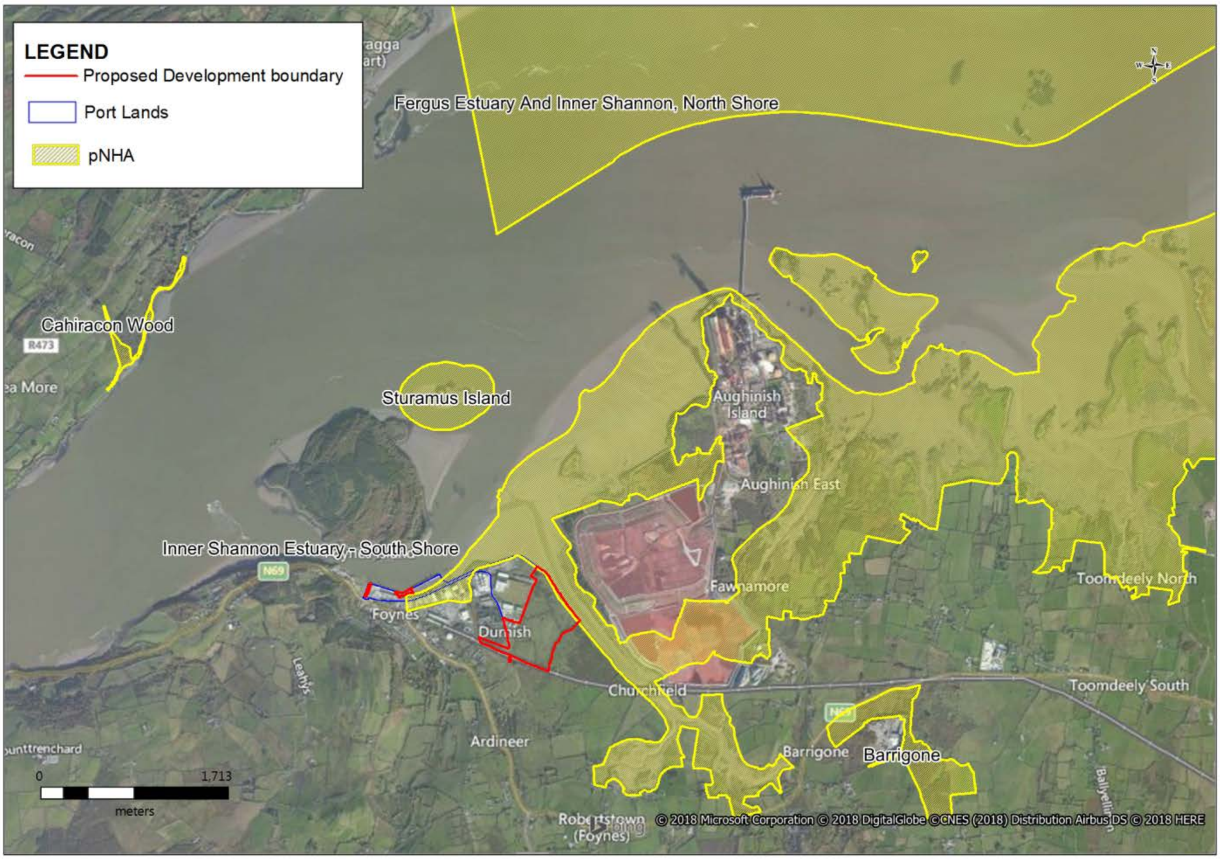


Figure 7.6.4 Proposed Natural Heritage Areas

7.5.10 LIKELIHOOD OF IMPACTS

As described in EIAR Chapter 2, the site of proposed development comprises two inter-related and inter-dependent elements. The site of the proposed East Jetty extension works, and removal and relocation of the existing small craft landing pontoon to an area identified at the west side of the existing West Quay is located within the Lower River Shannon SAC (Site Code 002165) and the River Shannon and River Fergus Estuaries SPA (Site Code 004077).

The proposed East Jetty extension is located within the estuarine habitat of the Lower River Shannon SAC and the intertidal wetland habitat of the River Shannon and River Fergus Estuaries SPA. The site of the proposed Durnish Lands development is located just over 1km to the east of the Jetty extension works, and the coastal boundary of this site has a flood berm on the bank of the Robertstown River. This berm feature forms the boundary of the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. The site of proposed development at Durnish contains land within the SAC and SPA for approximately 550m along a flood berm between the site of proposed development and the Robertstown River, although no development is proposed within the European sites.

NPWS (2012b) notes that the Lower River Shannon SAC overlaps with five other European sites and that it is also adjacent to a further European site, and advise that the conservation objectives for Lower River Shannon SAC should be used in conjunction with those for the overlapping and adjacent sites as appropriate.

Many screening analyses consider European sites within a 15km radius of a proposed plan or project, principally as a precautionary measure. A screening for appropriate assessment exercise contained in a NIS at EIAR Volume 6 has screened the proposed development against those European sites for which a pathway of effect can be reasonably established between a receptor and the source of effect.

The possibility of significant effects is considered in that NIS report using the source-pathway-receptor model. 'Source' is defined as the individual elements of the proposed works that have the potential to affect the identified ecological receptors. 'Pathway' is defined as the means or route by which a source can affect the ecological receptor. 'Ecological receptor' is defined as the Special Conservation Interests (for SPAs) or Qualifying Interests (of SACs) for which conservation objectives have been set for the European sites being screened. Each element can exist independently however an effect is created when there is a linkage between the source, pathway and receptor.

Possible effects are considered under four broad impact themes:

- Water quality and habitat deterioration
- Underwater noise and disturbance
- Aerial noise and visual disturbance
- Habitat Loss

There is a possibility of Likely Significant Effects (LSEs) on these two European sites under any of the four broad impact themes. Four additional European sites are considered also in Section 4.1 of the NIS, and LSEs are not predicted for those sites:

- Stack's to Mullaghareirks, West Limerick Hills and Mount Eagle SPA
- Askeaton Fen Complex SAC
- Barrigone SAC
- Curraghchase Woods SAC

7.5.11 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

The screening exercise contained at Section 4 of the NIS was completed in accordance with methodology outlined in this chapter at Section 7.6.1 to determine whether or not LSEs on any European site could be discounted as a result of the construction or operation of the proposed development.

- The possibility of likely significant Water Quality and Habitat Deterioration effects cannot be discounted for the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA without further evaluation and analysis.
- The possibility of likely significant Underwater Noise and Disturbance effects cannot be discounted for the Lower River Shannon SAC without further evaluation and analysis.
- The possibility of likely significant Aerial Noise and Visual Disturbance effects cannot be discounted for the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA without further evaluation and analysis.

- The possibility of likely significant Habitat Hoss effects cannot be discounted for the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA without further evaluation and analysis.

A shadow appropriate assessment of the implications of the proposed development on 150 nr. conservation objective targets of the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA was then conducted, and is contained in full in Section 5 of the NIS.

7.5.11.1 Lower River Shannon SAC

Site specific Conservation Objectives, Version 1.0 (SSCOs) published in August 2012 for the Lower River Shannon SAC seek to:

- maintain the favourable conservation condition of 10 no. Annex I habitats and 3 no. Annex II species, defined by 56 no. SSCO attributes and targets for the Annex I habitats and 13 no. SSCO attributes and targets for the Annex II species
- restore the favourable conservation condition of 4 no. Annex I habitats and 4 no. Annex II species, defined by 45 no. SSCO attributes and targets for the Annex I habitats and 30 no. SSCO attributes and targets for the Annex II species

Annex I habitats

Habitat Loss

As noted in Section 7.3, subtidal benthic surveys indicate the presence of a single community in the wider area around the proposed East Jetty extension and landing pontoon relocation areas which broadly corresponds with the '*Subtidal sand to mixed sediment with* Nephtys *spp. community complex*' biological community. This community is identified in NPWS (2012a) as comprising part of the Annex I *Sandbanks which are slightly covered by sea water all the time* [1110] habitat. Figure 7.3.3 illustrates this habitat to occur in the location where the proposed jetty extension is to be located. Map 9 of NPWS (2012b) shows this community to be present at the site of proposed development.

The construction of the jetty will requires the placement of 69 tubular steel piles driven into the seabed between the West Quay and East Jetty, resulting in the permanent loss of 81m^2 of soft sediment subtidal Annex I [1110] habitat. This is in contrast to an earlier design of the East Jetty extension which proposed to reclaim the area behind the new jetty, resulting in permanent habitat loss of subtidal and intertidal habitats of 4,690m^2 (58 times more permanent estuarine Annex I habitat loss within the SAC).

The relocation of the landing pontoon will result in the removal of two existing piles from subtidal habitat at the proposed jetty extension, and replacing them with two new piles in subtidal habitat to the west of the West Quay. Permanent habitat loss and permanent habitat gain will mirror each other's effects, and the outcome will be neutral.

As a result of the construction of the proposed development, the total area of this community within the subtidal Annex I [1110] habitat in the SAC remains as previously estimated at 1,353ha. Taking this permanent loss into consideration, and in relation to the SSCO '*Habitat area'* attribute and target, the permanent amount of habitat area remains the same (1,352.99ha). In relation to the SSCO '*Habitat* *distribution'* attribute and target, the range over which this habitat occurs remains the same. In relation to the SSCOs '*Habitat area'* and '*Habitat distribution'* attributes and targets, the permanent habitat loss of 0.0081ha subtidal habitat is not considered to prevent the maintenance of the favourable conservation condition of *Sandbanks which are slightly covered by sea water all the time* [1110] in the Lower River Shannon SAC.

Section 7.3 also notes that intertidal benthic surveys indicate the presence of a single community at the site of the proposed East Jetty extension which broadly corresponds with the '*Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex*' biological community. Map 9 of NPWS (2012b) shows this community to be present at the site of proposed development also.

SSCOs for the Annex I habitat *Estuaries* [1130] habitat note that this habitat type also encompasses the Annex I habitat *Mudflats and sandflats not covered by seawater at low tide* [1140]. There will be no loss of Annex I *Mudflats and sandflats not covered by seawater at low tide* [1140] or *Estuaries* [1130] habitat as a result of the proposed development.

It was noted in Section 7.3 that indirect habitat loss could also occur as a result of alterations to the coastal process regime of tidal flow and circulation changing sediment dispersion and deposition in this area. As there is no dredging or deposition of material required for the jetty extension, the risk of suspended sediment plumes and altered patterns of recirculation do not arise as a result of the absence of such activities.

No other Annex I habitat occurs in proximity to the site of proposed development. Map 7 of NPWS (2012b) shows the *Large shallow inlets and bays* [1160] Annex I habitat to be absent from the site of proposed development, being approximately 25km seaward at its closest mapped location. Map 8 of NPWS (2012b) shows the *Reefs* [1170] Annex I habitat to be absent from the site of proposed development, being located approximately 2km to the north and northwest in the main channel of the River Shannon.

Map 10 of NPWS (2012b) shows the *Perennial vegetation of stony banks* [1220] Annex I habitat to be absent from the site of proposed development, being approximately 26km seaward at its closest mapped location. NPWS (2012b) does however note that further unsurveyed areas maybe present within the SAC. It was not recorded from the site of proposed development.

Map 12 of NPWS (2012b) shows the *Salicornia and other annuals colonizing mud and sand* [1310] Annex I habitat to be absent from the site of proposed development, being approximately 1.2km southeast at its closest mapped location at the Robertstown River estuary. NPWS (2012b) does however note that further unsurveyed areas maybe present within the SAC. It was not recorded from the site of proposed development.

Map 13 of NPWS (2012b) shows the *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation* [3260] Annex I habitat to be absent from the site of proposed development, being approximately 27km towards Limerick City at its closest mapped location at the River Maigue, and at Ardbane and Muckinish Points on the River Shannon.

Map 6 of NPWS (2012b) shows the *Coastal lagoons* [1150] Annex I habitat to be absent from the site of proposed development, being approximately 7km by hydrological pathway around Aughinish Island at its closest mapped location (Quayfied and Poulaweala Loughs).

Map 12 of NPWS (2012b) shows the *Atlantic salt meadows (Glauco-Puccinellietalia maritimae)* [1330] and *Mediterranean salt meadows (Juncetalia maritime)* [1410] Annex I habitats to potentially be present on the opposite bank of the Robertstown River from the site of proposed development at Durnish, and both Atlantic salt meadows and Mediterranean salt meadows to be present at the Robertstown River estuary.

Water Quality and Habitat Deterioration

There is a possibility of hydrocarbon leaks and spills associated with poorly maintained construction vehicles or during re-fuelling of plant at the site of the proposed jetty extension. Pre-cast concrete beams and planks will be used for the construction of the jetty, and liquid concrete will be poured over the top to bind all concrete elements together using concrete pumps or concrete skips suspended from a crane. Cement spills are possible.

At Durnish, a significant volume of imported fill material shall be brought to the site of proposed development to raise the level of the existing lands. The top 200mm of topsoil shall be stripped across the extents of the lands prior to the importation of fill material. A roundabout, roads and access structures crossing an OPW drain shall be constructed. The existing land drainage regime means that all runoff from the Durnish site flows into the Robertstown River and the Lower River Shannon SAC.

There is a risk involved with any construction activity either in the marine environment, in proximity to or upstream of marine waters that a pollution incident might arise and result in spills or leaks of polluting substances into the estuary.

Effects associated with construction or operational stage pollution events (for example leakages / spillages of fuels, oils, other chemicals and waste water, controlled discharges under licence) could lead to a deterioration of water quality in the Annex I marine habitats. The risk of such pollution events occurring must be managed to ensure their likelihood is low and that there are effective measures which will be put in place in the event that they do occur to prevent any wide reaching or long term adverse effects. Unmanaged, these effects could prevent the maintenance of the favourable conservation condition of Annex I marine habitats in the Lower River Shannon SAC. Mitigation is required.

There is also a risk involved with normal port operations. These include the potential for pollution events to occur from:

- Discharges from vessels using the proposed jetty extension (ballast water, wastewater, oil spillages, fuel bunkering)
- Discharges from cargo handling at Durnish (leakages from containers, bulk material spillages, losses from conveyor systems); and
- Discharges from cargo storage areas at Durnish and onward transportation (losses from hoppers, flat bulk stores and HGVs).

EIAR Chapter 10 has included an assessment of the possible effects of nitrogen deposition on marine habitats based on UNECE critical loads for nitrogen deposition (in units kg N ha^{-1} yr^{-1}) on sensitive natural and semi-natural ecosystems. EIAR Table 10.24 presents the predicted nitrogen deposition concentrations on the estuarine habitats of the Lower River Shannon SAC and the intertidal wetland habitat of the River Shannon and River Fergus Estuaries SPA as a result of expanded capacity at the Port (the operation of the proposed development). The results indicate a slight increase in the level of nitrogen generated and subsequently deposited on the SAC/SPA adjacent to the Port. However, the overall scale of the impact (1.75kg(N)/ha/year) is well below the UNECE critical load that have been published for marine habitats (between 20-30kg(N)/ha/year). Based on the predicted deposition load, the assessment concludes that the proposed development will have negligible impact on the sensitive ecosystems in the area.

Vegetation spaying with herbicide in advance of topsoil stripping may be required. The herbicides for potential use are Gallup Biograde Amenity or Roundup Pro Bioactive. Careless storage, handling or use of pesticides, or improper disposal of empty pesticide containers, can easily cause breaches of the legal limit for pesticides in water.

The water quality assessment in EIAR Chapter 9 considers that the magnitude of the potential impacts arising from herbicides entering the aquatic environment are predicted to be moderate adverse with regard to water quality, given the scale of the works proposed, the distances to the aquatic zone and the fact that there are no drinking water resources likely to be impacted. Based on the matrix of environmental impact as present in EIAR Table 9.2 the rating of the impact is considered to be potentially severe in the extremely sensitive water bodies hydrologically connected to the development, in the absence of any mitigation.

Annex II Species

Lampreys [1095, 1096, 1099]

EIAR Section 7.3 describes the biology and presence of Sea Lamprey [1095], Brook Lamprey [1096] and River Lamprey [1099] in the River Shannon estuary. It describes how the majority of migrating adult Lampreys will be found in the 2km wide main Shannon River channel at any given time but especially during flood tides with perhaps a smaller amount of migrating adults in the narrower Foynes side-channel, mainly during ebb tides. The assessment notes that very little is known about sound detection in lamprey but as they do not possess a swim bladder it is thought that they respond to particle motion rather than sound pressure and are therefore less sensitive to sound. Piling will produce very high noise levels detectable as particle motion and is likely to generate an avoidance response in the species that would displace the species away from the closest 6-7m radius around an active piling activity where the sound levels could result in injury or death.

As regards River and Brook Lamprey species, their distribution shall not be adversely affected, and they will continue to have access to all watercourses draining into the Shannon Estuary down to first order streams throughout construction and operation of the proposed development. Population structure of juveniles and juvenile density in fine sediment shall not be adversely affected as the species are largely absent from the port area immediately adjacent to the proposed development. Extent and distribution of spawning habitat shall not be adversely affected as any loss of spawning habitat will not occur and no decline in extent and distribution of spawning beds will occur. Availability of juvenile habitat shall not be adversely affected as there will be no loss of positive sites in 2nd order channels (and greater), downstream of spawning areas.

As regards Sea Lamprey, their distribution (extent of anadromy) shall not be adversely affected, and they will continue to have access to >75% of main stem length of rivers accessible from the estuary. The population structure of juveniles and juvenile density in fine sediment shall not be adversely affected as the species are largely absent from the port area immediately adjacent to the proposed development. Extent and distribution of spawning habitat shall not be adversely affected as any loss of spawning habitat will not occur and no decline in extent and distribution of spawning beds will occur.

Availability of juvenile habitat shall not be adversely affected as there will be no loss of positive sites in 3rd order channels (and greater), downstream of spawning areas.

Atlantic Salmon [1106]

Section 7.3 describes how, during the period of inward adult salmon migration up the Shannon Estuary, there are times during parts of the ebb tide when some salmon may stem back down into the channel fronting the Foynes Port area and as such could be exposed to significant noise levels from pile driving, It notes that Salmon are considered poor hearing specialists, but known to be diverted by very loud sound levels and as a result are unlikely to come sufficiently close to the active pile to be at risk of injury or death (i.e. within 6-7m as noted in EIAR Table 11.2.2). When it is further considered that piles will only be driven periodically and not constantly, the fisheries assessment concludes that the possibility of a significant adverse effect on the population is very unlikely.

As regards smolts, on their outward journey Salmon smolts appear to follow a similar strategy as adults moving into the fastest flows toward the centre of the channel during ebb tides and moving toward the margins during flood tides in order to stem landward displacement during the flood. There is strong evidence that smolts actively swim during their outmigration in order to reach the open sea as quickly as possible, and have also been shown to swim faster in the lower parts of estuaries where the salinities are higher and in these reaches also are likely to make seaward progress, albeit slower, during the flood tide. There is also a suggestion that smolts are more likely to emigrate faster in estuaries with less complex typographies and current systems which is the case in the Lower Shannon Estuary. What is clear is that smolts do not hang about and are generally seen to make rapid seaward progress.

The fisheries assessment concludes that during most if not all ebb tides, smolts will be concentrated in the main channel of the Lower Shannon where the highest current speeds are to be found, i.e. outside of the Foynes channel. During the flood, some of smolts passing that part of the estuary at that stage of the tide may enter the side channel where the currents will be slacker in order to stem their landward progress potentially bringing them into the higher noise energy zone in proximity to piling where exposure could result in recoverable injury or death. The Foynes channel is approximately 350m wide and of adequate width for the smolts to travel downstream without piling causing a barrier to movement. The assessment in Section 7.3 concludes that at most a very small number of the many thousand smolts emigrating from the Upper Shannon Estuary are likely to be impacted by the piling, with no significant adverse impact predicted to occur at the population level.

Looking then at the COs set for Atlantic Salmon, their distribution (extent of anadromy) shall not be adversely affected, as they will continue to have access to all river channels down to 2nd order accessible from the estuary. The CL for each system is unlikely to be significantly affected, and the number of Adult spawning fish likely to be unaffected by the construction or operation of the proposed development. Salmon fry abundance in the Shannon tributaries are unlikely to be affected. Number and distribution of redds shall not be affected in their spawning habitat as this is not present in the area of proposed development.

Out-migrating smolt abundance may be affected if high numbers of smolt were to be present in the Foynes channel in proximity to the works, but the fisheries assessment does not consider this possible effect to adversely affect the population level. The measure of this target could reduce if individuals were to suffer mortality as a result of the piling works, although smolts are known to avoid loud sounds (EIAR Table 7.3.8). Measures are required to prevent this happening.

Bottlenose Dolphin [1349]

The CO for this Annex II species is to maintain its favourable conservation condition in the Lower River Shannon SAC, as defined by 3. no SSCO attributes and targets. The target for SSCO attribute '*Access to suitable habitat'* is measured by number of artificial barriers. The target for '*Habitat use: critical areas'* is measured by location and hectares. The target for '*Disturbance*' is measured in the level of impact.

NPWS (2012a) notes that the size, community structure, distribution and habitat use of the resident population in the Lower River Shannon SAC are well understood. EIAR Section 7.4 describes how Bottlenose dolphins are found throughout the estuary (as shown in Map 16 of NPWS, 2012b), use the waters adjacent to Foynes Harbour and occasionally enter the port. That assessment is based on the Shannon Estuary being one of the most extensively studies study sites for bottlenose dolphins in Europe with studies ongoing since 1993 (Berrow *et al*., 1996) including extensive use of passive acoustic monitoring since 2001 (Berrow, 2001).

Section 7.4 notes that sound pressure from piling activities may have a negative impact on bottlenose dolphins. EIAR Chapter 11 contains an underwater noise assessment. It is based on measured underwater background noise levels at Foynes Harbour and in the Shannon Estuary during normal port operations, and an underwater noise model to estimate underwater noise levels as a result of various construction activities. The predicted model outputs were then compared with international exposure guidelines for a range of sensitive species. Table 11.2.2 of the EIAR notes the threshold dB at which mortality, PTS, TTS and various behavioural effects occurs in different types of marine species. Table 11.2.3 lists noise levels for construction activities with potential to generate significant underwater noise. Table 11.2.4 lists estimated impact piling sound source levels at the site of proposed development. Table 11.2.5 lists the distances from the source of underwater noise at which various types of impact (in Table 11.2.2) are predicted to occur for various marine species.

The analysis reveals that PTS effects are not predicted to occur for Bottlenose dolphin, and behavioural effects may occur out to 250m from the noise source. Bottlenose dolphins have highly developed acoustically but are resident in the Shannon and have been exposed to shipping and marine industry for many years. It is predicted that adverse effects on individual Bottlenose dolphins may occur if they are close to piling at the point of initial piling start-up.

As regards the SSCOs set for Bottlenose dolphin, their access to suitable habitat shall not be adversely affected, and their range within the SAC will not be restricted by artificial barriers to their use of the site. Preferentially used habitats (critical areas) are located >15km seaward of the site of proposed development as indicated in Map 16 of NPWS (2012b) will not be interfered with and should be maintained in a natural condition. The level of impact is the measure of the CO attribute 'Disturbance', with the target being that human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site. Section 7.4 has predicted that no adverse population level effects are predicted, but that disturbance effects upon individuals of the population may arise, and mitigation measures must be put in place to prevent this happening.

Freshwater Pearl Mussel [1029]

The CO for this Annex II species is to restore its favourable conservation condition in the Lower River Shannon SAC, as defined by 11. no SSCO attributes and targets.

The target for SSCO attribute '*Distribution'* is measured in kilometres. The target for '*Population size*' is measured in number of adult mussels. The target for '*Population structure: recruitment"* is measured in percentage per size class. The target for 'Population structure: adult mortality' is measured by percentage. The target for '*Habitat extent'* is measured in kilometres. The target for '*Water quality: macroinvertebrate and phytobenthos (diatoms)*' is measured in Ecological quality ratio (EQR). The target for '*Substratum quality: filamentous algae (microalgae), macrophytes (rooted higher plants*)' is measured in percentage. The target for '*Substratum quality: sediment'* is measured in occurrence. The target for '*Substratum quality: oxygen availability'* is measured in redox potential. The target for '*Hydrological regime: flow variability'* is measured in metres per second. The target for '*Host fish'* is measured by number.

This species is recorded in parts of the Cloon River, which drains into the Shannon Estuary at Clonderalaw Bay. The site of proposed development is hydrologically located >25km further east and upstream of the Cloon River. An effective hydrological pathway of effect is not present to cause any adverse effects upon this species.

7.5.11.2 River Shannon and River Fergus Estuaries SPA

Site specific Conservation Objectives, Version 1.0 (SSCOs) published in September 2012 for the River Shannon and River Fergus Estuaries SPA seek to:

- maintain the favourable conservation condition of Cormorant defined by 8 no. SSCO attributes and targets
- maintain the favourable conservation condition of 20 no. wading and waterbird species defined by 2 no. SSCO attributes and targets
- maintain the favourable conservation condition of the wetland habitat in the SPA as a resource for the regularly-occurring migratory waterbirds that utilise it, defined and measured by 1 no. attribute and target.

Section 7.5 discusses how 16 of the 21 feature species of this SPA were recorded in the sub-sites containing or adjacent to the two principal components of the proposed development. Light-bellied Brent Goose, Scaup, Shoveler, Knot and Bar-tailed Godwit were not recorded and are not discussed further. Non-breeding waterbird surveys across four survey areas illustrated in EIAR Section 7.5 were carried out within approximately 3hrs of low tide monthly between November 2015 and March 2017. In this period the majority of waterbirds were dispersed in their foraging areas.

Sub-site 1 contains the marine area of proposed development comprising relocation of the landing pontoon to an area identified at the west side of West Quay, and a new open pile structure and quay furniture constructed to connect the existing West Quay to the existing East Jetty, creating a new Berth No.4. Sub-site 3 contains the terrestrial area of proposed development to provide additional port storage and prepare a site for the expansion of future port activities and processes.

Breeding Special Conservation Interests

Cormorant [A017] (Breeding)

The CO is to maintain the favourable conservation condition of Cormorant in the River Shannon and River Fergus Estuaries SPA, as defined by 8. no SSCO attributes and targets. Six of the eight CO attributes for Cormorant apply to the breeding population. NPWS (2012d) notes that Cormorant colonies are usually sited on flat or rocky islets or sea stack tops, less often on cliffs but they can also nest in trees (Walsh *et al.,* 1995). EIAR Section 7.5 describes the breeding birds recorded at the site of proposed development. Whilst Cormorant was recorded occasionally at Durnish lands in the grassland habitat, no evidence of breeding behaviour was observed during surveys. There is no breeding site of

Cormorant at the Durnish site. There is also no breeding site for Cormorant at the site of the proposed marine development.

Of the six CO attributes which apply to the breeding population, Breeding population abundance (AONs); Productivity rate; Distribution of breeding colonies; Barriers to connectivity and Disturbance at the breeding site will remain unaffected as a result of the construction and operation of the proposed development. As there is no Cormorant breeding site in this part of the Shannon Estuary, there is unlikely to be any significant decline in distribution of breeding colonies or AONs or productivity at the breeding colonies; nor is there likely to be any significant increase in barriers to connectivity between breeding colonies or disturbance caused by human activity at levels likely to adversely affect the breeding cormorant population.

Non-breeding Special Conservation Interests

In relation to maintaining the favourable conservation condition of wading and waterbird species, NPWS (2012d) notes that the overarching CO for the SPA is to ensure that waterbird populations and their wetland habitats are maintained at, or restored to, favourable conservation condition. This includes, as an integral part, the need to avoid deterioration of habitats and significant disturbance; thereby ensuring the persistence of site integrity.

To be favourable, the long term population trend for each waterbird SCI species should be stable or increasing. Waterbird populations are deemed to be unfavourable when they have declined by 25% or more, as assessed by the most recent population trend analysis. To be favourable, there should be no significant decrease in the range, timing or intensity of use of areas by the waterbird species of SCI, other than that occurring from natural patterns of variation.

NPWS (2012d) points out that factors that can adversely affect the achievement of the COs include:

- *Habitat modification*: activities that modify discreet areas or the overall habitat(s) within the SPA in terms of how one or more of the listed species use the site (e.g. as a feeding resource) could result in the displacement of these species from areas within the SPA and/or a reduction in their numbers
- *Disturbance*: anthropogenic disturbance that occurs in or near the site and is either singular or cumulative in nature could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and a reduction in their numbers
- *Ex-situ factors*: several of the listed waterbird species may at times use habitats situated within the immediate hinterland of the SPA or in areas ecologically connected to it. The reliance on these habitats will vary from species to species and from site to site. Significant habitat change or increased levels of disturbance within these areas could result in the displacement of one or more of the listed waterbird species from areas within the SPA, and/or a reduction in their numbers

EIAR Section 7.5 confirms that less than 10 individual non-breeding birds occurred in the area of the proposed marine development during the period 2105 to 2017. Oystercatcher and Black-headed Gull were the only waterbird species present here. Oystercatcher is not a SCI of this SPA. The assessment contained in Section 7.5 includes Oystercatcher. The remaining species recorded during survey occur in the marine and intertidal environment around the Port of Foynes and lands at Durnish within some or all of the four sub-sites surveyed, but not at the site of proposed development.

Waterbird surveys conducted for a previous port development to reclaim land at the East Jetty (Planning Reg. Ref.: 12/212) found the port area to be unimportant for SCI species also.

Section 7.3 of the EIAR describes the benthic community present at the intertidal and shallow subtidal areas at the port as containing low abundances of benthic infauna. Other areas within the SPA are likely to provide higher yielding feeding areas for wintering wader and waterbird SCI species. Intertidal and subtidal areas adjacent to the Port are very likely to be subject to higher levels of noise and visual disturbance than many other parts of the mudflats and sandflats of the estuary. SCI waterbirds are likely to avoid the immediate marine area surrounding the Port in high numbers in part due to these factors.

Black-headed Gull [A179] (wintering)

The CO is to maintain the favourable conservation condition of Black-headed Gull in the River Shannon and River Fergus Estuaries SPA, as defined by 2. no SSCO attributes and targets. The target for SSCO attribute '*Population trend'* is measured by percentage change. The target for '*Distribution*' is measured by range; timing and intensity of use of areas.

NPWS (2012d) notes that the conservation condition of Black-headed Gull is 'undetermined'. It has wide ranging food/prey requirements and its principal supporting habitats within the SPA are intertidal flats and sheltered and shallow subtidal areas. Black-headed Gull was recorded very frequently in moderate numbers in all months in the sub-sites shown in Section 7.3 and it was recorded at the site of proposed development East Jetty extension area in very small (single) numbers. Disturbance to this species could result in:

- Birds looking up or heads raised, temporarily stopping feeding or roosting
- Birds moving from the cause of the disturbance by walking away before resuming previous activity
- Birds taking flight and landing somewhere further from the disturbance stimulus in the same feeding area or mudflat
- Birds taking flight and leaving the area completely

This species has a foraging range of 40km (Thaxter *et al.,* 2012). The Dot-density distribution diagram for Black-headed Gull at Appendix 8 of the River Shannon and River Fergus Estuaries SPA Conservation Objectives Supporting Document (NPWS, 2012d) shows that the species forages widely across the estuary, and that the site of proposed development at the Port in Foynes and the Robertstown River flanking the site of proposed development at Durnish does not represent a significant foraging or roosting site for this species. Black-headed Gull using the site of the proposed East Jetty extension already co-exists alongside existing port activities at the existing port quays.

Given that the numbers observed here are very low (single figures) throughout the survey period when compared with the 8,550 peak count of the 2010/11 Waterbird Survey Programme (NPWS, 2012d), construction or operation of the proposed development will not likely interfere with the range, timing or intensity of use of areas within the SPA by Black-headed Gull. Construction or operation of the proposed development will not affect achieving a stable or increasing long term population trend for the species.

Wetland and Waterbirds [A999]

NPWS (2012d) notes that the wetland habitats contained within this SPA are considered to be a SCI in their own right. The wetland habitat is an important resource for other waterbird species which are part of the total waterbird assemblage of the site but are not specifically listed as Special Conservation Interests. These species may include those that stopover at the site during passage, those that are present in months of the year outside of the non-breeding season between September and March or species that use the site at certain times only (e.g. as a cold weather refuge).

NPWS (2012d) also notes that the maintenance of the 'quality' of wetland habitat lies outside the scope of the conservation objective for Wetlands, but for the SCI species, the scope of the other principal objective (to maintain the favourable conservation condition of the SCI species) covers the need to maintain, or improve where appropriate, the different properties of the wetland habitats contained within the SPA.

Following on from the discussion in Section 7.6.4.1 on Water Quality and Habitat Deterioration and given that the risk of pollution that exists during marine construction operations at the port and soil stripping and import of fill material at Durnish, mitigation measures are to be put in place to reduce this risk, and as a consequence the possibility of adverse effects on the COs set for Wetlands as a result of pollution events is very unlikely given that measures will be put in place to manage the pollution risk.

7.5.11.3 **Inner Shannon Estuary - South Shore pNHA**

As noted in Section 7.6.2.4, this pNHA is located behind the site of proposed development. The proposed East Jetty extension shall not result in any loss of habitats from within this pNHA. The wading and waterbird assemblage is largely considered as part of the assessment of implications of the proposed development outlined in the preceding section, and described more comprehensively in the NIS at EIAR Volume 6.

Oystercatcher is however a wader that was found to be present at the site of the proposed East Jetty extension and not included as a SCI of the River Shannon and River Fergus Estuaries SPA. It was recorded only in very small (single digit) numbers during surveys between 2015 and 2017.

Section 7.5.4 predicts that no significant adverse effects on breeding or non-breeding birds are predicted as a result of the construction or operation of the proposed development. On this basis, no adverse ecological effects are predicted upon Inner Shannon Estuary - South Shore pNHA beyond those already discussed in Section 7.6.4.2 and the accompanying NIS.

7.5.11.4 **Cumulative Effects**

Future phases of the proposed development

Having regard to the 10 year lifespan of the intended planning permission and the predicted increase in tonnage presented in Chapter 2, it is proposed to implement the operational use of the Durnish land in three phases in line with economic growth and customer demand and as illustrated in EIAR Figure 2.10. . However, to ensure the effective and timely availability of the Durnish lands for operational use as the needs arise, the proposed development includes the filling of all of the Durnish land as part of the initial phase of development.

It is possible that all sub phases could be undertaken simultaneously if market conditions dictate. However, the upfront capital cost of undertaking site development works and specifically the raising of ground levels across the entire of the Durnish lands is unviable in the absence of one specific user for the lands. Furthermore, the timescale for implementation of that specific measure (raising the ground levels across the entire site prior to any operational use) will delay the opportunity to provide for immediate storage requirements with the potential effects on maintaining Port competitiveness. Thus, in adopting a balanced approach, the development strategy has pursued a phased approach to the development of the Durnish lands, and, within the context of a defined 'development framework'. The proposed first phase of development reflects the 'development framework' for that area given that the immediate requirements are know at this time.

A Framework Plan (which is submitted as part of the planning application) sets out a development concept arrangement for the entire Durnish lands (Phase 1, 2 and 3) in order to present a holistic and co-ordinated approach toward the orderly and sustainable development of the Durnish Lands. This will guide subsequent developments within subsequent Phase 2 and Phase 3 given that the specific details of uses are not known at this time and assists this assessment process. The Framework Plan presents a strategic arrangement of inter-alia; general layout arrangements; the design and implementation of infrastructure including water, energy services, flood risk management, water services, lighting, and site security; the primary internal access roads, building heights and design across the entire site.

Examination of this 'worst-case' scenario is based on the likely effects of the proposed development and proposed uses as part of Phase 1, and, the anticipated land uses that will occur from subsequent operational use of Phase 2 and Phase 3 based on the information known and available at this time in respect of those subsequent Phases. Despite the consideration of those subsequent development phases as part of this cumulative assessment, the future uses in those phases shall be subject to planning consent in the future. Proposed and likely anticipated uses for future development in Phases 2 and 3 (based on existing and proposed port uses) are:

<u>Phase 2 – Likely Operational Scenario</u> *(Subject to future planning consent)*

Accommodation of additional (predicted) 991,874 tonnes of cargo throughput to deliver total Port tonnage throughput of 2,770,000 tonnes by 2025. Anticipated delivery consisting of:

- Covered storage of circa 1.2ha
- Open storage of circa 2.4ha
  - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
  - Construction of internal road network
  - Provision of foul water infrastructure
  - Provision of lighting and services

<u>Phase 3 – Likely Operational Scenario</u> *(Subject to future planning consent)*

Accommodation of additional (predicted) 510,000 tonnes of cargo throughput to deliver total Port tonnage throughput of 3,280,000 tonnes by 2030. Anticipated delivery consisting of:

- Covered storage 2.8ha
- Open storage 6.1ha
  - Construction of warehousing and open storage areas for marine related industrial use and port centric activities
  - Construction of internal road network

- Provision of foul water infrastructure
- Provision of lighting and services

Open storage uses (predicted for Phase 2 and 3):

- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high)
- Loose cargoes such as woodchip biomass fuel (stored 6m high)
- Scrap metal (stored 8m high)
- Storage of containers (up to 3nr high) approx. 8m high with handling equipment up to 17m height

Covered storage (predicted for Phase 2 and 3):

- Warehousing (up to 20m height)
- Storage tanks (up to 15m height)

The Framework Plan has been reviewed and the strategic plans of general layout arrangements; the design and implementation of infrastructure including water, energy services, flood risk management, water services, lighting, and site security; internal access roads, building heights and design across the entire site have been taken into account in making the cumulative assessment.

Mitigation has been proposed in Section 7.7.5 of this chapter which mirrors mitigation proposed in other chapters of this EIAR dealing with water quality and ground contamination impact pathways.

The assessment of the initial phase has considered the raising of the lands by infilling, provision of infrastructure and landscaping across a ten year window as shown in EIAR Figure 2.10. No new land-take is required for later phases. Operational noise and visual disturbance is not predicted to be significant as a result of the set-back distance of the proposed later phase uses and physical screen provided by both the landscaping to be planted and the flood berm of the Robertstown River in the north of the site.

Operational uses in later phases are not considered to act cumulatively to increase the magnitudes of predicted effect on the designated sites.

Other permitted development

A number of other consented developments were reviewed, as outlined in Table 7.6.1, to take account of any likely significant adverse effects on biodiversity features that were relevant to the assessment of effects on designated sites.

Table 7.6.1 Other Projects considered for cumulative effects

Planning Reg. Ref.	*Location and description of consented development*
12/212 and 17/7019	2.49 hectares of reclamation at the East Jetty in Foynes Port. This application was accompanied by an EIS and a NIS.
13/164	Aughinish East, Aughinish West, Island Mac Teige & Glenbane West, Askeaton. Amendment of planning reference no. 12/343 for provision of 2 no. gas-fired steam boilers including 2 no. 32m high exhaust stacks. This application relates to development requiring an IPCC Licence.
14/603	Lands at Durnish, Internal Port Road, Shannon Foynes Port, Foynes. Alterations and extension to the existing industrial building, erection of new buildings and new hardcore area for external storage, to accommodate the storage, screening, processing, binding and packaging of solid fuel briquettes by CPL and to use the property for purposes associated with the import and export of products through the Port of Foynes. An EIS and an AA Screening Statement were submitted with the planning application.
15/468	Durnish, International Port Road, Shannon Foynes Port. Smokeless and bio-mass based solid fuel manufacturing and packaging facility at and adjacent to existing coal storage and baggage facility. This application was accompanied by an EIS and a NIS.
16/418	Aughinish East, Aughinish West, Island Mac Teige, Glenbane West, Morgan North & Fawnamore, at/or adjacent to Aughinish Island, Askeaton. A ten year permission for development on a site of c. 0.225 ha located within the existing Aughinish Alumina plant consisting of the installation of 2 no. deep thickeners and ancillary elements, including stairs, access platforms and walkways linking to adjacent vessels, pumps, cabling and pipework.
17/714	Aughinish East, Aughinish West, Island Mac Teige, Glenbane West, Morgan North and Fawnamore at or adjacent to Aughinish Island, Askeaton. A ten year permission for development on this site of c. 7 hectares located adjoining the existing Aughinish Alumina Ltd plant for the provision of a Borrow Pit with an extraction area of c. 4.5 hectares to extract c. 374.000 m^3 of rock over a 10 year period. An EIS accompanied the application.

Shannon Foynes Port Company was granted planning permission (Planning Reg. Ref.: 12/212) to reclaim the foreshore behind the existing East Jetty. The permission for this consented development was extended in 2017 (17/7019). The project results in the provision of additional port lands but also the loss of 2.49ha subtidal and intertidal habitat from within the Lower River Shannon SAC and River Shannon, River Fergus Estuaries SPA and partially within the Inner Shannon Estuary - South Shore pNHA. The consented development also includes management of *Spartina anglica* within the designated sites at the Barrigone Inlet, Aughinish. A Foreshore Licence application (FS006785) has been submitted to permit the habitat management works on the foreshore.

When read together, the extant Planning Permission (12/212) together with the conditions/restrictions and environmental commitments enshrined therein, result in no residual adverse effects upon the features of the designated sites. With the mitigation proposed in this application applied to the proposed development, there is no significant adverse ecological effect upon the designated sites. Cumulatively, there is no significant adverse cumulative effect of the proposed development and the extant (12/212) Planning Permission.

The remaining projects considered in Table 7.6.1 do not result in significant adverse ecological effects upon the designated sites. With the mitigation proposed in this application applied to the proposed development, there is no significant adverse ecological effect upon the designated sites. Cumulatively, there is no significant adverse cumulative effect of the proposed development and the other projects listed in Table 7.6.1.

7.5.12 REMEDIAL AND MITIGATION MEASURES

7.5.12.1 Construction Phase

Water Quality

A Construction stage Environmental Management Plan (CEMP) will be prepared to capture all mitigation measures together with any conditions imposed by the competent authority to develop a practical programme of measures for the Contractor. The CEMP will form part of the specification of the Contract Documents for the construction stage. The CEMP will include mitigation measures to safeguard the receiving waters. It will set out established lines of communication, reporting and actions, and will contain at least but not limited to the following:

- Waste Management Plan
- Contamination Strategy
- Water Quality Management Plan

It will contain mitigation measures informed by best practice and adherence to relevant Irish guidelines, or recognised international guidelines where Irish guidelines are not available:

- Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001);
- Guidance for Pollution Prevention series (GPP), Pollution prevention guidelines (PPGs) in relation to a variety of activities developed by the Environment Agency (EA), the Scottish Environmental Agency (SEPA) and the Northern Ireland Environment Agency (NIEA);
- Fisheries Guidelines for Local Authority Works. Department of Communications, Marine & Natural Resources, Dublin, (Anonymous, 1998);
- Guidelines on protection of fisheries habitats during construction projects (Eastern Regional Fisheries Board, 2006);
- International Convention for the Prevention of Pollution From Ships, 1973, as modified by the Protocol of 1978 (MARPOL) for domestic waste discharges to the environment;
- International Marine Organisation guidelines; and
- Control of Substances Hazardous to Health (COSHH) Handling of Hazardous Materials.

Sediment Control

Mitigation and control measures to address the impact from suspended sediments associated with construction activities on the landward side of the development will follow best practice guidance and sound design principals as outlined above. Sediment control measures will be consistent with the following guidance outlined above.

Based on the guidance documents listed above the following measures will be used to mitigate the impact of suspended sediments and the potential damage they can cause to associated aquatic habitats and species that exist within and adjacent to the proposed development area as outlined in Chapter 7:

- Establish vegetation as soon as practical on all areas where soil has been exposed e.g. the stripped topsoil and the exposed sub-base at Durnish shall be seeded with clover to bind the material together to ensure that these areas do not provide a source of sediment prior to the infilling with imported rock material.
- The construction of the berm and the boundary treatment on the Northern, Eastern, Southern boundaries and part of the Western boundary of the Durnish Lands during the early stages of the phase 1 development will ensure that an effect barrier to intercept the pathway of any potential run-off from the site to the Ardaneer Stream and Robertstown Estuary will be established at the early stages of the development as illustrated in Drawing 1773.5.01 *Proposed Boundary Treatments*. As outlined in Chapter 2, planting will be carried out along the slope of the berm, extending to the crest, with the width of proposed planting varying dependent upon the width of the existing boundary planting which is to be retained and "gapped up". The retention of a minimum 5m buffer at the Durnish Stream on the Western Boundary for OPW access to the drainage channel, should this be required for maintenance will provide a buffer along the Western boundary.
- At the site accesses, where the Durnish Stream is crossed twice, proposed culverts will be laid in both instances with bank protection using gabions and bed protection using reno mattress as illustrated in Drawings H0548-RPS-XX-00-DR-HE-510-01 *Proposed Culvert Detail at Roundabout Access* and H0548-RPS-XX-00-DR-HE-510-02 *Proposed Culvert Detail at Secondary Access*. This will ensure that bank and bed will be protected from erosion that could introduce suspended solids to these water courses.
- The infilling of the site will be undertaken using suitable infill material sourced from authorised quarries. The location of active crushed rock quarries in the vicinity of the Durnish Lands is provided in Chapter 2. Any imported fill will be clean stone to ensure the wash out of fines and generation of suspended sediments does not occur across the site.
- During the construction of phase 1 at Durnish lands careful placement of the topsoil in the landscaping berms will be required. Silt fences or other suitable barrier measures will be installed where the working area for the berm treatment encroaches within 10m of a watercourse (with the exception of dedicated site access locations as illustrated on the site layout plan) and the local topography indicates there is potential for run-off to directly enter the watercourse.
- In the unlikely event that dewatering of foundations is required during construction and/or discharge of surface water from sumps, and exposed soil surfaces is required this will only happen through a treatment system prior to the discharge to storm water network, e.g. to silt traps or settlement skips prior to discharge;
- Construction of additional capacity at the existing attenuation pond will be undertaken at an early stage in the construction programme as part of Phase 1. This measure will provide additional treatment of storm water from the construction areas prior to discharge to the Robertstown Estuary.
- All water bodies that occur in areas proposed for site compounds and storage facilities will be fenced off to a minimum distance of 10m to reduce the risk to the aquatic environment. Appropriate sediment control measures will be installed where necessary, e.g., where preferential flow paths occur, silt fencing or other suitable barriers will be used to ensure silt laden or contaminated surface runoff from the compound does not discharge directly to a water body;

- Tool Box talks shall be given by the Environmental Manager nominated under the CEMP to all contractor's site personnel to inform them of the mitigation measures required to ensure protection and conservation the aquatic environment.

Cement and Concrete

Breaking of concrete (associated with structure demolition) has the potential to emit alkaline dust into the receiving environment. A barrier between the dust source and the sensitive receptor (the water body in this case) should be erected where possible to limit the possibility of dust contacting the receptor.

The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water body is carefully controlled so as to minimise the risk of any material entering the water, particularly from shuttered structures or the washing of equipment.

Concrete use and production shall adhere to control measures outlined in GPP 5: Works and maintenance in or near water (2017) particularly if on-site concrete production is proposed and careful initial siting of concrete mixing facilities is required with no production within a minimum of 10m from the aquatic zone.

It is noted in Chapter 2 that the concrete beams and planks supported by the tubular piles will be precast and lifted into position by crane. An in-situ concrete deck will be poured over the top of these precast units to bind all concrete elements together, using a concrete pump or concrete skips suspended from a crane. The in-situ concrete pour for the decking is likely to be located above the MHWS level however concrete placement below MHWS may be required e.g. to plug the top of piles, into the precast concrete troughs.

Where in situ stitching is required or where concrete is to be placed under water or in tidal conditions, specific fast-setting mix is required to limit segregation and washout of fine material / cement. This will normally be achieved by having either a higher than normal fines content, a higher cement content or the use of chemical admixtures.

Oils and Chemicals

The use of oils and chemicals on-site requires significant care and attention. It is important to ensure that the following procedures are followed to reduce the potential risk from oils and chemicals.

- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 "Safe storage – drums and intermediate bulk containers" (Environment Agency, 2011a) shall be implemented to ensure safe storage of oils and chemicals.
- The safe operation of refuelling activities shall be in accordance with PPG 7 "Safe Storage – The safe operation of refuelling facilities" (Environment Agency, 2011b).
- Port of Foynes has developed a Contingency Plan, which is approved by the Minister for Transport (Irish Coast Guard Section) under the Sea Pollution (Amendment) Act 1999, to address any major oil/HNS spill (or potential spill) within the Estuary. The plan is adhered to by all staff including those employed to carry out capital dredging on behalf of the Port. This plan

is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master of the Port of Foynes in dealing with an accidental discharge of oil and/or Hazardous Noxious Substances (HNS). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner. This plan (Oil Spill /HNS Plan) guides Port of Foynes staff (and other related organisations who hold a copy of the plan) through the various actions and decisions which will be required in an incident response. In the unlikely event that a major spill occurs during construction of the proposed development this contingency plan will be followed where required.

Contingency Planning

As is required for all major construction projects an environmental emergency response plan will be developed as part of the CEMP for the construction works and will be prepared in accordance with *PPG 21 Pollution Incident Response Planning* (Environment Agency, 2009). Whilst a major incident is unlikely to occur if the mitigation measures are fully detailed in the CEMP and implemented by the main works contractor and all sub-contractors the preparation of this document is considered to be best practice. The Plan will also detail the procedures to be followed if there is a breach in any licence conditions or a non-compliance.

It will be important to ensure that the contractors Environmental Manager and the client are notified of all incidents where there has been a breach in agreed environmental management procedures. Suitable training shall be provided to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions will be taken.

Herbicide Control

The application of Herbicides will only be undertaken by trained operators who are registered under the European Communities (Sustainable Use of Pesticides) Regulations 2012. The use of trained professionals to apply the herbicides in accordance with the Sustainable Use of Pesticides Directive will ensure that the potential impact from the application of herbicides during site preparation will be minimised.

Marine Mammals and Fisheries

NPWS *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (NPWS, 2014) shall be implemented.

A Marine Mammal Observer (MMO) shall be employed to ensure the marine piling area is clear of marine mammals prior to the commencement of piling activities.

A soft start procedure will be used where the equipment is ramped up slowly to full power.

The buffer zone to be monitored will be outwards to 1000m in line with DoEHLG (2007) guidance *Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters* unless otherwise agreed with NPWS.

Visual mitigation measures require daylight and favourable sea conditions in order to be implemented effectively. Bottlenose dolphins are quite easily detected in good to moderate sea-states and the port area is quite sheltered from all wind directions. The MMO can work effectively from land, with a suitable Vantage Point. This is consistent with MMO mitigation measures implemented as part of the most recent port project.

7.5.12.2 Operational Phase

Water Quality

Shannon Estuary Anti-Pollution Team (SEA-PT)

Shannon Foynes Port Company are part of a consortium consisting of the Port Company, Local Authorities and oil importers and was initiated to form a unified coordinated response to pollution incidents on the Shannon Estuary. Each member contributed initially to provide pollution response equipment and support tools. This equipment is available to respond to any pollution incident or threat. Members contribute annually to maintain equipment, carry out exercises and training and purchase new and replacement equipment.

The group has been in operation for the past 24 years under a committee of pollution officers representing the members. The aim of the group is to provide a unified response to oil pollution within the region, even though each member has individual responsibility for their own area. An Oil Spill Tracking Model, Geographic Information System, Environmental Atlas, Sensitivity Study, Oil Spill Response Strategy, Hydrocarbon Baseline Study and Emergency Response Plans have been developed for the region and updated.

The Pollution Control Plan is provided to assist the Shannon Estuary Ports Anti-Pollution Team (SEA-PT) in dealing with an accidental discharge of oil. Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner. This plan guides the Coordinator and On Scene Commander and other involved personnel through the decisions, which will be required in an incident response. The tables, figures and checklists provide a visible form of information, thus reducing the chance of oversight or error during the early stages of dealing with an emergency situation. For the plan to be effective, it must be:

- familiar to those with key response functions in the ports
- regularly exercised
- reviewed and updated on a regular basis.

The capacity extension and harbour development will be subject to the SEA-PT Pollution Control Plan allow effective controls to address pollution incidents.

East Jetty Extension

The key issues associated with the operation of the port facilities are associated with the risk of leaks or spillage of fuel, either during storage, quayside activities and vessel refuelling. The mitigation for the storm water drainage system is dealt with below. In addition care will be required during maintenance works, in order to ensure that adequate protection is given to receiving waters. As a result the key mitigation measures proposed include:

- Compliance with the Port of Foynes Contingency Plan as outlined under construction mitigation above

- Adequate bunding for any fuel, oils or chemicals stored on-land in accordance with relevant PPG, building regulations and following the same guidance outlined for storage and refuelling during the construction phase
- Regular inspection of the condition of chemical and fuel storage facilities along with routine maintenance to ensure the risk of leaks is minimised.

In particularly, the following shall be adhered to with respect to vessels at berth or travelling through the Port and Lower Shannon Estuary:

- No waste shall be disposed of at sea
- Ballast water shall be treated in accordance with MARPOL standards
- Ballast tanks shall be separate from hydrocarbon storage areas and no potentially contaminated streams shall be diverted to the ballast tanks
- De-ballasting shall be undertaken offshore in accordance with IMO guidelines
- Hazardous wastes shall be stored in sealed, labelled drums in locked chemical cabinets
- Vessels shall be equipped with oil-water separation systems in accordance with MARPOL requirements
- Spills on deck shall be contained and controlled using absorbing materials
- Vessels without sewage treatment systems shall have suitable holding tanks and will bring waste onshore for treatment by licensed contractors
- All chemicals used on-board shall be handled in compliance with COSHH instructions on handling hazardous materials
- Chemicals shall be stored appropriately in suitably bunded areas and with material safety data sheets; and
- All waste discharges shall be monitored and recorded as per vessel procedures.

Lands at Durnish

For all phases within the Durnish Lands, adequate bunding for any fuel, oils or chemicals stored on-land in accordance with relevant PPGs, building regulations will be followed by the Port and its tenants on these lands to ensure there is safe and adequate storage of such chemicals.

Control measures to collect and manage any spillage on hard standing areas within the different development phases are described below.

Foul Water drainage

As outlined in Chapter 2 foul water arrangements will be implemented on a phased basis consistent with each of the planned phases of development. Each phase will involve the implementation of a package treatment system which when implemented collectively, will service the entire Durnish lands, designed with sufficient capacity to accommodate predicted loadings (generated from the ‘population equivalent’ (PE) of the anticipated number of employees) thereby ensuring adequate treatment and protection of water quality. This approach allows for the foul wastewater treatment system to be individually sized for each development phase to maximise efficiency and afford a level of flexibility for future development given its long programme duration and uncertain land usage requirements of subsequent phases (beyond the immediate known requirements of Phase 1)

The preliminary design of the treatment plants has been based on the assumption that circa 120 people will occupy the fully developed site (calculated from the 186 FTE employees supported at Foynes Port within a 64ha site), with an assumption that 48nr people will be occupying Phase 1.

This system for phase 1 will consist of:

- Collection point for wastewater from the 3nr warehouses
- A package wastewater treatment plant which provides both primary and secondary treatment of foul waters I accordance with the EPA Guidance for Treatment Systems for Small Communities, Business, Leisure Centres and Hotels (EPA, 1999). For the design of the Phase 1 treatment system, a factor of safety of 1.25 was applied to the occupancy figure for Phase 1. Therefore, an occupancy figure of 60 personnel was considered and a design population equivalent of 30 was used in the system design (such as Klargester BioDisc model or similar)
- A 6m x 6m stratified sand polishing filter
- Collection sump and discharge to ground under Section 4 Licence (Water Pollution Act)

In line with EPA Code of Practice: Wastewater Treatment Systems for Single Houses, the treated effluent will be subjected to tertiary treatment by the means of a polishing filter which also acts as a percolation area to redistribute the treated and polished effluent to the groundwater. It is proposed to use a stratified sand polishing filter to provide the dual function of polishing the effluent and also infiltrating the treated effluent to the groundwater. The design arrangement is in accordance with EPA Code of Practice guidance and European standards (EN12566).

The design process followed for phase 12 as outlined above will also be applicable to phase 2 and 3 and will therefore ensure adequate foul water treatment across the Durnish Lands thereby mitigating any potential impact from foul water from the development site.

Storm Water Drainage

East Jetty Extension

As outlined above under the Ports Environmental Management Plan, Port of Foynes has a responsibility to ensure that no potentially polluting substances enter marine/riverine environment from its facilities. Runoff from jetties is managed by ensuring that the potential for cargo spillages onto the jetty deck is minimised through good handling practice, together with good housekeeping and cleaning practices to ensure that minor spills for hoppers or grabs are swept up.

As outlined in Chapter 2 storm water runoff will not be permitted to discharge directly to the marine environment from the jetty connection structure, but will be collected in a dedicated storm water drainage system. The surface water drainage system will be designed to consist of heavy duty gullies cast into the reinforced concrete deck, with concrete pipes cast into the in-situ concrete deck structure. These pipes will carry the storm water to an appropriate full retention oil separator which will trap oils and silt from the jetty prior to being discharged into the harbour waters through a non-return flap valve. A readily and safely accessible monitoring chamber will be provided on the storm water pipeline to allow for inspection and sampling of the storm water being discharged.

Lands at Durnish

The storm water drainage for Durnish Lands will be installed during Phase 1 for all phases of the development and therefore will be fully operational in advance of operational phases.

Storm drains will collect all surface water and convey it through full retention interceptors (to collect hydrocarbons and silt) and the stormwater will then be conveyed through perforated pipes to allow percolation into the infilled ground. Readily and safely accessible monitoring chambers will be provided on the storm water pipelines to allow for inspection and sampling of the storm water being discharged

The oil interceptors on the surface water drainage network will be selected and sized based on the pollution prevention guideline: "Use and design of oil separators in surface water drainage systems: PPG 3" (Environment Agency, 2006) and BS EN 858 which is the European Standard for the design, performance, testing, marking and quality control of separators within the EU. All separators must comply with this standard. In accordance with PPG3 a class 1 bypass separator will be required for general and car parking areas of the site whilst a class 1 full retention separator will be required for the HGV parking and loading areas. Notwithstanding this full retention separators are proposed for each phase of the development and will be sized in accordance with the design flow as present in Chapter 2 (590 l/s for a 6 hour duration storm) and the drainage area to be serviced.

7.5.13 RESIDUAL IMPACTS

A shadow appropriate assessment of the implications of the proposed development on the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA was undertaken. 150 nr. conservation objective targets of the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA were analysed and evaluated.

With the application of mitigation measures to reduce the risk of pollution incidents upon Annex I habitats and Annex II species that use them; and underwater noise or disturbance to Annex II species; it was concluded that the construction and operation of the proposed development will not prevent the maintenance or delay the restoration of favourable conservation conditions of the qualifying interests and special conservation interests of the European sites. Adverse effects upon the integrity of the European sites are not predicted.

No further or additional likely significant effects were predicted upon any proposed NHA site.

As a result there is no likely significant residual impact predicted upon designated sites as a result of the construction and operation of the proposed development.

7.6 CONCLUSION

This chapter of the EIAR identifies, describes and assesses in an appropriate manner, the direct and indirect significant effects of the proposed development on biodiversity. It contains a description of the terrestrial, marine and avian biodiversity features and designated sites within and surrounding the site of proposed development, followed by an assessment of the potential and likely significant effects of the proposed development alone and cumulatively with other consented projects on terrestrial, marine and avian biodiversity features and designated sites.

In accordance with the requirements of the EIA Directive 2014/52/EU, particular attention has been given to species and habitats protected under Council Directives 92/43/EEC and 2009/147/EC. A Natura Impact Statement (NIS) has been prepared on behalf of the applicant to document a shadow appropriate assessment exercise conducted in support of an application for consent to a competent authority (and/or a public authority) in respect of conducting an appropriate assessment prior to consenting proposed development. The NIS is contained at Volume 6 of the EIAR.

The assessment of **terrestrial biodiversity** features concludes that:

- there is no likely significant residual impact predicted upon terrestrial biodiversity features as a result of the construction and operation of the proposed East Jetty extension and pontoon relocation. Mitigation is not proposed.
- likely significant habitat loss, lighting disturbance, noise and visual disturbance and degradation of water quality effects were predicted as a result of the construction and operation of the proposed development at Durnish. Mitigation has been proposed and there is no likely significant residual impact predicted upon terrestrial biodiversity features with mitigation in place.

The assessment of **marine biodiversity** features concludes that:

- likely significant underwater noise and degradation of water quality effects were predicted as a result of the construction proposed East Jetty extension and pontoon relocation in relation to piling. Mitigation has been proposed and there is no likely significant residual impact predicted upon marine biodiversity features with mitigation in place.
- likely significant degradation of water quality effects were predicted as a result of the construction and operation of the proposed development at Durnish. Mitigation has been proposed and there is no likely significant residual impact predicted upon marine biodiversity features with mitigation in place.

The assessment of **avian biodiversity** features concludes that:

- there is no likely significant residual impact predicted upon avian biodiversity features as a result of the construction and operation of the proposed East Jetty extension and pontoon relocation. Mitigation is not proposed.
- likely significant noise and visual disturbance effects upon breeding birds was predicted as a result of the construction and operation of the proposed development at Durnish. Mitigation has been proposed and there is no likely significant residual impact predicted upon avian biodiversity features with mitigation in place.
- Moderate beneficial effects on avian biodiversity are predicted due to the proposed landscaping and boundary treatment planting.

The assessment of **designated sites** features concludes that:

- Likely Significant Effects can be discounted for Stack's to Mullaghareirks, West Limerick Hills and Mount Eagle SPA; Askeaton Fen Complex SAC; Barrigone SAC; or Curraghchase Woods SAC.
- Likely Significant Effects are predicted for Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.
- A Natura Impact Statement analyses and evaluates the implications of the proposed development on the conservation objectives of these two European sites. Mitigation is proposed and an Adverse Effect on the Integrity of the Site is not predicted for any European site.
- Significant adverse effects are not predicted upon the features of any proposed NHA.

8 SOILS, GEOLOGY, HYDROGEOLOGY AND WASTE

This chapter provides an assessment of the effects of the existing ground conditions on the proposed development and addresses the potential effects of the proposed development on the soils, geology and hydrogeology of the site and surrounding areas. The assessment is based on the development as described in **Chapter 2** of the EIS. Where potential adverse impacts are identified, the assessment identifies mitigation measures that will be implemented to prevent, reduce or offset potential adverse effects, or enhance potential beneficial effects where possible.

This chapter also assesses the waste management aspect of the development. It discusses the potential waste streams that will be generated during the construction and operation of the development. Effects from the forecast waste generation have been assessed in the context of the effects on waste management infrastructure and legislation, policy and strategy targets. Mitigation measures are proposed where adverse effects are identified.

8.1 SOILS, GEOLOGY AND HYDROGEOLOGY

8.1.1 Introduction

A Preliminary Risk Assessment (PRA) and Generic Quantitative Risk Assessment (GQRA) have been prepared to support this assessment. The PRA and GQRA reports are contained within Appendix 8.1 and Appendix 8.2 of Volumes 2 and 8 of the EIAR.

Scope of Assessment

This section describes the methodology which has been used in the assessment of soils, geology and hydrogeology which may impact, or be impacted by, the proposed East Jetty extension works and Durnish Lands development.

8.1.2 Assessment methodology

Guidance

The methodology outlined within the following guidance documents was utilised in the assessment:-

- ‘Geology in Environmental Impact Statements’, published by The Institute of Geologists of Ireland in September 2002, has been consulted. This document outlines the main geological issues that should be considered when undertaking an EIA.
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Environmental Protection Agency, Draft, August 2017.
- The National Roads Authority’s guidelines; ‘Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes’, published in 2008. These guidelines aim to provide guidance on the assessment of geological, hydrological and hydrogeological impacts through the EIA process.

The Preliminary Risk Assessment was prepared utilising guidance provided by the UK Environment Agency (EA). The UK technical guidance for assessing and managing risks from contaminated land is detailed in 'Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11', published by DEFRA and the EA in 2004 and this guidance is accepted by the EPA (in the absence of Republic of Ireland Government guidance).

Underpinning the guidance within CLR11 is a source-pathway-receptor methodology, which is used to identify Significant Pollutant Linkages (SPLs). The following definitions apply:-

- Source: identification of contamination source;
- Pathway: the means by which the contamination can come into contact with the receptor; and
- Receptor: the entity which is vulnerable to harm from the contamination source.

An important thread throughout the overall process of risk assessment is the need to formulate and develop a conceptual model for the site, which supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of the preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process. A risk is present only when a source-pathway-receptor linkage is present and active.

Human Health Risk Assessment

In the absence of government guidance on contaminated land risk assessment within the Republic of Ireland, current guidance provided by the UK Environment Agency (EA) has been utilised to form the basis of this assessment.

The Environment Agency has published guidance in relation to assessing the potential risk from contaminated land to human health. Science Report SR2 'Human Health Toxicological Assessment of Contaminants in Soil' and Science Report SR3 'Updated Technical Background to the CLEA Model', together with CLR 11 'Model Procedures for the Management of Land Contamination' provide the most up to date framework for human health risk assessment within the UK.

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils, RPS undertook an initial screening of the laboratory results using the 2015 LQM/CIEH (Land Quality Management/Chartered Institute of Environmental Health) Suitable 4 Use Levels (S4ULs) (Copyright Land Quality management Limited reproduced with permission; Publication Number S4UL3474. All Rights Reserved) as trigger values. These LQM/CIEH S4ULs replace the second edition of the LQM/CIEH Generic Assessment Criteria (GAC) published in 2009. Differences in modelling assumptions and added land uses and substances create the difference between these S4ULs and the previous GAC. These values are provided for 6 land use classifications:

- Residential with homegrown produce
- Residential without homegrown produce
- Allotments
- Commercial

- Public open space near residential housing
- Public park

For pollutants with no relevant S4ULs, assessment criteria were provided by Soil Guideline Values (SGVs) and CL:AIRE's (Contaminated Land: Applications in Real Environments) GAC. In light of the publication of SR2 and SR3 the Environment Agency published SGVs for a number of contaminants for the following standard land use scenarios assuming a Sandy Loam soil and Soil Organic Matter (SOM) content of 6%:

- Residential;
- Allotments; and
- Commercial.

CLAIRE in association with The Environmental Industries Commission (EIC) and Association of Geotechnical and Geo-environmental Specialists (AGS) published a set of GAC in 2009 for previously unpublished contaminants which are intended to complement the SGVs derived by the Environment Agency. The GACs have been derived predominantly for VOCs and SVOCs using CLEA v1.06 for a number of different Soil Organic Matter contents (1%, 2.5% and 6%).

European Legislation

European legislation is a significant consideration in assessing the effects of a scheme on the geological and hydrogeological attributes of a site, and is outlined below.

The Water Framework Directive (2000/60/EC) establishes a framework for community action in the field of water policy. The main objective of the Directive is for all groundwater, surface water and coastal water bodies to achieve 'good' status by 2015. The Directive introduced new broader ecological objectives as well as aims to prevent deterioration of all water bodies. The Directive must be considered in any scheme that has the potential to impact on any part of the water environment. The Water Framework Directive has been transposed into Irish law by means of the following main Regulations:-

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010);
- European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 (S.I. No. 610 of 2010);
- European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2011 (S.I. No. 389 of 2011);
- European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 (S.I. No. 489 of 2011);

- European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2012 (S.I. No. 149 of 2012); and

- European Union (Water Policy) Regulations 2014 (S.I. No. 350 of 2014).

The European Communities (Environmental Liability) Regulations 2008 (S.I. 547 of 2008) came into force in Ireland in April 2009. EU Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage is transposed into Irish law via these regulations. Their purpose is to establish a framework of environmental liability based on the 'polluter-pays' principle, to prevent and remedy environmental damage.

Sources of Information

The following sources of information were used in the compilation of this assessment:-

- Environmental Protection Agency Map viewer - http://gis.epa.ie/Envision/;

- Geological Survey of Ireland Spatial Resources;

- http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228;

- Environmental Protection Agency Radon Map - http://www.epa.ie/radiation/radonmap;

- Model Procedures for the Management of Land Contamination, Contaminated Land Report 11, Defra and Environment Agency, September 2004;

- Irish Aquifer Properties – A Reference Manual and Guide, Environmental Protection Agency and Geological Survey Ireland, March 2015;

- Geology in Environmental Impact Statements, The Institute of Geologists in Ireland, 2002

- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, National Roads Authority, 2008;

- Ordnance Survey Ireland Environmental Report (Ref. 19734562)

- Internet based aerial photography.

- Durnish Lands development.

8.1.2.1 Assessment methodology

Sensitivity of Receptor

Effects of the development on soils, geology and hydrogeology receptors have been assessed taking into account sensitivity of the receptor and magnitude of the effect. The sensitivity of the receptors is determined according to the methodology shown in Table 8.1.

Table 8-1: Sensitivity of Receptor (Amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

Sensitivity	*Criteria*	*Typical Examples*
Very high	Attribute has a high quality and rarity on regional or national scale.	Geology: World Heritage Sites; sites protected under EU wildlife legislation (SAC, SPA, SSSI, Ramsar site) or geological features that are rare on a regional or national scale. Surface waters: River, wetland or surface water body ecosystem protected by EU legislation.
High	Attribute has a high quality and rarity on local scale.	Geology: Regionally Important Geological Sites. Soils: Well drained and/or high fertility soils. Surface water: Ecosystem protected by national legislation. Groundwater: Regionally important potable water source supplying >2500 homes, groundwater vulnerability is classified as high; principal aquifer providing a regionally or locally important resource or supporting site protected under wildlife legislation.
Medium	Attribute has a medium quality and rarity on local scale.	Soils: Moderately drained and/or moderate fertility soils. Groundwater: Local potable water source supplying >50 homes, moderate classification of groundwater vulnerability; secondary aquifer providing water for agricultural or industrial use with limited connection to surface water.
Low	Attribute has a low quality and rarity on local scale.	Soils: Poorly drained and/or low fertility soils. Groundwater: Local potable water source supplying <50 homes, deep secondary aquifer with poor water quality not providing baseflow to rivers.
Neutral	Very low importance and rarity on local scale.	Geology: No rock exposures. Soils: Urban classified soils. Groundwater: Non-aquifer/Unproductive Strata.

For the purposes of this assessment it is considered that Regionally Important (R) Aquifers are Principal Aquifers; Locally Important (L) Aquifers are Secondary Aquifers and Poor (P) Aquifers are Unproductive Strata. Different classifications exist for each of the aquifer types, as listed below:-

Regionally Important (R) Aquifers

- Karstified bedrock (Rk) where Rkc represents an aquifer dominated by conduit flow and Rkd represents an aquifer dominated by diffuse flow.
- Fissured bedrock (Rf).
- Extensive sand and gravel (Rg).

Locally Important (L) Aquifers

- Bedrock which is generally moderately productive (Lm).
- Bedrock which is moderately productive only in local zones (Ll).
- Sand & gravel (Lg).
- Locally important karstified bedrock (Lk).

Poor (P) Aquifers

- Bedrock which is generally unproductive except for local zones (Pl).
- Bedrock which is generally unproductive (Pu).

Impact Assessment

The magnitude of a potential effect is independent of the sensitivity of the feature. The magnitude considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short term rather than long term) and whether the effect is direct or indirect. Definitions for impact magnitude are described in Table 8.2.

Table 8-2: Criteria to Determine the Magnitude of Effect (Amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

Magnitude	Criteria	Typical Examples
Major adverse	Total loss or major alteration to key features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.	Irreversible loss of high proportion of local high fertility soils. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Loss of, or extensive change, to nationally important geological features.
Moderate adverse	Loss or alteration to one or more key features of the baseline conditions such that post development character/composition of baseline condition will be materially changed.	Irreversible loss of moderate proportion of local high fertility soils Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Permanent loss of, regionally important geological features, or substantial changes to nationally important geological features.
Minor adverse	Results in some measurable change in attributes quality or vulnerability compared to baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of baseline condition will be similar to the pre-development situation.	Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems Loss of, or extensive change, to locally important geological features
Neutral	Very little change from baseline conditions. Change is barely distinguishable approximately to a "no change" situation.	No measurable impact upon surface waters or groundwater. No measurable impact on geological features. No measurable impact on soils.
Beneficial	Benefit to, or addition of, key characteristics, features or elements compared to baseline conditions.	Improvement to geological features

Significance Criteria

The significance of a specific potential effect is derived from both the sensitivity of the feature and the magnitude of the effect, and can be then determined using the matrix presented in Table 8.3 (has been amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'). Effects can be beneficial, adverse or neutral and their significance Very Large, Large, Moderate, Slight or Neutral or an intermediary designation as cases dictate based on professional judgement. The significance of an impact should also be qualified based on the likelihood of an effect occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment.

Professional judgement can be used to vary the category where specific circumstances dictate, for example due to the vulnerability or condition of the receptor.

Table 8-3: Assessment of Significance Matrix (Amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

		Magnitude of Effect			
		Major	**Moderate**	**Minor**	**Neutral**
Sensitivity of Attribute	**High**	Major	Moderate/Major	Minor/Moderate	Neutral
	Medium	Major	Moderate	Minor	Neutral
	Low	Minor/Moderate	Minor	Neutral	Neutral
	Neutral	Neutral	Neutral	Neutral	Neutral

Significance of Residual Effects

The significance of effects for soils, geology and hydrogeology has been assessed initially without taking mitigation measures into account. Residual effects (effects that remain once mitigation measures are taken into consideration) are then identified. Temporary effects are considered in the construction period whilst permanent effects are discussed in the operational phase, albeit that the effect may first occur during construction.

8.1.2.2 Consultation

A number of consultation responses were received as part of the scoping process. No specific issues with regards to soils, geology or hydrogeology were raised in these responses.

8.1.3 Receiving environment

8.1.3.1 Solid Geology

The bedrock geology anticipated in the vicinity of the site is shown on Figure 8.1. The geology of the wider Foynes area consists of formations from the Carboniferous system, from the Visean and basal Namurian stage. The formations are dipping gently to the south west. The bedrock of the Durnish lands site consists of the Rathkeale Formation to the east of the site and the Durnish Formation to the west. The bedrock geology of the Port of Foynes marine site is the Clare Shale Formation.

The Rathkeale Formation comprises non fossiliferous dark muddy limestone with mudstones, which are well bedded and brittle. This is uniformly overlain by the Durnish Formation, which is a uniform bioclastic limestone with bands that include chert nodules parallel to bedding. It is abundant in fossils, with complete coral beds. The Durnish formation is overlain by the Shanagolden Formation of black limestone and then the Parsonage and Corgrig Lodge formation, a fine grained muddy limestone. These are overlain by the Clare Shale Formation which is a clay rich mudstone with band of siltstone. The carboniferous limestone formations represent an offshore ramp. The changes in grain size and the fossil content between the formations indicates changes in relative sea level. The Clare shale formation which was deposited above the carboniferous limestone formations represents a deep marine, representing a significant rise in relative sea level.

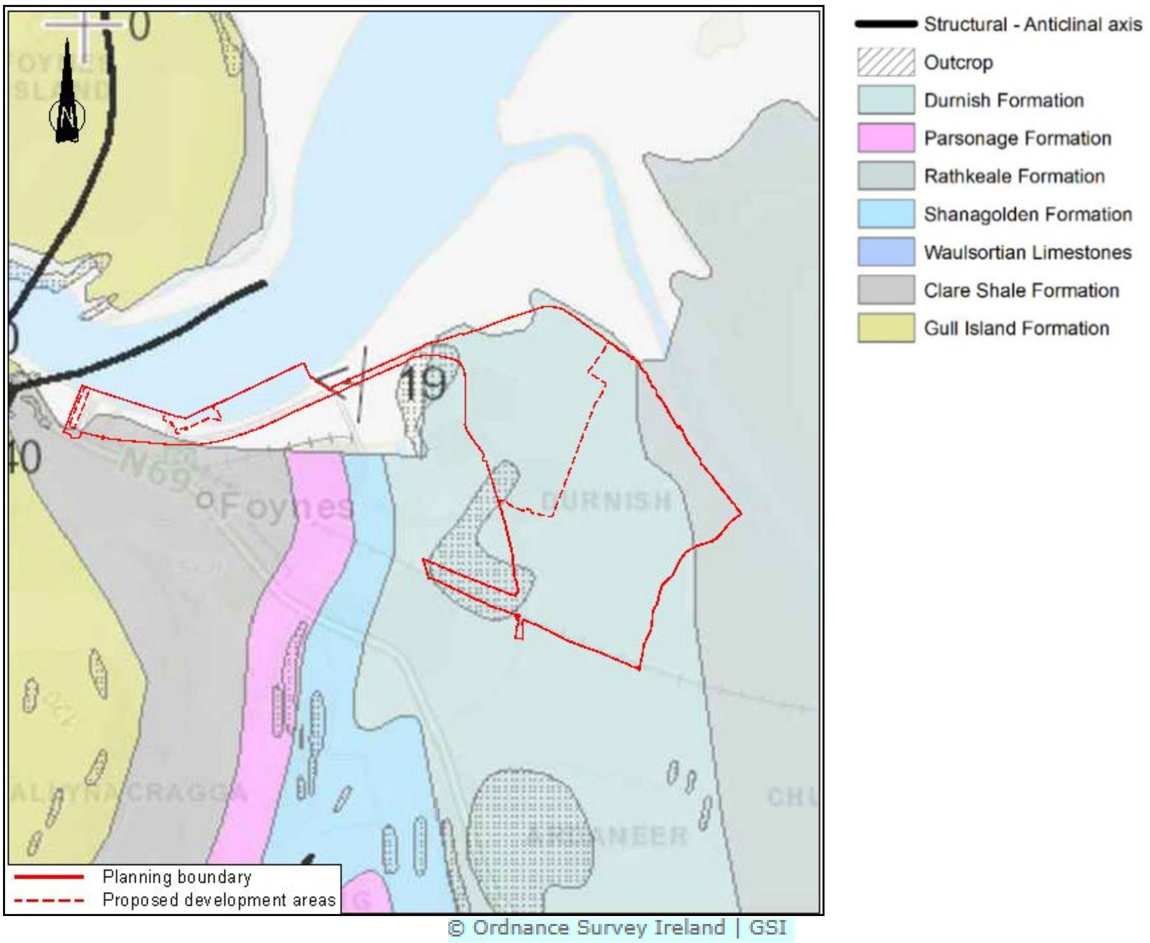


Figure 8.1 Solid geology (taken from GSI's Spatial Resources portal)

8.1.3.2 Drift Geology and Recent Deposits

Drift is a general term applied to all mineral material (clay, sand, silt, boulders) transported by a glacier and deposited directly by or from the ice, or by running water emanating from the glacier. It generally applies to Pleistocene glacial deposits.

As shown on Figure 8.2, the Port of Foynes is mapped as Made Ground (blue), which is superimposed on a region composed mostly of Estuarine Sediments of silts and clays (green). Glacial tills (purple), mainly of limestone origin, are present to the south of the Durnish site while bedrock (shale and limestone) is anticipated at surface in certain areas on and in proximity to the site (grey).

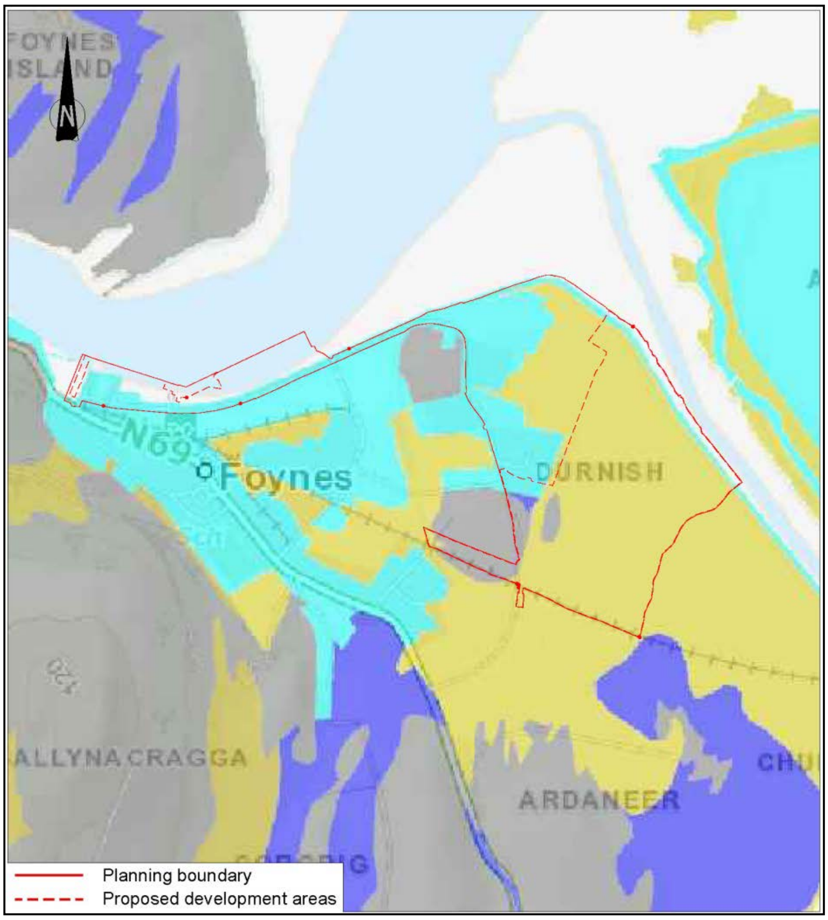


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Figure 8.2 Drift geology (taken from GSI's Spatial Resources portal)

8.1.3.3 Hydrogeology

Hydrogeology is the study of groundwater, including its origin, occurrence, movement and quality. As shown in Figure 8.3, the site area is located on two aquifer domains: Poor Aquifer (PU) and Locally Important Aquifer (LI). The PU designation represents bedrock which is generally unproductive while the LI designation represents bedrock which is moderately productive only in local zones. A Regionally Important Aquifer - Karstified (conduit) is present to the east of the site area (approximately 2km).

Karst activities were found in two boreholes less than 3k from Port of Foynes in the Walsortian Limestone and Rathkeale Formation.

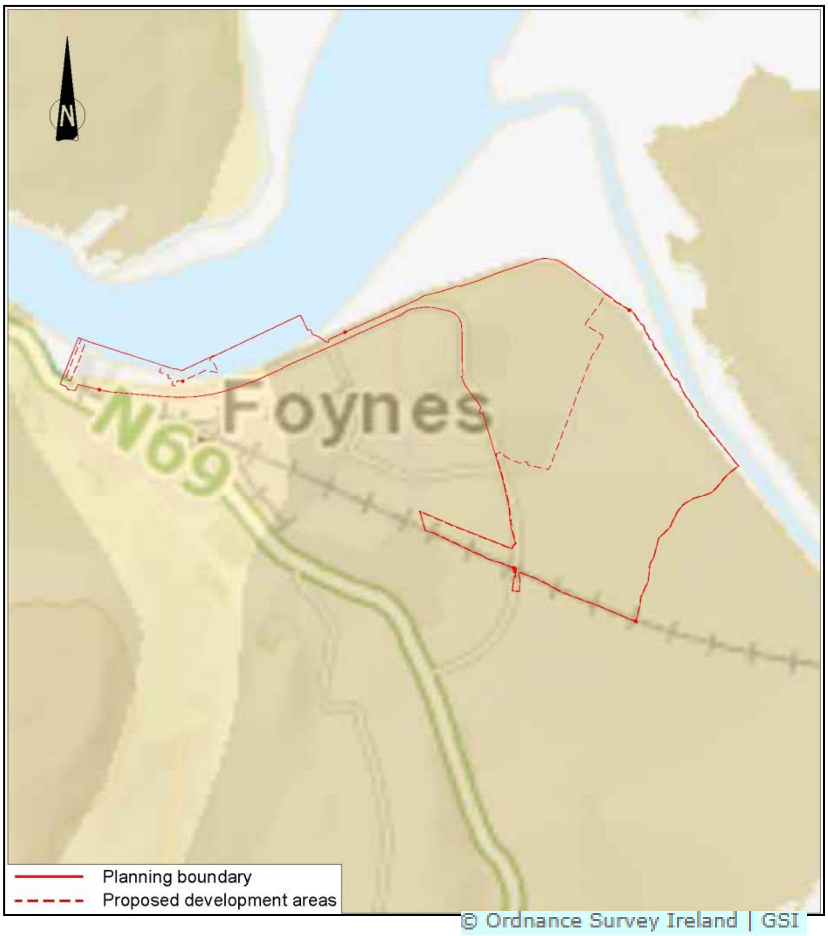


Figure 8.3 Groundwater aquifer (taken from GSI's Spatial Resources portal)

In accordance with the Water Framework Directive (2000/60/EC) it is necessary to understand the groundwater vulnerability of the site, which is defined as the tendency and likelihood for general contaminants to reach the water table after introduction at the ground surface.

The site mainly falls within an area of low groundwater vulnerability. However, higher groundwater vulnerability is anticipated where rock is present at surface i.e. in the south western portion of the Durnish lands.

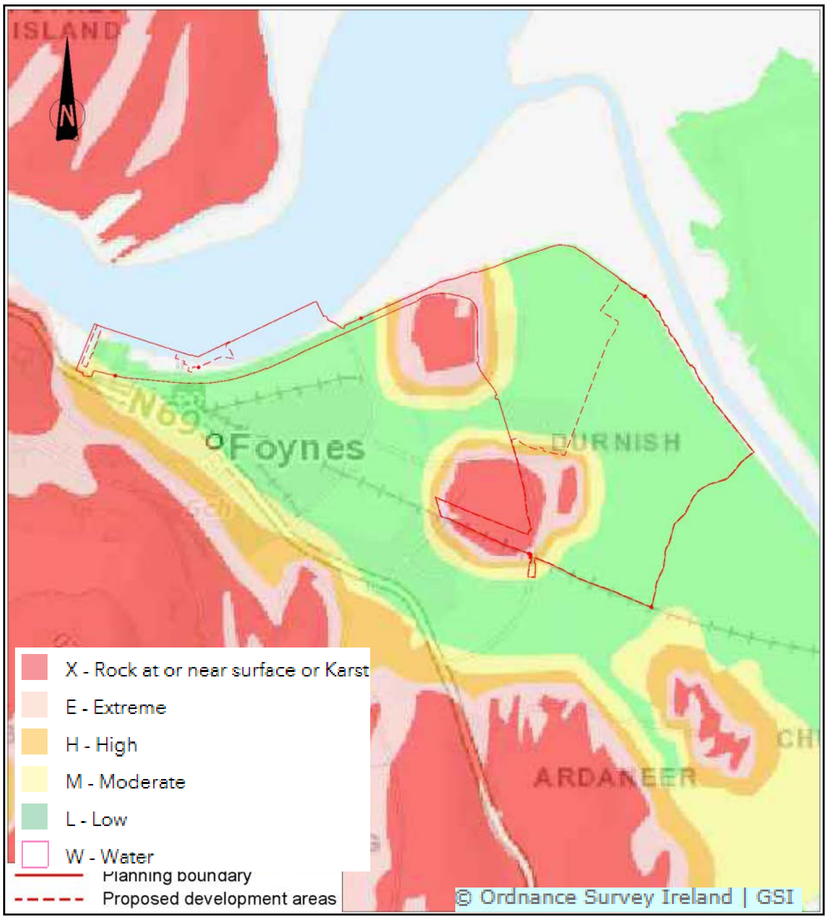


Figure 8.4 Groundwater vulnerability (taken from GSI's Spatial Resources portal)

Groundwater at the site is expected to be brackish / saline and unsuitable for potable supply.

8.1.3.4 Hydrology

Small watercourses seem to form the boundary of the site. In addition, a number of watercourses are present in the northern portion of the site with small field drains also present along many of the field boundaries. The large Robertstown River runs along the eastern boundary of the site, into the Shannon River/Estuary just north of the site.

The OSI Environmental Reports identifies one weir, four springs, two sluices and two pumps within the search radius of the site. The Lower Shannon Estuary is noted to be of unpolluted status.

8.1.3.5 Geological Heritage Areas

A Geological Heritage Area is one which contains geological or geomorphological features considered to be of national interest and recommended for Natural Heritage Area (NHA) designation by the GSI. Two areas are present in the vicinity of the site; Foynes Island and an area located 1km west of proposed jetty extension.

8.1.3.6 Karst Features

The GSI have identified two karst features within the vicinity of the site. An abstraction borehole is noted to be present 1.2km north-east of the Durnish lands. Karst phenomena such as minor cavities and passages to fairly large roofless cavities and gorge like features are noted by the GSI to be present 1.8km north-east of the Durnish lands.

8.1.3.7 Site Investigation

As discussed with the GQRA Report (Appendix 8.2), a site investigation was carried out by ABCO between March and July 2017. Table 8-4 summarises the type and number of exploratory locations across both the Durnish Lands and Jetty Extension sites.

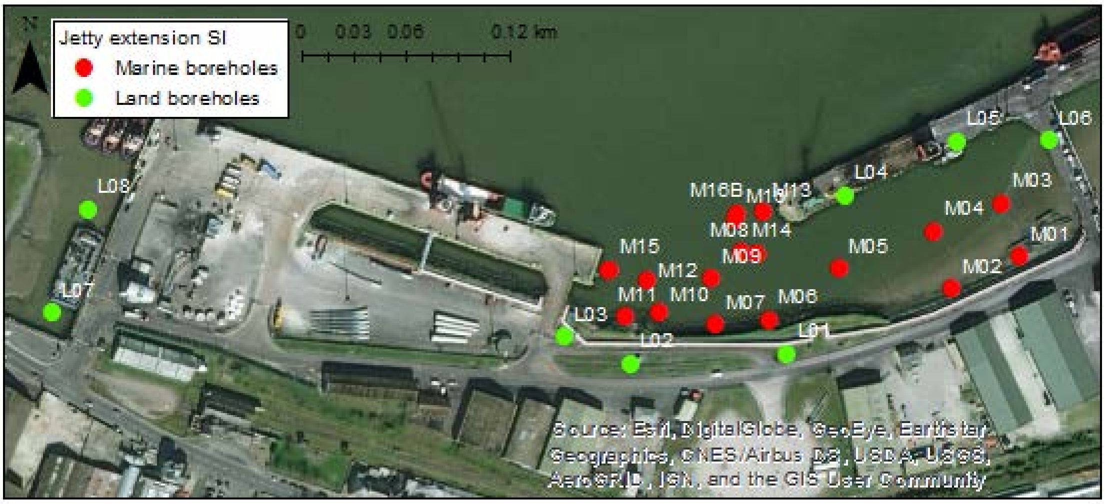


Figure 8.5 Jetty Extension Site Investigation Locations

Table 8-4: Composition of site investigation

Exploratory hole type	Number of exploratory locations on site	
	Durnish Lands	Jetty extension site
Land boreholes	6	8
Marine boreholes	0	15
Trial pits	10	8
Marine CPTs	0	8

Site specific soils and geology

The ground conditions for the Durnish land site vary across the site but generally comprise of a thin layer of top soil over thick estuarine/alluvial deposits and glacial tills, overlying the bedrock. The Bedrock of the Durnish land site is a limestone which is exposed at the surface in certain locations of the site. The ground investigations have generally confirmed the anticipated geology. The sequence and type of geological strata generally identified in the ground investigations are summarised in Table 8-5 to Table 8-7, starting with the most recent deposits.

Table 8-5: General ground profile summary for Durnish Lands

Material	Typical description	Depth bgl (m)	
		To top	To Bottom
Drift deposits			
Topsoil	Soft to firm sandy gravelly clay/silt	0.0	0.3
Estuarine/Alluvial – Cohesive	Soft sandy silty gravelly CLAY	0.0	7.7
Estuarine/Alluvial – Granular	Silty GRAVEL	2.6	12.0
Glacial – Granular	Cobbles and boulders	0.0	14.5
Solid geology: Rathkeale Formation			
Limestone	Strong to very strong grey bedded crystalline Limestone	0.0	17.8

The onshore area of the jetty extension site has thick layer of made ground which forms the current quay. This is above a thick layer of very soft estuarine/alluvial cohesive clays and silts, which becomes coarser with depth, towards estuarine/alluvial granular gravel and cobbles. The bedrock for this location is a fine grained limestone.

Table 8-6: General ground profile summary for Jetty Extension site onshore

Material	Typical description	Depth bgl (m)	
		To top	To Bottom
Made ground			
Made ground	Silty sandy GRAVEL with occasional cobbles placed as fill (current quay)	0.0	5.3
Drift deposits			
Estuarine/Alluvial – Cohesive	Very soft sandy CLAY	3.0	7.3
	Very soft sandy SILT with shell fragments	3.3	18.0
Estuarine/Alluvial – Granular	From clayey sandy GRAVEL to gravel and cobbles	18.0	29.3
Solid geology: Clare Shale Formation			
Limestone	Strong dark, fine to medium grained crystalline Limestone	22.2	25.8

The offshore area of the jetty extension has soft estuarine clays, above gravel that contains some boulders. The bedrock comprises mostly limestone, with occasional interbeds of siltstone and mudstone. The ground investigations have generally confirmed the anticipated change in geological formation described in the geological mapping.

Table 8-7: General ground profile summary for Jetty Extension site offshore

Material	Typical description	Depth bgl (m)	
		To top	To Bottom
Drift deposits			
Estuarine/Alluvial – Cohesive	Very soft silty CLAY to sandy gravelly CLAY	0.0	14.5
Estuarine/Alluvial – Granular	From GRAVEL to boulder GRAVEL	13.5	30.4
Solid geology: Clare Shale Formation			
Limestone	Strong dark, fine to coarse grained crystalline Limestone	9.0	45.2
Siltstone	Strong thinly laminated black Siltstone	14.1	21.3

Made Ground

Made Ground was encountered at boreholes L01, L02, L03 and L06. These boreholes are located within previously reclaimed land onshore at the jetty extension site. The thickness of the Made Ground is variable across the onshore area of the jetty extension site between approximately 2.9m and 5.3m and L02 and L03 respectively, and up to 9m of hardfill was encountered at L06. The Made ground stratum mainly comprises sandy GRAVEL and sandy, gravelly CLAY, however it is highly variable with varying content of sand and silt encountered also.

Topsoil

Soft to firm top layer mainly consisting of clay or silt, with some sand and gravel. This stratum layer ranges in thickness from 0.2m to 0.3m.

Estuarine/Alluvial Deposits

Deposits from the river estuary dominates all of the localities. The majority of the estuarine deposits are the cohesive sandy clay/silts. However, at greater depths there are the coarser grained more granular deposits of sandy gravels. The finer grained deposits are very soft, especially the deposits in the marine site which have undergone no consolidation. The estuarine deposits do include shell fragments in parts.

Glacial Deposits

Glacial deposits are found in the Durnish land site consisting of a glacial till. The deposits are granular in nature, consisting predominantly of cobbles and boulders. The cobbles and boulders consist of clasts of limestone. Within the site they are overlain by later estuarine deposits. The glacial deposit is classed as stiff.

Limestone

Limestone is the predominate bedrock of all sites. The limestone is exposed at the surface within the Durnish site but is at greater depths for the jetty extension site, ranging in depths from 0.0m to >25m. Limestone outcrops were observed at the Durnish site, particularly at the south west area of the site. The limestone has a dark appearance and varies in strength from weak to very strong. The limestone has differing thickness of lamination and is highly fractured with areas of iron staining.

Siltstone

The siltstone is strong and thinly laminated. It forms interbeds within the limestone beneath the offshore jetty extension site. The thickness of the siltstone interbeds vary from 0.7m to 2.1m.

Groundwater

Groundwater strikes were recorded in the test pits carried out in the Durnish Lands. The measurements are presented in Table 8-8.

Table 8-8: Groundwater strikes on Durnish Lands

Site investigation location	Ground level (m CD)	Waterstrike (m bgl)	Waterstrike (m CD)	Date	Remark
TP01	4.26	4.0	0.24	31/03/2017	Slight seepage
TP02	4.68	4.0	0.68	31/03/2017	Slight seepage
TP03	4.78	4.0	0.78	31/03/2017	Slight seepage
TP06	4.55	1.3	3.25	31/03/2017	Very fast
TP08	4.93	2.0	2.93	31/03/2017	Fast
TP09	4.25	1.5	2.75	31/03/2017	Very fast

Groundwater monitoring wells were installed in boreholes LD01 to LD06 on the Durnish Lands. Groundwater monitoring installations were targeted to the underlying bedrock. Groundwater measurements were recorded on 10th August 2017. The groundwater measurements are presented in 8.9. Groundwater is likely to be tidally influenced in proximity to the Shannon River, however overall it appears from the monitoring that groundwater is likely to flow in a north east to south west direction.

Table 8-9: Groundwater measurements at Durnish Lands

Site investigation location	Ground level (m CD)	Water depth (m bgl)	Water level (m CD)
LD01	11.8	1.2	10.6
LD02	17.9	1.3	16.6
LD03	8.0	1.5	6.5
LD04	8.8	1.7	7.1
LD05	7.7	2.2	5.5
LD06	6.3	1.9	4.4

8.1.3.8 Sub Soil Contamination

Environmental soil samples were taken at regular intervals throughout the length of the excavation of each test location across the site. The protocol observed during the recovery of samples followed the guidance set out in BS 10175:2011 the Code of Practice for the Investigation of Potentially Contaminated Sites. The borehole logs are contained within the GQRA Report (Appendix 8.2 -Volume 8 of this ES) and the test locations are highlighted within Figure 8.5 and 8.6.

Laboratory Analysis

Twenty-nine (29) soil samples from the Durnish Lands site investigation and five (5) samples from the marine-based site investigation at the proposed jetty extension site were sent to Exova Jones Environmental for analysis. Samples were analysed for a mixture of; pH, Sulphate as SO4, Chloride, Cyanide (total), Loss on ignition, Organic matter, Total organic carbon, Asbestos in soil, Aluminium, Arsenic, Barium, Beryllium, Boron (water soluble), Cadmium, Copper, Chromium (total), Chromium (hexavalent), Iron, Lead, Lithium, Mercury, Nickel, Selenium, Sulphur as S, Vanadium, Zinc, Dibutyltin, Tributyltin, Triphenyltin, Total Petroleum Hydrocarbons (TPH-CWG C5 – C35 aromatic-aliphatic split), Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs), Benzene, Toluene, Ethylbenzene, Xylenes, Methyl tert-butyl ether (MTBE), speciated Polycyclic Aromatic Hydrocarbons (PAHs), speciated Poly Chlorinated Biphenyls (PCBs) and Phenols (speciated HPLC).

Speciated TPH analysis was undertaken in order to provide a better understanding of the 'make up' of the hydrocarbon contamination in relation to the specific carbon banding, as suggested within the 'Total Petroleum Hydrocarbon Criteria Working Group' (TPH-CWG) literature and recommended by the Environment Agency document P5-080/TR3 'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbon in Soil'.

The soil laboratory analytical results are included within the GQRA report (Appendix 8.2 – EIAR Volume 8).

Human Health Risk Assessment

As per the methodology outlined within Section 8.1.2, a human health risk assessment was undertaken on the risk posed by potential ground contamination to future site users.

Due to the development proposals at both the Durnish Lands and jetty extension sites all the soil samples have been screened against generic values derived for a commercial end use.

Soil Contamination

All contaminants returned concentrations below their respective screening values for a commercial end use and as such no risk to human health is considered to exist.

8.1.3.9 Groundwater Contamination

Upon completion of the intrusive site investigation, groundwater samples were taken from LD01 – LD06 on the Durnish Lands site. These samples were analysed for a range of potential contaminants including:

- Metals
- TPH-CWG
- PAHs (16 USEPA Speciated)
- SVOCs
- VOCs

The vast majority of contaminants recorded concentrations less than the method detection limit in the groundwater samples. As shown in Table 8-10, the samples show some exceedances of the screening values.

Table 8-10: Groundwater contaminant concentrations exceeding screening values

Contaminant	Screening value	Exceeding concentrations	Locations exceeding
Sulphate as SO4	187.5 mg/l (Groundwater Regulations 2016)	198.3-1918.4 mg/l	LD03, LD04 & LD06
Chloride	18735 mg/l (Groundwater Regulations 2016)	195.4-13829 mg/l	LD01-LD06
Total Cyanide	10 µg/l (IGV, EPA 2003)	1090-3326 µg/l	LD01-LD06
Aluminium	150 µg/l (Groundwater Regulations 2016)	250-355 µg/l	LD01, LD02 & LD04
Arsenic	7.5 µg/l (Groundwater Regulations 2016)	10.9-52.5 µg/l	LD01, LD04, LD05 & LD06
Barium	100 µg/l (IGV, EPA 2003)	135 & 179 µg/l	LD03 & LD06
Boron	1000 µg/l (IGV, EPA 2003)	2459 & 2500 µg/l	LD03 & LD04
Calcium	200 µg/l (IGV, EPA 2003)	285.5-369 mg/l	LD01, LD02, LD03 & LD04
Iron	200 µg/l (IGV, EPA 2003)	1458-37220 µg/l	LD01, LD02, LD03 & LD04
Magnesium	50 mg/l (IGV, EPA 2003)	56.1-1062 mg/l	LD01, LD03 & LD04
Manganese	50 µg/l (IGV, EPA 2003)	77-6122 µg/l	LD01-LD06

Contaminant	Screening value	Exceeding concentrations	Locations exceeding
Nickel	8.6 µg/l (Surface water Regulations 2015)	23 & 34 µg/l	LD04 & LD05
Potassium	5 mg/l (IGV, EPA 2003)	9.2-291.7 mg/l	LD01-LD06
Sodium	150 mg/l (IGV, EPA 2003)	273.5-8473 mg/l	LD01, LD02, LD03, LD04 & LD06
Zinc	75 µg/l (Groundwater Regulations 2016)	126 µg/l	LD03
Exceeds groundwater/surface water regulations		Exceeds EPA Interim Guideline Values	

The EPA Interim Guideline Values were produced in 2003 and are guideline values only. Within the EPA's methodology the interim guideline value chosen was the GSI Trigger Value (background concentration) where it applied, and where is did not apply the most stringent value of the:

- The Drinking Water Standard, or
- The EQS for the Aquatic Environment/ Dangerous Substances, where appropriate.

In many cases these IGVs are therefore potentially outdated or based on Drinking Water Standards. It is therefore considered that exceedances of the groundwater or surface water regulations are more pertinent to this assessment.

No anthropogenic sources of Sulphate, Chloride, Aluminium, Arsenic, Nickel or Zinc were identified on the Durnish Lands. It is possible that geogenic sources of these potential contaminants are contributing to their concentrations in groundwater. Off-site sources, such as Aughinish Alumina Ltd could also be contributing to their concentrations.

8.1.3.10 Percolation Tests

Upon completion of the intrusive site investigation, five (5) percolation tests were undertaken across the Durnish lands. The tests were undertaken in accordance with *BS 6297:2007 +A1:2008 "Code of Practice for the Design and Installation of Drainage Fields for use in Wastewater Treatment*. The location of the percolation tests and the test results are contained within Appendix 8.3 of Volume 2 of the EIA report. The tests reveal that the southern portion of the Durnish lands have good hydraulic assimilative capacity.

8.1.4 Construction Impacts

As outlined in Chapter 2 Project Description, the development will be phased with Phase 1 comprising elements 1a – 1d. The completion of Phase 1 will see the infilling of phase 1, 2 and 3 lands with the phase 1 lands in operation. The operational phase 1 lands will be covered in hard-standing and will have operational storm and foul water drainage. The phase 2 and 3 lands will be infilled, not covered in hard-standing, non-operational and will have drainage infrastructure installed but not operating.

Future development of the phase 2 and 3 lands would see these lands covered with hard-standing, with operating drainage and likely operating in a commercial capacity (as described in Chapter 2). The use of the phase 2 and 3 lands are subject to a separate consent process but for the purpose of this assessment and specifically, a cumulative consideration of proposed and likely anticipated uses, the impact of the development and operation of these lands has been considered.

8.1.4.1 Soils and Geology

East Jetty extension works

Localised demolition of the existing deck structure will be necessary at the Western end of the existing East Jetty to allow for connection of the jetty extension to the existing jetty's rounded end. Similar localised demolition will also be required at the existing West Quay. No significant land based earthworks will be undertaken.

The impact to soils and geology is considered to be **Neutral.**

Durnish Lands Development

Development on the Durnish lands will involve the importation of stone fill material to raise site levels to +4.44m OD. The top 200mm of topsoil will be stripped off the entire Durnish site and re-used in the formation of the berm required for the landscaping boundary treatment around the perimeter of the Durnish site. The stripped soil will not be stockpiled and will be immediately used to form the berm.

As outlined in Chapter 2, the infilling will be undertaken in phases. Where topsoil has been stripped and not yet infilled, the stripped area will be seeded with clover to minimise loss of topsoil from dust and precipitation run-off.

The impact to soils and geology is considered to be Minor Adverse due to the loss of local high fertility soils.

8.1.4.2 Hydrogeology

East Jetty extension works

No significant land based earthworks will be undertaken. Piling will be required which will comprise tubular steel piles, circa 1219mm diameter x 25.4mm thick, shall be driven to a level of between approx. -32.0 to -35.0mCD. Piles shall be driven to provide approximately 3m deep penetration into rock. The impact to hydrogeology from these piling works is considered to be **Neutral**.

Durnish Lands Development

Fill material will be imported onto the site to a depth of between 1.8 and 2.8m. The underlying aquifer is classified as being a locally important aquifer. No groundwater wells or springs are present within the site, however a number of wells and springs are noted within the surrounding vicinity. The nearest adjacent wells are located 1.3km south-east of the site and 1.5km south-west of the site. These areas are noted to be classified as being of medium to extreme vulnerability whilst the Durnish lands are classified as being of low vulnerability. The impact of the infilling activities on the underlying aquifer is considered to be **Neutral**. The fill material will be imported from authorised quarries and will have minimal potential for leaching contaminants into the underlying groundwater. Given the distance to the offsite wells and springs, the impact to these offsite receptors is considered to be **Neutral**.

8.1.5 Operational Impacts

As highlighted in Section 8.1.4, the use of the phase 2 and 3 lands are subject to a separate consent process but for the purpose of this assessment and specifically, a cumulative consideration of proposed and likely anticipated uses, the impact of the development and operation of these lands has been considered.

8.1.5.1 Soils and Geology

East Jetty extension works

The impact to soils and geology is considered to be **Neutral.**

Durnish Lands Development

As part of the contamination assessment, the Conceptual Site Model (CSM) developed for the site could not identify any soil source-pathway-receptors linkages in relation to human health and therefore the risk to human health (future site workers and site users) from sub-soil contamination is considered to be negligible. It is anticipated that there will be no impacts on the soils and geology during the operational phase of the site.

Hydrogeology

East Jetty extension works

The impact to hydrogeology is considered to be **Neutral.**

Durnish Lands Development

The importation of fill material to a depth of between 1.8 and 2.8m across the site, in conjunction with covering the phase 1 lands in relatively impermeable hard-standing, has the potential to alter the depth of the unsaturated zone and lower the infiltration rate. However the proposed storm water drainage (see Chapter 2) will facilitate the percolation of precipitation back into the underlying ground at a rate that will be similar to the existing greenfield site scenario. Therefore the impact on groundwater recharge will be **Neutral**. For the cumulative phase 1, 2 and 3 operational scenario, the same drainage infrastructure will be in place on the phase 2 and 3 lands and the impact will also be Neutral.

Foul water will be treated to a tertiary level using a package treatment system (see Chapter 2). The effluent will be subjected to tertiary treatment by the means of a polishing filter which also acts as a percolation area to redistribute the treated and polished effluent to the groundwater. It is proposed to use a stratified sand polishing filter to provide the dual function of polishing the effluent and also infiltrating the treated effluent to the groundwater. The treated effluent will have a **Neutral** impact on existing baseline groundwater quality. For the cumulative phase 1, 2 and 3 operational scenario, the same foul treatment infrastructure will be in place on the phase 2 and 3 lands and the impact will also be Neutral.

Analysis of groundwater samples from beneath the Durnish lands indicated a number of exceedances of the 2016 Groundwater Regulations for a number of metals including Aluminium, Arsenic, Nickel and Zinc. The source of these contaminants may be geogenic or may be from off-site sources such as the adjacent aluminium plant. Monitoring of groundwater levels indicates that groundwater flow is likely in a north east to south west direction which would rule out Foynes Port as a potential source. The operation of the development (including the cumulative phase 1, 2 and 3) is not likely to cause any further reduction in baseline groundwater quality due to the storm drainage and foul water treatment systems as described above.

The overall hydrogeology impact from operation of the development is considered to be **Neutral**.

8.1.6 Remedial and mitigation measures

8.1.6.1 Construction Phase Mitigation Measures

East Jetty extension works

No specific construction phase mitigation measures with regard to soils, geology and hydrogeology are required.

Durnish Lands Development

The potential risk to construction workers from contaminants during the earthworks is low.

Fill material will be imported to raise site levels. The material will be sourced from authorised quarries and will have minimal potential to introduce contamination onto the site.

Mitigation measures are provided in **Chapters 7** and **9** in relation to ecology and surface water quality.

8.1.6.2 Operational Phase Mitigation Measures

East Jetty extension works

No specific operational phase mitigation measures with regard to soils, geology and hydrogeology are required.

Durnish Lands Development

No specific operational phase mitigation measures with regard to soils, geology and hydrogeology are required. Mitigation measures are provided in **Chapters 7** and **9** in relation to ecology and surface water quality.

8.1.7 Residual Impacts

No residual impacts are predicted for either the construction or operational phase.

8.1.8 Monitoring

No monitoring is required.

8.2 WASTE

Introduction

Section 8.2 assesses the waste management aspect of the capacity extension at Shannon Foynes (as described in Chapter 2 'Project Description'). It discusses the potential waste streams that will be generated during the construction and operation of the development. Effects from the forecast waste generation have been assessed in the context of the effects on waste management infrastructure and legislation, policy and strategy targets. Mitigation measures are proposed where adverse effects are identified.

Waste is defined as 'any substance or object the holder discards, intends to discard or is required to discard' under the Waste Framework Directive (European Directive 2006/12/EC as amended by Directive 2008/98/EC). Once a substance has become waste it will remain waste until it has been fully recovered and no longer poses a potential risk to the environment or human health. From that moment onwards, the material ceases to be waste and it is no longer subject to the controls of the Waste Framework Directive. This applies to waste used as aggregate or construction material in civil engineering applications. Waste recovery can be achieved when such waste is incorporated into a road, building or other infrastructure works, or in the case of inert waste, after processing if such a process is conducted following the criteria specified in the relevant quality protocols.

Assessment Methodology

This assessment comprises the following stages:

- *A review of applicable legislation and policy;*
- *A review of the proposed scheme design was undertaken in consultation with the project design team to estimate the waste generation during the various phases;*
- *Consideration of potential interactions between proposals and the current site conditions, and identification of possible impacts;*
- *Assessment of impacts, within the context of the receiving waste management environment;*
- *Identification of measures and solutions to avoid, minimise or mitigate potential impacts; and*
- *Assessment of residual impacts, taking account of mitigation measures.*

The methodology for assessing the significance of effects associated with the generation of waste is based upon an assessment of the quantity and types of waste that are likely to be produced during construction and operation of the development and how this deviates from baseline conditions.

The significance of effects in relation to waste management likely to occur during the construction and operation phases of the development is determined using the predominantly qualitative process described below. The criteria have been developed to be specific to this scheme while emulating the current principles of waste management, particularly the waste management hierarchy.

Table 8.11 Glossary of terms used to explain the quality and significance of impacts

Significant Criteria	Definition
Major Adverse Effect	Substantial deterioration compared to the current scenario – severe or irreversible adverse environmental or human health effects associated with waste management. Significant increase in waste sent to landfill.
Moderate Adverse Effect	Noticeable deterioration compared to the current scenario – long-term minor or short-term moderate adverse environmental or human health effects associated with waste management. Slight or moderate increase in waste sent to landfill.
Minor Adverse Effect	Slight deterioration compared to the current scenario – short-term minor adverse environmental or human health effects associated with waste management. Minor increase in waste sent to landfill.
Neutral	No noticeable alterations to the current scenario due to waste management. No discernible effects due to waste management.
Minor Beneficial Effect	Slight improvement compared to the current scenario – short-term minor improvement in environmental and human health associated with waste management. Minor increase in waste generation or minor increase in reuse and recycling levels. Slight or moderate local scale reduction in use of landfill.
Moderate Beneficial Effect	Noticeable improvement compared to the current scenario – long-term minor or short term moderate improvement in environmental or human health effects associated with waste management. Slight or moderate decrease in waste generation or moderate increase in reuse and recycling levels. Slight or moderate reduction in use of landfill.
Major Beneficial Effect	Substantial improvement compared to the current scenario – significant improvement in environmental or human health effects associated with waste management. Significant decrease in waste generation, landfill disposal or major increase in recycling and reuse levels.

A review of the operational waste types generated at the port was undertaken in preparation for this chapter. This data was used to estimate waste types that will be generated from the construction and operational phases of the proposed development. An extensive document review was completed to assist in identifying current and future requirements for waste management which included:

National and Regional Policies and Strategies such as:

- *Changing Our Ways; A Policy Statement on Waste Management,* Department of Environment, Heritage and Local Government, 1998;
- *Preventing and Recycling Waste – Delivering Change*, Department of Environment, Heritage and Local Government, 2002;
- *Taking Stock and Moving Forward*, Department of Environment, Heritage and Local Government, 2004;
- *National Strategy on Biodegradable Waste*, Department of Environment, Heritage and Local Government, 2006;
- *A Resource Opportunity – Waste Management Policy in Ireland,* Department of the Environment, Community and Local Government (DoECLG), 2012;
- *National Hazardous Waste Management Plan 2014 – 2020,* EPA, 2014;
- *The Southern Region Waste Management Plan 2015 – 2021*, Limerick City & County Council / Tipperary County Council, 2015.

National and European Legislation including:

- *Waste Management Act 1996 (as amended);*
- *Waste Management (Facility Permit and Registration) Regulations, S.I No. 821 of 2007 (as amended);*
- *Waste Management (Collection Permit) Regulations (as amended) 2008 (S.I. No 87 of 2008);*
- *Waste Management (Packaging) Regulations 2003 (as amended) (S.I. No. 61 of 2003);*
- *Waste Management (Planning) Regulations 1997 (S.I. 137 of 1997);*
- *Waste Management (Hazardous Waste) Regulations 1998 (S.I. 163 of 1998);*
- *Waste Management (Landfill Levy) Regulations 2011 (S.I. No. 434 of 2011) as amended 2012 (S.I. No. 221 of 2012);*
- *European Communities (Waste Electrical Electronic Equipment) Regulations 2011;*
- *Waste Management (Food Waste) Regulations 2009 (S.I. No. 508 of 2009);*
- *Local Government Act 1994 (and Amendments) and Regulations (S.I. No. 8 of 1994);*
- *Litter Pollution Act 1997 (S.I. No. 12 of 1997);*
- *Protection of the Environment Act 2003 (No. 27 of 2003);*
- *Industrial Emissions Directive (2010/75/EU);*
- *European Communities (Waste Directive) Regulations, 2011;*
- *Waste Framework Directive (2008/98/EC).*

Other EPA guidelines such as Guidelines on the Information to be Contained in Environmental Impact Statements [2002] and Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) [2003] have been referred to also in the preparation of this Waste section.

Specifically in relation to the waste management requirements at Port facilities the following were also considered:

- *EU Directive 2000/59/EC on port reception facilities for ship generated wastes and cargo residues*
- *S.I. No. 117 of 2003: European Communities (Port Reception Facilities for Ship-Generated Waste and Cargo Residues) Regulations 2003*
- *Directive 2002/84/EC amending the Directives on maritime safety and the prevention of pollution from ships*
- *S.I. No. 659 of 2003: European Communities (Port Reception Facilities for Ship-Generated Waste and Cargo Residues) (Amendment) Regulations 2003*
- *Commission Directive 2007/71/EC of 13 December 2007 amending Annex II of Directive 2000/59/EC of the European Parliament and the Council on port reception facilities for ship-generated waste and cargo residues*

- *S.I. No. 376 of 2009: European Communities (Port Reception Facilities for Ship-Generated Waste and Cargo Residues) (Amendment) Regulations 2009*
- *Commission Directive (EU) 2015/2087 amending Annex II to Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues*
- *S.I. No. 550 of 2016: European Communities (Port Reception Facilities for Ship-Generated Waste and Cargo Residues) (Amendment) Regulations 2016*
- *Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements*
- *Directive 2009/123/EC amending Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements*
- *S.I. No. 542 of 2010: European Communities (Ship-Source Pollution) Regulations 2010*
- *MARPOL 73/78, International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978*
- *A guide to good practice – IMO Consolidated Guidance for port Reception Facility Providers and Users.*

Existing Environment

National Waste Legislation in Ireland

The statutory basis for waste management policy in Ireland comes from the Waste Management Act 1996. This Act provided the framework for the then Government's 1998 Policy Statement entitled "Waste Management: Changing Our Ways". This document outlined national targets and plans to modernise waste management practice over a 15 year period. A key concept of the Policy Statement was the Hierarchy of Waste Management (Figure 8.7), whereby waste prevention and re-use is preferable to non-sustainable practices such as disposal to landfill.

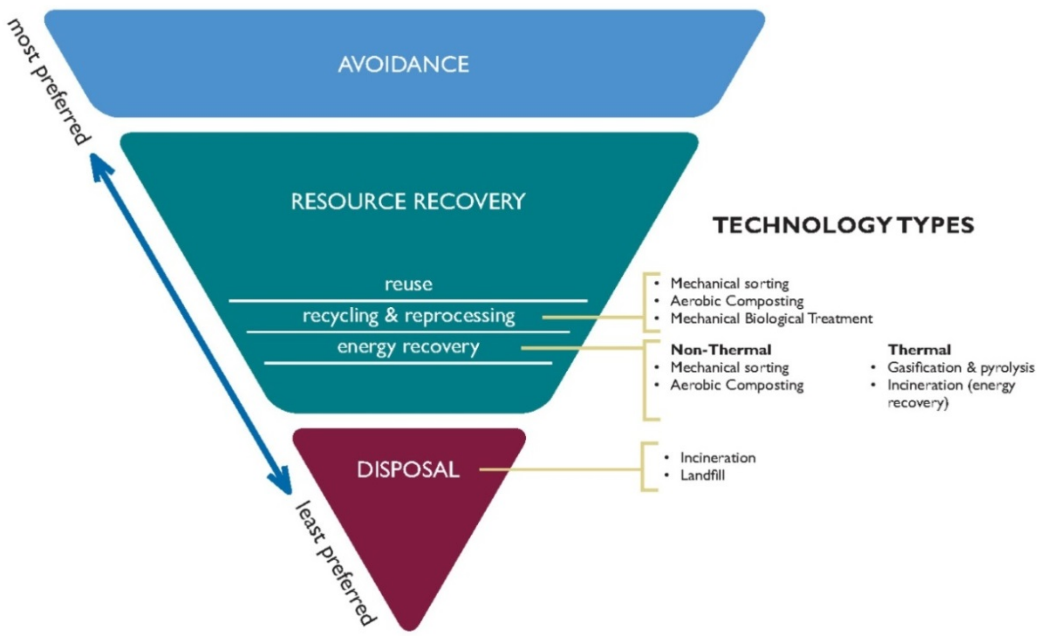


Figure 8.7 Waste Management Hierarchy

In Ireland, the Department of the Environment, Community and Local Government (DoECLG) has divided the responsibility for waste regulation between the Environment Protection Agency (EPA) and the local authorities. With respect to waste planning, the EPA manages hazardous waste nationally while the responsibility for non-hazardous waste facilities lies with the local authorities.

Since the 1996 Waste Management Act, waste management planning of non-hazardous waste has been the responsibility of the local authorities. Section 22 of the Act allowed local authorities to amalgamate their waste management planning duties at their discretion. As a result, prior to 2013, there were 10 groupings of local authorities nationally. Subsequent reform of local Government structures in 2013 reduced the number of groupings further from 10 to 3, which are as follows; Eastern & Midlands, Southern & Connacht & Ulster.

Foynes Port is located in Foynes, Co. Limerick. As such the Port is part of the Southern Waste Region and is subject to the requirements of the associated Waste Management Plan (WMP). This region is currently inhabited by approximately 34% of the Irish population and brings together 10 Local Authorities; Carlow County Council, Clare County Council, Cork City Council, Cork County Council, Kerry County Council, Kilkenny County Council, Limerick City & County Council, Tipperary County Council, Waterford City & County Council and Wexford County Council. In May 2015 the Southern Waste Region published the *Southern Region Waste Management Plan 2015-2021*. One of the key policies of the plan is to encourage industry to adopt a circular approach to waste management and view waste steams as potentially a valuable resource. The new plan builds on the success of previous plans in areas such as recycling and goes further by directing industry to focus on practices higher up on the waste hierarchy pyramid such as; waste prevention, reduction and material reuse. In an effort to minimise waste to landfill, the plan seeks to develop infrastructure for the recovery of embodied energy from non-recyclable waste streams. This is the Southern Region's circular approach to waste management which recognises the value of residual waste as potential fuel.

The *Southern Region WMP 2015-2021* sets out three strategic targets for waste management, related to prevention, recycling and landfilling. These targets set for the period of the WMP are as follows:

1. Achieve a 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
2. Achieve a recycling rate of 50% of managed municipal waste by 2020;
3. Reduce to 0% the direct disposal of "unprocessed" residual municipal waste to landfill (from 2016 onwards) In favour of higher value pre-treatment processes and indigenous recovery practices.

The Southern Region WMP 2015-2021 also sets longer term targets to 2030 including:

1. Absolute decoupling of household waste from economic growth and disposable Income;
2. Preparing for reuse and recycling rate of 60-70% of municipal waste by the end of 2030;
3. Reduce and where possible eliminate landfilling of all major waste streams including; municipal, industrial, construction, and demolition wastes in favour of the recovery of residual wastes.

Characteristics of Current Wastes

SFPC currently operate a waste management plan '*Waste Management Plan 2018*[1]' to ensure:

- Compliance with all relevant legislation;
- Company's responsibilities are discharged and transparent;
- Port users are aware of their obligations;
- All vessels using the Estuary are aware of their obligations and the systems in place with regard to waste management;
- Local Authorities, when planning for waste management in their region, allow for the proper reception of port related waste; and
- Department of Agriculture, Food and the Marine requirements in relation to waste management are met.

The overall control of waste management at the Port remains with the Harbour Master.
Current wastes arising at the Port are typically non-hazardous, and are classified in accordance with local procedures, national waste classification requirements, and relevant waste legislation.

Waste management procedures at the Port incorporate the Waste Framework Directive's principles of prevention, minimisation, re-use, recycling, recovery, and disposal. These waste management procedures are implemented on site through the *Standard Operating Procedure (SOP) for the Landing of Ship's Waste* and other procedures contained in the *Waste Management Plan 2018* which are established on site for waste segregation, handling, labelling, documenting, storage and treatment / disposal of waste off-site.

A number of different waste types are generated on site and are detailed in Table 8.12.

[1] http://www.sfpc.ie/download/SFPC%20Waste%20Plan%202018.pdf

Table 8.12 Types of waste produced and current management route

Waste Type	Details		Management Route
Ship Waste	International catering waste	This includes swill and other waste on board ships and will be varied and in the main bulky. This includes packaging, bottles, cartons, wood, paper, and many other items.	International catering waste is stored in a fully sealed 30 cubic yards roll pack compactor at Port of Foynes. Mr. Binman has the contract and appropriate licence to remove and dispose of this waste. The Harbour has responsibility to provide through its contractor, adequate reception facilities. Collection frequency – as required
	Hazardous waste	This includes all types of HNS as defined under Annexes of Marpol.	Provision for this service will be arranged directly through ship's agent with ENVA or other suitable contractor.
Port Waste	This is all non-ship generated waste and does not include waste generated by companies operating within the port area, who provide for their own disposal.		Port waste is segregated into general waste and hazardous waste and disposed of accordingly. 12 cubic yard skip and one 660 litre bin for general waste and one 660 litre bin for recyclable waste is supplied at Port of Foynes. Collection frequency – skip is collected as required, 660 litre bins are collected weekly. SFPC also segregates recyclable waste into the following fractions: timber, steel, paper and cardboard. Currently Mr. Binman has the contract to recycle / dispose of all port waste. Batteries (non-lead acid batteries, lead acid batteries, mixed batteries including lead acid, NiCad's, Alkaline, NiMH, LiIon etc) are collected at a collection point in the Port. RILTA Environmetnal Ltd is fully licensed and contracted to recycle/dispose of used / waste batteries.
Cargo Waste	This is waste associated with the load / discharge of cargo.		It is the responsibility of the ship and the cargo receivers to collect and dispose of cargo waste.

Table 8.13 Details on weight of waste managed at Foynes Port[2]

Contractor Details	Waste Type	Weight (kg)
Mixed waste bins (660l)	Residual	818.8
Mixed waste compactor	Residual	31,560.0
General waste skip	Residual	2,380.0
Subtotal	Residual	34,758.8
Wood only skip	Recyclable	5,100.0
Dry recycling bins (660l)	Recyclable	412.9
Subtotal	Recyclable	5,512.9
Total		**40,271.7**

Method of Management

The reception and management route of waste at the Port is managed as per the Port's *Waste Management Plan 2018*. All waste generated and/or received at Foynes Port is currently managed and disposed by licenced waste contractors. The management / disposal route is at the discretion of the approved contractor.

Pre-treatment and Recovery Infrastructure

Pre-treatment infrastructure covers a wide variety of facilities in the region, but is mainly mechanical sorting, separation and processing plants which can vary in scale and sophistication. Recovery infrastructure covers a wide range of activities which fall within the treatment tiers of preparing for reuse, recycling and other recovery. Pre-treatment and recovery facilities can be authorised either by the EPA, under a waste licence, or by the local authorities, under a waste facility permit (WFP) or certificate of registration (CoR).

Table 8.14 presents the number of facilities present in the Southern Region to show the treatment market available.

Table 8.14 Number of facilities authorised by activity group

Description	WFP Classes	COR Classes	WFP (No. of Facilities)	COR (No of Facilities)
Store / Processes / transfer of waste including MSW & C&D waste	1, 7, 10	1, 7, 10	77	2
Metals and ELVs	4, 12	-	106	-
Other waste vehicles	2	3	6	3
WEEE Batteries	3, 9	4	2	-
Land Improvements	5, 6	5,6,9	62	51
Biological	8	11,12	14	10
Organic landspread	-	13	-	2

[2] EPA National Waste Report 2010-2012 and Annual Environmental Reports for landfill facilities.

Description	WFP Classes	COR Classes	WFP (No. of Facilities)	COR (No of Facilities)
Storage of non-hazardous & refrigerant wastes	11	14	7	0
Temp. storage	-	2	-	34
Total	**12 classes**	**13 classes**	**274**	**102**

Disposal Infrastructure

It is understood that Drehid Landfill, Co. Kildare is the final destination for International Waste.

There are a number of landfills licensed to accept non-hazardous waste, as set out in Table 8.15 below with remaining capacity in the area. As there is only one landfill active and open in the region, there was only 91,000 tonnes of landfill disposal capacity for residual type municipal waste available at the end of 2014.

Table 8.15 Permitted non-hazardous landfill sites with capacity available

Licensee	Landfill Site Name	EPA Licence Reg. No	Remaining consented disposal capacity (t)	Remaining constructed disposal capacity (t)	Remaining life expectancy consented (years)	Remaining life expectancy = constructed & consented (years)	Operational Status
Cork Co. Co.	Bottlehill	W0161-02	5,392,000	675,000	29	4	Un-commenced
Carlow Co. Co.	Powerstown	W0025-03	91,000	91,000	2.5	2	Open
Wexford Co. Co.	Holmestown	W0191-02	1,100,000	150,000	20	3	Closed
			6,583,000	**916,000**	-	-	

Likelihood of Impacts

The proposed development comprises two sites; a marine site related to the jetty extension, and a land site.

Jetty Extension

The marine site is located in the existing port and comprises two existing marine structures; i.e. the East Jetty and the West Quay. It is proposed that the existing East Jetty is extended to meet the West Quay. The jetty extension marine site is bound by the River Shannon to the north, the existing east jetty to the east, the existing West Quay to the west and the port facilities site to the south. The proposed jetty extension works is detailed in Chapter 2.0.

The proposed harbour development will generate construction related waste and once operational the extended capacity at the port will facilitate an increased number of berthing opportunities and the likelihood of increased waste arising associated with the additional port capacity during the operational phase.

Durnish Lands Development

The land site is located to the east and south east of the existing port in the Durnish land area. The Durnish land site is bound by the River Shannon to the North, the River Robertstown (a tributary river to the River Shannon) to the east, N69 Road to the south which leads into Foynes Village and Harbour Entrance Road to the west.

The proposed works to be carried out on the Durnish Lands includes infilling of the existing Greenfield site with imported clean fill material to raise the level of the existing site above the flood plain, facilitating a mixture of warehousing, storage and port centric development. The proposed development works is set out in Chapter 2.

As such the development on this land will be a Greenfield development and typical waste arisings associated with the construction of warehousing and access infrastructure are considered likely.

Description of Significant Impacts

The predicted waste management impacts are assessed in accordance with Table 8.11. Based on the capacity extension and harbour development proposals, the potential impacts associated with waste generation and management is considered for two distinct phases:

1. Construction Phase; and
2. Operational Phase.

Construction Phase Impacts

Jetty Extension

i. Demolition

Localised demolition of the existing deck structure will be necessary at the Western end of the existing East Jetty to allow for connection of the jetty extension to the existing jetty's rounded end. Similar localised demolition will also be required at the existing West Quay. The localised demolition will generate Construction, Demolition and Excavation (CD&E) type waste materials. It has been estimated that the demolition works will generate approximately 130m^3 of concrete / demolition waste.

There is the potential for quantities of materials to be deposited in landfill sites rather than reused or recycled, unless site waste management plans are implemented and adhered to. The use of non-permitted waste contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/pollution. Therefore, it is essential that all waste materials are dealt with in accordance with regional policies, national legislation, and that site management procedures are in place to ensure the appropriate management of waste segregation, storage, handling, and transportation.

Initial investigations should establish the existence of any hazardous wastes. Any such materials must be correctly identified, segregated and appropriately managed in order to avoid incorrect handling of the material which could impact negatively on workers as well as environments both onsite and offsite.

ii. Construction

Typical waste materials arise from site management practices during the construction phase, for example, excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase. Typically, construction waste is 'cleaner' than demolition waste. Packaging waste can make up a significant part of this waste stream. In terms of waste arising from the construction compound, general office waste such as paper, packaging and canteen waste will be collected in covered skips/large bins for disposal by a licensed waste contractor. Sewage from the temporary site toilets will be emptied under contract for disposal at an appropriate facility.

Table 8.16 Waste types likely to be generated by the works and disposal routes

Activity	Waste Generated	Disposal/Treatment Recommendations
General Construction Waste	Waste oils	Collected by waste recycling contractor
	Other waste	Collected in skips for disposal by licensed contractor
General Office / Messing	Paper, packaging, canteen etc	Collected in covered skips/large bins for disposal by a licensed waste contractor
Temporary Site Toilets	Sewage	Emptied under contract for disposal at an appropriate facility

Durnish Lands Development

i. Site Clearance & Demolition

This involves stripping of topsoil across the existing site; however this material will be stockpiled for use in boundary treatment. Demolition of existing shed "lean to" of Foynes Engineering to facilitate construction of mid-point access road into developed lands is also required. This structure is a steel frame structure, with single skin steel corrugated sheeting, and measures 6.9m wide by 19.3m long. Waste arising from the demolition of this lean to structure will be recycled were possible.

ii. *Construction*

Typical waste materials arise from site management practices during the construction phases, for example, excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase.

Summary of Construction Phase Impacts

In terms of the overall impact of the construction stage of the scheme there is the potential to have a minor adverse effect due to the increase in waste being generated and the potential for this waste to be sent to landfill over a short-term duration, however the intention will be to achieve high diversion from landfill through reuse, recycling and recovery throughout the construction phase for both the Jetty Extension and the Durnish Lands Development.   Operational Phase Impacts

Jetty Extension

The Port of Foynes harbour provides the interface to the land waste management and disposal system for ships and boats. Operational waste from vessels, if not properly managed, could potentially end up in the sea where the potential for contamination or pollution occurs. Waste management at the port is currently operated to best practice guidance and in accordance with the SOPs set on the in Waste Management Plan 2018 for the facility.

It is imperative that the current port waste management strategy, policies and procedures consider any additional waste that may arise. The current systems may require revision in order to reflect the potential for potential upscale in operational waste arisings coming from ship generated waste and cargo residues. Therefore in terms of the overall impact of the works on the operational phase the scheme has the potential to have a **moderate adverse effect** to the anticipated slight increase in waste sent to landfill.

Durnish Lands Development

The developed lands will be used for open storage and warehousing, and will be used primarily for the handling and storage of general cargo. In addition, the lands will also be used for portcentric processing operations such as bulk raw material being graded, mixed or sorted before being bagged or put into tankers. The following facilities are anticipated (all phases of development):

- Warehousing (up to 15m height)
- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc (stored 10m high)
- Loose cargoes such as woodchip biomass fuel (stored 6m high)
- Storage of containers (3nr high) approx. 13m high with handling equipment up to 24m height
- Open storage: Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high), Loose cargoes such as woodchip biomass fuel (stored 6m high), Scrap metal (stored 8m high), Storage of containers (3nr high) approx. 13m high with handling equipment up to 24m height
- Covered storage: Warehousing (up to 20m height) and storage tanks (up to 15m height)

Materials handled will vary depending on trade requirements but the following is anticipated;

- Construction materials including timber, steel sections reinforcement etc.
- scrap metal

- Project cargoes such as wind turbine components, steel pipes etc.
- All types of dry and liquid bulk cargoes
- Storage of containers

It is noted that the development at the Durnish Lands may be progressed in a series of phases as described in Chapter 2. In order to ensure an effective and conclusive environmental assessment consistent with best practise, the assessment of potential effects on waste arising from the physical characteristics of the proposed scheme (for which planning permission is sought), and also; the collective cumulative effects of the overall development scheme for the Durnish lands if all development phases were implemented has been considered. The examination of the 'all phase' development scenario for Durnish is consistent with best practice in order to examine a 'worst-case' scenario of the project effects.

Mitigation Measures

In order to mitigate against the potential impacts that the proposed development could have on the production of waste during each phase, mitigation measures will be put in place to ensure that all waste is dealt with in a sustainable and legislatively compliant manner. These measures are set out below for the various phases of the development.

Construction Phase

Duty of Care
Contractors working on site during the works will have a duty of care and be responsible for the collection, control and disposal of all wastes generated by the works. SFPC and their appointed contractor will ensure that all waste materials leaving the site will be transported via road via a registered and licensed carrier and arrive at a licensed / permitted site. Waste will only be disposed or recovered through licenced operators and in accordance with national waste legislation.

Construction Environmental Management Plan (CEMP)
Construction waste will be managed as part of the CEMP, which will be implemented by the appointed contractors for the duration of the construction works. The CEMP will contain procedures for the management of waste and related pollution control measure. The CEMP will be a live document and will be subject to revision throughout the course of the construction phase. The plan will include specific details on the projected waste types and subsequent management. It should identify and capture the decisions made in the design process to reduce waste generation; identify the methodologies for waste management at each stage of the project. Other specific waste management requirements will include:

a) Identify how the waste will be dealt with (i.e. disposal, re-use on/off site etc.); and,
b) Identify potential end markets e.g. reuse, recycling facilities, waste treatment facilities and disposal sites.
c) On-site segregation of inert waste materials into appropriate categories
d) On-site segregation of non-hazardous waste materials into appropriate categories, where possible, including:
    i. Metals;
    ii. Timber

e) On-site segregation of any hazardous waste materials into appropriate categories including:
   i. Any contaminated soils;
   ii. Waste oil and fuels; and
   iii. Paints, glues, adhesives and other known hazardous substances.

f) Control measures and attention to materials quantity requirements to avoid over-ordering and generation of waste materials.

g) Agreements with materials suppliers to reduce the amount of packaging or to participate in a packaging take-back scheme.

h) Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of the damage and disposal as waste.

i) Segregation of waste at source where practical

j) All waste materials will be stored in skips or other suitable receptacles in designated areas of the site. The waste storage area(s) will be assigned and all construction staff provided with training regarding the waste management procedures on commencement of the project.

k) Measures to ensure appropriate staff training and levels of awareness in relation to waste management.

l) Measures and procedures to monitor waste flows on site.

m) All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available.

n) Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities.

o) Measures to ensure monitoring and updating of records under Duty of Care requirements.

p) Reuse and recycling of materials off-site where reuse on site is not practical.

q) Provide a method to calculate the difference between expected waste quantities prior to commencement of the project and actual waste quantities after the project is complete;

r) Assist with providing a complete audit trail;

Reuse of Demolished Material on Site
In order to divert waste from landfill, possibilities for reuse of inert demolition material as fill on site will be considered, following appropriate testing to ensure materials are suitable for their proposed end purpose. This demolished material will be concrete from the existing deck structures and will be approximately 130m^3 of material. Should there be no suitable reuse option on site this material will be removed off-site for disposal.

Operational Phase

Waste Management Plan
The current Waste Management Plan underpins all waste related operations at Port of Foynes. SFPC will continue to review and implement any required changes in this port waste management plan in order to avoid and minimise the potential effects of ship and boat generated wastes once the jetty extension and warehousing and storage facilities are operational. SFPC will continue to provide adequate reception facilities and remove, as far as is practicable, any disincentives to landing waste

in the port. SFPC will continue to encourage the responsible management of waste, including minimisation and recycling, at the point of generation on ships, reception in ports/harbours, transportation and disposal, and ensure that port and harbour employees and users dispose of wastes responsibly in facilities provided.

Cumulative Impacts

There are no anticipated cumulative impacts associated with waste management predicted as a result of the proposed development. There are a range of suitable permitted waste sites with capacity to accommodate waste arisings from the proposed development.

Residual Impact

Construction Phase
A carefully planned approach to waste management and adherence to the CEMP and SWMP during the construction and installation phase will ensure that the impact on the environmental will be neutral, short term and imperceptible. There is significant available capacity within the existing waste management infrastructure in the Region to manage C, D and E waste from the proposed development works. Therefore the effect of the operational phase in relation to waste management is deemed as neutral.

Operational Phase
From a waste management point of view the site will return to the baseline situation as it is anticipated that due to recycling and reuse policies, procedures and the implementation of the Waste Management Plan. While there may be a minor increase in waste arisings there will be no discernible effects to waste management once operational. Therefore the effect of the operational phase in relation to waste management is deemed as neutral.

	Receptor	**Predicted Effect**	**Adverse/ Beneficial**	**Permanent/ Temporary**	**Mitigation Measures**	**Residual Effect**
Construction Phase	Environment	Minor	Adverse	Temporary	See section 8.2.6	Neutral
Operational Phase	Environment	Moderate	Adverse	Permanent	See section 8.2.6	Neutral

Conclusions

By implementing the mitigation measures set out in this Chapter and by managing wastes in accordance with the waste management hierarchy and best practice guidance, and the Waste Management Plan, wastes generated during the distinct phases of the works the proposed development will have no adverse effect on waste management in the area.

It is concluded that the capacity extension at Shannon Foynes, which includes the safe and proper management of waste streams will have a neutral effect on the environment in relation to waste management.

9 WATER QUALITY & FLOOD RISK ASSESSMENT

9.1 WATER QUALITY

Introduction

This section assesses the potential impact of the proposed development on water quality within the receiving environment. The assessment is based on the project description detailed in Chapter 2. Existing water quality in the vicinity of the proposed development is established based on available water quality information, the likelihood for significant negative impacts on water quality is determined and mitigation measures to reduce impacts are proposed, where necessary.

9.1.1 Assessment methodology

Baseline water quality within the receiving environment has been established through review of monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD). An assessment has then been made of the proposed capacity extension at Shannon Foynes to determine the likelihood for significant negative impacts on water quality using criteria for rating significance as set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008). Mitigation measures are proposed to reduce impacts, where appropriate, to enable an assessment to be made of any residual impact as a result of the construction and operational phases of the proposed development.

9.1.1.1 Criteria for Rating Impact Significance

In order to estimate the magnitude of the impact on the water environment in the vicinity of the proposed capacity extension at Shannon Foynes, the criteria for rating significance set out in the NRA Guidelines 2008 has been used in the assessment. This rating is based on a series of criteria which determines both negative and positive impacts associated with the proposed development. Table 9.1 provides a summary of the criteria for rating the significance of the impact as presented in the NRA Guidelines (NRA, 2008).

Table 9.1 Criteria for Rating Impact Significance (based on the NRA, 2008)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat.
		Increase in predicted peak flood level >100mm.
		Extensive loss of fishery
		Extensive reduction in amenity value
		Potential high risk of pollution to water body from routine run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm
		Partial loss of fishery
		Potential medium risk of pollution to water body from routine run-off
		Partial reduction in amenity value

Magnitude of Impact	Criteria	Typical Examples
Minor Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm Minor loss of fishery Potential low risk of pollution to water body from routine run-off Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level Negligible loss of amenity value Negligible loss of fishery

9.1.1.2 Rating of Significance of Environmental Impacts

The impact significance and assessment of the potential environmental impacts of each component of the proposed development has been made based on the matrix presented in Table 9.2.

Table 9.2 Rating of Environmental Impacts (derived from NRA, 2008)

		Magnitude of Impact			
		Negligible	**Minor**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant / moderate	Profound / severe	Profound
	Very High	Imperceptible	Moderate	Significant	severe
	High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

9.1.1.3 Consultation

The assessment has been informed by the consultation process described in Chapter 4.

Statutory Consultees

Consultations were undertaken with relevant stakeholders for the proposed development in October 2017 in order to inform the baseline and to establish the scope for the assessment of impacts. At that time the project included reclamation of foreshore to the landward side of the proposed East Jetty extension linking the East Jetty to West Quay. It was envisaged that this work would be undertaken similar to the permitted development on the adjoining site to the east. Since that time, the project works have evolved and further developed such that it is no longer proposed to advance with the reclamation element of the development proposal. A full list of the statutory and non statutory organisations consulted is detailed in Chapter 4 and Appendix 4.1. Responses relevant to water quality were received from Clare County Council and Bord Iascaigh Mhara (BIM).

Clare County Council

Clare County Council has recommended that due consideration is given to the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary. The development proposal is located within a Strategic Development Location for Marine Related Industry identified within the SIFP which has been adopted into the Limerick City & County Development Plan.

The SIFP sets out overarching mitigation measures which must be adhered to as set out in its Strategic Environmental Assessment (SEA) and Natura Impact Report (NIR).

- Overarching mitigation measures included in the SEA Environmental Report (SEA ER) (Table 11.2 - Measures W MM1 – W MM5) and the NIR (Table 6.1 W MM 27- W MM 30)
- Mitigation Measures for Marine Related Industry (Section 6.2.1 of the NIR), in particular, to consider dredging and potential hydromorphological impacts on associated water bodies.
- Site specific mitigation measures for the "*Lands to the Rear of Foynes Port*", as per Table 3.24 of the NIR for the relevant qualifying interests and Table 11.3 of the SEA ER relating to W MM 9 which requires mitigation measures to address the potential for affected water bodies to achieve the Environmental Objectives as per Article 4 (1) of the WFD.

Bord Iascaigh Mhara (BIM)

BIM highlighted that there are a number of licensed aquaculture sites within the Foynes Estuary, some of which are close to the proposed development. Licenced shellfish are designated under SI No. 268 of 2006 European Communities (Quality of Shellfish Waters) Regulations 2006 and the proposed works should therefore adhere to the provisions of this instrument and in particular the need to ensure that the background levels of suspended solids are not increased by more than 30%. To this end BIM recommend that an in-situ continuous monitoring programme is established to ensure compliance with the suspended solids limits.

EPA and WFD Datasets

A number of EPA resources and datasets were consulted including the 'Catchments.ie' website, an online EPA resource, to ensure the most current baseline for water quality status, pressure assessment and water body characterisation was being used.

Public Consultation

Two separate public consultation events were held in Foynes on the 22nd November 2017 and on the 14th March 2018 in Foynes Community Centre and the Harbour Offices respectively to illicit the views of those who live, work or have an interest in the area. The key area for concern in relation to water quality was the potential siltation within the Foynes Harbour area as a result of the proposed development.

The assessment was also informed by the results of the Coastal Processes assessment described in Chapter 12 in the context of potential hydromorphology impact and the potential for alterations in the hydrodynamic regime to impact on water quality and WFD status.

9.1.2 Receiving water environment

9.1.2.1 Study Area Water Bodies

The study area is presented in Figure 9.1. The proposed development lies within two water bodies as depicted by Ireland's River Basin Management Plans which implement the EU Water Framework Directive (WFD):

- Foynes Harbour Transitional water body (IE_SH_060_0350).

  Foynes Harbour Transitional water body is relatively small with an area of circa 1.98km^2. This water body was identified as a Heavily Modified Water Body within the Shannon River Basin Management Plan 2009-2015 due to the presence of Foynes Port.

- Foynes_010 river water body

  The Foynes_010 river water body is also relatively small with an entire river length of 12.27 km. It is a coastal inter-basin sub-catchment (small water body discharging directly into a marine water body).

The proposed development lies adjacent to the Lower Shannon Estuary (IE_SH_060_0300) transitional water body which flows into the mouth of the Shannon coastal water body (IE_SH_060_0000). The lower Shannon Estuary is a large monitored water body and covers an area of approximately 127.45 km^2.

These water bodies are within the Shannon Estuary South Catchment (Hydrometric Area No. 24) which is within the South Western Region of the Irish River Basin District.

The Foynes Harbour and Lower Shannon Estuary transitional water bodies and the Foynes_010 river water body must achieve the core environmental objectives outlined in Article 4(1) of the WFD including the achievement of water related objectives for designated protected areas. These objectives include:

Surface Waters

- To prevent deterioration of the status of surface waters;
- To protect, enhance and restore surface waters with the aim of achieving good status (ecological and chemical) for all water bodies;
- For heavily modified water bodies (including Foynes Harbour Transitional water body), the aim is to protect and enhance those bodies to achieve good ecological potential and good chemical status;
- To progressively reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances into surface waters.

Protected Areas

- To achieve compliance with objectives and standards under which the individual protected areas have been established.

Foynes Harbour and the Lower Shannon Estuary transitional water bodies are considered to be features of extremely high sensitivity within the assessment based on the evaluation of significance set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008). The significance of the water bodies are deemed extremely high as sections are protected by EU legislation, i.e. Natura 2000 sites (European Sites) designated under the Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC).

The Foynes_010 river water body is considered to be of medium sensitivity within the assessment.

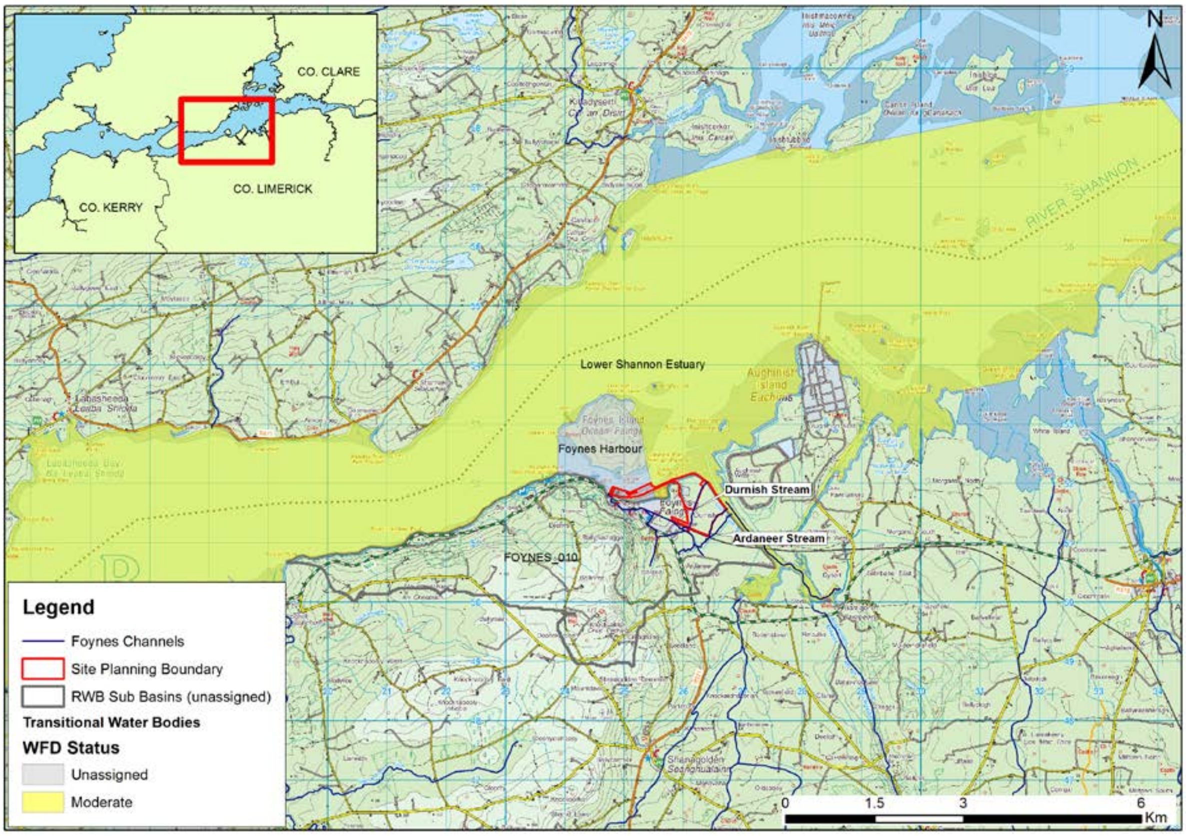


Figure 9.1 Site Location in the Context of the Wider Surface Water Environment

The proposed capacity extension at Shannon Foynes has the potential to directly affect the Foynes_010 (IE_SH_24F230770) river water body and Foynes Harbour transitional waters. It also has the potential to impact upon the adjacent Lower Shannon Estuary transitional waters.

9.1.2.2 Water Framework Directive water body status

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive), and transposing regulations, European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003), as amended by the European Communities (Water Policy) (Amendment) Regulations, 2005 and the European Union (Water Policy) Regulations 2014, establish a legal framework for the protection, improvement and sustainable management of rivers, lakes, transitional waters (estuaries), coastal waters (to a distance of one nautical mile) and groundwater.

For the purposes of monitoring and assessing the quality of surface waters, all rivers, lakes, coastal interbasins, estuaries, and coastal waters (within 1 nautical mile of the shoreline) have been divided into management units called “water bodies”. The condition of each water body must be reported to the European Commission in the form of ecological status and chemical status. For the purposes of water management these water bodies are grouped into sub-catchments, of which there are 583 nationally, which are further grouped into catchment management units of which there are 46 based on the hydrometric areas used by public authorities.

The fundamental objectives of the WFD are to maintain “high status” of waters where it exists, prevent deterioration in the existing status of waters and achieve at least “good status” in relation to all waters by the end of the current river basin management cycle (2021) unless subject to extended deadlines. A water body must achieve both good ‘ecological status’ and good ‘chemical status’ before it can be considered to be at good overall status. An assessment of the risks to the achievement of these objectives for water bodies has been undertaken by the EPA through the extensive characterisation of water bodies and the key pressures acting upon them. This will allow the development of a programme of measures to allow the achievement of the WFD objectives.

The Programme of Measures (POMs) outlines the steps that will be taken to meet WFD objectives as applicable to each water body. This Programme is contained within an overarching River Basin Management Plan (RBMP). These measures will require implementation at a strategic level but also on regional and local level through the establishment of Regional Integrated Catchment Management Programme.

Environmental Quality Standards (EQSs) for classifying surface water status are established in the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (SI No. 272 of 2009). These regulations set standards for biological quality elements, physico-chemical conditions supporting biological elements (including general conditions and specific pollutants), priority substances and priority hazardous substances.

The ‘ecological status’ of a water body is established according to compliance with the EQSs for biological quality elements, physico-chemical conditions supporting biological elements and relevant pollutants (Figure 9.2). The ‘chemical status’ of a water body is established according to compliance with the EQSs for priority substances and priority hazardous substances (SI No. 272 of 2009).

In order to establish the WFD status of water bodies, the EPA developed a new, WFD-compliant monitoring programme which began in 2006. Interim status classifications were published in 2009 based on monitoring information collected between 2006 and 2008. Final status classifications, based on the results of the latest monitoring cycle, i.e. 2012 to 2015, are available on the EPA WFD APP.

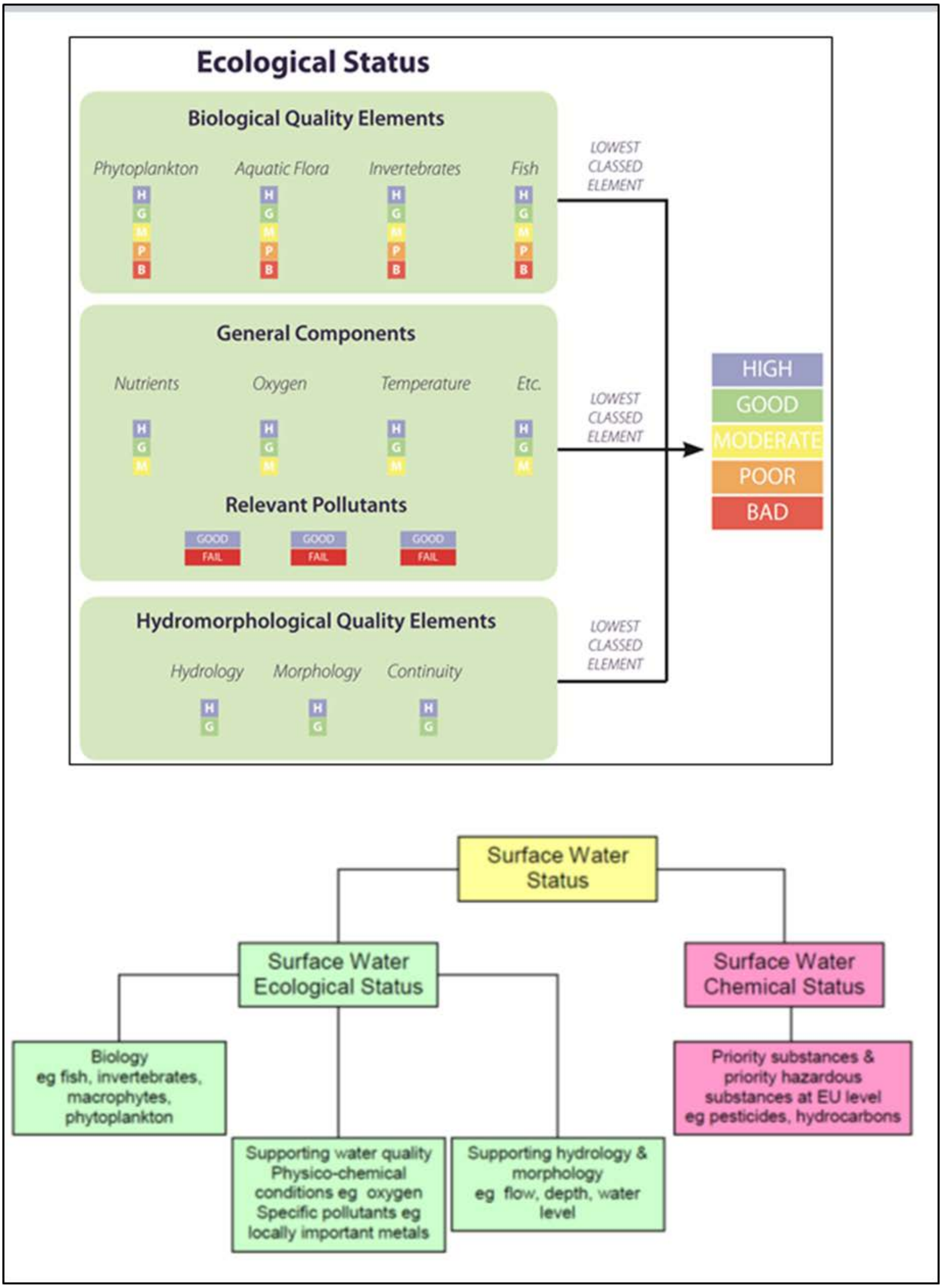


Figure 9.2 Elements of WFD status

As well as achieving good ecological and chemical status, a water body must achieve compliance with standards and objectives specified for protected areas, which include areas designated by the Bathing Water Directive; the Urban Waste Water Treatment Directive; the Shellfish Waters Directive; the Habitats Directive and the Birds Directive. Waters bodies that are compliant with WFD standards, but that contain protected areas that are non-compliant with protected area standards are downgraded to 'less than good' status.

WFD status classifications apply at the water body scale and are based on several samples/surveys targeting the variety of parameters, including biological, physico-chemical, chemical and hydromorphological elements, required to establish WFD status.

The status classification of transitional and coastal water bodies is primarily based on information and data collected by the EPA, Marine Institute and Inland Fisheries Ireland. In addition, assessments of the conservation status of protected areas carried out by NPWS were also taken into account. The WFD status classifications for the water bodies potentially affected by the capacity extension are included in Figure 9.3.

The Foynes Harbour transitional water body is not monitored in the WFD monitoring programme and therefore the WFD status remains unassigned. The WFD Characterisation process has established that this water body is at risk of failing to achieve the WFD objectives and therefore is under review as part of the current monitoring programme review, for additional monitoring and assessment to confirm the water quality issues and identify appropriate measures.

The Foynes_010 (IE_SH_24F230770) river water body is also unassigned for both its surface water status but also the risk to the achievement of the WFD objectives as there is currently no monitoring information available for this water body. Under the WFD characterisation the action is to retain this water body under review until the significant pressures in the downstream water bodies i.e. Foynes Harbour and Lower Shannon Estuary are better understood.

In the previous WFD monitoring cycle (2007-2009) the Lower Shannon Estuary water body achieved 'high' or 'good' status in relation to all of the physico-chemical and biological parameters and was compliant with the standards established in the Habitats and Birds Directives. However, it failed chemical status, and therefore its status was downgraded to 'moderate'. In the most recent monitoring programme the Lower Shannon Estuary water body achieved 'high' or 'good' status in relation to all of the physico-chemical and chemical parameters and is compliant with the standards established in the Habitats and Birds Directives. However biological conditions only achieved a moderate scoring, and therefore the water body is assigned a status of 'moderate' (see Table 9.3).

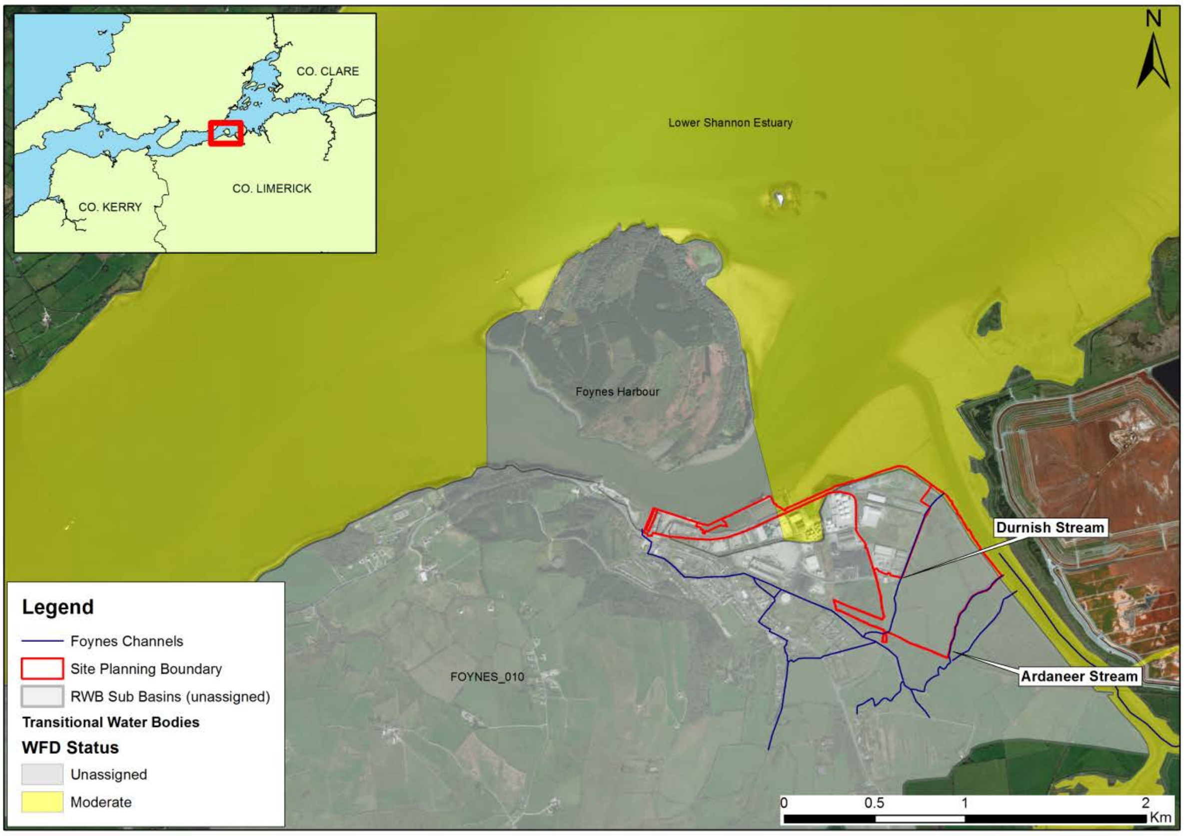


Figure 9.3 Water Framework Directive water body status

Table 9.3 Individual WFD Status Elements

Status Element	Foynes (transitional & river water bodies)	Lower Shannon Estuary (transitional water body)
ECOLOGICAL STATUS OR POTENTIAL	Unassigned	Moderate
Biological Status or Potential		Moderate
Phytoplankton Status or Potential		High
Invertebrate Status or Potential		Good
Fish Status or Potential		Moderate
Hydromorphological Conditions		Good
Supporting Chemistry Conditions		Good
General Conditions		Good
Oxygenation Conditions		High
Dissolved Oxygen (% Sat)		High
Other determinand for oxygenation conditions		High
Nutrient Conditions		Good
Other determinand for nutrient conditions		High
Phosphorous Conditions		Good
Orthophosphate		Good
Specific Pollutant Conditions		Pass
CHEMICAL SURFACE WATER STATUS		Good

The Lower Shannon Estuary water body has not been prioritised as an area for action for the second River Basin Management Cycle as published in the Final River Basin Management Plan (2018-2021) (DHPLG, 2018). The EPA has determined that the water body is at risk from nutrients (orthophosphate) and further investigations into chemical pollution are required. For this reason targeted measures to address the pressures causing a status classification of 'less than good' will be undertaken in the third cycle RBMP, however the measures required to ensure compliance with existing legislation will be implemented during this river basin management cycle.

Whilst the Lower Shannon Estuary, Foynes Harbour and Foynes_010 water bodies are not identified as areas for action under the second cycle RBMP, it will be necessary to ensure that the proposed development does not prevent the achievement of the WFD objectives for these water bodies in subsequent RBMP cycles. The water quality assessment therefore needs to demonstrate that the proposed development will not cause a deterioration in the status or prevent the improvement in status where necessary under the environmental objectives of the WFD.

9.1.2.3 EPA Water Quality Report 2010-2012

The EPA Water Quality Report 2010-2012 was published in 2015 and presents a review of Irish ambient water quality for the years 2010 to 2012. The water quality information in relation to transitional and coastal waters outlined in the report was generated by the EPA as well as other organisations including the Marine Institute, Inland Fisheries Ireland (IFI), the Sea Fisheries Protection Authority (SFPA), the Irish Coast Guard and the Radiological Protection Institute of Ireland (RPII).

Trophic status

The trophic status of transitional and coastal water bodies is assessed using the EPA's Trophic Status Assessment Scheme (TSAS). This assessment is required for the Urban Waste Water Treatment Directive and Nitrates Directive. The scheme compares the compliance of individual parameters against a set of criteria indicative of trophic state (Dissolved Inorganic Nitrogen (DIN), Molybdate Reactive Phosphorus (MRP), chlorophyll, macroalgae, dissolved oxygen). These criteria fall into three different categories which broadly capture the cause-effect relationship of the eutrophication process, namely nutrient enrichment, accelerated plant growth, and disturbance to the level of dissolved oxygen normally present;

- Eutrophic water bodies are those in which criteria in each of the categories are breached, i.e. where elevated nutrient concentrations, accelerated growth of plants and undesirable water quality disturbance occur simultaneously;
- Potentially Eutrophic water bodies are those in which criteria in two of the categories are breached and the third falls within 15 per cent of the relevant threshold value;
- Intermediate status water bodies are those which breach one or two of the criteria;
- Unpolluted water bodies are those which do not breach any of the criteria in any category.

The Lower Shannon Estuary water body is classed as unpolluted in the most recent water quality report and was also unpolluted in the previous two reports dating back to 2004.

Nitrogen levels

Levels of Dissolved Inorganic Nitrogen (DIN) are monitored in winter, when levels are expected to be at their seasonal maximum due to the absence of any significant plant or algal growth, and in the summer, to capture the potential effect of seasonal changes in river flow which can have an effect on concentrations. Each water body is assessed against salinity-related thresholds and the WFD EQS for DIN. The Lower Shannon Estuary water body was compliant with both.

Phosphorus levels

Levels of Molybdate Reactive Phosphorus (MRP) are monitored in winter, when levels are expected to be at their seasonal maximum due to the absence of any significant plant or algal growth, and in the summer, to capture the potential effect of seasonal changes in river flow which can result in higher phosphate concentrations in some estuaries.

Each water body is assessed against salinity-related assessment levels and the WFD EQS for MRP. The Lower Shannon Estuary water body was compliant with both.

Dissolved oxygen levels

Low levels of Dissolved Oxygen (DO) can have adverse effects on aquatic organisms including slower growth rates, impaired immune response and, in severe cases, mortality. DO levels are classified as follows:

- Anoxic (0 - 0.5 mg l-1)
- Hypoxic (0.5 – 2.0 mg l-1)
- Deficient (2.0 – 6.0 mg l-1)
- Sufficient (6.0 – 10.0 mg l-1)

The Lower Shannon Estuary water body is classified as sufficient.

Biochemical Oxygen Demand

Biolochemical Oxygen Demand (BOD) was compared with the WFD EQS for BOD. The Lower Shannon Estuary water body was compliant with the EQS.

Oil pollution incidents

There were no oil pollution incidents recorded in the Lower Shannon Estuary during the most recent monitoring cycle.

9.1.2.4 Protected Areas

A significant proportion of waters in the Shannon catchment are protected under existing EU legislation requiring special protection due to their sensitivity to pollution or their particular economic, social or environmental importance. All of the areas requiring special protection in the Irish River Basin

District have been identified by EPA, then mapped and listed in a register of protected areas (required under Article 5 of the WFD Directive). The register of protected areas includes:

- Drinking Water Areas;
- Economically Significant Waters;
- Recreational Waters;
- Nutrient Sensitive Areas;
- SPAs; and
- SACs

The portion of the works area concerned with the jetty extension and associated infrastructure is located within the Lower River Shannon Special Area of Conservation (SAC) and the River Shannon and River Fergus Estuary Special Protection Area (SPA):

The portion of the works area concerned with the development of lands at Durnish and associated infrastructure is located adjacent to the Lower River Shannon SAC and the River Shannon and River Fergus Estuary SPA.

- SAC – Lower River Shannon SAC (SAC site code: 002165);
- SPA – River Shannon and River Fergus Estuaries SPA (SPA side code: 004077).

Foynes Harbour and the Lower Shannon Estuary water bodies must achieve the water quality standards for these areas in accordance with the Habitats and Birds Directives.

The closest designated shellfish waters are West Shannon Ballylongford and West Shannon Poulnasharry Bay which are located more than 20 kilometres from the works area. However there are licence shellfish areas in the area, the closest of which is 4 kilometres away at Poularone Creek. There are no nutrient sensitive areas, drinking (surface) water areas or designated bathing waters in the vicinity of the works area.

These protected areas have their own monitoring and assessment requirements to determine their condition. They are often assessed for additional pollutants or requirements relevant to their designation. It is pertinent to ensure the proposed development will not cause a deterioration in the existing protected area status or the ability of these areas to achieve their environmental objectives.

9.1.2.5 Overall water body status

The available monitoring information for the water bodies in the immediate vicinity of the Project (i.e. the Lower Shannon Estuary water body) indicates that:

- the overall WFD status of the water bodies is 'moderate' due to biological elements, i.e. fish. All other contributing elements, including chemical surface water status and hydromorphological conditions are classified as good or better;
- tropic status is 'unpolluted';
- dissolved oxygen levels are satisfactory and capable of supporting nearly all forms of aquatic life; and

- the level of oxygen demand in the water body is acceptable.

9.1.2.6 Marine Strategy Framework Directive environmental status

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) was formally adopted by the European Union in June 2008 and is transposed into Irish law by the European Communities (Marine Strategy Framework) Regulations, 2011 (SI No. 249 of 2011). The overarching aim of the Directive is to protect Europe's marine waters by applying an ecosystem-based approach to the management of human activities while enabling the sustainable use of the marine environment for present and future generations. The Directive establishes a legal framework for the development of marine strategies designed to achieve Good Environmental Status (GES) in the marine environment by the year 2020. The marine strategy involves defining GES, setting environmental targets and indicators, implementing monitoring programmes for ongoing assessment, and developing and implementing programmes of measures to achieve or maintain GES.

GES is defined as '*the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations*'.

The assessment of GES is undertaken by reference to 11 qualitative descriptors which define overarching objectives in respect of key socio-economic or ecological aspects of the marine environment. These specifically require the consideration of the following:

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

To date, an Initial Assessment (constituting a comprehensive review of the physical, chemical and biological characteristics of the marine area, as well as the human pressures acting upon it) has been undertaken (DEHLG 2013)). A comprehensive set of environmental targets and associated indicators is under development. These will be used to demonstrate that GES has been achieved or is being maintained in accordance with the objectives of the MSFD. A monitoring programme will be established by the Department of Housing, Planning and Local Government and the Marine Institute to identify measures which will need to be taken in order to achieve or maintain GES in marine waters. To date, GES has not been established for individual water bodies.

9.1.3 Likelihood of impacts

9.1.3.1 Construction phase impacts

It is noted that the development at the Durnish Lands may be progressed in a series of phases as described in Chapter 2. In order to ensure an effective and conclusive environmental assessment consistent with best practise, the assessment of potential effects on water quality examines the effects arising from the physical characteristics of the proposed scheme (for which planning permission is sought), and also; the collective cumulative effects of the overall development scheme for the Durnish lands if all development phases were implemented. The examination of the 'all phase' development scenario for Durnish is consistent with best practice in order to examine a 'worst-case' scenario of the project effects. A phased construction would result in a lower construction impact, albeit over a longer timeframe.

Temporary impacts on water quality have the potential to occur during the construction phase of the works. Pollution from mobilised suspended sediment and cement are of prime concern.

- Increased suspended sediment levels due to topsoil stripping at Durnish as well as piling and demolition works in Foynes Harbour;
- Release of highly alkaline contaminants from concrete and cement during open piled jetty construction;
- Sedimentation due to settling of suspended silt;
- Herbicides used to control existing vegetation on Durnish lands immediately prior to site clearance and topsoil stripping;
- Water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages /spillages of fuels, oils, other chemicals and waste water, controlled discharges under licence).

The impacts in regards to construction of each component of works are assessed in Section 9.1.4 in sequence. For the purpose of this assessment the construction of quay furniture, safety equipment, security and fencing, mechanical and electrical services etc. are not deemed to pose significant affect to water quality and will be assessed together under general construction.

9.1.3.2 Operational phase impacts

A noted earlier, the development at the Durnish Lands may be progressed in a series of phases as described in Chapter 2. A 'worst-case' scenario of the project operational effects has been examined whereby an assessment is made of the effects arising from the physical characteristics of the proposed scheme (for which planning permission is sought), and also; the collective cumulative effects of the overall development scheme for the Durnish lands if all development phases were implemented.

Operational phase impacts are associated with normal port operations whilst dealing with continued growth. The nature of the development is intended to invite more business/ traffic through the port and therefore increasing the risk of potential impacts to the water environment. These include potential impacts from:

- Additional welfare facilities foul water and storm water drainage;
- Discharges from vessels using the port (ballast water, wastewater, oil spillages, fuel bunkering);
- Discharges from cargo handling operations (leakages from containers, bulk material spillages, losses from conveyor systems);
- Discharges from cargo storage areas and onward transportation (losses from hoppers, flat bulk stores and HGVs).and
- Discharges from potential port-centric processing operations such as bulk raw material being graded, mixed or sorted before being bagged or put into tankers.

9.1.3.3 Impact matrix

The impacts described above are rated in accordance to their severity (major, moderate, minor and neutral) in the absence of any mitigation (Table 9.4).

Table 9.4 Impact matrix (in the absence of mitigation)

	Rating of environmental Impact	
CONSTRUCTION PHASE	**East Jetty Extension**	**Durnish Land Development**
Suspended sediments / Sedimentation	Moderate	Moderate/Significant
Concrete and Cement pollution	Significant	Significant
Oil and Chemicals (including Herbicides)	Significant	Severe
Hydromorphological Impacts	Negligible	Slight
OPERATIONAL PHASE		
Maintenance	Negligible	Negligible
Oil and Chemicals	Significant	Significant
Foul and Storm Water Drainage	Moderate to Significant	Moderate to Significant
Cargo handling and storage	Moderate to significant	Moderate to significant
Road Improvements	Neutral	Neutral

9.1.4 Description of significant impacts

9.1.4.1 Construction Phase Impacts

Suspended Sediment and Sedimentation

East Jetty Extension

The removal of the existing small craft landing pontoon and the localised demolition of the East Jetty (western side) and West Quay (eastern side) is required at Foynes Harbour to accommodate the construction of the East Jetty extension. Although relatively small scale, demolition works within or in close proximity to the water column have the potential to release fine sediments into the water column. The installation of piles may also cause temporary localised increases in suspended sediment during construction. Demolition processes, impact piling and physical disturbance to an area within the intertidal area may result in a temporary increase in suspended sediment levels and therefore the potential to impact the marine environment.

The proposed jetty extension is to be constructed as an open piled structure to allow tidal circulation to continue therefore the impacts to tidal currents and coastal processes have been minimised within the design stage of the project. Changes in tidal currents are restricted to the immediate vicinity of the structure and limited to less that 10mm/s as outlined in Chapter 12 which concludes that the installation of the additional piles to facilitate the jetty extension will have very little effect on tidal currents and therefore negligible impact on coastal processes. Based on the limited impact on the coastal process and the relatively low physical disturbance of sediment within the works area the magnitude of the impact from suspended sediment is assessed to be a localised minor risk to water quality and the WFD status and objectives, the rating of the environmental impact is therefore moderate adverse in the absence of mitigation based on the extremely high sensitivity of the receiving environment over the short term.

Lands at Durnish

The impact of the construction activities such as topsoil stripping, stockpiling, infilling at the existing green-field site at Durnish and the construction of road infrastructure, pathways and warehousing units could potentially result in an increase in suspended sediments concentrations in run-off from the site.

Suspended sediment due to run off from stripped construction areas, infilling and excavations can have a severe negative impact on water quality, water dependant habitats and aquatic ecology. This is particularly true in sloping areas with underlying clay following topsoil stripping. In areas of moderate to high rainfall, the potential problems are clearly exacerbated. If allowed to enter surface watercourses this run off can give rise to high suspended solids and detrimental impacts, in particular to fisheries.

There are two watercourses which traverse the site which could provide a direct pathway to the Shannon Estuary from the Durnish site, these are the Durnish Stream and Ardaneer Stream as illustrated in Figure 9.1. There are currently clay embankments forming a barrier between the site and the Robertstown Estuary and ultimately the Lower Shannon Estuary and therefore these watercourses represent the key pathway for pollutants to the Lower Shannon Estuary.

The design of the scheme has been undertaken with sympathetic boundary treatment and the need to retain a minimum buffer strip of 5 metres adjacent to the water courses to allow OPW access for drainage maintenance. The boundary treatment along the Ardaneer Stream and the OPW drainage channel behind the clay embankments along the Robertstown Estuary allow a minimum buffer zone of 10 metres (20 metre maximum) with riparian planting whilst the need to retain access to the Durnish Stream for OPW maintenance ensures a minimum of 5 metre buffer between the topsoil stripping and infilling area of the development lands. The topsoil will be used in the creation of the berms for the boundary treatment immediately after it has been removed and therefore there will be no requirement for stockpiling of material that could be a source of suspended solids.

The magnitude of the potential impacts arising from sediment from construction at Durnish entering the aquatic environment are considered to be minor adverse with regard to localised water quality and the wider transitional water body. Based on the rating of environmental impacts as presented in Table 9.2 the magnitude of the impact, in the absence of mitigation, is considered to be minor adverse in the immediate area and, due to the presence of Natura network sites in the downstream Lower Shannon Estuary, the rating of the impact is moderate in the context of that water body, water quality and WFD Status and objectives.

Phasing of the development

There is the potential that the development of the lands at Durnish could be undertaken in a phased manner. As described in Chapter 2 the phasing would be undertaken in three phases. The first phase would represent the most significant portion of the work and the greatest risk for suspended solids generation given the entire site would be top soil stripped with immediate re-use in boundary treatment as outlined in Chapter 2 and detailed in planning drawing "1773.5.01-Proposed Boundary Treatments". All the lands would be raised to the development level and the provision of surface water drainage and boundary treatment will be provided. There is the potential that a number of sub phases would be implemented in phase 1 meaning that the sublayer across the extent of the phase 2 and phase 3 lands could potentially be exposed for a longer periods of time over a 10 year development programme. Where this is the case the exposed lands would be seeded with a suitable clover mix to significantly reduce the potential for silt laden run-off from these areas. Depending on how the boundary treatment is undertaken and how quickly the buffer zones are established the magnitude of the impact is potentially moderate adverse resulting in environmental impact rating of significant for the more sensitive downstream water bodies in the absence of mitigation.

Phases 2 and 3 of the development will not result in any significant cumulative impact in the context of construction phase suspended solids as the site will have been cleared and readied for development under phases 2 and 3.

Use of Herbicides

Vegetation spaying with herbicide in advance of topsoil stripping may be required. The herbicides for potential use are Gallup Biograde Amenity or Roundup Pro Bioactive. Careless storage, handling or use of pesticides, or improper disposal of empty pesticide containers, can easily cause breaches of the legal limit for pesticides in water.

The magnitude of the potential impacts arising from herbicides entering the aquatic environment are considered to be moderate adverse with regard to water quality, given the scale of the works proposed, the distances to the aquatic zone and the fact that there are no drinking water resources likely to be impacted. Based on the matrix of environmental impact as present in Table 9.2 the rating of the impact is considered to be potentially severe in the extremely sensitive water bodies hydrologically connected to the development, in the absence of any mitigation.

The use of herbicides will only occur during Phase 1 of the development. Phases 2 and 3 will not result in any significant cumulative impact in the context of herbicide use as the site will have been cleared and readied for development during Phase 1.

Concrete and Cement Pollution

Fresh concrete and cement is highly alkaline and therefore will affect water quality (particularly in terms of pH) if washed into the water body. The extent of the impact will remain localised given the sheltered nature of the harbour where the residual current is circulatory in nature (see Chapter 12 Coastal Processes).

The impacts in relation to cement and concrete for the proposed development are, for the most part (but not limited to); the demolition of existing concrete structures; the installation of the concrete deck (to be poured in-situ) and other concrete elements of the jetty extension; the foundations for warehousing units and the construction of reinforced concrete headwalls at the crossing structures for the proposed accesses to the Durnish Lands.

It is likely that demolition processes will consist of a combination of high pressure water jetting (hydro-demolition) and localised breaking out of concrete using a rock breaker mounted on an excavator. This has the potential to create high volumes of highly alkaline dust in the absence of mitigation, which in turn could find its way into the water column and pose detriment to water quality and aquatic life.

The magnitude of the potential impacts arising from concrete / cement entering the aquatic environment are considered to be minor adverse, given the scale of the works proposed with regard to water quality. Based on the matrix of environmental impact as present in Table 9.2 the rating of the impact is considered to be potentially significant in the extremely sensitive water bodies hydrologically connected to the development, in the absence of any mitigation.

Phasing of the development

The lands at Durnish will be developed over three phases however the potential construction impacts from concrete and cement will be largely confined to the current planning application, i.e. phase 1 of the development. The greatest risk is associated with the construction of the jetty extension in the marine environment but also construction of the foundations and the fabric of the warehousing facilities and headwall construction for the culverts to facilitate access to the lands at Durnish under phase 1. The buffer zones and riparian planting established in the boundary treatment under phase 1 will serve to ensure an effective barrier for the pathway of pollutants to the water courses at Durnish. This coupled with the application of construction best practice will ensure the impact from the phase 1, and possible sub phases, of this element of the development will not change the assessment outlined above which is based on the development occurring over one construction period.

Subsequent phases will include further development of the Durnish lands to include the construction of warehousing, storage areas, roads and foul water infrastructure. The development of these lands will not have a significant cumulative effect given the establishment of effective boundary treatments and construction best practice to ensure adequate protection of surface waters from concrete and cement pollution.

Pollution from Oils and Chemicals

The proposed construction works will involve the use of plant and machinery, as well as the associated temporary storage of construction materials, oils, fuels and chemicals. During the construction phase there is the potential for accidental spillage or release of construction materials (e.g. diesel, oil, chemicals), and although the potential site compounds will not be sited immediately adjacent to the water body there is the potential for contaminants to drain into the harbour and estuary in the absence of mitigation. It is also possible that residual contaminants post-construction may be mobilised by surface run-off and washed into the harbour. The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages /spillages of fuels, oils, other chemicals and waste water) can be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels.

Given the scale of the proposal the magnitude of the impact is considered to be minor/ small adverse, however the Lower Shannon Estuary water body is considered to be of extremely high importance and based on the rating of the environmental impact presented in Table 9.2 the impact rating is assessed as potentially of moderate/ significant importance in the absence of mitigation.

Phasing of the development

The assessment above has been based on the development of phase 1 for which the current planning application relates, however phases 2 and 3 of the development to include warehousing, storage facilities, road and foul infrastructure will also be subject to the same mitigation and will not therefore have any cumulative effects on water quality.

Hydromorphological impacts

East Jetty Extension

Water bodies can be physically modified to provide beneficial human uses such as water supply, navigation, flood/coastal protection and transport. In the context of this development the new East Jetty Extension works and pontoon relocation will modify the coastline albeit over a relatively small length of coastline in terms of Foynes Harbour and the Lower Shannon Estuary. Such modifications can reduce the diversity of plant and animal communities either directly by affecting habitats or indirectly by changing natural processes.

Foynes Harbour is already currently assigned as a Heavily Modified Waterbody (HMWB) and the combined extent of the alterations to the coast line as a result of the proposed development is less than 120 metres. However these alterations coincide with sections of the coastline that have already been altered or reclaimed and therefore do not impact upon the natural coastline.

In consideration of the impact of the modification of the coastline and intertidal area through the construction of the East Jetty Extension the coastal modelling chapter (Chapter 12) has concluded that the long term impact of the jetty extension would be small scale with low magnitude changes in tidal currents at the pier locations. Chapter 12 highlights that the area behind the pier may experience circulation however this is consistent with the existing pile array associated with the east and west jetties.

On this basis the morphological impact of the development in the context of the hydromorphological conditions of Foynes Harbour as a heavily modified water body can be considered as negligible/imperceptible. The changes in the hydomorphology will not prevent Foynes Harbour or the Lower Shannon Estuary from achieving its WFD objectives.

Lands at Durnish

The development of the lands at Durnish for the most part will not have a significant impact on the hydromorphology of the Foynes_010 water body. The retention of buffer zones and boundary treatment will ensure that the riparian zone and channel will remain largely unaffected with the exception of the two access roads and crossing structures required to facilitate access to the development.

These structures are required at the central and southern access points and will be designed to the following specification:

- Southern access structure circa 12m span and 14m wide
- Central access structure circa 12m span and 14m wide

As outlined in Chapter 2 the structures will consist of a 1.2m diameter precast concrete pipe with reinforced concrete headwalls with Reno mattresses and gabion baskets to support the existing channel side slopes at both ends of the concrete pipes, positioned either side of the road crossing. However the Durnish Stream is a significantly modified channel and is canalised and overdeepended therefore the construction of these structures to facilitate access to the site will not have a significant hydromorphological impact on this heavily water course.

The raising of the lands will have the potential to reduce the connectivity of the river with the floodplain however as outlined in Section 9.2 the flooding of the Durnish lands from fluvial sources is limited, most likely given the overdeepened and canalised nature of the water course therefore the floodplain connectivity at these lands is already modified above what would be expected in a natural water course.

The potential magnitude of the hydromorphological impact at the Durnish Lands is therefore considered to be minor in a water body that is of medium sensitivity, therefore the rating of the environmental impact is considered to be slight.

Phasing of the development

The works that have the potential to impact on hydromorphology of water bodies associated with the proposed development will not be phased but rather will be undertaken at the initial stages of phase 1 of the development.

9.1.4.2 Operational Phase Impacts

Maintenance

Upon completion of construction of the port expansion and associated infrastructure, little additional measures will be required in terms of maintenance with the exception of the foul package treatment plants and storm water drainage system required to service the phased developments in the Durnish Lands. Any impact from such maintenance works associated with this new proposal can be considered negligible/imperceptible given the existing environmental management systems in place at the port.

Oil and Chemicals

Pollution from oils, diesels or chemicals is a potential impact during the operations of the new facilities. This may arise from the vehicles operating in the quays area and the developed lands at Durnish as well as directly from the ships. If vessels are being re-fuelled on site, any fuel spillages would potentially have adverse impacts on water quality in the area depending on the volumes released. Even small leaks and spills may have localised affects near the berths. Storage of chemicals or fuels and oils on-site for activities such as re-fuelling also has the potential to result in leaks or spillages which may enter directly into the adjacent water body.

Phasing of the development

The potential for impacts from oil and chemicals is relevant to all phases of the development and it will be important to ensure mitigation measures to address this pressure are implemented throughout all phases of the development to ensure that there is no potential for cumulative effects.

Given the scale of the proposal the magnitude of the impact from oil and chemical pollution is considered to be moderate, which in an extremely important water body can have a significant environmental impact rating in the absence of mitigation.

Foul water drainage

East Jetty Extension

In terms of foul sewerage, no additional facilities are required to accommodate the extension of the East Jetty.

Lands at Durnish

A foul water collection system and treatment plant will be required to accept and treat the foul water generated at the Durnish site under phase 1 of the proposed development. It will be necessary to ensure that the package plant is designed appropriately to accommodate the potential pollutant loads likely to arise from the proposed development site.

Phasing of the development

Similar package plants will be required to service the development of phase 2 and phase 3 lands at Durnish. Further details on the proposed package plants are provided in the mitigation section. Given the scale of the proposal the magnitude of the impact from foul water drainage is considered to be minor/ small adverse, which in an extremely important water body can have a moderate to significant rating in the absence of mitigation.

Storm water drainage

East Jetty Extension

As described in Chapter 2, storm water runoff from the site will be collected in the current dedicated storm water drainage system at the Port. The storm water drainage system will collect rainwater incident upon the site for discharge to the Port waters via a series of appropriate interceptors.

Lands at Durnish

Appropriate drainage infrastructure is proposed for the lands at Durnish outlined in drainage layout drawing 'M0679-RPS-00-XX-DR-PR-08'. The storm water drainage will collect rainwater incident upon the site for discharge to the existing OPW drainage channel via appropriate interceptors. Non-return valves will be fitted to the discharge outfalls in the channel. It will be necessary to ensure the storm water drainage system is designed to not only ensure the site drainage is of adequate quality prior to discharge but that the discharge rates will be commensurate with existing greenfield rates.

As outlined in Chapter 2, the operational lands proposed for phase 1 development at Durnish include the storage of:

- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc;
- Loose cargoes such as woodchip biomass fuel; and
- Containers

It will be important to ensure that the surface water drainage infrastructure is adequate to ensure the potential impacts on water quality of site run-off from these activities are addressed. Most of the storage activities highlighted above in themselves will have a relatively low risk of causing contaminated surface run-off, with storage of loose cargoes such as woodchip likely to occur under cover to ensure weatherproofing. However, vehicle maintenance areas, goods vehicle parking or vehicle manoeuvring associated with these storage activities can increase the risk of regular surface water contamination with oil and/or oil spillages and therefore the surface water drainage design will need to ensure the inclusion of appropriate oil interceptors in accordance with pollution prevention guidelines.

In addition the storage of palletised fuel and fertilisers needs to be carefully managed as damage to packaging could result in fertiliser spillage which could have implications for nutrient contamination of the surface water drainage system.

Phasing of the development

Similar storm water drainage infrastructure will be required to service the development of phase 2 and phase 3 lands at Durnish. It will be necessary to ensure that the storm water design for these later phases is designed appropriately to accommodate the potential contaminated surface run off to ensure cumulative effects of the phasing of the development will not be significant.

Given the scale of the proposal the magnitude of the potential impact from the storm water drainage is considered to be minor/ small adverse, which in an extremely important water body can have a moderate to significant rating in the absence of mitigation.

Road Improvements and increased hardstanding areas

The extent of road improvement works is relatively minor and is primarily focussed on the upgrading/improving of the existing network. The run-off has the potential to carry contaminants derived from either wear and tear of vehicles' mechanical parts, or from combustion of fuel or oil leaks. Generally the concentration of contaminants in surface water run-off from a roads scheme increases with traffic density (NRA, 2008). The road will be designed to the appropriate Transport Infrastructure Ireland standards and will include for the use of highway grade petrol/oil interceptors prior to any discharge to receiving waters via the attenuation pond. The operational impacts of which can be considered negligible/imperceptible to water quality, WFD Status and objectives.

9.1.5 Remedial & Mitigation measures

Mitigation has been incorporated within the engineering design of the proposed development to minimise its potential impact on the water environment. Most impacts to water quality posed by this project during construction and operation will be dependent on the quality of drainage and treatment of run off and foul waste before discharge to the Estuary / Harbour. Therefore it is pertinent to ensure that measures are taken to ensure existing drainage pathways are kept free from construction sediment and pollutants through the use of effective barriers to pollutant export and best practice techniques to control these pressures at source. In addition the new development areas will be serviced by appropriate foul and storm water drainage systems that effectively treat any potential pollutants generated from the operation of the development areas prior to discharge to the receiving environment.

The mitigation measures proposed are consistent with the measures listed in the SIFP SEA Environmental Report and Natura Impact assessment in terms of the general principles, mitigation for the Marine Related Industry theme and the site specific mitigation. These measures are required to ensure the WFD status does not deteriorate and the proposed development does not prevent the achievement of the Environmental Objectives for the associated water bodies, including the protected area qualifying interests for the downstream Natura 2000 network.

9.1.5.1 Construction Phase Mitigation Measures

General

The following general water quality control measures will be implemented during construction:

- Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with required permits, licenses, certificates and planning permissions;
- Existing and proposed surface water drainage and discharge points are mapped on the Drainage layout (drawing number M0679-RPS-00-XX-DR-PR-08). These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants;
- Mitigation measures will include adherence to the construction techniques and timing of works (outlined in Chapter 2) which form an integral part of the engineering design and which have been developed to minimize the impact of the project on the receiving water environment.

Mitigation measures will include the requirements for best practice and adherence to the following relevant Irish guidelines, or recognised international guidelines where Irish guidelines are not available:

- Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001);
- Guidance for Pollution Prevention series (GPP), Pollution prevention guidelines (PPGs) in relation to a variety of activities developed by the Environment Agency (EA), the Scottish Environmental Agency (SEPA) and the Northern Ireland Environment Agency (NIEA);
- Fisheries Guidelines for Local Authority Works. Department of Communications, Marine & Natural Resources, Dublin, (Anonymous, 1998);
- Guidelines on protection of fisheries habitats during construction projects (Eastern Regional Fisheries Board, 2006);
- International Convention for the Prevention of Pollution From Ships, 1973, as modified by the Protocol of 1978 (MARPOL) for domestic waste discharges to the environment;
- International Marine Organisation guidelines;
- Protecting Drinking Water from Pesticides: Advice for Farmers and Other Professional Users;
- Control of Substances Hazardous to Health (COSHH) Handling of Hazardous Materials.

Sediment Control

Based on the guidance documents listed above the following measures will be used to mitigate the impact of suspended sediments and the potential impact they can cause to associated aquatic habitats and species that exist within and adjacent to the proposed development area as outlined in Chapter 7:

- Establish vegetation as soon as practical on all areas where soil has been exposed e.g. the stripped topsoil and the exposed sub-base at Durnish shall be seeded with clover, where appropriate, to bind the material together to ensure that these areas do not provide a source of sediment;

- The construction of the berm and the boundary treatment on the Northern, Eastern, Southern boundaries and part of the Western boundary of the Durnish Lands during the early stages of the phase 1 development will ensure that an effect barrier to intercept the pathway of any potential run-off from the site to the Ardaneer Stream and Robertstown Estuary will be established at the early stages of the development as illustrated in drawing number 1773.5.01 Proposed Boundary Treatments. As outlined in Chapter 2, planting will be carried out along the slope of the berm, extending to the crest, with the width of proposed planting varying dependent upon the width of the existing boundary planting which is to be retained and "gapped up". The retention of a minimum 5 metre buffer at the Durnish Stream on the Western Boundary for OPW access to the drainage channel, should this be required for maintenance will provide a buffer along the Western boundary.

- At the site accesses, where the Durnish Stream is crossed twice, proposed culverts will be laid in both instances with bank protection using gabions and bed protection using reno mattress as illustrated in Drawings H0548-RPS-XX-00-DR-HE-510-01 Proposed Culvert Detail at Roundabout Access and H0548-RPS-XX-00-DR-HE-510-02 Proposed Culvert Detail at Secondary Access. This will ensure that bank and bed will be protected from erosion that could introduce suspended solids to these water courses;

- The infilling of the site will be undertaken using suitable infill material sourced from authorised quarries. The location of active crushed rock quarries in the vicinity of the Durnish Lands is provided in Chapter 2;

- During the construction of phase 1 at Durnish lands careful placement of the topsoil in the landscaping berms will be required. Silt fences or other suitable barrier measures will be installed where the working area for the berm treatment encroaches within 10m of a watercourse (with the exception of dedicated site access locations as illustrated on the site layout plan) and the local topography indicates there is potential for run-off to directly enter the watercourse;

- In the unlikely event that dewatering of foundations is required during construction and/or discharge of surface water from sumps, a treatment system prior to the discharge to storm water network will be used such as silt traps or settlement skips prior to discharge;

- Construction of additional capacity at the existing attenuation pond will be undertaken at an early stage in the construction programme as part of Phase 1. This measure will allow additional settlement of any suspended solids within storm water arising from the construction areas prior to discharge to the Shannon Estuary; and

- All watercourses that occur in areas proposed for site compounds and storage facilities will be fenced off to a minimum distance of 10m to reduce the risk to the aquatic environment. Appropriate sediment control measures will be installed where necessary, for example, where preferential flow paths occur, silt fencing or other suitable barriers will be used to ensure silt laden or contaminated surface runoff from the compound does not discharge directly to a water body.

Herbicide Control

The application of Herbicides will only be undertaken by trained operators who are registered under the European Communities (Sustainable Use of Pesticides) Regulations 2012. The use of trained professionals to apply the herbicides in accordance with the Sustainable Use of Pesticides Directive will ensure that the potential impact from the application of herbicides during site preparation will be minimised.

Cement & Concrete

Breaking of concrete (associated with structure demolition) has the potential to emit alkaline dust into the receiving environment. A barrier between the dust source and the sensitive receptor (the water body in this case) will be erected, where possible, to limit the possibility of dust contacting the receptor.

The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water body is carefully controlled so as to minimise the risk of any material entering the water, particularly from shuttered structures or the washing of equipment.

Concrete use and production shall adhere to control measures outlined in GPP 5: Works and maintenance in or near water (2017) particularly if on-site concrete production is proposed and careful initial siting of concrete mixing facilities is required with no production within a minimum of 10 metres from the aquatic zone.

It is noted in Chapter 2 that the concrete beams and planks supported by the tubular piles will be precast and lifted into position by crane. An in-situ concrete deck will be poured over the top of these precast units to bind all concrete elements together, using a concrete pump or concrete skips suspended from a crane. The in-situ concrete pour for the decking is likely to be located above the MHWS level however concrete placement below MHWS may be required e.g. to plug the top of piles, into the precast concrete troughs.

Where in situ stitching is required or where concrete is to be placed under water or in tidal conditions, specific fast-setting mix is required to limit segregation and washout of fine material / cement. This will normally be achieved by having either a higher than normal fines content, a higher cement content or the use of chemical admixtures.

Oils and Chemicals

The use of oils and chemicals on-site requires significant care and attention. It is important to ensure that the following procedures are followed to reduce the potential risk from oils and chemicals:

- Fuel, oil and chemical storage must be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 “Safe storage – drums and intermediate bulk containers” (Environment Agency, 2011a) shall be implemented to ensure safe storage of oils and chemicals;

- The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities” (Environment Agency, 2011b);

- SFPC has developed a Contingency Plan, which is approved by the Minister for Transport (Irish Coast Guard Section) under the Sea Pollution (Amendment) Act 1999, to address any major oil/HNS spill (or potential spill) within the Estuary. The plan is adhered to by all staff including those employed to carry out capital dredging on behalf of the Port. This plan is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master of the Port of Foynes in dealing with an accidental discharge of oil and/or Hazardous Noxious Substances (HNS). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner. This plan (Oil Spill /HNS Plan) guides SFPC staff (and other related organisations who hold a copy of the plan) through the various actions and decisions which will be required in an incident response. In the unlikely event that a major spill occurs during construction of the proposed development this contingency plan will be followed where required.

Contingency Planning

As is required for all major construction projects an environmental emergency response plan will be developed as part of the Construction Environmental Management Plan (CEMP) for the construction works and will be prepared in accordance with *PPG 21 Pollution Incident Response Planning* (Environment Agency, 2009). Whilst a major incident is highly unlikely to occur if the mitigation measures as detailed in the CEMP are implemented by the main works contractor and all sub-contractors, the preparation of this document is considered to be best practice. The Plan will also detail the procedures to be followed if there is a breach in any licence conditions or a non-compliance.

It will be important to ensure that the contractors Environmental Manager and the client are notified of all incidents where there has been a breach in agreed environmental management procedures. Suitable training shall be provided to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions will be taken.

9.1.5.2 Operational Phase Mitigation Measures

The capacity extension at Shannon Foynes, when complete, will be subject to the Port’s existing Environmental Management Plan which will provide the method for the implementation of the operational phase mitigation measures recommended for the proposed development.

Foynes Port has been designated an ‘Ecoport’ at European level, in relation to its environmental management system (Port Environmental Review System (PERS)). SFPC is one of 26 port companies across Europe operating to this standard and one of three operating in Ireland, the others being Dublin Port & Port of Cork.

The implementation of the Ports PERS furthermore demonstrates the commitment of SFPC’s Board, Management and Staff of continual improvements in environmental performance in and around the ports at Foynes and Limerick Docks through proactive environmental management of Port operations.

SFPC has a responsibility to ensure that no potentially polluting substances enter marine/riverine environment from its facilities. Runoff from jetties is managed by ensuring that the potential for cargo spillages onto the jetty deck is minimised through good handling practice, together with good housekeeping and cleaning practices to ensure that minor spills for hoppers or grabs are swept up.

The requirement to collect and properly dispose of cargo residues is set out in the Port's Waste Management Plan (Ref EHS 024 Waste Management Plan 2013).

Training of staff and exercises are undertaken in line with best practice.

Pollution from Oils, Chemicals and other contaminants

East Jetty Extension

The following mitigation measures are proposed for oils, chemicals and other contaminants stored at the Port:

- Adequate bunding will be provided for any fuel, oils or chemicals stored on-land in accordance with relevant PPG, building regulations; and

- Regular inspection of the condition of chemical and fuel storage facilities along with routine maintenance to ensure the risk of leaks is minimised.

The following will be adhered to with respect to vessels at berth or travelling through the Harbour and Lower Shannon Estuary:

- No waste will be disposed of at sea;
- Ballast water will be treated in accordance with MARPOL standards;
- Ballast tanks will be separate from hydrocarbon storage areas and no potentially contaminated streams will be diverted to the ballast tanks;
- De-ballasting will be undertaken offshore in accordance with IMO guidelines;
- Hazardous wastes will be stored in sealed, labelled drums in locked chemical cabinets;
- Vessels will be equipped with oil-water separation systems in accordance with MARPOL requirements;
- Spills on deck will be contained and controlled using absorbing materials;
- Vessels without sewage treatment systems will have suitable holding tanks and will bring waste onshore for treatment by licensed contractors;
- All chemicals used on-board will be handled in compliance with COSHH instructions on handling hazardous materials;
- Chemicals will be stored appropriately in suitably bunded areas and with material safety data sheets; and
- All waste discharges will be monitored and recorded as per vessel procedures.

Shannon Estuary Anti-Pollution Team (SEA-PT)

SFPC are part of a consortium consisting of the Port Company, Local Authorities and oil importers and was initiated to form a unified coordinated response to pollution incidents on the Shannon Estuary. Each member contributed initially to provide pollution response equipment and support tools. This equipment is available to respond to any pollution incident or threat. Members contribute annually to maintain equipment, carry out exercises and training and purchase new and replacement equipment.

The group has been in operation for the past 24 years under a committee of pollution officers representing the members. The aim of the group is to provide a unified response to oil pollution within the region, even though each member has individual responsibility for their own area. An Oil Spill Tracking Model, Geographic Information System, Environmental Atlas, Sensitivity Study, Oil Spill Response Strategy, Hydrocarbon Baseline Study and Emergency Response Plans have been developed for the region and updated.

The Pollution Control Plan is provided to assist the Shannon Estuary Ports Anti-Pollution Team (SEA-PT) in dealing with an accidental discharge of oil. Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner. This plan guides the Coordinator and On Scene Commander and other involved personnel through the decisions, which will be required in an incident response. The tables, figures and checklists provide a visible form of information, thus reducing the chance of oversight or error during the early stages of dealing with an emergency situation. For the plan to be effective, it must be:

- familiar to those with key response functions in the ports
- regularly exercised; and,
- reviewed and updated on a regular basis.

The proposed capacity extension at Shannon Foynes will be subject to the SEA-PT Pollution Control Plan to allow effective controls to address pollution incidents.

Lands at Durnish

For all phases within the Durnish Lands adequate bunding for any fuel, oils or chemicals stored on-site will be required in accordance with relevant PPGs and building regulations to ensure there is safe and adequate storage of such chemicals.

Foul Water drainage

As outlined in Chapter 2 foul water arrangements will be implemented on a phased basis consistent with each of the planned phases of development. Each phase will involve the implementation of a package treatment system which when implemented collectively, will service the entire Durnish lands, designed with sufficient capacity to accommodate predicted loadings (generated from the 'population equivalent' (PE) of the anticipated number of employees) thereby ensuring adequate treatment and protection of water quality. This approach allows for the foul wastewater treatment system to be individually sized for each development phase to maximise efficiency and afford a level of flexibility for future development given its long programme duration and uncertain land usage requirements of subsequent phases (beyond the immediate known requirements of Phase 1).

The preliminary design of the treatment plants has been based on the assumption that circa 120 people will occupy the fully developed site (calculated from the 186 FTE employees supported at Foynes Port within a 64ha site), with an assumption that 48 people will be occupying Phase 1.

This system for phase 1 will consist of:

- Collection point for wastewater from the 3nr warehouses
- A package wastewater treatment plant which provides both primary and secondary treatment of foul waters in accordance with the EPA Guidance for Treatment Systems for Small Communities, Business, Leisure Centres and Hotels (EPA, 1999). For the design of the Phase 1 treatment system, a factor of safety of 1.25 was applied to the occupancy figure for Phase 1. Therefore, an occupancy figure of 60 personnel was considered in the system design (such as Klargester BioDisc model or similar)
- A 6m x 6m stratified sand polishing filter
- Collection sump and discharge to ground under Section 4 Licence (Water Pollution Act)

In line with EPA Code of Practice: Wastewater Treatment Systems for Single Houses, the treated effluent will be subjected to tertiary treatment by the means of a polishing filter which also acts as a percolation area to redistribute the treated and polished effluent to ground. It is proposed to use a stratified sand polishing filter to provide the dual function of polishing the effluent and also infiltrating the treated effluent to the groundwater. The design arrangement is in accordance with EPA Code of Practice guidance and European standards (EN12566).

The design process followed for phase 1 as outlined above will also be applicable to phases 2 and 3 and will therefore ensure adequate foul water treatment across the Durnish Lands thereby mitigating any potential impact of foul water from the development site.

Storm Water Drainage

East Jetty Extension

As outlined in Chapter 2 storm water runoff will not be permitted to discharge directly to the marine environment from the jetty connection structure, but will be collected in a dedicated storm water drainage system. The surface water drainage system will be designed to consist of heavy duty gullies cast into the reinforced concrete deck, with concrete pipes cast into the in-situ concrete deck structure. These pipes will carry the storm water to an appropriate full retention oil separator which will trap oils and silt from the jetty prior to being discharged into the harbour waters through a non-return flap valve. A readily and safely accessible monitoring chamber will be provided on the storm water pipeline to allow for inspection and sampling of the storm water being discharged.

Lands at Durnish

The storm water drainage for Durnish Lands will be installed during Phase 1 for all phases of the development and therefore will be in place in advance of operational phases of the development.

Storm drains will collect all surface water and convey it through full retention interceptors (to collect hydrocarbons and silt) and the stormwater will then be conveyed through perforated pipes to allow percolation into the infilled ground. Readily and safely accessible monitoring chambers will be provided on the storm water pipelines to allow for inspection and sampling of the storm water being discharged.

The oil interceptors on the surface water drainage network will be selected and sized based on the pollution prevention guideline: "Use and design of oil separators in surface water drainage systems: PPG 3" (Environment Agency, 2006) and BS EN 858 which is the European Standard for the design, performance, testing, marking and quality control of separators within the EU. All separators must comply with this standard. In accordance with PPG3 a class 1 bypass separator will be required for general and car parking areas of the site whilst a class 1 full retention separator will be required for the HGV parking and loading areas. Notwithstanding this full retention separators are proposed for each phase of the development and will be sized in accordance with the design flow as presented in Chapter 2 (590 l/s for a 6 hour duration storm) and the drainage area to be serviced.

9.1.6 Residual Impacts

Provided the appropriate mitigations measures are fully implemented during the construction and operational phases as outlined above, the impact of the proposed development on the water quality in the area will be neutral to minor as indicated in Table 9.5.

The Capacity Extension at Shannon Foynes Project is therefore not expected to have a significant detrimental impact on the water quality of the receiving waters or make a significant change to the existing morphology. It can therefore be concluded that the proposed works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and consistent with the mitigation measures outlined in the SIFP in the context of water quality.

Table 9.5 Residual Impacts (with mitigation)

	Rating of environmental Impact	
CONSTRUCTION PHASE	**East Jetty Extension**	**Durnish Land Development**
Suspended sediments / Sedimentation	Minor	Minor
Concrete and Cement pollution	Minor	Minor
Oil and Chemicals (including herbicides)	Minor	Minor
Hydromorphological Impacts	Negligible	Slight
OPERATIONAL PHASE		
Maintenance	Negligible	Negligible
Oil and Chemicals	Negligible	Negligible
Foul and Storm Water Drainage	Negligible	Negligible
Road Improvements	Neutral	Neutral

9.1.7 Cumulative Impacts

There are a number of committed developments within the vicinity of the proposed development. Each development with the potential to impact on the water environment has been considered through a review of the environmental supporting information (where available) for the applications and the proposed Capacity Extension at Shannon Foynes Project.

9.1.7.1 East Jetty Reclamation Project (Planning Ref 12212)

In terms of cumulative impacts the reclamation of the East Jetty at Foynes Port has the potential for in combination and cumulative effects with the extension of the East Jetty under the current proposal, however the mitigation strategy included in the Environmental Statement and NIS for the reclamation of the East Jetty and the associated Construction Environmental Management Plan will ensure cumulative effects will not be significant in the context of water quality and WFD compliance. The long term impact of the jetty extension would be small scale low magnitude changes in tidal currents at the pier locations. The area behind the pier may experience tidal circulations however this is consistent with the existing pile array associated with the east and west jetties and therefore it can be concluded that cumulative impacts on water quality will not be significant.

9.1.7.2 Provision of 2 no. 150 tonne per hour gas-fired steam boilers (Planning Reference 13164)

This application relates to development which comprises or is for the purposes of an activity requiring an Integrated Pollution Prevention and Control Licence. This is therefore a regulated industry and environmental controls will be in place at this existing facility in order to satisfy the requirements of the IPPC licence. There are therefore no anticipated cumulative impacts in the context of water quality.

9.1.7.3 Solid fuel briquettes manufacturing facility (Planning reference 14603)

The environmental documentation, an EIS and AA screening, for this facility has been reviewed and from a water quality perspective there is adequate control measures in place including an onsite dedicated treatment plant for foul water, site drainage proposals that are consistent with PPG3, and closed system for the trade effluent which is recycled through the manufacturing process. The implementation of best practice during construction as outlined in the EIS ensures that the development will not have cumulative or in-combination effects with the Capacity Extension at Shannon Foynes Project.

9.1.7.4 Smokeless and bio-mass based solid fuel manufacturing and packaging facility at and adjacent to existing coal storage and baggage facility (Planning reference 15468)

The environmental documentation, an EIS and NIS, for this facility has been reviewed and from a water quality perspective there is adequate control measures in place. The application was appealed to An Bord Pleanala who undertook an Appropriate Assessment and concluded that the impact would not be significant on the qualifying interests of the downstream Natura 2000 sites. The implementation of best practice during construction as outlined in the EIS will ensure that the development will not have cumulative or in-combination effects with the Capacity Extension at Shannon Foynes Project.

9.1.7.5 Development on a site of c. 0.225 ha located within the existing Aughinish Alumina plant consisting of the installation of 2 no. deep thickeners (steel vessels with a diameter of c. 22m and maximum overall height of c.21.9m) (Planning Reference 16418)

The application relates to development which comprises or is for the purposes of an activity requiring an Industrial Emissions Directive Licence. This is therefore a regulated activity and the compliance with the IED licence and conditions should ensure that there will be no cumulative impacts with the proposed Capacity Extension at Shannon Foynes Project.

9.1.8 Monitoring

A Construction Environmental Monitoring Programme will be prepared to provide an assessment of the effectiveness of the mitigation measures implemented to address any potential environmental impacts to the receiving environment during the construction phase of the works. The monitoring programme will form part of the specification of the Contract Documents for the construction stage.

The design of the Construction Environmental Monitoring Programme will include the establishment of a baseline for suspended solids, pH, dissolved oxygen and conductivity within the receiving waters. This will be required for the water courses in the Durnish lands but also Foynes Harbour. The baseline will be established through a series of regular grab samples to be collected in advance of construction.

Monitoring will continue during construction to assist in the determination of the effectiveness of the mitigation measures identified in this EIAR. Regular visual monitoring and audits will also be undertaken during the construction phase of the works.

The Ports existing Environmental Management Plan and monitoring protocols will monitor the operational activities to ensure measure to address operation impacts are effective and providing adequate protection to the sensitive receiving waters.

9.2 FLOOD RISK

9.2.1 Introduction

Foynes Port and the proposed lands at Durnish into which the port extension is proposed are located at the junction of the Shannon tidal estuary and the Roberstown River. A number of small watercourses flow through the Durnish lands which are located behind an earthen embankment adjacent to the Robertstown River. This earthen flood defence embankment provides significant protection against coastally driven flood events propagating up the Robertstown River and into the lower ground within the Durnish lands through the series of drains and watercourses which act as the drainage system for this area. On the northern side of Foynes Port a recently constructed flood defence scheme largely comprising of hard defence walls through the port lands provides some protection from coastally driven flood events from the Shannon Estuary to the north.

A network of interconnected watercourses representing small catchments emanating in the higher ground to the west and south drain through the port and the lower lying Durnish lands. All of these watercourses drain through the system of flood defences around the port and Durnish lands. Discharge of these watercourses to the Shannon Estuary/Roberstown River is therefore dependent on the structures themselves and the coastal water levels behind them. Likewise the drainage of the low lying Durnish lands cannot occur during periods of high coastal water levels. An attenuation/storage pond is located behind the earthen flood defences at the eastern edge of the port/northern corner of the proposed extension lands to allow for the build-up of run-off when gravity driven discharge through the embankment cannot occur due to higher water levels in the estuary. The location of the application site in relation to the waterbodies which could potentially affect it is shown in Figure 9.2.1.

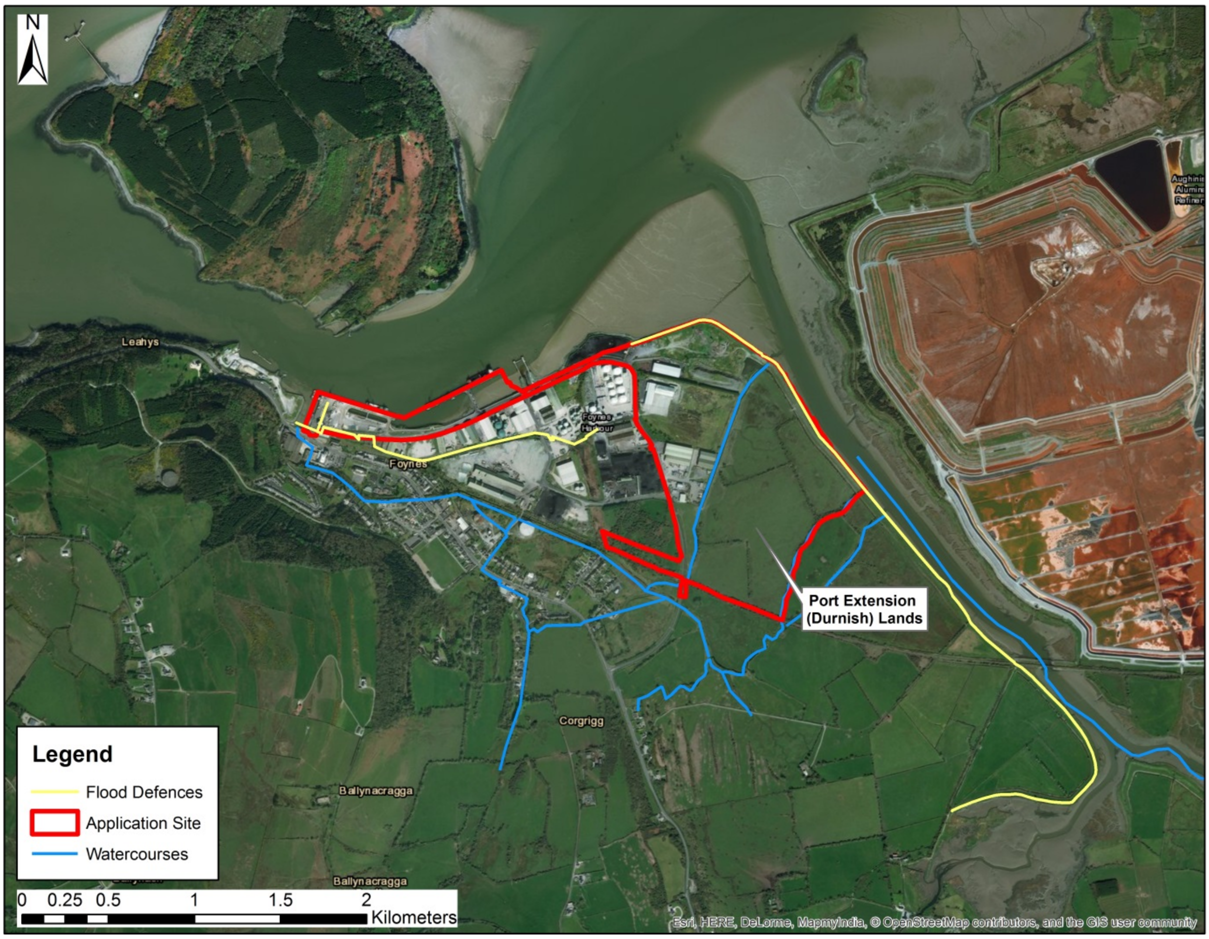


Figure 9.2.1– Application Site and Waterbodies

The location of the site in relation to potential sources of flooding, the low lying nature of the site and its dependence on a number of structures to provide a level of defence against flooding all combine such that the flood can be considered relatively complex. All the main sources of flood risk; fluvial, coastal and pluvial require consideration. Furthermore the impacts arising from the individual sources of flooding may be interdependent on one another.

9.2.2 Assessment Methodology

The assessment framework is based on a probability assessment based on the best available historic records of observed data. The probability assessment is considered against the potential consequences of flooding to arrive at an understanding of the long term risk. As well as a risk assessment based on the currently available observed data, scenarios considering the impact of climate change are also considered. The assessment methodologies reflect best practice in the UK and Ireland. The main elements of the analysis are:

- Data collection and Surveys
- Hydrological analysis
- Hydraulic analysis (modelling) and mapping

The methodologies applied for each element of the analysis are described in the following sections.

9.2.2.1 Data Collection and Surveys

There are a number of previous studies which inform the analysis which has been undertaken in support of this flood risk assessment primarily:

- Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study
- Foynes Flood Alleviation Scheme
- Irish Coastal Protection Strategy Study (ICPSS)

Various portions of the analysis and data used are extracted from the aforementioned studies/projects and where this is the case it is identified throughout the report.

A number of surveys have also been used to inform this assessment as discussed below. A summary of the survey data that was collected is provided in Figure 9.2.2.

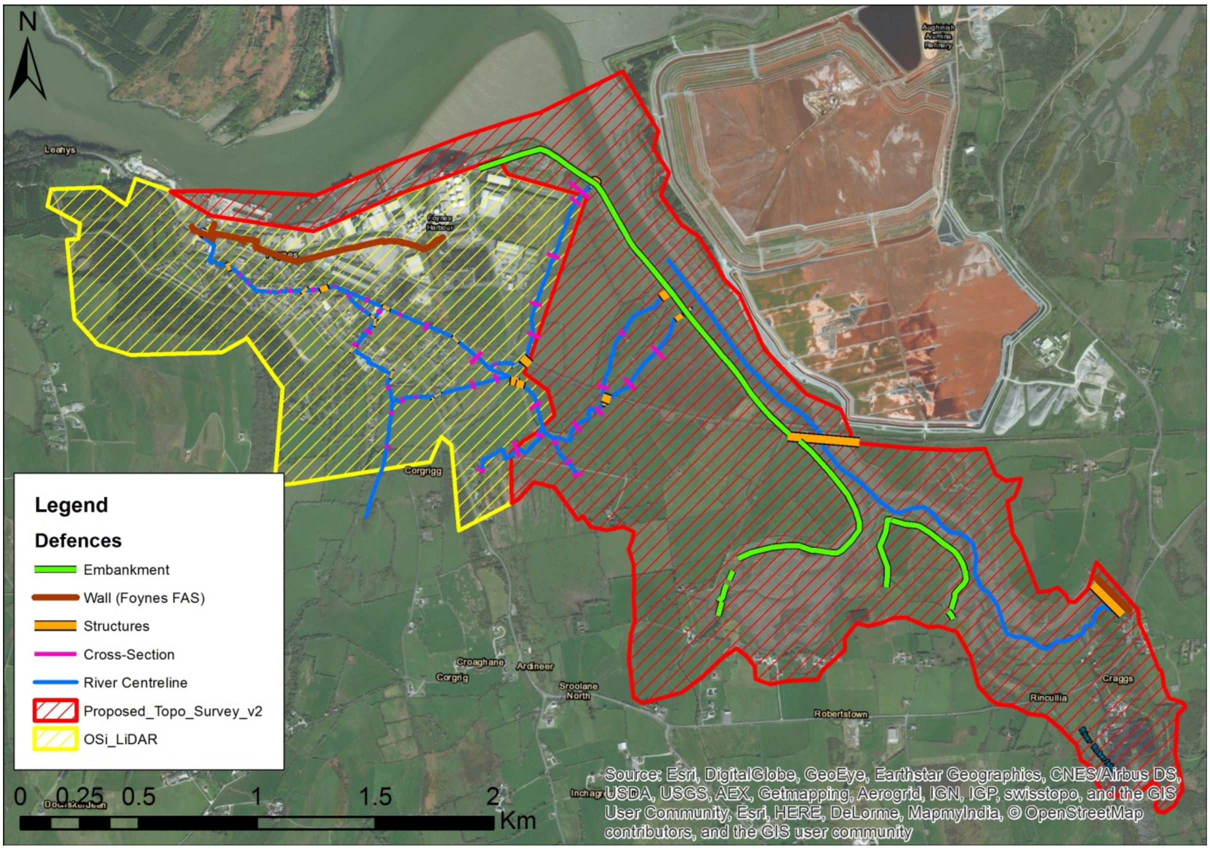


Figure 9.2.2 – Survey data collected for Flood Risk Assessment

9.2.2.1.1 River Channel Cross Section Survey

Murphy Surveys Limited (MSL) completed a watercourse channel and structure cross sectional survey. The survey was undertaken in early October 2017. In total 61 no. cross sections were surveyed across the watercourse channels and at the face of relevant structures. The location of the survey cross sections is shown in Figure 9.2.2.

9.2.2.1.2 Flood Defence Survey

Murphy Surveys Limited completed a topographical survey of the flood defence structures at the port and surrounding the Durnish lands/lands to the south of the port. The survey was undertaken in early to mid-October 2017. The crest and ground level along approximately 1.3km of flood defence wall was surveyed. This flood defence was recently constructed through the port to provide protection to both the village and the port as part of a Flood Alleviation Scheme for Foynes developed by Limerick City & County Council and the OPW. The crest and toe level along approximately 3.5km of earthen embankment was also surveyed. This earthen embankment generally provides protection from high water levels in the Robertstown River to the east and south of Foynes. The location of the defences surveyed is shown in Figure 9.2.2.

9.2.2.1.3 Digital Terrain & Bathymetric Data

In order to assess the propagation of coastally driven events within the Shannon Estuary, Robertstown River and overland it was necessary to collect topographical data to define the x, y and z levels on land and below the water line. A large amount of bathymetric data defining the estuary bed levels within the Shannon Estuary including around the port and mouth of the Robertstown River was available to RPS from previous models developed and owned by RPS. This data is considered fit for the purposes of the analysis to support this Flood Risk Assessment.

It was necessary to collect topographical data for the application site, the surrounding low lying ground potentially at flood risk and for the Robertstown River estuary. At the time RPS requested LiDAR data only a small portion of the port, village and high ground to the south and west was available from OSi (shown in yellow hatch in Figure 9.2.2). Coverage of the rest of the area was undertaken by Murphy Surveys Limited in mid-October 2017 using UAV based techniques. The vertical accuracy of this dataset is comparable to the available LiDAR dataset. The area covered by the MSL survey dataset is shown hatched in Figure 9.2.2. It is considered that the merged OSi and Murphy Surveys Limited DTM data represent and appropriate digital terrain dataset upon which to undertake hydraulic analysis of the floodplain to the appropriate level of detail and accuracy.

9.2.2.2 Hydrological Analysis – Coastal

In order to assess through hydraulic modelling the impact of the proposed development of the application site during an extreme coastal flood event the coastal design events must be defined. This is a probability based assessment using the best available coastal water level data to determine the frequency of various peak water levels. It is considered that the entire application site is vulnerable to the combination of two components of extreme coastal water levels; extreme astronomical tides and storm surge. The portions of the application site which face onto the Shannon Estuary are potentially vulnerable to the action of wave overtopping but that the areas adjacent to the Robertstown River are not (i.e. extension into Durnish lands). This is based on the analysis undertaken for OPW as part of the Irish Coastal Wave and Water Level Study (RPS, 2013).

9.2.2.2.1 Irish Coastal Protection Strategy Study (ICPSS) – Shannon Estuary

A comprehensive analysis of extreme peak coastal water levels was undertaken through the Irish Coastal Protection Strategy Study. These peak water levels were used as the boundaries for the Shannon CFRAM Study modelling of coastal flood mechanism 1 (the joint combination of tide and surge components) at Foynes. These extreme coastal boundaries were generated using a model of the Shannon Estuary with a grid resolution of 45 metres. 82 historic storm events were simulated spanning the years 1959 to 2009 with the results calibrated to observed data. An extreme value analysis was then performed on the results of the long term simulated peak levels at various points within the estuary upon which extreme design peak water levels were generated. The locations of the points in the vicinity of Shannon Foynes Port are shown in Figure 9.2.3.

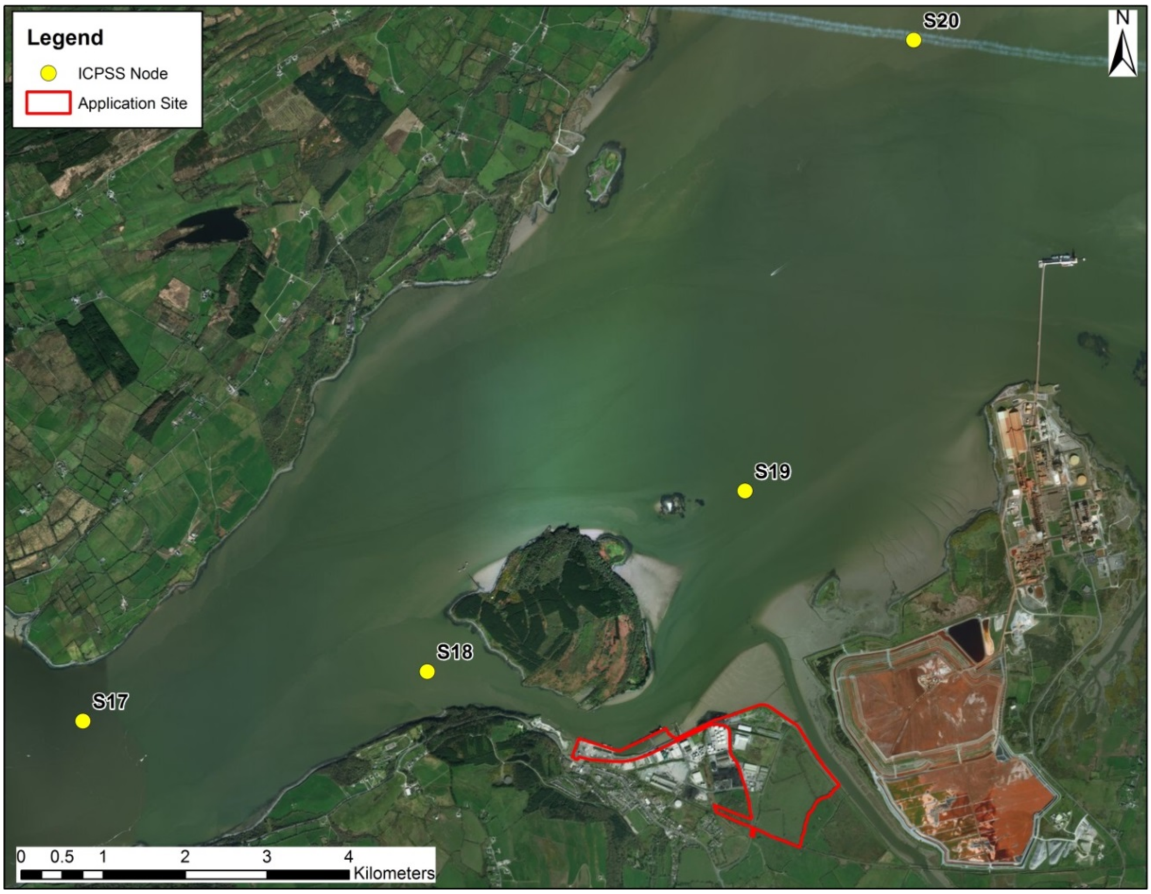


Figure 9.2.3 – Location of ICPSS Nodes

The peak water levels for each of the nodes are shown in Table 9.2.1.

Table 9.2.1– ICPSS Peak Water Levels

			Water Level (m OD Malin) / Return Period (Years)							
ICPSS Node	Eastings	Northings	2	5	10	20	50	100	200	1000
S17	121126	152131	2.78	2.929	3.042	3.155	3.304	3.416	3.529	3.79
S18	123686	152457	2.833	2.987	3.105	3.222	3.378	3.496	3.615	3.889
S19	126062	153757	2.885	3.044	3.165	3.286	3.446	3.567	3.688	3.97
S20	127363	157071	2.929	3.093	3.217	3.342	3.507	3.632	3.758	4.048

9.2.2.2.2 Foynes Flood Alleviation Scheme

The Foynes Flood Alleviation Scheme commissioned by Limerick City & County Council in August 2014 included a detailed analysis of observed water level data at both Foynes Port (13 years of useable AMAX data) and at Limerick Docks (83 years of useable AMAX data). This analysis represents a long term frequency based analysis of the best available local peak water level data up to 2014, including the large coastal flood event which occurred in January 2014 and led to flooding of the port and properties in the village. The analysis included the application of de-trending techniques which essentially adjusts the historic data to remove the effects of the long term trends upwards. In other words historic records are adjusted upwards such that they are consistent with modern day sea levels. This is based on the peak water levels data itself in the Annual Maxima (AMAX) series and is not a comprehensive analysis of sea level rise (i.e. climate change). The analysis used the UK industry standard flood frequency analysis software WINFAP-FEH to analyse the AMAX series. It considered a number of typical flood like distributions to best fit the historic data. The Log Normal 2 parameter distribution was chosen as the most appropriate for application to the Foynes port historical data resulting in a 200 year return period estimated peak water level of 3.94m OD Malin. The peak water levels based on the chosen distributions at both Foynes and Limerick Docks are shown Table 9.2.2.

Table 9.2.2 – Foynes Flood Alleviation Scheme Calculated Peak Water Levels

	Water Level (m OD Malin) / Return Period (Years)							
Gauging Station Location	2	5	10	25	50	100	200	1000
Limerick (LO Distribution)	3.69	3.94	4.08	4.26	4.39	4.51	4.64	4.92
Foynes (LN2 Distribution)	3.15	3.39	3.52	3.67	3.77	3.86	3.94	4.12

Although the analysis undertaken on the Limerick Docks gauge is not directly applicable to Foynes it does represent a much more statistically robust analysis given the length of record period. It is worth noting that for the largest historic event for which concurrent peak water level data is available peak levels of 4.51m OD and 3.79m OD were recorded at Limerick Docks and Foynes respectively. This represents a difference of 0.72m. This provides a degree of validation of the 200 year peak water level estimated from the Foynes gauging station as the relationship between the Foynes calculated value and the Limerick Docks value displays a similar difference (0.70m). In other words the 200 year value at Foynes is consistent with the more statistically robust value calculated at Limerick Docks.

9.2.2.2.3 Design Peak Water Levels for Modelling

It is considered that the Foynes values calculated as part of the Foynes Flood Alleviation Scheme represent the most prudent peak levels to be taken forward as the basis of design coastal events. These levels are more conservative than those developed through the ICPSS and represent levels which reflect observed local data. The design 200 year return period peak water level is therefore 3.94m OD Malin for the present day scenario.

9.2.2.2.4 Design Coastal Water Level Profile

The design coastal water level profiles for each return period are developed by adding a representative storm surge profile to an astronomical tide to reach peak water levels as set out for Foynes Port in Table 9.2.2. The peak of astronomical tide profile is representative of a tide halfway between an average high water level of 1.53m OD Malin and a mean high water spring level of 2.13m OD Malin as defined within the Admiralty Tide Tables (2017) for Foynes Island. A 48 hour surge profile has been applied to bring the peak tidal level up from 1.83m OD Malin to the design level. The components of the 0.5% AEP coastal boundary and the final total water level profile are shown in Figure 9.2.4.

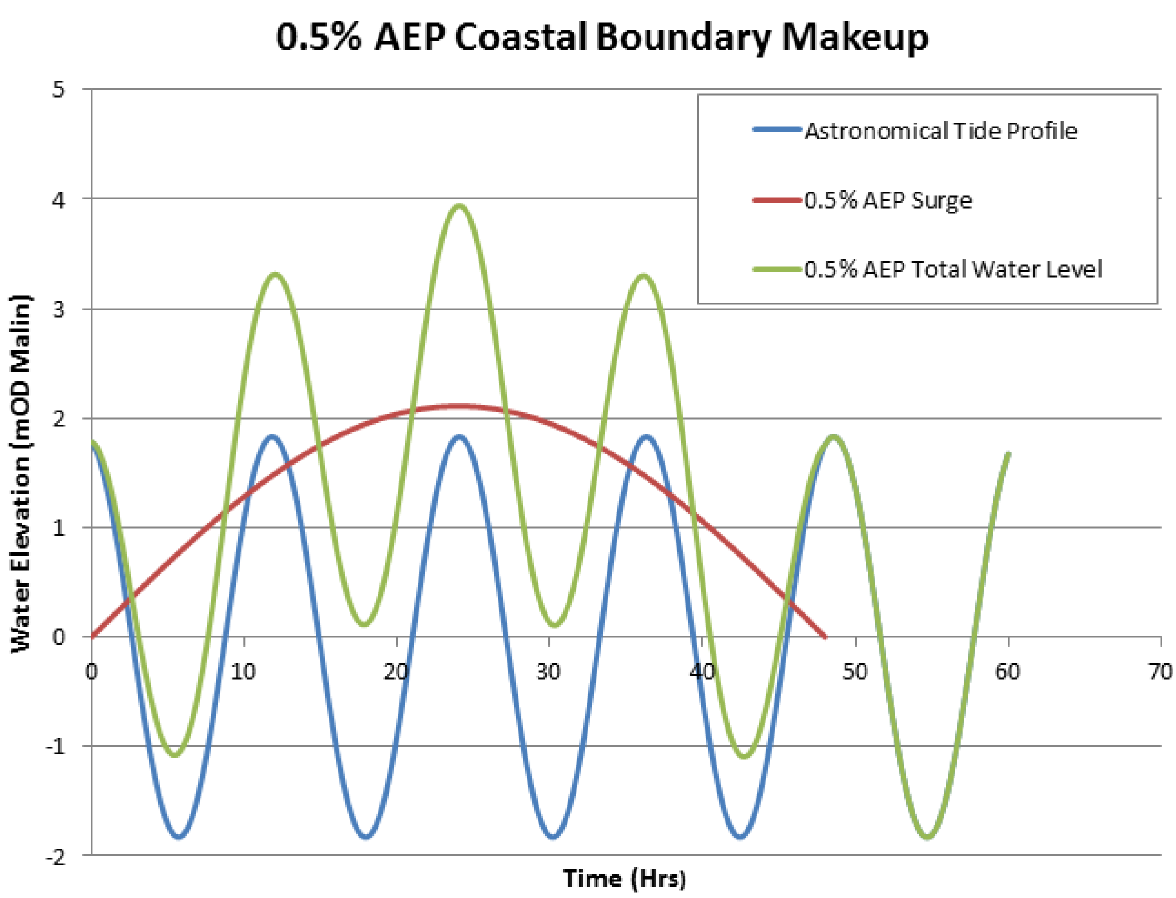


Figure 9.2.4 – 0.5% AEP Coastal Boundary

9.2.2.2.5 Climate Change

OPW guidance contained within 'Climate Change Sectoral Adaptation Plan, Flood Risk Management (2015 - 2019)' provides the most relevant guidance for the allowances to be applied in relation to climate change modelling. It recommends that a 0.5m rise in sea level is applied for a mid-range future scenario (MRFS) over a 100 year time horizon. For a high end future scenario (HEFS) a sea level rise of 1.0m is recommended. This can be applied to the design water level profiles derived for the present day design events by adding the relevant uplifts to all values.

9.2.2.3 Hydrological Analysis – Fluvial

9.2.2.3.1 Catchment and HEP Delineation

Hydrological Estimation Points (HEPs) have been specified across the extents of the watercourse network at Foynes which are to be modelled. These represent the inflow locations at the upstream extents of the models but also intermediate and downstream points along the modelled watercourses such that lateral flow entering the model can be estimated. Specifying a large number of HEPs across the modelled watercourses helps ensure that the correct flood frequency conditions are captured throughout the model. This also aids anchoring of the hydraulic model to the hydrological estimates.

Many of the HEPs and catchments representing the network of small drains within the study area are not defined within the FSU and as such required delineation using digital terrain data to ascertain the contributing catchment area. For these HEPs the other physical catchment descriptors were calculated using digital terrain data, mapping, survey information and in some instances, where appropriate, were borrowed from adjacent similar catchments that are defined under the FSU. Table 9.2.3 shows the locations of the HEPs and their associated catchments and Figure 9.2.5 lists the principal catchment descriptors used in the derivation of peak flood flows.

Table 9.2.3 – Physical Catchment Descriptors Used

HEP	Easting	Northing	AREA	DRAIND	S1085	ARTDRAIN2	FARL	SAAR	URBEXT	BFI_{SOIL}
HEP_01	125559	150874	1.67	1.83	46.28	0	1.00	1090	0	0.62
HEP_02	124777	151772	3.08	2.02	33.66	0	1.00	1089	11.3	0.59
HEP_03*	125963	150781	0.27	1.94	7.99	0	1.00	1088	0	0.59
HEP_04*	126217	150951	0.35	2.98	4.79	0	1.00	1090	0	0.62
HEP_05*	125551	151458	0.00	0.00	0.65	0	1.00	1090	0	0.62
HEP_06*	126835	151452	0.45	2.17	1.87	0	1.00	1090	45.55	0.62
HEP_07*	126004	151209	0.13	2.54	4.63	0	1.00	1090	95.52	0.61
HEP_08*	126438	151999	1.52	1.13	0.29	0	1.00	1093	16.86	0.59
HEP_09*	126478	151128	1.53	0.00	0.88	0	1.00	1093	0	0.64
HEP_10*	126734	150749	0.13	3.87	0.21	0	1.00	1093	0	0.64
HEP_11*	126361	150749	0.17	0.41	0.21	0	1.00	1074	0	0.65
HEP_12*	126361	150906	0.25	0.70	0.21	0	1.00	1093	0	0.64
HEP_13	128670	150195	4.80	0.89	2.51	0	1.00	1074	0	0.66
HEP_14	128169	149936	1.05	2.66	47.55	0	1.00	1090	0	0.62

HEP	Easting	Northing	AREA	DRAIND	S1085	ARTDRAIN2	FARL	SAAR	URBEXT	BFI_{SOIL}
HEP_15	126953	150059	32.04	1.09	13.28	0	1.00	1093	1.69	0.64
HEP_16	128621	144710	22.57	1.32	10.66	0	1.00	1085	0	0.67

DRAIND – Drainage Density (km/km^2)
S1085 – Slope of main stream excluding the bottom 10% and top 15% of its length (m/km)
ARTDRAIN2 – Proportion of river network length included in Arterial Drainage Schemes
FARL – Index of flood attenuation by reservoirs and lakes
SAAR – Standard-period average annual rainfall (mm)
URBEXT – Proportional extent of catchment area mapped as urbanised
BFISOIL – Soil baseflow index (estimate of BFI derived from soils, geology and climate data)

Note * - Calculated based on orthophotography, mapping and Corine 2012 land use data

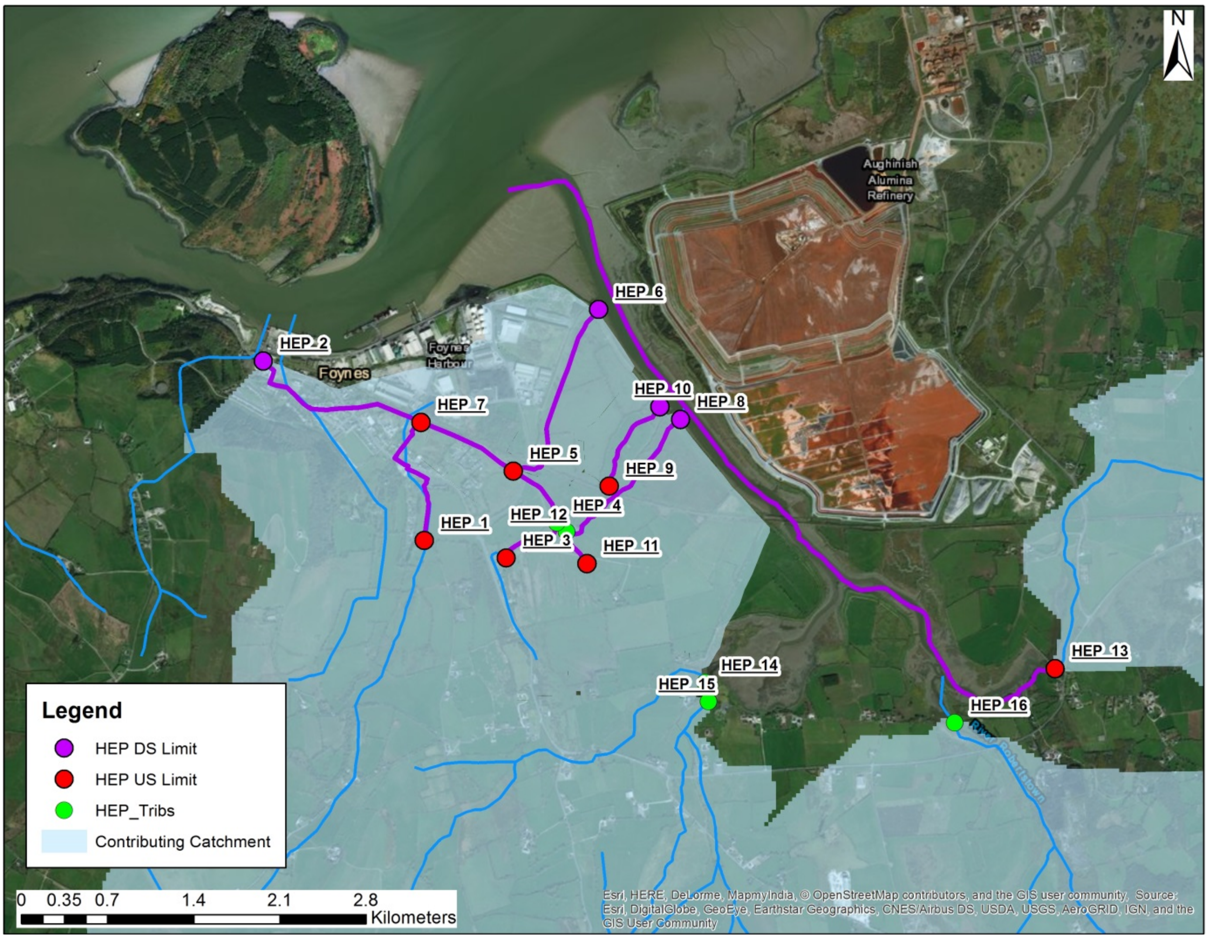


Figure 9.2.5 – Location of HEPs and Contributing Catchments at Foynes

9.2.2.3.2 Qmed Estimation

The estimation of the index flood flow for rural ungauged catchments, referred to henceforth as $Q_{med\ rural}$, is initially based on the FSU method for ungauged catchments, i.e. using the seven variable regression equation derived under FSU Work Package 2.3 to calculate the $Q_{med\ rural}$:

$$Q_{med\ rural} = 1.237*10^{-5}*AREA^{0.937}*BFI_{SOIL}^{-0.922}*SAAR^{1.306}*FARL^{2.217}*DRAIND^{0.341}*S1085^{0.185}*(1+ ARTDRAIN2)^{0.408}$$

This $Q_{med\ rural}$ value does not consider the effects of urbanisation which is considered separately through an Urban Adjustment Factor calculated as follows:

$$\mathbf{UAF = (1+URBEXT)^{1.482}}$$

The final Q_{med} which considers the effect of urbanisation is then calculated:

$$\mathbf{Q_{med} = UAF^{*}\ Q_{med\ rural}}$$

9.2.2.3.3 Qmed Adjustment

The FSU recommends that ungauged Q_{med} estimates are adjusted where there is appropriate observed data available which suggests that the catchment descriptor equation over or under estimates in that particular catchment. The gauged catchment from where this adjustment is derived is referred to as a ‘pivotal’ site and it may refer to a gauging station up or downstream or a gauging station from a different catchment which is hydrologically similar or geographically close. In the case of the watercourses within the study area a number of geographically close and hydrologically similar pivotal sites were considered. All of the nearby pivotal sites represented catchments much larger than those affecting Foynes. The average of the 10 closest sites indicates an average upwards adjustment of 9%. A review of hydrologically similar sites also indicated an average adjustment upwards of 9%. The most hydrologically similar site is listed as the Frankfort gauging station on the Slang in South Dublin which has a downwards adjustment factor of 8%. This catchment is highly urbanised and as such is not considered an appropriate pivotal site. The next most hydrologically similar site is at Ballygoly on the Big River in the Cooley Mountains in County Louth. This is a steep, hilly catchment remote from the Shannon. It has a large pivotal site adjustment factor of 71% which is not consistent with the average of the hydrologically similar sites. The third most hydrologically similar site is at Rochfort on a tributary of the Shannon draining into Lough Ennell in Westmeath. This site has a very similar hydrological similarity measure to the Ballygoly site but is much closer geographically, located 150km to the north east, within the Shannon catchment. The adjustment based on this pivotal site is 33% upwards which is closer to the average. Its application to the estimates at Foynes would represent an appropriately conservative approach given the uncertainty in relation to the flows in the small watercourses at Foynes and as such it is taken forward as the basis for pivotal site adjustment of the Q_{med} values, i.e. all of the initial estimates have been factored by 1.33.

9.2.2.3.4 Growth Curve Development

In order to derive design event peak flows for the range of probabilities / return periods requires a growth curve to be developed which defines the relationship between the index flood flow Q_{med} and the various event probability peak flows. As recommended under the FSU for ungauged catchments a pooled flood frequency is performed whereby the flood frequency behaviour from a number of appropriate flood flow gauging stations is combined to define the growth curve. This pooled analysis has been undertaken using the FSU Web Portal hosted by the OPW. The analysis has been undertaken for HEP01 and HEP08 which represent the main watercourses affecting the site. A summary of the pivotal site gauging stations which were used in the pooling groups as well as the final flood like distributions which have been chosen to fit the pooled data are shown in Table 9.2.4. The target pooling group size was 500 years of data in line with the FSU recommendation that 5 times the target return period years are pooled with the target return period considered to be 100 years (fluvial 1% AEP event).

Table 9.2.4 – Summary of Stations and Distributions used in Pooled Flood Frequency Analysis.

Catchment	Stations used in Pooling Group	Flood Frequency Distribution
HEP01	6030, 25034, 9011, 10022, 30020, 8005, 25040, 22009, 16051, 24022, 10021, 8002, 6031, 9035, 9002, 8012, 13002, 26058, 26022, 19046, 1055, 6033, 8007,16006 36071	EV1
HEP08	6030, 25034, 9011, 10022, 30020, 8005, 25040, 22009, 16051, 24022, 10021, 8002, 6031, 9035, 9002, 8012, 13002, 26058, 1055, 26022, 19046, 6033, 8007, 16006, 36071	EV1

As can be seen from Table 9.2.4 the pooling groups for both HEPs are identical with the only difference being the order in which the most hydrologically similar pivotal sites have been listed. Both sites result in the same pooled growth curve and as such only one pooled growth curve has been derived for the Foynes watercourses. Both the EV1 and GEV distributions were considered to be a good fit in terms of L-moment ratios with only approximately 1% difference in the derived growth factors. The EV1 distribution was taken forward for use in deriving the design flows.

The final growth factors which are taken forward for deriving peak flow estimates, as well as growth factors from the Shannon CFRAM Study for the relevant watercourses in Foynes are shown in Table 9.2.5 below.

Table 9.2.5 – Foynes Derived Growth Factors and Equivalent Shannon CFRAM Study Growth Factors

	Annual Exceedance Probability (Return Period)							
	50% (2yr)	**20 % (5yr)**	**10% (10yr)**	**5% (20yr)**	**2% (50yr)**	**1% (100yr)**	**0.5% (200yr)**	**0.1% (1000yr)**
Foynes	1	1.41	1.67	1.93	2.26	2.51	2.76	3.34
For Comparison								
Shannon CFRAM Study UoM 24 at **24_1419_3**	1	1.30	1.51	1.70	1.95	2.14	2.32	2.76

There is a significant difference between the growth curve derived as part of this project and the relevant Shannon CFRAM Study growth factor. The derived growth factors for this project range from 8% to 21% higher than the CFRAM Study derived growth factors. Both were derived using pooled analysis based on the catchment descriptors for the main watercourses flowing through Foynes and both use the same FSU methodologies and datasets. The difference appears to be arising from the choice of pooled sites. The Shannon CFRAM Study removed many of the initially listed hydrologically similar sites as they were deemed on inspection to be potentially not representative. The main reason for this was the degree of urbanisation and all sites which had over 2.5% urban extent were removed. This results in many of the very small catchment gauging stations being removed from the pooled analysis. It is considered that this is a reasonable screening however it has not been applied for this project as it results in less conservative design flows. Given the level of uncertainty in the Foynes ungauged catchments and the purposes of this FRA in arriving at robust design recommendations it is considered that the more conservative approach of retaining these stations within the pooling group is appropriate. The difference in growth curves is the main difference in the design flows used in both analysis as shown in Table 9.2.6.

Table 9.2.6 – Peak Design Flows and Equivalent Shannon CFRAM Study Design Flows

		Annual Exceedance Probability (Return Period)							
	Catchment Area	50% (2yr)	20 % (5yr)	10% (10yr)	5% (20yr)	2% (50yr)	1% (100yr)	0.5% (200yr)	0.1% (1000yr)
HEP01	1.67	0.96	1.35	1.60	1.85	2.16	2.40	2.64	3.20
CFRAM Study – 24_1419_3	1.6	1.0	1.3	1.5	1.7	2.0	2.2	2.4	2.8
HEP02	3.08	2.03	2.87	3.39	3.92	4.59	5.10	5.61	6.79
CFRAM Study – 24_248_2	3.1	2.3	3.0	3.5	3.9	4.5	4.9	5.3	6.3

The final design flows which are taken forward to the hydraulic analysis are shown in Table 9.2.7

Table 9.2.7 – Final Design Flows for Hydraulic Analysis

Node ID	AREA (km^2)	Qmed	Flows for AEP							
			50% (2)	20% (5)	10% (10)	5% (20)	2% (50)	1% (100)	0.5% (200)	0.1% (1000)
HEP_01	1.67	0.96	0.96	1.35	1.60	1.85	2.16	2.40	2.64	3.20
HEP_02	3.08	2.03	2.03	2.87	3.39	3.92	4.59	5.10	5.61	6.79
Lateral between HEP_01 & HEP_02	1.41	0.36	0.36	0.51	0.60	0.70	0.81	0.91	1.00	1.20
HEP_03	0.27	0.13	0.13	0.19	0.23	0.26	0.30	0.34	0.37	0.45
HEP_04	0.35	0.17	0.17	0.24	0.29	0.33	0.39	0.43	0.48	0.58
Lateral between HEP_03 & HEP_04	0.08	0.04	0.04	0.06	0.07	0.08	0.10	0.11	0.12	0.14
HEP_11	0.17	0.02	0.02	0.03	0.04	0.05	0.06	0.06	0.07	0.08
HEP_12	0.25	0.04	0.04	0.06	0.07	0.08	0.09	0.10	0.11	0.14
Lateral between HEP_11 & HEP_12	0.07	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.07
HEP_07	0.13	0.19	0.19	0.26	0.31	0.36	0.42	0.47	0.52	0.63
HEP_08	1.52	0.35	0.35	0.50	0.59	0.68	0.80	0.88	0.97	1.18
Lateral between HEP_07 & HEP_08	0.79	0.34	0.34	0.48	0.56	0.65	0.76	0.85	0.93	1.13
HEP_05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEP_06	0.45	0.20	0.20	0.29	0.34	0.40	0.46	0.51	0.57	0.68

Node ID	AREA (km^2)	Qmed	Flows for AEP							
			50% (2)	20% (5)	10% (10)	5% (20)	2% (50)	1% (100)	0.5% (200)	0.1% (1000)
Lateral between HEP_05 & HEP_06	0.45	0.21	0.21	0.29	0.34	0.40	0.47	0.52	0.57	0.69
HEP_09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEP_10	0.13	0.06	0.06	0.09	0.10	0.12	0.14	0.15	0.17	0.21
Lateral between HEP_09 & HEP_10	0.13	0.06	0.06	0.09	0.10	0.12	0.14	0.15	0.17	0.20
HEP_13	4.80	1.09	1.09	1.53	1.81	2.10	2.46	2.73	3.00	3.63
HEP_14	1.05	0.71	0.71	1.00	1.19	1.37	1.61	1.78	1.96	2.37
HEP_15	32.04	10.15	10.15	14.32	16.96	19.60	22.95	25.49	28.02	33.91
HEP_16	22.57	6.90	6.90	9.73	11.52	13.31	15.59	17.31	19.04	23.04

	Point Inflows
	Intermediate/total target flows (for checking)
	Lateral inflows between HEPs

9.2.2.3.5 Hydrograph Development

The previous sections discuss the process of arriving at design peak flows. Before being applied within a hydraulic model these must be coupled to a hydrograph such that they represent a true representation of the rising and falling of a flood flow over time. The approach adopted is the FSU based approach as discussed in the Technical Research Report Volume III. The method is similar in principle to the estimation of the index flood in that it uses catchment descriptors to arrive at an initial estimate of the hydrograph shape, defined in three parameters, and then uses a pivotal site to adjust the shape based on observed data. The pivotal sites which were used for hydrograph shape adjustment across all of the HEPs were Ballyedmond on the Owenacurra River in Cork (19020) and the White Bridge station on the Deenagh River in Kerry. Both stations represent small to medium sized catchments close to the coast/large waterbodies which are hydrologically similar to the subject catchment. Both have relatively low proportions of alluvium soils in the catchment and neither is arterially drained. These characteristics which are similar to all of the subject catchments are particularly important in determining hydrograph shape. The final hydrographs for each HEP for the 1% AEP event are shown in Figure 9.2.6.

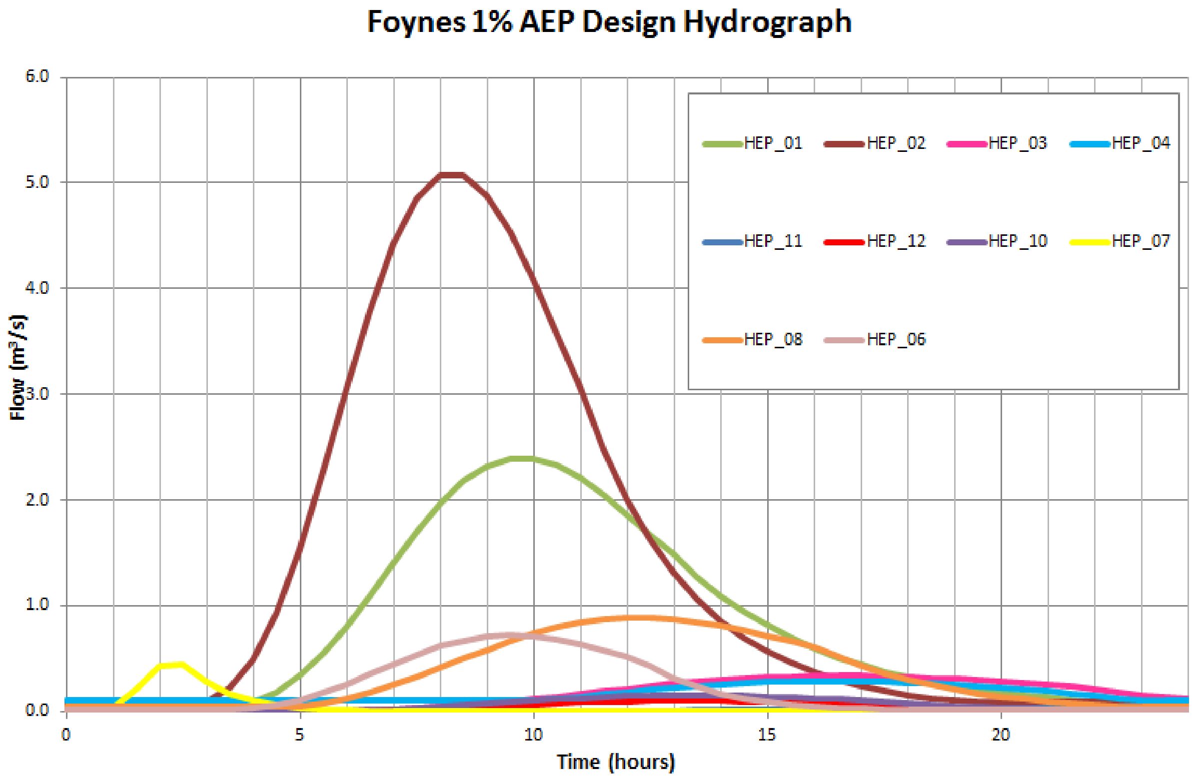


Figure 9.2.6 – Design 1% AEP Hydrographs at HEPs

9.2.2.3.6 Climate Change

The effects of climate change on flood risk management are obvious but in terms of fluvial flooding they are not straightforward to quantify. Changes in sea level have direct impact on coastal flooding and a range of predictions on projected rises are available. A number of meteorological projections are also available for changes in rainfall but these have a wide degree of variance particularly from season to season and are difficult to translate into river flow.

Research into climate change in Ireland is coordinated by Met Éireann through the Community Climate Change Consortium for Ireland (www.c4i.ie). Research summarised in the report 'Ireland in a Warmer World – Scientific Predictions of the Irish Climate in the 21st Century' (Mc Grath et al, 2008) seeks to quantify the impact of climate change on Irish hydrology and considers the impacts of nine Irish catchments including the Suck catchment, part of the middle/upper Shannon catchment. The ensemble scenario modelling from the regional climate change model predicts that between the two periods of 1961 – 2000 and 2021 – 2060 that Ireland is likely to experience more precipitation in autumn and winter (5 – 10%) and less precipitation in summer (5 – 10%). Between the periods of 1961 – 2000 and 2060 – 2099 this trend is likely to continue with increases of 15 – 20% generally, but up to 25% in the northern half of the country in autumn and drier summers of up to 10 – 18%.

The report seeks to further quantify the impact on hydrology in Ireland through the use of a HBV-Light conceptual rainfall run-off model (provided by Prof. Jan Seibert of Stockholm University) to simulate the effects of climate change on stream flow within nine Irish catchments. The HBV-Light conceptual rainfall run-off model of the Suck catchment was calibrated using historical meteorological data against the hydrometric gauge record at the Bellagill gauging station (26007). Validation of the models found that the Suck model overestimated flows . Following simulation of the meteorological climate change ensembles within the run-off model the following observations were made for the changes between the periods (1961 – 2000) and (2021 – 2060):

- Reductions in mean daily summer flow of up to 60% and increases in mean winter flow of up to 20% within the Suck catchment
- The risk of extremely high winter flows will increase in all of the catchments considered

In addition to the research undertaken by C4i, the paper titled 'Quantifying the cascade of uncertainty in climate change impacts for the water sector' (Dept. of Geography, National University of Ireland, Maynooth, 2011) seeks to quantify the cumulative effect of uncertainties on catchment scale climate change run-off models from uncertainties in emissions scenarios, climate model selection, catchment model structure and parameters. This paper concludes that uncertainties are greatest for low exceedance probability scenarios and that there is considerable residual risk associated with allowances of +20% on fluvial flows for climate change, as recommended in the draft guidelines 'Climate Change Sectoral Adaptation Plan, Flood Risk Management' (OPW, 2015)[1] for the mid range future scenario (MRFS). In light of this conclusion there is an even greater weight to be placed on higher end future predictions for climate change. The use of the OPW high end future scenario (HEFS) for fluvial flows of +30% is even more relevant in this context.

9.2.2.3.7 Fluvial-Coastal Joint Probability

The model requires the application of fluvial and coastally driven boundary conditions to assess the flood risk arising from each mechanism. However the two mechanisms may not be totally independent of one another given that both are driven by extreme meteorological conditions. For Foynes, located within the Shannon Estuary this is likely to be a significant consideration given the same weather fronts, coming from the prevailing direction of the south west, are likely to drive both surges in the Shannon Estuary and extreme rainfall.

Analysis of dependence was undertaken as part of the Shannon CFRAM Study and is detailed in the UoM24 Hydrology Report[2]. This analysis found little evidence of the coincidence of extreme fluvial and coastal events however concurrent data upon which to base such an analysis was found to be scarce. In light of this it was assumed that some degree of dependence was appropriate and a relationship was assumed for all the small to medium sized watercourses draining to the Shannon Estuary was assumed to apply. For this assessment in light of the evidence of joint occurrence of fluvial and coastal flooding for historic events the combined events have been increased slightly such that for model simulations the non-dominant event return period was held at a minimum of 2 years. Table 9.2.8 below details the combination of events suggested from the Shannon CFRAM Study. Where different values have been used in this assessment they are shown in bold in brackets.

[1] http://www.opw.ie/en/media/Draft%20Climate%20Change%20Sectoral%20Adaptation%20Plan.pdf
[2] http://shannoncframstudy.ie/docs/hydrology/UoM24/HydrologyRpt_UoM24.pdf

Table 9.2.8 – Joint Probability Combinations Assumed for Modelling

Scenario	Joint Probability Design Event		Return Periods (Years) from Analysis		Return Periods (Years) Adopted for Modelling	
	Overall AEP	*Return Period (Years)*	*Fluvial*	*Tidal*	*Fluvial*	*Tidal*
1	50%	2	2	0.2	2	0.2 **(2)**
2	50%	2	0.2	2	2	2
3	20%	5	5	0.2	5	0.2 **(2)**
4	20%	5	0.2	5	2	5
5	10%	10	10	0.5	10	0.5 **(2)**
6	10%	10	0.5	10	2	10
7	5%	20	20	1	20	1 **(2)**
8	5%	20	1	20	2	20
9	2%	50	50	2	50	2
10	2%	50	2	50	2	50
11	1%	100	100	5	100	5
12	1%	100	5	100	5	100
13	0.5%	200	200	10	200	10
14	0.5%	200	10	200	10	200
15	0.1%	1000	1000	50	1000	50
16	0.1%	1000	50	1000	50	1000

9.2.2.4 Hydraulic Analysis

Hydraulic analysis followed the completion of the hydrological analysis; with the provision of hydrological input files (boundary conditions), including design flows and hydrographs and the data collection process which provided the input survey data. The MIKE FLOOD modelling system was utilised to hydraulically analyse the relevant watercourses and coastal areas at Foynes. The MIKE FLOOD shell comprises MIKE11 for 1-dimensional modelling (fluvial application) and MIKE21 for 2-dimensional modelling (fluvial and coastal application), thus enabling seamless integration of the fluvial and coastal models.

9.2.2.4.1 One-Dimensional River Model Input (MIKE 11 HD)

The Foynes one-dimensional River model (MIKE11) comprises of several interlinked files controlled by the simulation editor. This file contains details relating to the model simulation and the link to other information including the modelled network, cross-sections, boundary information and hydrodynamic parameters. Figure 9.2.7 shows the Network Editor file that contains information relating to the location of the rivers or streams and details of modelled structures including weirs, culverts and bridges. The location of each cross-section can be seen in the Figure 9.2.7 below outlined by red rectangles, whereas the location of structures is outlined by a blue rectangle. A total of 12 individual hydraulic structures are also modelled, Reach 2 and Reach 6 is modelled as an open channel and did not include any structures. Six interlinked fluvial branches are included into the 1D model, these are labelled as Branch 1 to 6 with local names included.

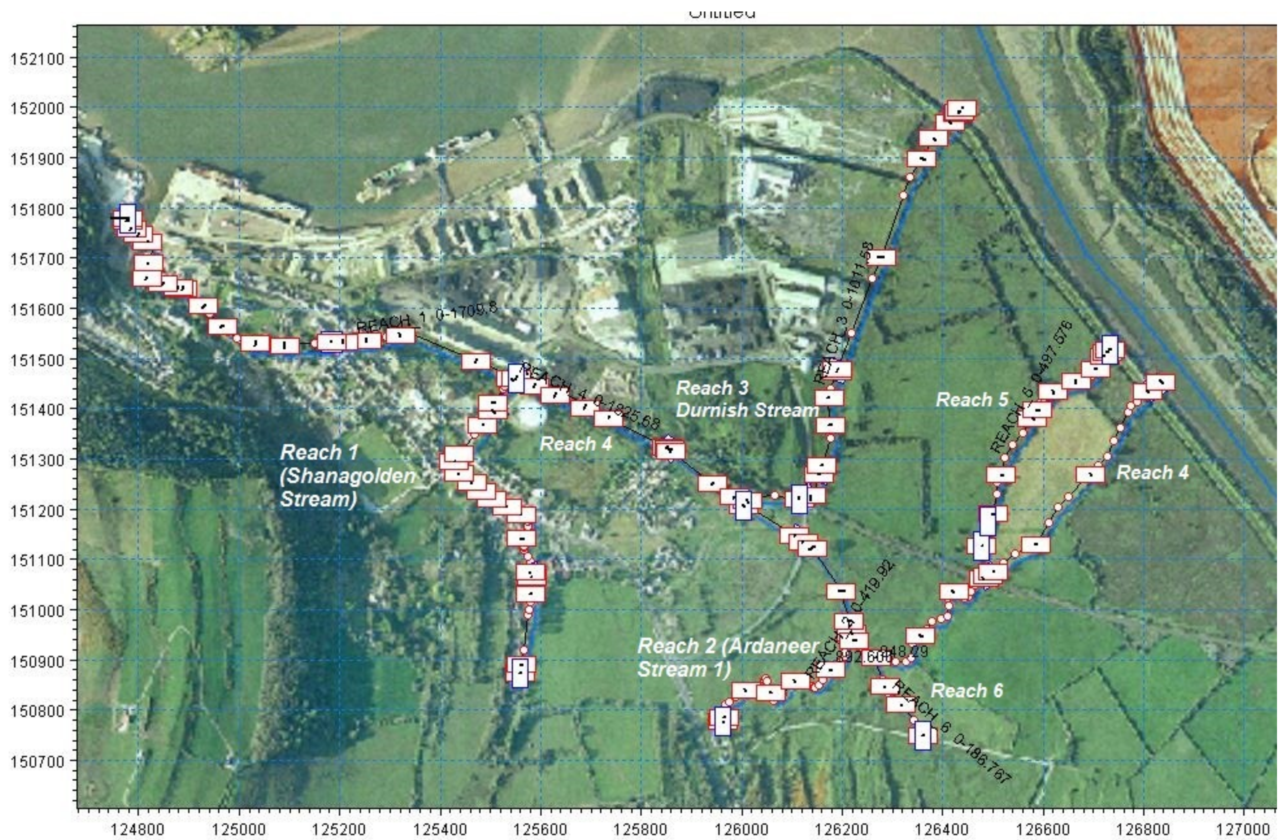


Figure 9.2.7 – Foynes Model MIKE 11 Network Editor File

The Boundary Editor file provides the MIKE 11 model with boundary condition information. As mentioned previously in Section 9.2.2.3, design flows and hydrographs derived from hydrological analysis are included incorporated into MIKE11 by this file.

Table 9.2.9 – Foynes Model MIKE 11 Boundary Editor File

	Boundary Description	Boundary Type	Branch Name	Chainage	Chainage	Gate ID	Boundary ID
1	Open	Inflow	REACH_1	0	0		HEP_01
2	Distributed Source	Inflow	REACH_1	0	800		Lateral_between_HEP_01&HEP_02
3	Open	Water Level	REACH_1	1709.7	0		DS_Reach_1_Boundary_Dummy
4	Open	Inflow	REACH_4	0	0		HEP_07
5	Distributed Source	Inflow	REACH_4	0	1800		Lateral between HEP_07& 08
6	Open	Inflow	REACH_2	0	0		HEP_3
7	Distributed Source	Inflow	REACH_2	0	235.84		Lateral between HEP_03& 04
8	Open	Inflow	REACH_6	0	0		HEP_11
9	Distributed Source	Inflow	REACH_6	0	125		Lateral between HEP_11&12
10	Open	Inflow	REACH_3	0	0		HEP_05
11	Distributed Source	Inflow	REACH_3	121.49	0		Lateral between HEP_05&06
12	Open	Inflow	REACH_5	0	0		HEP_09
13	Distributed Source	Inflow	REACH_5	50	0		Lateral between HEP_09&10
14	Open	Water Level	REACH_5	497.576	0		DS_Reach_5_dummy_level
15	Open	Water Level	REACH_4	1825.68	0		DS_Reach_4_dummy_level
16	Open	Water Level	REACH_3	1011.58	0		DS_Reach_3_dummy_level

The generation of peak flows and hydrographs used for the boundary editor are discussed in Section 9.2.2.3. The model boundary editor includes information relating to upstream input discharge hydrograph for each watercourse, a specified downstream boundary and a number of point / distributed discharge hydrographs along the length of the river. The downstream dummy levels connect the MIKE11 model to the MIKE 21. During model simulation, these dummy levels in the 1D model are replaced by the flows generated by the 2D model. Table 9.2.9 (above) is an example of the Foynes MIKE 11 Boundary Editor file.

9.2.2.4.2 Two-Dimensional River Model Input (MIKE 21 HD)

Figure 9.2.8 shows the extent of the MIKE 21 model. This part of the model represents the 2D surface of the study area. In general terms, this model represents the free surface flow in the estuary and floodplain. The topography in the floodplain area is based on LiDAR and DTM information of the study site. A MIKE flexible mesh was created with the resolution varying from 5m^2 in areas where greater detail was required e.g. small watercourses or drains not included within the 1D model to greater than 100m^2 in areas requiring less detail e.g. the Shannon Estuary.

Buildings were represented in this mesh as voids. Buildings were identified by a GIS analysis of national vector mapping and the relevant areas of the mesh blocked out accordingly. This approach is considered to appropriately represent the flow paths across the floodplain for this model. It is acknowledged that in reality buildings would provide an element of flood storage thus marginally reducing the overall flood extents but there is uncertainty as to the actual volume they would store. Therefore, it was considered that preventing flood flows through buildings was a more conservative approach, ensuring that flood extents are not underestimated.

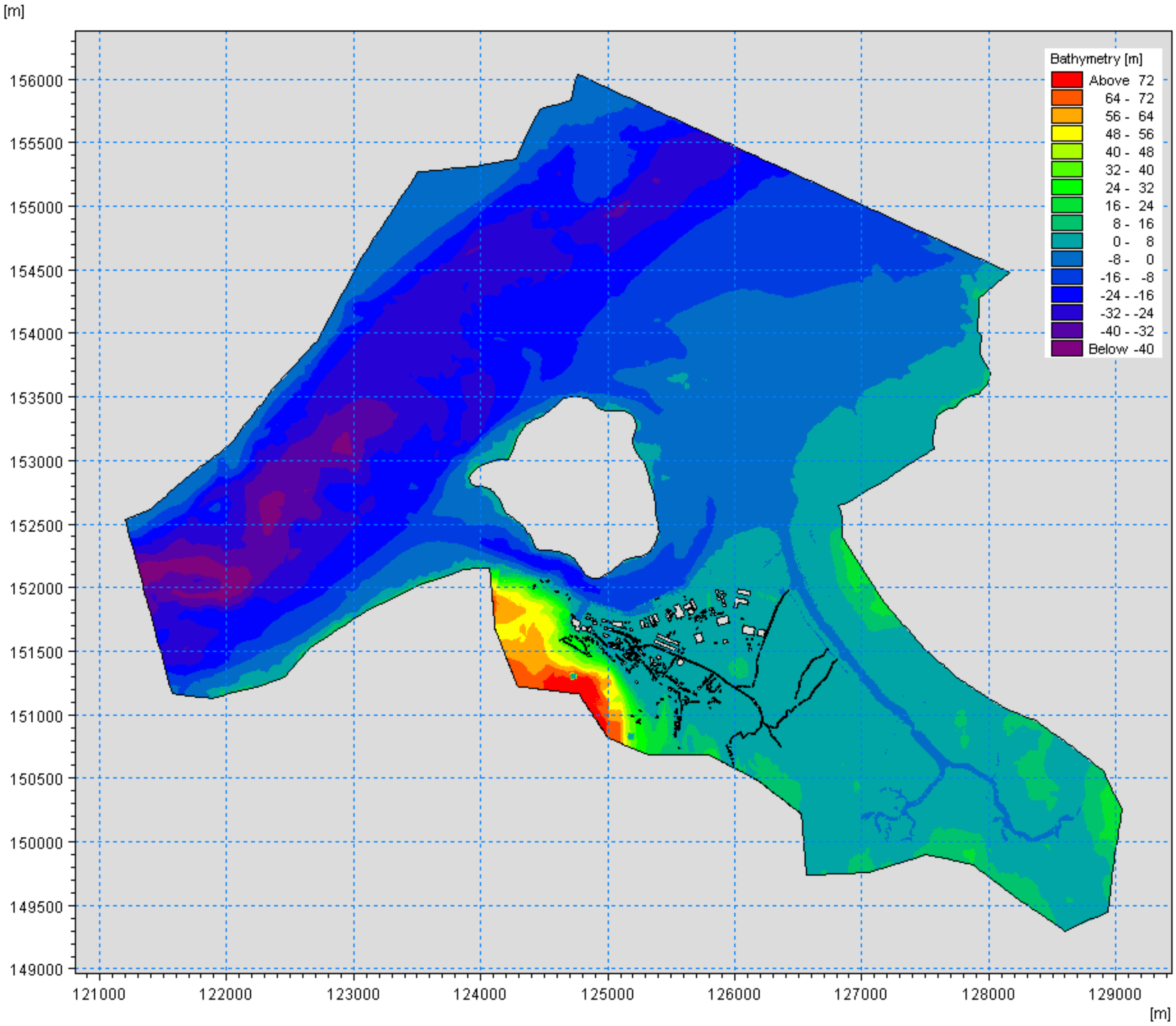


Figure 9.2.8 – Foynes Model 2d Surface

9.2.2.4.3 Roughness Coefficients

Roughness coefficients for cross-sections and structures within 1D river models are based on the CIRIA (1997) Culvert design guide Figure 9.2.9 and Figure 9.2.10 below are examples of model cross-sections and hydraulic structures, with the Manning's 'n' information applied. Through site visits, photographs and videos included within the topographical survey information, an appropriate Manning's n value is selected for each cross-section and structure. These initial Manning's n values may be amended (within normal bounds) to facilitate achieving model calibration.

Figure 9.2.9 Examples of In-Bank Roughness Coefficients:

	
Reach 1 XS R1.01750 **Manning's n = 0.055** **Artificial channel, clean base, brush on sides**	**Reach 2 XS R2.00250** **Manning's n =0.07** **Minor Stream, sluggish, weedy, deep pools**
	
Reach 3 XS R3.00700 **Manning's n =0.05** **Artificial channel, clean base, brush on sides**	**Reach 4 XS R4.00000** **Manning's n =0.03** **Minor Stream, clean no rift or weeds**

	
Reach 5 XS R5.00500 **Manning's n =0.055** **Artificial channel, clean base, brush on sides**	**Reach 6 XS R6.00115** **Manning's n =0.1** **Minor Stream, sluggish, weedy, deep pools**
Figure 9.2.10: Examples of Structure Roughness Coefficients:	
	
Reach 1 XS 00245 **Manning's n =0.025** **Brick, cement, mortar, poor condition**	**Reach 3 XS 00760** **Manning's n =0.013** **Concrete pipe good joints, smooth walls**
Refer to ftp://ftp.odot.state.or.us/techserv/Geo-Environmental/Hydraulics/Hydraulics%20Manual/Chapter_08/Chapter_08_Appendix_A/Chapter_08_Appendix_A.pdf for further information on basis of assigning Manning's n values.	

The selection of roughness values used for the 2D domains has been based on the 500m grid resolution CORINE land use dataset. This is the best land use dataset currently available, covering Ireland at a consistent resolution. The CORINE dataset comprises of 44 different land use types - each of these were assigned an appropriate Manning's n and M value (Manning's 'M' is the inverse of the commonly used Manning's 'n' number). The CORINE shapefile incorporating Manning's values was converted allowing it to be imported into the hydraulic modelling software. The values selected are shown in Table 9.2.10.

Table 9.2.10 - CORINE Description and corresponding Manning's Values for Foynes

CORINE - Description	Manning's Value	
	n	M
Continuous urban fabric	0.011	91
Industrial and commercial units	0.014	71
Road and rail network	0.013	77
Sea ports	0.014	71
Construction sites	0.04	25
Green urban areas	0.03	33
Pastures	0.035	29
Annual crops associated with permanent crops	0.035	29
Land principally occupied by agriculture with significant areas of natural vegetation	0.06	17
Agro-forestries	0.06	17
Coniferous forests	0.06	17
Natural grassland	0.035	29
Beaches, dunes, sand	0.025	40
Bare rocks	0.02	50
Sparsely vegetated areas	0.025	40
Salt marshes	0.03	33
Intertidal flats	0.02	50
Stream courses	0	0
Water bodies	0	0
Estuaries	0	0

9.2.2.4.4 Coastal Defences

Foynes is protected by a series of coastal flood defences; these include a series of embankments or coastal walls. Figure 9.2.13 below shows how these defences have been represented within the MIKE 21 (2D model regime). These defences have been included within the 2D modelling area as five separate dike structures. Dike 1, 2 and 3 protect the Foynes Port area, Dike 4 protects the Durnish lands, Dike 5 protects the Oorla and Robertstown area to the east of the Foynes Port. Dike 6, protects the Dysert area, at the upstream extent of the Robertstown River. A survey of Dikes 1 to 4 has been undertaken to provide x, y and z information. While the topographic information relating to Dikes 5 and 6 have been extracted from Lidar and the NDHM.

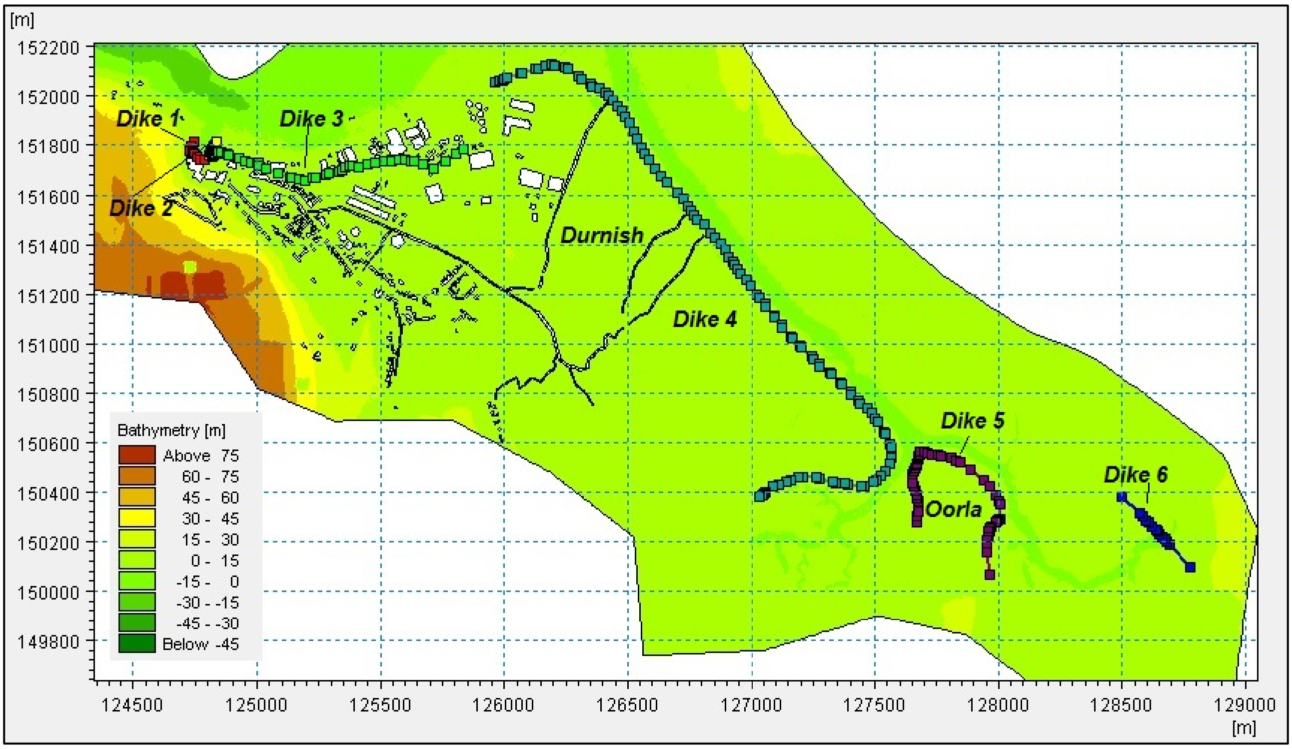


Figure 9.2.11 – Foynes Coastal Flood Defences represented in MIKE 21 (2D Model)

Table 9.2.11: Foynes Modelled Coastal Defences and Elevation Ranges.

Defence Name	Elevation Range (mOD)
Dike 1	**4.879 – 4.697**
Dike 2	**4.818 – 4.7**
Dike 3	**4.837 – 4.484**
Dike 4	**6.374 – 4.108**
Dike 5	**3.6 – 2.99**
Dike 6	**5.32 – 3.9**

9.2.2.4.5 Fluvial and Coastal Model Software – MIKE FLOOD

MIKE FLOOD integrates the one-dimensional model and the two-dimensional model into a single, dynamically coupled modelling system. The integration of MIKE11 and MIKE21 models allows the best features of both model types to be utilised, whilst at the same time avoiding many of the limitations of resolution and accuracy encountered when using either model separately.

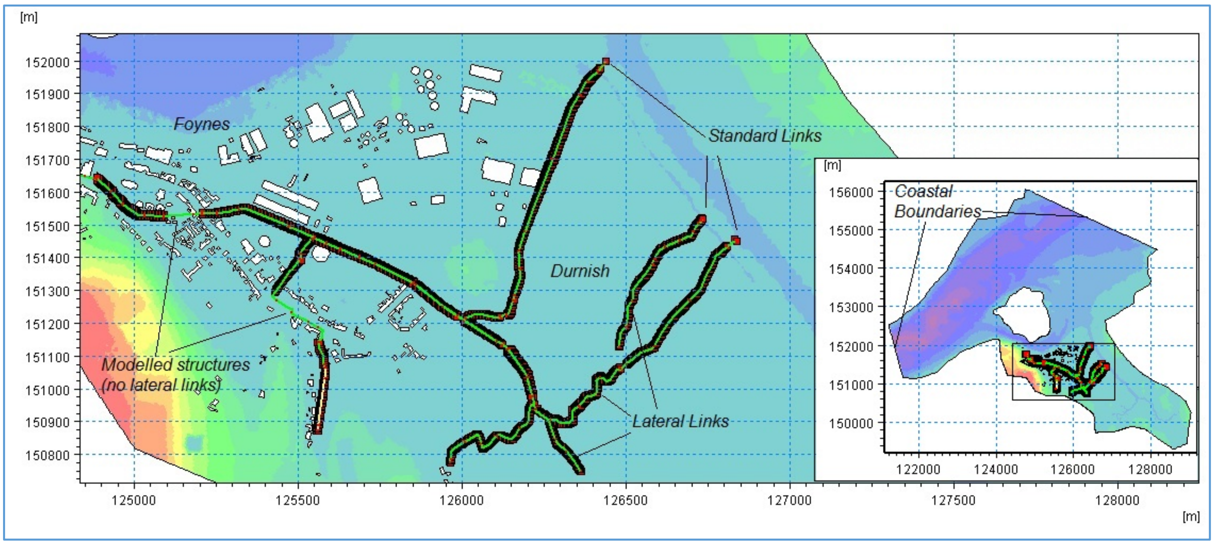


Figure 9.2.12 - Annotated MIKE FLOOD Model Labelling MIKE11 and MIKE21 Integration

Figure 9.2.12 shows the integration of MIKE11 and MIKE21 within MIKE FLOOD, this is achieved by a series of lateral links, on both the left and right banks of the MIKE11 model. Each lateral link allows a string of MIKE21 cells to be laterally linked to a defined reach in the MIKE11 model. These links are used to simulate overflow from the river channel onto a floodplain. Consequently, links are not provided where lateral exchange of water would not occur e.g. along culverts or bridge structures. MIKE FLOOD provides options to adjust the parameters associated with each link including friction, weir coefficient, calculation type and source of flooding i.e. water transfer occurs when the water level exceeds the highest of the MIKE21 cell level or the marker level in MIKE11.

Standard links have also been used, to link MIKE21 cells to the end of a MIKE11 river branch. In essence, these links are used to connect the MIKE21 grid / mesh into a broader MIKE11 network.

9.2.2.4.6 Other Parameters

The MIKE21 models provide a facility for specifying the depth at which the model cells are identified as wet or dry. The drying depth is the minimum water depth allowed in a cell or element before it is taken out of the calculation. The flooding depth is the depth at which the cell or element will be entered into the calculation. This removes very shallow depths of water from the flood maps, leading to better representation of the flood extents. The drying depth is set at 0.02m and the flooding depth is set at 0.03m.

The value for eddy viscosity is normally defined as $0.02(x\hat{}^2/T)$ where x represents the mesh resolution and T is the timestep interval. The eddy viscosity value can be amended beyond this calculated value (within normal bounds) in order to improve model stability.

The timestep for this model is 2 seconds; this is consistent between the 1D and 2D model.

9.2.2.4.7 Modelling Assumptions

Due to an inability to survey the culvert outlet structure at Reach 1 due to health and safety concerns the downstream extent of Reach 1 was omitted from the survey. The presence of estuarine muds prevented data collection at this location; therefore modelling assumptions have been made based on photographs, correspondence with the surveyor, Google street view and LiDAR information. Figure 9.2.13 is an image taken from the Buildings of Ireland website (http://www.buildingsofireland.ie/niah/search.jsp?type=images&county=LC&regno=21829004). This image shows the most likely location of the downstream extent of Reach 4. This outlet has been represented within the MIKE 11 (1D) model at chainage 1684m as a structure, with a 0.6m diameter set at an invert level of -1.62m OD. Based upon correspondence with the surveyor, it is estimated that this structure probably measures 19m in length.

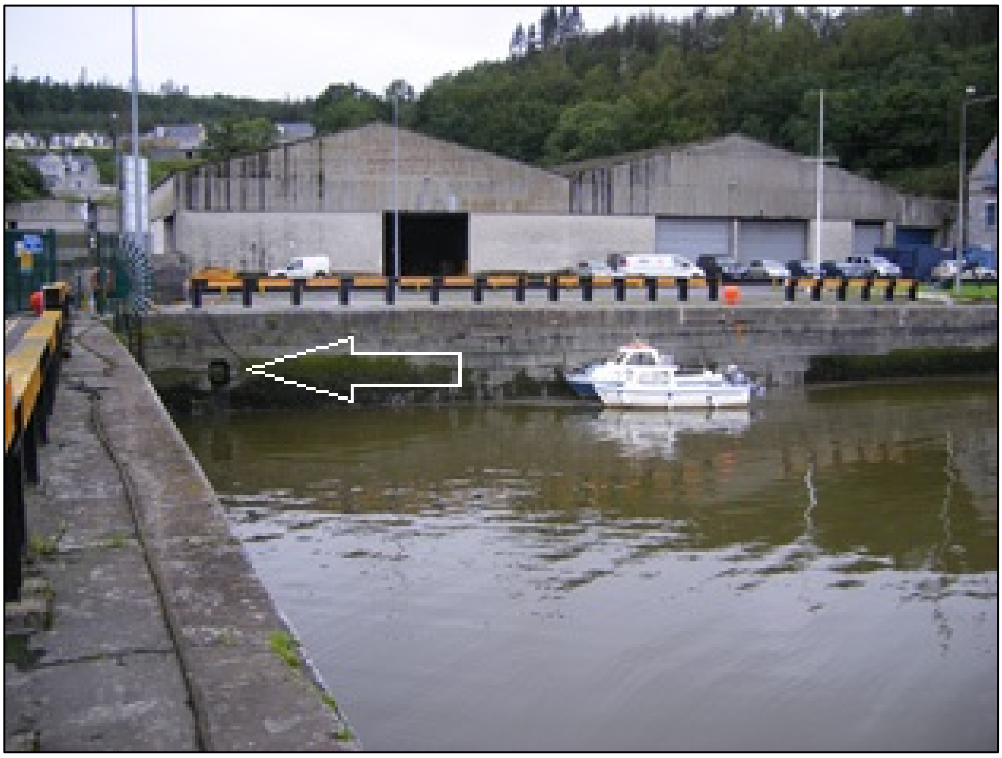


Figure 9.2.13 – Downstream Extent of Reach 1 (Arrow pointing to downstream outlet).

9.2.3 Existing Flood Risk

9.2.3.1 Historical Flooding and Model Calibration

Records of historic flooding can be useful in the understanding of the existing flood risk and in providing calibration and verification of the model. Historical flooding incidents associated with Foynes provide evidence of both coastal and fluvial flooding mechanisms. Generally, due to its coastal location, it is assumed that coastal is the predominant flood mechanism, with flood risk increased during occurrences of high tide and storm conditions. During this set up, water levels have been of a significant level to enable it to overtop the port quay wall to flow along the main street leading to flooding of premises. The occurrence of high coastal water levels is also responsible for retaining fluvial and pluvial flooding in the area; high coastal water levels have contributed to the backing up of several small streams that flow through Foynes village and into the Shannon estuary; and to the east of the village across Durnish and into the Robertstown River. These watercourses become tide locked and cannot discharge seawards. During significant rainfall events, runoff combined with inadequate culvert capacity contributes to flooding at Foynes village, the port and surrounding area. www.floodmpas.ie provides some information describing several flooding incidents that have occurred since the mid-1990s. These reports are summarised and presented in chronological order, as follows. It should be noted that there is no active hydrometric flow gauging station within the modelled extent on which an assessment of the frequency of fluvial events can be assessed. There are coastal water level gauges at Foynes and at Limerick Dock which can be used, along with the Extreme Value analysis carried out by JBA Consulting in support of the Foynes Flood Alleviation Scheme, to assess the frequency of coastal water level events. The main historic flood events are discussed below:

23rd February 1995: The Cork Examiner described this flooding incident as the worst case of flooding to have occurred within Foynes in recent memory. This flood event followed a period of severe rainfall. During this flood event, a section of the N69 was flooded continuously for a number of days. As a response, remedial action was proposed; this involved the partial diversion of the Corgrig stream that was described as the main cause of flooding (Reach 1). The Corgrig Stream was located to the south of Foynes and east of the N69. The Corgrig Stream was only partially diverted since it was reported that some flow was required through the village for cleansing of drains. Works included the culverting in a non-uniform fashion of the stream through the main street in Foynes. The daily rainfall gauge at Shanagolden approximately 4km to the south of the application site recorded 122mm of rainfall in the seven days leading up to the 23rd February. A review of this rainfall sum using the FSU rainfall Depth Duration Frequency model indicates that this rainfall has a frequency of approximately 10% AEP. The data from the coastal water level gauge at Limerick Docks does not indicate that this was a significant coastal flood event.

Considering that remedial works have taken place since the occurrence of this particular event, it is not recommended to use this event to verify the existing flood model. Regardless, model results indicate that a section of the N69 floods during the occurrence of both Coastal and Fluvial 10% AEP flood events.

1st February 2002: A combination of factors including heavy rainfall, gales associated with the presence of a low depression system (central pressure of 930hPa) located to the northwest of Ireland, enhanced an already higher than normal tide. This set of circumstances lead to flooding around the coast of Ireland with Foynes being no exception. The combination of a high tide and storm surge contributed to the flooding of Foynes Harbour, the Railway line and a number of properties located along the Main Street. There is significant uncertainty as to the actual peak water level which occurred during the event as the tidal gauge at Foynes did not accurately record the peak water level. An OPW letter dated 18th September 2002 put the peak water level for the tide of Feb 1st at 5.98m OD Poolbeg. OPW stated that the peak water level was estimated to be approximately 0.19m above defences. During this incident, flood waters spilled out of the port entrance, into the Port and flowed landwards towards the village. Due to the higher than normal tides, fluvial flood waters were prevented from being discharged into the Robertstown River and Shannon Estuary and hence the fluvial system became tidally locked. This resulted in the backing up in the streams that normally flowed through the village and discharged into the Shannon Estuary and Robertstown Channel. Some flooding of agricultural land also occurred to the east of Foynes due to the overtopping of the OPW Embankment. It was estimated that up to 20no domestic and commercial properties, including a shop, a pub and a number of homes were flooded.

Based on an extreme value analysis of the tidal water level gauge at the port it is estimated that this particular flood event, equates to approximately a coastal 20% AEP flood event. The daily rainfall gauge at Shanagolden recorded 145mm of rainfall in the twelve days leading up to the 2nd February and 59mm in the three days leading up to 2nd February. A review of this rainfall sum using the FSU rainfall Depth Duration Frequency model indicates that this rainfall has a frequency of approximately 20-50% AEP. This indicates evidence of joint occurrence of fluvial and coastal events. Considering that significant flood alleviation works have taken place within Foynes since the event occurred, caution should be exercised when using this particular event for model verification purposes. Figure 9.2.14 shows the modelled coastal 10% AEP flood extent in the area of the port frontage, the railway line and Main Street were most affected properties are located.

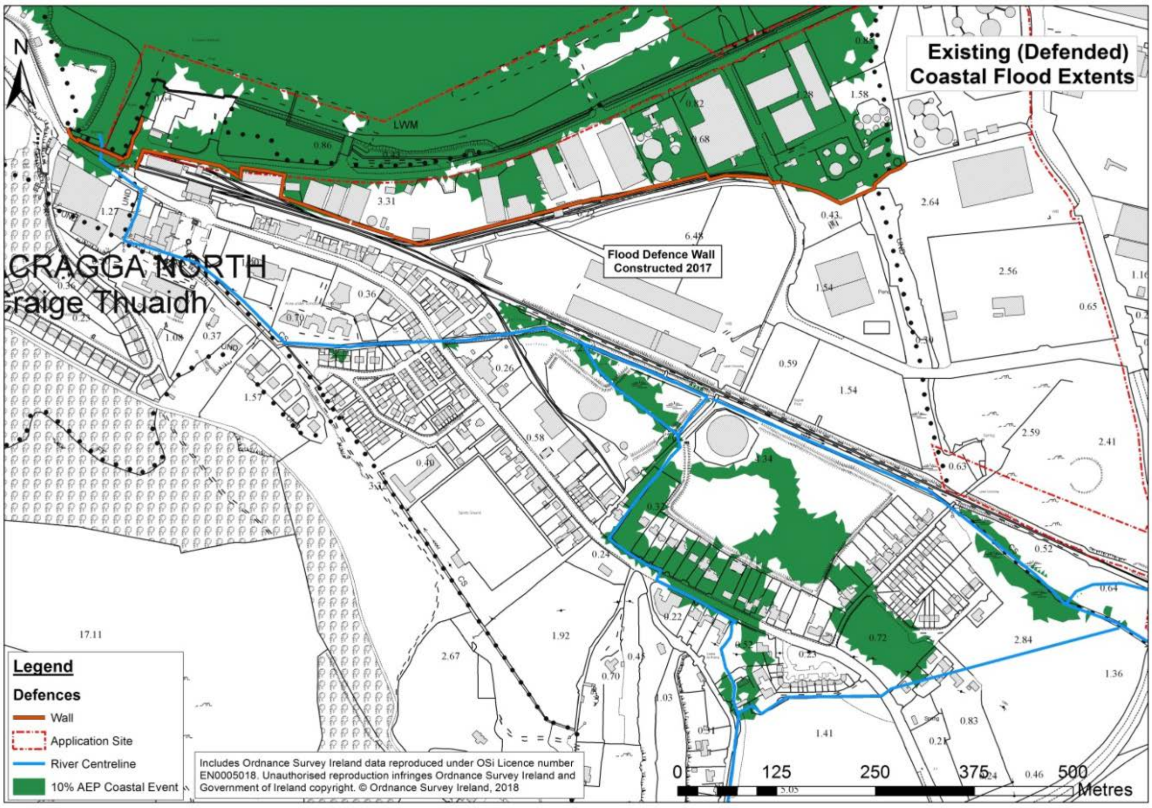


Figure 9.2.14 – Model Output Coastal 10% AEP Flood Extent

The 10% AEP event shown in the figure represents a slightly larger flood event than that recorded in 2002 however the flooding is not extensive as that which was recorded. It was estimated that up 30 properties were affected and flooding spread from the port along the railway line which is not evident in the model simulation of the 10% AEP event. Around 10-15 properties are affected along Main Street in the 10% AEP simulation.

The difference in the flood extents is considered to represent the significant amount of flood alleviation works which have taken place since the 2002 event occurred including works in 2006 to improve the OPW maintained embankments and drainage system (discussed further below in relation to the 2005 event) and the recent construction of the hard defence wall through the port (discussed further in relation to the 2014 event).

8th January 2005: Severe flooding was reported in the village of Foynes by the media (RTE News). Met Éireann described how stormy conditions and heavy rain brought some severe flooding to the western half of Ireland, as a low pressure system (central pressure >975 hPa) passed over Ireland. It was described that a number of homes in the main street in Foynes were damaged following a day of persistent rain. During this event, the Corgrig Stream (Reach 1), overflowed and caused considerable damage to at least 4no dwellings and 2no businesses. A review of the tidal data suggests this event was more frequent than a 50% AEP (<2 year return period).

Following this flood incident, the OPW Foynes remediation scheme was proposed, and subsequently completed in 2008. This scheme involved the diversion of watercourses away from the town and increasing the storage available behind the tidal embankments to receive flood waters when the system is tide locked. Considering that flood alleviation works have taken place since the occurrence of this event, including the re-routing of the Corgrig Stream (Reach 1), model verification using this event is not recommended. It is also deduced that the raising of ground levels in and around Corgrigg Wood (constructed since 2005), has probably been the cause for the re-routing of former flood flow paths.

3rd January 2014: The winter of 2013-2014 was affected by the occurrence of several successive storms due to the jet stream extending over Ireland. Met Éireann has described how this exceptional weather set-up combined with high tides resulted in serious coastal damage and widespread flooding. In particular, high spring tides on the 3rd January coincided with storms with over 0.6m of flooding reported at Foynes. It is estimated that flooding began around 7:10 and peaked 7:30, coinciding with the occurrence of high tide. Similar to the 2002 flooding event, the main source of flooding was attributed to high water levels breaching the Port. The combination of heavy rainfall, gales and storm surge coinciding with high tide impacted approximately 25 residential properties and 7 commercial properties, comprising of both one and two storey properties located in Main Street and on the laneway between Main Street and the Railway line. It was also reported that 300m of the N69 was flooded. Approximately 300-500m of the intercity Railway line was flooded when flood waters from the Port area entered into the area. There are reports of up to 0.3m depth of flood waters at the garden walls of the residential properties adjacent to the railway line. The Irish Times reported on how more than 2ft of water flooded Main Street after the flood defences were breached. In more detail, it was reported that 0.25m flooding depth was recorded at the internal Port Road and 0.1m is the approximate depth of flooding recorded on Main Street.

The tide level recorded by the Foynes Port Company tide gauge was 6.79m (Chart Datum which equates to a peak water level of 3.79m OD Malin, the largest recorded flood event with an estimated frequency of 2% AEP (50 year return period). The daily rainfall gauge at Shanagolden did not indicate that the rainfall which fell in the days prior to the 3rd January were particularly significant although December 2013 was a particularly wet month and 200mm of rainfall were recorded in the 22 days prior to the 3rd January (approximately a 50% AEP). Coastal flooding was described as originating from four breach points, listed as follows;

1. a low point at the revetments at the West Quay;
2. the inlet to the west of the West Quay;
3. a low point at the viaduct at the East Jetty;

4. the access point to the Mooring Dolphins.

Breach points 1, 3 and 4 contributed to flooding with the town, whereas breach point 2 was eliminated by the Limerick County Council and Shannon Foynes Port Company (SFPC) who provided protection at this point. This was described as the worst case of flooding in 15 years.

This event has been the impetus for the signing of a 2.3million Euro contract that was issued in September 2016 to construct a permanent tidal flood alleviation scheme. The proposed works consisted of the construction of a defence wall extending from the slipway on the western quay across the west gates to Foynes Port, along the boundary of Shannon Foynes Port Company and Irish Rails lands. There is also a section of tidal defence barrier which runs along the west end of the west pier from the entrance to the end of the pier. A summary of the various defences in place at the time of the 2014 event, the estimated flood extents and the breach points is shown in Figure 9.2.15 as extracted from the Flood Event Report prepared by Jacobs as part of the Shannon CFRAM Study.
Figure 9.2.16 shows the flood extent associated with the coastal 10% and 0.5% AEP event model simulations. It should be noted that the flood defences (completed to date) have been included in the model simulation.

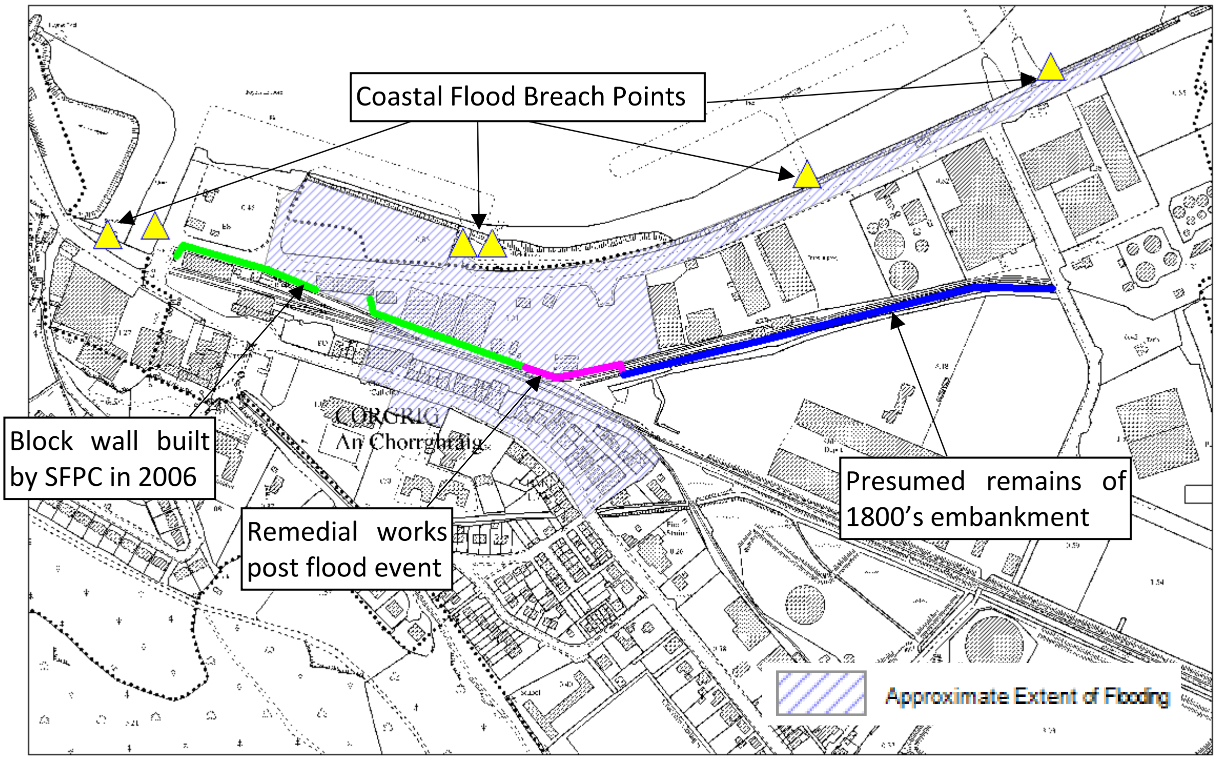


Figure 9.2.15 – Extract from Flood Event Report on January 2014 event by Jacobs (Shannon CFRAM Study)

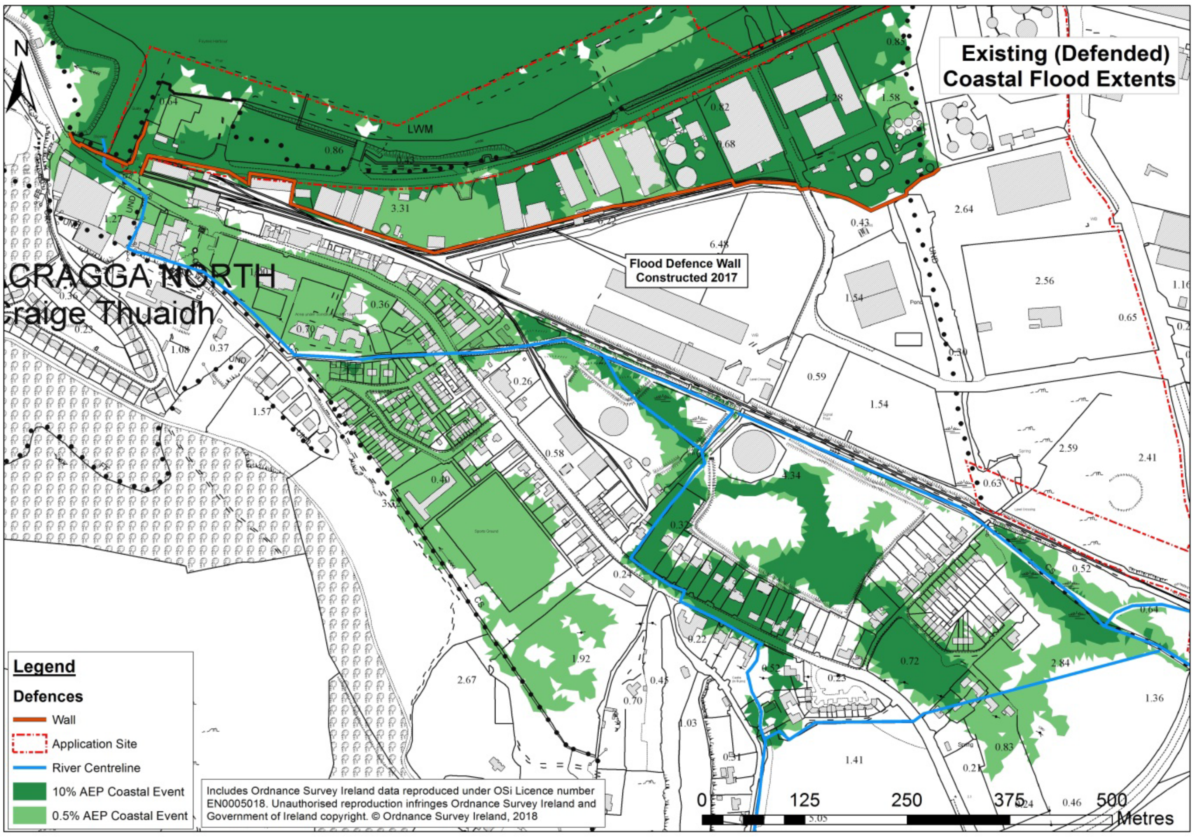


Figure 9.2.16 – Simulated 10% and 0.5% AEP Flood Extents and Location of Recently Constructed Flood Defence

22nd November 2017: The Irish Times**,** described how the occurrence of heavy rain and flash flooding lead to serious flooding on the N69 at Mount Trenchard in the Foynes area, with several cars being trapped. Met Eireann described how a slow moving frontal system from the west brought the wettest spell of the month with the highest daily rainfall recorded at Dublin Airport of 52mm. Heavy rain fell overnight starting on the 21st November, with flooding occurring on the 22nd November. The daily rainfall gauge at Shanagolden recorded 37.3mm for the 21st November which represents an estimated 50% AEP event.

The Limerick Leader, described how a private garage of a property located near the entrance of Dernish Avenue was flooded. There were no reports of homes being flooded during this incident. No further descriptions of levels have been given. It is also likely that the quick response of local authorities may have reduced the potential extent of flood damage to the Foynes area during this event, since they were in operation and responded quickly to this flood event. It is also suggested that this event may have been exasperated if the coastal surge coincided with high tide, however as shown by Figure 9.2.17. which shows tidal and surge data extracted from the RPS in-house Storm Surge Forecast model, the peak tidal surge occurred during low tide on the 23rd of November (02:15 0.23m). This set-up would have allowed the flood waters to drain from Foynes and reduced the likely impact of flooding.

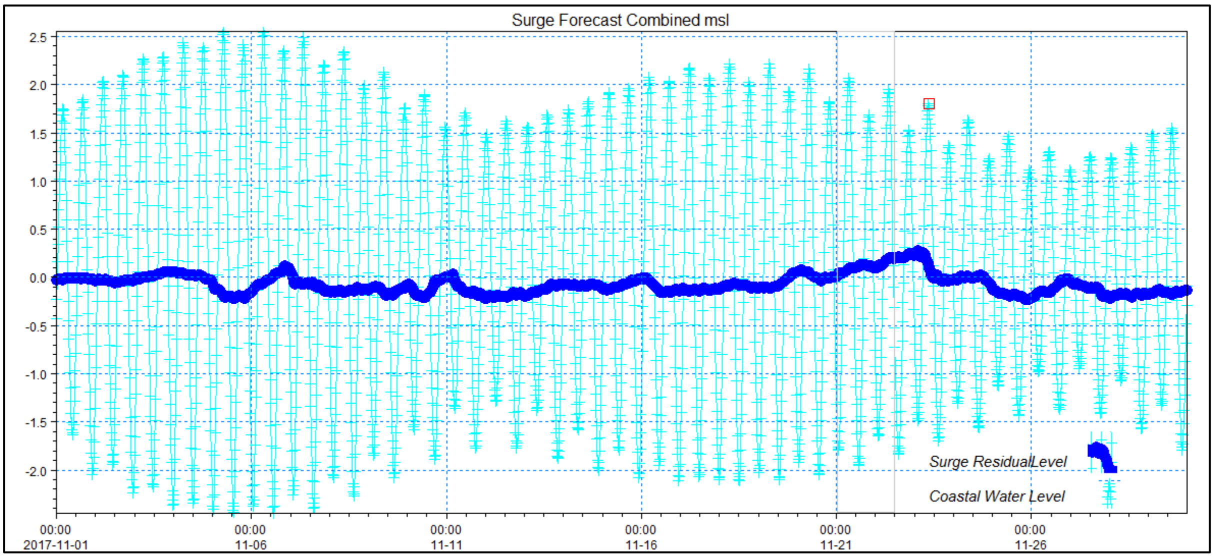


Figure 9.2.17 – Coastal Water Levels and Surge Data November 2017 (RPS & OPW Irish Surge Forecast Model)

Figure 9.2.18 shows the modelled flood extent relating 10% AEP Fluvial dominated event. This image shows that approximately 400m of the N69 is flooded, whereas some properties in and around Durnish Ave are also impacted. As mentioned earlier, the quick response of the local authorities and a receding tidal element reduced the likely impact of this particular flood event. The 10% AEP fluvial model results relate somewhat to this flood event in terms of location of recorded flooding, although the magnitude of the event appears to be much smaller than a 10% event based on the rainfall. The use of sandbags issued by the local authorities during this event may also have reduced the likely impact to properties located adjacent to the N69/Main Street.

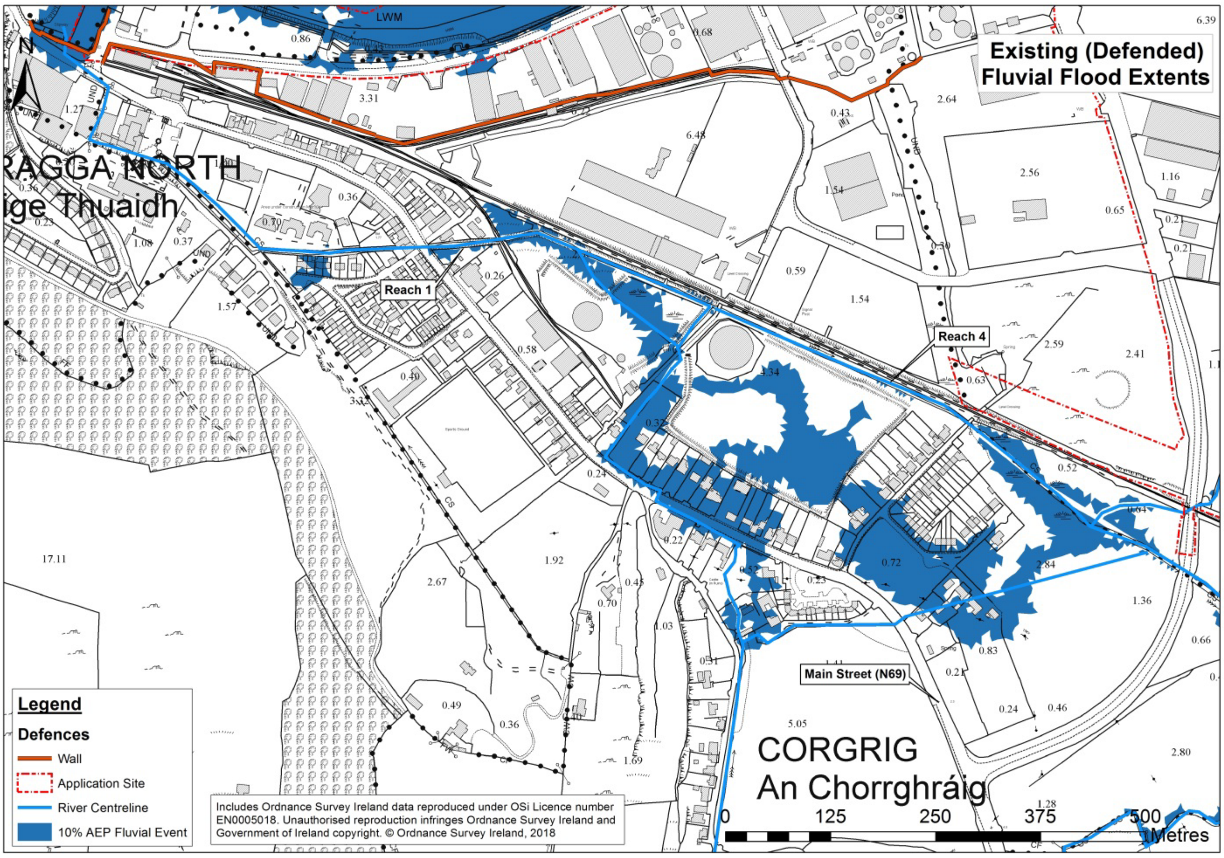


Figure 9.2.18 – Model Output Fluvial 10% AEP Fluvial Flood Extent

Reoccurring and Frequent Flood Events: Reoccurring flooding has been described along a stretch of the N69/Horans Cross area of the Foynes. Cork Examiner mentioned that flooding occurs within Foynes on an annual basis, including a section of the N69. This flooding is caused by heavy rainfall/runoff combined with the inadequate capacity of the steam downstream of the N69. There is also frequent flooding of the Foynes Harbour, Railway and Main Street. Figure 9.2.18 above shows the Fluvial 10% AEP and Figure 9.2.14 shows the Coastal 10% AEP modelled flood extents. Although the reoccurring and frequent flood events are likely to have a lesser extent compared to the fluvial and coastal 10% AEP, these descriptions are useful for model verification purposes due to the mention of particular geographical spatial references.

In both coastally and fluvially dominant 10% AEP events, a section of the Main Street and N69 is flooded with several properties both commercial affected. The Port area and railway track are also affected. It should be noted that the extent of a 10% AEP event is greater than that of more frequent/recurring events however the fact that the above mentioned locations are flooded during this simulation, is useful for model verification purposes.

9.2.3.2 Coastal Flood Risk

The risk of coastal flooding to the application site was assessed to varying degrees through the aforementioned previous studies. The level of risk has been re-analysed in light of updates to the data available upon which the extreme water level analysis has been carried out and the need to provide site specific information in relation to the level of flood risk and the requirements of the study area/this assessment.

The consideration of coastal flood risk is complicated by the presence of the existing defences at Foynes Port in the form of structural flood wall through the port under construction at the time of survey and the earthen embankment surrounding the Port and lands to the south. The defences in terms of line and level are sufficient to provide a high level of flood protection to the study area lands however there is some uncertainty, particularly in relation to the earthen flood defence embankment, as to whether the structural integrity is such that the defences will provide the standard of protection which the line and level would suggest. For this reason the assessment of coastal flood risk has considered three scenarios:

1. The defences are effective up to their crest level, henceforth referred to as the ***Defended scenario***.

2. The defences are totally ineffective i.e. their complete failure over time, henceforth referred to as the ***Undefended scenario***. It is necessary to consider such a scenario due to the uncertainty surrounding the ability of the earthen flood defences to provide the required standard of protection now and into the future and such that flood risk management planning accounts for such a scenario.

3. The defences are maintained as an effective defence but there is a localised breach in the defences, henceforth referred to as ***Breach Scenario***. The level of flood risk in this scenario will be somewhere between that which would occur in the Defended and Undefended scenarios depending on the size of the breach and the duration of the event over which the breach is present. It is necessary to consider this Breach scenario for the purposes of impact assessment. Where the volume of water which can inundate the study area is limited by the size and duration of the breach this may result in the most onerous impact arising from the development of the application site.

In addition to the three coastal scenarios which describe the state of defence provided to the study area it may also be necessary to consider alternative baseline time horizons, particularly due to the effect climate change may have on the level of flood risk. The assessment of flood risk is considered predominantly for the ***Present Day*** scenario representing the best estimates of flood risk based on the present day conditions. To consider the effect of climate change the **Mid-Range Future Scenario** or **MRFS** represents the central estimates of the effect of climate change and the **High End Future Scenario** or **HEFS** may be considered as the potential upper limit of the effects of climate change.

9.2.3.2.1 Existing Defended Coastal Flood Risk

Modelling of the existing coastal flood extents in the defended scenario has been mapped for the study area and is shown in Figure 9.2.19. The existing flood depths for the 0.5% AEP scenario are shown in Figure 9.2.20. It can be seen that even in this defended scenario there is extensive flooding to the port and to the village of Foynes. In relation to the village this is because at the time of survey the flood defence system through the port is not yet completed such that it provides a continuous line of defence. In particular coastal flood events can inundate the village via the N69 and the access points to the port until such times as measures to form a complete defence line (e.g. by raising the N69 or completing flood barriers at the port access) are in place. The village is shown to subject to flooding in all three modelled scenarios (10%, 0.5% and 0.1% AEP). It should be noted that in the modelled scenarios there is also a significant flow simulated in the watercourses to account for some joint probability of fluvial flooding occurring at the same time, as per the combinations set out in Table 9.2.8. Depth of flooding is generally less than 0.5m in the 0.5% AEP scenario with some localised locations where it is greater.

The area between the recently constructed flood defence wall and the quay within the port lands is shown to be flooded in all three modelled scenarios. Flood depths are generally up to 1m in depth in this area in the 0.5% AEP event. This represents the working port area where it is not practical or necessary to defend, due to the need to access the water's edge and as the property and infrastructure is generally developed to be flood resilient.

In relation to the Durnish lands the flood risk is low with some watercourse flooding affecting a small area.

9.2.3.2.2 Existing Undefended Coastal Flood Risk

Modelling of the existing coastal flood extents in the undefended scenario has been mapped for the study area and is shown in Figure 9.2.21. The existing flood depths for the 0.5% AEP scenario are shown in Figure 9.2.22. It can be seen that in this undefended scenario all of Foynes Village, much of the port and the agricultural lands to the south and south east are inundated. The only area between the high ground to the south west of Foynes and the Robertstown River which is not inundate in the 0.5% AEP event is the higher ground (above 3.94m OD) on the eastern side of the port. Flood depths range between 1m and 3m in depth in the 0.5% AEP event.

This scenario can be considered a worst case where the existing flood defences become completely ineffective over time. This has been represented in the model by removing all of the defences such that extreme coastal water levels can pass freely at existing ground level into the area.

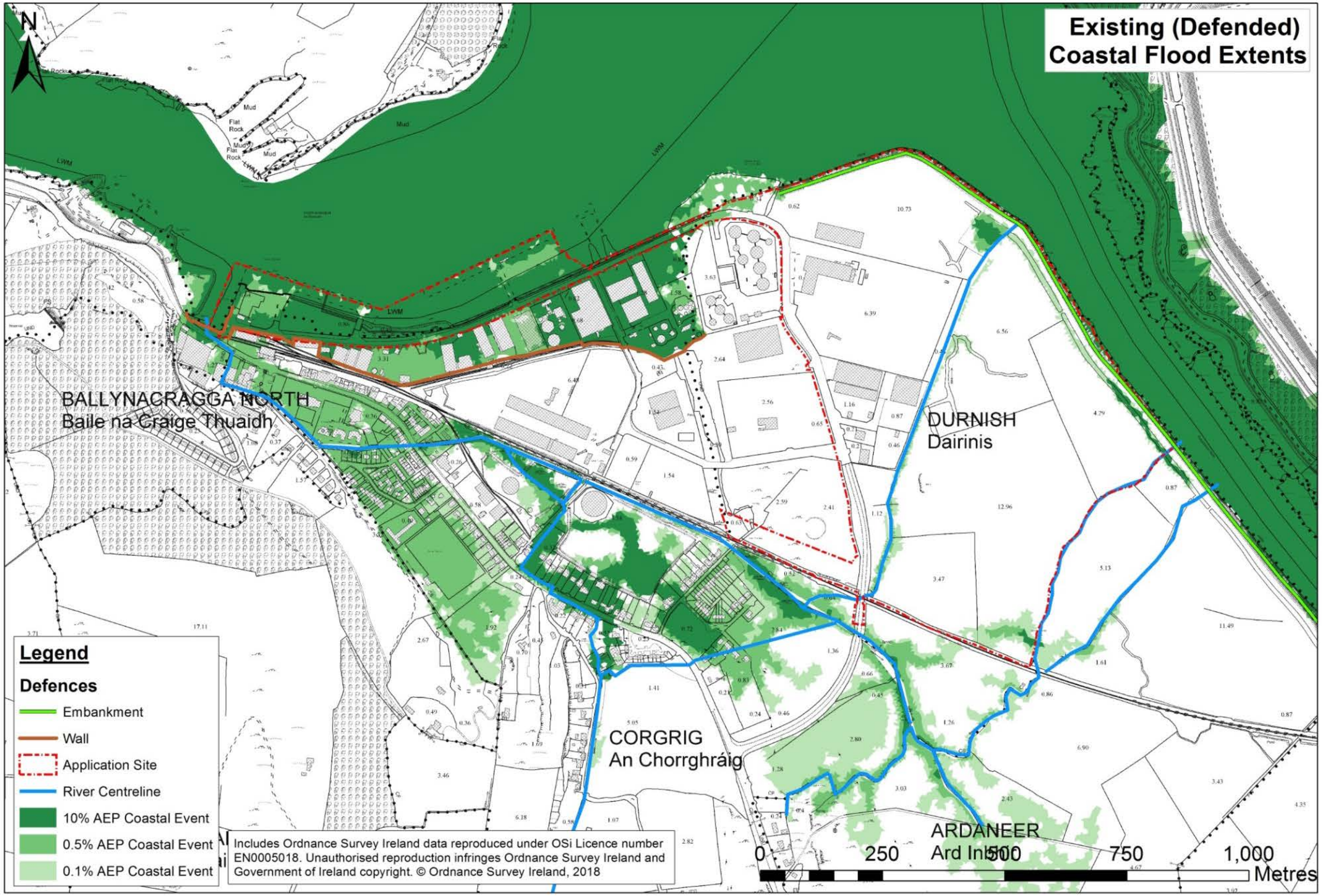


Figure 9.2.19 – Existing Coastal Flood Extents in the Defended Scenario

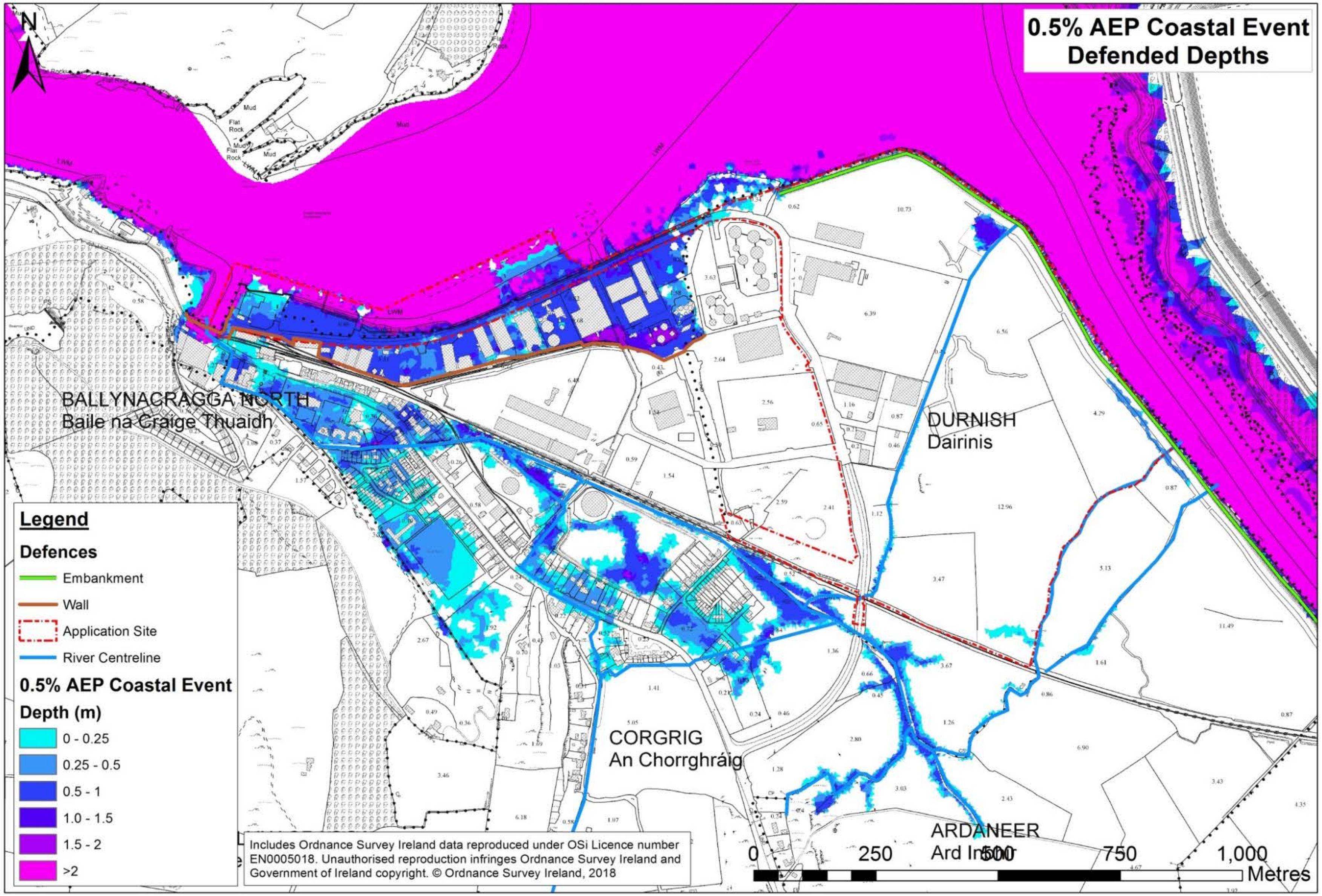


Figure 9.2.20 – Existing Coastal Flood Depths in the 0.5% AEP Defended Scenario

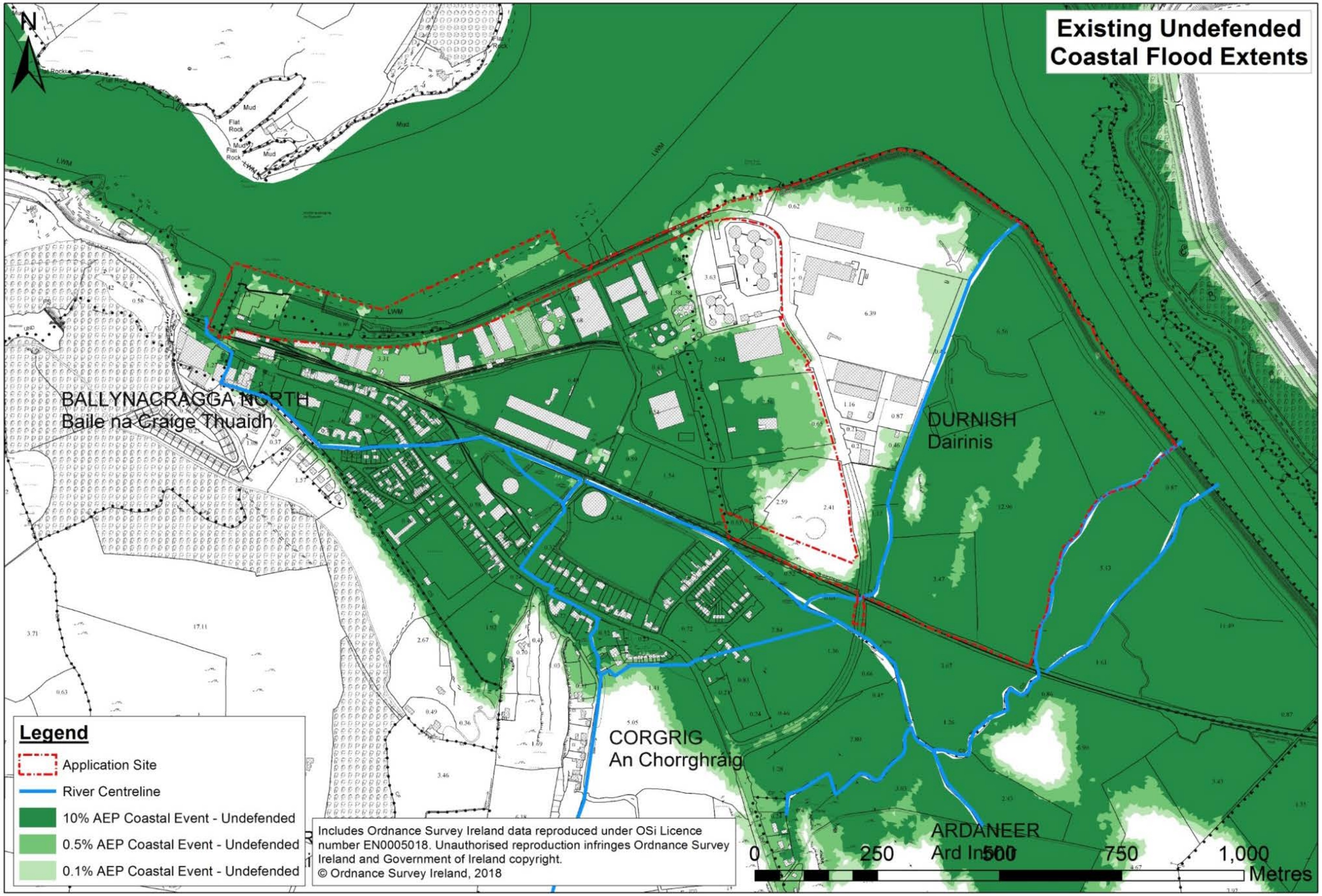


Figure 9.2.21 – Existing Coastal Flood Extents in the Undefended Scenario

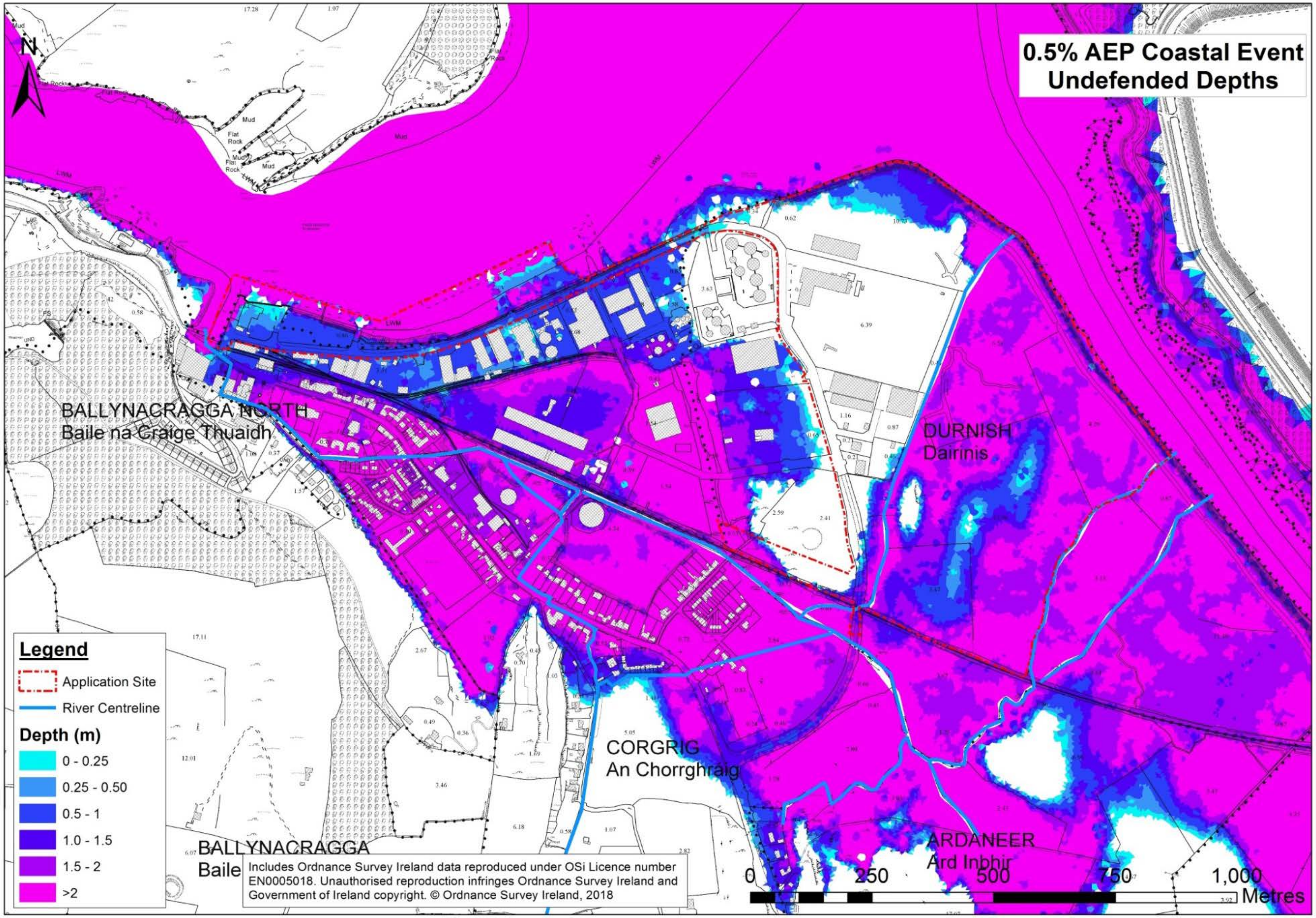


Figure 9.2.22 - Existing Coastal Flood Depths in the 0.5% AEP Undefended Scenario

9.2.3.3 Fluvial Flood Risk

The risk of coastal flooding to the application site was assessed through the Shannon CFRAM Study to a high level of detail. The level of risk has been re-analysed in light of:

- The presence of the recently constructed flood defences at the Port which may influence the magnitude of fluvial flooding and the flow routes
- Updates to the data available upon which the extreme water level analysis has been carried out
- The need to provide site specific information in relation to the level of flood risk and the requirements of the study area/this assessment.

The existing defences were not constructed for the purposes of alleviating fluvial flood risk however their presence has a significant effect in that fluvial flows are dependent on flap valved culverts through/under the defences in order to discharge to the Shannon Estuary and Robertstown River. For that reason it is considered that the most onerous fluvial scenario is the ***Defended scenario*** as it restricts the free flow of the watercourses and drainage ditches.

9.2.3.3.1 Existing Defended Coastal Flood Risk

Modelling of the existing coastal flood extents in the existing defended scenario has been mapped for the study area and is shown in Figure 9.2.23. The existing 1% AEP fluvial flood depths are shown in Figure 9.2.24. It can be seen that the extents of the predicted fluvial flooding are less than those shown for the equivalent coastal flooding scenario in the port and in Foynes Village. It must be noted that there is still significant flooding shown in the port area adjacent to the Shannon Estuary but this is driven by the coastal boundary condition used in the model to reflect the joint probability of a significant coastal event occurring at the same time as outlined in Section 9.2.2.3.7.

In the Durnish lands where significant expansion of the port is proposed only a small area of lands are effected however this flooding emanating from the watercourses is more extensive. As a result the fluvial defended scenario is considered the most onerous in terms of impact assessment in relation to these watercourses.

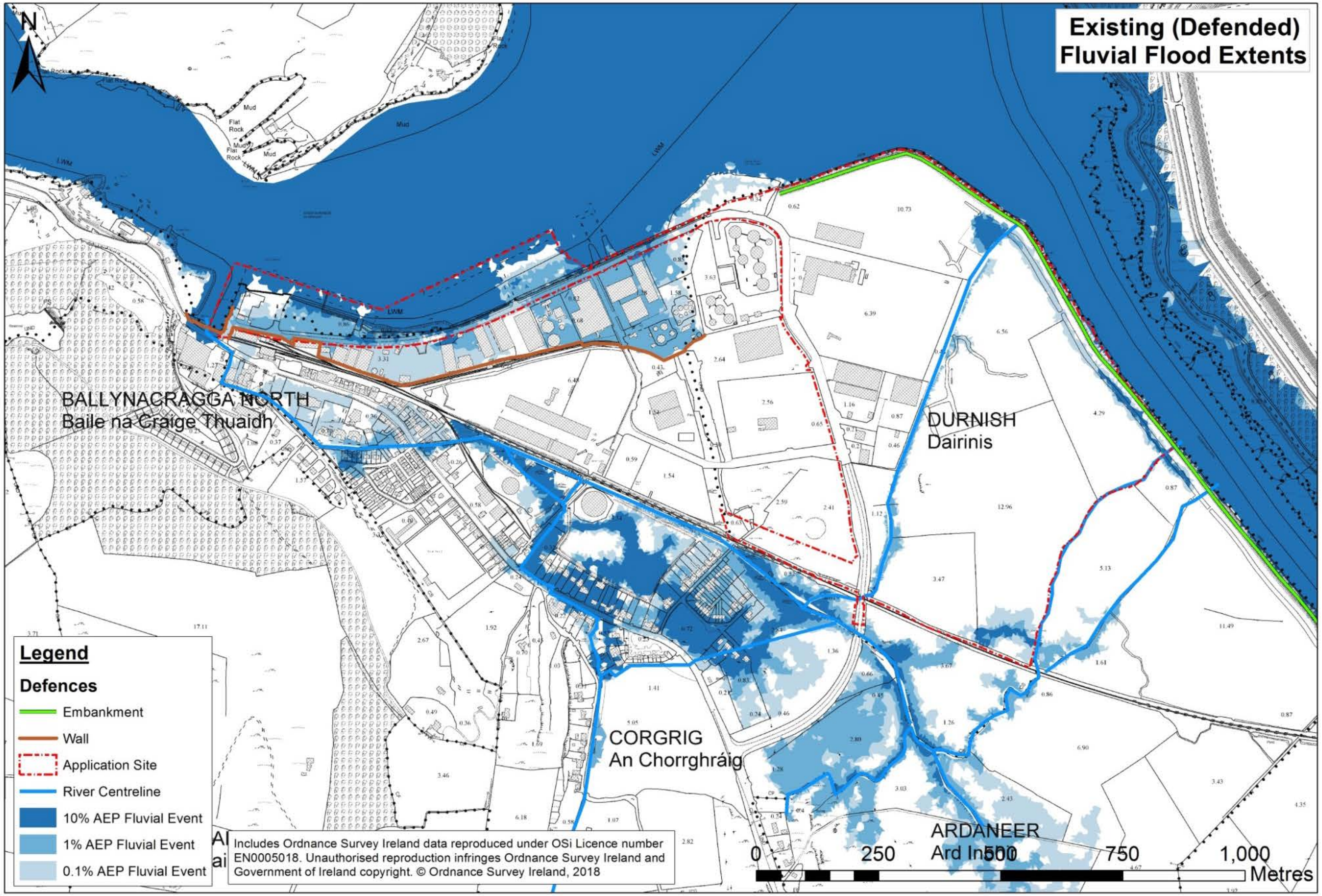


Figure 9.2.23 – Existing Fluvial Flood Extents in the Defended Scenario

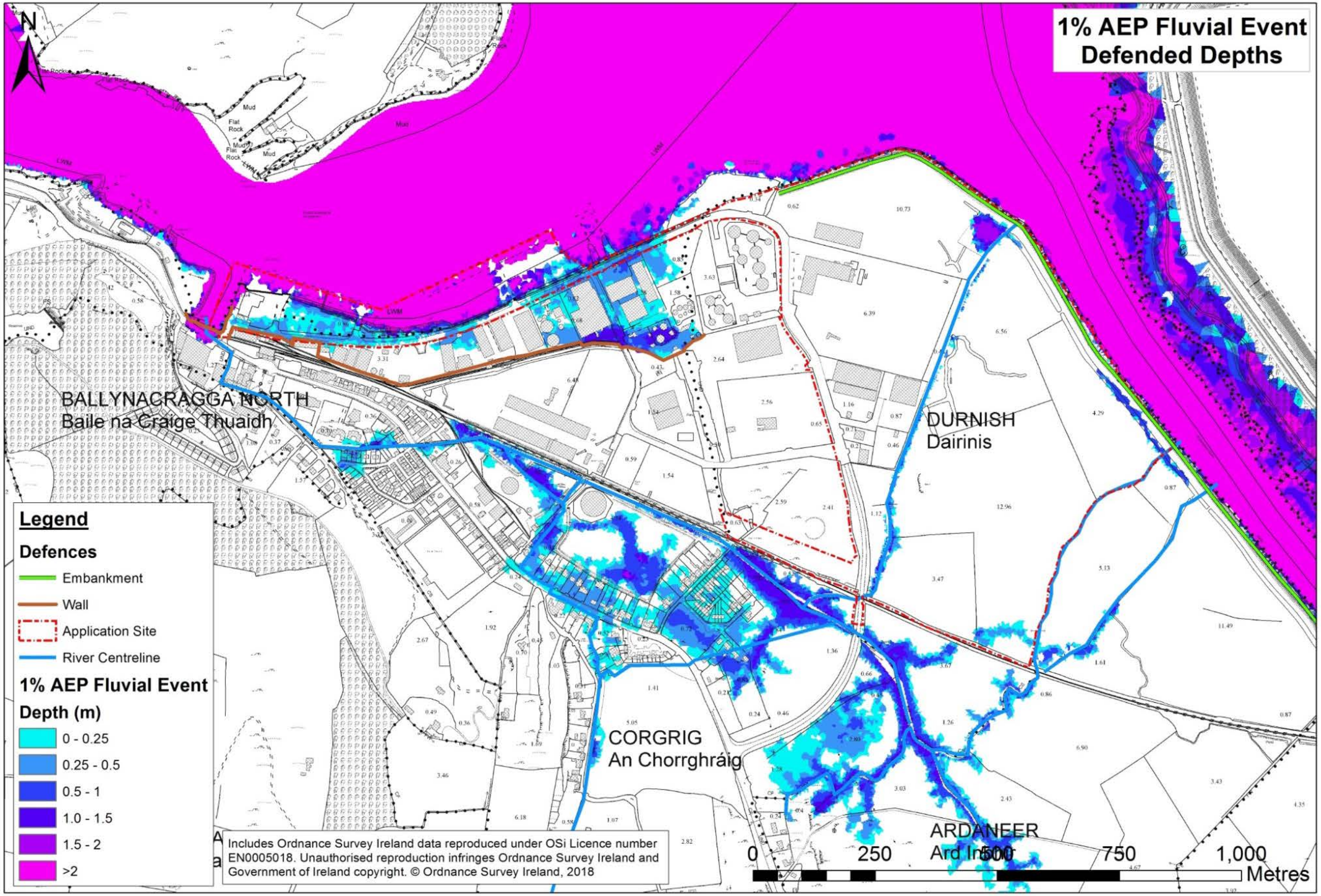


Figure 9.2.24 – Existing Fluvial Flood Depths in the 1% AEP Scenario

9.2.4 Impact Assessment

9.2.4.1 Proposed Development & Mitigation

Given the level of flood risk the proposed development plans of the port have inherently considered flood risk through their development from concept design through to development of planning drawings. The level of mitigation to be provided has centred on the effectiveness of the proposed flood defence system around the port and more significantly the earthen embankment and drainage system around the Durnish lands and lands to the south which is maintained by the OPW. The earthen flood defences have been shown in terms of line and level to provide protection to the present day 0.5% AEP coastal design event standard. The minimum level on the embankments was surveyed at 4.108m OD Malin which is 168mm above the 0.5% AEP coastal design event level in the Robertstown River and Shannon Estuary which has been determined to be 3.94m OD Malin.

Figure 9.2.25 – View from crest of embankment looking north west towards application site

Reliance on these embankments to provide the required level of flood protection is problematic for a number of reasons:

1. It is understood that they were constructed in phases partly from material dredged from the Robertstown River and Estuary. Although they are maintained in a good condition in terms of visual assessment their structural integrity to withstand an extreme coastal flood event up to the present day 0.5% AEP event is uncertain. In essence they were not designed to modern standards and there is some risk of failure in the event of an extreme coastal flood event up to the present day 0.5% AEP coastal design event. This has been confirmed by the OPW who have stated that the defences were executed for agricultural purposes and are not to the standard that would be expected for the protection of development.

2. The defences would not provide full protection to a design coastal flood event of 0.5% AEP when considering the Mid-Range Future Scenario (MRFS) which is accepted, based on current projections, to result in an increase in sea level rises of approximately 0.5m. In the

0.5% AEP MRFS they are predicted to be overtopped by up to 0.33m. Considering the High End Future Scenario these would be overtopped by a further 0.5m.

3. To provide the required standard of protection it is good practice to allow a degree of freeboard above the design peak flood level to account for uncertainty in the analysis and construction tolerances. Currently OPW include within the design of flood defences an allowance of between 300mm and 500mm depending on whether the defence is provided through a hard level (such as a wall) or a soft structure (such as an embankment). The additional 200mm provided on soft structures is to allow for the consideration of settlement amongst other things.

In light of the uncertainty surrounding the existing defence system to provide the required standard of protection now and into the future for the protection of the proposed development, SFPC along with RPS considered various options to provide the required standard of protection to the proposed development. Three potential options for flood risk mitigation were considered for the port expansion lands at Durnish:

1. Raising the levels of the lands out of the floodplain to a finished ground level of +4.44mOD
2. Providing hard defences such as an earthen embankment around the lands with localised filling to facilitate drainage
3. Provision of exposed sheet pile wall around the perimeter of the land and an enhanced storage and pumped drainage system.

Whilst the option of raising the land levels out of the floodplain (Option 1) is likely to be the most expensive, it was considered the only option which is in line with the precautionary approach recommended in paragraph 3.1 of 'The Planning System and Flood Risk Management Guidelines' (DEHLG/OPW, 2009) and detailed in paragraph 5.16 as follows:

> ***Where development has to take place in areas at risk of flooding following the application of these Guidelines, the risks should be mitigated and managed through the location, lay-out and design of the development to reduce such risks to an acceptable level. The residual risks to the proposed development should be considered carefully, taking into account the type of development and its vulnerability, how flood risks to the occupants will be managed, insurance provision, scale of the risks and the provision of flood defence works. A precautionary approach would be to set floor levels above the 1% flood level ignoring the moderating effects of flood defences. However, within an existing built-up area the approach above may not produce an appropriate streetscape and therefore for proposed developments with a lower vulnerability, flood resistant and flood resilient construction methods to reduce the impact of flooding would be appropriate. In this situation the flood risk assessment should be thorough and measures to manage these residual risks carefully detailed. More information on flood risk management by design is available in Appendix B. In all cases, a precautionary approach should be taken to allow for uncertainties in data and risk assessment procedures and to enable adaptability to future changes in risk, including the effects of climate change.***

The option of raising the land levels is not reliant on the performance of defences and other infrastructure which require ongoing operation and maintenance. The alternative mitigation options considered would have resulted in, to various degrees, higher levels of residual risk to the development as they are dependent on the performance of flood defence structures. This was considered an unnecessary level of residual risk and not consistent with the precautionary approach set out in the guidelines.

Other factors which were considered in relation to selection of Option 1 as the preferred option as opposed to Options 2 & 3 included:

- The need to ensure continuous inspection and maintenance of the earthen embankment (Option 2) and the risk associated with embankment failure;
- The additional requirement to infill some of the land to ensure drainage of the land can occur by gravity under normal conditions (Option 2);
- The provision of a barrier along the eastern boundary of the site, which would prevent the future holistic and integrated development of adjoining marine related industrial zoned land (Options 2 & 3);
- The adverse visual impacts associated with a sheet pile wall with piles protruding circa 3m above ground level (Option 3);
- The need to construct, operate and maintain a pumped / storage based drainage system to facilitate drainage at times of high coastal water levels and the reliance on this system to prevent flooding of the lands (Option 3). Providing a pumped drainage system for a development at existing ground levels would become more challenging into the future due to sea level rise.

Following the consideration of all potential options it has been determined that the filling of the site to the levels as specified is the only design response that is consistent with the precautionary approach set out in the guidelines. ***It is therefore proposed that the Durnish lands portion of the application site into which the expansion of the port is to take place is to be filled to a minimum level of 4.44m OD Malin. Finished floor levels (FFLs) on buildings within the Durnish lands are to be set at a minimum of 4.74m OD Malin.*** It is considered that this will mitigate the impacts of the MRFS 0.5% AEP scenario with FFLs allowing for 300mm of freeboard. Levels above this were considered but were not considered necessary given that in the event of a flood elevation of 4.44m OD Malin and above the development would not be viable given the entire surrounding area, with the exception of the area of higher ground in the port would be flooded. In addition to raising the site levels a number of other proposed measures are proposed which may have a hydraulic impact in the event of a flood. These include:

- Two culverts are required such that access into the raised Durnish lands can be provided across the watercourse (Reach 3) between the port and Durnish lands. It is proposed based on an initial assessment of the capacity against the estimated peak 1% AEP fluvial flow that a 1.2m diameter circular culvert section will be required to convey the flows in Reach 3 including an allowance for freeboard.
- Access to the watercourses which are maintained by OPW is required in the form of a 5m wayleave on the bank. This wayleave will be provided at existing levels at the top of bank, typically 1.5-2.5m OD rather than at the filled 4.44m OD level.

9.2.4.2 Operational Phase Impacts – Fluvial/Drainage

The impact of the development on fluvial flooding has been analysed by comparing model simulations for the present day 10%, 1% and 0.1% AEP and the Mid-Range Future Scenario (MRFS) 1% pre and post development scenarios. Figure 9.2.26 shows a comparison of the flood extents. It can be seen that there is very little difference in the pre and post development flood extents. Along reach 3 and reach 5 the small areas of out of bank flooding in the raised Durnish lands are no longer visible in the post development scenario, as would be expected given these lands are raised. Upstream of these reaches, to the south and west and into Foynes there are some instances of small reductions of flood extents in the post development scenario. This would not immediately have been expected given that the proposed development reduces (by a very small amount) the area of available floodplain in reaches 3 and 5. A review of the hydraulic model found that this is occurring due to the presence of the two proposed culverts to facilitate the access road entering the Durnish lands. These culverts are hydraulically more efficient than the sluggish watercourse reaches that they replace and are have the effect of draining the lands upstream more efficiently, albeit in a small way. A summary of the changes in-channel water levels is presented in Table 9.2.12 for all of the scenarios.

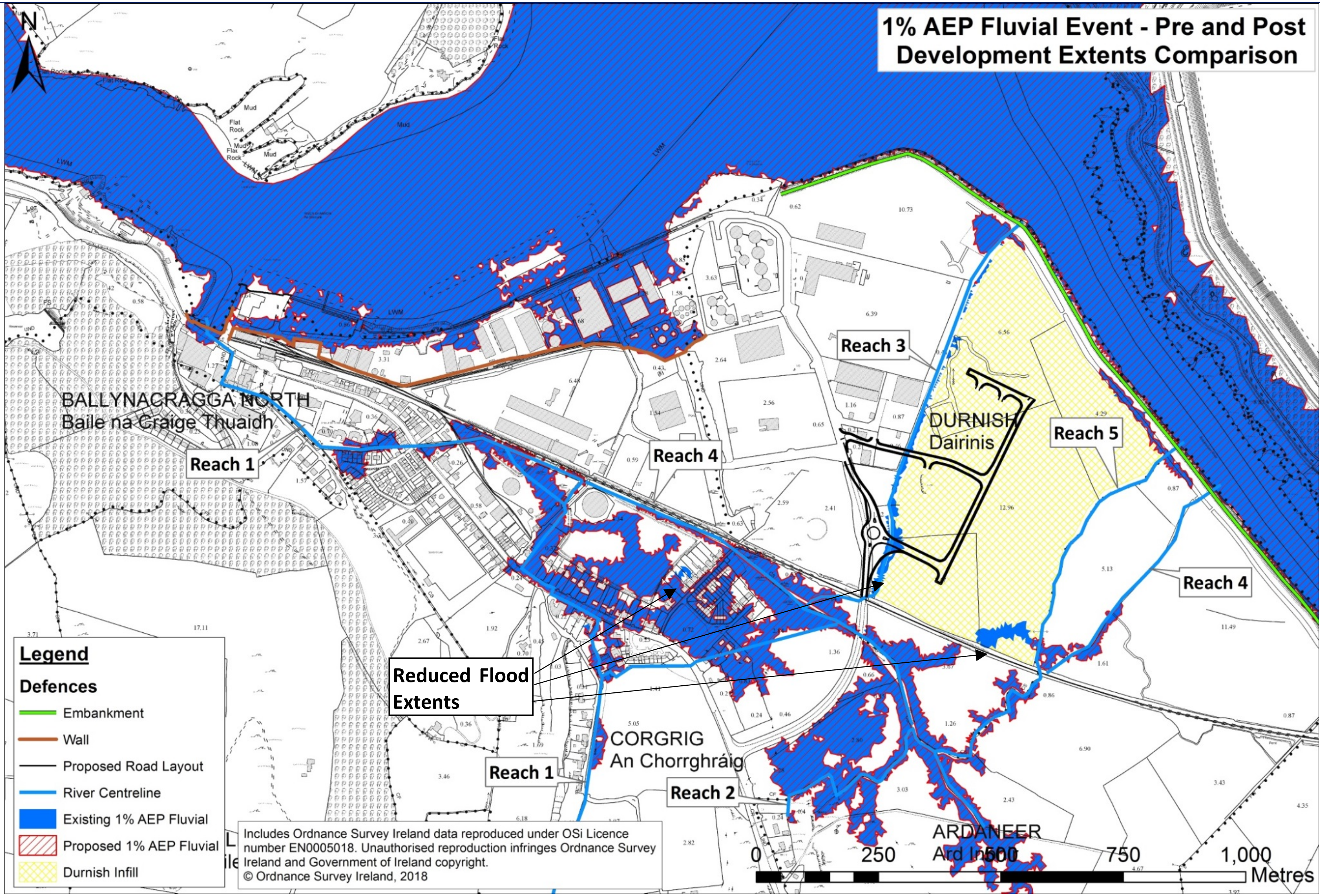


Figure 9.2.26 – Existing and Proposed 1% Fluvial Flood Extents for Comparison

Table 9.2.12 – In-Channel Water Level Impacts

	Difference in In-channel Peak Water Level between Pre and Post Development (m)											
	10% AEP			1% AEP			0.1% AEP			1% AEP MRFS		
	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.
Reach 1	-0.019	0.017	-0.001	-0.004	0.006	-0.001	-0.028	0.006	-0.002	-0.003	0.005	0.000
Reach 2	-0.011	-0.01	-0.010	-0.005	-0.004	-0.004	-0.005	-0.005	-0.005	-0.008	-0.007	-0.008
Reach 3	-0.018	0	-0.013	-0.012	0	-0.008	-0.006	0.013	-0.001	-0.01	0	-0.007
Reach 4	-0.011	0	-0.009	-0.012	0	-0.003	-0.005	0.014	0.004	-0.008	0	-0.007
Reach 5	-0.002	0	-0.001	-0.002	-0.001	-0.001	-0.027	0.004	-0.019	-0.002	0.011	0.004
Reach 6	-0.01	-0.01	-0.010	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	-0.008	-0.008	-0.008

Table 9.2.12 shows the maximum, minimum and average change in peak water levels for each reach. Water level changes above 10mm have been highlighted as these could be considered potentially significant in the vicinity of receptors (such as a property at risk). On average water levels are shown to be either unchanged or reduced in all reaches which generally represents a reduction in flood risk. However there are some instances of increases at cross section locations which must be considered further, particularly at reaches 1, 3, 4 and 5. At reach 1 the increase above 10mm happens at only one location and only in the 10% AEP. There are no increases in the sections upstream and downstream and does not translate into increases in flood depth in the adjacent floodplain.

In reach 3 the increases occur at three cross sections at the start of the reach, just to the west of the crossroads of the railway line and the eastern access road into the port. These occur only in the 0.1% AEP whereas there are reductions in these cross sections in all other scenarios. It is considered that this is caused by the new culvert arrangements downstream as their efficiency over an open channel decreases in the most extreme events.

In reach 4 there are similar increases in the 0.1% AEP from the point where it meets reach the top of reach 3 back up to its upstream to the north / north west of Dernish Avenue. As per reach 3 this only occurs in the 0.1% AEP with reductions in all other return periods. The cause of this is the same as described in relation to reach 3. Given that this reach is adjacent to Dernish Avenue this does represent an increase in the flood risk for this extreme scenario. However for all the other, more frequent simulated events (present day 10%, 1% AEPs and MRFS 1% AEPs) there is reduction in flood levels in this reach and considered in this context it is considered that overall there is no net increase in overall flood risk to properties in Dernish Avenue.

In reach 5 there is a localised increase in in-channel water levels in the 1% AEP MRFS scenario at the downstream extent where it drains into the OPW channel at the landward base of the embankment. This localised increase is not apparent in any other events and is not close to any receptors. The application site adjacent to it will be raised and the agricultural land to the south east contains no receptors.

9.2.4.3 Operational Phase Impacts – Coastal

The impact of the development on coastal flooding has been analysed by comparing model simulations for the present day 10%, 0.5% and 0.1% AEP and the Mid-Range Future Scenario (MRFS) 0.5% AEP pre and post development scenarios. For the defended scenario there is no potential for impact on water levels and extents in the Shannon and Robertstown River as the infilling of the site does not displace any flooding. This defended scenario does of course consider significant fluvial flows in the drains and watercourses inside the embankments albeit it is extreme coastal water levels which are the more extreme conditions simulated. A review was undertaken of the in-channel water levels similar to that described in relation to fluvial flooding (9.2.4.2). The only significant increase in in-channel water level (up to +22mm) was observed at the same location as described in relation to fluvial flooding in reach 1. This cross section is at the headwall structure on the Corgrigg Wood road, remote from the application site and far from the coastal boundary. It is apparent in both the 10% and 0.5% AEP events where the equivalent joint probability derived fluvial flows driving the water levels at this location are only 50% and 10% AEP flows respectively. There are no increases in the sections upstream and downstream and it does not translate into increases in flood depth in the adjacent floodplain. This increase seems to be apparent in higher frequency fluvial events and given where it is occurring and its isolated location it is best described as a quirk arising from differences between the pre and post development models.

The most significant impacts in relation to coastal flooding will occur in the scenario where Durnish lands to be infilled displace coastal flood water. A review was undertaken in the undefended scenario whereby the floodplain water levels were compared for all events. In this undefended scenario coastal flood waters flow freely into the Foynes / Durnish area completely filling all areas up to the design peak tidal water level. Given the capacity of coastally driven flooding to totally fill areas unimpeded by flood defences, as is the case in the undefended model simulations, the levels in the pre and post development scenarios are identical. In other words the volume of water displaced by filling the Durnish lands is irrelevant in the context of flood waters driven unimpeded in an area by coastal surge and tide mechanisms.

In coastal flooding terms, the scenario where the infilling of the Durnish lands would have most impact is where coastal flooding inundates the Durnish lands but it does not completely fill up the area behind the defences. In such a ‘breach’ scenario there is a limited volume which inundates the area and the filling of the Durnish lands could potentially displace flood waters resulting in increased flood levels elsewhere. Two separate locations on the earthen embankment protecting these lands were considered. The locations were chosen to represent two inundation locations representative of low points were it would be likely the embankment would fail first but might give differing results. The breach was assumed to be a 50m wide total failure in the embankment over the entire 0.5% AEP coastal water level event. Pre and post development flood extents for each breach location are compared in Figure 9.2.26 and Figure 9.2.28.

Breach 1 represents a location approximately 500m to the south west of the application site. Breach 2 represents a location a further 850m to the south west along the line of the embankment. Breach 1 is located in the portion of land inside (to the north) of the disused railway line along with the application site. Breach 2 represents a location outside the area of land between the earthen embankment and the railway line.

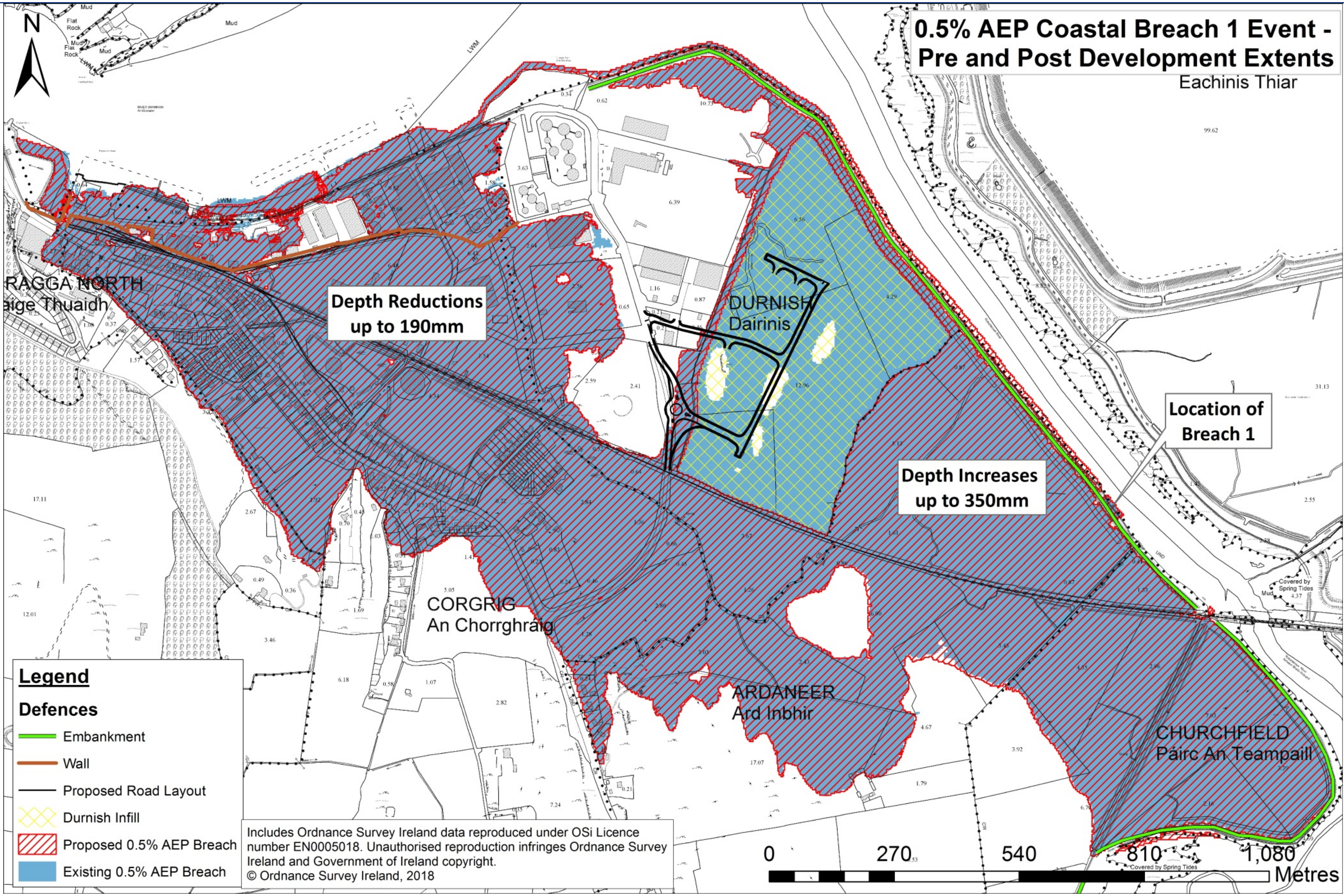


Figure 9.2.27 – Existing and Proposed 0.5% AEP Breach Location 1 Extents for Comparison

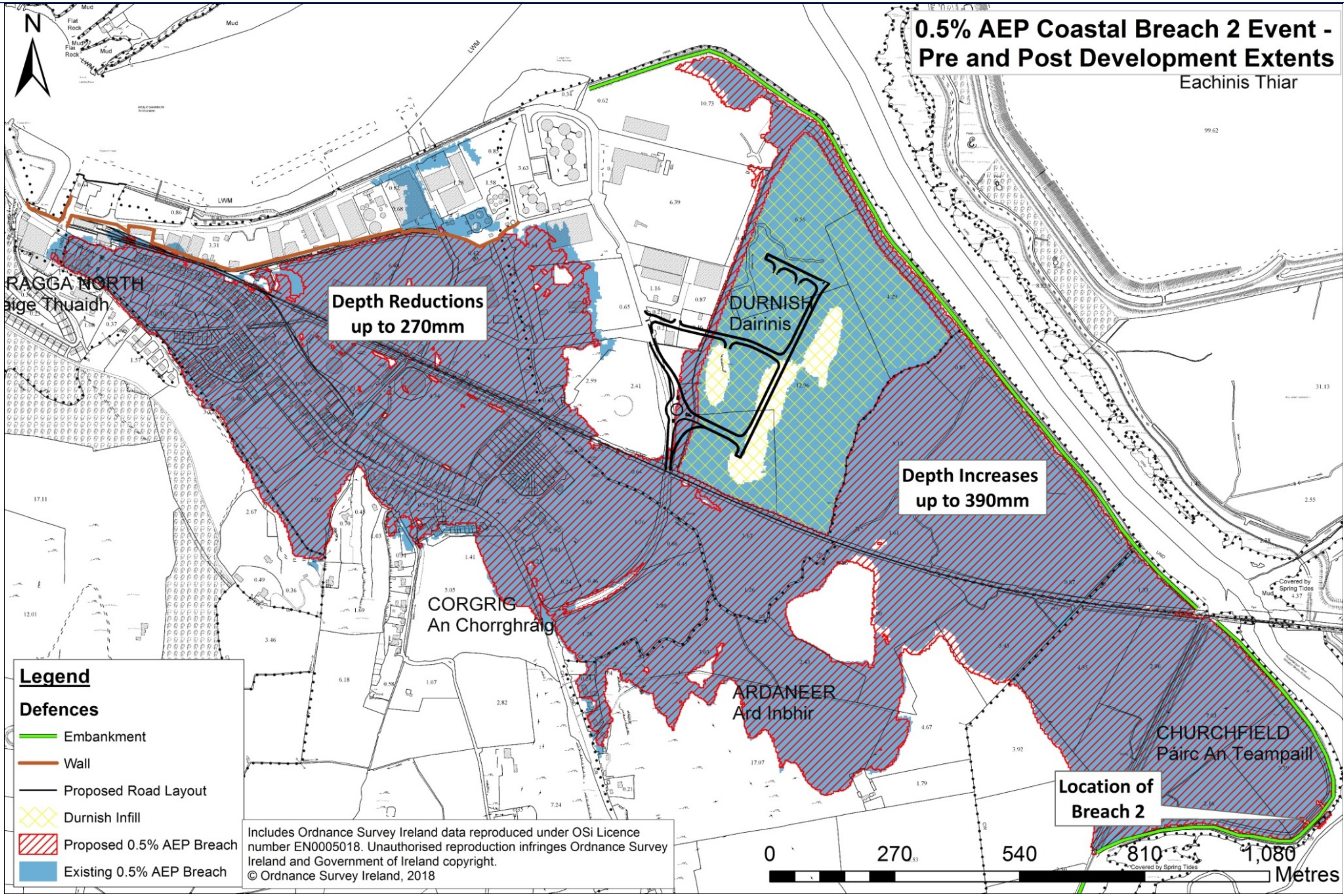


Figure 9.2.28 – Existing and Proposed 0.5% AEP Breach Location 2 Extents for Comparison

In the event of either breach scenario the results of the development of the application site, particularly the filling of the Durnish lands, are similar. In both breach scenarios peak flood levels in the area of agricultural land to the south east of the application site are increased whereas peak flood level in Foynes Village and in Shannon Foynes Port are decreased. This is because the infilling of the application site acts as a barrier to the progression of flood flows out of the agricultural lands to the north and west into the port lands and Foynes Village. Results are most variable and pronounced in the Breach 2 scenarios where the breach occurs further to the south at the upstream end of the Robertstown River. In this case increases of up to 380mm in flood depth are simulated in the agricultural lands. For context depths in these lands are typically between 0.75m to 2m in the existing scenario. In Foynes Village and the port decreases of up to 270mm in flood depth are simulated. Depths in this area are typically 0.5m to 1m in the existing scenario.

The increases in flood depth in the agricultural lands to the south east in the breach scenarios are relatively large. However there are no significant flood risk receptors in this area so the increase in flood hazard does not translate into a large increase in flood risk. This is a particular scenario designed to highlight the case where the worst possible impacts are identified; in the coastal defended and coastal undefended scenarios there is no increase in flood hazard to these lands.

The decreases in flood depth in the breach scenarios at Foynes Village and the port is considered a significant decrease and given the presence of a large number of highly vulnerable receptors in this area it is considered that this does represent a real reduction in flood risk.

Taken together the overall picture of the impact of flood risk in the breach scenarios resulting from the filling of the Durnish lands ranges from at worst neutral to at best a real reduction in flood risk.

9.2.4.4 Potential Drainage System Impacts

The development of the application site and an associated drainage system could potentially lead to a number of flood risk related issues:

- The creation of large areas of hardstanding could increase run-off rates and volumes into the receiving watercourses leading to increased flood risk.
- The drainage system could create a route for coastal flooding into the site through discharge points directly to the Robertstown River.

In relation to the potential for increased run-off it is proposed that the surface water drainage system is designed to the appropriate NRA standards for the road network and to the principles of Sustainable Drainage Systems (SuDS) such that the post development run-off peak flow rates and volumes are not increased.

In relation to drainage discharge directly into the Robertstown River the site levels have been set at a minimum of 4.44m OD Malin and as such only an event greater than the Mid-Range Future Scenario 0.5% AEP Coastal Event could breach through drainage openings in the filled Durnish lands. Nevertheless it is prudent that the drainage system outlet is flapped such that below ground infrastructure does not sit submerged with tidal waters during a coastal event. This will remove any potential risk of coastal flood water reaching the site through the drainage system discharging to the Robertstown River.

9.2.4.5 Construction Phase

Construction Phase impacts are not a significant consideration in relation to flood risk if good construction practices are followed. Potential construction related risks include:

1. Blockage of the watercourses – this will be avoided by constructing the culvert crossing in the first phase of the works and ensuring all fill material is kept outside the OPW 5m wayleave zone.
2. Disturbance of the existing earthen flood defences – this will be avoided by maintaining a working area outside the OPW wayleave to the south of the drain, behind the embankment.

The development phasing strategy (see Chapter 2) has been developed such that all flood risk mitigation will be delivered within Phase 1 of the development. Phases 2 and 3 of the development will be subject to separate consent however it is considered that within Phase 1 mitigation will be delivered to facilitate the development of Phases 2 and 3. Consequently the development of Phase 2 and 3 will not alter the level of flood risk to Phase 1.

9.2.4.6 Summary of Mitigation

A summary of the design responses which form the mitigation measures in relation to flood risk management are provided below:

- Finished floor levels (FFLs) on buildings within the Durnish lands are to be set at a minimum of 4.74m OD Malin. Filling of the site to a level of 4.44m is necessary to facilitate development of finished floor levels and the practical functioning of the development for its intended usage.
- Culverts of 1.2m diameter will be provided to facilitate access into the Durnish lands.
- A 5m wayleave along the existing OPW maintained watercourses will be provided at existing levels at the top of bank, typically 1.5-2.5m OD rather than at the filled 4.44m OD level.
- Phasing of the works will be such that all flood mitigation is provided in Phase 1 of the development such that development will only become operational when the full standard of protection proposed is in place.
- Construction management measures will be implemented such that the development will ensure the functioning of the existing drainage network and flood defence system is not compromised.

9.2.4.7 Summary of Potential Impacts

Table 9.2.13 lists all of the locations at which the modelling demonstrated that there are potential flood risk impacts. Included within the table are details of the flood mechanism, description and a qualitative assessment of the effect on residual flood risk.

Table 9.2.13 – Summary of Impacts

Flood Mechanism	Location	Description	Impact
Fluvial / Drainage	Reaches 3 & 4 (Dernish Avenue, Foynes)	Peak flood levels are reduced for more frequent flood events (10% AEP), negligible change in 1% AEP and slight increase for most extreme events (0.1% AEP).	Neutral
Coastal (Embankment Breach Scenario)	Agricultural land to the south east of Durnish lands	Peak flood levels are increased from 1.39m to 1.59m on average for a 0.5% AEP event.	Neutral / slight positive
	Foynes Village	Peak flood levels are reduced from 1.01m to 0.78m on average for a 0.5% AEP event.	
Coastal (Undefended Scenario)	All locations	Loss of coastal floodplain storage arising from raising ground levels within the application site. Modelling found slight reductions in peak water levels.	Neutral

It can be seen from Table 9.2.13 that in all flood risk scenarios the overall impacts of development of the application site are at worst neutral. In the fluvial/drainage scenario the changes in peak water level observed at Dernish avenue range from slightly positive for the most frequent 10% AEP event to slightly negative in the most extreme 0.1% AEP event. Overall it is considered that there is a neutral impact on flood risk at the area affected around reach 4 and Dernish Avenue.

In relation to coastal flood risk RPS have identified that a scenario where a breach occurs, and the volume of flood water which inundates the Foynes/Durnish area is finite and hence potentially impacted by the filling of the Durnish lands, is the most onerous scenario. Modelling of this scenario found that the agricultural land to the south east of the Durnish lands would be flooded to a greater depth up from 1.39m to 1.59m. However there are no property or infrastructure assets in this area and it is considered unlikely that the increased depth of flood water in this breach scenario would significantly increase the damage to agricultural assets, given that the average depth would already be greater than 1m. The development proposals would not make a breach event more likely/frequent. The cause of the increased flood depth is the filled Durnish lands which present a partial barrier to floodwaters propagating west and north to Foynes Village. This has the positive effect of reducing the flood depths at Foynes Village, where the vast majority of the higher vulnerability receptors are located and where the potential for economic damages is much more extensive. Although it is acknowledged that flood depths are increased in the agricultural lands to the south east in this breach scenario, balanced against the reduction in depth at Foynes Village it is considered that this represents an overall neutral or slight reduction in flood risk.

In the undefended scenario the analysis demonstrated that there was no increase in flood depth behind the defences arising from the filling of the Durnish lands. This is due to the nature of coastal flooding within undefended areas. This flooding mechanism in this scenario is free to completely inundate undefended areas up to the peak flood level driven by coastal effects. i.e. floodplain storage volume is essentially irrelevant in this scenario.

9.2.5 The Planning System and Flood Risk Management Guidelines

'The Planning System and Flood Risk Management' (DEHLG 2009), referred to henceforth as 'the guidelines', set out the types of development which are appropriate in the different flood zones, A, B and C defined as:

Flood Zone A – The 1% AEP fluvial (or 0.5% AEP for coastal) flood extents

Flood Zone B – The area beyond the 1% AEP fluvial (or 0.5% AEP for coastal) flood extents but within the 0.1% AEP flood extents

Flood Zone C – The area outside the 0.1% AEP flood extents

Furthermore the guidelines define flood zones based on flood risk which ignores the effect of flood defences as set out in paragraph 2.25:

"The provision of flood protection measures in appropriate locations, such as in or adjacent to town centres, can significantly reduce flood risk. However, the presence of flood protection structures should be ignored in determining flood zones. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of defences and the fact that there may be no guarantee that the defences will be maintained in perpetuity. The likelihood and extent of this residual risk needs to be considered, together with the potential impact on proposed uses, at both development plan and development management stages, as well as in emergency planning and applying the other requirements of these Guidelines in chapter 3. In particular, the finished floor levels within protected zones will need to take account of both urban design considerations and the residual risk remaining."

Chapter 3, paragraph 3.4 further defines the assessment of flood zones:

"As outlined in paragraph 2.25 the flood zones ignore the presence of defences. Areas that benefit from an existing flood relief scheme or flood defences have a reduced probability of flooding but can be particularly vulnerable due to the speed of flooding when overtopping or a breach or other failure takes place. Because this residual risk of flooding remains, the sequential approach and the Justification Test apply to such defended locations. The range of residual risks is described in Appendix A."

As the undefended coastal scenario represents the most onerous scenario which ignores the presence of the flood defences the vast majority of the development in the Durnish lands is considered to be within Flood Zone A. The development of the Durnish lands is for the purposes of facilitating port expansion. 'Docks, marinas and wharves' are considered water compatible development under the guidelines and as such are considered appropriate development within Flood Zone A. This is because by their nature they must almost always be located within a flood zone where the risk of flooding must be accepted and managed. They are generally designed and constructed with some degree of flood resilience. However the development proposed for the Durnish lands would more appropriately fit within the category described in the guidelines as 'Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions' which is classed as less vulnerable development but still subject to the Justification Test as outlined in the guidelines. These uses in general terms are not necessarily required to be located within areas at risk of flooding and hence the justification test must be met. However in reality any expansion of the current Foynes Port site must include development within areas currently classed as Flood Zone A.

9.2.5.1 Justification Test for Development Plans

The development plan justification seeks to ensure that the zoning of land under a development plan has received appropriate consideration in relation to flood risk. It is set out in Box 4.1 in Chapter 4 of the guidelines as follows:

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan1, a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1. ***The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.***

2. ***The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:***
   i. ***Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement2;***
   ii. ***Comprises significant previously developed and/or under-utilised lands;***
   iii. ***Is within or adjoining the core of an established or designated urban settlement;***
   iv. ***Will be essential in achieving compact and sustainable urban growth; and***
   v. ***There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.***

3. ***A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.***
   N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

In relation to points 1 and 2 of the Development Plan Justification Test it is considered that the relevant Development Plan is the Limerick County Development Plan (Appendix Map A2). Flood Risk Assessment was undertaken in respect to Variation No.3 of the County Development Plan that introduced the ‘Marine Related Industrial Zoning’ for the application site and Durnish lands.

In relation to point 3 it is considered that this chapter represents a flood risk assessment to an appropriate level of detail, considered to be Stage 3 under the guidelines. It is considered that this chapter demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

9.2.5.2 Justification Test for Development Management

The Justification Test for development management is set out in Chapter 5 of the guidelines. The various stages of the test are set out below in bold italics. A response to how each stage of the test has been met is provided under the relevant text:

1. ***The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.***

The County Development Plan as varied under Variation No.3 is the operative development plan and is considered to have taken account of these guidelines.

2. ***The proposal has been subject to an appropriate flood risk assessment that demonstrates:***
   i. ***The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;***

This FRA Chapter incorporates hydraulic modelling and mapping to a high level of detail consistent with that which was undertaken as part of the Shannon CFRAM Study but including analysis and mapping of the flood risk with the proposed development in place and including all scenarios. This FRA meets the requirement of a Stage 3 Detailed flood risk assessment as detailed in the guidelines. The assessment of fluvial risk as detailed in Section 9.2.3 demonstrates that the development of the application site will lead to localised increases in flood extents and levels in the watercourses and floodplains adjacent the site however there are no flood risk receptors located within the increased extents or affected by increased levels and as such there is no increase in flood risk in relation to these locations. In relation to the assessment of coastal flood risk it is considered that the infilling of the coastal floodplain does affect the level of flood risk in the event of a breach of the existing defences. In the agricultural lands to the south and south east of the application site there are some increases in flood hazard however these lands are not considered significant flood risk receptors and as such the increase in risk is negligible. The impact of infilling the development lands on Foynes Village and the surrounding flood risk receptors has been shown to be positive as the infilled site constrains flood flows to the village and port in the scenario where there is a breach of the existing earthen flood defences which may be vulnerable. i.e. there is a reduction in flood risk to Foynes Village and surrounding receptors.

   ii. ***The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;***

The development proposals include for design measures primarily in the form of raised site levels. This has been shown to minimise flood risk in the present day and Mid-Range Future Scenario 0.5% AEP (200 year return period) events. These design measures are considered to deliver the most effective level of flood risk mitigation. These design measures are the only measures which are consistent with the pre-cautionary approach outlined in paragraph 5.16 as they are not dependent on the effectiveness of flood defence structures now and into the future. The inclusion of access structures which are appropriately sized to convey the design event and a 5m wayleave along the existing OPW maintained drainage channels further ensures flood risk is minimised.

In relation to the pluvial flood risk the road drainage system will be constructed based on the latest drainage design standards from the NRA and to SuDS principles such that the post drainage characteristics mimic the pre-development ('greenfield') run-off characteristics.

It is considered therefore that the design measures minimise flood risk from all mechanisms as far as is reasonably possible consistent with this element of the justification test for development management.

iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access;

The level of residual risk to the development has been minimised as far as reasonably possible through design measures which are not dependent on the effectiveness of defence structures. Following the implementation of the design measures residual risk to the proposed development is low. There is a significant level of existing flood risk to the surrounding area arising from its reliance on the system of flood defences but the design measures do not negatively impact on this and in some areas risk is reduced as the depth of flooding to Foynes and the port in the event of an embankment breach is reduced. The filled Durnish lands do not increase flood risk to any of the access routes in and out of the area and they may represent an area for refuge in the event of a defence failure.

iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The greenfield location of the application site and the nature of the development allows flexibility in the design and finished levels while not conflicting with wider planning objectives in relation to development of good urban design and active streetscapes. The proposed development and intended activity is consistent with the adopted development objectives and land use zoning provisions contained within the Limerick County Development Plan with regard to the provision of port expansion and maritime related industrial activities at this specific location while at the same time consistent with the pre-cautionary approach to flood risk recommended within the guidelines. Mitigation of the potential flood risk has not required the usage of flood risk management methods which may conflict with the objectives above, such as hard defence structures.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

With the design measures in place the development will be within Flood Zone C. This flood zone is consistent with the type of development which is proposed – warehousing and industrial uses consistent with a 'Marine Related Industrial' zoning.

10 AIR AND CLIMATE

10.1 INTRODUCTION

This chapter should be read in conjunction with the site layout plans and **Chapters 1-3** of this EIAR. This assessment was prepared having regard to the EPA Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2002), Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements) (EPA, 2003); the Revised Guidelines on the Information to be contained in Environmental Impact Statements (Draft September 2015) and the Advice Notes for Preparing Environmental Impact Statements (Draft September 2015).

In addition the NRA Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA 2011) are also referenced. While aimed at national road projects these guidelines provide a number of impact assessment guidance methodologies that may be applied to this project.

10.2 ASSESSMENT METHODOLOGY

10.2.1 General Approach

Site specific baseline air quality monitoring has been carried out within the study area to supplement the existing air quality data available from the EPA National Air Quality Monitoring Programme and other local data sources. The site specific monitoring identifies the existing pollutant trends in the area and establishes compliance with relevant ambient air legislation. Risk assessments and dispersion models have been prepared in order to predict the future air quality trends as a result of the construction and operation of the proposed development.

10.2.2 Baseline Air Quality Data

Baseline air quality data has been derived from site specific monitoring undertaken within the study area coupled with reference to the EPA National Air Quality Monitoring Programme, Air Quality Zone D: Rural Ireland. As a result of the proximity of key receptors (residential, commercial, ecological and agricultural) to the port, the following parameters were monitored in the site specific baseline assessment using Diffusion Tube monitoring:

- Oxides of Nitrogen (NO_x) at 7 locations; and
- Volatile Organic Compounds (BTEX) at 7 locations.

The locations used for the baseline monitoring survey are presented in **Table 10.1** and in **Figure 10.1**. At each of the sites A1 to A7, levels of nitrogen oxides (NO_x) and Volatile Organic Compounds (VOCs) were measured using diffusion tubes, which were left at key kerbside locations for a period of three months. The tubes were then analysed at a UKAS accredited laboratory, giving an average concentration over the period. All results have been corrected for bias based on standard practice.

Table 10.1: Description of Site Specific Baseline Air Quality Monitoring Locations

Reference	Type	Description	Duration and Timeframe
A1	Kerbside (national road)	West of the village of Foynes adjacent to the N69	January to April 2017
A2	Kerbside (national road)	Western Port Entrance off the N69	January to April 2017
A3	Kerbside (national road)	Foynes Main Street	January to April 2017
A4	Kerbside (local road)	Eastern Port Entrance	January to April 2017
A5	Kerbside (local road)	Junction between the port access road and the N69	January to April 2017
A6	Kerbside (suburban)	Dernish Avenue residential area	January to April 2017
A7	Kerbside (rural roads)	Robertstown area south east of the town	January to April 2017

In addition to the site specific baseline assessment, monitoring data is reported by the EPA on a continuous basis at a series of monitoring stations both in the Shannon Estuary area as well as the wider rural monitoring network (Zone D) in Ireland. Further to the EPA monitoring network, a number of other operators carry out ambient monitoring within the Foynes area and these are listed as follows:

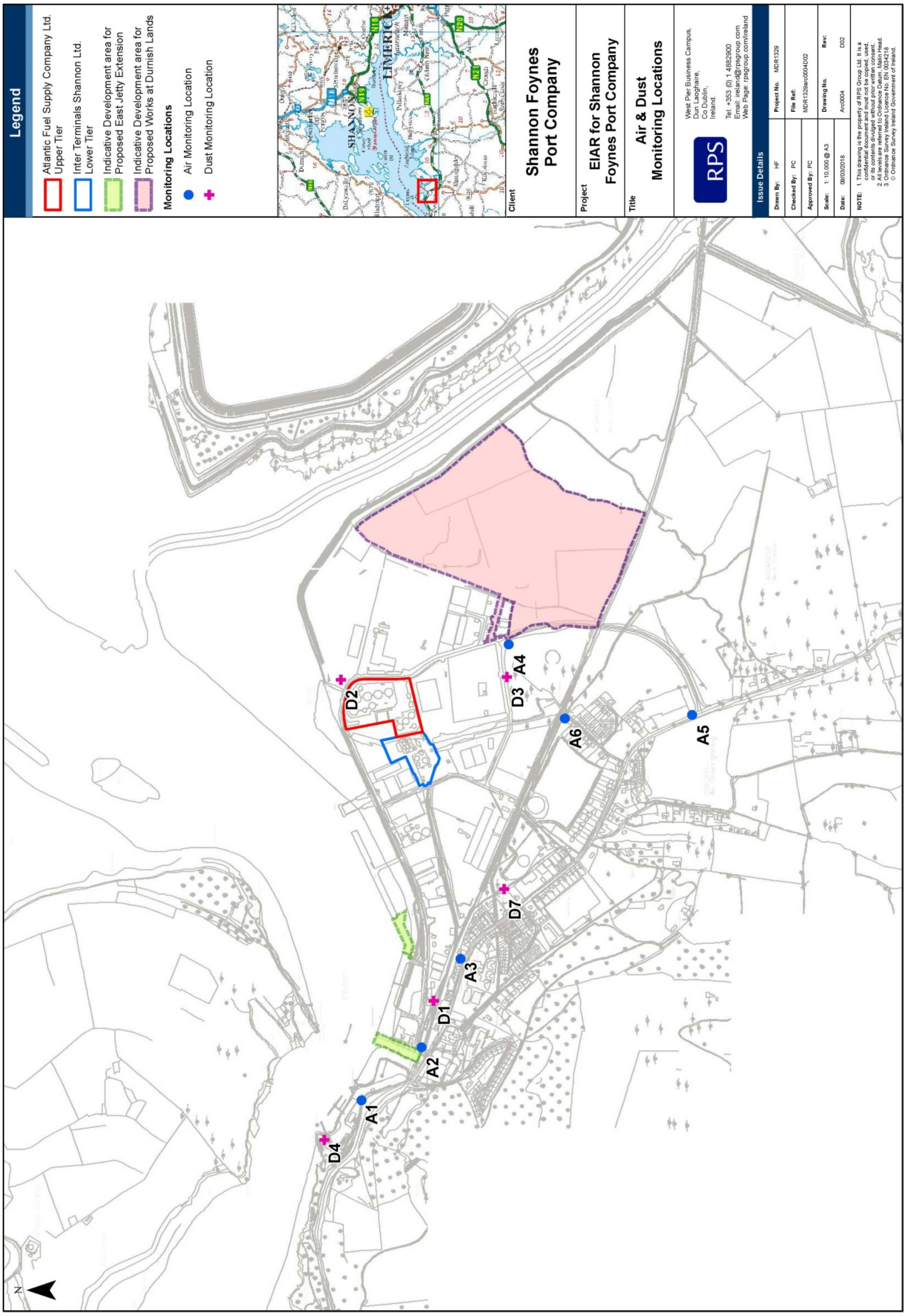
- Dust deposition monitoring undertaken by Shannon Foynes Port Company as part of the companies pro-active environmental policy.
- Ambient Sulphur Dioxide (SO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$) carried out by Aughinish Alumina Ltd. (AAL) in the Foynes area for the purposes of the site's Industrial Emissions Licence (Licence Register No P0035-06).

This information has also been collated to further inform the level and spatial variation of pollutant levels within the study area.

Baseline Climate

Existing climate data for the study area has been derived from the Met Éireann 30 year averages. While is it not possible to apportion the changes in GHG emissions from this project with specific climate impacts, existing trends in transport related GHG emissions are noted with reference to the targets outlined in Ireland's National Policy Position on Climate Action and Low Carbon Development. In this regard, GHG emissions are quantified but it is not possible to predict the resultant climate impact from this project.

Figure 10.1: Baseline Air Quality Monitoring Locations



10.2.3 Construction Phase

Dust Emissions

The potential for dust emissions from the construction phase of the project is addressed qualitatively in accordance with the risk assessment approach presented in the NRA Guidelines (2011) which follows best practice.

Construction Traffic

The estimation of emissions from construction traffic was carried out using the methodologies outlined in the UK Highways Agency Design Manual for Roads and Bridges (UK DMRB 2007), Volume 11, Section 3, Air Quality Assessment (referred to hereafter as the UK DMRB). The assessment includes both local air quality impact for receptors long the haul route and a regional impact assessment of greenhouse gas emissions and acidifying gases generated.

10.2.4 Operational Phase

Dust Emissions

As per the construction phase, the potential for dust emissions from the operation phase of the project is addressed qualitatively in accordance with the risk assessment approach presented in the NRA Guidelines (2011) and the Institute of Air Quality Management (IAQM) guidance on the assessment of dust from demolition and construction.

Road Traffic

The air quality exposure assessment was carried out using the methodology outlined in the NRA Guidelines and the UK DMRB. The assessment was based on the local model of the DMRB to simulate the net change in impact from road traffic on the network.

Sensitive Ecosystems

The NRA has developed guidelines for the assessment of the significance of the impact of traffic emissions on sensitive ecosystems. The guidelines state that should the predicted concentrations exceed 90% of the annual NO_x limit (30μg/m^3 as specified in S.I. 180 of 2011 – **Table 10.2**) or predict an increase of 2μg/m^3 in the annual average, then the sensitivity of the relevant species should be assessed by the project ecologist. The impacts of road traffic from the development on all sensitive ecosystems during operation are assessed as per the NRA methodology.

Emissions of Greenhouse and Acidifying Gases

The potential impact of the proposed project during the operational phase in terms of GHG emissions (CO_2) and acidifying gas emissions (NO_x) was addressed by calculating the relevant changes in road traffic emissions. These predictions were carried out using the procedures outlined in the UK DMRB regional model.

10.2.5 Impact Assessment Criteria

During the construction phase, dust is considered the principle pollutant to atmosphere. However, there is no Irish or European Union or Commission guideline or legislative limits for total suspended particles, so the guidelines provided by the TA Luft guidance *Technical Instructions on Air Quality Control* (TA Luft, 2002) are employed. Under this guidance, an operation is required to maintain monthly dust levels below the guideline of 350mg/m^2/day as an annual average at sensitive residential receptors. Below this threshold, the potential for dust nuisance to impact people in the nearest residential, commercial or other structures will be minimised.

In addition to the potential for human impact, dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The DMRB has reported that based on a literature review, the most sensitive species (Epiphytic lichen and Sphagnum dominated communities) appear to be affected by dust deposition at levels above 1000mg/m^2/day which is significantly greater than the level at which dust deposition may start to cause a perceptible nuisance to humans (350mg/m^2/day). As such, the human nuisance limit (350mg/m^2/day) may also be employed as a conservative guideline for ecological receptors.

In May 2008, the European Commission introduced a Directive on ambient air quality and cleaner air for Europe (2008/50/EC), which has been transposed into Irish Legislation through the revised Air Quality Standards Regulations (S.I. 180 of 2011). These Air Quality (AQ) Standards are presented in **Table 10.2**. The legislation specifies limits and target values in ambient air for sulphur dioxide (SO_2), lead (Pb), benzene, particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x). These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants. In addition, the Air Quality Standards Regulations (S.I. 180 of 2011) specify limits that apply to the protection of the wider environment including ecological receptors.

The NRA Guidelines for road projects impact specifies the significance criteria for determining air quality impacts as presented in **Tables 10.3, 10.4** and **10.5** which may be employed in this assessment to assign the significance of impact.

Table 10.2: Air Quality Standards Regulations (Source: S.I. 180 of 2011)

Pollutant	Criteria	Value
Nitrogen Dioxide (NO_2)	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 $\mu g/m^3$ NO_2
	Annual limit for protection of human health	40 $\mu g/m^3$ NO_2
	Annual limit for protection of vegetation	30 $\mu g/m^3$ NO + NO_2
Benzene (C_6H_6)	Annual limit for protection of human health	5 $\mu g/m^3$
Carbon Monoxide (CO)	Maximum daily 8-hour running mean	10 mg/m^3
Lead (Pb)	Annual limit for protection of human health	0.5 $\mu g/m^3$
Sulphur Dioxide (SO_2)	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 $\mu g/m^3$
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 $\mu g/m^3$
	Annual limit for protection of vegetation	20 $\mu g/m^3$
Particulate Matter (PM_{10})	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 $\mu g/m^3$ PM_{10}
	Annual limit for protection of human health	40 $\mu g/m^3$ PM_{10}
Particulate Matter ($PM_{2.5}$)	Annual target value for the protection of human health (Stage 1 to be achieved by 2018)	25 $\mu g/m^3$ $PM_{2.5}$
	Indicative limit for the protection of human health (Stage 2 to be achieved by 2020)	20 $\mu g/m^3$ $PM_{2.5}$

Table 10.3: Definition of Impact Magnitude for Changes in Ambient Air Pollutant Concentrations (Source: NRA, 2011)

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. of Days with PM_{10} Concentration greater than 50$\mu g/m^3$	Annual Mean PM
Large	Increase/decrease ≥4$\mu g/m^3$	Increase/decrease >4 days	Increase/decrease ≥2.5$\mu g/m^3$
Medium	Increase/decrease 2 - <4$\mu g/m^3$	Increase/decrease 3 of 4 days	Increase/decrease 1.25 - <2.5$\mu g/m^3$
Small	Increase/decrease 0.4 - <2$\mu g/m^3$	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25$\mu g/m^3$
Imperceptible	Increase/decrease <0.4$\mu g/m^3$	Increase/decrease <1 day	Increase/decrease <0.25$\mu g/m^3$

Table 10.4: Air Quality Impact Descriptors for Changes in Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor (Source: NRA, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Changes in Concentration		
	Small	Medium	Large
Increase with Proposed Project			
Above Objective/Limit Value (≥40μg/m^3 of NO_2 or PM_{10}) (≥25μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value (36-<40μg/m^3 of NO_2 or PM_{10}) (22.5-<25μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value (30-<36μg/m^3 of NO_2 or PM_{10}) (18.75-<22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Project			
Above Objective/Limit Value (≥40μg/m^3 of NO_2 or PM_{10}) (≥25μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value (36-<40μg/m^3 of NO_2 or PM_{10}) (22.5-<25μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value (30-<36μg/m^3 of NO_2 or PM_{10}) (18.75-<22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Table 10.5: Air Quality Impact Descriptors for Changes in Number of Days with PM_{10} Concentrations Greater than 50μg/m^3 at a Receptor (Source: NRA, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Changes in Concentration*		
	Small	Medium	Large
Increase with Proposed Project			
Above Objective/Limit Value (≥35days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value (32-<35days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value (26-<32days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Project			
Above Objective/Limit Value (≥35days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value (32-<35days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value (26-<32days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value (<26 days)	Negligible	Negligible	Slight Beneficial

In addition to the statutory limits for the protection of human health listed in Air Quality Standards Regulations (**Table 10.2**), the World Health Organisation (WHO) has published a set of air quality guidelines for the protection of human health. The key publication is the "*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005 Summary of risk assessment*". The WHO guidelines are based on reducing the risk to human health and, in some cases, the levels differ from the EU statutory limits as these EU limits are based on balancing health risks with technological feasibility, economic considerations and various other political and social factors in the EU.

The 2005 WHO guidelines are presented in **Table 10.6** and illustrate that while the NO_2 levels are analogous to the EU limits (excluding the tolerance levels for the 1-hour averages), the annual average PM_{10} and $PM_{2.5}$ levels specific by the WHO are half of the EU limits specified in the legislation. The WHO note that these are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to $PM_{2.5}$. Similarly, the daily limit for SO_2 in the WHO guidelines is significantly lower than the EU limit. The EPA has called for movement towards the adoption of these stricter WHO guidelines as the legal standards across Europe and in Ireland.

Table 10.6: WHO 2005 Air Quality Guidelines

Pollutant	Criteria	Value
Nitrogen Dioxide (NO_2)	Hourly level for protection of human health	200 $\mu g/m^3$ NO_2
	Annual level for protection of human health	40 $\mu g/m^3$ NO_2
Sulphur Dioxide (SO_2)	10 minute level for protection of human health	500 $\mu g/m^3$
	Daily level for protection of human health	20 $\mu g/m^3$
Particulate Matter (PM_{10})	24-hour level for protection of human health	50 $\mu g/m^3$ PM_{10}
	Annual level for protection of human health	20 $\mu g/m^3$ PM_{10}
Particulate Matter ($PM_{2.5}$)	24-hour level for protection of human health	25 $\mu g/m^3$ $PM_{2.5}$
	Annual level for protection of human health	10 $\mu g/m^3$ $PM_{2.5}$

10.3 RECEIVING ENVIRONMENT

10.3.1 Existing Sources and Receptors

The existing Foynes Port is located to the north of the town of Foynes between the N69 national primary route and the Shannon Estuary. The port itself is a Tier 1 port of national significance and is engaged in the handling of a range of materials including:

- Dry bulk fertilisers, animal feeds, salt, coal and alumina hydrate;
- Break bulk including timber, construction materials, machinery and materials for the offshore industry;
- Liquids – primarily oils but also chemicals;

- Cruise vessels; and
- Project cargoes including materials for the renewable wind energy industry;

In terms of shipping movements, approximately six vessels per week visit the port. Vessels will emit combustion emissions (both gases and particulates) while at sea and also while in the port (including manoeuvring and hoteling operations). The extent of the emissions depends mainly on the fuel type and the size/type of vessel. Exhaust emissions arise from both the main propulsion engines and the auxiliary engines used to provide power and services within vessels. At a current average of circa one vessel per day the current emissions from shipping in the Foynes area is not considered significant.

EU Directives are in force which relate to the content of sulphur in marine gas oil (EU Directive 93/12 and EU Directive 1999/32) and the content of sulphur in heavy fuel oil used in Sulphur Emission Control Areas (EU-Directive 2005/33) such as the North Sea. The Marine Environment Protection Committee (MEPC) of IMO has approved amendments to Marpol Annex VI in October 2008 in order to strengthen the emission standards for NO_x and the sulphur contents of heavy fuel oil used by ship engines.

The current Marpol 73/78 Annex VI legislation on NO_x emissions, formulated by IMO (International Maritime Organisation) is relevant for diesel engines with a power output higher than 130 kW, which are installed on a ship constructed on or after 1 January 2000 and diesel engines with a power output higher than 130 kW which undergo major conversion on or after 1 January 2000. The Marpol Annex VI, as amended by IMO in October 2008, considers a three tiered approach as follows:

- Tier I: diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2000 and prior to 1 January 2011;
- Tier II: diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2011;
- Tier III (1): diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2016.

Given the existing legal requirements around fuel and emissions for shipping, the extent of emissions are gradually reducing and will continue to reduce in future years.

There are a number of other berths located along the Shannon estuary that will also generate shipping emissions when vessels visit these ports. These include Aughinish Alumina, Shannon Airport and Limerick to the east of Foynes and Moneypoint and Tarbert to the west of Foynes.

The landside port operations at Foynes are maintained through a series of jetties, cargo handling equipment and storage facilities. Existing port operations have the potential release of fugitive organic compounds from the handling/storage of fuels/chemicals and direct exhaust emissions of gaseous and particulate pollutants from cargo handling plant at the port. From the 1st January 2017, all non-road mobile plant employed at the port will have to comply with Regulation (EU) 2016/1628 on requirements for pollutant emission limits for internal combustion engines for non-road mobile machinery. Under this legislation, manufacturers have to ensure that engine types and engine families are designed, constructed and assembled so as to comply with the requirements laid down in the Regulations. The Regulations also require that all new plant on the market:

- Meets the most stringent emission limit values; and

- Is tested using the test cycles that correspond to the most stringent emission limit values.

These Regulations (and earlier versions) ensure that emissions from non-road mobile plant are controlled at source before the equipment is placed on the market for use. In this regard, emissions from mobile plant operating at the port are not considered significant.

There is potential for dust generation from the current practice of open storage and handling of high dust risk materials such as aggregates, grains or solid fuels at a number of locations around the port. Potential for dust emissions is heightened during the handling/transport of this material and during dry and/or windy weather conditions. SFPC has a standard operating procedure (SOP) for the Handling of Dry Bulk Cargoes which is currently in operation at the port to ensure that discharges of particulate from the facility are managed in a way that might reasonably be expected not to be detrimental to human health and the wider environment. This procedure includes strict guidelines for the following operations:

- Handling of cargo: loading/unloading, facility cleaning, vessel cleaning and cleaning of local roads
- Cargo planning
- Inspections
- Remedial action

These procedures are devised and enforced to minimise dust impact from current operations at the port and are updated as required to ensure that operations comply with the principles of continuous improvement.

Shannon Foynes Port Company maintains a log of environmental complaints and a review of this log indicates a total of eight dust related complaints since 2011. Typically the dust complaints have been tracked to loading/unloading of potentially dusty cargo such as animal feed and coal but also the open storage of coal has also acted as a source of complaints.

The port has two access points to the west of the port and to the east of the port, both of which access the N69 national primary road. Other traffic on the N69 and associated local and regional roads in the area will also act as an existing source of traffic derived pollution in the area. Where this traffic is slow moving or congested for longer periods of time the existing impacts will be more significant.

Space heating for residential and commercial premises is likely to generate levels of gaseous (NO_x, SO_2, CO) and particulate (PM_{10} and $PM_{2.5}$) pollution especially in the areas of higher population density such as Foynes. The extent of the emissions depends on the fuel used with solid fuels (coal, peat, wood) generating higher levels of pollution followed by liquid fuels (oil) and gaseous fuels (such as natural gas) generating the lowest emissions. Under the Air Pollution Act (Marketing, Sale, Distribution and Burning of Specified Fuels) Regulations 2012 (S.I. No. 326 of 2012) the study area is not covered by the smoky coal ban so emissions from space heating may pose a higher risk of PM_{10}, $PM_{2.5}$ or SO_2 emissions in the area. However, it is noted that in March 2018, the government announced that a nationwide ban on the use of smoky coal will come into force in September 2018.

There are two EPA licensed facilities located within Foynes as listed in **Table 10.7**, however, it is noted that neither of the “licenced activities” on these sites are operational (note the sites are operational but not the EPA licensed activity) and there are currently no direct emissions licensed from these facilities.

Table 10.7: EPA Licensed Facilities in the Study Area

Licence Register	Licensee	Nature of Operation
W0193-01	Irish Bulk Liquid Storage Ltd	Hazardous Waste Transfer Station – operation ceased but licence remains active
W0271-01	Greenport Environmental Limited	Composting Plant – application withdrawn

Outside the study area in Foynes, the Aughinish Alumina Limited (AAL) facility is directly east of the port and town of Foynes. The facility is licensed by the EPA (Licence Register No. P0035-06) as a primary aluminium production plant and has a typical throughput of 1.95 million tonnes/year. The plant operation involves the extraction alumina from bauxite, which is a red earth ore imported from West Africa and Brazil. The plant process has 15 main discharges to atmosphere (including a CHP, boilers and calciners) as well as an on-site landfill is known as the Bauxite Residue Disposal Area (BRDA) where the tailings are deposited and which may act as a fugitive source of dust. The 2016 reported direct emissions from the facility are presented in **Table 10.8**.

Table 10.8: Reported Direct Emissions (in kg) from the AAL facility

Sources	Oxides of Sulphur (as SO_2)	Nitrogen Oxides (as NO_2)	Dust/Particulates	Carbon Monoxide	GHG (as CO_2)
HFO Boilers	10,782	3,980	396		
Gas Boilers		89,910		17,302	
Calciners	0	528,245	118,581		
CHP		391,570		61,837	
Dust Collection Units			8,694		
Total 2016	**10,782**	**1,013,705**	**127,671**	**79,139**	**1,235,104,410**

As part of the licence application to the EPA in 2013, AAL prepared an air dispersion model to predict the impacts from the main emission sources (including the new gas boilers which were granted planning permission in 2013 – planning ref 13/164) on the environment. All results were compared to the statutory limits for the protection of human health (**Table 10.2**). The model report covered a number of operational scenarios from the emission points listed above and demonstrated that all emission scenarios would operate without causing an adverse impact on air quality.

On a regional basis the oil fired Tarbert Generating Station (EPA Licence Register P0607-02) is located circa 16km west of Foynes. Similarly, the coal fired Moneypoint Generating Station (EPA Licence Register P0605-03, currently under review) is located circa 20km north west of Foynes at Killimer, County Clare. The main emissions associated with these facilities for 2016 are presented in **Table 10.9** and the levels indicate the scale of the emissions from these major sources. It is noted that the government has announced the planned cessation of the combustion of coal at Moneypoint in 2025, however, the plant may remain operational but fuelled by an alternate source.

Table 10.9: Reported Direct Emissions (in kg) from other key sources in the area

Source	Oxides of Sulphur (as SO_2)	Nitrogen Oxides (as NO_2)	Dust/Particulates	Carbon Monoxide	GHG (as CO_2)
Tarbert	190,614	73,335	11,780	8,264	43,382,400
Moneypoint	2,222,444	3,114,397	189,401	430,195	4,414,769,829

There are two Major Accidents (Seveso III) Directive sites within the Foynes Port area. These are Atlantic Fuel Supply Company Ltd. and Irish Bulk Liquid Storage Ltd. Both are engaged in the storage of bulk fuels and may generate trace fugitive emissions of organic compounds during loading/unloading.

10.3.2 Future Sources of Emissions

In addition to the existing sources of air emissions in the area, there are a number of consented operations that have potential to generate emissions that have yet to commence operation. These are described below to facilitate an assessment of potential for significant cumulative air quality impact.

Shannon Foynes Port Company has permission (Planning Reference 12/212) to carry out reclamation works between the rear of the existing East Jetty and the adjacent shoreline. The works will include dredging, importation of fill material, retaining wall construction, surfacing, drainage installation and site lighting. No buildings are proposed on the proposed reclaimed area which will be used for the storage and handling of cargo up to an anticipated height of approximately 7.7m. A series of best practice dust mitigation measures are presented within the EIS including cleaning of site and public roads, use of wheel washes, boundary screens, material handling procedures, etc. In addition, the EIS states the requirement for ongoing dust monitoring (this data is referenced in the baseline for this EIAR) and the continued adherence to the SFPC "Procedures for Handling Dusty Product". The EIS for this development notes the potential for minor, localised and temporary adverse impacts from construction dust but no significant changes in air quality during the operation phase (given the absence of any significant changes to port operations). The prescribed mitigation is a requirement of planning as dictated by Condition 1 of the planning consent. In addition, Condition 8 restricts the handling and storage of materials on the reclaimed area to minimise the potential for airborne emissions.

In 2017, Auhginish Alumina (AAL) have been granted permission (Planning Reference 17/714) for development of a circa 4.5 hectare borrow pit located adjacent to the eastern boundary of the existing BRDA to extract circa 374,000m^3 of rock over a 10 year period. The EIS for this development has modelled the dust impact and predicts that the worst-case dust deposition level (including background) will be 106.7 mg/m^2/day. This level is predicted at the AAL site boundary with negligible impacts predicted off site.

Planning Reference 14/603 relates to a development within the port for the storage, screening, processing, binding and packaging of solid fuel briquettes by CPL and this development is now operational. The development includes for the "partially enclosed" storage of all raw materials (petcoke, bituminous fines, biomass, molasses, phenol formaldehyde resin, esters, etc.) except anthracite which will be stored externally. The EIS states that given the high moisture content of the anthracite (10-12%) the external storage has a low risk of dust generation. In addition, to the open storage the site will include an emission stack from a rotary coal dyer which will be fitted with a bag filter to prevent significant emissions. There is also the potential for fugitive dusts from the internal processing (crushing, screening, etc.).

Planning reference 15/468 relates to a smokeless and bio-mass based solid fuel manufacturing and packaging facility to be developed by Bord na Mona. The development includes for the cessation of the former coal bagging operation and the associated open storage of coal the site. It is noted that Bord na Mona has recently (March 2018) announced that the company does not intend to proceed with this consented development. Furthermore, the company announced the plan to close the existing coal storage facility within the port. Notwithstanding these changes, as this development is consented, the cumulative impact of the development is considered within this EIAR for completeness.

Similar to the CPL plant, the Bord na Mona facility plans to import bituminous coal, petcoke, anthracite and biomass by ship and road for storage (both internal and external) on site. The movement and storage of these materials has the potential to generate dust emissions from storage and handling and transport emissions on the road network. Further to the storage of materials at his site, the process also includes for a total of five emission points which will discharge combustion emissions (CO, NO_x, SO_2, VOCs and fine particulate matter) as well as process particulates (PM_{10} and $PM_{2.5}$).

The EIS for the Bord na Mona facility has carried out an analysis of the cumulative impacts of both the Bord na Mona and CPL developments operating simultaneously. The analysis has been carried out using a refined air dispersion model of both the open sources (stockpiles of materials) and the scheduled sources (stacks) and the results are presented in **Table 10.10**. The modelling employed a series of background levels of all pollutants to account for existing sources in the area (such as the existing port operations, road traffic, space heating, etc.) so the levels predicted do account for current port operations.

Table 10.10: Cumulative Emissions from planned development in the Foynes area

Source	Background Employed	Cumulative Impact (including background)	Limit/Guideline
Nitrogen Oxides (µg/m^3)	10	35	40
Oxides of (µg/m^3)	5	11	20
PM_{10} (µg/m^3)	14	26	40
$PM_{2.5}$ (µg/m^3)	9	19	
Dust Deposition (mg/m^2/day)	127	154	350

The EIS predicts that the additional dust deposition associated with both planned developments will be up to 27mg/m^2/day over the baseline levels at the Bord na Mona site boundary. Extrapolation of the contour mapping presented in the EIS dictates that the dust contribution in the town of Foynes will be less than 13mg/m^2/day from these plants once operational.

The results presented for the other parameters are the worst case levels for the area. The levels of combustion gases and fine particulates will be increased in the area as a result of the combined operations by a significant fraction. This includes an approximate doubling of the backgrounds employed for the model for the highest areas of impact which are within the port and close to the two plants.

10.3.3 Baseline Air Quality Results

The Study Area is located within EPA Zone D, rural Ireland. The results of the baseline air quality monitoring and data from the Zone D EPA National Air Quality Monitoring Programme are presented for each pollutant below. In addition, other key sources of valuable information on baseline air quality are also collated and referenced.

The State of Ireland's Environment 2016

In October 2016 the EPA published the "State of Ireland's Environment 2016" which provides the most recent update of the quality of Ireland's environment and identifies the key stresses and pressures for each environmental media.

The report identifies that Ireland's air quality currently is good, relative to other EU Member States and all air quality monitoring stations show that Ireland continues to meet all EU air quality standards. In the past 5 years, Ireland has had no breaches of the EU air quality standards at any of the 31 monitoring stations located around the country in both urban and rural areas. Ireland's good air quality is largely thanks to the prevailing clean Atlantic air and the absence of large cities and heavy industry.

The report states that in Ireland the premature deaths attributable to air pollution are estimated at 1,200 people. The most common causes of premature death attributable to poor air quality are strokes and heart disease. In Ireland, the most overtly problematic pollutants causing disease in humans are particulate matter (PM), ground-level ozone (O_3) and nitrogen dioxide (NO_2).

Baseline Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) is classed as both a primary and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car or ship engine). As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources. NO_2 has been shown to reduce the pulmonary function of the lungs and long term exposure to high concentrations of NO_2 can cause a range of effects, primarily in the lungs, but also in the liver and blood. The results of the site specific baseline monitoring undertaken in January-April 2017 are presented in **Table 10.11**.

Table 10.11: Baseline Nitrogen Dioxide Results

Reference	Description	NO_2 Concentration (µg/m^3)
A1	West of the village of Foynes adjacent to the N69	16.32
A2	Western Port Entrance off the N69	12.84
A3	Foynes Main Street	12.75
A4	Eastern Port Entrance	13.23
A5	Junction between the port access road and the N69	12.39
A6	Dernish Avenue residential area	3.90
A7	Robertstown area south east of the town	5.74
Annual Limit for the Protection of Human Health (AQ Standards)		**40**
Annual Guideline for the Protection of Human Health (WHO)		**40**

All monitoring locations show levels less than the annual limit and WHO Guideline for the protection of human health (40µg/m^3). Levels detected are less than half this limit/guideline and the locations closer to the road network (A1 to A5) show levels higher than those located further from the main roads (A6 and A7). These trends and the levels detected are largely as expected as road traffic is likely the dominant source of NO_2 in the area.

The EPA uses a continuous chemiluminescent analyser to determine nitrogen dioxide (NO_2) concentrations at the Zone D rural monitoring stations around the country. The relevant monitoring station that is considered representative of the study area is the Kilkitt station in Co. Monaghan which is typically used as an indicator of rural areas of Ireland which are located away from major sources such as roads. The EPA data for this station is outlined in **Table 10.12**.

Table 10.12: Results of NO_2 Monitoring carried out by the EPA at Kilkitt (Zone D)

Statistic	2015	2016	AQ Limit
Annual Mean (µg/m^3)	2.0	3.0	**40**
Max 1-hour (µg/m^3)	97.0	80.2	**200**
NO_2 Values >200µg/m^3	0	0	**18**

Air quality data from the Kilkitt monitoring station indicate that the levels detected in rural Ireland are well below the relevant air quality limits and WHO guidelines for each year. The data indicates that a typical background level in the area would be of the order of 3µg/m^3 which is similar to Locations A6 and A7 in the site specific baseline as expected. The station also shows full compliance with the annual and 1-hour limits for the protection of human health as specified in S.I. 180 of 2011 (refer **Table 10.2**).

Baseline Sulphur Dioxide (SO_2)

Sulphur Dioxide (SO_2) is primarily classed as a primary pollutant emitted from the combustion of fuels containing sulphur which includes oils and solid fuels but not gases. Sulphur content of oils used for transport and space heating are controlled but the content in marine fuels is less controlled. Health effects from elevated levels of SO_2 include aggravation of asthma, reduced lung function, inflammation of the respiratory tract and general discomfort, anxiety and headaches. SO_2 is also a contributor to acidification of rivers and lakes.

No site specific baseline for SO_2 was undertaken given the extent of the existing monitoring in the area which is undertaken by the following:

- The EPA carries out continuous monitoring for SO_2 at a site located on raised ground on a farm near Askeaton in Co. Limerick which is located circa 5km east of Foynes.
- Aughinish Alumina Limited (AAL) carries out continuous SO_2 monitoring in the town of Foynes (at the Limerick County Council reservoir) in accordance with Conditions 5.8 and 6.18 of the IE Licence.

The most recent set of results for both data sets are presented in **Table 10.13**.

Table 10.13: Results of SO_2 Monitoring carried out by the EPA and AAL

Station	Statistic	2015	2016	AQ Limit	WHO Guideline
Askeaton (EPA Monitor)	Annual Mean (μg/m^3)	2	2	**20**	-
	Max 1-hour (μg/m^3)	14	15.7	**350**	-
	Max 24-hour (μg/m^3)	4	5.4	**125**	**20**
Foynes (AAL Monitor)	Annual Mean (μg/m^3)- Winter Mean	5.7	5.5	**20**	-
	Max 1-hour (μg/m^3)	96.6	63.1	**350**	-
	Max 24-hour (μg/m^3)	22.4	8.5	**125**	**20**

The results of the monitoring at both stations show levels less than the limits and WHO Guidelines for the protection of human health and the wider environment for each of the annual, daily and hourly values. The only exception was a single 24-hour measurement at the Foynes site in 2015 which was above the WHO daily limit. The levels at the Askeaton site are typical rural background levels in areas where there are no major sources of pollution. The levels detected in Foynes are higher than the corresponding levels in Askeaton and this likely a direct result of the location within the town and the proximity to the main sources – in this case space heating for commercial/residential premises. Other major sources (e.g. Tarbert, Moneypoint and AAL) would not appear to be having a significant impact in Foynes as any impact would also be detected in the Askeaton monitor.

Fine Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate matter (PM_{10}) may be emitted as a primary pollutant from road vehicle exhausts and combustion of solid fuels for heating which are the main sources of this pollutant in urban areas. In rural areas, sources will include traffic, agricultural activities and natural processes. PM_{10} may also be formed as secondary pollutants from the condensation or reaction of chemical vapours in the atmosphere. Health effects associated with PM_{10}, in the long term, include chronic effects such as increased rates of bronchitis and reduced lung function.

Particulate Matter ($PM_{2.5}$) has similar effects on health as PM_{10}, however, $PM_{2.5}$ is a better indicator of anthropogenic (man-made) emissions. Fine particulate matter $PM_{2.5}$ can be responsible for significant negative impacts on human health.

No site specific baseline for PM_{10} and $PM_{2.5}$ was undertaken given the extent of the existing monitoring in the area which is undertaken by AAL in the town of Foynes (at the Limerick County Council reservoir) in accordance with Conditions 5.8 and 6.18 of the IE Licence. The results of the most recent monitoring are presented in **Table 10.14**.

Table 10.14: Results of Particulate Monitoring carried out by AAL in Foynes

Statistic	2015	2016	AQ Limit	WHO Guideline
Annual Mean PM_{10} ($\mu g/m^3$)	9	9	**40**	**20**
Annual Mean $PM_{2.5}$ ($\mu g/m^3$)	5	4	**25**	**10**

The results recent monitoring in Foynes indicate that annual average PM_{10} and $PM_{2.5}$ concentrations are well below the statutory limits for the protection of human health and also the more stringent WHO guidelines for air quality.

Total Particulate Matter (General Dust)

General dust or total particulates are similar in nature to the fine particulates (PM_{10} and $PM_{2.5}$) but general dust covers all sizes of dusts and not simply the fine particle fraction. General dusts are typically in the range of 1 to 75 microns with fine particulates less than 10 microns. Dusts can have significant nuisance impact on top of the health impact posed by fine particulates. Dusts may be generated by man-made sources such as construction, agriculture, industry, etc. as well as natural sources such as sea-salt aerosol, natural erosion, etc.

Shannon Foynes Port Company carries out a series of dust deposition monitoring in the area to characterise the impact of the operations and protect the wider environment. The locations of the monitoring are shown in **Figure 10.1** and may be described as follows;

- D1: South western boundary of the port and adjacent to Foynes Main Street;
- D2: North eastern boundary of the port;
- D3: Southern boundary of the port;
- D4: Western boundary of the port; and

- D7: Southern boundary of the port and close to the residential properties on Main Street and Brendan Cottages.

The monitoring undertaken for 2015-2017 is presented in **Table 10.15**. There are no legislative limits for total suspended particles, so the guidelines provided by the TA Luft guidance *Technical Instructions on Air Quality Control* (TA Luft, 2002) are employed. The guidance states that monthly dust levels should remain below the guideline of 350mg/m^2/day as an annual average at sensitive residential receptors. Below this threshold, the potential for dust nuisance to impact people in the nearest residential, commercial or other structures will be minimised.

Table 10.15: Baseline Dust Deposition Monitoring 2015-2017

Month	Dust Deposition Rate (mg/m^2/day)				
	D1	D2	D3	D4	D7
January 2015	301	241	410	203	-
February 2015	352	288	284	245	-
March 2015	115	367	1307	-	-
April 2015	145	308	163	93	-
May 2015	100	230	190	42	-
June 2015	28	47	35	110	-
July 2015	848	303	135	-	-
August 2015	93	134	226	597	-
September 2015	361	117	127	119	-
October 2015	77	110	62	-	-
November 2015	165	786	187	-	-
December 2015	58	300	165	-	-
2015 Annual Average	**220**	**269**	**274**	**201**	**-**
January 2016	1034	188	168	-	-
February 2016	199	333	358	-	-
March 2016	72	911	188	-	-
April 2016	103	262	211	-	-
May 2016	117	102	659	-	-
June 2016	91	0	233	-	-
July 2016	92	269	325	-	-
August 2016	95	363	157	-	-
September 2016	42	82	128	-	-
October 2016	41	192	72	-	-
November 2016	35	160	131	-	-
December 2016	107	269	89	-	-
2016 Annual Average	**169**	**261**	**226**	**-**	-
January 2017	91	193	253	-	-
February 2017	57	125	367	-	-
March 2017	61	200	278	-	-
April 2017	151	501	411	-	-
May 2017	27	256	263	-	-
June 2017	81	333	688	-	-
July 2017	88	176	128	-	-
August 2017	77	270	200	-	-
September 2017	138	139	241	-	-
October 2017	148	661	209	-	-
November 2017	116	111	213	74	89

Month	Dust Deposition Rate (mg/m^2/day)				
	D1	D2	D3	D4	D7
December 2017	188	1298	870	-	267
2017 Annual Average	**102**	**355**	**343**	**74**	**178**
Guideline	**350**				

The results indicate that for a number of months the levels detected are above the relevant guideline at all locations. It is noted that the monitoring data does note that a contributory factor to some of the elevated levels is from non-dust organic matter (leaves, insects, etc.) which impact on the accuracy of the results in certain months.

At both D2 and D3, a total of seven (at D2) and eight (at D3) of the 36 months monitored showed levels above the guideline (highlighted in grey) and in some months well above the guideline. Both of these locations are in close proximity to the open storage of potentially dusty materials within the port and indicate that these sources have the potential to generate periodic levels of dust nuisance in the area. In addition, at location D2 the 2017 annual average is above the guideline indicating the potential for more prolonged nuisance.

Locations D1 and D7 offer the best indicator of potential for dust nuisance at residential properties as these are located adjacent to the centre of the town of Foynes. Location D1 shows four monthly levels above the guideline back in 2015 and early 2016 but no recent elevated levels. D7 has only recently commenced as a monitoring point and the data to date shows compliant levels.

On average for all monitoring locations across the port the level detected in the period 2015 to 2017 is 241mg/m^2/day which, while below the guideline (350mg/m^2/day), illustrates an elevated source (or sources) of dust in the port area.

In summary, the results would indicate that there are current open sources of dust on the port site that are leading to localised dust generation around the site. While, the most recent data set indicate that these dusts are not being detected close to residential areas, the potential for dust nuisance at these area exists in the baseline scenario. This is consistent with the log of dust complaints as described in **Section 10.3.1** whereby eight dust related complaints have been documented since 2011 and these typically relate to cargo handling and open storage.

Baseline Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) consist of any organic substance (solvent) that can exist in the vapour phase at ambient temperatures. There is a wide variety of VOCs available but the principle VOCs relevant to this project are those derived from vehicle emissions, in particular the aromatic hydrocarbons benzene, toluene, ethylbenzene and the xylenes which are collectively known as BTEX. Aromatic hydrocarbons typically consist of one third of the constituent of petrol and provide a good indicator of traffic related emissions. In addition, benzene is a known carcinogen and S.I. 180 of 2011 (**Table 10.2**) show the statutory limit for the protection of human health. Due to its carcinogenic nature the WHO have not stated a safe level of exposure for benzene. The other aromatic compounds are not classed as carcinogens and do not have limits for the protection of human health. The results of the site specific baseline monitoring undertaken are presented in **Table 10.16**.

The results of the VOC baseline illustrate that levels detected in the area are low and benzene levels are well below the limit for the protection of human health. There are no limits for the other VOCs detected.

Table 10.16: Baseline Volatile Organic Compounds (VOCs) Results

Reference	Description	Benzene (μg/m^3)	Toluene (μg/m^3)	Ethylbenzene (μg/m^3)	m,p-Xylene (μg/m^3)	o-Xylenes (μg/m^3)
A1	West of the village of Foynes adjacent to the N69	0.67	0.50	<0.27	0.49	<0.27
A2	Western Port Entrance off the N69	0.83	0.67	<0.27	0.60	<0.27
A3	Foynes Main Street	<0.21	<0.22	1.02	1.36	0.48
A4	Eastern Port Entrance	0.57	0.45	<0.27	0.28	<0.27
A5	Junction between the port access road and the N69	0.61	0.46	<0.27	<0.27	<0.27
A6	Dernish Avenue residential area	0.69	0.34	<0.27	<0.27	<0.27
A7	Robertstown area south east of the town	0.67	0.50	<0.27	0.49	<0.27
Annual Limit for the Protection of Human Health AQ		**5**	**-**	**-**	**-**	
Weekly Guideline for the Protection of Human Health WHO		**-**	**260**	**-**	**-**	**-**

Climate

The weather in the study area is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction in Ireland is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer.

The nearest meteorological station to the area is the Met Éireann Station in Shannon Airport which lies approximately 15km north east of Foynes. The 30-year averages from the station at Shannon Airport are presented in **Table 10.17**.

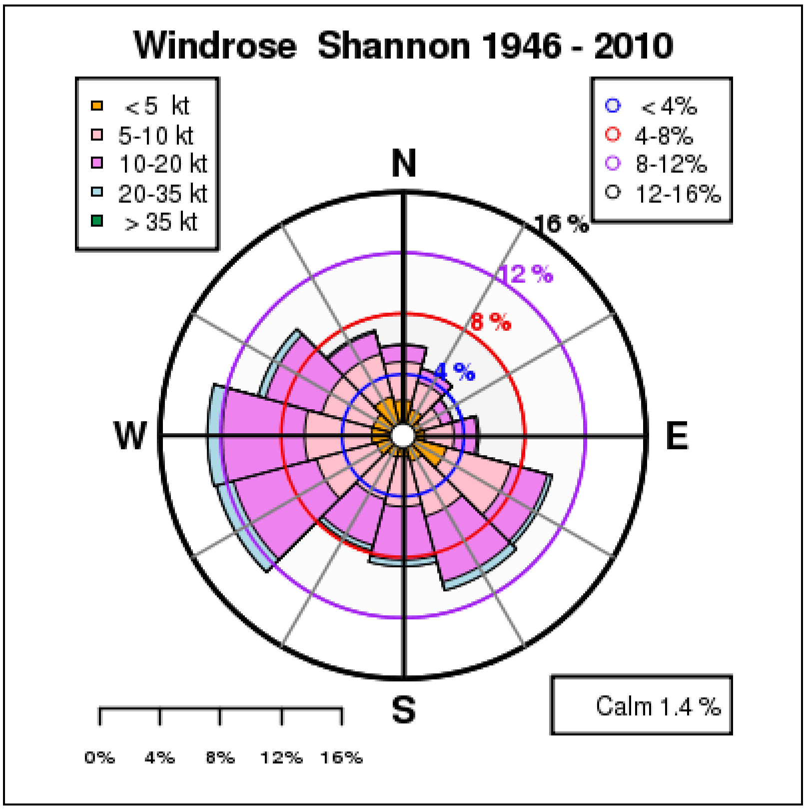
Table 10.17: 30-year Average Meteorological Data from Shannon Airport (Annual Values from 1981-2010)

Parameter	30-year Average
Mean Temperature (^{0}C)	10.7
Mean Relative Humidity at 0900UTC (%)	83.6
Mean Daily Sunshine Duration (hours)	3.5
Mean Annual Total Rainfall (mm)	977.6
Mean Wind Speed (knots)	9.1

The prevailing wind direction for the area is between northwest to southwest as presented in the windrose for Shannon Airport Met Station in **Figure 10.2**. Easterly winds tend to be very infrequent. Wind characteristics vary between a moderate breeze to gales (average 6.7 days with gales per annum). Monthly average wind speeds range between 8.2 and 9.3 knots with highest wind speeds occurring during winter months (December and January). Lowest wind speeds were recorded in the June, July and August period.

Poor dispersion can occur under certain weather characteristics known as inversions that form in very light or calm wind and stable atmospheric conditions. The wind rose illustrated in **Figure 10.2** identifies that such wind conditions are very infrequent (1.4%).

Figure 10.2: Windrose for Shannon Airport Met Station (source: www.met.ie)



The National Policy Position on Climate Action and Low Carbon Development was published on the 23rd April 2014. The policy sets a fundamental national objective to achieve transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. The policy states that GHG mitigation and adaptation to the impacts of climate change are to be addressed in parallel national strategies – respectively through a series of National Mitigation Plans and a series of National Climate Change Adaptation Frameworks.

The National Policy Position envisages that development of National Mitigation Plans will be guided by a long-term vision of low carbon transition based on the following:-

- An aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and

- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

With reference to this project, the aggregate reduction emissions of at least 80% from the electricity generation, built environment and transport sector by 2050 is the relevant policy reference.

Further to the National Policy Position, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted on the 10th of December 2015. The Climate Act sets out the proposed national objective to transition to a low carbon, climate resilient and environmentally sustainable economy by the end of 2050.

Ireland reported an emission level of 61.19 million tonnes in 2016 which was an increase of 3.5% from the 2015 emissions. These EPA predict that Ireland will be in compliance with its 2016 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC3. However, the EPA's latest projections indicate that Ireland will exceed its annual targets in 2017.

Greenhouse gas emissions from the Transport sector increased by 3.7% or 0.44 Mt CO_{2eq} in 2016. This is the fourth successive year of increases in transport emissions. In road transport in 2016, gasoline use continued to decrease by 6.7% while diesel use increased by 8.0% and biofuels use decreased by 8.0%. Looking at the underlying drivers, the number of passenger diesel cars increased by 11.9% in 2016 while the number of passenger petrol cars decreased by 5.7%, commercial vehicle numbers increased by 3.5% and employment continued to grow with 3.3% growth recorded between Q4 2015 and Q4 2016.

10.4 LIKELIHOOD OF IMPACTS

10.4.1 Construction Phase

It is noted that the development at the Durnish Lands may be progressed either as a single phase or on a phased basis through three distinct phases (as outlined in Chapter 3). As the greatest intensity of construction would be through a single phase construction, this is the scenario presented in this EIAR. A phased construction would result in a lower construction impact, albeit over a longer timeframe.

The potential air and climate impacts during the construction phase of the proposed development are listed as follows:

- Construction dusts during the construction of the various elements of the works; and
- Construction traffic (both at a local and national level).

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. The potential for dust generation from the construction activities associated with the port development is assessed on the basis of a review of the proposed methodologies and the proximity of these activities to sensitive receptors.

Construction activities such as demolition at the western end of the existing East Jetty, earthmoving and importation of materials to the Durnish Lands as well as general works across the site including concrete works, road construction, etc. may generate quantities of dust, particularly in dry weather conditions. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. The likelihood of impact is largely dependent on the proximity of sensitive receptors to the works.

The proposed construction phase will require the importation of materials (aggregates, concrete, etc.) during the construction phase and this material will be transported to and from the site via the N69 and the existing network. This additional traffic on the network has the potential to generate addition emissions both a local level affecting properties along the haul routes and at a national level (greenhouse gases and acidifying gases).

10.4.2 Operation Phase

A noted earlier, the development at the Durnish Lands may either as a single phase or on a phased basis. The proposed development addressed in this EIAR is for the construction of all phases followed by the operation of Phase 1. For completeness the full operation of Phases 1 to 3 has also been considered as a worst case assessment as this includes for a greater intensity of traffic and other operational impacts.

The main operational phase impacts with the proposed development include the following:

- Direct impacts from the port operations including shipping, quayside plant and fugitive dusts; and
- Traffic related emissions from the additional road traffic.

As noted in the baseline section, the current number of vessels servicing the port is not considered to pose a significant source of air emissions at present and emissions per vessel are predicted to decrease in future years based on the implementation of Marpol. The UK Local Air Quality Management (LAQM) Technical Guidance (TG16) states that there is a risk of exceedance of the relevant air quality limits where shipping numbers exceed the following:

- More than 5,000 large ship movements per year with relevant exposure within 250m of the berths and main areas of manoeuvring; or
- More than 15,000 large ship movements per year with relevant exposure within 1km of these areas.

While there are sensitive receptors within 250m of the berths and main areas of manoeuvring, the number of vessels visiting the port on an annual basis is circa 300 per annum, increasing to circa 350 per annum with the proposed development. As a consequence, the potential for significant air quality impact from shipping numbers associated with the existing or proposed development is low.

At the East Jetty extension, the operations will be as per the existing jetties and will generally comprise the loading and unloading of vessels using harbour mobile cranes. It is intended that hours of operation on the jetty extension will be unchanged from the existing scenario. An intensification of the existing operation may give rise to additional operational/shipping emissions, dust generation (depending on cargo) and road traffic.

The proposed development at the Durnish Lands includes a mixture of warehousing, storage and port centric development that may be developed either as a single phase or through a phased development as follows:

- Phase 1- development of circa 11.5 hectares of lands
  - Covered storage 1.2ha
  - Open storage 6ha
- Phase 2- development of approx. 5 hectares of lands
  - Covered storage 3ha
  - Open storage 2ha
- Phase 3- development of 10 hectares of lands
  - Covered storage 5ha
  - Open storage 5ha

Among the material storage infrastructure at the site the following will be developed:

- Warehousing (up to 15m height);
- Breakbulk and project cargo such as steel sections/reinforcement, timber, palletised fuel/fertiliser, wind turbine blades etc. (stored 10m high);
- Loose cargoes such as woodchip biomass fuel (stored 6m high); and
- Storage of containers (up to 3nr high) approx. 13m high with handling equipment up to 24m high.

The open storage of materials such as biomass or fertiliser has the potential to generate further quantities of dust that may have a potential for increased impact on sensitive receptors in the area. Given the baseline dust levels noted in **Table 10.16**, the continued and intensified operations (both loading/unloading and open storage) have the potential for continued dust nuisance impact in the absence of a more rigorous dust mitigation regime.

Port handling equipment such as mobile cranes, mobile hoppers, mobile weighbridges, straddle carriers, loading shovels reach stackers, mast lift trucks, or similar will be used in this area. Each of these types of mobile plant can generate combustion emissions with the extent of the emissions dependent on the fuels employed, the number of vehicles and the duration of operation. As outlined earlier, all new plant on the site must comply with the strict emission limit values specified in Regulation (EU) 2016/1628. As a consequence, the additional numbers of mobile plant required for port operations is not considered to give rise to a significant air quality impact in the area.

The additional storage operation on the Durnish Lands will give rise to additional haulage traffic to and from the area and access will primarily be via the newly constructed roundabout on the existing port access road.

10.5 DESCRIPTION OF SIGNIFICANT IMPACTS

10.5.1 Construction Phase

Dust Emissions

In accordance with the NRA Guidelines, where there are construction activities there is a risk that construction dust may cause an impact at sensitive receptors in close proximity to the source of the dust generated. These distances are presented in **Table 10.18** (source NRA Guidelines, May 2011 Revision).

Table 10.18: Assessment Criteria for the Impact of Dust Emissions from Construction Activities, (with standard mitigation in place)

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large Construction sites, with high use of haul routes.	100m	25m	25m
Moderate	Moderate Construction sites, with moderate use of haul routes.	50m	15m	15m
Minor	Minor Construction sites, with minor use of haul routes.	25m	10m	10m

The main sources of dust emissions from the proposed construction phase will be from the following areas:-

- East Jetty Extension Works
- Durnish Lands Development (assuming a worst case single phase development of all three phases simultaneously as opposed to the phased development)

The number of properties within the dust risk zone for each of the above areas is presented in **Table 10.19**. The data indicates that 28 properties are located within the dust risk zone for the two areas that may be affected by dust nuisance during the construction phase of the project. A series of dust mitigation measures are presented in **Section 10.6.1** of this EIAR. With these mitigation measures in place these 28 properties are predicted to experience a slight adverse impact as a result of dust nuisance of temporary nature.

Table 10.19: Construction Area and Proximity to the Nearest Residential Receptors

Area	Size (Risk Distance)	Receptors Impacted
East Jetty Extension Works	Major (100 metres)	Approximately 10 residential and 6 commercial receptors lie within 100 metres of the proposed works in this area. It is noted that one of the receptors is the Foynes Health Centre.
Durnish Lands Development	Major (100 metres)	Approximately 12 properties at Dernish Avenue lie within 100 metres of the proposed works at the western perimeter of the Durnish Lands to support Phase 1 of the development in this area.

Construction Traffic

A review of the planned construction phases has been undertaken to estimate the additional volumes of construction traffic anticipated on the local road network. An estimated additional 252 HGV movements per day on the network has been predicted during construction – assuming a worst case single phase construction.

This information has been employed to determine the potential air quality impact of this traffic over and above the existing traffic volumes in the area. In order to quantify the local impact on human receptors in the area the following locations have been modelled:

- R1 Properties along Foynes main street (N69)
- R2 Properties along the N69 south of the access road to the eastern port entry point.

The results of the modelling are shown in **Table 10.20** and illustrate that all properties on these routes will experience levels of air quality pollutants well below the limits for the protection of human health and the WHO guidelines both with and without the construction traffic. The construction traffic does increase pollutant levels in both areas marginally. The extent of the increases are classed as "imperceptible" to "small" (using NRA terminology in **Tables 10.3 to 10.5**) and the resultant air quality impact of this construction traffic emissions is classed as "negligible" for local populations.

Table 10.20: Local Impact from Construction Traffic Emissions

Receptor	Scenarios	Nitrogen Dioxide ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)		Particulates ($PM_{2.5}$) ($\mu g/m^3$)
		Annual Average NO_2	Annual Average PM_{10}	Days > $50\mu g/m^3$	Annual Average $PM_{2.5}$
Background		**13**	**9**	**-**	**5**
R1	2017 Baseline	14.90	9.53	0.00	5.32
	With Construction	15.53	9.64	0.00	5.38
	Net Change	**+0.63**	**+0.11**	**-**	**+0.06**
R2	2017 Baseline	16.11	9.76	0.00	5.46
	With Construction	16.68	9.86	0.00	5.52
	Net Change	**+0.57**	**+0.10**	**-**	**+0.06**
Statutory Limits		**40**	**40**	**35**	**25**
WHO Guidelines		**40**	**20**	**-**	**10**

Note: $PM_{2.5}$ estimated based on 60% of PM_{10} annual average

The regional impact of the proposed construction traffic (based on a 39 month construction timeframe) has been assessed in terms of the total mass of CO_2 and NO_x emitted and the results are presented in **Table 10.21**. The predicted levels from this construction traffic are not considered significant relative to large industrial sources such as Aughinish and the predicted CO_2 levels from the construction traffic are circa 2% of the annual emissions from Aughinish. Notwithstanding this point a series of good practice mitigation is proposed in **Section 10.6.1** for the construction phase.

Table 10.21: Regional Impact from Construction Traffic Emissions

Scenario	Carbon Dioxide (CO_2) (tonnes)	Oxides of Nitrogen (NO_x) (tonnes)
Construction Traffic	27,969	98

10.5.2 Operational Phase

Operational Dust Emissions

The risk of fugitive dust emissions from the ongoing and increased operation at the port and subsequent dust nuisance impacts are dependent on the following:

- the nature activities being undertaken (loading, unloading, open storage, etc.);
- the duration of these activities;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activities;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and
- the sensitivity of the receptors to dust.

Table 10.15 shows the baseline dust deposition data from existing operations at the port and illustrate an average level of 241mg/m^2/day in the area in the years 2015 to 2017. The results indicate that there are current operations (loading and unloading) and open sources of dust on the port site that are leading to localised and periodic dust generation around the site. The ongoing operations at these locations coupled with additional storage proposed at the Durnish Lands have the potential for further dust generation and impact.

The NRA dust risk assessment criteria as outlined in **Table 10.18**, states that there is potential for significant operational dust impacts to properties within 100 metres of any major source. However, the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction states that dust can affect a “human receptor” at distances up to 350 metres from the site boundary.

The risk of any dust impact also depends on the sensitivity of the receiving environment to any dust impact. **Table 10.22** shows how the sensitivity of the area may be determined for dust soiling (source IAQM). While devised to predict construction dust impacts, these distances have been employed to determine the potential dust impact from the proposed operations at the port.

The nearest residential area to the lands at Durnish are those ay Dernish Avenue which are located circa 230 metres from the boundary of this development area. The number of properties within 350 metres from the Durnish Lands is within the band 10-100 and hence the site has a “low” sensitivity for dust impact from this element of the proposed development. The nearest residential area to the East Jetty are those in the Main Street which are located circa 90 metres from the boundary of this development area. There are 10-100 properties within 100 metres of this area but greater than 100 within 350 metres of his development area. Hence this site also has a “low” sensitivity for dust impact from this element of the proposed development. However, taking the entire port as a source, there are greater than 100 within 100 metres and hence a “medium” sensitivity for dust impact.

Table 10.22: IAQM Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance From Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Low	Low	Low	Low
Low	>1	Low	Low	Low	Low

Given the history of dust deposition levels in the port area and the “medium” sensitivity of the area to continued and additional dust impacts, there is a long-tem “slight adverse” direct impact to air quality predicted for all properties within 350 metres of the existing and proposed port boundaries. As a consequence a series of best practice mitigation measures are proposed for the operation phase of the development.

Further to the existing aggregated baseline level of 241mg/m^2/day within the port, the consented developments by Bord na Mona and CPL within the port are predicted to lead to a further increase of 27mg/m^2/day and the site boundary and a further 13mg/m^2/day within Foynes town. The dust from the AAL borrow pit is predicted to increase levels at this borrow pit to circa 107mg/m^2/day (albeit a significant distance from the port). This cumulative baseline will establish levels of dust that are circa 75% of the guideline value in the wider Foynes area in advance of the proposed development. As a consequence there is little headspace available for any further generation within the port and a series of detailed mitigation measures are required to manage this impact. Overall, the cumulative dust impact within the Foynes area is predicted to be a long-tem "slight adverse" direct impact to air quality in the absence of further mitigation.

Road Traffic Emissions

Modelling of road traffic emissions associated with the proposed development has been undertaken for a series of receptors along the road network (including the new access point) where there is the potential for sensitive receptors to experience a significant impact as a result of the proposed development. The following receptors have been modelled in this analysis:

- R1 Properties along Foynes main street (N69)
- R2 Properties along the N69 south of the access road to the eastern port entry point.

The traffic modelling has predicted a number of operational scenarios as follows and each of these scenarios is presented for the receptors modelled:

- Do-Minimum: Traffic on the local road network without the proposed development for each of the scenario years 2023, 2029 and 2041;
- Do-Something: Traffic on the local road network with the proposed development for each of the scenario years 2023, 2029 and 2041;

It is noted that the scenario years are aligned with the phased development whereby 2029 represents the fully operational Phase 1 aspect of the proposed development and 2041 represents the fully operational development, i.e. Phases 1 to 3 of the Durnish Lands in operation.

The results of the modelling for the two receptors are presented in **Table 10.23.** For R1 (Foynes main street) the model predicts that all properties will experience levels of air quality pollutants well below the limits for the protection of human health and the WHO guidelines both with and without the additional traffic volumes in all future years. This includes both the operation of Phase 1 in 2029 and the operational traffic associated with the full Phases 1-3 developed at the Durnish Lands in 2041. The additional operational traffic does increase pollutant levels within the town but the extent of the increases are classed as "imperceptible" to "small" (using NRA terminology in **Tables 10.3 to 10.5**) and the resultant air quality impact of this traffic through the town is classed as "negligible".

For R2 (properties on the N69 south of Foynes) a similar scale of impact is predicted. All levels are below the limits and guidelines for all future scenario years (both Phase 1 and all phases operational). The predicted impact for these properties is greater than that in Foynes town given the greater traffic volumes anticipated along this section but the increases are also classed as "imperceptible" to "small" and the resultant air quality impact of this traffic along this section of the N69 is classed as "negligible".

The results of the modelling illustrate that these properties on the main routes in the network will experience levels of air quality pollutants well below the limits for the protection of human health and the WHO guidelines in all future scenario years. The additional traffic does increase pollutant levels at both receptors assessed. The extent of the increases are classed as "imperceptible" to "small" (using NRA terminology in **Tables 10.3 to 10.5**) and the resultant air quality impact of this operation phase traffic emissions is classed as "negligible" for local populations.

Note: $PM_{2.5}$ estimated based on 60% of PM_{10} annual average

The traffic analysis on the operation phase of the development has undergone further sensitivity analysis to generate a "worst-case" traffic scenario based on a 4% annual increase in growth of external traffic, peak seasonal impact and assuming the construction phase runs simultaneously to the operation phases. This worst case scenario is modelled and the results presented for the same scenario years and receptors in **Table 10.24**. The results of the modelling illustrate that these properties on the main routes in the network will experience levels of air quality pollutants well below the limits for the protection of human health and the WHO guidelines in all future scenario years even under this "worst case" traffic.

As expected the worst case traffic scenario presents a greater impact than the predicted traffic. This is evident through the increased net change in the various scenario years when comparing **Table 10.24** with **Table 10.23**. For example, in 2029 (Phase 1 operational), the predicted traffic shows an increase of annual average NO_2 in Foynes village (R1) of 0.36µg/m^3 (**Table 10.23**) whereas the worst case traffic shows an increase of 1.15µg/m^3 (**Table 10.23**). This is expected given the higher traffic volumes and greater fraction HGVs and this is consistent across all scenario years and at both receptors.

Notwithstanding this greater impact with the worst case scenario, the increases in annual air quality levels as a result of the development are still categorised as "imperceptible" to "small" and the resultant air quality impact of this worst case traffic at both receptors is classed as "negligible" (using NRA terminology in **Tables 10.3 to 10.5**).

Table 10.23: Local Impact from Operational Traffic Emissions

Receptor	Scenarios	Nitrogen Dioxide (µg/m^3)	Particulates (PM_{10}) (µg/m^3)		Particulates ($PM_{2.5}$) (µg/m^3)
		Annual Average NO_2	Annual Average PM_{10}	Days > 50µg/m^3	Annual Average $PM_{2.5}$
Background		**13**	**9**	**-**	**5**
R1	2023 Do-Minimum	15.12	9.62	0.00	5.37
	2023 Do-Something	15.28	9.65	0.00	5.39
	2023 Net Change	**+0.17**	**+0.03**	**-**	**+0.02**
	2029 Do-Minimum	15.31	9.70	0.00	5.42
	2029 Do-Something	15.67	9.76	0.00	5.46
	2029 Net Change	**+0.36**	**+0.06**	**-**	**+0.04**
	2041 Do-Minimum	15.59	9.80	0.00	5.48
	2041 Do-Something	16.19	9.91	0.00	5.54
	2041 Net Change	**+0.61**	**+0.11**	**-**	**+0.06**

Receptor	Scenarios	Nitrogen Dioxide (µg/m^3)	Particulates (PM_{10}) (µg/m^3)		Particulates ($PM_{2.5}$) (µg/m^3)
		Annual Average NO_2	**Annual Average PM_{10}**	**Days > 50µg/m^3**	**Annual Average $PM_{2.5}$**
Background		**13**	**9**	**-**	**5**
R2	2023 Do-Minimum	16.41	9.86	0.00	5.52
	2023 Do-Something	16.78	9.93	0.00	5.56
	2023 Net Change	**+0.37**	**+0.07**	**-**	**+0.04**
	2029 Do-Minimum	16.72	9.97	0.00	5.58
	2029 Do-Something	17.51	10.12	0.00	5.67
	2029 Net Change	**+0.78**	**+0.15**	**-**	**+0.09**
	2041 Do-Minimum	17.15	10.11	0.00	5.66
	2041 Do-Something	18.50	10.38	0.00	5.83
	2041 Net Change	**+1.35**	**+0.27**	**-**	**+0.16**
	Statutory Limits	**40**	**40**	**35**	**25**
	WHO Guidelines	**40**	**20**	**-**	**10**

Note: $PM_{2.5}$ estimated based on 60% of PM_{10} annual average

The traffic analysis to generate a "worst-case" traffic scenario based on a 4% annual increase in growth of external traffic, peak seasonal impact and assuming the construction phase runs simultaneously to the operation phases. This worst case scenario is modelled and the results presented for the same scenario years and receptors in **Table 10.24**. The results of the modelling illustrate that these properties on the main routes in the network will experience levels of air quality pollutants well below the limits for the protection of human health and the WHO guidelines in all future scenario years even under this "worst case" traffic.

As expected the worst case traffic scenario presents a greater impact than the predicted traffic. This is evident through the increased net change in the various scenario years when comparing **Table 10.24** with **Table 10.23**. For example, in 2029 (Phase 1 operational), the predicted traffic shows an increase of annual average NO_2 in Foynes village (R1) of 0.36µg/m^3 (**Table 10.23**) whereas the worst case traffic shows an increase of 1.15µg/m^3 (**Table 10.23**). This is expected given the higher traffic volumes and greater fraction HGVs and this is consistent across all scenario years and at both receptors.

Notwithstanding this greater impact with the worst case scenario, the increases in annual air quality levels as a result of the development are still categorised as "imperceptible" to "small" and the resultant air quality impact of this worst case traffic at both receptors is classed as "negligible" (using NRA terminology in **Tables 10.3 to 10.5**).

Table 10.24: Local Impact from "worst case" Operational Traffic Emissions

Receptor	Scenarios	Nitrogen Dioxide ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)		Particulates ($PM_{2.5}$) ($\mu g/m^3$)
		Annual Average NO_2	Annual Average PM_{10}	Days > $50\mu g/m^3$	Annual Average $PM_{2.5}$
Background		**13**	**9**	**-**	**5**
R1	2023 Do-Minimum	15.15	9.56	0.00	5.34
	2023 Do-Something	16.26	9.80	0.00	5.48
	2023 Net Change	**+1.11**	**+0.24**	**-**	**+0.14**
	2029 Do-Minimum	15.62	9.71	0.00	5.43
	2029 Do-Something	16.77	9.98	0.00	5.59
	2029 Net Change	**+1.15**	**+0.27**	**-**	**+0.16**
	2041 Do-Minimum	16.86	10.14	0.00	5.69
	2041 Do-Something	17.42	10.35	0.00	5.81
	2041 Net Change	**+0.56**	**+0.21**	**-**	**+0.13**
R2	2023 Do-Minimum	15.23	9.66	0.00	5.40
	2023 Do-Something	15.80	9.83	0.00	5.50
	2023 Net Change	**+0.57**	**+0.17**	**-**	**+0.10**
	2029 Do-Minimum	15.71	9.85	0.00	5.51
	2029 Do-Something	16.40	10.06	0.00	5.64
	2029 Net Change	**+0.69**	**+0.22**	**-**	**+0.13**
	2041 Do-Minimum	16.99	10.36	0.00	5.81
	2041 Do-Something	17.33	10.50	0.00	5.90
	2041 Net Change	**+0.34**	**+0.14**	**-**	**+0.09**
	Statutory Limits	**40**	**40**	**35**	**25**
	WHO Guidelines	**40**	**20**	**-**	**10**

Note: $PM_{2.5}$ estimated based on 60% of PM_{10} annual average

In terms of cumulative impact, it is noted that the planned CPL and Bord na Mona plants within the port will also generate additional levels of combustion emissions (including NO_x and PM_{10}/$PM_{2.5}$) on top of the baseline. The modelling of these emissions illustrates that the levels of combustion gases and fine particulates will be increased in the area as a result of the combined operations by a significant fraction. This includes an approximate doubling of the backgrounds employed for the model for the highest areas of impact which are within the port and close to the two plants. Impacts further from the two plants for receptors close to the road network will be significantly lower than predicted at these site boundaries. As a consequence the cumulative impact of the road traffic from the proposed development on top of the background levels and including the levels predicted from the two plants are not predicted to breach the air quality limits and/or the WHO guidelines.

Impact on Sensitive Ecosystem

The principal pollutants of concern in terms of impact on sensitive ecosystems are the nitrogen oxides (NO_x). Nitrogen oxides (NO_x) may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on vegetation growth, photosynthesis, and nitrogen assimilation/metabolism.

The proposed East Jetty extension is located within the estuarine habitat of the Lower River Shannon SAC (Site Code 002165) and the intertidal wetland habitat of the River Shannon and River Fergus Estuaries (Site Code 004077). The coastal boundary of these European sites runs along a flood berm on the bank of the Robertstown River at the site of the proposed Durnish Lands development. The site of proposed development at Durnish contains land within the SAC and SPA for approximately 550m along the flood berm between the site of proposed development and the Robertstown River, although no development is proposed within the European sites. Given the ecological sensitivity of the area, a nitrogen deposition assessment has been carried out on the proposed development.

The Lower River Shannon SAC ha a number of habitat types that are listed as qualifying interests including, but not limited to the following:

- 1110 Sandbanks which are slightly covered by sea water all the time
- 1130 Estuaries
- 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
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- 1310 Salicornia and other annuals colonizing mud and sand
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
- 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- 91E0 *Alluvial forests

The UNECE (United Nations Economic Commission for Europe) has published a series of critical loads for nitrogen deposition (in units kg N ha^{-1} yr^{-1}) on sensitive natural and semi-natural ecosystems. The 2003 loads are published in the NRA Guidelines (2011) but since this publication a new set of critical loads have been devised by the UNECE. The UNECE critical loads for all marine habitats are used in this assessment to determine the potential for impact.

Table 10.25 presents the predicted nitrogen deposition concentrations on these sensitive ecosystems in the SAC and SPA as a result of expanded capacity at the Port (the operation of the proposed development).

The results indicate a slight increase in the level of nitrogen generated and subsequently deposited on the SAC/SPA adjacent to the Port. However, the overall scale of the impact (1.75 kg(N)/ha/year) is well below the UNECE critical loads that have been published for marine habitats. Based on the predicted deposition load, the proposed development will have negligible impact on the sensitive ecosystems in the area.

Table 10.25: Predictions of Nitrogen Deposition at Sensitive Ecosystems during operation phase of development

Year	Do-Minimum NO_2 Concentration ($\mu g/m^3$)	Do-Something NO_2 Concentration ($\mu g/m^3$)	Nitrogen Deposition with Proposed Development kg(N)/ha/year
2023	15.41	15.78	1.58
2029	15.72	16.51	1.65
2041	16.15	17.50	1.75
UNECE Critical Load (kg(N)/ha/year) – Marine Habitats/saltmarsh			20-30

Other than nitrogen oxides (NO_x), the other potential impact on sensitive ecosystems will be the potential impact of construction dusts during the construction phase. Dusts can be deposited on the leaves of plants reducing the photosynthetic potential. DMRB guidance states that dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 1000 mg/m^2/day. As such, once dust deposition rates are maintained within the standard guideline for human nuisance (350mg/m^2/day) the impact of construction dust on sensitive ecosystems is considered negligible.

Impacts at the National/International Level

The regional impact of the proposed development has been assessed in terms of the total mass of CO_2 and NO_x emitted from the associated changes in road traffic emissions and the results are presented in **Table 10.26**.

Table 10.26: Total Emissions from the Proposed Development

Year	Scenario	Carbon Dioxide (CO_2) (tonnes)	Oxides of Nitrogen (NO_x) (tonnes)
2023	Do Minimum	4,088	9.21
	Do Something	4,479	10.69
2029	Do Minimum	4,546	10.36
	Do Something	5,300	13.02
2041	Do Minimum	5,197	11.84
	Do Something	6,671	17.05

The results of the assessment indicate that the total GHG emissions as CO_2 from the proposed development will increase by approximately 10-20% over the years 2023 to 2041 which equates to up to 1,474 tonnes of carbon dioxide per annum compared to the do-minimum scenario in 2041. Similarly, the annual emissions of oxides of nitrogen (as NO_x) from the proposed development will increase by approximately 16-44% which equates to up to 5.21 tonnes of NO_x per annum compared to the do-minimum scenario in 2041. These increases are considered to be a permanent "slight adverse" impact.

10.6 REMEDIAL AND MITIGATION MEASURES

10.6.1 Construction Phase

Construction Dust

At the construction phase, the potential for dust emissions must be assessed qualitatively by the contractor through a documented Dust Risk Assessment. This assessment must be based on the details of construction works and methodologies to be utilised by the contractor and proximities of works to residential, commercial and ecological receptors.

A construction compound should be selected so that it is located as far as practicable from sensitive receptors such as residential dwellings, etc. in Foynes but also at a sufficient distance from ecological receptors (such as the estuary). A Dust Risk Assessment and a Dust Minimisation Plan will be prepared by the contractor in advance to the commencement of works. The Dust Minimisation Plan will be based upon the industry guidelines in the Building Research Establishment document entitled '*Control of Dust from Construction and Demolition Activities' (BRE 2003)*. In order to ensure that any dust nuisance is minimised, a series of mitigation measures have been listed below.

- Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only.
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential).
- All vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Wheel washes should be self-contained systems that do not require discharge of the wastewater to water bodies.
- Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary. The contractor will be required to submit for approval the methodology for monitoring dust emissions both on and beyond the site boundary.
- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind.
- Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

In addition to the standard methods outlined above the following additional measures will be applied for works close to sensitive areas such as the 28 receptors identified in the higher risk areas:

- Site traffic in these areas will be restricted to 20km/hr to minimise dust re-suspension.
- All material handling will be carried out to minimise drop heights from plant to plant or from plant to stockpile.
- Water bowsers will be used across the areas as required on roads, stockpiles and material handling systems.

With the implementation of the mitigation measures as set out in this chapter and adherence to good working practices by the contractor, the levels of dust generated are unlikely to cause a significant environmental nuisance. The contractor will be required to maintain monthly dust levels below the guideline of 350mg/m^2/day as an annual average at sensitive receptors. Where dust levels are found to be above this threshold, the mitigation measures in the area must be reviewed as part of the Dust Minimisation Plan.

Construction Greenhouse Gas Emissions

Mitigation measures to minimise CO2 emissions from transport during the construction phase that must be implemented include the following:

- Local sourcing of construction materials such as the recycling of material won on excavations for reuse on site.
- Implementation of the Traffic Management Plan. This will outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads.
- Reducing the idle times by providing an efficient material handling plan that minimises the waiting time for loads and unloads. Reducing idle times could save up to 10% of total emissions during construction phase.
- Turning off engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons.
- Regular maintenance of plant and equipment. Technical inspection of vehicles will be undertaken to ensure they will perform the most efficiently.

Materials with a reduced environmental impact may also be incorporated into the construction design through re-use of materials or incorporation of recycled materials in place of conventional building materials. The following materials may be considered for the construction phase:

- Ground Granulated Blast Furnace Slag (GGBS) & Pulverised Fuel Ash - Used as replacements for Portland cements to increase sustainability and carbon footprint of civil and structural works.
- Steel - The recovery rates associated with using recycled steel are high and research exists which shows that 99% of structural steel arising from demolition sites is recycled or re-used. The carbon emissions emitted during the production of virgin steel can be higher than some other structural materials on a tonne by tonne basis, and recycled steel should be used where possible.

As part of the Construction Environmental Management Plan, the contractor will be required to implement an Energy Management System for the duration of the works. This Energy Management System will include such measures as:

- The use of thermostatic controls on all space heating systems in site buildings to maintain optimum comfort at minimum energy use.
- The use of sensors on light fittings in all site buildings and low energy lighting systems.
- The use of adequately insulated temporary building structures for the construction compound fitted with suitable vents.

- The use of low energy equipment and "power saving" functions on all PCs and monitors in the site offices.
- The use of low flow showers and tap fittings.
- The use of solar/thermal power to heat water for the on-site welfare facilities and contamination unit (sinks and showers).

These good working practices implemented in the energy management during the construction phase will result in the reduction in the generation of energy and transport related greenhouse gas emissions during this phase.

10.6.2 Operational Phase

Operation Phase Dust Emissions

A significant series of operation phase dust mitigation measures are currently in operation at the port through the SFPC *Handling of Dry Bulk Cargoes* standard operating procedure (SOP) and these are listed below:

Loading and Unloading of Cargo

- All activities carried out at the facility including dry bulk cargo handling, movement and storage, must be carried out in accordance with this SOP.
- Subject to the cargo level in the vessel's hold, while loading / unloading, grabs must be lowered fully into the vessel's hold and also fully lowered into the hoppers, before releasing cargoes. At all times, cargoes must be released from a grab at a height and a speed that minimises escape of particulates from the hopper. Trucks must not be overloaded directly from the hopper to minimise the risk of spillage from the top of the truck while in transit to the store.
- No cargo may be placed on the jetty deck unless its properties are such that wind blown dust emissions can be managed and any residues can be cleaned off the jetty deck without staining. No cargo is allowed to be stored on jetty decks without the permission of SFPC.
- The tipping of cargo onto the jetty by trucks must be kept to a minimum.
- All cargo handling must be carried out at all times in a manner that minimises emission of particulates and spillage of cargo.
- The loading / unloading of light cargos subject to wind-blown dust emission must cease in the event of winds causing particulates to disperse past the port boundary. The SFPC Port Services Manager (PSM) or his designated supervisor may suspend operations in the event that dust particles from any port operation are noted to have dispersed beyond the port boundary. In the event that operations are suspended by the PSM a review of the operation and the prevailing weather conditions will determine to what extent and when operations may recommence. The SFPC Port Services Department will log any such interruption to operations against the ships file on the Cargo Pro database including any revised operating parameters as determined on the day.
- Loading or unloading operations may also be suspended if wind-blown dust emissions are found to be negatively impacting on neighbouring port tenants, operations or third party lands. All such interruptions will be recorded by the Port Services Department on the Cargo Pro data base against the ships file.

Facility Cleaning

- All spillage arising from dry bulk cargo handling at the facility must be cleaned up and where necessary disposed of in line with the SFPC Waste Management Plan, EHS024.
- All spilt cargo must be continually swept up to minimise cargo build up on the jetty and to ensure no offsite emission of particulates occurs during the loading or unloading of dry bulk cargo as well as at the end of the cargo transfer.
- Clean up following completion of cargo handling must be undertaken as soon as practical and after discussion and agreement with the SFPC Duty Supervisor. The extent of the cleaning operation must be to the satisfaction of the SFPC Duty supervisor. Failure to properly clean a jetty after cargo operations may lead to delays for the following cargo operation.
- Clean up includes manual sweeping and collection of cargo residues around jetty capping, bollards and other jetty features. All cargo residues must be disposed of in line with the SFPC waste management plan.
- SFPC staff will water wash jetties if required.
- At no time shall cargo residues be swept or disposed of into Port waters or the port estate storm water system.
- It is the responsibility of the receiver and or his agent/stevedore to remove excessive cargo residue from hoppers at the end of cargo operations in preparation for SFPC staff to wash the hoppers.

Vessel Cleaning

- All spillage on vessels arising from dry bulk cargo handling must be cleaned up and disposed of in an appropriate manner before the vessel departs.
- All spilt cargo on a vessel must be continually swept up to minimise cargo build up on the vessel deck and to ensure that no offsite emission of particulates occurs during the loading or unloading of dry bulk cargo as well as at the end of the cargo transfer.
- At no time shall cargo residue be swept or disposed of into Port waters.
- Water must not be used to wash down a vessel's deck or equipment whilst the vessel is within Port waters.
- Ballast water intake must not overflow onto the vessel deck resulting in cargo residues being washed into Port waters.

Cleaning of Local Roads

- Excessive spillage on local roads arising from cargo operations and or the carriage of dry bulk cargo from SFPC facilities is required to be cleaned up on a regular basis by vacuum road sweeper or by mechanical sweeper.

Further to the existing measures as listed above, it is recommended that the Handling of Dry Bulk Cargoes SOP is updated to include the following:

- Develop and implement a stakeholder communications plan that includes community engagement with specific reference to dust generation, monitoring, complaints and incident investigation.

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk operators in the area to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.
- Undertake regular on-site and off-site inspections to monitor dust, record inspection results.
- Carry out regular site inspections to monitor compliance with the SOP, record inspection results.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out (e.g. loading or unloading of dusty cargoes such as coal, grains, etc.) and during prolonged dry or windy conditions.

As a consequence of the operational phase dust risk the following specific dust mitigation measures are proposed for any open storage at the lands in Durnish:

- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind.
- Water misting or sprays may be used if particularly dusty activities are necessary and/or during prolonged dry or windy periods.
- Plan storage layouts so that machinery and dust causing activities are located as far away from receptors as possible. Use intelligent screening where possible – e.g. locating site offices, warehouses, etc. between potentially dusty activities and the receptors.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

For the ship loading and unloading operations at the East Jetty and existing jetties the following operation specific mitigation is proposed:

- A SFPC representative shall be assigned the responsibility of managing and reporting the dust risk and impact of high dust risk cargoes (as a minimum grains, biomass and coal) and shall be present during all loading and unloading operations.
- Dust suppression hopper(s) shall be utilised for dusty cargos where appropriate.
- Efficient dust management practices shall be conducted at all times and shall be documented in the SOP, such as :
    - Lowering of grab into the hopper cone and not releasing cargo from a height;
    - Keeping cargo levels below the tide board of trucks to minimise dust blow off from the top of trucks;
    - All trucks leaving the port must have suitable dust covers fitted; and
    - Trucks to be tipped inside of storage sheds and loaded inside of storage sheds at all times where possible.
- Portable water misting systems may be used to mitigate dust from potentially dusty cargoes during loading operations and/or during prolonged dry or windy periods where appropriate.

The intensification or relaxation of these measures will be dictated by the levels of dusts detected in the ongoing monitoring regime proposed.

Road Traffic

There is no project specific mitigation proposed for road traffic emissions as these are mitigated at EU level. The collection of EU Directives, known as the Auto Oil Programme, have outlined improved emission criteria which manufacturers are required to achieve from vehicles (including heavy goods vehicles) produced in the past and in future years. This is a trend which has been in operation for many years and is destined to continue in future years for both cars and heavy duty vehicles. As such, mitigation measures for traffic emissions are set at EU and national level and there is limited scope for reducing traffic emissions at the project level.

10.7 RESIDUAL IMPACTS

10.7.1 Construction Phase

Dust Emissions

Once dusts are effectively managed, the potential impact of construction dust on affected properties is a temporary “slight adverse” impact for 28 properties (residential and commercial) in the Foynes area.

Construction Traffic

Based on the predicted additional volumes of traffic on the local road network, the resultant air quality impact of construction traffic emissions is predicted to be “negligible” for local populations adjacent to the road network.

Greenhouse Gas Emissions

The construction traffic for the proposed development is predicted to generate 27,969 tonnes of CO_{2eq} and 98 tonnes of NO_x and this will be a permanent “slight adverse” impact.

10.7.2 Operational Phase

Dust Emissions

Given the history of dust deposition levels in the port area and the sensitivity of the area to continued and additional dust impacts, there is a long-tem "slight adverse" direct impact to air quality predicted for all properties within 350 metres of the existing and proposed port boundaries.

Furthermore, the cumulative baseline (for the existing baseline in addition to other consented development) will establish levels of dust that are circa 75% of the guideline value in the wider Foynes area in advance of the proposed development. Overall, the cumulative dust impact within the Foynes area is predicted to be a long-tem "slight adverse" direct impact to air quality in the absence of further mitigation.

Road Traffic

The results of the modelling of the additional operation phase traffic on the main routes in the network show that properties will experience an increase pollutant levels in future scenario years. The air quality impact of this operation phase traffic emissions is classed as "negligible" for local populations.

Similarly, while there is a predicted slight increase in the level of nitrogen generated and subsequently deposited on the SAC adjacent to the road, the overall scale of the impact (1.75 kg(N)/ha/year) is well below the various UNECE critical loads and the additional traffic will have a negligible impact on the sensitive ecosystems in the area.

Greenhouse Gas Emissions

The total GHG emissions as CO_2 from traffic associated with the proposed development will increase by approximately 10-20% over the years 2023 to 2041 which equates to up to 1,474 tonnes of carbon dioxide per annum compared to the do-minimum scenario in 2041. Similarly, the annual emissions of oxides of nitrogen (as NO_x) from the proposed development will increase by approximately 16-44% which equates to up to 5.21 tonnes of NO_x per annum compared to the do-minimum scenario in 2041. These increases are considered to be a permanent "slight adverse" impact.

10.8 MONITORING

10.8.1 Construction Phase

The Contractor will be required to prepare a Dust Minimisation Plan and part of the project Construction Environmental Management Plan. The Dust Minimisation Plan will include details of a monitoring regime using standard Bergerhoff gauges (to VDI standard) at a series of locations that are identified based on potential risk of dust nuisance (including the quarry) and agreed with the local authority. The Contractor will be required to maintain monthly dust levels below the guideline of 350mg/m^2/day as an annual average at sensitive receptors. Where dust levels are found to be above this threshold, the mitigation measures in the area must be reviewed as part of the Dust Minimisation Plan.

10.8.2 Operation Phase

Shannon Foynes Port Company should continue the implementation of the existing dust monitoring regime in the area. Consideration should be given to the installation of a new monitoring location to the east of the lands in Durnish to monitor impact in this area on sensitive properties (in particular those at Dernish Avenue). This monitoring should be used to inform the ongoing dust management and mitigation procedures and these procedures should be revised where levels above the guideline are recorded.

11 NOISE AND VIBRATION

11.1 TERRESTRIAL NOISE & VIBRATION

11.1.1 Introduction

This section includes an assessment of the likely noise and vibration impacts associated with the proposed Capacity Extension at Shannon Foynes. Section 11.1 deals specifically with the land-based noise and vibration impacts and Section 11.2 deals with the underwater noise impacts.

During the construction phase, there is potential for noise impacts at the nearest noise sensitive properties from the use of noisy plant and equipment, from construction traffic and vibration impacts from the use a certain construction phase activities (e.g. piling).

The assessment of operational phase noise includes an assessment of the noise impact from new plant/equipment at the port as a result of the proposed development and the assessment of road traffic changes in the vicinity of the port as a result of the proposed development.

The proposed development will result in the development of two areas of the port, extension of the east jetty and the development of the Durnish lands in the western portion of the port lands. A full description of the proposed development is included in Chapter 2 of this EIAR.

This chapter should be read in conjunction with Figure 11.1, which illustrates the noise monitoring locations and the noise prediction locations.

Figure 11.1: Noise Monitoring and Noise Prediction Locations

11.1.2 Assessment Methodology

11.1.2.1 Relevant Noise Guidance Document

Environmental Protection Agency (EPA) Office of Environmental Enforcement (OEE) - Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (2016)

NG4 is the most recent Irish guidance document in relation to noise survey and assessment and as such is the most relevant Irish guidance document for the purposes of this assessment. The document relates primarily to noise surveys and assessments for EPA licensed facilities but in the absence of any other directly applicable guidance documents, it provides useful reference material for the purposes of completing the noise assessment for the proposed development.

NG4 provides detailed consideration of a range of noise related issues including basic background to noise issues, various noise assessment criteria and procedures, noise reduction measures, Best Available Techniques (BAT) and the detailed requirements for noise surveys.

This guidance sets out typical limit values for noise from licensed sites, namely:

- Daytime (07:00 – 19:00) – 55dB $L_{Ar,T}$;
- Evening (19:00 – 23:00) – 50dB $L_{Ar,T}$;
- Night-time (23:00 – 07:00) – 45dB $L_{Aeq,T}$

Where a proposed development occurs in a low background noise area, the above limits can be reduced by 10dB(A). Low background noise levels are defined in the document as < 40dB(A) during daytime, <35dB(A) during evening and <30dB(A) during night-time.

This guidance document has been used in this chapter for the assessment for operational phase noise from the proposed development.

NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)

This guidance document is primarily concerned with setting out the design criteria with regard to noise from new road schemes in Ireland, however it also provides useful reference material in terms of supplying suitable noise and vibration threshold limits for construction phase activities in Ireland.

The NRA Guidelines indicate noise levels typically deemed to be acceptable for the construction phase of road schemes (See Table 11.1). These values are indicative only and more stringent limits may be applied where pre-existing noise levels are low.

Table 11.1 Maximum Permissible Noise Levels at the Façade of Dwellings during Construction

Days & Times	$L_{Aeq\ (1\ hr)}$ dB	$L_{pA(max)slow}$ dB
Monday to Friday 07:00 – 19:00hrs	70	80
Monday to Friday 19:00 – 22:00hrs	60*	65*
Saturday 08:00 – 16:30hrs	65	75
Sunday Bank Holidays 08:00 – 16:30hrs	60*	65*

* Construction activity at these times. Other than that required in respect of emergency works, will normally require explicit permission of the relevant local authority.

This guidance document has been used in this chapter for the assessment for construction phase noise from the proposed development.

NRA Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (2014)

The purpose of this good practice guidance is to expand and supplement the advice already provided in the NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004).

The good practice guidance is based on two studies completed by Atkins and Trinity College Dublin, which aimed to evaluate the effectiveness of the NRA Guidelines (2004). The studies included consideration of the Constraints Studies, Route Selection Studies, present practice in other countries both in Europe and beyond, recently published revisions to the UK DMRB and noise research on the design and effectiveness of noise barriers.

The good practice guidance has been used in tandem with the NRA Guidelines (2004) to inform portions of the assessment of the proposed development that are covered within these guidance documents.

This guidance document has been used in this chapter for the assessment for operational phase noise from the proposed development.

British Standard BS5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites

This British standard consists of two parts and covers the need for protection against noise and vibration of persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels;
- Methods for summing up contributions from intermittently operating plant;
- A procedure for calculating noise propagation;
- A method for calculating noise screening effects; and
- A way of predicting noise from mobile plant, such as haul roads.

The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration.

The ABC method outlined in Section E3.2 has been used for the purposes of determining whether the predicted noise levels from the construction activities will result in any significant noise impact at the nearest noise sensitive properties.

Table 11.2 below outlines the applicable noise threshold limits that apply at the nearest noise sensitive receptors. The determination of what category to apply is dependent on the existing baseline ambient (LAeq) noise level (rounded to the nearest 5dB) at the nearest noise sensitive property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75dB) applies. The applicable limits that apply at each of the sensitive receptors included in the construction phase noise model are presented and discussed in Section 11.1.4 of this section.

Table 11.2 Noise Threshold Limits at Nearest Sensitive Receptors

	Threshold Limits [dB(A)]		
	Category A	**Category B**	**Category C**
Night-time (23:00 - 07:00)	45	50	55
Evening and Weekends (19:00 - 23:00 Weekdays, 13:00-23:00 Saturdays, 07:00-23:00 Sundays)	55	60	65
Weekday daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75

This guidance document has been used in this chapter for the assessment for operational phase noise from the proposed development.

British Standard 8233:2014 Sound Insulation and Noise Reduction for Buildings - Code of Practice

BS8233:2014 provides guidance values for a range of ambient noise levels within residential and commercial/industrial properties as shown in Table 11.3 below.

Table 11.3 Internal Ambient Noise Levels for Living Spaces

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq, 8hr}$

The standard allows for a further relaxation in standards of up to 5dB where "development is considered necessary or desirable". In relation to external amenity areas such as gardens and patios, the standard states that it is desirable that external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$.

This guidance document has been included in this chapter as reference for the standard internal ambient noise levels to be achieved inside residential properties.

World Health Organisation (WHO) - Guidelines for Community Noise

In 1999, the World Health Organisation (WHO) proposed guidelines for community noise. In this guidance, a L_{Aeq} threshold daytime noise limit of 55 dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. A second daytime limit of 50 dB is also given as a threshold limit for moderate annoyance.

The guidelines suggest that an internal L_{Aeq} not greater than 30 dB for continuous noise is needed to prevent negative effects on sleep. This is equivalent to a façade level of 45 dB L_{Aeq}, assuming open windows or a free-field level of about 42 dB L_{Aeq}. If the noise is not continuous, then the internal level required to prevent negative effects on sleep is a $L_{Amax,fast}$ of 45 dB. Therefore, for sleep disturbance, the continuous level as well as the number of noisy events should be considered.

The Night Noise Guidelines for Europe was published in 2009 on the back of extensive research completed by a WHO working group. Considering the scientific evidence on the threshold of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect public, including the most vulnerable groups such as children, the chronically ill and the elderly. An interim target of 55dB is recommended where the NNG cannot be achieved. These guidelines are applicable to Member States of the European Region and may be considered as an extension to the previous WHO Guidelines for Community Noise (1999).

In 2012, the WHO published the Methodological Guidance for Estimating the Burden of Disease from Environmental Noise. This document outlines the principles of quantitative assessment of the burden of disease from environmental noise, describes the status in terms of the implementation of the European Noise Directive and reviews evidence on exposure-response relationships between noise and cardiovascular diseases.

This guidance document has been included in this chapter as reference for the standard internal/external ambient noise levels to be achieved for residential properties.

UK Department of Transport (Welsh Office) - Calculation of Road Traffic Noise [CRTN]

This Calculation of Road Traffic Noise (CRTN) guidance document outlines the procedures to be applied for calculating noise from road traffic. These procedures are necessary to enable entitlement under the Noise Insulation Regulations (NI) 1995 to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning.

The document consists of three different sections, covering a general method for predicting noise levels at a distance from a highway, additional procedures for more specific situations and a measurement method for situations where the prediction method is not suitable. The prediction method constitutes the preferred calculation technique but in a small number of cases, traffic conditions may fall outside the scope of the prediction method and it will then be necessary to resort to measurement. The prediction method has been used in this instance to determine the likely noise impact from traffic flow increases as a result of the proposed development.

This guidance document has been included in this chapter as it provides the prediction methods for determining road traffic noise associated with road traffic.

11.1.2.2 Relevant Vibration Guidance

There is no published Irish guidance relating to vibration during construction activities. When assessing vibration on roads proposed in Ireland, it has been common practice to use guidance from internationally recognised standards.

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 11.4 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 11.4, and major damage to a building structure can occur at values greater than four times the tabulated values (definitions of the damage categories are presented in BS7385-1:1990, 9.9).

Table 11.4 Transient Vibration Guide Values for Cosmetic Damage (Ref BS5228-2:2009+A1:2014)

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

British Standard BS 7385 (1993) *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration* indicates that cosmetic damage should not occur to property if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz. These guidelines refer to relatively modern buildings and therefore, these values should be reduced to 50% or less for more sensitive buildings.

The NRA *Guidelines for the Treatment of Noise & Vibration in National Road Schemes* recommends that vibration is limited to the values set out in Table 11.5 in order to ensure that there is little or no risk of even cosmetic damage to buildings. These values and the values indicated in Table 11.5 should be used as guidance for monitoring vibration levels from the construction phase of the proposed scheme.

Table 11.5 Recommended Vibration Level Thresholds for NRA Schemes

Allowable Vibration Velocity (Peak Particle Velocity) at the Closest Part of Any Sensitive Property to the Source of Vibration, at a Frequency of:		
Less than 10Hz	10 to 50 Hz	50 to 100 Hz (and above)
8mm/s	12.5mm/s	20mm/s

This guidance provides the relevant vibration threshold limits that must be adhered to during the construction phase.

11.1.2.3 Assessment Methodology for Determining Noise Impacts

General Significance Criteria

Table 11.6 contains the general significance criteria that have been used for determining the level of impact associated with a particular aspect of the proposed redevelopment. Different aspects of noise from the proposed redevelopment (e.g. construction, plant/equipment, traffic etc.) are assessed using the different methodologies as described in the relevant guidance document. Where feasible, the significance criteria have been used in the various assessments included in this chapter having regard to the sensitivity of receptors.

Table 11.6: Criteria to Define the Sensitivity of Receptors

Sensitivity	Description	Examples of receptor
High	Receptors where occupants or activities are particularly susceptible to noise	Residential Quiet areas for outdoor recreation Religious institutions (e.g. churches and cemeteries) Schools during the daytime
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Restaurants Sports grounds where noise is not a normal part of the event (e.g. golf courses and tennis courts)
Low	Receptors where distraction or disturbance from noise will have minimal effect	Commercial buildings not occupied during operational hours Factories and working environments with existing high noise levels Sports grounds and facilities where noise levels are a normal part of activity

The majority of receptors expected to be affected by noise and vibration impacts arising due to the proposed development are the residents of dwellings in the vicinity of the existing port. Residents are deemed to be highly sensitive. The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact it is exposed to. This is set out in Table 11.7.

Table 11.7: Matrix for Determining Significance of Effect for Receptors of High Sensitivity

Magnitude of Impact (beneficial or adverse)	Significance of effect for receptors of high sensitivity
Major	Large or very large
Moderate	Moderate or large
Minor	Slight
Negligible	Slight
No impact	Neutral

Effects are considered to be significant when identified as likely to have a Moderate, Large or Very Large effect.

Construction Noise

The NRA Guidelines for the Treatment of Noise & Vibration on National Road Schemes (2004) British Standard BS 5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites are the standard noise guidance documents for assessing construction phase noise impacts. Section 11.1.2.2 contains a brief description of these guidance documents.

On account of the temporary nature of construction activities, higher noise threshold limits apply to construction phase activities as compared to permanent operational phase activities. The appropriate noise threshold limits for construction phase activities are outlined in Tables 11.1 and 11.2. These guidance documents do not apply significance criteria for noise impacts other than outlining permissible threshold limits for noise as outlined in these tables.

Traffic Noise

As outlined in Section 11.1.2.2, the CRTN is the standard noise guidance document for predicting traffic noise levels from traffic flow information and other relevant road topographical information. While the CRTN provides a methodology for predicting traffic noise levels, it does not provide significance criteria for assessing changes in traffic noise levels.

The Design Manual for Roads and Bridges (DMRB) is a guidance document which was created for the purpose of assessing noise and vibration impacts from road projects. While the proposed redevelopment is not a road project, the classification of magnitude of noise impact tables included in Section 3, Part 7 of DMRB Volume 11 are applicable to the assessment of road traffic changes associated with the proposed redevelopment.

Tables 11.8 and 11.9 present the magnitude of noise impacts for both short-term changes in traffic noise levels and long-term changes in traffic noise levels. The short-term criteria is used for the purposes of assessing the construction phase noise levels and the commencement of operational phase in the year of opening, while the long term criteria has been used for the purposes of assessing long term operational phase traffic noise levels 10 years after the year of opening. An additional column has been included in Tables 11.8 and 11.9 to link the magnitude level defined in the DMRB with the significance criteria outlined in Table 11.7.

Table 11.8: Classification of Magnitude of Noise Impacts in the Short Term

Noise Change $L_{A10,18hr}$	Magnitude of Impact	Equivalent Significance Criteria (See Table 11.7)
0	No Change	Neutral
0.1 - 0.9	Negligible	Neutral
1.0 - 2.9	Minor	Minor Adverse/Beneficial Effect
3.0 - 4.9	Moderate	Moderate Adverse/Beneficial Effect
5.0 +	Major	Major Adverse/Beneficial Effect

Table 11.9: Classification of Magnitude of Noise Impacts in the Long Term

Noise Change $L_{A10,18hr}$	Magnitude of Impact	Equivalent Significance Criteria (See Table 11.7)
0	No Change	Neutral
0.1 - 2.9	Negligible	Neutral
3.0 - 4.9	Minor	Minor Adverse/Beneficial Effect
5.0 - 9.9	Moderate	Moderate Adverse/Beneficial Effect
10.0 +	Major	Major Adverse/Beneficial Effect

Vibration

In terms of significance criteria, BS 5228:2009+A1:2014 provides guidance on the effects of vibration levels on residential receptors. Table B1 of Annex B provides an outline of vibration levels and associated effects; this is reproduced in Table 11.10 below. An additional column has been added to the Table to link these vibration levels to the equivalent significance criteria as outlined in Table 11.7

Table 11.10: Guidance on Effects of Vibration Levels on Sensitive Receptors

Vibration Level	Effect	Significance Criteria (See Table 11.7)
0.14 - 0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Neutral
0.3 - 1.0 mm/s	Vibration might be just perceptible in residential environments	Minor Adverse Effect
1.0 - 10.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Moderate Adverse Effect
>10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	Major Adverse Effect

11.1.2.4 Methodology for Noise Monitoring

Four monitoring locations were used for the baseline noise survey, one unattended and three attended. All noise monitoring locations are illustrated in Figure 11.1. For the unattended noise monitoring location, monitoring was undertaken continuously in 15-minute logging periods over a period of approximately 2 days. For attended monitoring locations 1 and 2, noise monitoring was conducted over a period of one hour during the day in 15-minute logging periods. For attended monitoring location 3, monitoring was undertaking over a period of 2 hours during the day and 2 hours at night in 15-minute logging periods. The unattended location is representative of the nearest noise sensitive receptors to the proposed works at the Durnish Lands, hence the reason for the significantly longer monitoring period at this location.

Short-term noise monitoring was carried out on-site using a Bruël & Kjær 2250 Hand Held Analyzer and a Bruël & Kjær Type 4231 Sound Level Calibrator. The unattended noise measurements were completed using A Rion NL-32 Class 1 Sound Level Meter with associated outdoor kit (outdoor casing, Rion WS-03SO1 Windscreen head assembly, Rion EC-04 2m Extension Cable & Rion NC-74 Class 1 Acoustic Calibrator). This instrumentation conforms to the requirements for integrating averaging sound level meters (Type 1) as specified in BS EN 60804. The sound level meter was accurately calibrated before use.

Measurements were made at a height of 1.2 – 1.5m above ground level. The weather conditions were in accordance with the requirements of *BS7445: Description and Measurement of Environmental Noise* and *ISO 1996: Acoustics - Description, Measurement and Assessment of Environmental Noise*.

The following parameters were recorded during each monitoring period:

$\mathbf{L_{Aeq}}$ The continuous equivalent A-weighted sound pressure level. This is an “average” of the sound pressure level.

$\mathbf{L_{Amax}}$ This is the maximum A-weighed sound level measured during the sample period.

$\mathbf{L_{Amin}}$ This is the minimum A-weighted sound level measured during the sample period.

$\mathbf{L_{A10}}$ This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.

$\mathbf{L_{A90}}$ This is the A-weighted sound level that is exceeded for 90% of the sample period.

11.1.3 Existing Environment

Noise Survey at Nearest Sensitive Receptors

Baseline noise monitoring was undertaken at four locations to determine the existing noise environment in the vicinity of the proposed development. The noise monitoring locations are illustrated in Figure 11.1. Subjective observations were recorded during each survey.

The existing noise environment in the vicinity of the port is dominated by road traffic noise, which contributions from various other industrial and human noise sources including the existing port activities. Communications with the port has confirmed that there is no history of significant noise complaint associated with port activities.

Tables 11.11 and 11.12 present the noise monitoring data for the unattended survey location, which is representative to the nearest noise sensitive properties to the Durnish lands. These are presented in one-hour reference period for the daytime data and 15-minute reference periods for the night-time data.

Table 11.11: Daytime Noise Monitoring Data at Unattended Location

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
05/04/17 – 17:47 – 18:47	44	56	33	47	39
05/04/17 – 18:47 – 19:47	44	61	32	47	37
05/04/17 – 19:47 – 20:47	44	61	30	48	34
05/04/17 – 20:47 – 21:47	37	54	24	39	30
05/04/17 – 21:47 – 22:47	33	46	21	36	26
06/04/17 – 07:47 – 08:47	55	66	37	57	44
06/04/17 – 08:47 – 09:47	52	67	38	55	44
06/04/17 – 09:47 – 10:47	50	69	32	51	39
06/04/17 – 10:47 – 11:47	51	67	35	55	44
06/04/17 – 11:47 – 12:47	54	73	37	56	47
06/04/17 – 13:18 – 14:18	48	63	33	49	40
06/04/17 – 14:18 – 15:18	52	62	37	55	44

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
06/04/17 – 15:18 – 16:18	54	61	37	57	45
06/04/17 – 16:18 – 17:18	46	58	31	49	37
06/04/17 – 17:18 – 18:18	45	59	30	48	37
06/04/17 – 18:18 – 19:18	45	59	28	48	35
06/04/17 – 19:18 – 20:18	46	63	32	50	38
06/04/17 – 20:18 – 21:18	43	60	28	44	33
06/04/17 – 21:18 – 22:18	34	47	27	36	30
07/04/17 – 07:18 – 08:18	50	65	37	53	44
07/04/17 – 08:18 – 09:18	48	66	36	51	41
07/04/17 – 09:18 – 10:18	47	68	39	49	43
07/04/17 – 10:18 – 11:18	48	65	37	51	43
Combined	**49**	**73**	**21**	**49**	**39**

Table 11.12: Night-time Noise Monitoring Data at Unattended Location

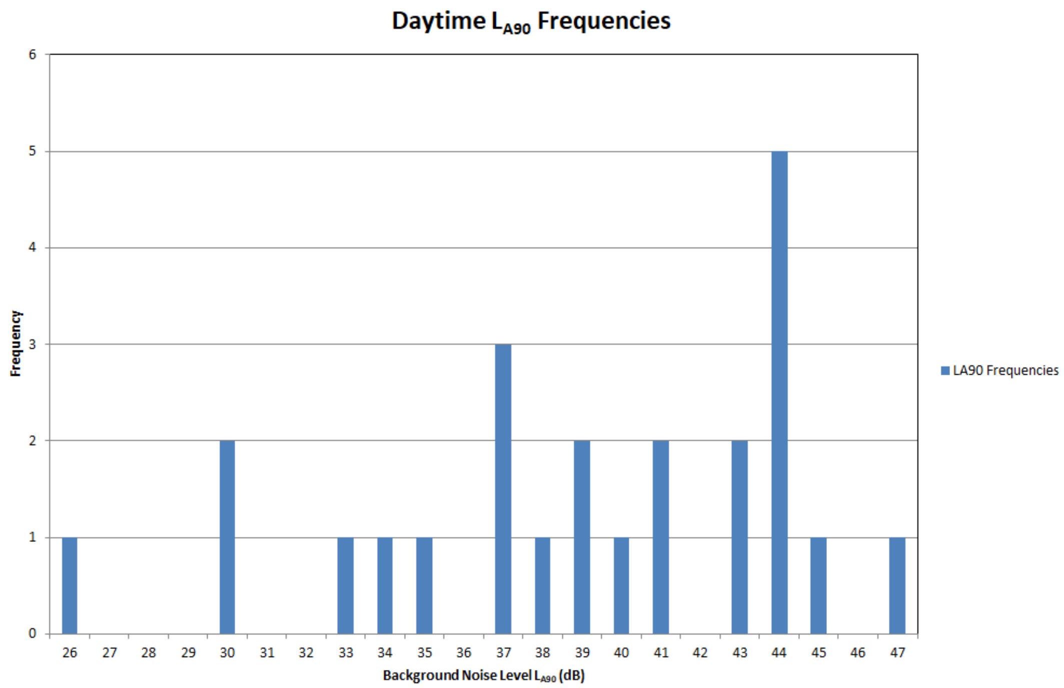
Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
05/04/17 – 23:02 – 23:17	28	37	21	32	22
05/04/17 – 23:17 – 23:32	28	38	20	32	21
05/04/17 – 23:32 – 23:47	32	45	21	37	21
05/04/17 – 23:47 – 00:02	31	43	20	35	22
06/04/17 – 00:02 – 00:17	32	42	20	36	21
06/04/17 – 00:17 – 00:32	30	41	20	34	22
06/04/17 – 00:32 – 00:47	28	38	20	32	21
06/04/17 – 00:47 – 01:02	27	40	20	29	21

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
06/04/17 – 01:02 – 01:17	31	42	22	36	23
06/04/17 – 01:17 – 11:32	26	32	22	27	24
06/04/17 – 01:32 – 01:47	29	40	23	32	24
06/04/17 – 01:47 – 02:02	32	41	20	37	21
06/04/17 – 02:02 – 02:17	33	51	20	35	22
06/04/17 – 02:17 – 02:32	26	39	19	29	20
06/04/17 – 02:32 – 02:47	25	40	19	29	20
06/04/17 – 02:47 – 03:02	27	40	19	32	20
06/04/17 – 03:02 – 03:17	26	41	19	29	20
06/04/17 – 03:17 – 03:32	28	43	19	30	20
06/04/17 – 03:32 – 03:47	29	43	19	34	20
06/04/17 – 03:47 – 04:02	32	44	19	38	20
06/04/17 – 04:02 – 04:17	26	35	19	29	21
06/04/17 – 04:17 – 04:32	31	44	19	36	20
06/04/17 – 04:32 – 04:47	28	39	19	33	20
06/04/17 – 04:47 – 05:02	29	44	19	34	20
06/04/17 – 05:02 – 05:17	30	42	20	35	22
06/04/17 – 05:17 – 05:32	31	43	20	36	21
06/04/17 – 05:32 – 05:47	34	44	21	38	25
06/04/17 – 05:47 – 06:02	37	47	23	41	29
06/04/17 – 06:02 – 06:17	47	59	33	51	38
06/04/17 – 06:17 – 06:32	54	61	42	57	49
06/04/17 – 06:32 – 06:47	53	67	38	57	45
06/04/17 – 23:03 – 23:18	35	47	27	37	29

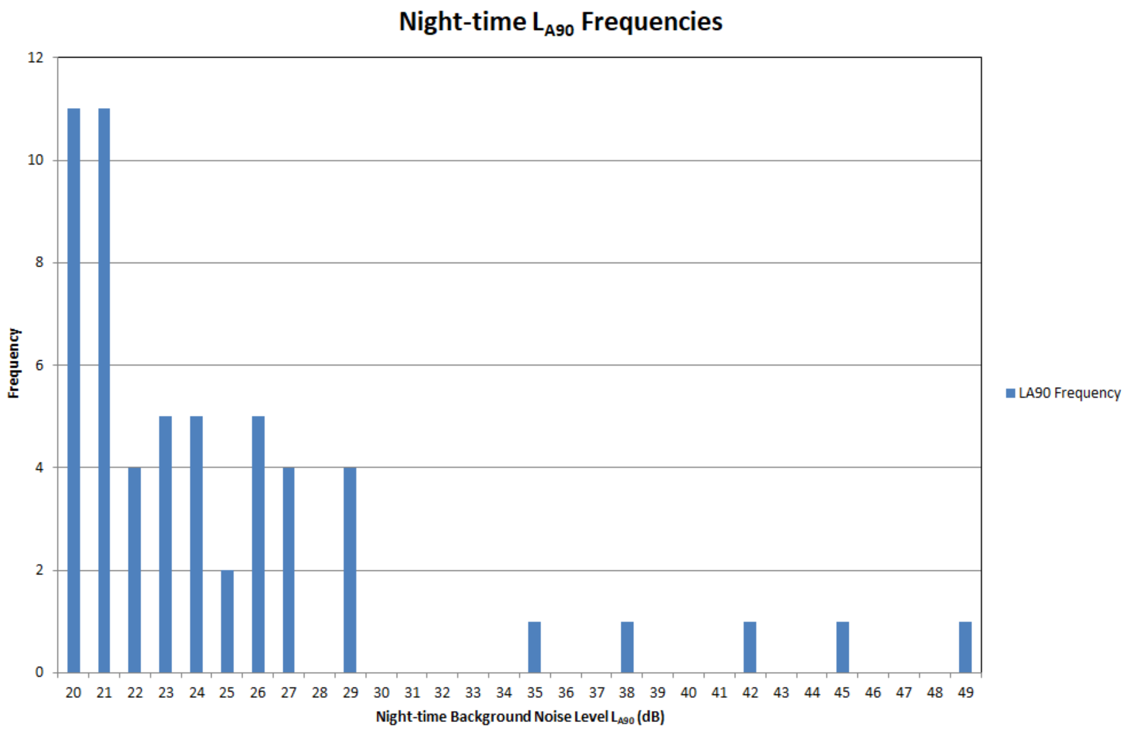
Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
06/04/17 – 23:18 – 23:33	33	45	26	35	27
06/04/17 – 23:33 – 23:48	32	46	26	34	27
06/04/17 – 23:48 – 00:03	30	38	25	33	26
07/04/17 – 00:03 – 00:18	29	35	24	32	26
07/04/17 – 00:18 – 00:33	35	47	25	3	26
07/04/17 – 00:33 – 00:48	35	48	27	39	29
07/04/17 – 00:48 – 01:03	36	48	27	40	29
07/04/17 – 01:03 – 01:18	33	45	26	36	27
07/04/17 – 01:18 – 01:33	32	45	25	35	26
07/04/17 – 01:33 – 01:48	30	43	25	33	26
07/04/17 – 01:48 – 02:03	31	45	25	33	27
07/04/17 – 02:03 – 02:18	32	50	22	34	23
07/04/17 – 02:18 – 02:33	30	44	23	34	24
07/04/17 – 02:33 – 02:48	33	49	22	38	24
07/04/17 – 02:48 – 03:03	32	45	22	35	23
07/04/17 – 03:03 – 03:18	29	44	21	30	23
07/04/17 – 03:18 – 03:33	32	43	20	36	21
07/04/17 – 03:33 – 03:48	23	31	21	25	21
07/04/17 – 03:48 – 04:03	30	40	22	34	23
07/04/17 – 04:03 – 04:18	34	49	20	38	21
07/04/17 – 04:18 – 04:33	36	48	20	38	25
07/04/17 – 04:33 – 04:48	33	48	21	37	24
07/04/17 – 04:48 – 05:03	29	44	20	33	21
07/04/17 – 05:03 – 05:18	29	38	20	33	21

Monitoring Time Period	**Measured L_{Aeq} dB(A)**	**Measured L_{Amax} dB(A)**	**Measured L_{Amin} dB(A)**	**Measured L_{A10} dB(A)**	**Measured L_{A90} dB(A)**
07/04/17 – 05:18 – 05:33	43	57	19	45	20
07/04/17 – 05:33 – 05:48	40	53	24	43	29
07/04/17 – 05:48 – 06:03	48	65	30	46	35
07/04/17 – 06:03 – 06:18	53	60	37	57	42
07/04/17 – 06:18 – 06:33	55	65	44	58	51
07/04/17 – 06:33 – 06:48	53	63	43	56	46
Combined	**43**	**67**	**19**	**36**	**25**

Graphs 11.1 and 11.2 have been presented below to illustrate the predominant background noise levels (L_{A90}) during the day and night-time periods at the unattended noise monitoring location. As this monitoring location is located some distance from the dominant noise source in the study area (i.e. road traffic noise), lower ambient (L_{Aeq}) and background (L_{A90}) noise levels are observed in comparison to some of the attended monitoring locations.



Graph 11.1: Daytime Background Noise Levels (LA90) at Unattended Noise Monitoring Location



Graph 11.2: Night-time Background Noise Levels (LA90) at Unattended Noise Monitoring Location

Table 11.13 and 11.14 present the noise monitoring data for the three short-term monitoring locations. Monitoring was conducted for one hour during the daytime at locations 1 and 2 and fore 2 hours during both day and night-time periods at location 3.

Table 11.13: Noise Monitoring Results – Short-term Monitoring Locations 1 & 2

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
Location 1 (07/04/17)					
10.20 – 10.35	75	95	35	80	46
10.35 – 10.50	74	91	34	78	42
10.50 – 11.05	76	94	43	79	52
11.05 – 11.20	76	99	36	80	51
Combined	**75**	**99**	**34**	**79**	**48**

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
Location 1 (07/04/17)					
Location 2 (07/04/17)					
12.22 – 12.37	65	79	37	70	43
12.37 – 12.52	65	79	39	69	44
12.52 – 13.07	65	80	37	70	44
13.07 – 13.22	65	82	35	70	45
Combined	**65**	**82**	**35**	**70**	**44**

Table 11.14: Noise Monitoring Results – Short-term Location 3

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
Daytime (06/04/17)					
14.22 – 14.37	59	74	37	63	43
14.37 – 14.52	62	91	39	65	47
14.52 – 15.07	60	75	38	64	46
15.07 – 15.22	60	77	40	63	48
15.22 – 15.37	60	76	37	63	46
15.37 – 15.52	59	76	38	63	45
15.52 – 16.07	58	73	43	62	48
16.07 – 16.22	60	74	39	64	45
Combined	**60**	**91**	**37**	**64**	**46**
Night-time (05/04/17 – 06/04/17)					
23:46 – 00:46	52	68	27	56	29

Monitoring Time Period	Measured L_{Aeq} dB(A)	Measured L_{Amax} dB(A)	Measured L_{Amin} dB(A)	Measured L_{A10} dB(A)	Measured L_{A90} dB(A)
00:49 – 01:49	49	71	27	40	29
Combined	**50**	**71**	**27**	**48**	**29**

11.1.4 Construction Phase Impacts

Construction Noise - General

In order to predict worst-case construction noise impacts, it was necessary to define the various typical plant and equipment to be used as part of the construction phase activities. Table 11.15 includes a list of the most significant plant/equipment likely to be used during the construction phase of the proposed development.

Table 11.15 Typical Plant and Equipment to be used During Construction Phase (Ref: BS5228:2009+A1:2014)

Activity / Plant (Reference from Annex C & D, BS5228:2009+A1:2014)	Power Rating (kW)	Equipment Size, Weight (Mass), Capacity	Sound Power Level (dB)
Demolition: Dumping brick rubble - tracked excavator loading dump truck (C1 - Ref10)	228	44t	113
Demolition: Tracked excavator (C2 - Ref 3)	2102	22t	106
Clearing Site: Dozer (C2 - Ref 1)	142	20t	103
Clearing Site: Tracked excavator (C2 - Ref 3)	102	22t	106
Clearing Site: Wheeled backhoe loader (C2 - Ref 8)	62	8t	96
Ground Excavation: Dozer (C2 - Ref 12)	142	20t	109
Ground Excavation: Tracked excavator (C2 - Ref 14)	226	40t	107
Ground Excavation: Wheeled loader (C2 - Ref 27)	193	-	108
Distribution of Material: Tipper Lorry (C8 - Ref 20)			107
Rolling & Compaction: Roller (C2 - Ref 38)	145	18t	101
Piling: Tubular Steel Piling - hydraulic hammer - (C3 - Ref 3)		240mm diameter	116
Pumping Water: Water pump (C2 - Ref 45)	20	6 in	93
Dredging: Ship Chain Bucket (D12 - Ref 1)		35m long	124

Predicted Impact of Construction Noise from Proposed Development

Where construction activity takes place for a development in the vicinity of residential properties, it is standard practice that the activities would operate between the hours of 08:00 and 18:00 on Monday to Fridays, between 08:00 and 13:00 on Saturdays and there will be no activity on Sundays or Bank Holidays.

The precise construction phasing to be adopted for the proposed development is detailed in the Construction Programme which is included in Chapter 2 Project Description of the EIAR.

Of the different construction phase plant/equipment items listed in Table 11.15, some activities will only take place in very restricted areas, for example piling at the jetty and demolition of one lean-to building in the Durnish lands. Generally, only one particular activity (e.g. demolition, site clearance etc.) will take place in a specific area at any one time. The noise level from particular activities has been presented in Table 11.16 based on the plant/equipment included in Table 11.15.

Table 11.16: Typical Combined Construction Noise Levels

Activity	L_{Aeq} @ 10 m	L_{Aeq} @ 40 m	L_{Aeq} @ 80 m	L_{Aeq} @ 160 m	L_{Aeq} @ 320 m
Demolition	86	74	68	62	56
Clearing Site	80	68	62	56	50
Ground Excavation	85	73	67	61	55
Piling	88	76	70	64	58
Distribution of Materials	80	68	62	56	50
Rolling & Compaction	73	61	55	49	43
Pumping Water	63	51	45	39	33

The combined noise levels in this table have been calculated by combining the various noise levels for the various plant listed in Table 11.15

In order to predict worst-case construction noise levels from the proposed development, calculations of worst-case construction noise were undertaken on the basis of the nearest noisiest activity that will take place to particular properties in the vicinity of the proposed construction works. In relation properties closest to the jetty extension, this is assumed to be piling, while in relation to properties closest to the Durnish lands, this is assumed to be ground excavation.

There will be a small amount of demolition on the Durnish lands, however this will take place some distance further away from the nearest properties and hence will not be the noisiest activity in the vicinity of the nearest properties on the Durnish lands.

Table 11.17 contains worst-case construction noise levels from the proposed development at the nearest noise sensitive properties. The nearest noise sensitive properties are illustrated in Figure 11.1. In each case, it is assumed that the relevant construction activity is taking place at the nearest point of the construction activity to the relevant property.

Table 11.17: Worst-Case Predicted Construction Noise Levels at Nearest Noise Sensitive Properties

Prop Ref	Nearest Property (See Figure 11.1)	Worst-Case L_{Aeq} @ 10m (dBA)	Distance from Construction Boundary (m)	Distance Attenuation (dBA)	Predicted Worst-Case Construction Noise (dBA)
1	2 Marine Cove	88	170	-25	63
2	21 Marine Cove	88	236	-27	61
3	17 Marine Cove	88	246	-28	60
4	13 Marine Cove	88	269	-29	59
5	7 Marine Cove	88	222	-27	61
6	Marine Cove	88	244	-28	60
7	Marine Cove	88	270	-29	59
8	15 Wood Vale	88	228	-27	61
9	Main Street	88	86	-19	69
10	Main Street	88	90	-19	69
11	Main Street	88	96	-20	68
12	Main Street	88	116	-21	67
13	Main Street	88	161	-24	64
14	Main Street	88	230	-27	61
15	23 Wood Vale	88	254	-28	60
16	26 Wood Vale	88	266	-28	60
17	1 Wood Vale	88	329	-30	58
18	Main Street	85	488	-34	51
19	Main Street	85	451	-33	52
20	Dernish Avenue	85	373	-31	54
21	Dernish Avenue	85	333	-30	55
22	Dernish Avenue	85	254	-28	57
23	Dernish Avenue	85	340	-31	54
24	Dernish Avenue	85	302	-30	55
25	3 Cogrigg Close	85	442	-33	52
26	10 Cogrigg Close	85	499	-34	51
27	Cogrigg	85	621	-36	49
28	N69	85	504	-34	51
29	Cogrigg	85	708	-37	48
30	N69	85	621	-36	49
31	Cogrigg	85	1074	-41	44
32	Robertstown	85	953	-40	45

Additional construction phase traffic noise (see Table 11.18) may elevate these worst-case prediction in the range of 0.5 – 2.0 dB depending on when these activities are taking place. The predictions in Table 11.17 do not take account of any barrier effects from the considerable number of buildings located between the proposed construction activities associated with the jetty extension and the nearest properties to those portions of the works (i.e. properties 1-17 in Figure 11.1). The majority of these properties will experience attenuation of 10dB(A) or greater from the buildings shielding these properties from the proposed works.

On the basis of the predictions included in Table 11.17, it is anticipated that worst-case construction noise levels from the proposed development will be below the relevant noise threshold limits for construction noise as stipulated in the NRA Guidelines (2004) (Table 11.1) and BS5228:2009+A1:2014. Mitigation measures to reduce noise levels to the lowest possible levels are included in Section 11.1.6.

Construction Phase (and Operational Phase) Traffic Impacts

On account of the phasing of the proposed development over a period of years, construction phase traffic will occur simultaneously with operational phase traffic associated with earlier phases of the proposed development. In order to assess worst-case traffic noise impacts, Table 11.18 presents combined construction and operational phase traffic noise levels increases at different stages of the construction/operation of the proposed development.

Table 11.18: Traffic Noise Increases from Combined Construction/Operational Phase

Year	Location	Traffic Noise Increase dB(A)	Impact Level (See Table 11.8)
2023	N69 (Railway Station)	+1.9	Minor Adverse
	N69 (Topaz)	+1.1	Minor Adverse
	West Entrance Road to Port	+1.7	Minor Adverse
	N69 (Ardineer)	+1.2	Minor Adverse
	N69 (Junction R521)	+1.6	Minor Adverse
2029	N69 (Railway Station)	+1.7	Minor Adverse
	N69 (Topaz)	+1.1	Minor Adverse
	West Entrance Road to Port	+1.5	Minor Adverse
	N69 (Ardineer)	+1.3	Minor Adverse
	N69 (Junction R521)	+1.3	Minor Adverse
2041	N69 (Railway Station)	+0.8	Negligible
	N69 (Topaz)	+0.8	Negligible
	West Entrance Road to Port	-0.1	No Change
	N69 (Ardineer)	+0.5	Negligible
	N69 (Junction R521)	+0.5	Negligible

Table 11.18 illustrates that predicted worst-case combined construction and operational phase traffic flows associated with the proposed development will be minor adverse at worst during the construction phase of the proposed development. When construction has been completed, operational phase traffic noise increases will be lower than the combined construction and operational phase traffic noise increases presented in Table 11.18.

Construction Phase Vibration Impacts

Some of the construction phase activities associated with the proposed construction phase have the potential to result in vibration impacts at sensitive receptors if sufficiently close to the respective receptor. The only activity associated with the construction phase that has any potential to result in vibration impacts is the proposed piling at the jetty extension.

BS5228:2009:+A1:2014 Code of Practice for Noise and Vibration Control on Construction and open Sites - Part 2: Vibration gives pages of reference data relating to measured vibration levels associated with different types of piling activities in different ground strata. BS5228:2009+A1:2014 references vibration levels measured for various types of bored piling / cast-in-situ piling (using hammer), a technique which is used as reference in this assessment to ensure a worst-case assessment is conducted.

Reference 11 from Table D1 of BS5228:2009+A1:2014 indicates that bored piling on loose rock over weathered rock over rock, gives a measured PPV of 1.2mm/s at 30m. The nearest piling activity on the jetty extension will be over 90m away from the nearest properties along Main Street. On this basis, the worst-case vibration levels from the proposed construction works will be significantly less than 1mm/s, which is substantially below the vibration threshold limits outlined in Tables 11.4 and 11.5.

On the basis of the discussion included above, worst-case vibration impacts will be Negligible to Minor Adverse on the basis of the criteria set out in Table 11.10.

11.1.5 Operational Phase Impacts

Noise Impact from Plant/Equipment as a result of Proposed Development

The assessment of operational phase plant/equipment has two aspects to it, which are described in the bullet points below:

- Changes in the number and location of items of plant/equipment within the Port;
- Plant/Equipment noise associated with the new uses in the Durnish lands.

Chapter 2 Project Description contains a detailed outline of the proposed uses of the new jetty extension and the Durnish lands. It is not proposed that there will be new plant/equipment brought into the jetty extension, existing plant/equipment already operating in the port areas adjacent to the jetty extension will use this extension in additional to the existing areas they are currently operating in. The jetty extension will not bring this plant/equipment closer to the nearest noise sensitive properties, therefore it is not anticipated that there will be any significant noise impact associated with the new jetty extension area.

The Durnish lands will be developed in three phases and will be used for open storage and warehousing. There will be some processing operations such as bulk raw material being graded, mixed or sorted before being bagged or put into containers. While the areas in Phase 1 have been defined, Phases 2 and 3 have not been defined and will be subject to separate consent process when defined.

Phase 1 will include warehousing, areas for the storage of breakbulk and project cargo, storage of loose cargoes such as woodchip biomass fuel and an area for storage of containers which is located in the portion of Phase 1 furthest from the nearest noise sensitive properties.

In relation to plant/equipment, it is difficult to define exactly what type and numbers of plant/equipment will be operating in each of the areas located in Phase 1 and when they will be operating. Port handling equipment such as mobile cranes, mobile hoppers, mobile weighbridges, straddle carriers, loading shovels, reach stackers, mast lift trucks will be used in the different areas as and when required.

It is expected that operational activities will take place during daytime hours predominantly, with only sporadic and occasional activities taking place during evening and night-time hours as dictated by specific needs related to arrivals/departures of cargo.

The nearest portion of the Durnish lands to the nearest noise sensitive receptors is proposed to contain open storage and is greater than 250m from the nearest property (Figure 11.1, property 22). For the purposes of undertaking a worst-case noise prediction, a standard mobile crane [L_W - 109dB] and reach stacker [L_W - 110dB] have been assumed to be located at the nearest part of the boundary of the Phase 1 open storage area to property 22. Based on a combined sound power level of 113dB, this will result in a predicted noise level of 57dB at property 22 when distance attenuation is taken into consideration. For the purposes of this worst-case assumption, no mitigation measures are assumed and the plant/equipment is assumed to be active continuously.

The covered storage area is largely covered by a large warehouse and on the basis of increased distance and the likelihood of activities taking place within the warehouse, it is likely that the noise impact from this portion of Phase 1 will be significantly less than that from the open storage area.

The container storage area is located the furthest from the nearest property, however there is potential for more activity from plant/equipment in this area. For the purposes of undertaking a worst-case noise prediction, a combination of a mobile crane [L_W - 109dB], a reach stacker [L_W - 110dB], a straddle carrier [L_W - 114dB], a Rubber Tyre Gantry (RTG) [L_W - 118dB] has been assumed at the nearest portion of the container storage area to property 22. Based on a combined sound power level of 116dB, this will result in a predicted noise level of 52dB at property 22 when distance attenuation is taken into consideration. For the purposes of this worst-case assumption, no mitigation measures are assumed and the plant/equipment is assumed to be active continuously.

The EPA guidance document NG4 (See Section 11.1.2.1) presents typical applicable noise threshold limits of 55dB $L_{Ar,T}$, 50dB $L_{Ar,T}$ and 45 $L_{Aeq,T}$ for day, evening and night-time periods. It does state however that for areas with lower background noise levels (i.e. L_{A90}), a reduction of 10dB can be used in relation to the threshold limits listed above. Graphs 11.1 and 11.2 show that while the lower background noise level criteria does not apply for daytime monitoring undertaken at the nearest noise sensitive properties (i.e. unattended location, Figure 11.1), it could be applied for evening and night-time periods which are clearly below 30dB and 35dB respectively for night-time and evening periods.

On the basis of the guidance in NG4 and using the background noise levels recorded at the nearest noise sensitive properties, the appropriate noise threshold limits are:

- Day – 55dB $L_{A,rT}$
- Evening – 40dB $L_{A,rT}$
- Night-time – 35dB $L_{Aeq,T}$

Based on the worst-case predictions for the open storage area and the container storage area of 52-57dB without mitigation measures in place, it is clear that some form of mitigation will be required to reduce plant/equipment noise from the Durnish lands at the nearest noise sensitive properties. Worst-case predictions are only marginally greater than the daytime threshold limit, however they are 15-20dB greater than the evening and night-time limits.

Section 11.1.7 contains a range of mitigation measures to reduce place/equipment noise from the Durnish lands to within the required threshold limits for day, evening and night-time periods as outlined in NG4.

11.1.6 Cumulative Noise Impacts

As part of the assessment of noise impacts from the proposed development, a review of current planning application was undertake to determine if there was potential for any significant cumulative noise impacts from these proposals in tandem with the current proposed development.

There are 6 different planning applications for sites within the port area. On the basis of the proposals, their location and distance to the nearest noise sensitive receptors, there will be no significant cumulative noise impact from these proposals in tandem with the current application at the nearest noise sensitive properties.

A planning application for a solar farm in the area of Ballynash is located several kms to the south west of Foynes town and is too far from the nearest sensitive properties to the proposed development to result in any cumulative noise impact at the nearest noise sensitive properties.

There are 4 planning applications that were reviewed on the Aughinish peninsula, several kms to north east of the proposed site. These are too far from the nearest noise sensitive receptors to result in any cumulative noise impact at the nearest noise sensitive receptors.

11.1.7 Mitigation Measures

Construction Phase

Section 11.1.4 contains an assessment of the noise impact associated with the construction phase of the proposed development at the nearest noise sensitive properties. The assessment of the worst-case predicted construction noise levels using the ABC Method (BS5228:2009+a1:2014) and the NRA Guidelines (2004) indicates that worst-case construction noise levels will be within the required threshold limits included in these guidance documents.

British Standard *BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites: Part 1 - Noise* outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures should be applied by the contractor where appropriate during the construction phase of the proposed development. Examples of some of the best practice measures included in BS5228:2009+A1:2014 are listed below:

- ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- careful selection of quiet plant and machinery to undertake the required work where available;
- all major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use;
- any ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use should be shut down in the intervening periods between work;
- ancillary plant such as generators, compressors and pumps should be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines should be placed away from sensitive locations, in order to cause minimum noise disturbance.
- Handling of all materials should take place in a manner which minimises noise emissions;
- Audible warning systems should be switched to the minimum setting required by the Health & Safety Authority;

A complaints procedure should continue to be operated by the Contractor throughout the construction phase and all efforts should be made to address any noise issues at the nearest noise sensitive properties.

Operational Phase

The assessment of operational phase noise from the proposed development (see Section 11.1.5) included the assessment of plant/equipment noise from the Port. On the basis of the worst-case plant/equipment noise predictions, there is potential for plant/equipment noise from Phase 1 of the Durnish lands to exceed the relevant noise threshold limits as stipulated in NG4 (particularly during evening or night-time periods).

It is proposed that a 4m acoustic barrier is located on the southern and western boundaries of the Phase 1 lands at Durnish. The extent of this noise barrier is illustrated in drawing number M0679-RPS-00-PL-DR-C-0160 that accompanies the planning application and the Proposed Boundary Treatments drawing (Reference: 1773.5.01). Such a barrier will achieve a minimum of a 10dB reduction in all plant/equipment noise from Phase 1 lands in the direction of the nearest noise sensitive receptors.

The boundary noise barrier in combination with the barrier effects achieved by the various storage warehouses and stacked containers will ensure that the daytime threshold limit of 55dB $L_{Ar,T}$ is complied with at the nearest noise sensitive properties to these activities.

It is recommended that additional management practices are put in place, which in combination with the various barrier effects, will assist in ensuring that the evening and night-time threshold limits of 40dB $L_{Ar,T}$ and 35dB $L_{Aeq,T}$ are adhered to. These management practices include:

- Limiting outdoor use of plant/equipment in these areas to times that are strictly necessary during evening and night-time periods;
- Limiting use of plant/equipment to areas inside warehouse buildings where practicable during evening and night-time periods;
- Storing materials and cargo stockpiles in the open storage area to along the southern and eastern boundaries so that they can act as additional noise barriers;
- Placing container stacks in the container storage areas in locations where they can act as additional noise barrier to the propagation of noise in the direction of the nearest noise sensitive properties;

Vibration

As outlined in Section 11.1.4, the construction phase of the proposed development is not likely to result in any significant vibration impacts at the nearest sensitive receptors. There will be no operational phase activities likely to give rise to vibration impacts at any of the nearest sensitive receptors.

BS5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and open Sites - Part 2: Vibration includes a range of measures for the reduction of vibration associated with piling activities and for general surface based activities. The contractor will adhere to the mitigation measures included in BS5228:2009 where practicable to reduce vibration levels from general and piling activities to the lowest possible levels.

11.1.8 Residual Impact

During the construction phase, worst-case construction activities may contribute to elevating the noise levels at some of the nearest noise sensitive properties, although worst-case predicted noise levels from construction phase activities are within the required thresholds outlined in the relevant noise guidance documents.

The will be no significant noise impact associated with traffic flow changes as a result of the construction or operational phase of the proposed development. Any minor traffic flow changes associated with the proposed development will not be in the range whereby they would be audible at the nearest noise sensitive properties.

There is potential for plant/equipment noise impacts from the Durnish lands at the nearest noise sensitive properties if no mitigation measures in place. Subject to the mitigation measures stipulated in this chapter being enforced, plant/equipment noise will be within the appropriate noise threshold limits. Noise monitoring as outlined in Section 11.1.9 will be put in place to ensure that there are no exceedances of the NG4 noise threshold limits at the nearest noise sensitive receptors.

There will be no significant vibration impact associated with the proposed development.

11.1.9 Monitoring

A noise monitoring programme will be undertaken by the port during the first months of operation at the Durnish lands to verify that plant/equipment noise from the operations taking place in Phase 1 is compliant with the NG4 noise threshold limits at the nearest noise sensitive properties. Noise monitoring will be conducted on a regular basis thereafter to ensure the changes to the activities within the Durnish lands does not result in exceedance of the NG4 noise threshold limits. A Noise Management Plan will be in place which will outline immediate corrective actions to be undertaken in the case of any exceedance of the relevant noise threshold limits.

11.2 UNDERWATER NOISE

11.2.1 INTRODUCTION

This section of the EIAR presents an assessment of potential underwater noise impacts arising during the construction and operation phases of the proposed capacity extension at Shannon Foynes. The assessment will determine any potential noise impacts on fish and marine mammal species. As outlined in Chapter 2, the marine and consequently the potential underwater noise element, comprise of the jetty extension works and the pontoon relocation. The Durnish lands development will not have any significant underwater noise impact.

In this section the underwater noise impact of the construction and operation of the jetty extension will be assessed in light of relevant guidelines and international best practice. The jetty extension will connect the berthing lines of Berth 5 and Berth 3 to an intersecting point.

The proposed jetty extension works include the following:

- Removal and relocation of the existing small craft landing pontoon to an area identified at the west side of the existing West Jetty.
- An open pile jetty structure with suspended concrete deck constructed between East Pier and West Jetty, tying into the existing structures.
- A transition slab to provide access from the open pile jetty structure to the Berth 5 reclamation.

The relocation of the small craft landing pontoon will require two locating piles. The jetty extension construction will comprise a 25m wide x 118m long open pile structure connecting the existing West Jetty and the existing East Jetty. This structure will be constructed over 69 tubular steel piles (1219mm diameter x 40-45m in length).

A jack-up barge will be used for the jetty construction, which will be in place for a 10 month piling period. Piles will be worked on individually until completion. It is anticipated that the piles will be lowered and sank into place. Then a vibrating hammer will be used to drive the pile as much as possible, with a hydraulic impact hammer used to drive the pile to the required toe level (or until refusal).

This noise impact assessment will consider the construction phase primarily because it will involve the highest underwater noise levels. The assessment will give due consideration to other construction activities and the potential cumulative impact of the port operation and the construction activities.

Foynes Harbour is part of the network which includes Moneypoint (Killimer), Tarbert, Foynes, Aughinish, Shannon Airport and Limerick City. The Shannon Estuary is a busy commercial shipping channel and the Killimer-Tarbert Ferry crosses the estuary nearby.

Figure 11.2.1 Foynes Harbour Area (Image from Google Maps)

Figure 11.2.1 shows the port area, which is located south of Foynes Island in a sheltered channel. The channel is dredged to provide access to the estuary for shipping at the western end. A dredged berth is maintained close to the existing quay walls. A shallower channel is maintained to the East of the island for smaller vessels. There is a tidal range of approximately 5m at spring tides. For clarity Foynes Harbour is used to refer to the port area inside the island at Foynes in order to distinguish it from the wider Shannon Foynes Port area.

The marine species of interest for the purpose of this assessment include fish, as the Lower Shannon SAC has a diverse population of resident and migratory fish species. The SAC also includes bottlenose dolphins and otter as qualifying interests. This assessment will use the appropriate underwater noise metrics for the species listed above.

11.2.2 ASSESSMENT METHODOLOGY

11.2.2.1 Fundamentals of Underwater Noise

A sound may be defined as the periodic disturbance in pressure from some equilibrium value. Sound pressure is measured in Pascals. The unit of pressure is given in Pascals (Pa) or Newton per square metre (N/m^2). In order to avoid dealing with a very large range of numbers, i.e. from 0.00002 Pascals to 20,000 Pascals the logarithmic decibel scale is used. This simplifies the same range of numbers, by setting up a logarithmic scale based on a reference pressure.

For historical and scientific reasons the reference pressure chosen for airborne noise is not the same as that chosen for underwater noise. The reference pressure for underwater noise is 1 µPa so underwater noise levels are referred to as dB re 1 µPa. This means that there is no direct relationship between decibels in air and decibels in water.

decibels in air ≠ decibels in water

Quoted (peak) source levels for underwater noise sources are quoted in dB re µPa at 1 metre. This is a 'notional' figure extrapolated from far field measurements as it is not practicable to measure sound levels at 1m from an active source such as a ship or a pile-driver. Measurements are taken in what is known as the far field and extrapolated back to a notional 1 m from the idealised point source. It is usual to take measurements at several hundred metres or kilometres in deep water and extrapolate the measured levels to what has become known as a 1 m source level. This is illustrated in **Figure 11.2.2.** The actual propagation of sound in the near (Fresnel) field produces an undulating curve, but the extrapolated dashed line indicates a much higher source level.

A table of typical underwater noise levels is set out below in **Table 11.2.1**.

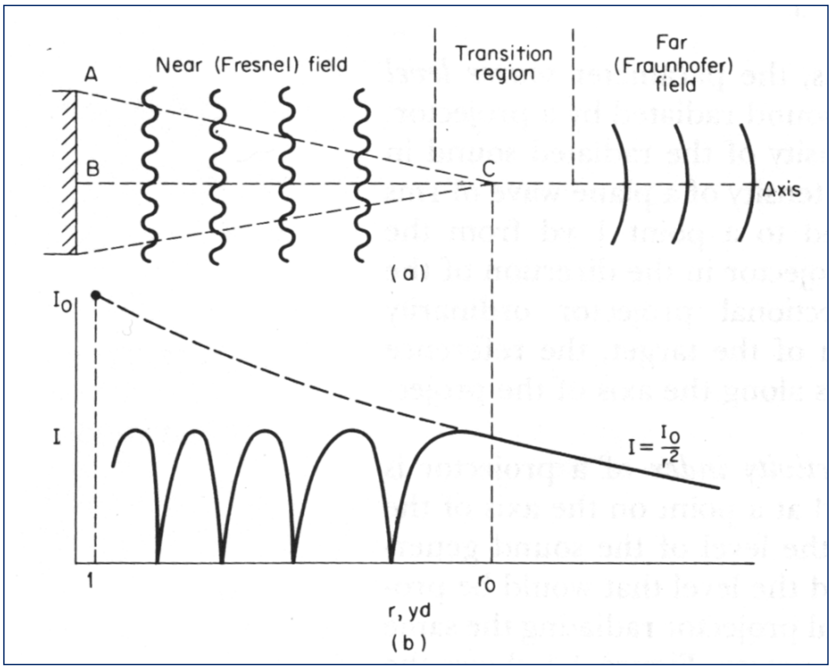


Figure 11.2.2 Underwater Noise source level fields (Urich 1983, Fig. 4)

Table 11.2.1 Typical Underwater Noise Levels

Source	**SPL dB re: 1µPa @ 1m**	**SEL dB re: 1µPa^2-s**	**Sound Duration seconds**	**Peak Frequency Hz**	Band Width Hz
Super Tanker 337m long @ 18 knots	185	-	constant	23	5-100
Dredging (Suction/Hopper dredge)	177	-	constant	80-200	20-8,000
Tug vessel (while towing)	145-170	-	constant	-	37-5,000
Fishing vessel (12m long @ 7 knots)	150	-	constant	300	250-1000

This extrapolation leads to apparently high values for the source level and can lead to erroneous conclusions about the impact on marine mammals and fish for the following reasons:

- Far field source levels do not apply in the near field of the array where the sources do not add coherently; sound levels in the near field are, in fact, lower than would be expected from far field estimates.
- Source level calculations are generally based on theoretical point sources with sound propagating equally in all directions. This is not easily replicated in real world conditions.
- The majority of published data for underwater sources is based on deep water measurements. Sound propagation in shallow water is significantly more complex and sound does not propagate as efficiently as it would in deep water.

11.2.2.2 Underwater Noise Assessment

This underwater noise assessment comprises of; a description of the receiving environment, a description of the significance of the potential impacts, recommendations for remedial measures, an statement of residual impacts and monitoring proposals for the project. The methodology used for this assessment is consistent with best practice for underwater noise assessments and includes interaction with the benthic and marine mammal specialists.

Sound transmission in shallow water is highly variable and site specific because it is strongly influenced by the acoustic properties of the bottom and surface as well as by variations in sound speed within the water column (Richardson et. al., 1995). With shallow water sound transmission the combination of environmental factors makes it difficult to develop accurate theoretical models. The theory must be combined with site-specific empirical data to obtain reliable propagation predictions.

Background noise levels were measured underwater at Foynes Harbour during normal operations. Measurements were taken at two locations, one inside the port and one at the port entrance in the Shannon Estuary.

An underwater noise model was created to estimate underwater noise levels and these were compared with international exposure guidelines for a range of sensitive species.

There are two main impacts to be assessed; construction of the jetty, during which the worst case noise will relate to piling activity, and the normal port operation. This assessment is based on the piling and construction activity being carried out while the port is still in operation.

11.2.3 RECEIVING ENVIRONMENT

The Shannon Foynes port area includes the full estuary and features some of the largest vessels to dock at Irish ports. With a number of subsidiary harbours and the operation of the Killimer-Tarbert ferry nearby there is a significant level of marine traffic in the area at all times.

The Foynes Harbour area is well sheltered and formed by a channel south of Foynes Island. The main navigation route for the estuary is located to the north of the island in deeper water. The harbour area is underlain with approximately 30m of mud over the rock layers.

The dredged harbour forms a plateau (approximately 900 m long by 300 m wide) between the shallow east/northeast entrance and the deeper main channel (approximately 1,300 m long by 200 m wide) to the Northwest of the berthing area. The main estuary channel is approximately 1.5 km wide and 32 m deep at the deepest section in the area.

11.2.3.1 Character

The thick layer of mud in the harbour area provides an acoustically 'soft' surface with a high level of sound absorption. The shallow depth combined with convoluted contours means that sound generated in the harbour area will not easily propagate to the estuary.

In order to determine background underwater noise levels in the harbour, RPS undertook an underwater noise background level measurement survey at Foynes Harbour for this project. The target of the study was to determine the background noise of the underwater environment (i.e. acoustic noise) during normal conditions including vessel noise from activities in Shannon Estuary and Foynes Harbour.

Acoustic measurements were carried out using recorders deployed from a vessel on the 26th January 2017 in the vicinity of Foynes Harbour and the Shannon Estuary. Underwater noise measurements that were taken during normal activity at Foynes Harbour with the recorded movement of vessels in and out of the port.

11.2.3.2 Measurement Locations

The locations of the noise measurements are shown in **Figure 11.2.3**. Two measurements were made using two hydrophones, at the Pontoon and at Beacon No. 2. These locations were chosen to provide data at the port entrance and the for the inner port area, the area most likely to be impacted by underwater noise. The hydrophone at the Pontoon was located 200m from Foynes Harbour and moored to the bed of the estuary at a depth of 8m. Beacon No. 2 was located 1.5km from the port at a depth of 6 m beside the route used by vessels entering and exiting Foynes Harbour.

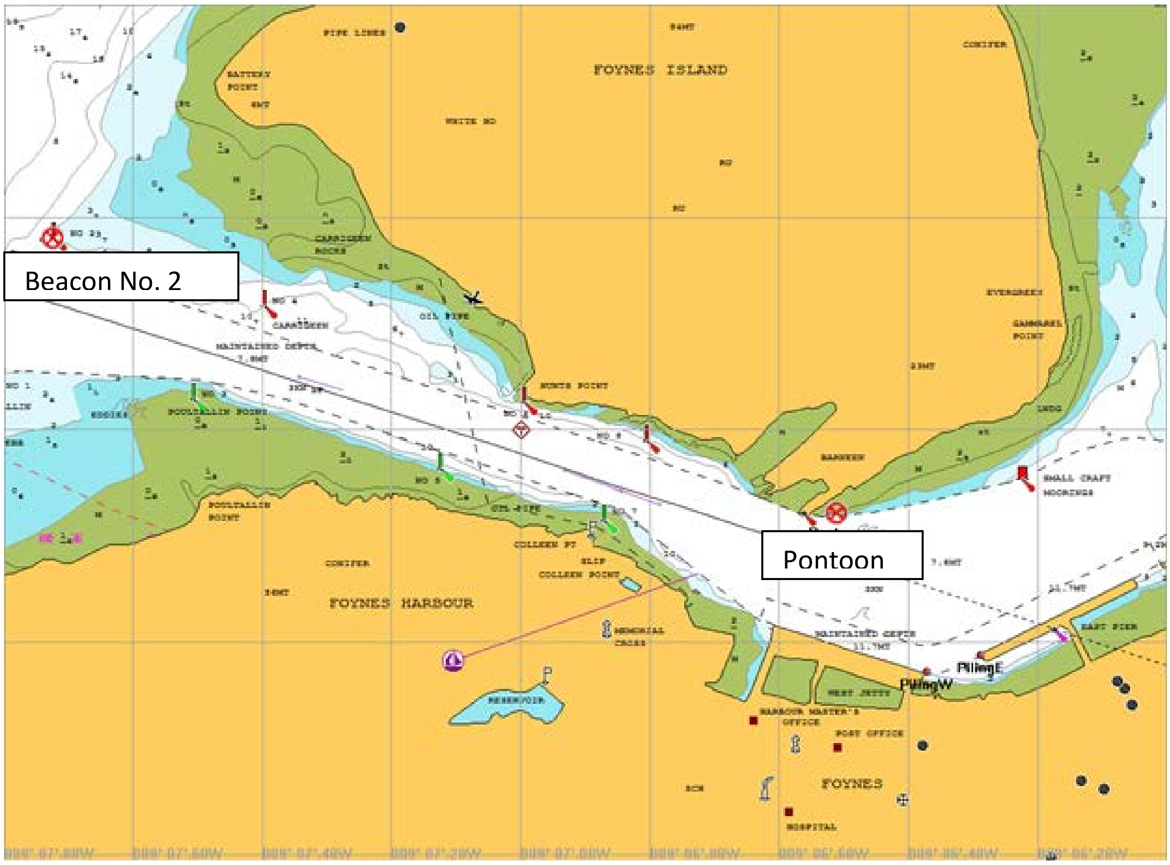


Figure 11.2.3 Survey Locations

11.2.3.3 Underwater Noise Propagation Test

The propagation test was carried out on the 26th January 2017 and measured the RMS values of a moving noise source at one second intervals. A vessel was used as the noise source to minimise any potential impact from the testing. In order to assess the propagation characteristics of the site, recordings of the boat engine noise running at constant speed were taken at multiple positions within the study area.

Shannon I (see **Figure 11.2.4**) was the vessel used to deploy the recorders in the study area and conduct the propagation test. The noise created by the vessel, as it departed and approached each hydrophone deployment point, was measured from the recorder. Vessel noise was measured at one second intervals. The time of departure and the distance travelled away from and approaching the deployment points were used to determine the propagation loss in the area.

The distance measured was the slant distance, the straight line distance from the source of noise (the vessel) and the receiver (hydrophone moored to the seabed) measured using the known distance of the moored hydrophone to the surface and the known distance of the deployment point on the surface to the vessel. From the retrieved data the period of useful data in deep and shallow water surveys was when the vessel was close to the moored hydrophone. Once the vessel was more than 200 m from the recorder it could not be distinguished from background noise. The acoustic data was analysed to provide a propagation loss curve for the Foynes site.

Figure 11.2.4 Shannon I

The result of the underwater noise propagation test is shown as a logarithmic trend-line in **Figure 11.2.5** and shows that the source noise level from Shannon I is approximately 150 dB re 1 µPa @ 1 m. Underwater noise levels return to background levels at a distance of approximately 120 m. This is rapid attenuation in underwater noise is indicative of a highly absorbent acoustic environment.

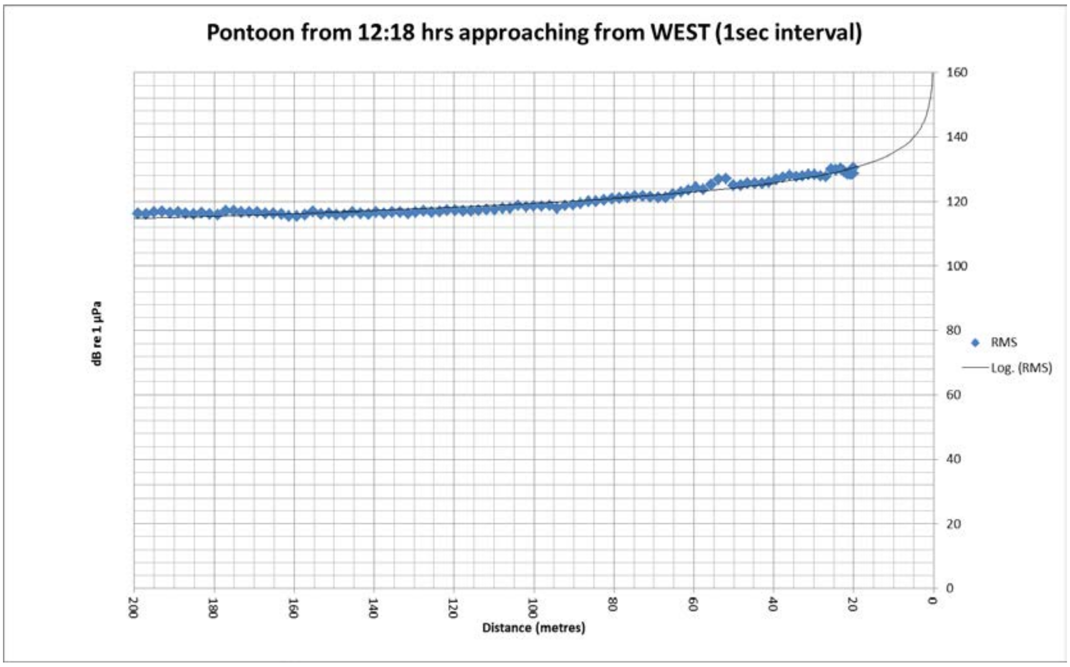


Figure 11.2.5 Underwater Noise Propagation Test Result

11.2.3.4 Background Noise Levels

In order to quantify the background noise levels an underwater noise survey was carried out over 6 days. The period chosen represents a typical level of activity at the harbour with an approximate average of 1 large vessel entering the port per day. The background noise level was measured by a recorder moored at the pontoon opposite the berthing area (R2). A second recorder was located at Beacon 2 at the entrance channel. Underwater noise levels were as shown in **Figure 11.2.6** and **Figure 11.2.7**. The data is plotted in 10 minute intervals for the period 26th January 2017 to 31st January 2017 with ship movements noted, where known. Other vessels, such as small service vessels or tugs transited through the area and could have approached closer to the recorders than larger vessels confined to the navigation channel.

The plots show that the noise levels are higher (circa 110-120 dB re 1µPa) in the harbour area than the outer area (90-100 dB re 1µPa) in the absence of shipping traffic. Noise levels rise to 135 dB re 1µPa in the harbour area while shipping is docking whereas peak levels at Beacon 2 are lower at 130 dB re 1µPa. It is notable that the duration of the peak noise event is much longer at Beacon 2, typically 2 hours, while the duration inside the harbour is significantly shorter, generally 10 minutes with a maximum of 30 minutes.

The shorter duration inside the harbour area is symptomatic of significant propagation losses in the confined harbour space. As the vessel passed close to the recorder at the pontoon RMS noise level reached a maximum and as the vessel moved away the noise level dropped quickly. At Beacon 2 the higher noise level persisted for a longer period because the recorder was located at the entrance to the channel close to deeper water and could detect the noise from the vessel as it navigated in the estuary as well as it entering the harbour area.

The noise level patterns are indicative of an area with high propagation losses which is expected due to the muddy seabed and confined space. The underwater noise propagation test results confirm the high propagation losses close to the source.

11.2.3.5 Significance of the baseline Noise Levels

The Foynes Harbour area is part of the Lower River Shannon SAC and there are a number of protected species active in the area as outlined in Chapter 7. The area is however a Tier 1 national port with current significant level of industrial activity and associated underwater noise in the estuary. The passage of each vessel through the area results in brief but significant increases in underwater noise levels.

The proposed activity will involve construction equipment and vessels operating in the area for that phase of the operation (ten months duration). The most significant noise event will arise during piling. Piling activity will be intermittent and take a limited time to complete. The usual piling sequence involves a number of short (less than 30 minutes) piling periods followed by a similar measurement/checking period each day. Piling activity generally will comprise about one working day per pile hence the description of 'intermittent'.

The current noise levels comprise a background level which is elevated when a vessel or activity is taking place in a specific area. For example the underwater nose level at any location is relatively steady and increases for a short while if a vessel is transiting the area. Once the vessel has passed, noise levels revert to the original level. During construction there may be a vessel (jack-up barge) present for an extended period with piling taking place intermittently. Once this is completed noise levels revert to background. Similarly during the operational phase underwater noise levels are relatively steady until a vessel either enters or leaves Foynes Harbour. The noise level increases for a brief period and then reverts to background level.

Unlike other sources of pollution noise is not persistent. Brief increases in underwater noise associated with shipping traffic will remain consistent with existing intensity (decibel) levels. The increased berthing area will allow larger vessels to dock, but the increased vessel size is not sufficient to lead to any significant increase in underwater noise intensity. There may be limited (temporal) increases in shipping noise due to larger vessels taking a few minutes longer to enter and leave the harbour, but this is not likely to result in any significant increase in baseline noise levels.

11.2.3.6 Sensitivity of the receiving environment

The receiving environment is an enclosed section of a busy estuary. Existing underwater noise levels in the area are elevated in the presence of shipping traffic but noise attenuates quickly due to absorption by the mud on the seabed. From an underwater noise perspective any sources of additional noise will be confined to an area close to the source and attenuate rapidly.

The site is noise sensitive due to the proximity of marine species including fish; Salmon, River Lamprey, Sea Lamprey, Eel, Smelt and Shad, and marine mammals, primarily the resident bottlenose dolphin population in the estuary. Otters may be present in the area. The underwater noise impact thresholds used in this chapter are the same as those referred to in Chapter 7 and represent current best practice.

The criteria used to assess the significance of the underwater noise impacts is presented in **Table 11.2.2**. Underwater noise criteria are the subject of ongoing research. In many cases species specific data is sparse or does not currently exist and has to be extrapolated from similar species. The criteria are selected from best international practice and publications. The thresholds for mustelids is taken from the only available guideline which provides a threshold for sea otters because there is no published threshold for the Eurasian otter.

Based on the criteria in **Table 11.2.2** shipping noise in the harbour area does not present a risk to any of the sensitive species.

Table 11.2.2 Underwater Noise Impact Criteria

Organism	Impact Type	Threshold dB	Criteria	Data Source
Fish	Mortality of fish eggs and larvae	210 dB re 1µPa^{2}s	SEL_{cum}	Popper *et al.*, (2014)
		207 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al.*, (2014)
	Mortality/ PTS in adult fish*	207 – 219 dB re 1µPa^{2}s	SEL_{cum}	Popper *et al.*, (2014)
		207 – 213 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al.*, (2014)
	Recoverable injury in adult fish*	203 – 216 dB re 1µPa^{2}s	SEL_{cum}	Popper *et al.*, (2014)
		207 – 213 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al.*, (2014)
	Temporary Threshold Shift (TTS)	186 dB re 1µPa^{2}s	SEL_{cum}	Popper *et al.*, (2014)
Cetaceans	Permanent Threshold Shift (PTS) [SPL_{Peak}]	230 dB re: 1µPa SPL_{Peak}	Peak	Southall *et al.* (2007)
		198 dB re 1µPa^{2}s	SEL	Southall *et al.* (2007)
	Behaviour effects	160 dB re: 1µPa SPL_{RMS}	RMS	NOAA (2013)
Pinnipeds	Permanent Threshold Shift (PTS) [SPL_{Peak}]	218 dB re: 1µPa SPL_{Peak}	Peak	Southall *et al.* (2007)
		186 dB re 1µPa^{2}s	SEL	Southall *et al.* (2007)
Mustelids (Sea Otters)	Permanent Threshold Shift (PTS)	220 dB re 1µPa2s	SEL	Finneran & Jenkins (2012)

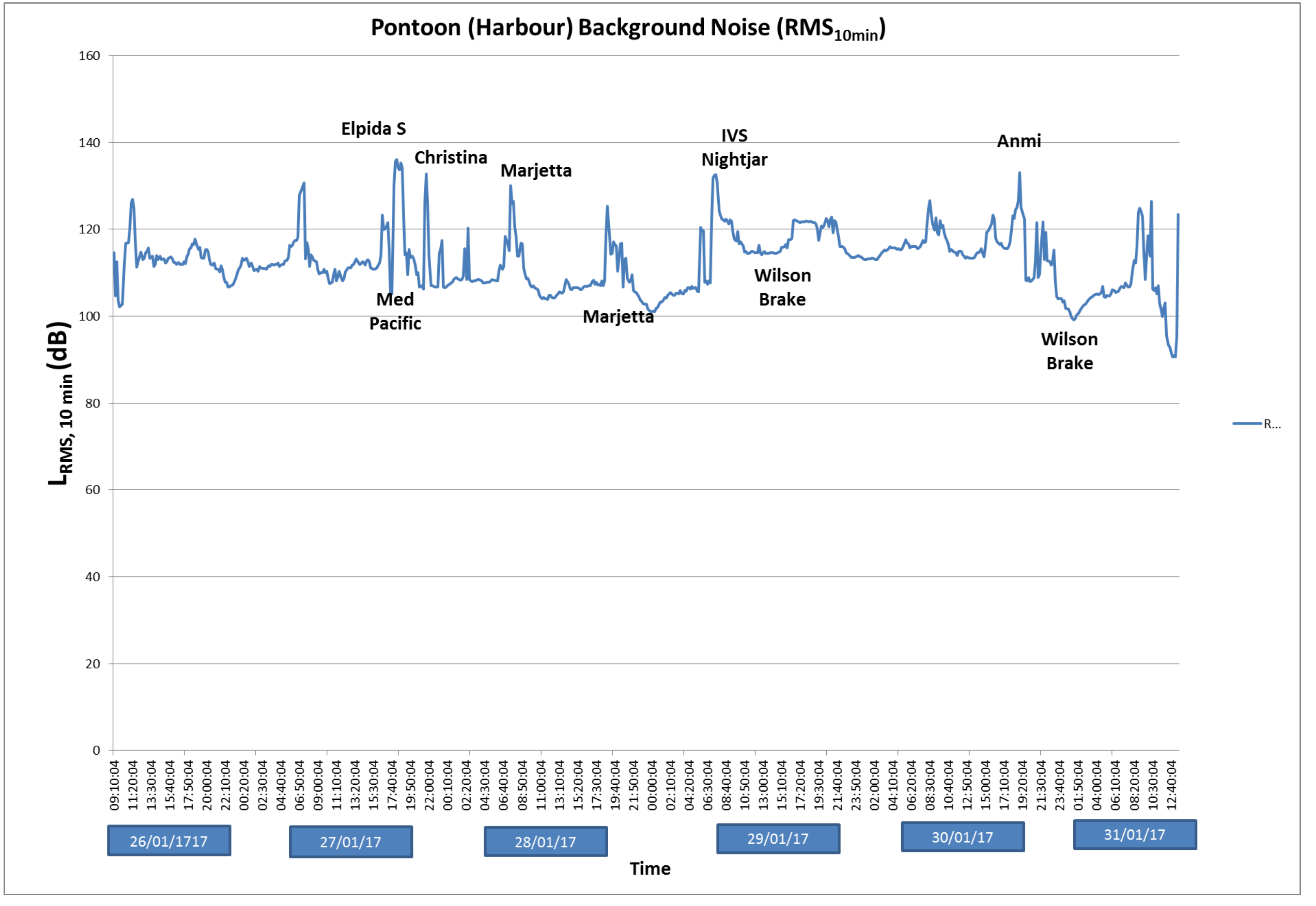


Figure 11.2.6 Background Noise Levels in the Harbour Area (Pontoon) – Major vessel traffic indicated

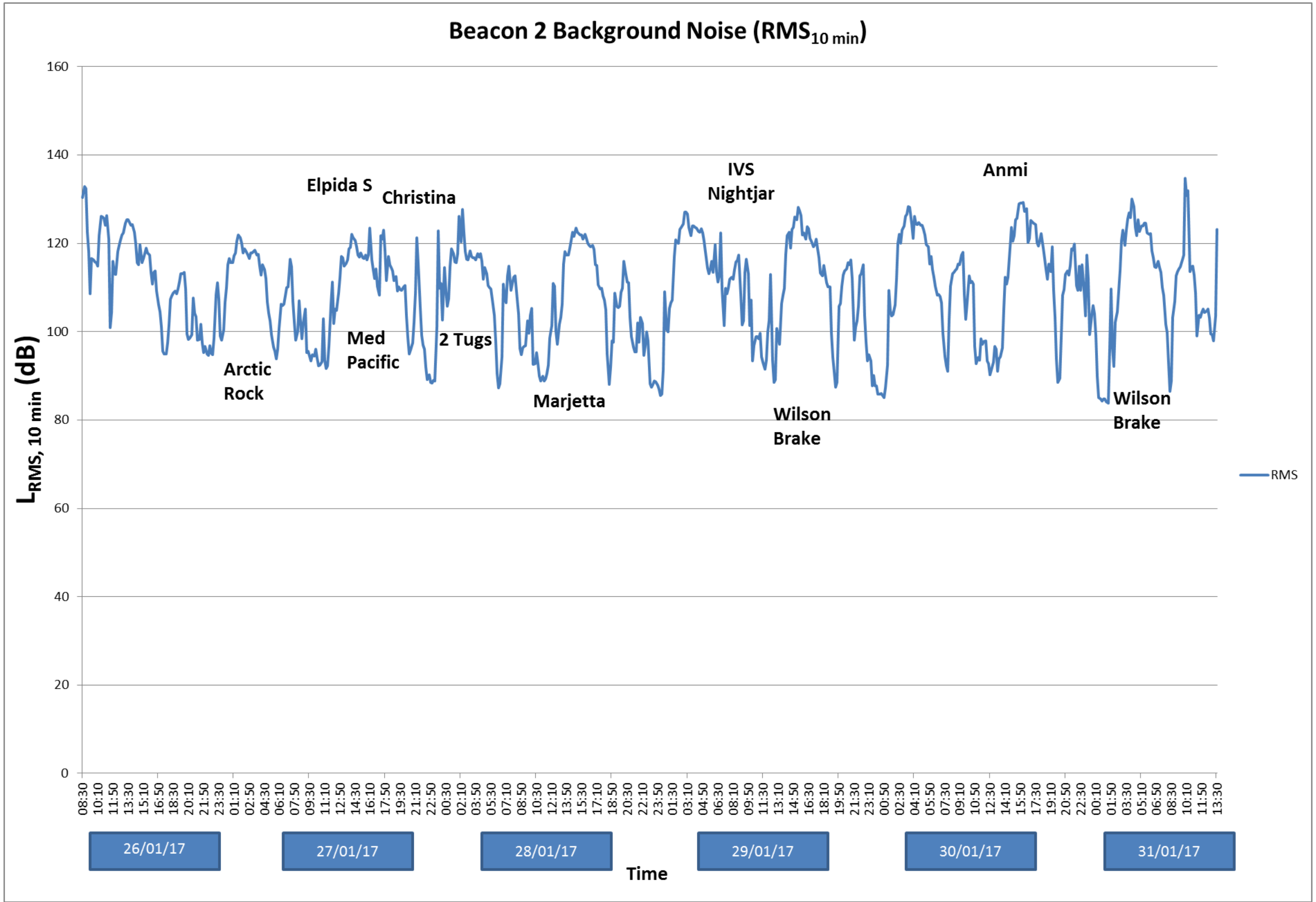


Figure 11.2.7 Background Noise Levels at the Entrance to the Navigation Channel (Beacon 2) – Major vessel traffic indicated

11.2.4 Underwater Noise Impacts

The construction of the jetty extension may involve some marine traffic transporting materials but the most significant underwater noise element of the construction will be the piling requirement. The piles will be approximately 40-45m long and driven 30-35m into the seabed. Heavy piles such as this will sink several metres when lowered vertically to the seabed. A vibratory pile driver will then be used to drive the piles as far as possible. It is likely however that at least half of the pile driving will require an impact hammer to drive the piles into rock. The total duration of the piling activity will be 10 months.

Driving large piles such as those proposed is an intermittent activity. The pile is lifted into place, aligned and lowered slowly into position. The vibratory driver is then brought into position and begins to vibrate the pile into position. Initially there will be multiple stops for alignment checks, each lasting as long as the preceding pile driving period. Gradually the pile is secured and vibrated for longer periods. At some point the vibratory driver will cease to be effective and the impact driver will be brought into position. As this is used frequent checks on alignment are again required. Due to the length of the piles it is likely that the piles will be installed in sections so further time is required to weld extension sections to the pile.

As can be seen from the above, the impact piling is not a continuous activity, the likelihood is that even at peak requirement, the impact hammer will only be used for a portion of the day.

Support activities will involve relocating the jack up barge and operating hydraulic power packs to power the piling rig. A crane will be required to lift the piles into place. It is unlikely that a barge large enough to support both a crane for lifting the piles and handling the impact driver will be utilised. A single crane with a change-over in operations will more than likely be utilised.

11.2.4.1 Underwater Noise Sources

The underwater noise impacts will occur in two phases, the construction phase and the operations phase. For the operations phase the impact will be confined to vessel traffic at the port. Underwater noise levels will remain as they are currently, i.e. elevated levels for a period of approximately 2 hours in the Estuary as a vessel navigates the channel and elevated levels for short periods (10 to 30 minutes) while the vessel berths in the harbour. The noise levels associated with shipping traffic are outlined in **Table 11.2.1**.

Noise levels during construction will be significantly higher than those arising from port operations. The main activities required during construction with potential underwater noise impacts are outlined in **Table 11.2.3**. Noise from impact piling will represent the worst case noise event during construction.

The assessment of underwater noise impacts will be carried out on the basis of the impact piling noise during construction as all other activities will have lower impacts. The cumulative impact of all activities is addressed in **Section 11.5.5**.

Table 11.2.3 Construction tasks with potential underwater noise impacts

Construction Activity	Details	Extent/Duration	RMS Noise Levels dB re: 1µPa @ 1m
Delivery of piles (by sea if required)	Vessel traffic, similar to existing	One or two cargo vessel deliveries to port	170
Delivery and assembly of the jack up barge	Can be delivered by road but could be towed in by sea. Mobilisation activity similar to ship unloading using a crane in the harbour	One vessel trip in and one vessel trip out. Mobilisation and Demobilisation will take 2-3 days each	170
Relocation of jack up barge	Required for each of 69 piles	Estimated every 3 days over the 10 month piling period	170
Support vessel	Safety requirement	10 month piling period	150
Operation of jack up barge	Support equipment (hydraulics, crane, etc.)	10 month piling period	150
Vibratory Piling	Required for each of 69 piles	10 month piling period	170
Impact Piling	Required for each of 69 piles	10 month piling period	206

11.2.4.2 Likelihood of impacts

It is clear from **Table 11.2.3** that impact piling will be the worst case underwater noise impact. Each of the other activities is at least 30 dB quieter than the piling activity. Vibratory piling is likely to be utilised instead of impact piling for a significant portion of the time depending on the ground conditions.

Based on previous experience`at Dublin Port where extensive piling was being carried out, piling will probably occur about 50% of the working time during the day. The balance of the time being taken up with alignment checks, welding and other support activities and meal breaks. This utilisation factor is in agreement with Bailey et al. (2010) referenced in Chapter 7. The total duration of impact piling will therefore be a small proportion of the overall construction period. As stated in Chapter 7 bottlenose dolphins and migrating fish are more likely to be present in the Foynes Harbour area at night, when no piling will be permitted, thus reducing the potential impact.

11.2.4.3 **Significance**

Due to the proximity of sensitive protected species and the potential for high levels of underwater noise from impact piling in particular, this EIAR includes this specific assessment of underwater noise levels.

The context for this assessment includes the enclosed area in which the activity takes place along with the scale of the development. These factors in particular indicate that potential underwater noise impacts will be on the lower end of the scale.

11.2.4.4 **Underwater Noise Prediction**

As outlined in **Table 11.2.3** the worst case underwater noise impact is during impact pile driving. Impact pile driving is the subject of considerable interest due to the noise levels arising from driving large (4-5 m diameter) piles for offshore wind farms. It is important to distinguish that type of piling from the activity proposed at Foynes Harbour.

Piling intensity can be determined by the energy input per strike. De Jong and Ainslie (2008) relate impact piling energy to sound output and provide underwater noise source level data for an 800 kJ piling operation. The California Department of Transport has provided a compendium of pile driving sound data, Caltrans (2007), which has a large database of pile types and diameters.

Four appropriate examples of piling activity across a range of piling energies were taken from this compendium and plotted in **Figure 11.2.8**. Measured data, collected by RPS in Dublin Port as part of the Alexandra Basin Redevelopment Project (ABR) construction works are also included on the figure. The plot is completed with data taken from Duncan et al. (2010) from two projects in Australia.

Trend-line plots are provided for all the data. It should be noted however that the Duncan et al (2010) data appears to be significantly higher than data from the other sources. If this data were excluded, the trend-line fit for the remaining data (comprising 6 different independent projects) would be much better. There may be site specific factors that gave rise to higher levels, in particular the calcarenite seabed.

The estimated strike energy required at Foynes Harbour has been estimated to be 106 kJ. Including the Duncan et al. (2010) data on a trend-line curve in **Figure 11.2.8** this provides the source level estimates for pile driving noise (**Table 11.2.4**). SEL_{cum} is based on 1000 strikes.

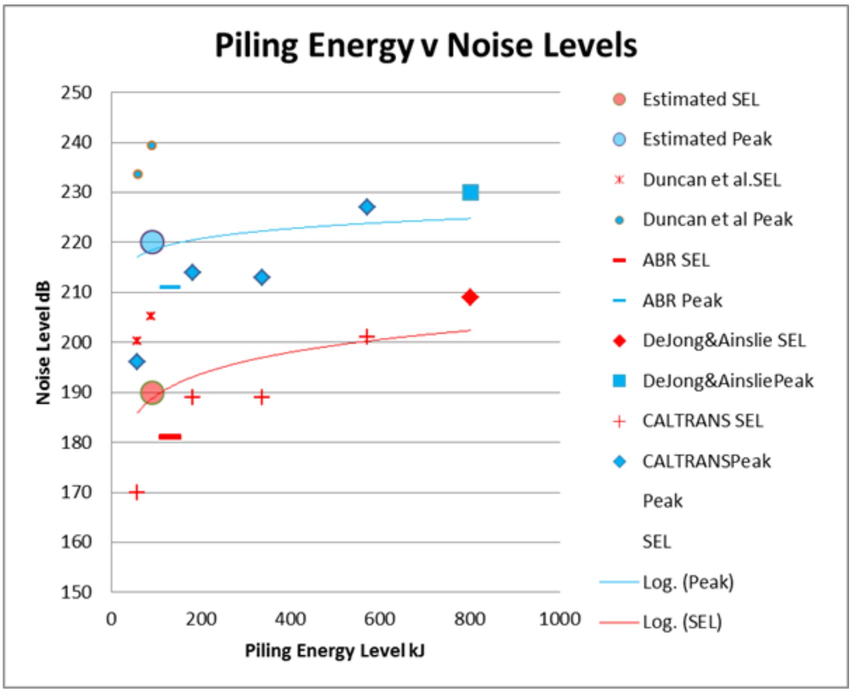


Figure 11.2.8 Source sound levels from a range of piling activities

Table 11.2.4 Estimated Impact Piling Sound Source Levels for Foynes Harbour

Metric	Noise Levels
Peak Sound Level	212 dB re 1µPa @ 1m
Sound Exposure Level SEL	187 dB re 1µPa^2-s @ 1m
SEL_{cum}	217 dB re 1µPa2-s @ 1m
RMS Sound Pressure Level	206 dB re 1µPa @ 1m

11.2.4.5 Underwater Noise Model

When the water is very shallow (as is the case at Foynes) sound propagation theory predicts that, if the effective water depth is less than λ/4, (where λ = wavelength of the sound) waves are not matched to the duct and very large propagation losses occur (this means that frequencies lower than 30 Hz will not propagate effectively in the area). The situation at Foynes is further complicated by the bathymetry and the confined nature of the harbour.

With a shallow source, the source and its reflected image become a dipole source with a vertical directionality (Urich 1983). In deep water with both a shallow source and a shallow receiver, spreading loss may be as much as 40 log R, versus the 20 log R expected from spherical spreading. In shallow water, the shallow source dipole effect introduces an additional 10 log R spreading loss (Grachev 1983, quoted in Richardson et. al. (1985)), increasing the loss from ~15 log R to ~25 log R. A similar interference effect occurs when the receiving location is within ¼ wavelength of the surface, (At 15 metres depth this impacts all frequencies under 25 Hz). Thus, propagation from a shallow source to a shallow receiver in shallow water will show a spreading loss of ~35 log R.

The spreading loss is therefore a complex issue, can vary significantly in magnitude and has a significant impact on propagation losses. Under certain conditions the losses could be as high as 40 log R but it is likely that site conditions will reduce this rate somewhat. In order to be certain of the appropriate spreading loss to apply in each case it must be verified with site specific measurements.

It is possible to make reasonable propagation predictions from empirical models, such as the Marsh and Schulkin model which will be used in this assessment. Urich (1983) describes the Marsh and Schulkin (1962) model which was based on a large number of measurements in "shallow" water for the frequency range 100 Hz to 10,000 Hz.

RPS has used an octave band frequency spectrum for piling derived from Duncan et al.(2010) and measurements taken at Dublin Port during pile driving activity, as part of the approved Alexandra Basin Refurbishment (ABR) Project, to calculate the propagation losses using the Marsh & Schulkin (1962) model. Underwater noise models using the Marsh & Schulkin approach have been presented and approved for the ABR Project in addition to Galway Port and Doolin Pier projects. The received levels have then been corrected using the marine mammal weighting functions in Southall et al.(2007).

The weighted received levels are then used to calculate a radius at which the underwater noise criteria set out in **Table 11.2.2** occur. The results are presented in **Table 11.2.5**.

As can be seen from the table the impact radius for fish is of the order of 7 metres. This indicates that there may be some mortality for fish eggs and larvae in addition to impacts on fish with swim bladders. The consequences of this potential impact zone for fish are addressed in Chapter 7.

Regarding marine mammals, the proposed development is located in an enclosed area within the Lower River Shannon SAC, with a resident population of bottlenose dolphins. While there is the possibility of a harbour porpoise or a seal presenting in the Foynes Harbour area it is unlikely. The two mammal species of concern are the bottlenose dolphin and the otter. There is no risk of hearing injury to bottlenose dolphin but at extremely close range (3 m from the piling activity), there is a risk of damage to the otters hearing. The potential impact radii are in the same range as those quoted from Bailey et al. (2010) in Chapter 7. Due to the enclosed nature of Foynes Harbour in comparison to the open water scenario at Moray Firth (25km offshore in water 42m deep) the potential impact zone will be considerably less, in fact will be entirely confined within the Foynes Harbour area with no significant impact on the estuary.

There are no published criteria for underwater noise disturbance to otters whereas there is a guideline for 'behavioural response' to underwater noise at 160 dB RMS from marine mammals. At 250m from the source, mid-frequency cetaceans would perceive 160 dB RMS, which is above ambient noise level and therefore potentially audible, but this does not imply a behavioural or negative effect. Based on where the piling activity will take place this potential impact zone is confined to the immediate Foynes Harbour area.

The potential impact on marine species are addressed in Chapter 7 which are based on the results of this underwater noise assessment.

Table 11.2.1 Results of noise modelling

Organism	Impact Type	Threshold dB	Criteria	Data Source	Distance(m)
Fish	Mortality of fish eggs and larvae	210 dB re $1\mu Pa^2s$	SEL_{cum}	Popper *et al.*, (2014)	3
		207 dB re: $1\mu Pa$ SPL_{Peak}	Peak	Popper *et al.*, (2014)	6
	Mortality/ PTS in adult fish*	207 – 219 dB re $1\mu Pa^2s$	SEL_{cum}	Popper *et al.*, (2014)	5
		207 – 213 dB re: $1\mu Pa$ SPL_{Peak}	Peak	Popper *et al.*, (2014)	6
	Recoverable injury in adult fish*	203 – 216 dB re $1\mu Pa^2s$	SEL_{cum}	Popper *et al.*, (2014)	7
		207 – 213 dB re: $1\mu Pa$ SPL_{Peak}	Peak	Popper *et al.*, (2014)	6
	Temporary Threshold Shift (TTS)	186 dB re $1\mu Pa^2s$	SEL	Popper *et al.*, (2014)	50
Cetaceans	Permanent Threshold Shift (PTS) [SPL_{Peak}]	230 dB re: $1\mu Pa$ SPL_{Peak}	Peak	Southall *et al.* (2007)	No effect
		198 dB re $1\mu Pa^2s$	SEL	Southall *et al.* (2007)	No effect
	Behaviour effects	160 dB re: $1\mu Pa$ SPL_{RMS}	RMS	NOAA (2013)	250
Pinnipeds	Permanent Threshold Shift (PTS) [SPL_{Peak}]	218 dB re: $1\mu Pa$ SPL_{Peak}	Peak	Southall *et al.* (2007)	2
		186 dB re $1\mu Pa^2s$	SEL	Southall *et al.* (2007)	3
Mustelids (Sea Otters)	Permanent Threshold Shift (PTS)	220 dB re $1\mu Pa2s$	SEL	Finneran & Jenkins (2012)	No effect

11.2.4.6 In-combination effects

As outlined in **Table 11.2.3** the source noise level from impact piling is 30 dB higher than any of the other construction or operation activities. When adding the individual contribution of noise sources, the greatest increase arises from the addition of similar noise levels. Where noise levels differ by more than 10 dB, the cumulative noise level is effectively the level of the louder source. This is due to the nature of logarithmic addition of noise levels. With a 30 dB difference in levels the additional cumulative impact of any or all of the other sources in combination with impact pile driving will be nil.

Impact pile driving can therefore be considered on its own as a worst case scenario.

11.2.4.7 Cumulative Impact

The following planning files were examined to identify any potential in cumulative impacts with other permitted development: 12-212 East Jetty reclamation; 13-164 Boiler installation; 14-603 Alterations to an industrial building; 15-468 Fuel manufacturing facility; 16-418 Installation of thickener vessels; 17-174 Solar farm; and 17-714 Borrow pit.

With the exception of planning reference 12-212, all of these applications relate to development on land and will have no underwater noise impacts. Planning reference 12-212 includes dredging at a limited scale.

Maintenance dredging is also carried out at Foynes Port, generally using the Shannon I, shown in Figure 11.2.4, by towing the plough at the rear of the vessel to maintain seabed levels. This vessel was used for the noise propagation tests in Section 11.2.3.3 in which noise levels were demonstrated to reduce to background levels at a range of approximately 120 m.

Underwater noise levels arising from any of the activities referred to in this section will not alter underwater noise levels to any significant extent and will therefore have no cumulative impact.

11.2.4.8 Underwater Noise Impact Significance

Any increase in underwater noise levels, even for short periods in a small footprint such as the Foynes Harbour area during construction, can only be considered as an adverse impact. The long term impact is likely to be neutral as any change in underwater noise from vessels is unlikely to affect the overall underwater noise level.

Noise levels will increase during the construction phase. The spatial impact will be confined to the inner section of the Foynes Harbour area, and the construction activity will not result in a continuous increase in noise level. The operational phase may result in larger vessels taking longer to dock in and depart from the port but any change in noise level is likely to be neutral. Given the scale of the change in noise levels the overall impact of the project could be considered temporary adverse and long term neutral.

11.2.5 Remedial and Mitigation Measures

11.2.5.1 Construction Phase

The primary 'interest' for the purpose of this assessment during the construction phase is the pile driving process. The use of heavy pile sections which have the capacity to sink under their own weight and facilitate the use of a vibratory pile for a substantial portion of their depth is a significant mitigation measure as any reduction in impact driving will be beneficial.

Pile driving activity will be carried out as efficiently as possible, to reduce the duration of the piling activity. Piling will only take place for a portion of each day and will not be carried out at night. Underwater noise modelling has indicated that due to the shallow water depth and the absorptive seabed noise levels are confined to a small area in the inner section of Foynes Port.

Due to the proximity of a resident population of bottlenose dolphins the harbour area will be scanned for the presence of marine mammals prior to the commencement of impact piling. Details of the mitigation will comply with NPWS (2014) guidelines as set out in Chapter 7.

11.2.5.2 Operational Phase

Underwater noise levels during the operational phase of the proposed development are not expected to change the underwater noise levels in any measurable way. No mitigation measures are therefore required for the operational phase.

Table 11.2.6 Summary of proposed mitigation

Impact	Magnitude	Significance	Proposed Mitigation
Underwater noise while impact piling	Limited to: Range from piling activity specified in **Table 11.2.5** 10 month period Daytime operation	Slight adverse	Marine Mammal Observer to scan prior to impact pile driving, see Chapter 7 for detail.
Operational Phase	No measureable change from existing levels	Imperceptible	None

11.2.6 Residual Impacts

During the construction phase, there may be slight adverse impacts due to the increase in underwater noise levels from piling activities. With appropriate mitigation as outlined in **Section 11.2.5** the likelihood of any residual impact will be minimised. There will be no residual impact during the operational phase.

11.2.7 Monitoring Proposals

An underwater noise survey will be undertaken during the construction period at both the Pontoon and Beacon 2 locations. The monitoring will be carried out at the commencement of the piling activity.

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12 MATERIAL ASSETS- COASTAL PROCESSES

The proposed works at Shannon Foynes are separated into two main elements; the East Jetty Extension Works and Durnish Lands Development. The East Jetty Extension will connect the existing West Quay to the existing East Jetty by continuing the berthing lines of Berth 5 and Berth 3 to an intersecting point. The proposed jetty extension works include provision of an open pile jetty structure with suspended concrete deck constructed between East Jetty and West Quay, tying into the existing structures and a transition slab to provide access from the open pile jetty structure to the Berth 5 reclamation (permitted development under LCCC planning permission 12/212). The coastal processes assessment undertaken and presented within this Chapter appraises the potential impact of the marine elements of these construction works on tidal flows.

The proposed jetty extension works also includes the removal and relocation of the existing small craft landing pontoon to an area identified at the west side of the existing West Quay. This pontoon structure will consist of two small diameter locating piles and a platform tied into the existing Quay; it's relocation will have insignificant impact on the tidal flows and hence coastal processes in the wider Foynes Harbour area due to the diminutive size of the structures.

The second section of the scheme relates to the Durnish Lands Development. This is an area located on the eastern side of the main entrance road leading into the Shannon Foynes Port. The proposed works to be carried out on the Durnish Lands includes infilling of the existing greenfield site with imported fill material to raise the level of the existing lands, facilitating a mixture of warehousing, storage and port centric development. This development does not encroach on either shore-side or inter-tidal areas and therefore will have no effect on coastal processes and is not considered further within this Chapter.

The proposed eastern jetty extension will join the West Quay and the east jetty. The construction is to be an open pier structure with the provision of circa 69 piles between the two existing jetties to support deck slabs as shown in Figure 12.1. No infilling of the foreshore is proposed. No capital dredging is required.

This Chapter of the Environmental Impact Assessment Report (EIAR) examines the impact of the pier structures on the tidal flows and therefore any potential changes in coastal processes and associated implications on the receiving waters. The impact of the proposed works was assessed using computational modelling techniques based on the MIKE suite of coastal process modelling software developed by the Danish Hydraulics Institute (DHI) and is a global standard, used internationally for many environmental, planning, legal, engineering and other predictive applications.

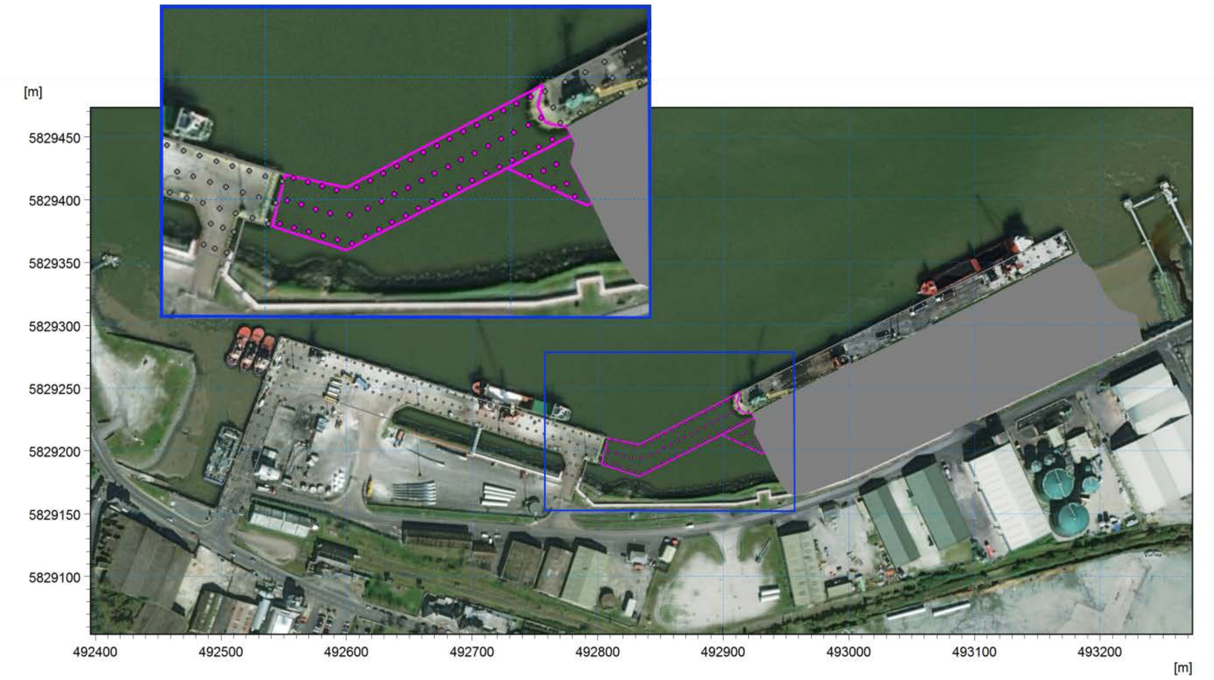


Figure 12.1 Proposed pile & jetty layout at Foynes Port (coloured magenta)

12.1 ASSESSMENT METHODOLOGY

RPS used a suite of coastal process models based on the MIKE 21 software developed by DHI to assess the potential impact of the proposed development on the coastal processes of Foynes Harbour. A numerical model was developed of the layout prior to the proposed work; this was then amended to provide a second scenario with the additional piles in place. The impact of the presence of the additional structures on tidal flows was then quantified.

The layout prior to the proposed works included the reclamation works currently being undertaken behind the east jetty. The impact on coastal processes resulting from this reclamation work was examined and submitted under LCCC permission 12/212. The implementation of the sub-grid pier structures within the model is shown in Figure 12.2 with existing piles in grey whilst the proposed additional piles are illustrated in magenta.

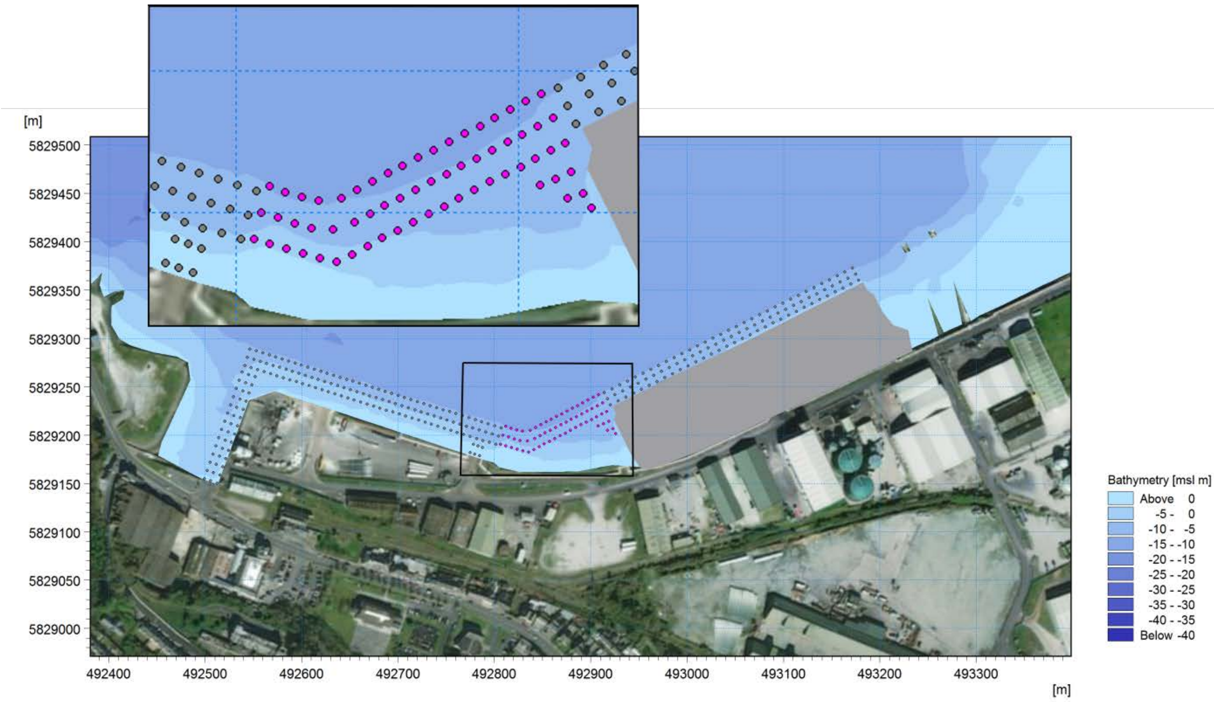


Figure 12.2 Pier structures within the numerical models (grey existing, magenta proposed)

12.1.1 Tidal Model

The tidal flow simulations were undertaken using the MIKE21 flexible mesh flow module. The module is a 2-dimensional, depth averaged hydrodynamic model which simulates the water level variations and flows in response to a variety of forcing functions in estuaries and coastal areas. The water levels and flows are resolved on a flexible mesh covering the area of interest when provided with bathymetry, bed resistance coefficient, wind field, hydrodynamic boundary conditions, etc.

The system solves the full time-dependent non-linear equations of continuity and conservation of momentum using an implicit ADI finite difference scheme of second-order accuracy. Two modelling stages were used; the RPS Irish Coastal Waters model was utilised to provide boundary conditions for a more detailed Shannon Estuary model.

Irish Coastal Waters Model

The Irish Coastal Waters model stretches from the North-western end of France including the English Channel as far as Dover out into the Atlantic to 16° west, including the Porcupine Bank and Rockall. In the other direction it stretches from the Northern part of the Bay of Biscay to just south of the Faeroes Bank. Overall the model covers the Northern Atlantic Ocean and UK continental shelf up to a distance of 600km from the Irish Coast as illustrated in Figure 12.3.

This model was constructed using flexible mesh technology allowing the size of the computational cells to vary depending on user requirements. Along the Atlantic boundary the model features a mesh size of 13.125' (24km). The Irish Atlantic coast has been described using cells of on average 200m but most estuaries have cells of around 50m.

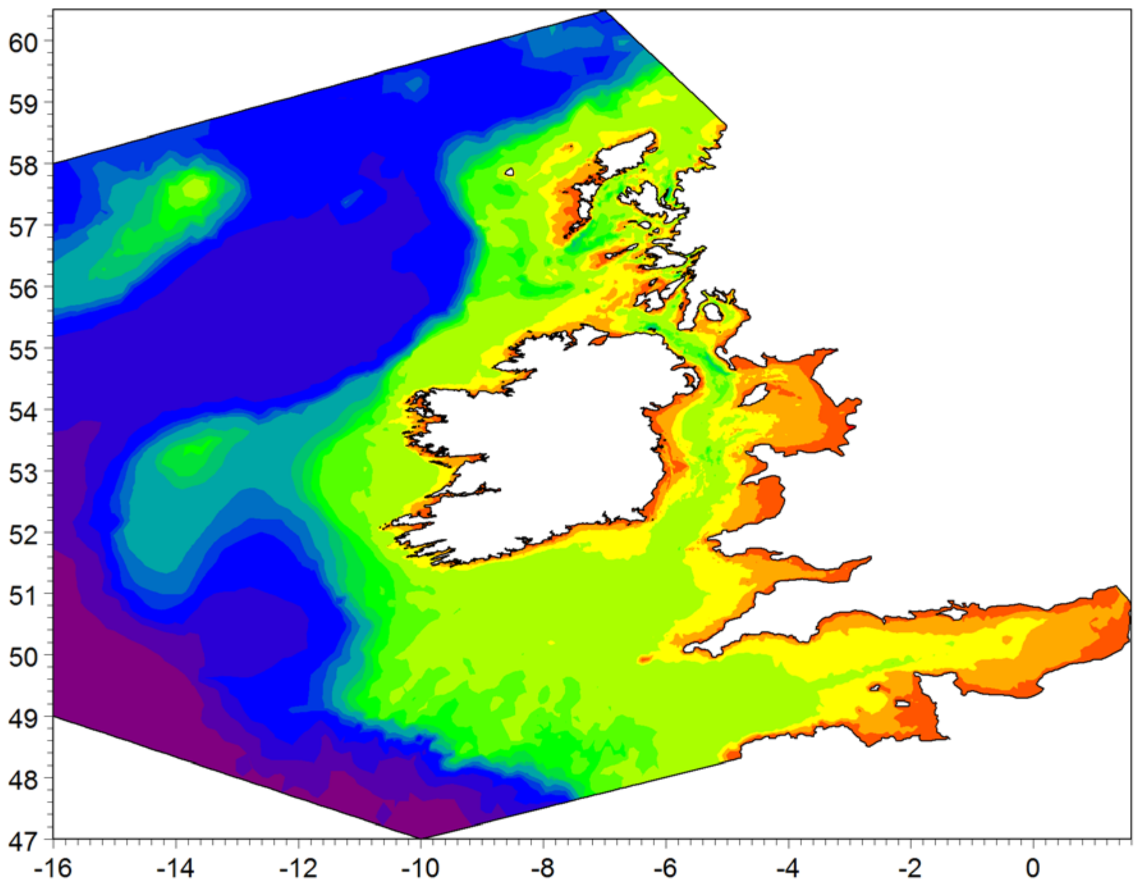


Figure 12.3 Extent of Irish Coastal Waters Model

The bathymetry was generated from a number of different sources. Large parts of the bathymetric information were obtained from surveys carried out as part of the INFOMAR project, a joint venture between the Geological Survey of Ireland (GSI) and the Marine Institute (MI). Additional data was provided from Admiralty Charts as produced digitally by C-MAP of Norway and local surveys undertaken as part of various studies. The datum of the various bathymetry sources was adjusted to mean sea level using over 350 reference levels to obtain a consistent dataset.

The simulation of the astronomic tides in the model area is mainly driven by the oscillation of water levels along the open boundaries. The Irish Coastal Waters model has six open boundaries, five in the Atlantic and one in the English Channel. The time series of tidal elevations along these boundaries are generated using a global tidal model designed by a team at the National Space Institute, Demark (DTU10). The DTU10 global tidal model is based on the prediction of tidal elevations using 10 semi-diurnal and diurnal tidal harmonic constants (as opposed to the United Kingdom Hydrographic Office approach which uses 4-6 harmonic constants). These constants were derived through the simulation of the effect of astronomic forces due to the sun and moon on the water surfaces.

Shannon Foynes Model

The extent of the model for the Shannon Foynes study included the Shannon Estuary illustrated in Figure 12.4. The bathymetry for this model was taken from the same sources as the Irish Coastal Waters model with the addition of OSI Lidar data and recent surveys undertaken by Shannon Foynes Port Company in the vicinity of the Port. The western boundary conditions were defined using the Irish Coastal Waters model.

The simulation period used for the study was selected for a spring – neap period where the tidal range covers the full extent of that experienced at the site. The time period was chosen when meteorological conditions showed neutral pressure, i.e. minimum surge, and reliable data was available from the Foynes Port tide gauge. This ensured that validation could be undertaken without the need for harmonic analysis and tidal prediction. In locations, such as Foynes Port, drying or shallow water conditions will reduce the effectiveness of these analytical methods.

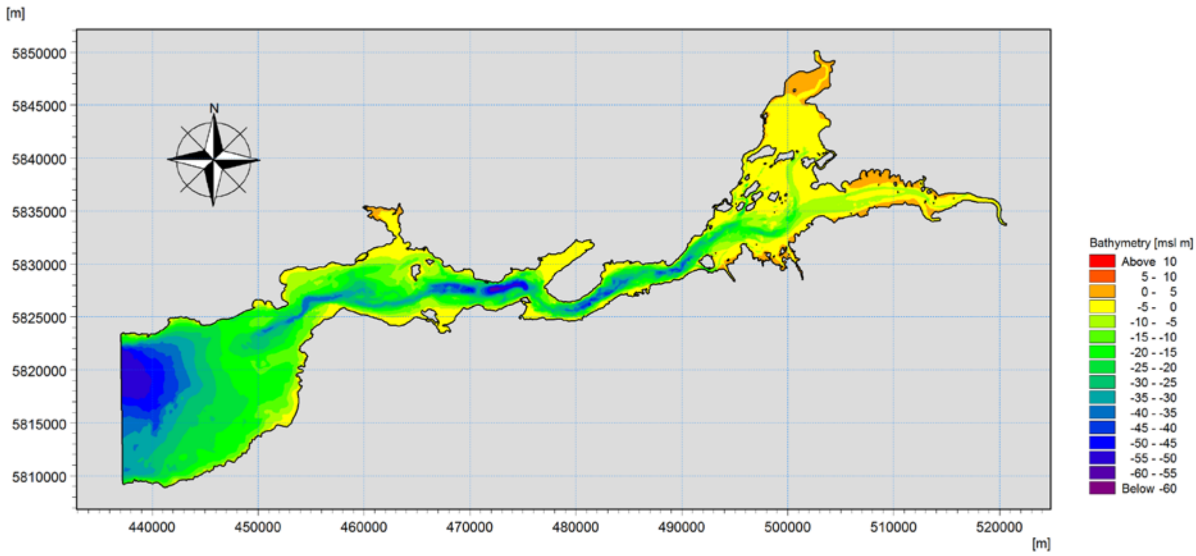


Figure 12.4 Shannon Estuary Base Model

The model mesh resolution fluctuated throughout the domain to ensure that the variation in bathymetry was captured within the model. Figure 12.5 shows how the bathymetry around Foynes Island was characterised within the model whilst Figure 12.6 shows the Port area with the inclusion of individual mesh elements. Within the immediate vicinity of the jetties the cell size was circa 5m to ensure the inter-tidal zone was well represented. The use of a fine mesh ensured that the tidal current variations due to both the varied bed levels and tidal range were well represented.

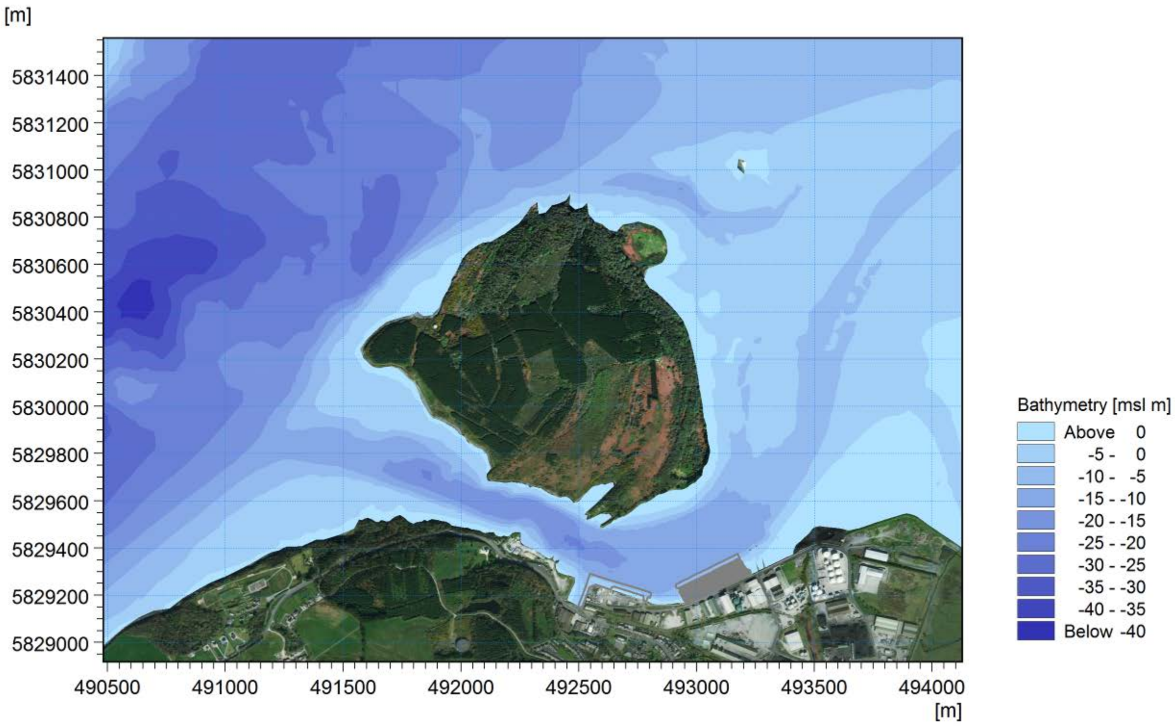


Figure 12.5 Model bathymetry in the vicinity of Foynes Island

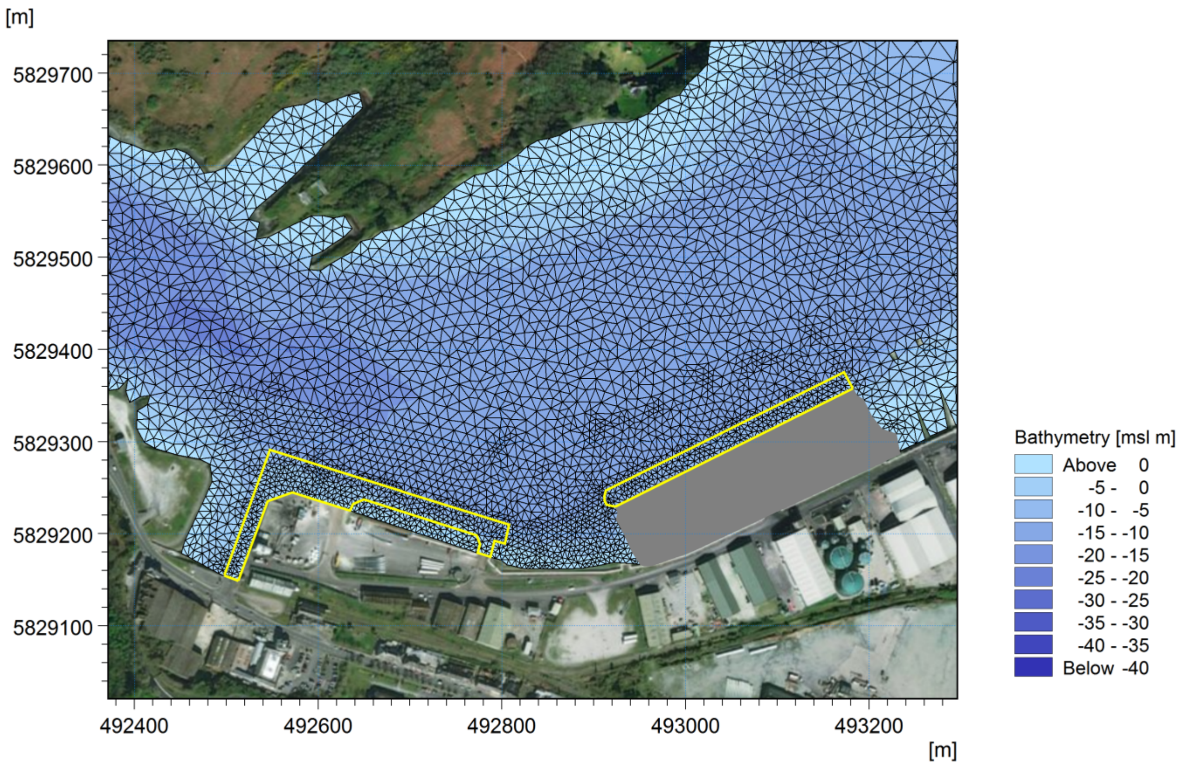


Figure 12.6 Model mesh within the Foynes channel (existing piled jetty shown as yellow outline)

12.2 RECEIVING ENVIRONMENT

In this section of the report the tidal patterns within the Shannon Estuary, and in particular in the Foynes area, are presented. This is undertaken with reference to both the simulated model data and the measured field data used in model verification.

The Shannon Estuary is strongly bi-directional with no large eddies nor complex flow patterns in the main channel. In the estuary, as a whole, the ebb current is generally stronger but through the Foynes channel the flood tide is (marginally) stronger. This is a function of the shape of the channel approaches either side of the Port. There are smaller scale circulations associated with localised features for example where there are shallow rocky outcrops and promontories e.g. Sturamus Island and Barneen Point opposite Foynes Port.

12.2.1 MODEL VERIFICATION

As previously stated the simulation period used for the study was selected for a spring – neap period where the tidal range covers the full extent of that experienced at the site. The period was also selected for minimal surge and when reliable data was available from the Foynes Port tide gauge.

The hydrodynamic model was also verified using field data collected for the previous study undertaken in 2010 and relating to the east jetty reclamation (submitted under LCCC Planning reference 12/212). It should be noted that the model simulation period was not the same as the monitoring period and therefore data was compared in terms of the occurrence of similar tidal ranges using the measured data. It was also recognised that in the intervening period reclamation works and dredging campaigns have been undertaken (along with additional surveys) so representative locations were selected.

The measured (black trace) and modelled (blue trace) tidal elevations are presented for Carrigaholt and Foynes Port in Figure 12.7 and Figure 12.8 respectively. These locations show good correlation over the full neap-spring cycle. The underestimate of tidal levels towards the end of the simulation is due to a low pressure system moving in which was not included within the modelled scenario.

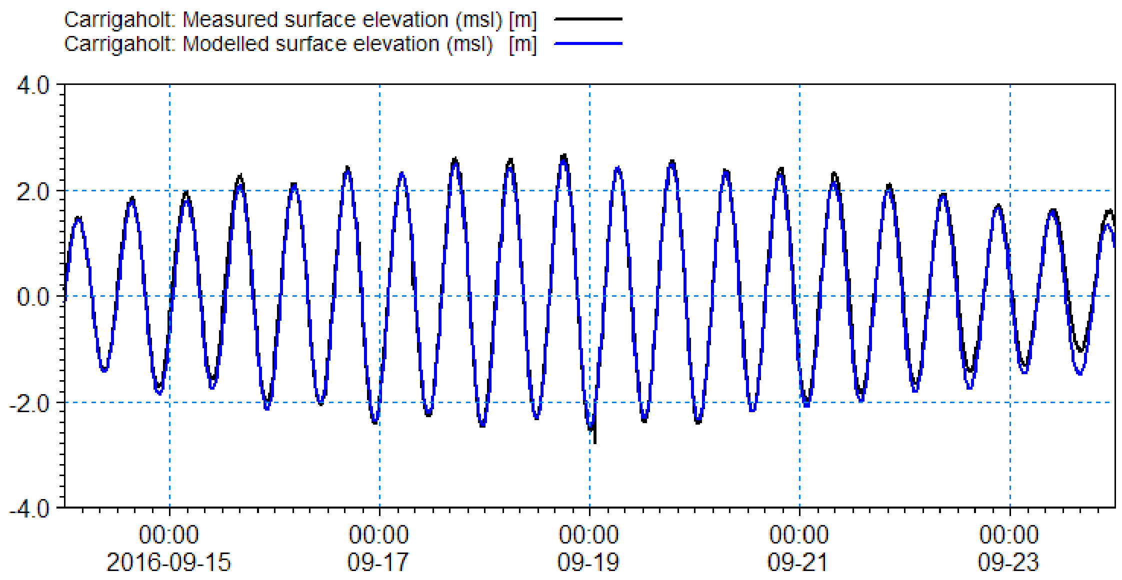


Figure 12.7 Measured and Simulated Tidal Elevations at Carrigaholt

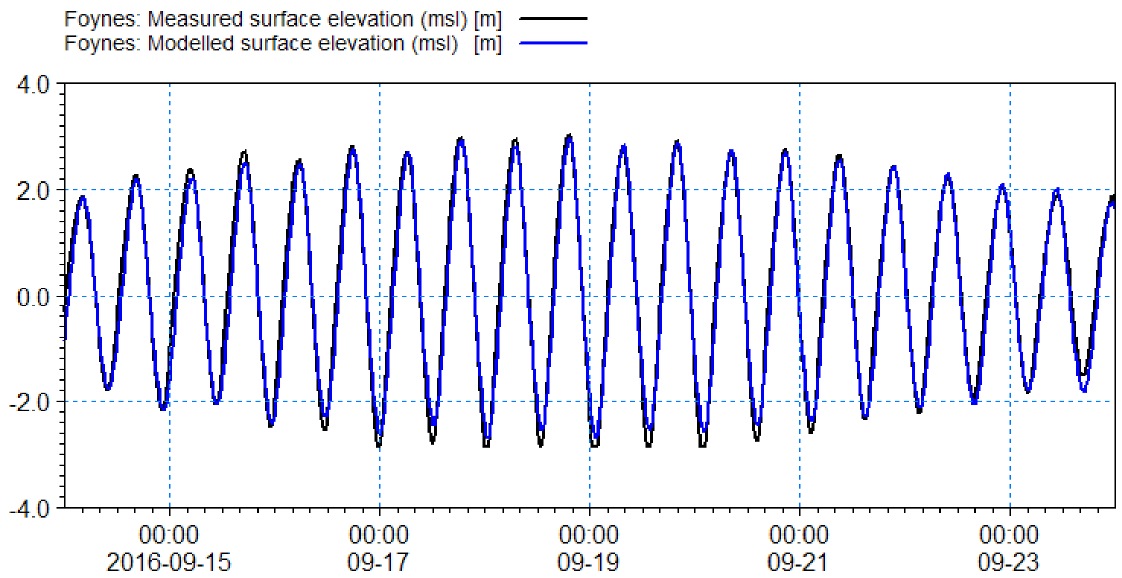


Figure 12.8 Measured and Simulated Tidal Elevations at Foynes Port

In addition to tidal levels the currents in the vicinity of the port were also examined to ensure that the observed tidal flow regime in the Foynes area was adequately simulated within the model. Figure 12.9 shows the location of the monitoring sites at which data was collected for the 2010 study. It was noted that the first stage of the east reclamation has been undertaken since this monitoring programme was undertaken and indeed the modelling assumes that it has been completed therefore model calibration at this location is indicative. However given the comparative nature of this study the use of the 2010 data is deemed appropriate. The model simulations for this application were found to be consistent with those derived and submitted under the 12/212 application.

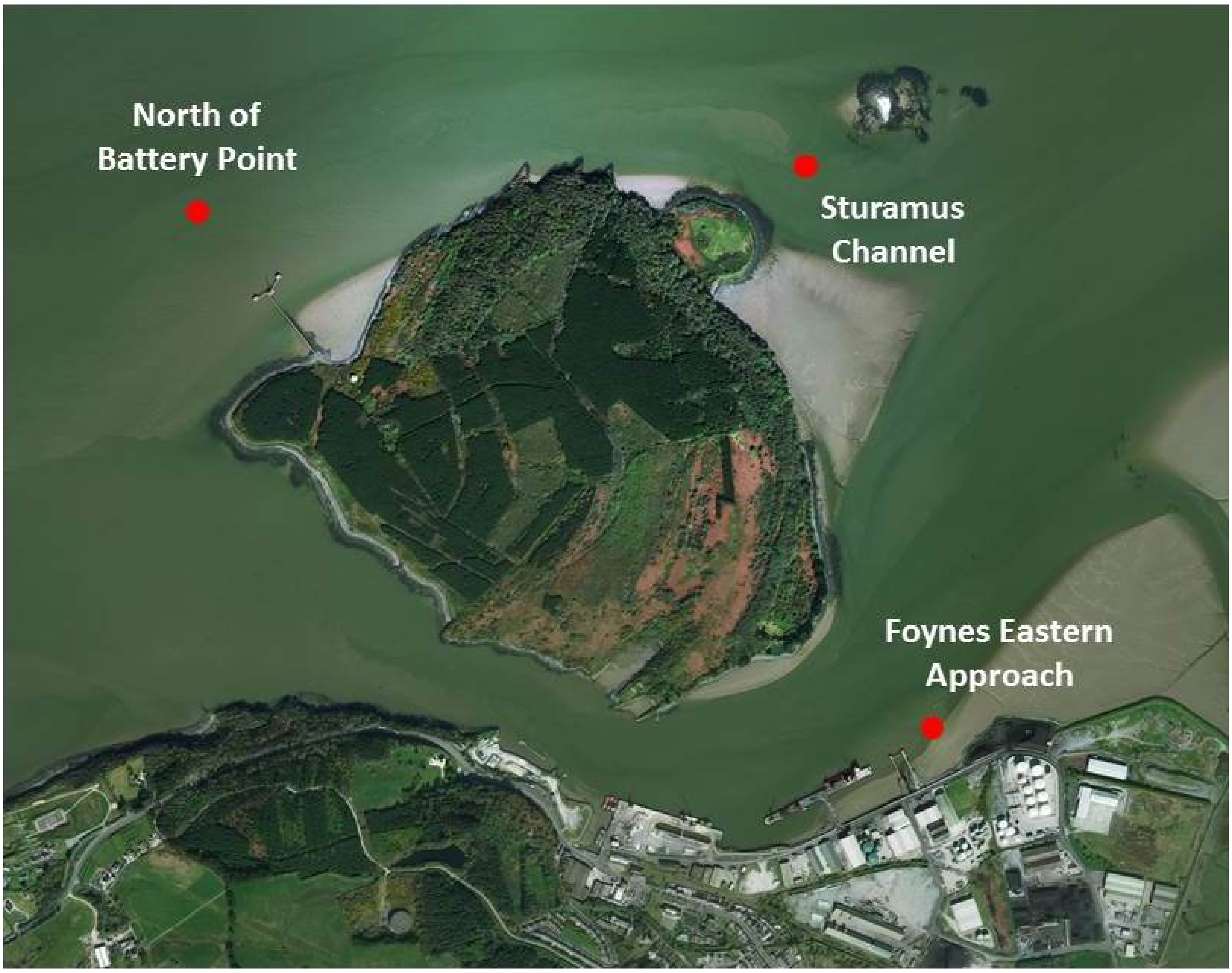


Figure 12.9 Location of Tidal Current Monitoring Points (2010 study)

Figure 12.10 to Figure 12.15 show the comparison between the measured data and the model data at each of the monitoring locations shown in Figure 12.9 for both spring and neap tides. The measured data for current velocity and direction are shown as a series of points (as they are discrete measurements). At each location surface, middle and bed measurements were collected to describe the water column; however for the purposes of this calibration, the readings from the middle of the water column were considered the most representative to be compared with the model results.

The simulated data is presented as a continuous trace which presents the depth averaged value of either current speed or direction at the corresponding location within the model domain.

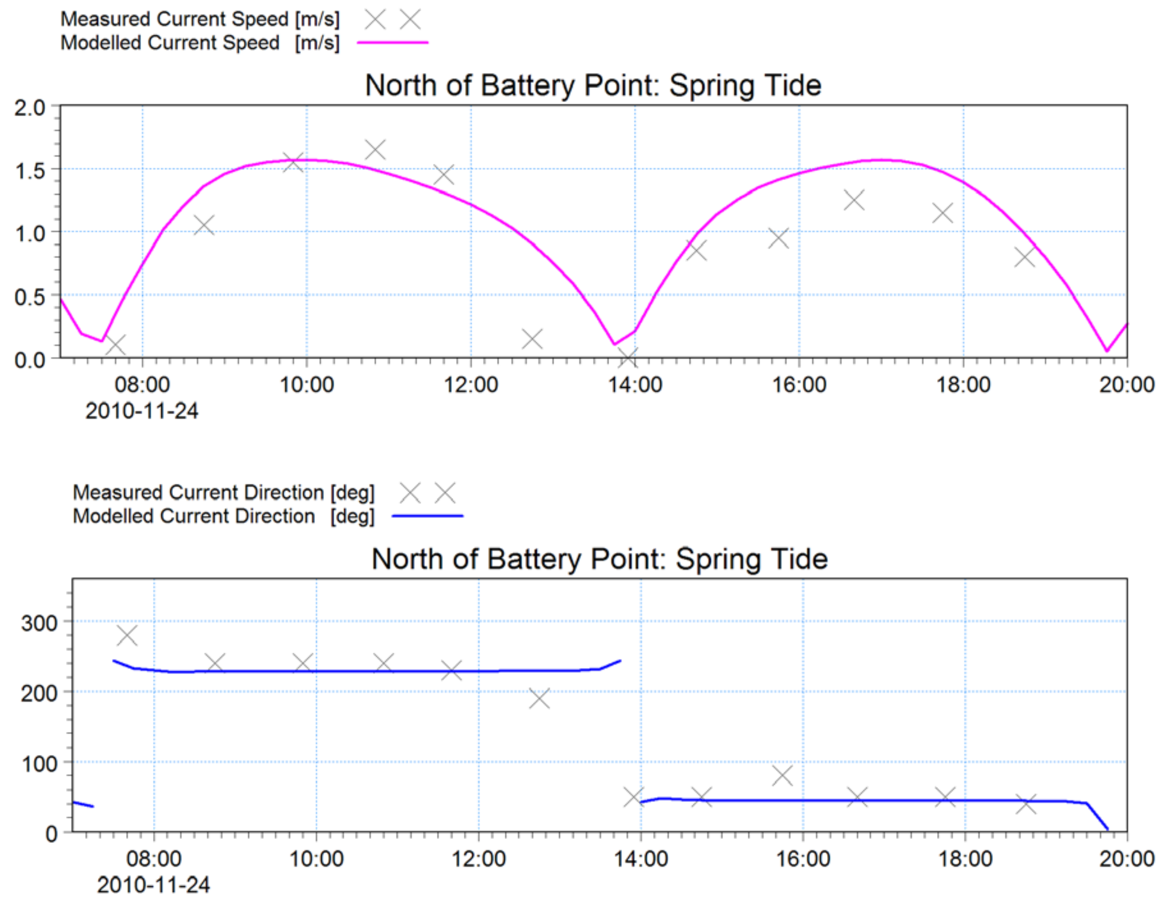
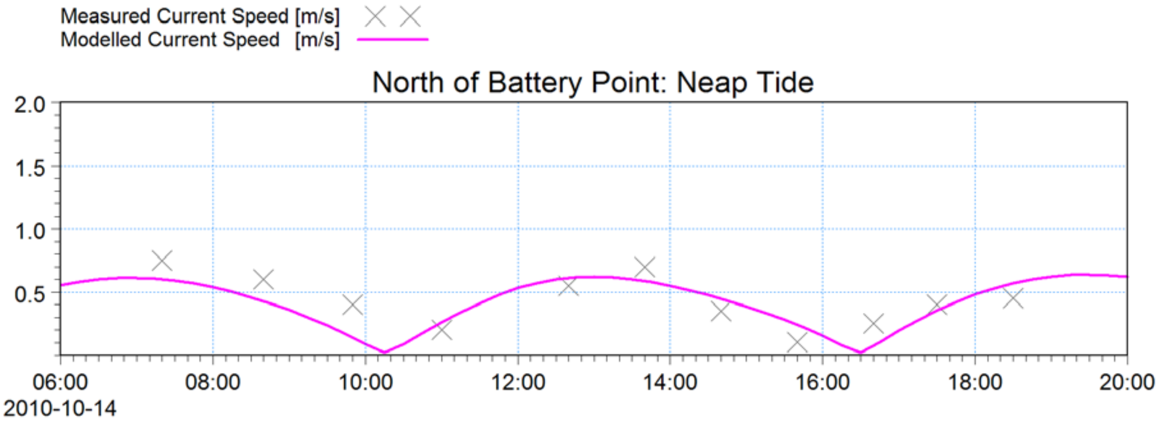


Figure 12.10 Current speed (top) and Current direction (bottom) North of Battery Point – Spring Tide



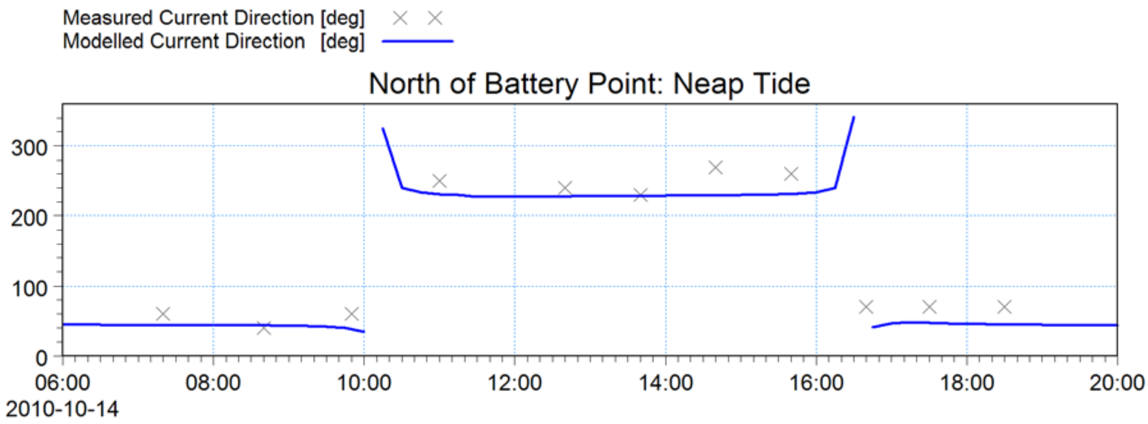
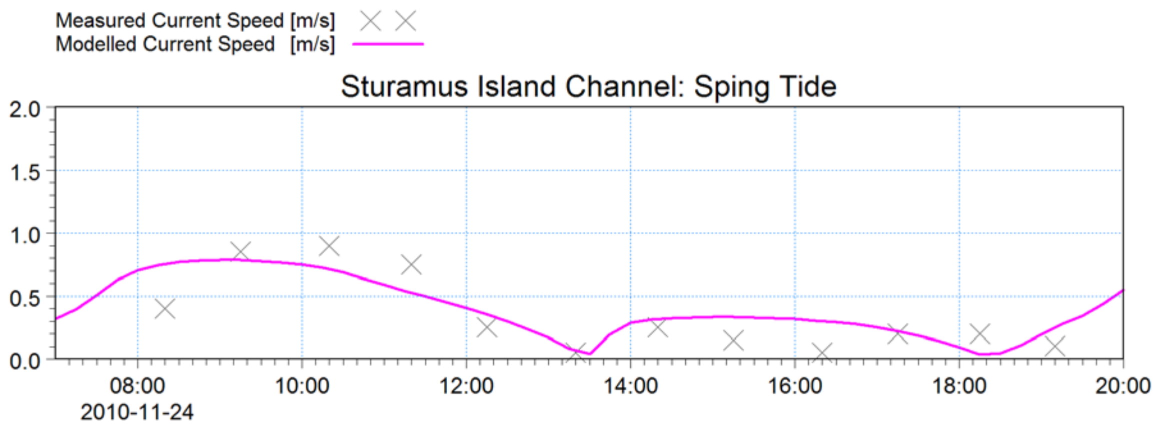


Figure 12.11 Current speed (top) and Current direction (bottom) North of Battery Point – Neap Tide



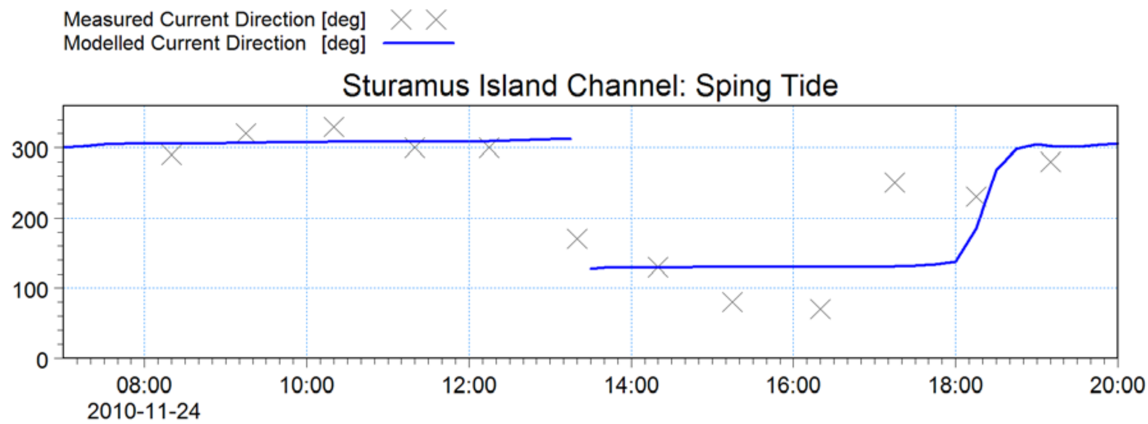


Figure 12.12 Current speed (top) and Current direction (bottom) Sturamus Channel – Spring Tide

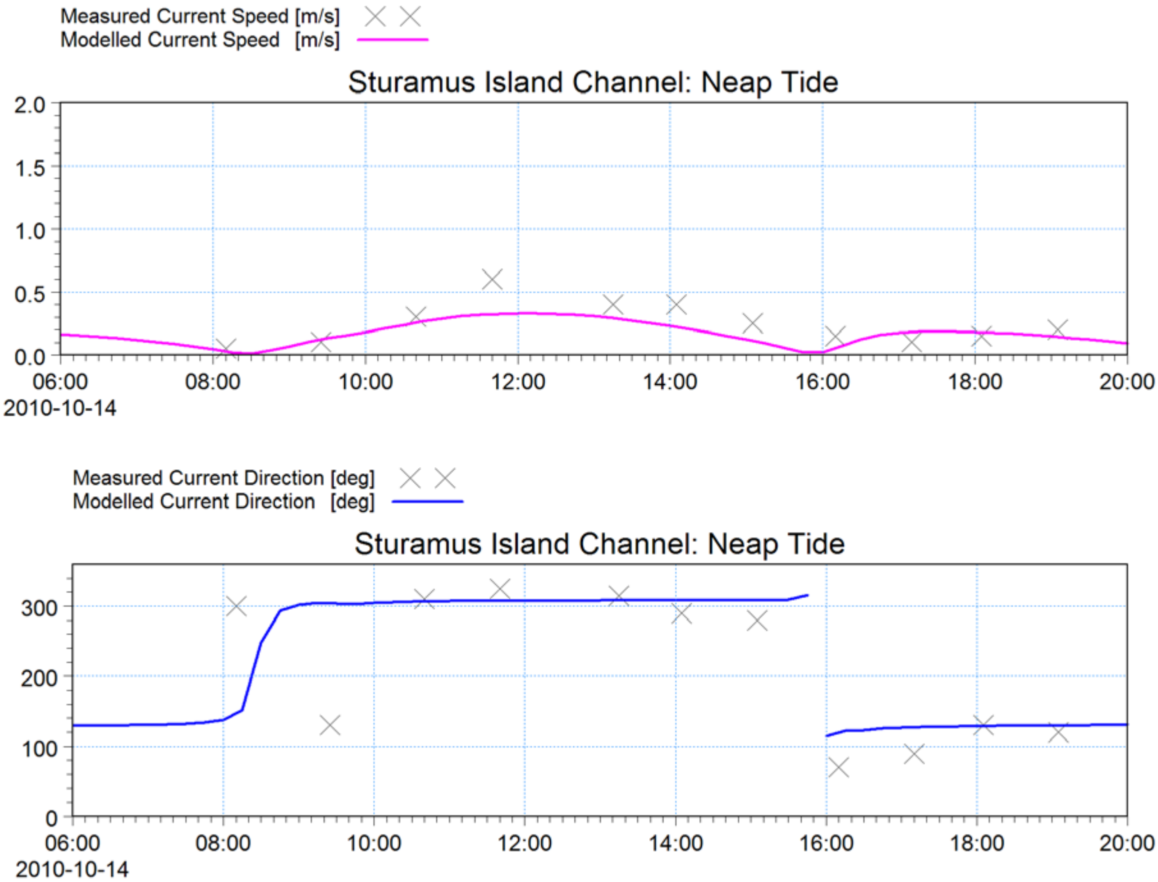
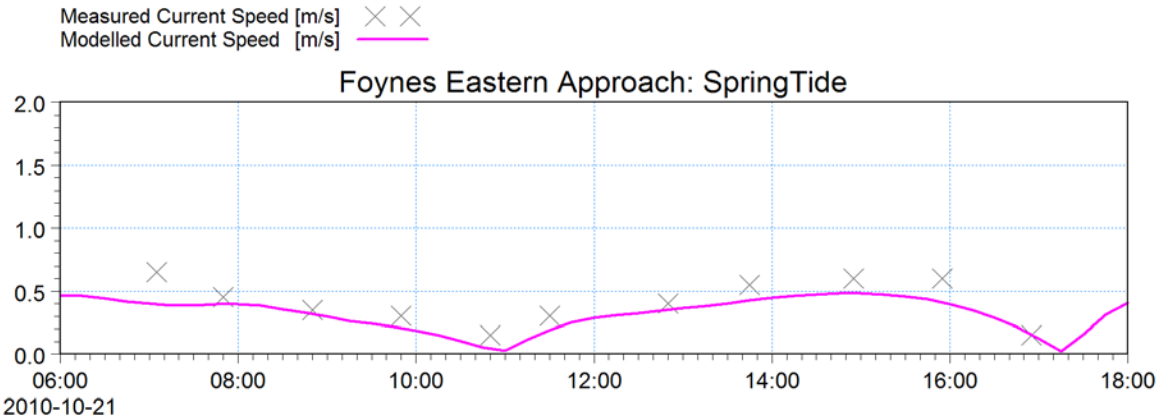


Figure 12.13 Current speed (top) and Current direction (bottom) Sturamus Channel – Neap Tide



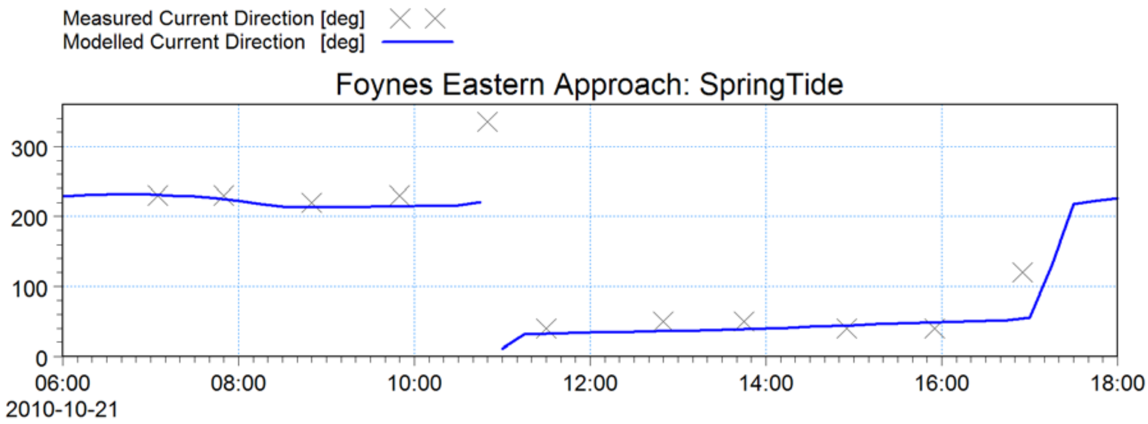
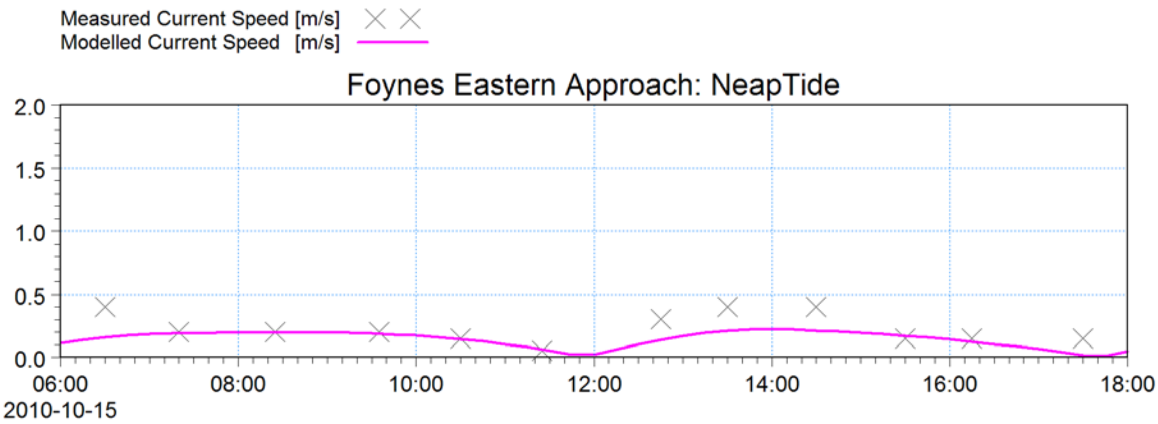


Figure 12.14 Current speed (top) and Current direction (bottom) Eastern Approach Durnish Point – Spring Tide



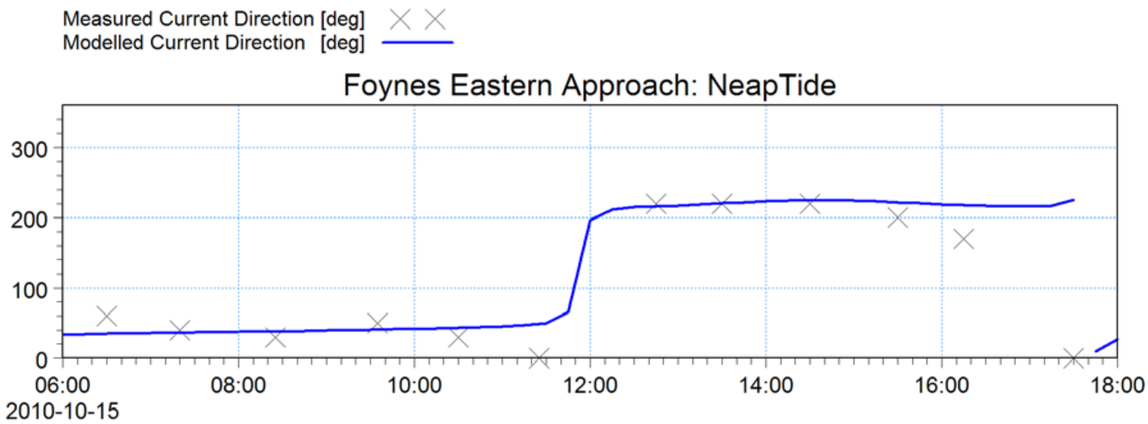


Figure 12.15 Current speed (top) and Current direction (bottom) Eastern Approach Durnish Point – Neap Tide

This first point was located at the north west of Foynes Island in around 23m of water. Both spring and neap flows, shown in Figure 12.10 and Figure 12.11 respectively, show similar flow patterns. There are clearly defined south westerly tidal currents on the ebb tide and north easterly tidal currents on the flood tide. In both cases a good correlation has been achieved between the measured and simulated data, with the predicted current speed and directions falling within the range of those measured.

The second point is located at the north east of Foynes Island, close to Sturamus Island in a water depth of circa 10m. Shallower water along with drying banks to the north east and south west of this site gives rise to eddying in the vicinity. Figure 12.12 and Figure 12.13 show the measured and simulated data for this site during spring and neap tides. In both cases, the tidal flow runs in a north westerly direction on the ebb tide and a south easterly direction on the flood tide, however much higher current velocities occur on the ebb tide than the flood tide. Agreement between the modelled and observed data is reasonable considering the high level of variability in the shallow waters and the tidal asymmetry is captured within the model.

Figure 12.14 shows the spring tide and Figure 12.15 the neap tide currents for the final site to east of Port, close to Durnish Point. This meter was sited in around 8m of water with the tidal currents flowing in a north easterly direction on the flood tide and a south easterly direction on the ebb tide. The extraction point from the model was located slightly further offshore to avoid the direct influence of the reclamation which was not present at the time of monitoring. Even so, the model shows good correlation in current speed at this location on both the spring and neap tides.

To provide an overview of the receiving waters typical spring tidal flow patterns are presented in the following figures. Figure 12.16 and Figure 12.17 show the flood tidal flow patterns for the Foynes Island region and Port channel areas respectively. Similarly Figure 12.18 and Figure 12.19 show the corresponding ebb tidal flow patterns for the two model areas. The detailed plots given demonstrate the tidal flows in both the Port channel and the nearshore area; with a number of areas in which localised tidal eddies occur due to the presence of partially submerged rock outcrops and plateaux.

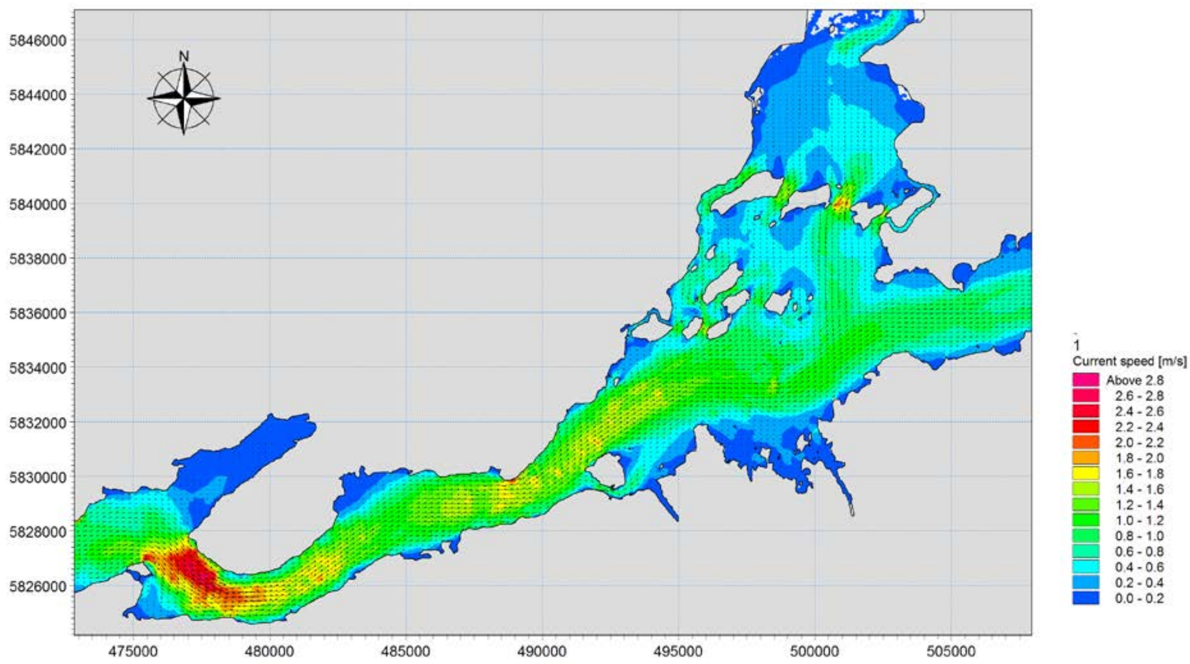


Figure 12.16 Flood tide pattern inner Shannon Estuary – Spring Tide

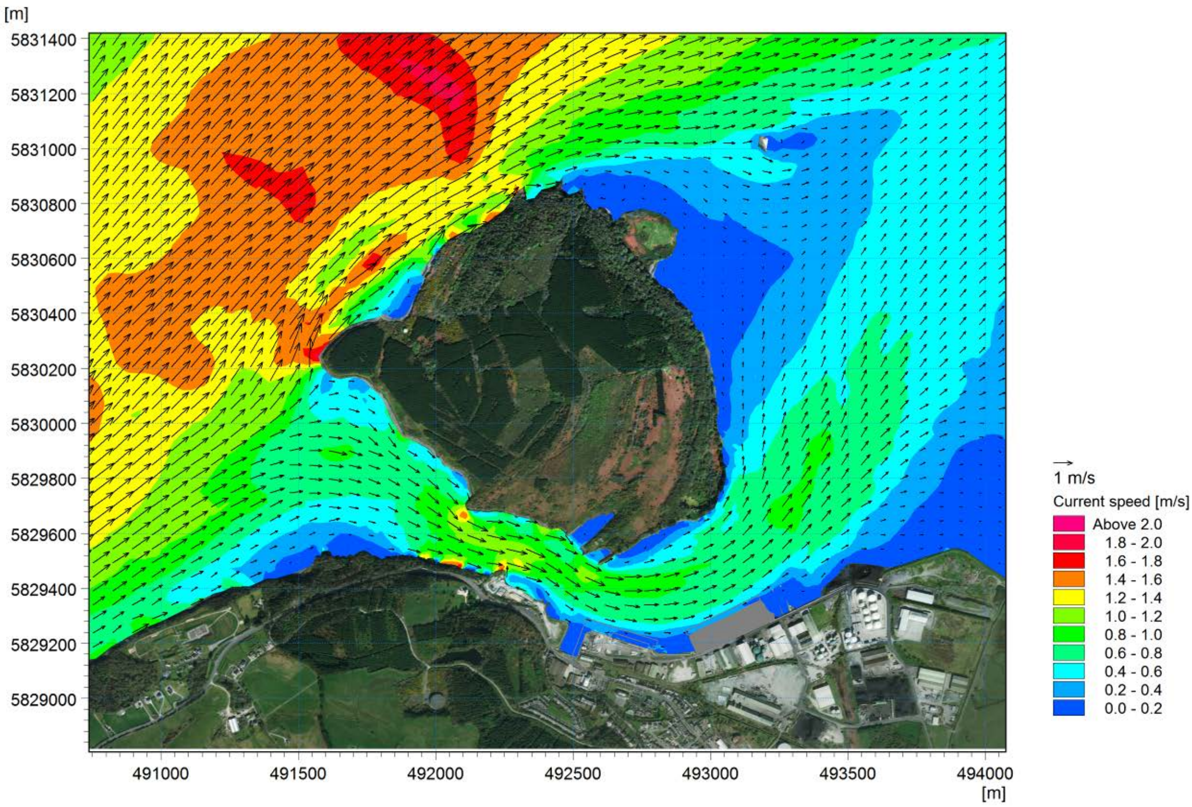


Figure 12.17 Flood tide pattern for area of interest – Spring Tide

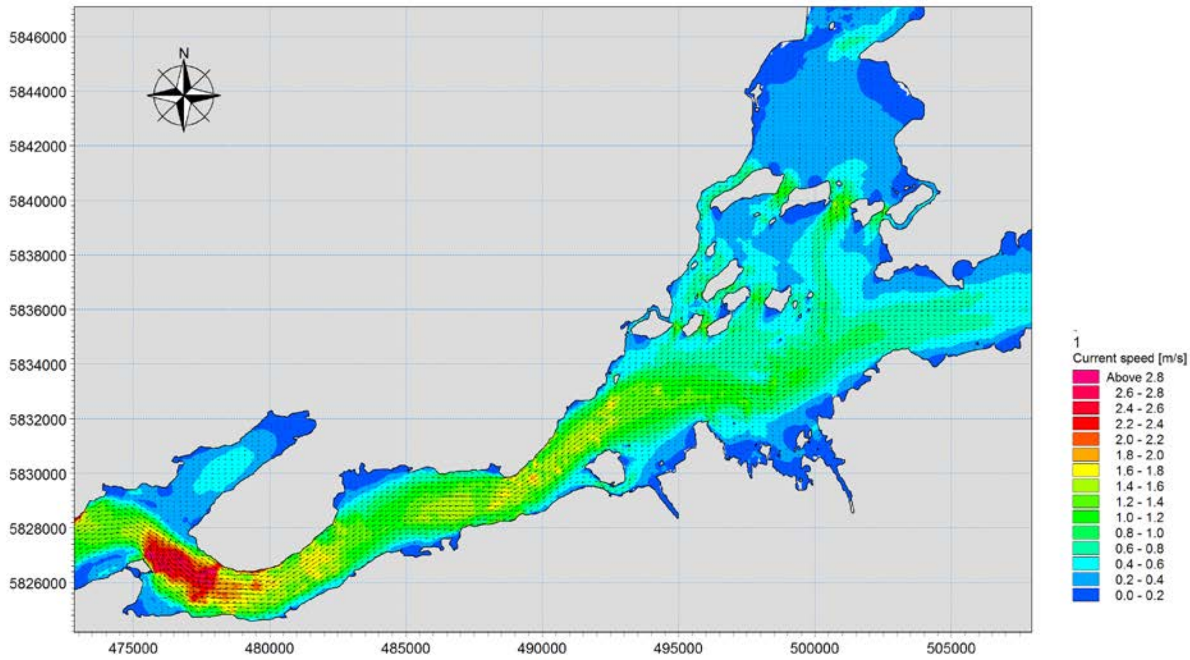


Figure 12.18 Ebb tide pattern inner Shannon Estuary – Spring Tide

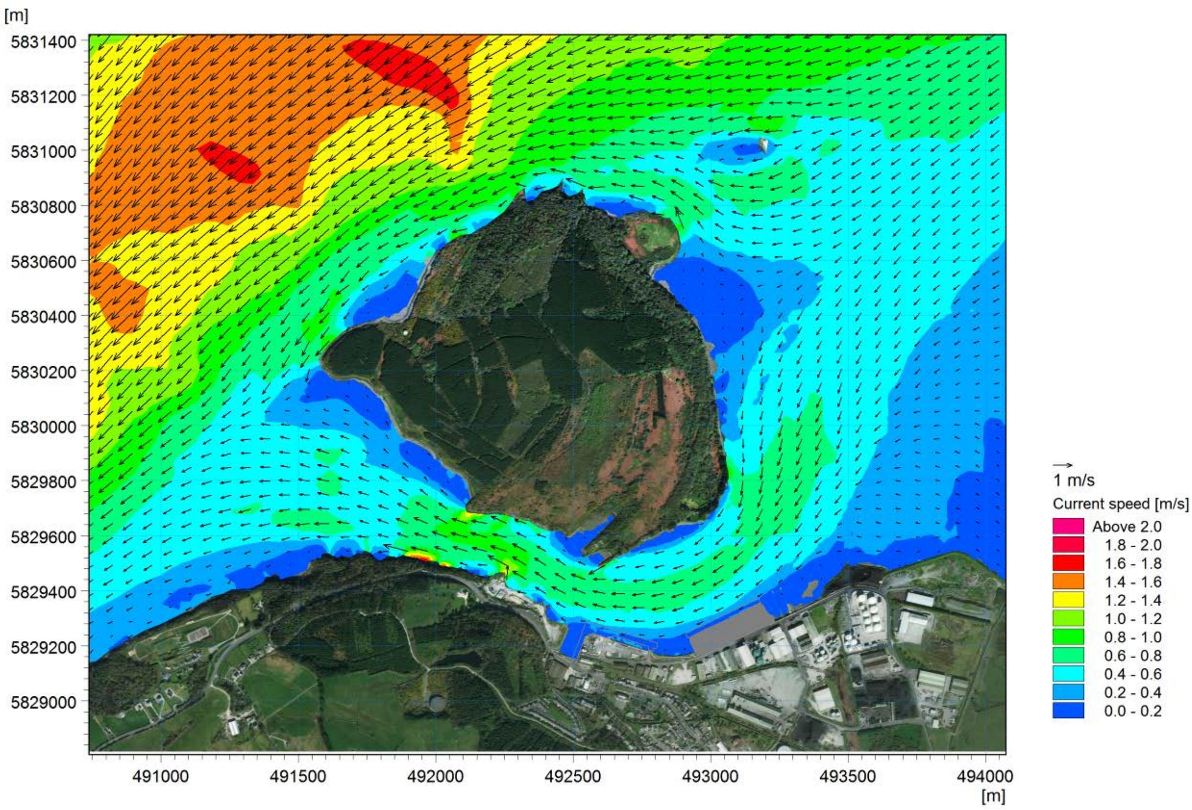


Figure 12.19 Ebb tide pattern for area of interest – Spring Tide

12.3 LIKELIHOOD OF IMPACTS

The impacts of construction schemes are generally categorised under construction phase, operational phase and cumulative impacts. The proposed jetty extension is to be constructed as an open piled structure to allow tidal circulation to continue therefore the impacts to tidal currents and coastal process have been minimised within the design stage of the project. The prior scenario layout included the reclamation works currently being undertaken behind the east jetty as the proposed jetty extension will provide additional shore-side access to this area. The impact on coastal process of the reclamation work was examined and data submitted under permission 12/212. Therefore the cumulative impact with the east jetty reclamation is intrinsic and included within the current assessment.

The modelling presented within this Chapter incorporated the 69 additional piles in the locations outlined within the preliminary design drawings therefore alteration in tidal flows will occur albeit of a very limited nature. This is particularly the case as the additional piers are to be located in an area where some 200 piers are already present. There are no further developments planned within the marine or inter-tidal domain in the vicinity of the jetty extension.

In terms of coastal processes and changes to tidal currents, these will occur incrementally as each pile is installed until the operational stage is reached at the end of the 10 month construction plan. Construction will be undertaken using a jack-up barge therefore plant will cause little or no interference to flow patterns as there will be no temporary structures such as bunds restricting tidal flow.

12.4 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

The impact of the proposed jetty extension was simulated by including the additional piles within the model. It was not necessary to change model bathymetry as the jetty location is currently maintained to the required depth and the modelling scenario includes the completed east jetty reclamation. Comparisons of the tidal flow conditions throughout the area were made to assess the impact of the additional structures.

The following figures consist of the peak flow pattern prior to the work and the subsequent differences after the pier installation at the same point in time. The plots of prior ebb and flow patterns are consistent with those presented in the previous section (i.e. Figure 12.17 and Figure 12.19) but are reproduced here to enable examination in conjunction with the difference plots. The period of peak flow during spring tide showed the greatest impact and at other times the influence is significantly less and in many cases imperceptible. Therefore only peak spring tides are presented in this document.

Figure 12.20 and Figure 12.21 show the before situation and changes to current speed following construction during the flood tide respectively. These changes are extremely localised and a closer view is required to examine them. Figure 12.22 and Figure 12.23 show the same data in the Port area. It can be seen that the changes in tidal currents are restricted to the immediate vicinity of the structure and limited to less that 10mm/s.

The ebb current plots for the wider domain are shown in Figure 12.24 and Figure 12.25 whilst the Port is shown in Figure 12.26 and Figure 12.27. In the case of ebb tides the changes in currents are even smaller due to the location in the lee of the reclamation and also due to the alignment of the existing east pier piled structure.

It may be concluded that the installation of the additional piles to facilitate the jetty extension will have very little effect on tidal currents and therefore negligible impact on coastal processes. There may be some circulation around the structures themselves and in the shallow area behind the jetty extension however this is in line with the existing surrounding piled structures and reclaimed areas.

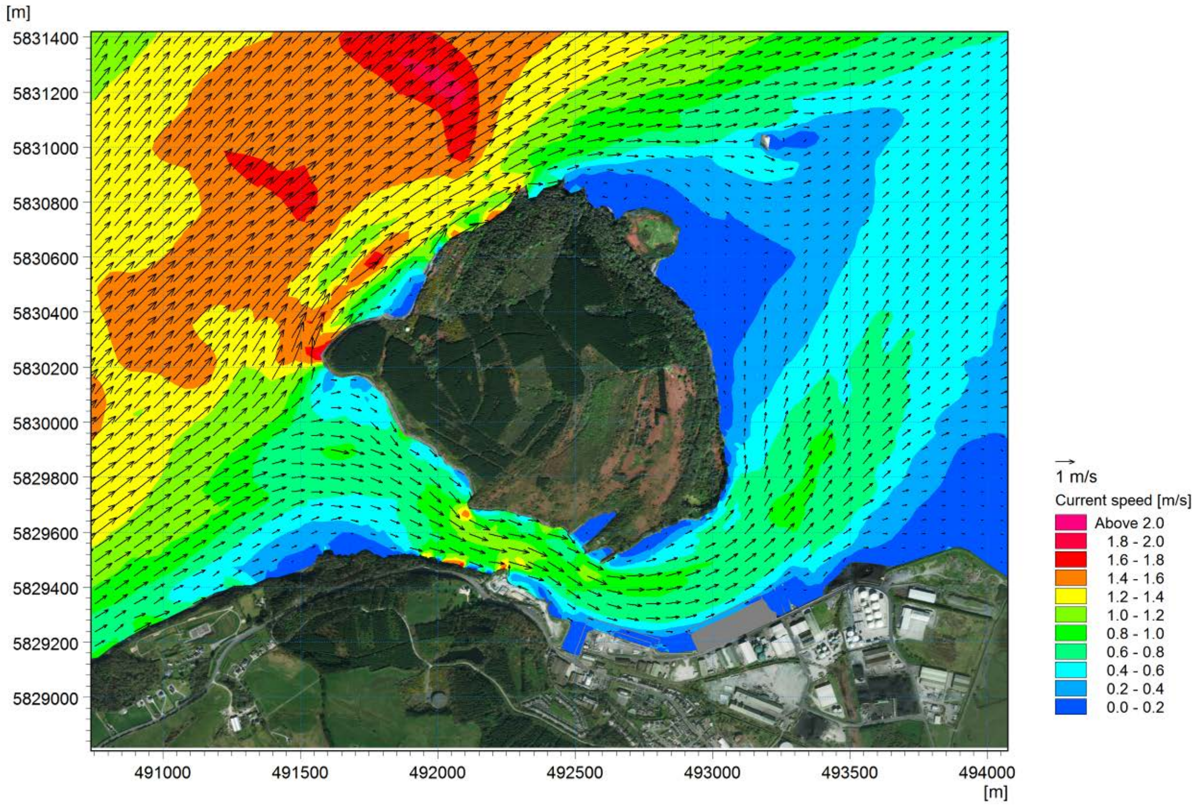


Figure 12.20 Peak spring flood flow pattern Foynes Island – Before Development

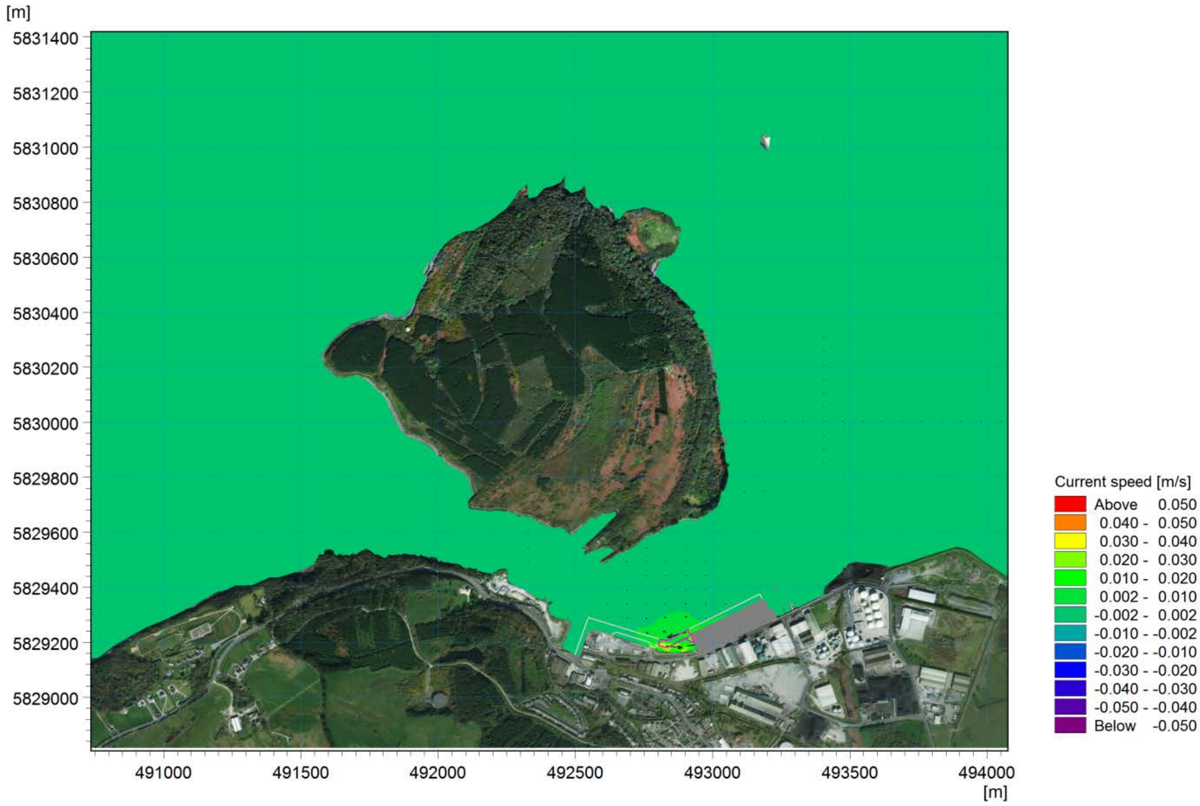


Figure 12.21 Difference in peak spring flood current velocity Foynes Island – Proposed development minus existing

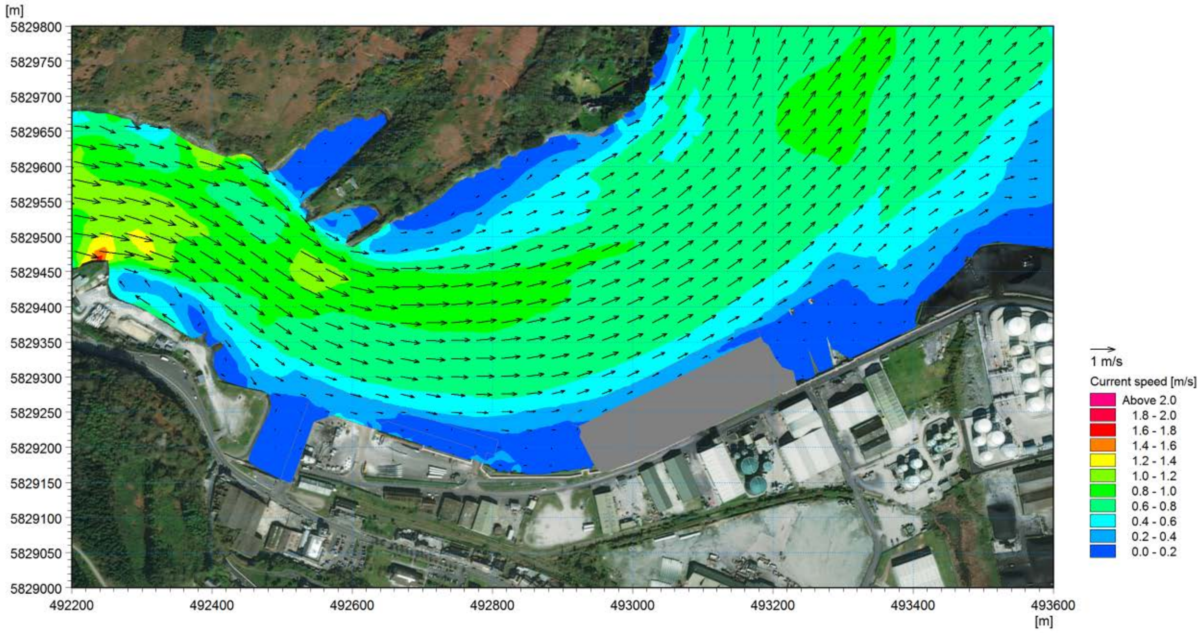


Figure 12.22 Peak spring flood flow pattern Foynes Port – Before Development

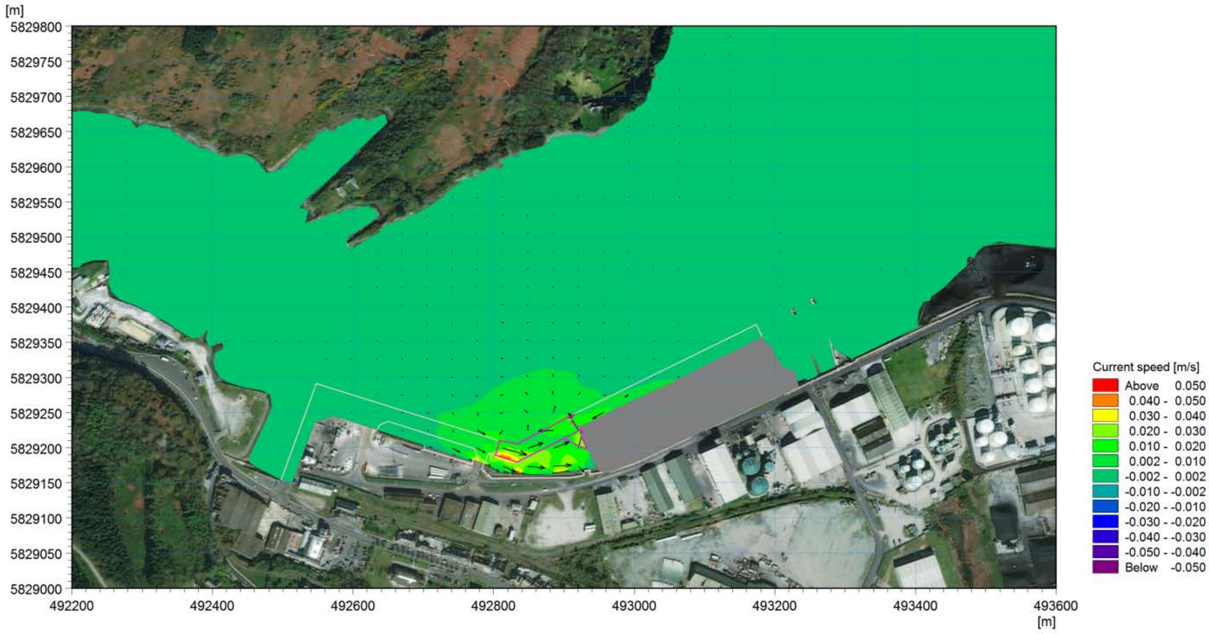


Figure 12.23 Difference in peak spring flood current velocity Foynes Port – Proposed development minus existing

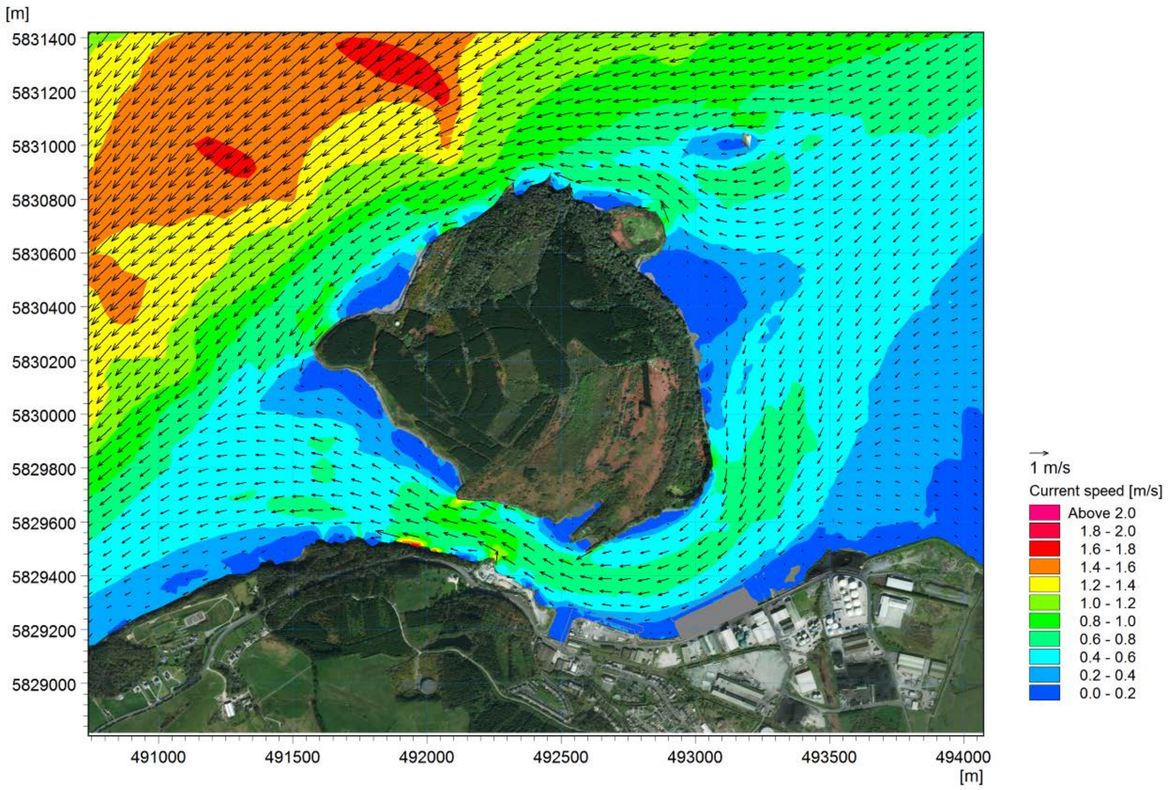


Figure 12.24 Peak spring ebb flow pattern Foynes Island – Before Development

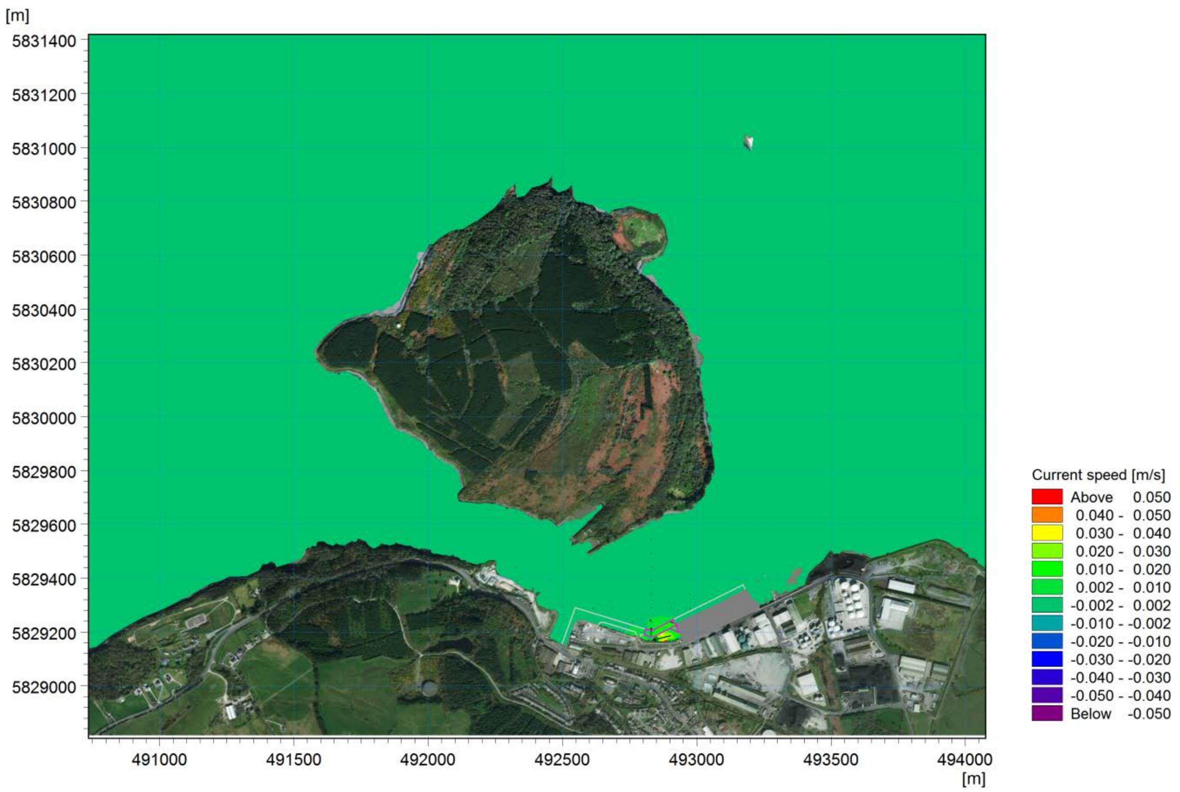


Figure 12.25 Difference in peak spring ebb current velocity Foynes Island – Proposed development minus existing

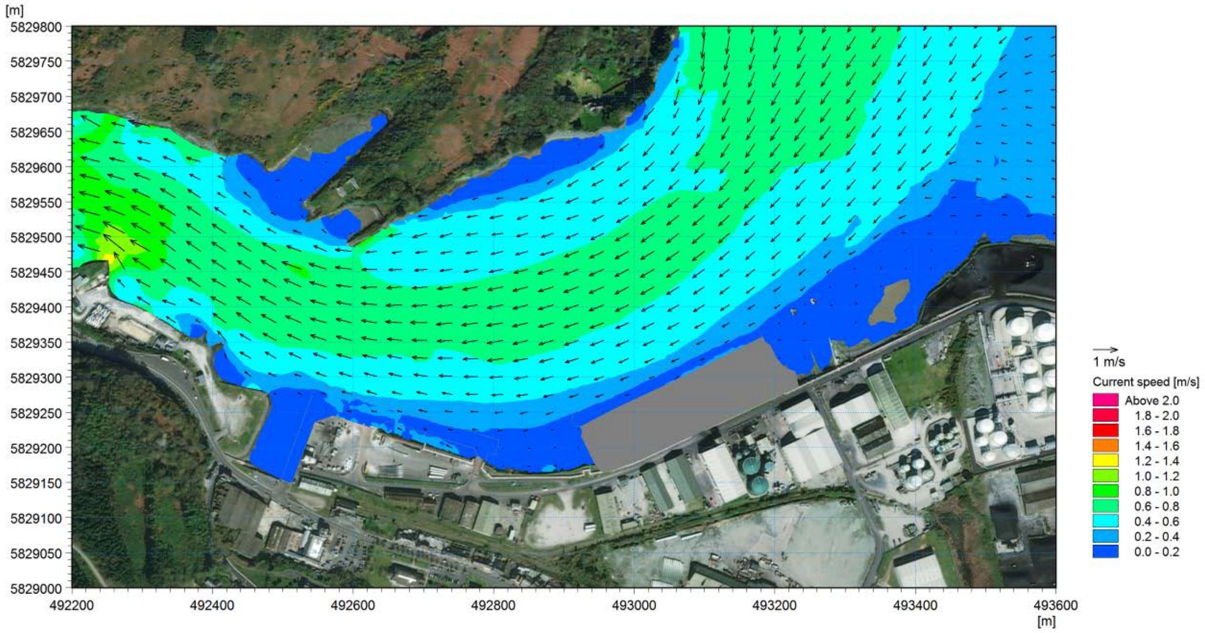


Figure 12.26 Peak spring ebb flow pattern Foynes Port – Before Development

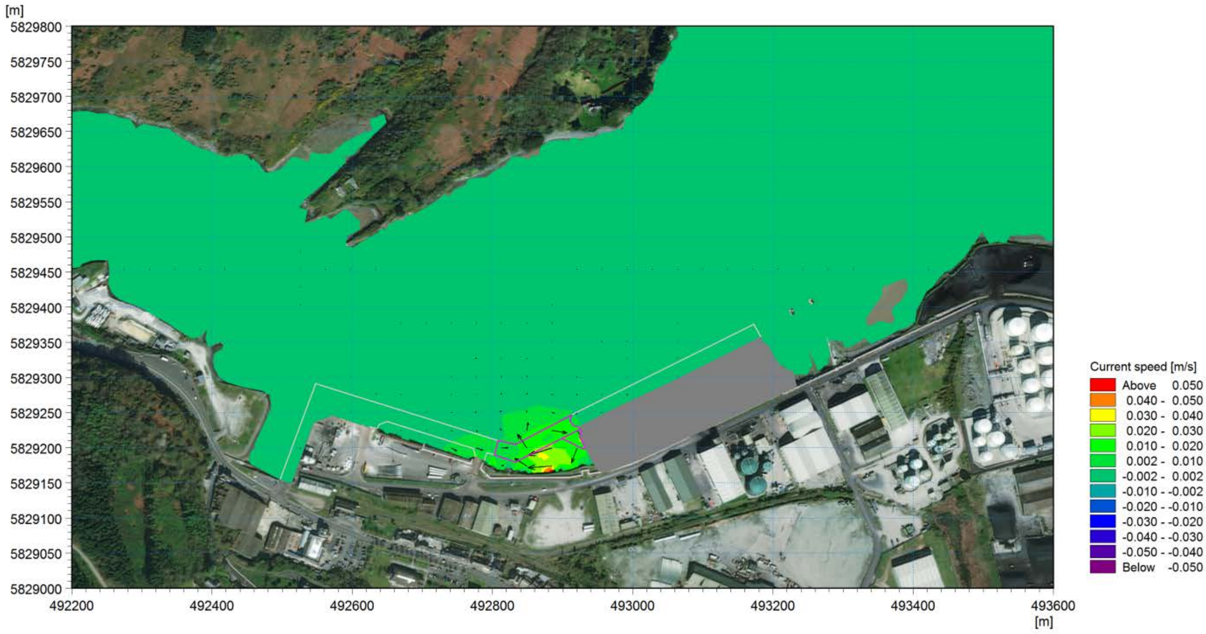


Figure 12.27 Difference in peak spring ebb current velocity Foynes Port – Proposed development minus existing

12.5 REMEDIAL AND MITIGATION MEASURES

The proposed jetty extension is to be constructed as an open piled structure to allow tidal circulation to continue therefore the impacts to tidal currents and coastal process have been minimised within the design stage of the project. The modelling presented in this chapter has demonstrated that the remaining impacts will be negligible and therefore further remedial or mitigating measures are unnecessary.

12.6 RESIDUAL IMPACT

The long term impact of the jetty extension would be small scale low magnitude changes in tidal currents at the pier locations. The area behind the jetty may experience circulation however this is consistent with the existing pile array associated with the east and west jetties. The limited nature of the changes in flow, with respect to existing tidal currents, are such that these variations would not have an adverse effect on the receiving environment.

12.7 MONITORING

In terms of coastal processes the predicted impacts on tidal currents during both the construction and operational stages are well within the natural variability of tidal flows and therefore monitoring would be neither necessary nor effective.

13 TRAFFIC AND TRANSPORT ASSESSMENT

13.1 INTRODUCTION

Figure 13.1 –Shannon Foynes Port

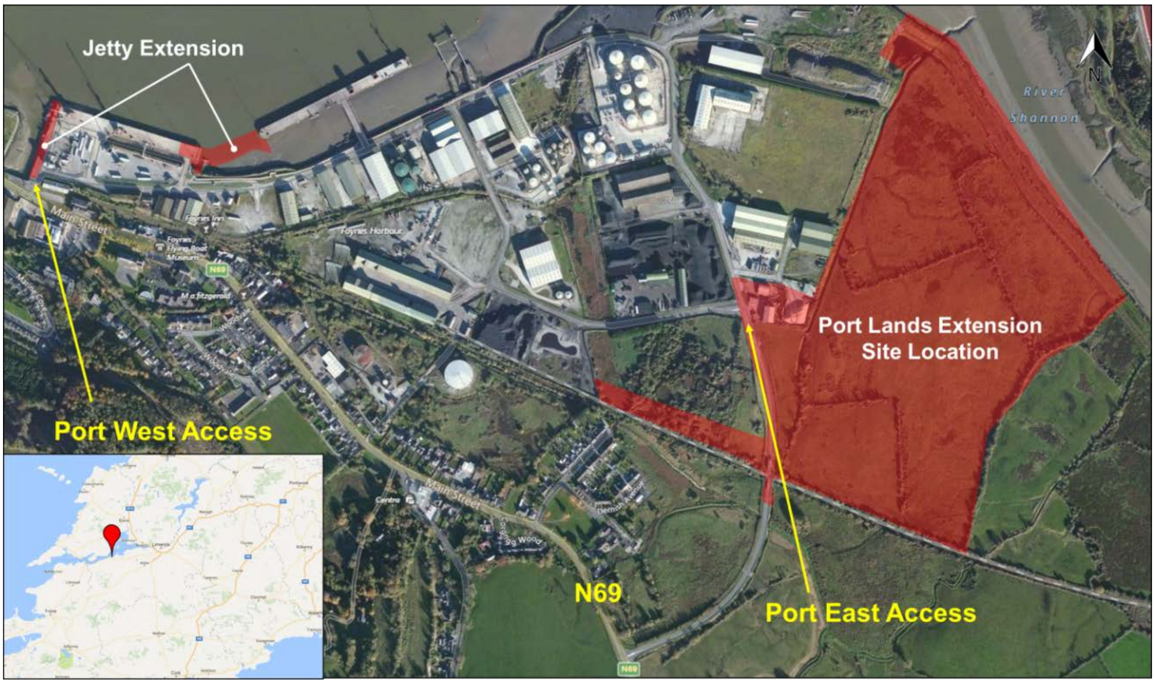
RPS was commissioned by Shannon Foynes Port Company (SFPC) to prepare a Traffic and Transport Assessment (TTA) chapter within this EIAR, for the proposed expansion of Shannon Foynes Port in Foynes, Co. Limerick.

Shannon Foynes Port, illustrated in **Figure 13.1**, is the principal Deepwater general purpose terminal on the Estuary and caters for dry bulk, break bulk, liquid and project cargoes.

Shannon Foynes Port is categorised as a Tier 1 Port of National Significance under the Department of Transport, Tourism and Sport's National Ports Policy (2013) document, with clear potential to lead the development of future port capacity in the medium and long term.

The TTA has been completed in support of a planning application for a jetty extension and extension of the existing port lands to the east, which will accommodate an aspirational increase in port activity tonnage throughout as set out by SFPC. The site location is indicated in **Figure 13.2.**

Figure 13.2 – Site Location



13.1.1 Site History

SFPC was formed in 2000, resulting from the merger of the former Shannon Estuary Ports and Foynes Port companies; these in turn were originally formed in 1996 following the Harbour's Act of that year, which provided for the establishment of statutory port companies, free to operate independently with a strong commercial remit, while ownership was retained by the State.

With port facilities at Foynes, Limerick Docks and Shannon Airport and with commercial jurisdiction over marine activities on a 500 km^2 area on the Shannon Estuary, SFPC is Ireland's largest bulk port and second largest port based on tonnage.

SFPC specialises in bulk cargoes, which constitute more than half the cargoes transiting Irish ports. SFPC accounts for more than 37% of all bulk cargoes in the Republic (Irish Marine Development Office 2016). Typical cargoes include liquid fuels and chemicals, ores, coal and other energy products, agri-business inputs such as animal feedstuffs and fertilisers, recyclable materials and various project cargoes, including wind turbines for wind energy projects.

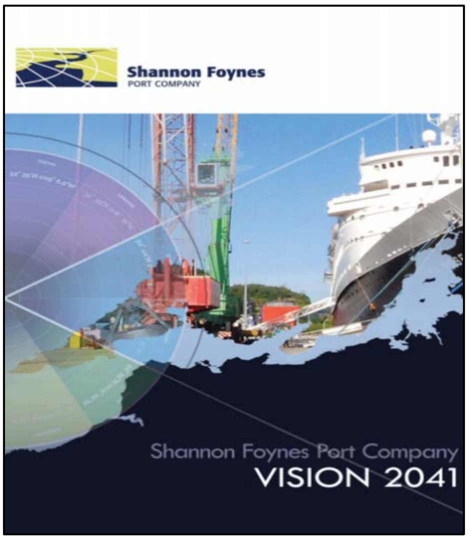
Shannon Foynes Port currently operates 0900-1700 Monday to Friday; however this is largely dependent on the operating times of the tenants and the port has scope to operate 0600-0000 daily.

There have been a number of planning applications within the port over the past 6 years, as the port has expanded; including a smokeless and bio-mass based solid fuel manufacturing and packaging facility, storage areas and numerous other alterations and extensions.

13.1.2 Shannon Foynes Port Company VISION 2041 (SFPC Vision 2041)

SFPC Vision 2041 (February 2013) is a thirty year plan setting out a port development strategy that is aligned with all stakeholder interests. SFPC Vision 2041 identifies the key options needed to work towards the Port's future aspirations, such as:

Figure 13.3 - SFPC Vision 2041



- The provision of a new Deepwater berth (circa 15m draft) at Foynes and the continued expansion of existing infrastructure at Foynes in order to capitalise on the trend toward larger vessels;
- The promotion of the nine strategic deep water sites identified in the Strategic Integrated Framework Plan for marine related investment;
- The attainment of land zoning to facilitate port expansion;
- The diversification of noncore assets at Limerick by promoting a themed designation such as the Marine Energy Park;
- Effective utilisation of existing assets will be a key component in future land strategy and in planning the expansion of Port infrastructure; and

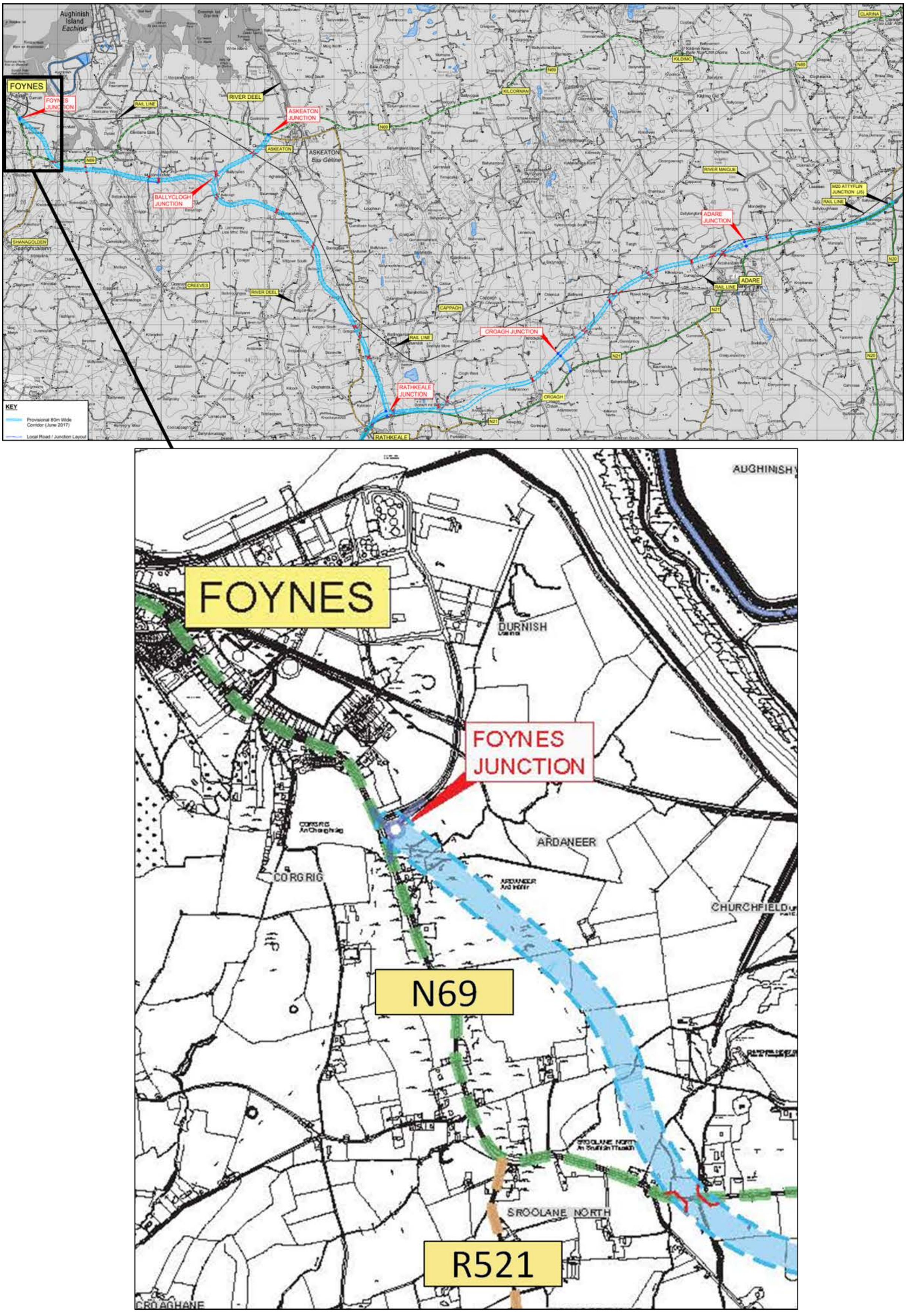
- Improving the visual appearance of Limerick Docks and Foynes Port as well as enhancing the relationship with local communities by introducing various public awareness initiatives.

13.1.3 Foynes to limerick road improvement scheme

Foynes town centre is bisected by the N69, which connects Foynes to Limerick in the east and Tralee in the west, including a number of settlements in between. Limerick City and County Council (LCCC) in consultation with Transport Infrastructure Ireland (TII) have aspirations to provide a road improvement scheme, which connects Foynes to Limerick, as well as other roads through county Limerick as indicated in **Figure 13.4**. The scheme is to provide a high quality road to connect the Port of Foynes with the M20 at Limerick and will provide a bypass of Ardare in addition to a link to Shannon Foynes Port from the new N21. The scheme is currently at planning stage.

A junction capacity assessment for the Foynes Junction highlighted in **Figure 13.4** has been included within this report as requested by LCCC during pre-application discussions. The details of the assessment are set out within the traffic impact assessment in **Section 13.4** of this report.

Figure 13.4 – Foynes to Limerick Road Improvement Scheme Location



13.1.4 Development proposals

The proposed development is separated into two sections:

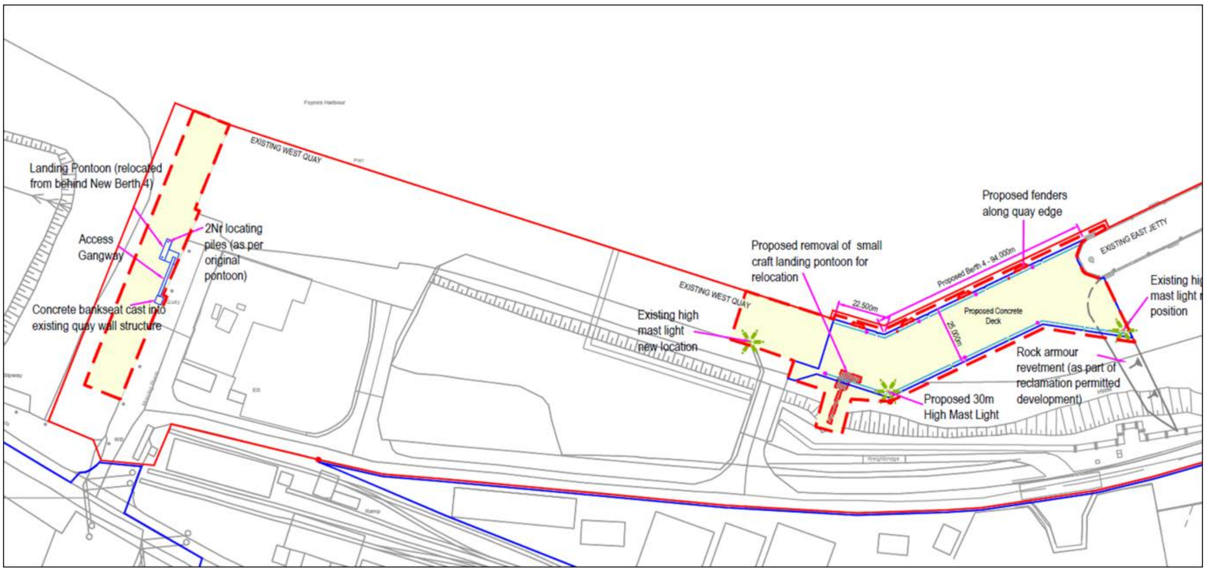
- Jetty Extension; and
- Durnish Lands.

Jetty Extension

The proposed development is located in the near shore region of Shannon Foynes Port between the existing East Jetty and the existing West Quay. The proposed jetty shall connect the existing West Quay to the existing East Jetty by continuing the berthing lines of Berth 5 and Berth 3 to an intersecting point. An indicative layout of the jetty extension site is provided in Figure 13.5 with detailed layout of the proposed jetty extension presented in Appendix 13.1. The proposed jetty extension works include the following:

- Removal and relocation of the existing small craft landing pontoon to an area identified at the west side of the existing West Quay;
- An open pile jetty structure with suspended concrete deck constructed between East Jetty and West Quay, tying into the existing structures; and
- A transition slab to provide access from the open pile jetty structure to the Berth 5 reclamation (permitted development under LCCC planning permission 12/212).

Figure 13.5 – Indicative Site Layout: Jetty Extension



All existing jetty structures will be retained during the works and will continue to be used for berthing, unloading and loading of vessels. Port operations on the jetty extension will be as per the existing jetties, and will generally comprise the loading and unloading of vessels using Harbour

Mobile Cranes. Materials handled will vary depending on trade requirements; however, the following is anticipated:

- Construction materials including timber, steel sections reinforcement etc.;
- Project cargoes such as wind turbine components, steel pipes etc.; and
- All types of dry and liquid bulk cargoes.

Durnish Lands

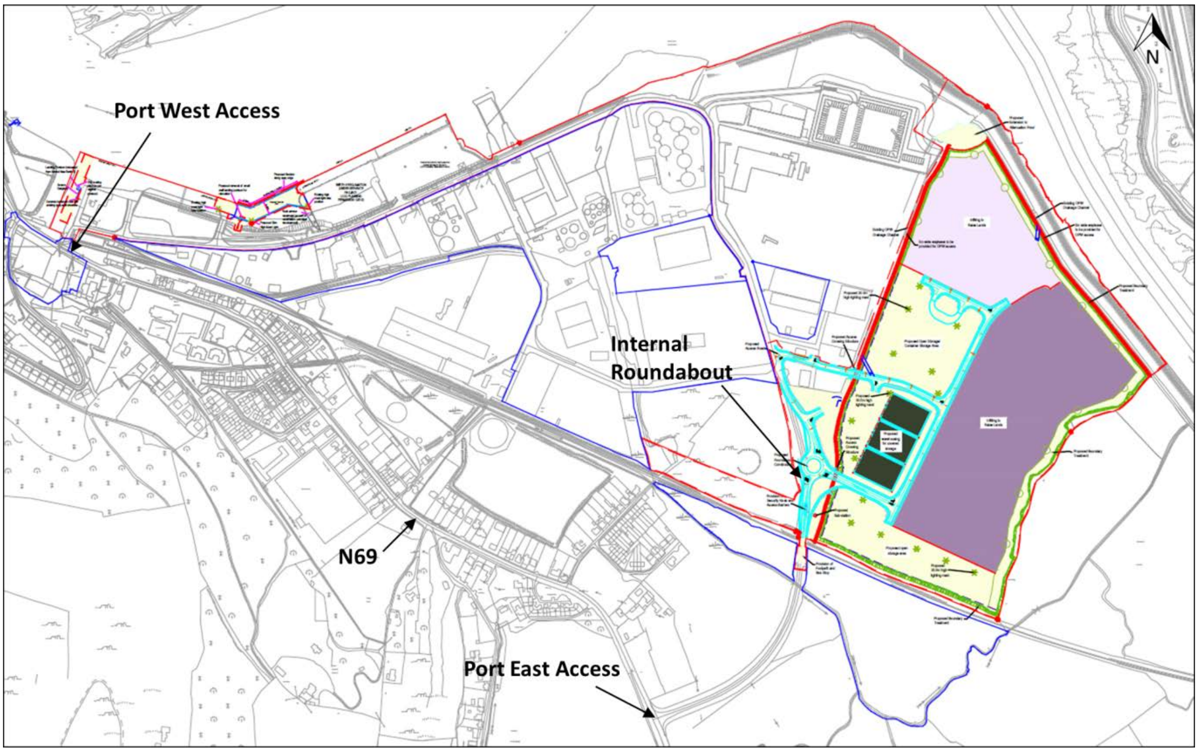
The extent of Durnish Lands associated with the proposed development is located on the eastern side of the port's east access road. The proposed development site is located approximately 1.5km east of the village of Foynes, and is within 500 metres of the N69.

The proposed works to be carried out on the Durnish Lands includes infilling of the existing site with imported fill material to raise the level of the existing above the flood plain, facilitating a mixture of warehousing, storage and port centric development. The proposed development works include:

- Raising of the existing lands to a level of +4.44m OD Malin using imported fill material;
- Roundabout construction to facilitate access to developed lands from main port access road;
- Provision of 2nr bridge structures to facilitate access across existing drainage channel which extends along the Western boundary of the lands;
- Development of internal road and footpath network;
- Appropriate surfacing for open storage and covered storage;
- Erection of warehousing for covered storage; and
- Provision of appropriate boundary treatment, drainage, fencing, lighting and services.

It is proposed that construction activity for the proposed development will last for approximately 39 months, with an estimated completion date of 2029. An indicative layout of the site is provided in **Figure 13.6** and **Appendix 13.1**.

Figure 13.6 – Indicative Site Layout: Durnish Lands

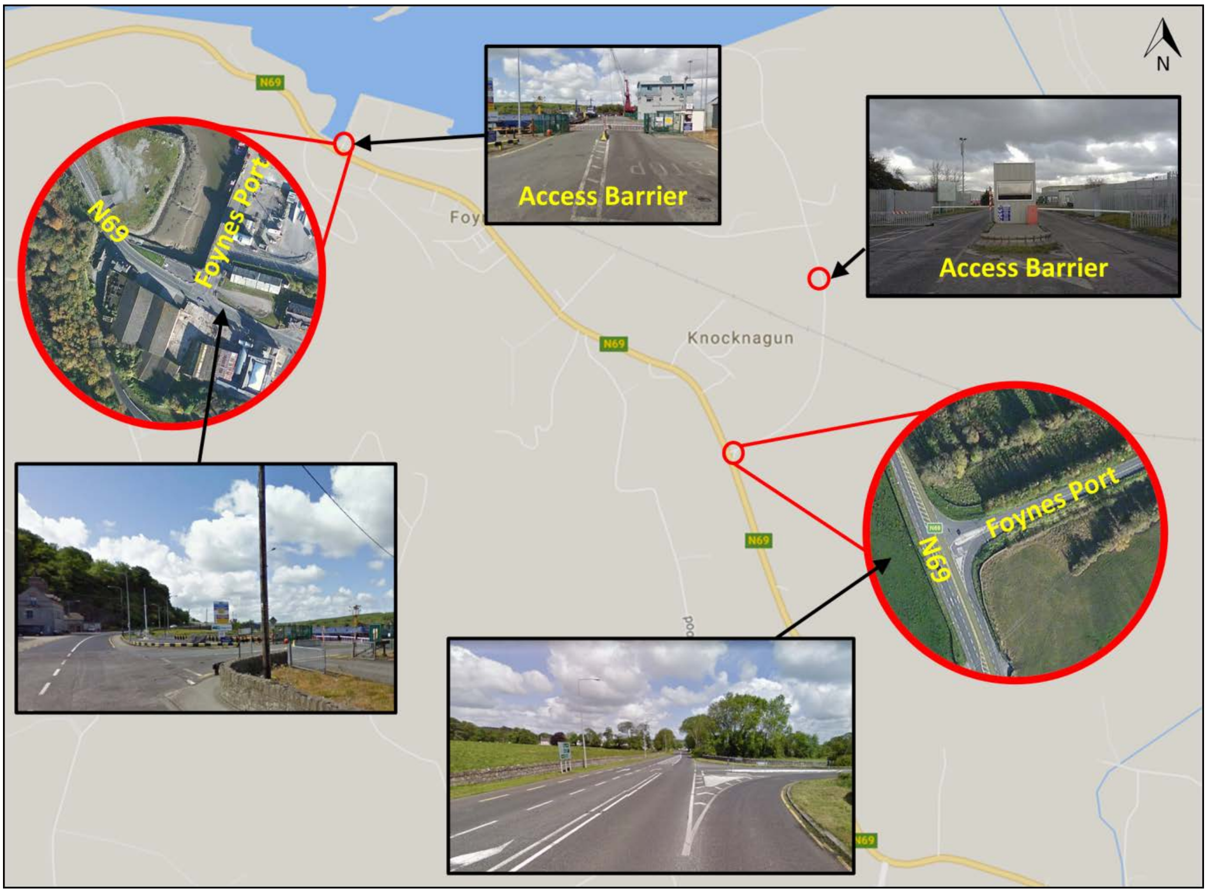


13.1.5 Access Proposals

Existing Port Access

The port is served by two separate vehicle access points, which are connected via an internal road. These two accesses include a security kiosk / access barrier to halt unauthorised public vehicles from entering the port lands. The existing accesses, which consist of two priority junctions on the N69, are shown in **Figure 13.7** and the security kiosk / access barriers are indicated in **Figure 13.8** and **13.9** for the west and east site access respectively.

Figure 13.7 – Site Accesses



The existing internal road carriageway width has been measured at 7.5 metres wide with verges of varying width. The posted speed limit on the port access road is 50kph on the external adopted road section and 20kph within the port lands.

An existing railway crossing is present on the port access road at a location approximately 440 metres from the N69 junction. The crossing is approximately 13 metres wide and with existing rail barriers within the verge.

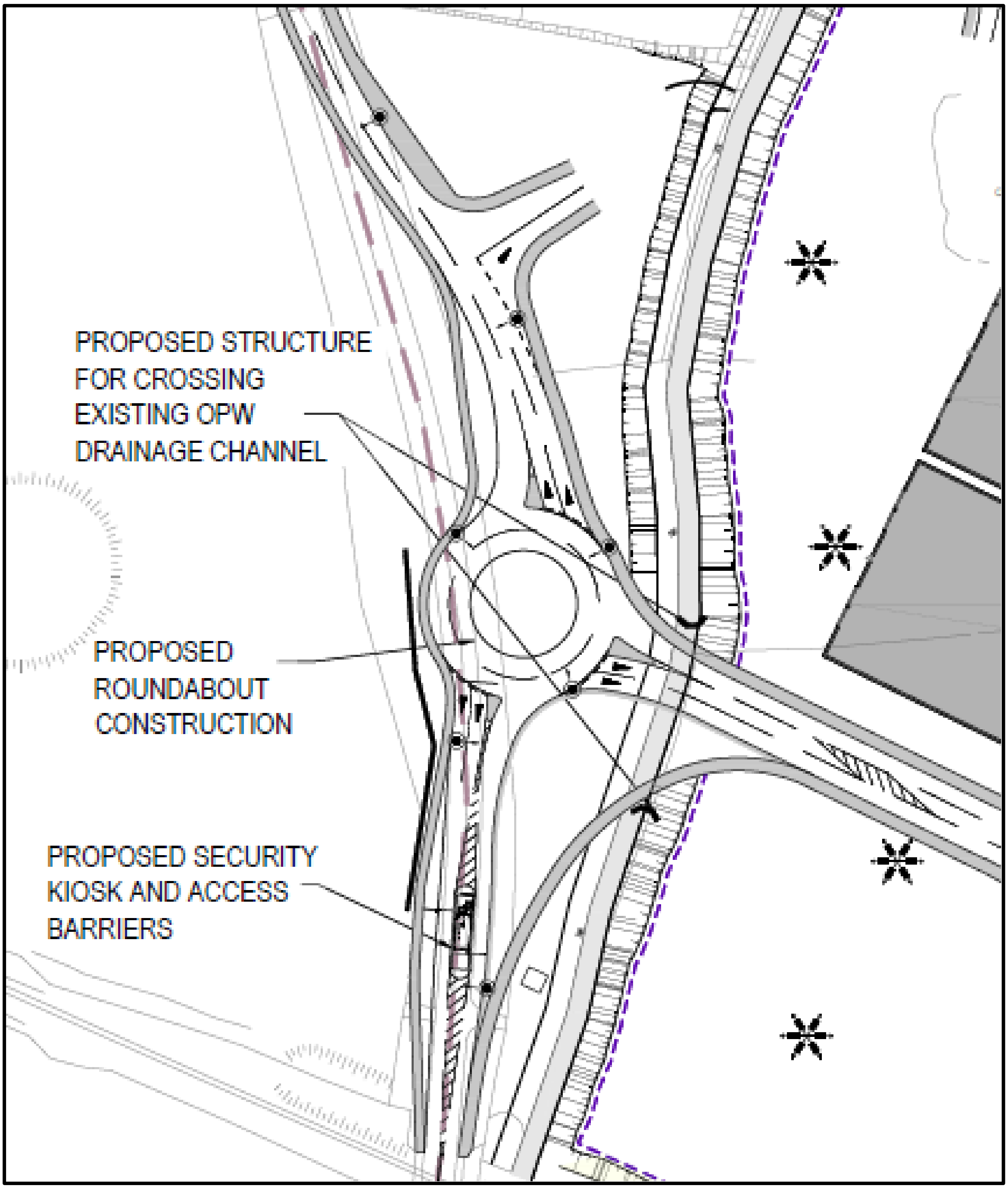
Figure 13.8 – West Site Access: Security Kiosk / Access Barrier

Figure 13.9 – East Site Access: Security Kiosk / Access Barrier

Proposed Port Eastern Access Roundabout

It is proposed that a new access roundabout will be constructed as part of the development, as illustrated in **Figure 13.10,** which has been designed in accordance with the National Roads Authority (NRA) Design Manual for Roads and Bridges (DMRB) Volume 6, Section 2, Part 3 TD 16 and with NRA DMRB Volume 6, Section 1, Part 1 TD 9. The design speed has been assumed to be 50kph based on the posted design speed. A more detailed layout of the proposed access roundabout is included in **Appendix 13.2.**

Figure 13.10 – Proposed Access Roundabout Layout

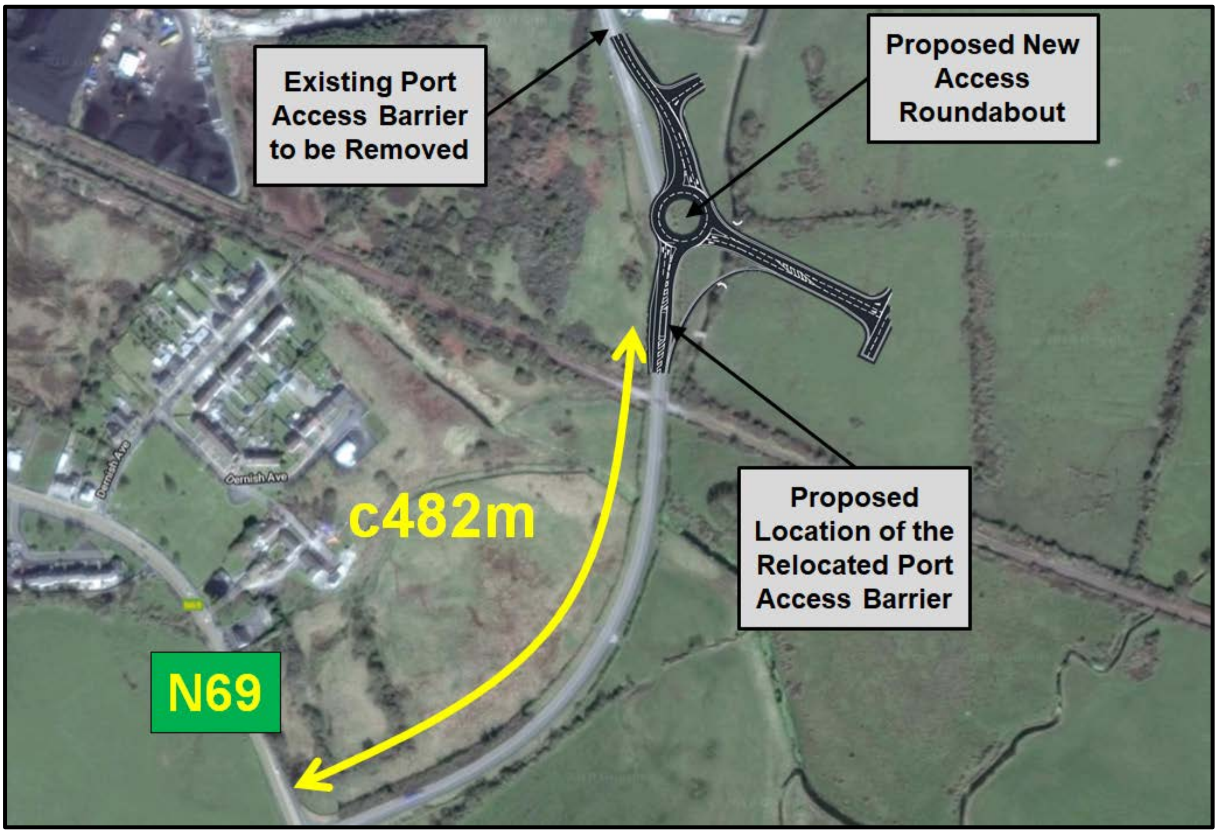


A roundabout with an Inscribed Circle Diameter (ICD) has been proposed to facilitate a new access to the Foynes Durnish Lands. This size of roundabout is considered to be appropriate to facilitate Heavy Good Vehicle (HGV) movements, allow appropriate arm spacing and achieve desired deflection. The roundabout is positioned approximately 115 metres from the railway crossing on the port access road and realignment of the port access road is required over a length of approximately 255 metres to provide adequate deflection at the roundabout. The circulatory carriageway width is 10 metres, and carriageway width on the port access road is retained at 7.5 metres with a minimum verge with of 2.0 metres on the west side of the road and a 3 metre footway / cycleway on the east side of the road. The approach arms on the roundabout have been widened to allow for two lanes of traffic for straight through and right turning movements.

On approach to the roundabout from the existing railway crossing, road widening has been provided to facilitate the relocated security kiosk / access barrier, with dimensions of 3.75 metres wide by 17.3 metres long. Road widening is also provided to offer an express lane / layby for quick access to the port. A second access point referred to as the Mid-Access is provided for direct access from the existing port road into Durnish Lands at a point approximately 190 metres north of the proposed roundabout, and connects to the proposed internal road network.

The access roundabout will be located at the interface between the public road and the port internal road of the port's existing eastern access road. The proposed roundabout will tie into the existing LCCC owned road network, and some LCCC lands will be required for the proposed footprint of the roundabout. A Letter of Consent from LCCC requesting their permission to show the proposed roundabout on their lands within the planning application drawings was received in March 2018. The correspondence is included in **Appendix 13.12**.

Figure 13.11 – Proposed Access Roundabout Layout and Proposed Access Barrier Relocation



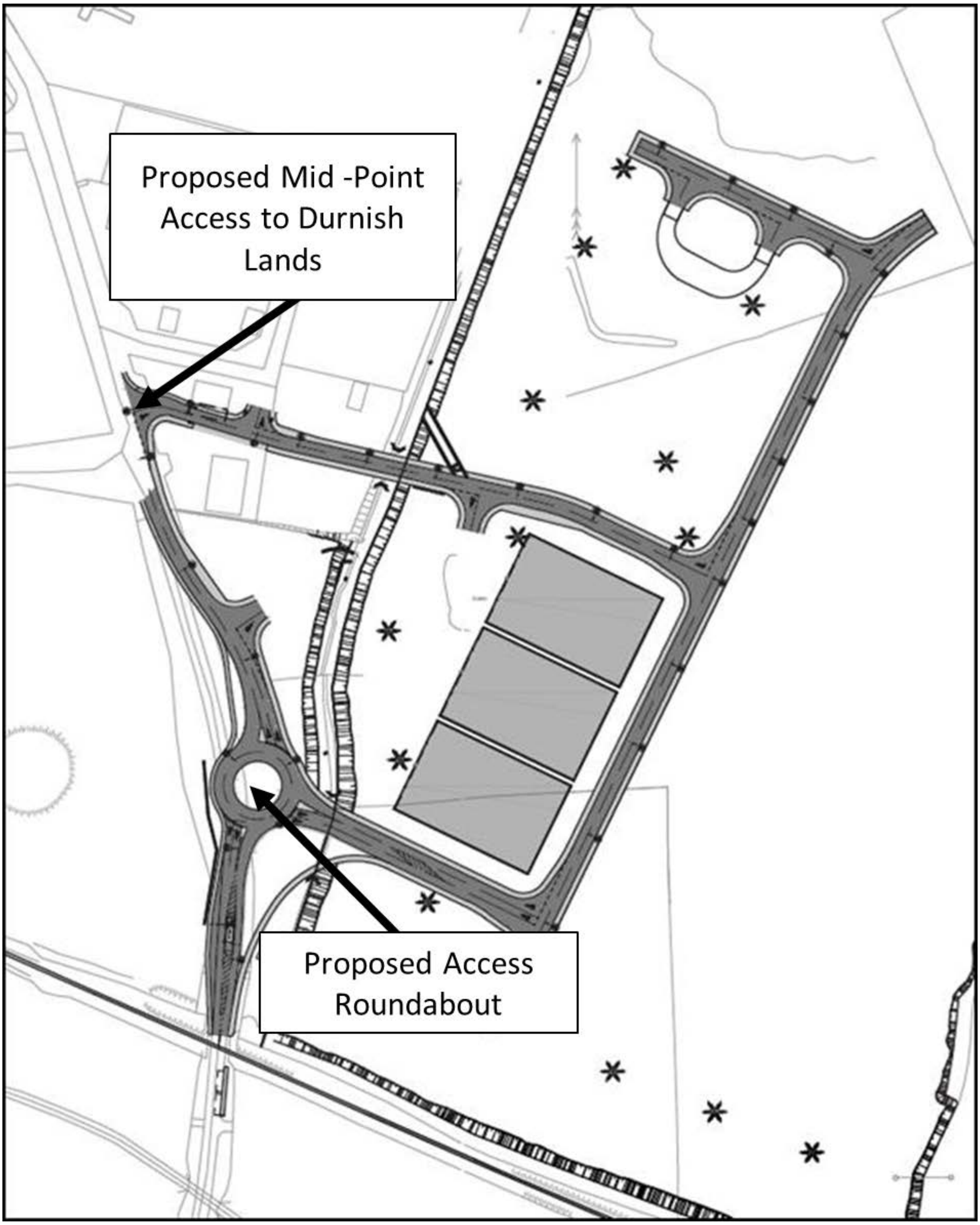
To avoid the need for two separate security kiosks and access barriers, SFPC propose to relocate the existing security kiosk and access barrier to a location south of the new port access roundabout as illustrated in **Figure 13.11**. It is proposed that the security kiosk / access barrier will be relocated a distance of circa. 482 metres from the junction with the N69, providing a queuing distance of 83 Passenger Car Units (PCUs) between the barrier and N69 as indicated in **Figure 13.11.** A more detailed layout of the proposed access roundabout is included in **Appendix 13.2.**

The proposed new location of the security kiosk / access barrier is on lands controlled by LCCC. Following advice on the matter at a pre-application meeting with LCCC on the 20 February 2018, LCCC were informed in writing at pre-application stage that the proposals will include the principle of the barrier being relocated to an area within LCCC lands. This correspondence is included in the RPS letter in **Appendix 13.12**.

Figure 13.12 shows the proposed internal road network for Phase 1, which also shows the location of the Mid-Point Access to Durnish Lands to provide direct access from the existing port road into the section Durnish lands to the west of the drainage channel.

The roundabout provides access the Durnish Lands and connects to a proposed internal road network which typically has a carriageway width of 8 metres with 3 metre footway/cycleway on both sides of the road, which total 1.7km length and with provision of access to internal development plots.

Figure 13.12 – Proposed Internal Road Network for Phase 1



Road Safety Audit for the Proposed Access Roundabout

As it ties into an adopted section of the road network, a Road Safety Audit (RSA) is being carried out for the proposed access roundabout.

The recommendations from the RSA will be considered by the Designers as the roundabout design progresses from Planning stage to Detailed Design stage to ensure that they safety of the proposed design has been maximised.

Retention of Existing Accesses to Lands south of the Railway Line

Figure 13.13 shows the location of lands to the south of the railway line. In the design of the proposed scheme, it has been ensured that the existing vehicular access to these sections of land has been retained.

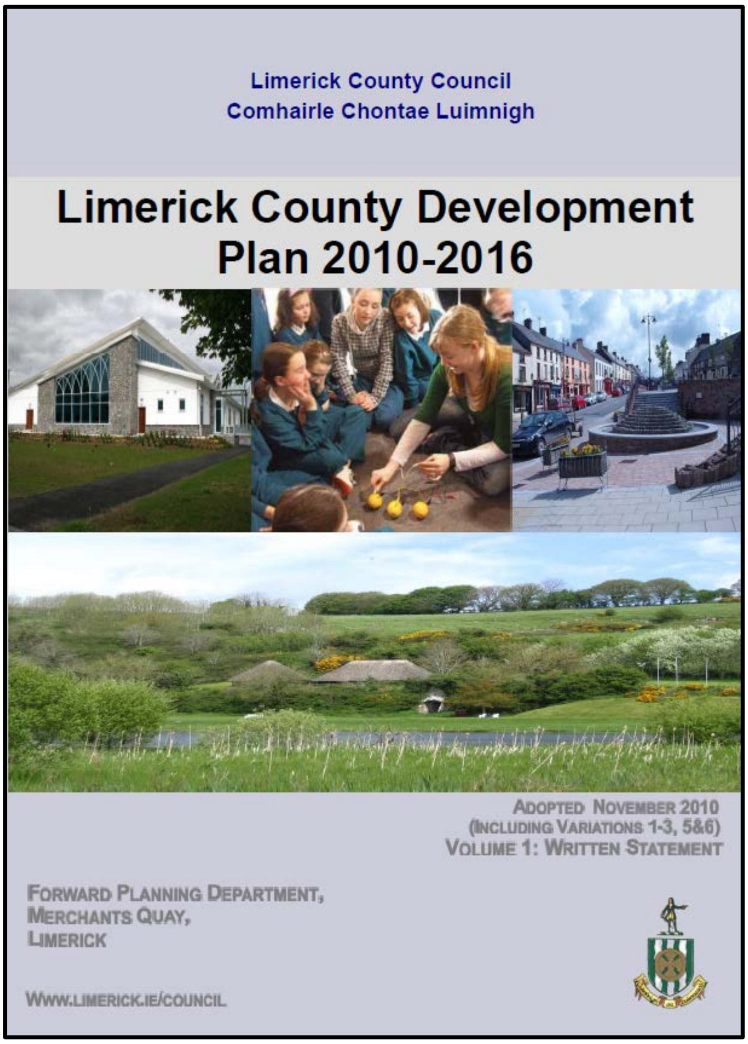
Figure 13.13 – Location of Lands to the South of the Railway Line

In particular, this report will explain the proposal for an on-road bus stop, on the southbound carriageway in the environs of a western parcel of land, which has been designed to ensure that the existing access arrangement to the lands to the west are unaffected.

13.1.6 Parking

The parking provision for the proposed development will be based on LCCC's County Development Plan 2010-2016 (November 2010) general parking standards within Section 10.11.13 (Page 10.43) of the document. Some relevant extracts are shown in **Figure 13.14.**

Figure 13.14 – General Parking Standards extracted from Limerick County Development Plan



Land Use	Unit		Parking Spaces per Unit
Retail (Class 1)* Offices/ Banks/Financial institutions (Class 2)* (i.e. where services provided principally to visiting members of the public)	Core Retail Areas**	Any other Area	
	1 per 50sq.m (gross)	1 per 20sq.m (gross) - Up to 1000 sq.m 1 per 12sq.m (gross) Over 1000 sq.m	
Offices (Class 3)*	1 per 70sq.m (gross)	1 per 35sq.m (gross)	
Light/General industry	Per 35sq.m of Gross floor area		1
Warehousing	Per 100sq. m of gross floor area		1

13.1.7 Scoping Correspondence / Meeting

Several pre-application meetings were held with An Bord Pleanála (ABP) for the scheme. ABP released a Record of Meeting correspondence in relation to a meeting that was held on the 19th October 2016, in which it was confirmed that the traffic assessment for the proposed scheme should assess the effects on the local road network.

Both TII and the Commission for Railway Regulation (CRR) responded to the Environmental Scoping letter issued for the scheme. Both pieces of correspondence are included in **Appendix 13.3**. Their comments have been taken into account in the preparation of the application.

On the 20th February 2018 a pre-application meeting was held at the LCCC offices in Limerick, with members from both the Application/Client team and the LCCC, including representatives from the roads department of the LCCC. During the meeting a summary of the envisaged approach to undertaking the TTA was described and discussed.

13.1.8 Chapter 13: TTA Report Structure

Section 13.2 of this report presents a review of the existing sustainable transport links in the vicinity of the site, with a Mobility Management Plan framework presented in **Section 13.3**. **Section 13.4** describes the predicted trip generation associated with the development proposals and provides an assessment of the development proposals on the local road network. **Section 13.4** also analyses the key modelling results for the proposed development on the local road network. A summary and conclusions of the TTA are presented in **Section 13.5**.

13.2 ACCESSIBILITY

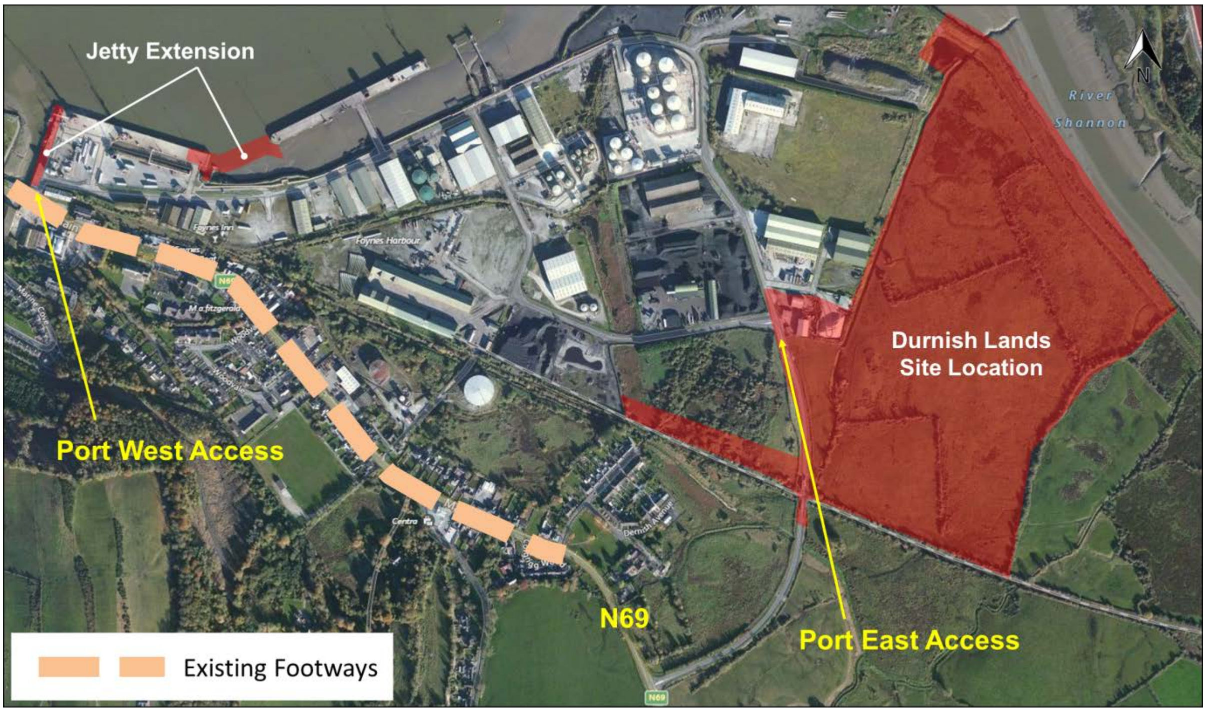
A baseline accessibility assessment was undertaken to establish the existing transport provision serving the site and its surrounds. The assessment considers travel by sustainable modes of transport including walking, cycling and public transport; and provides a brief assessment of available infrastructure and service provision.

It should be noted that due to the location of the site and the nature of the existing and proposed development, access to the site by sustainable modes of transport is likely to be minimal.

13.2.1 Pedestrian and Cycling facilities

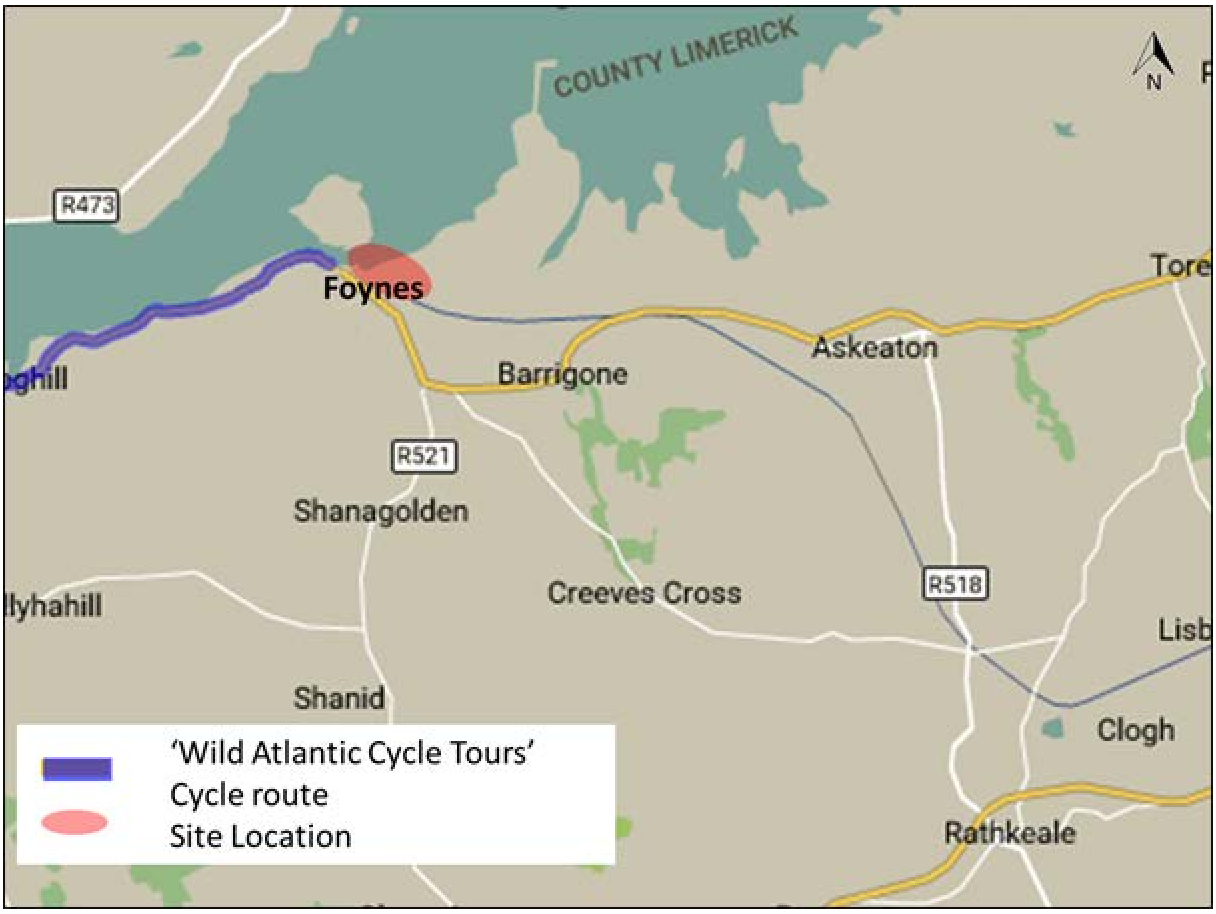
There are existing footways provided on both sides of the N69 carriageway, from west of Durnish Avenue to north of the Port West Access, the extent of which is shown in **Figure 13.15**. The footways are well lit and maintained, with the footway to the south of the carriageway terminating for a short section in the vicinity of Saint Senan's car park.

Figure 13.15 – Existing Footway Provision



There are no existing dedicated cycling facilities in the vicinity of the proposed development site. A section of the N69 to the west of Foynes forms part of the dedicated *'Wild Atlantic Cycle Tours'* route as indicated in **Figure 13.16**.

Figure 13.16– Wild Atlantic Way Cycle Tour – N69 Route Section



In order to enhance walking and cycling sustainable travel options, the proposed scheme has been future-proofed to accommodate a possible future internal footway and cycle connection at the Port. The proposals include the provision of 1.7 kilometres of 3.0 metres width walkway / cycleways along the proposed roads within the Durnish Lands. The location of the proposed walkway / cycleways is shown in **Figure 13.17.**

Figure 13.17–Location of the Proposed Shared 3.0 metres width Walkway / Cycleways

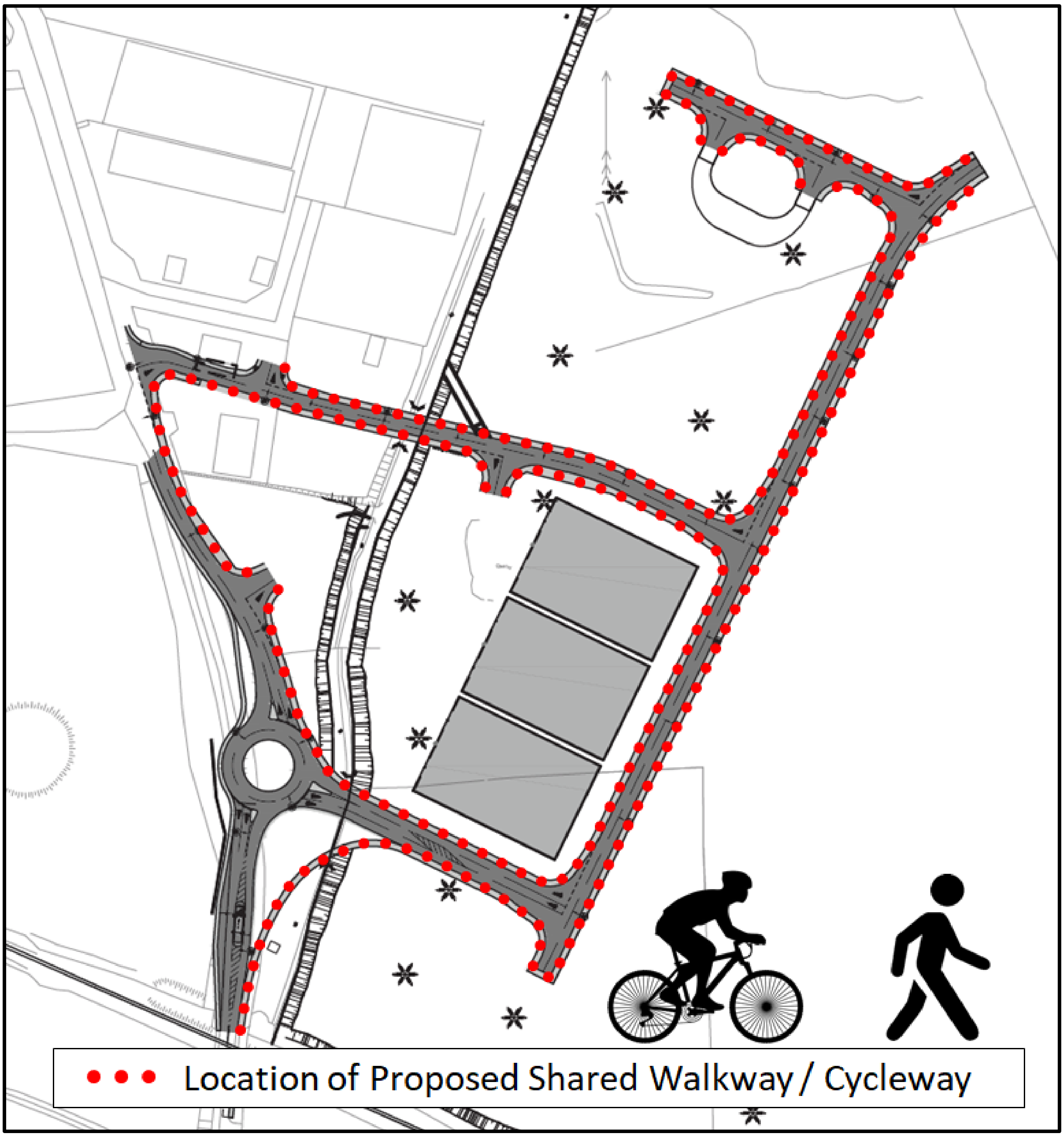
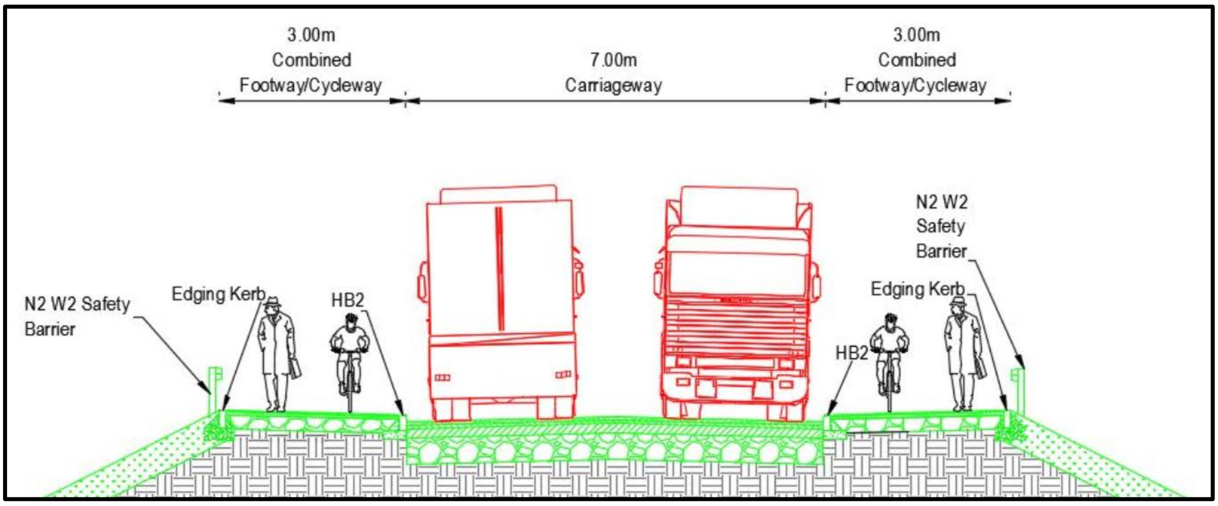


Figure 13.18 shows a typical cross section of the proposed road network, which includes 1.7 kilometres of proposed walkway / cycleway.

Figure 13.18– Typical Cross Section on the Proposed Roads showing the Proposed Shared 3.0m Walkway / Cycleways



In addition to the provision of the 3.0 metre width walkway / cycleways, cycle parking spaces will be provided within the proposed development site as indicated in **Figures 13.19** and **13.20**. The 15 'Sheffield' type stands, as illustrated in **Figure 13.20**, can facilitate up to 30 bicycles.

Figure 13.19 – Proposed Cycle Parking, Large Scale

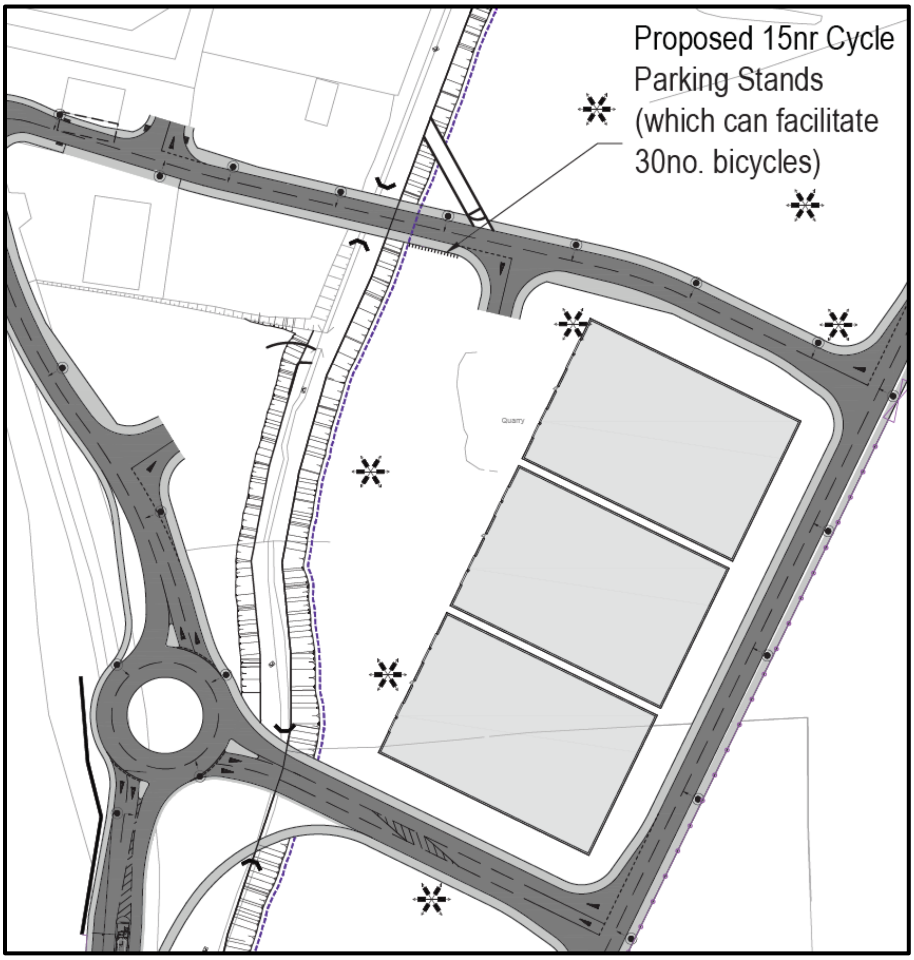
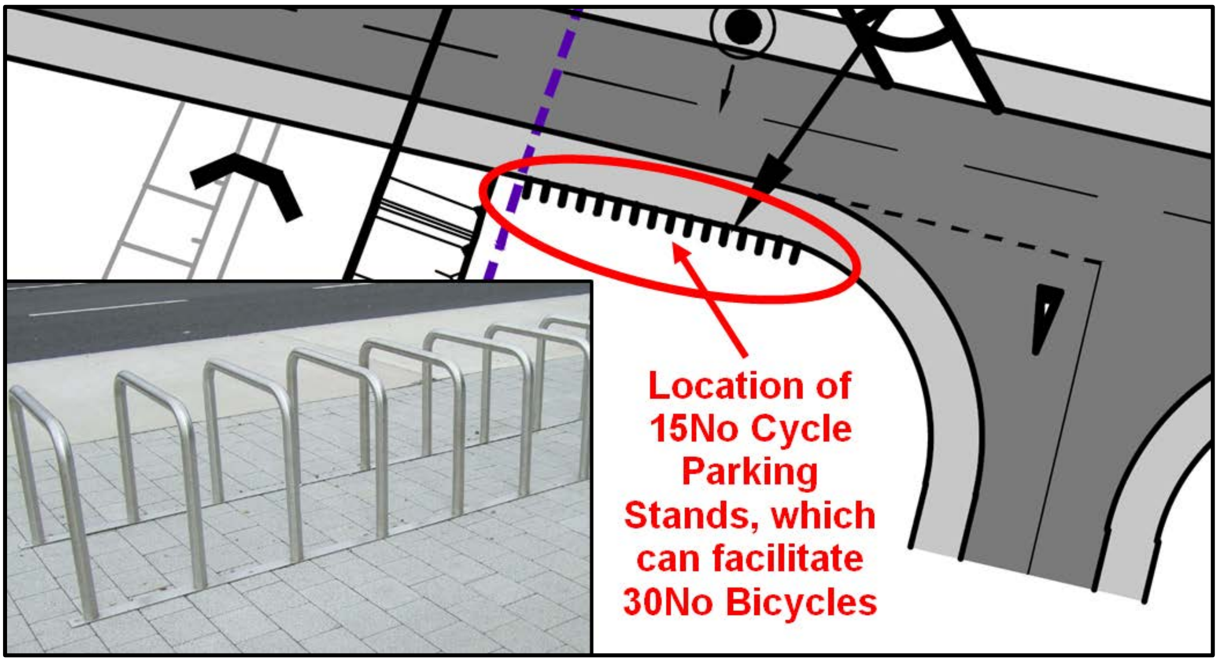


Figure 13.20 – Proposed Cycle Parking, Closer Scale



13.2.2 Public Transport Facilities

13.2.2.1 Existing Bus Services

The nearest bus stops to the proposed development site are located approximately 100 metres from the Port West access on the N69. The location of the bus stop is indicated in **Figure 13.21**.

The main bus operator serving the stops at the site is Bus Éireann Service 314. This service provides a direct route from Foynes to Limerick and Tralee, including settlements of Askeaton, Talbert and Listowel. The bus stops at the site are served 5 times a day in both directions. The details of existing bus services are provided in **Table 13.1**.

Figure 13.21 – Existing Bus Stop Facilities

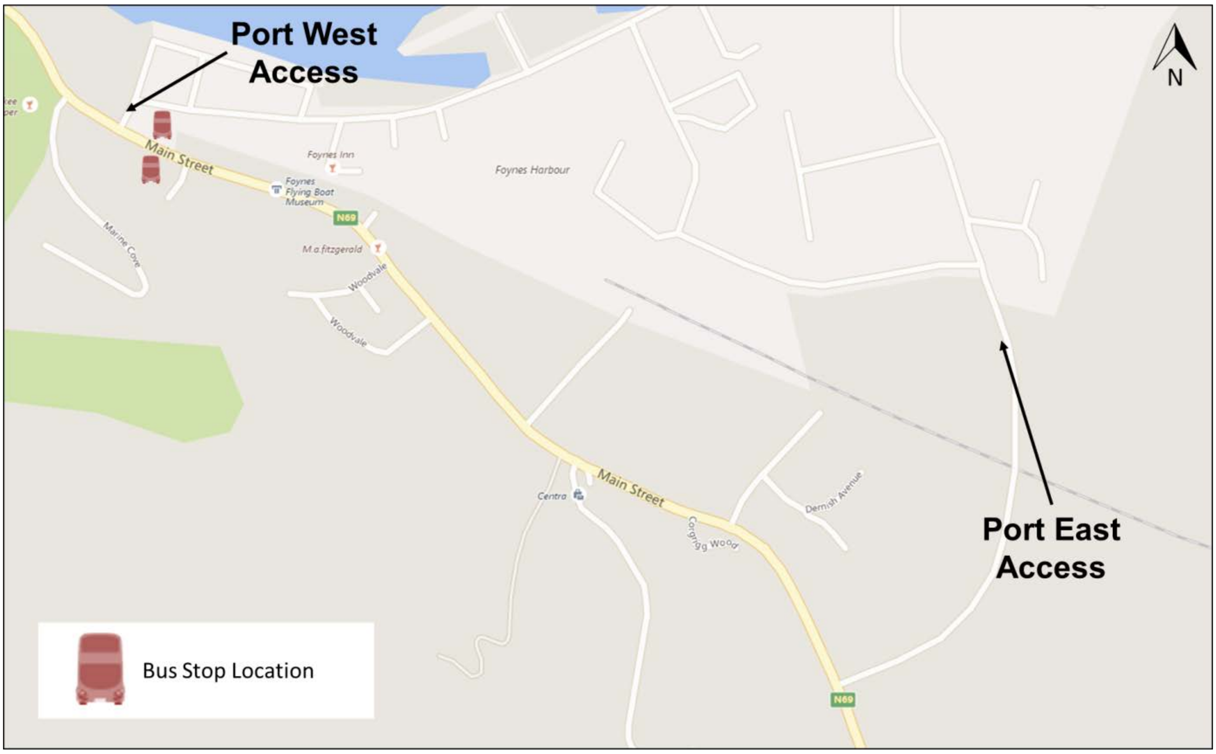


Table 13.1 – Summary of Bus Services in the Vicinity of the Site

Service Number	Service Route	Number of Services		
		Monday- Friday	**Saturday**	**Sunday**
314	Limerick - Tralee	4	2	-
	Tralee - Limerick	3	2	1

13.2.2.2 Proposals to Facilitate a Future Bus Stop

As described above, the existing Bus Éireann Service 314 operates along the N69 in the proximity of the Shannon Foynes Port. It is proposed to facilitate a possible future bus stop to future-proof the possibility of the extension of the 314 Bus Service from the N69 along the eastern access road to serve the Durnish Lands. The proposal is summarised as follows:

- Extend the proposed footpath from the eastern side of the access roundabout to a possible on-road bus stop location on the southbound side of the carriageway just south of the railway line, as indicated on **Figure 13.22**;

- Suggest an appropriate location for Bus Éireann to provide a bus stop as indicated on **Figure 13.23**, to be an on-road bus stop marked with a flag pole, similar to the existing examples from the Limerick area shown in **Figure 13.24**;

- This future proofs the possibility of the extension of the 314 Bus Service from the N69 along the eastern access road to the Port Access;

- In this proposal, the bus can approach the barrier without stopping, use the express lane to enter the Port, U-turn at the roundabout without stopping to let anyone get in or off the bus, go through the exit barrier and stop once on the southbound carriageway. This ensures that no one can get on or off the bus within the Port boundary without going through security.

- The stop will be about 70m from the exit barrier to minimise any delay to exiting vehicles that the stopped bus may cause;

- Bus patrons, both those exiting from the Port and those wishing to access the Port, can use the footpath to access between the bus stop and the security area. Therefore there is no need for a separate northbound and a southbound bus stop;

- This proposal doesn't affect the existing field access gate to the SFPC lands south of the railway line.

- This concept has been approved in principle by Bus Éireann at pre-application stage.

Figure 13.22 –Concept of Facilitating a Bus Stop to the South of the Proposed Security Barriers

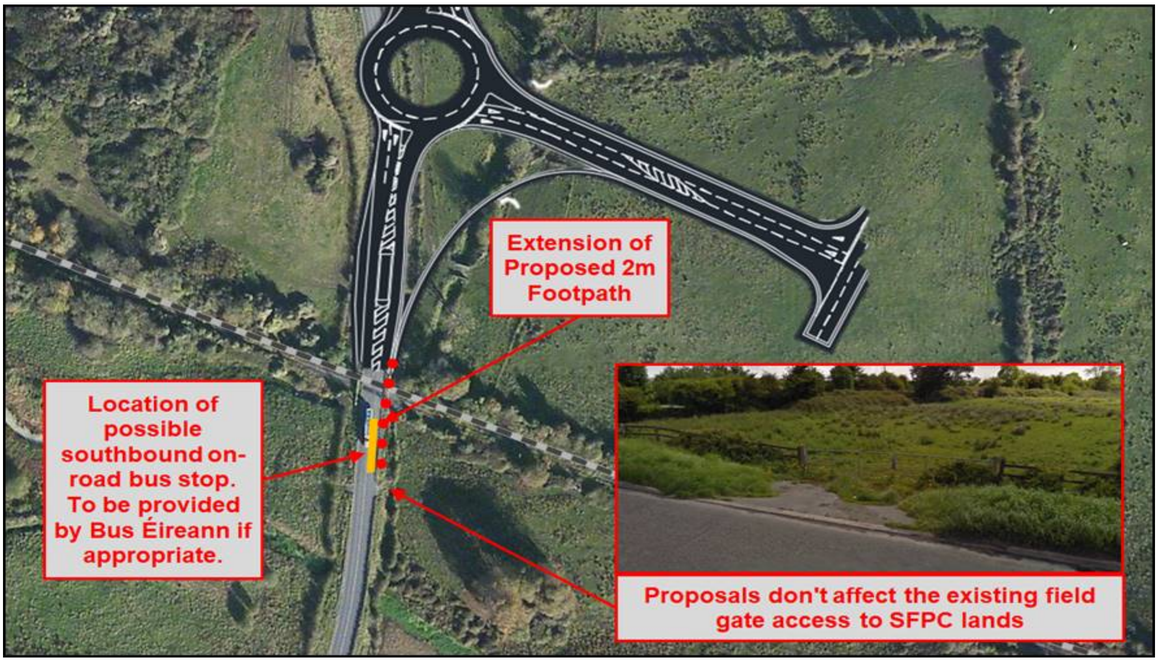


Figure 13.23 –Proposed Location of Bus Stop as Shown on the Planning Drawings

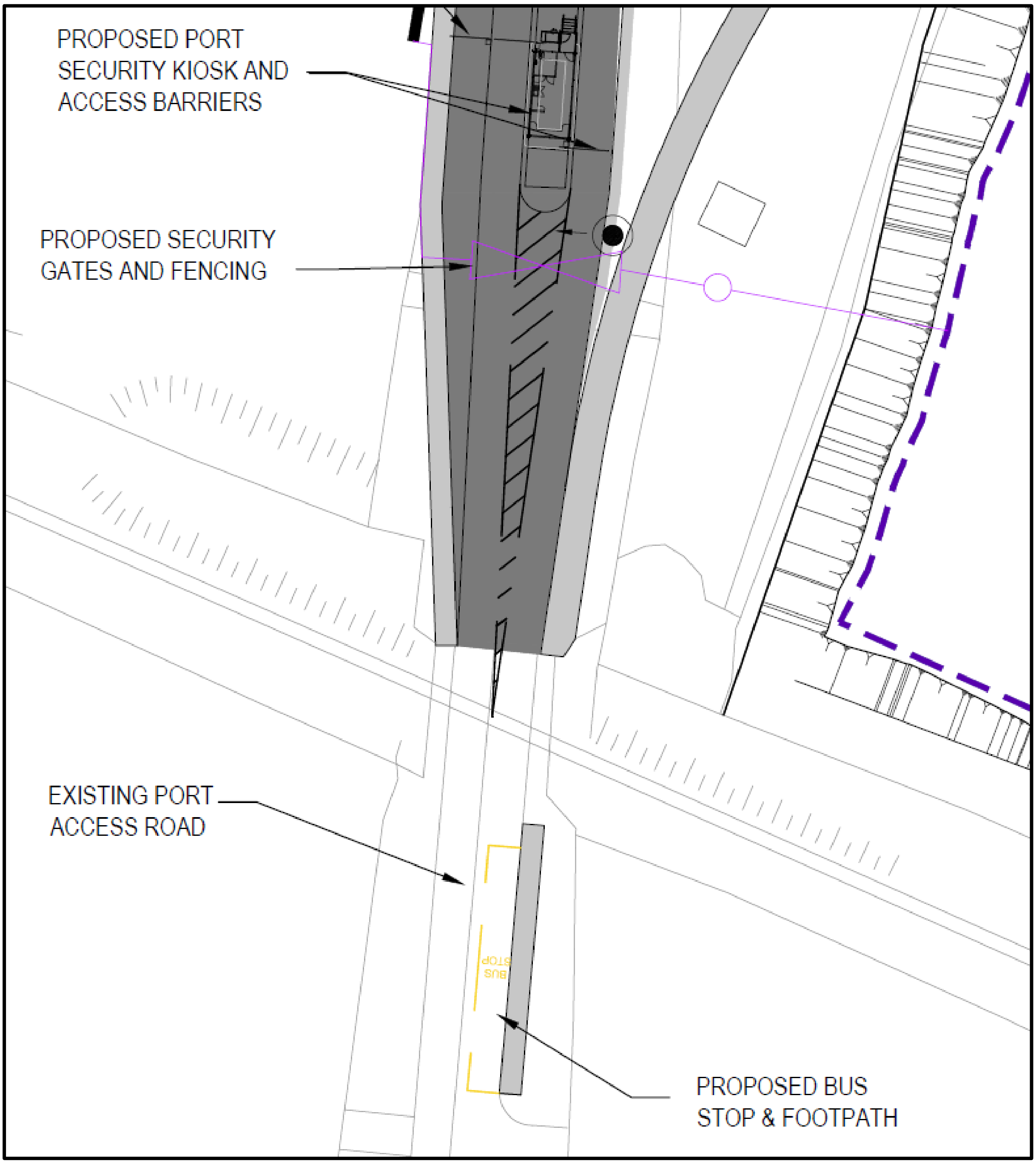


Figure 13.24 –Examples on Existing On-Road Bus Stops Provided by Bus Éireann in the Limerick Area

13.2.3 Rail

An Iarnród Éireann (Irish Rail) owned single rail line extends from Limerick and extends directly up to the East and West Jetties at the Port. The 43 kilometre rail line extends along the southern boundary of the existing port estate effectively separating the port estate from the Foynes Village urban area. The line extends along the southern boundary of the Durnish Lands. The use of the rail line was discontinued in 2000 and is not currently in use; however it remains a key asset to the Port. **Figure 13.25** shows the Foynes to Limerick rail line in the context of the National Rail Network.

Figure 13.25 –Foynes to Limerick Rail Line in the Context of the National Rail Network.

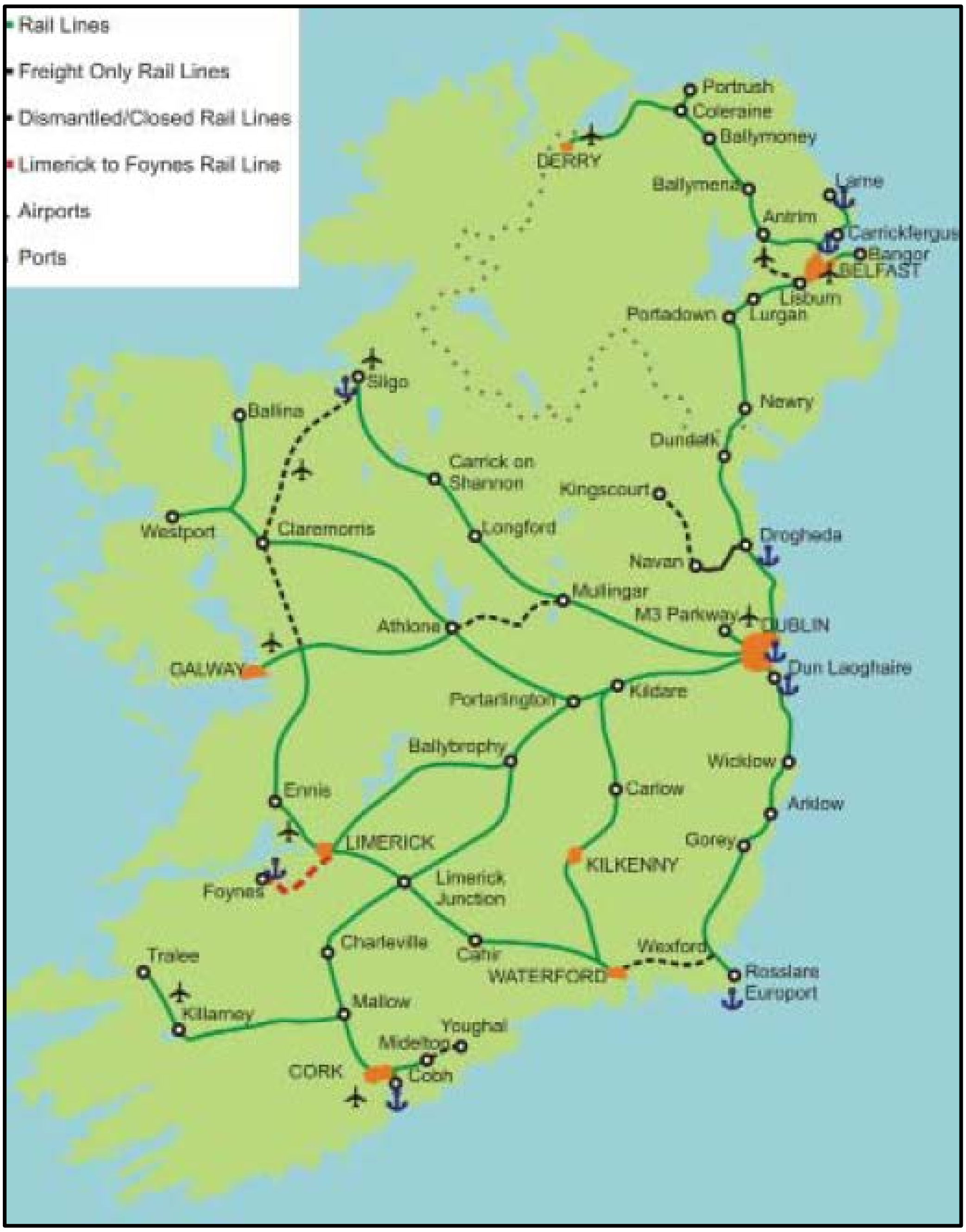


Figure 13.26 shows the location on the rail line between Foynes and Limerick; **Figures 13.27** and **13.28** show the location of the railway in the context of the existing Port and the proposed site, and the Foynes Railway Station building respectively.

Figure 13.26 – Location on the Rail Line between Foynes and Limerick

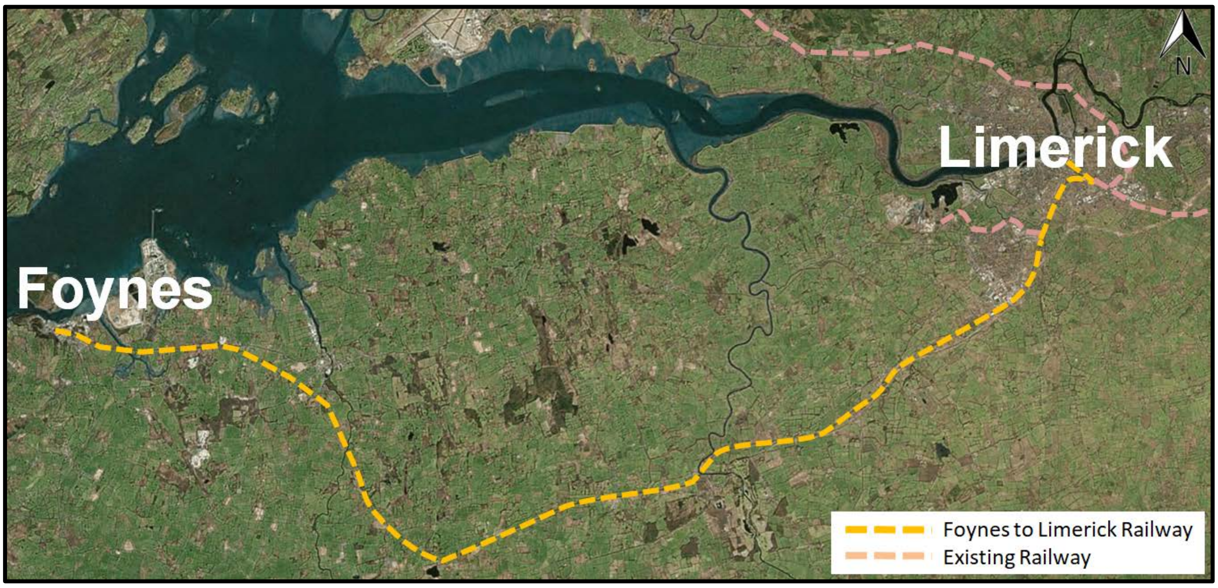


Figure 13.27 – Location on the Rail Line at Shannon Foynes Port

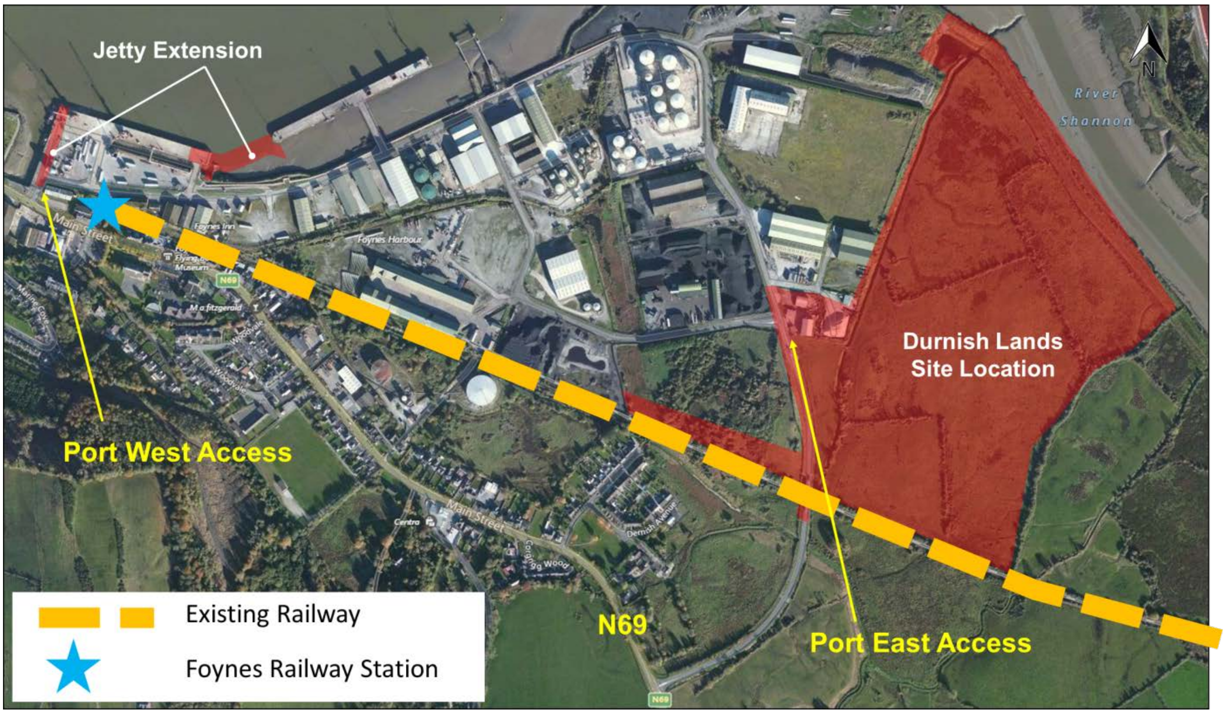


Figure 13.28 – Foynes Railway Station Building

No works are proposed to the existing rail line for this development proposal. The future operational use of the rail line is under constant review but at this time, the operational reuse of the rail line is subject to a specific end user requirements and / or viability of investment in the upgrade in the infrastructure. Despite that, the proposal seeks to retain and safeguard the integrity of that line and infrastructure, and do not compromise or preclude any future potential uses relating to the railway line. This is discussed further in **Section 13.3.2** - Future Measures to reduce environmental emissions from freight.

13.2.4 Access by road

Vehicular access to the site will utilise the existing accesses in the N69. The N69 is a single carriageway two-way road providing a link between Limerick and Tralee. In the vicinity of the site, N69 is approximately 6 meters wide and subject of 50kph speed limit. The access roads leading to the site have a security kiosk / access barrier to separate the public from the port lands. As highlighted in **Section 13.1**, it is proposed to relocate the existing security kiosk / access barrier on the east access to cater for the proposed new roundabout to serve the proposed development.

13.3 MOBILITY MANAGEMENT PLAN & SMARTER TRAVEL

13.3.1 Introduction

As the proposed development with be an extension of an established port development, there are existing opportunities to travel to the site by sustainable modes as identified in **Section 13.2**. It will be important, however, to ensure that the development continues to be accessible by a choice of travel modes. This outline Mobility Management Plan (MMP) has been prepared to set out the type of measures which could be adopted by the Operator(s) within the proposed development to ensure such choice is available to staff and visitors.

A MMP is a management tool that brings together transport and other staff and site management issues in a coordinated manner. A successful plan can help competitiveness by reducing transport costs for both staff and the employer and provide a more conductive working environment. It brings together a package of measures tailored to the needs of an individual work site or a collection of work sites. This package generally includes measures to promote and improve the attractiveness of using public transport, cycling, walking, car sharing, flexible working or a combination of these as alternatives to single occupancy private car travel.

The MMP can consider all travel associated with a work site, including business travel, fleet management, customer access and deliveries. It should be considered as a dynamic process where a package of measures and campaigns are identified, piloted and monitored on an on-going basis. The impact of these measures should be reviewed by LCCC and the Operator against a set of agreed targets, principally in relation to:

- A reduction in car journeys to and from the work site;
- An increase in the number of journeys by people who share their journeys by car;
- A reduction in the need to travel, especially during the rush hour periods; and
- Enabling staff to use alternative modes of transport.

A MMP may take the form of a formally published document, which outlines its measures and targets. Alternatively, it may simply evolve over time as different initiatives are piloted. Depending on the circumstances of the organisation, either approach can be applied.

Due to the nature and location of the port, Shannon Foynes Port generally has limited opportunities for a significant modal shift towards sustainable transport modes compared with, say, an office development located with a core City Centre area. However, SFPC recognise the importance of promoting a variety of travel modes to access the proposed development and are committed to the development of the MMP.

Close working will be required between the Operator and LCCC in order to develop a MMP which sets achievable targets and which provides benefits not only to the staff and visitors travelling to the development, but also the wider community. It is important when setting out the MMP for the proposed development that, the MMP should be relevant to the size and nature of the development, recognising the assumed travel demand, which as described above is limited at the Port.

13.3.1.1 Roles and Responsibilities

Support from the Operator's senior management is critical to the overall success of the MMP. It is important that this support is secured from the outset, with the Operator's management team being very supportive of the need to develop a MMP and reduce reliance on single occupancy private car trips, whilst encouraging sustainable modes of transport trips to the site. The support of senior management is important in order to:

- Lead by example for other staff;
- Allow budget allocations for MMP activities;
- Appoint an on-site MMP coordinator; and
- Secure the release of staff time for work concerned with the MMP (particularly the appointed MMP coordinator).

A MMP coordinator will be appointed by the Operator's senior management to oversee the implementation and operation of the MMP. This role is normally assumed by an existing member of staff as an additional responsibility. The coordinator will be responsible for the promotion of walking, cycling and public transport amongst staff. This outline MMP identifies the following key tasks likely to be attributed for the MMP coordinator:

- Oversee the continuing development and implementation of the MMP;
- Obtain and maintain the support of senior management and employees;
- Implement marketing activities;
- Coordinate and undertake data collection and review;
- Undertake a review and development of the MMP;
- Act as contact point for the MMP;
- Monitoring and updating travel patterns;
- Promoting benefits of cycling, walking and public transport use;
- Amending procedures as necessary to promote sustainable transport; and
- Ensuring adequate facilities are provided to encourage alternative modes of travel.

13.3.1.2 Travel Survey / Audit

The MMP will be reviewed at the beginning of each year to ensure all travel patterns and requirements are considered within the MMP. Travel surveys will be undertaken and updated every year, which will comment on the existing modal shift targets made (if they have been achieved or not). The surveys will then enable new modal shift targets to be set or incentives changed to achieve existing targets.

The MMP coordinator will undertake travel surveys of staff soon after the opening of the section of the proposed development that the Operator has taken control of. This will enable a dataset of information to be constructed and will aid the implementation of the MMP. The survey is likely to include the following:

- Personal and employment details (subject to compliance with Data Protection Act);
- Current modal split of employees, together with journey lengths (distance and time);
- Reasons for current mode of travel;
- Hours of work;
- Level of business trip activity and modal split;
- Level of interest in car sharing;
- Problems encountered in communicating; and
- Ideas for improvement of the MMP.

This information will enable the MMP coordinator to identify where staff are travelling from on a daily basis and identify areas where the largest groups of staff are travelling from / to, allowing the MMP coordinator to concentrate on areas where most impact can be made on changing travel habits.

Once the MMP coordinator has compiled the survey data, targets for the reduction in car based travel can be determined. The MMP coordinator will then monitor and review these targets at regular intervals and determine how successful the MMP is. The monitoring of staff travel could include car park surveys to establish car usage, and monitoring of specific initiatives such as car sharing.

Promotion of sustainable transport modes is paramount to the MMP and emphasis should be placed on the provision of information for staff identifying available services, timetables and pick up / drop off point locations.

13.3.1.3 Objectives and Targets

The overall objective of the MMP is to reduce the number and reliance on private car trips, especially by staff, while increasing the number of pedestrian, cycling and public transport trips. The application of the MMP will help further encourage the shift from car based trips to more sustainable modes.

The initial surveys undertaken by the MMP coordinator will indicate modal split associated with the section of the proposed development that the Operator has taken control of. From these initial surveys, further incentives / disincentives can be considered to increase the use of sustainable modes and reduce private car trips. Each year surveys will be undertaken and revisited modal split targets set. The MMP will aim to achieve a number of key objectives which are broadly set out below:

- To enable and encourage staff and visitors to access the development by sustainable modes of transport, where appropriate;
- To ensure that sustainable travel choices are available at times relevant to the development proposal;
- To minimise the need for staff and visitors to travel to and from the development by private vehicle;
- To ensure staff and visitors are aware of the health and environmental benefits of travel by non-car modes;
- To foster a culture amongst staff in seeking to travel by sustainable modes in preference to the private vehicle wherever possible;
- To ensure staff and visitors are aware of the MMP and kept informed of its development; and
- To ensure a broad range of sustainable travel options are available for staff and customers to access the development.

13.3.1.4 Measures

Within one month of the opening of the section of the proposed development that the Operator has assumed control of, the position of the MMP coordinator will have to be filled to ensure that the requirements of the MMP can be implemented quickly and efficiently. As part of this development, the following will be implemented by the MMP coordinator to try and reduce the number of single vehicle journeys and increase the number of trips by sustainable modes of transport:

- In order to minimise single occupancy car trips to the proposed development, it is recommended that a car-sharing scheme is established at an early stage. Implementation of such a scheme would assist staff to find a car share partner in their organisation. For a small scale development, this can be as simple as an all staff email or a coffee morning;
- Provision of cycle parking spaces within the proposed development site, as is shown within the proposed scheme as indicated in **Figures 13.19** and **13.20**. The 15 'Sheffield' type stands, as illustrated in **Figure 13.20**, can accommodate 30 bicycles;
- Raise awareness of the existing Bus Éireann 314 that operates along the N69 in the proximity of the Shannon Foynes Port. Also raise awareness of the proposal to facilitate a possible future bus stop to future-proof the possibility of the extension of the 314 Bus Service from the N69 along the eastern access road to serve the Durnish Lands, as summarised in **Section 13.2.2.2**.
- Encouragement for staff to walk to work (where possible) through advertising the health, social and economic benefits of walking;
- Display / provision of maps showing key walking routes, distances and walking times to / from origins and destinations;
- Provision of locker and changing facilities for staff use;

- Implementation of cycle to work scheme, which is government-led tax incentive scheme enabling employers to purchase a bicycle and equipment through salary sacrifice for 12 months; and

- Establish a Bike User Groups (BUGs), which is simply a group of cyclists in a workplace sharing concerns and ideas.

13.3.2 Future Measures to reduce environmental emissions from freight

An objective of Smarter Travel includes reducing the environmental emissions from freight. Items that SFPC can promote in the longer period of its Masterplan in respect of this item include the following:

- The promotion of LNG (Liquefied Natural Gas) facilities within the Port in the medium to long term for HGVs;

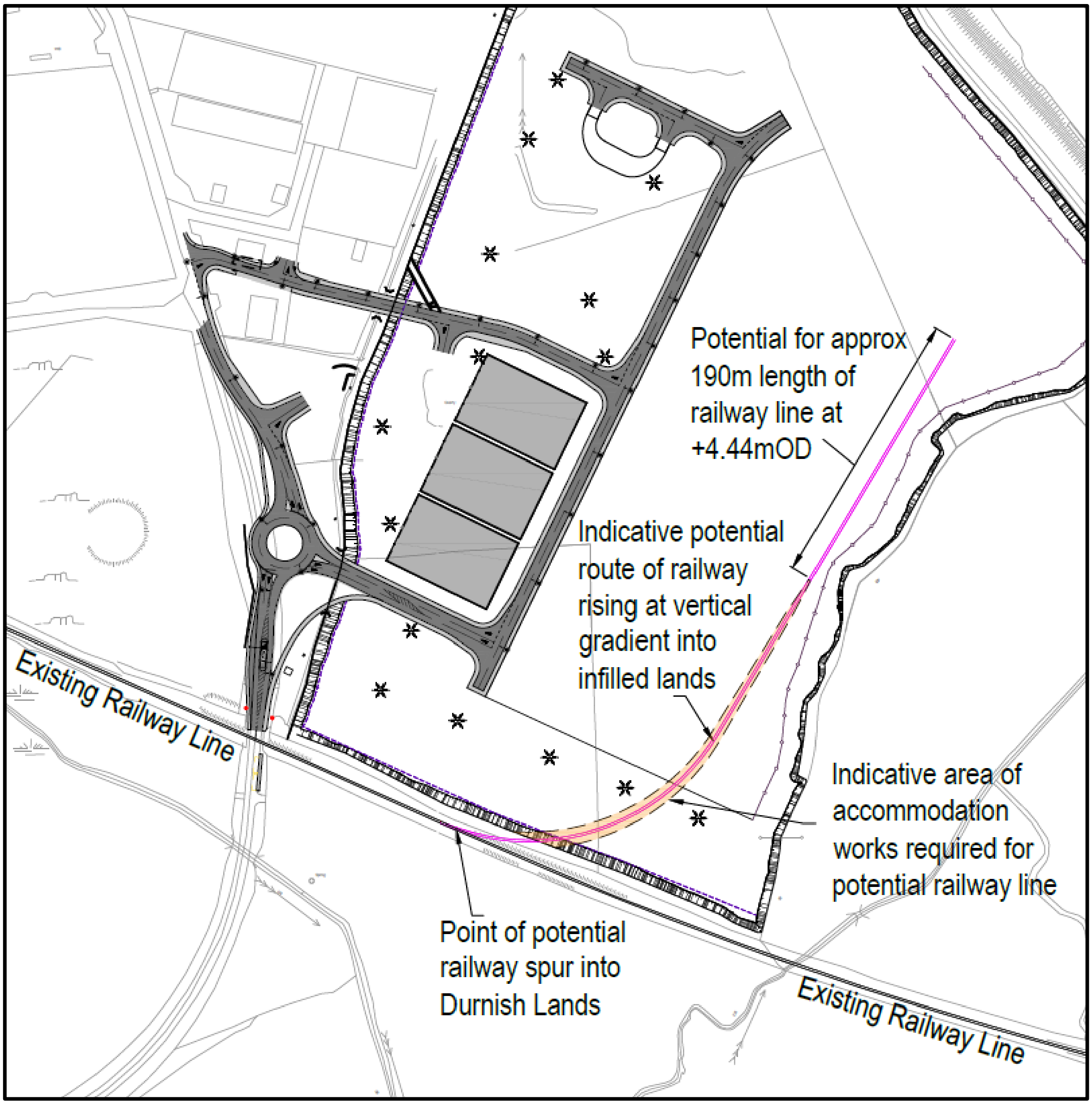
- Longer term plans for alternative fuels for ships while docked;

- It is envisaged that the Foynes to Limerick proposed Road Scheme is to provide a service area to include for suitable rest areas and possible LNG and EV (Electric Vehicles) charge facilities;

- Potential upgrade of the rail line to facilitate future commercially viable rail freight.

The scheme proposals currently under consideration have been designed to ensure that these future possible aspirations are not compromised. For example, in Chapter 5 of the EIAR, Examination of Alternatives, it has been demonstrated that the footprint of Phase 3 has the potential to accommodate a train halt to serve the Port lands in future years as shown in **Figure 13.29**. Therefore the scheme does not preclude future options for the potential for train infrastructure from being delivered.

Figure 13.29 –Demonstration that the Footprint of Phase 3 has the Potential to Accommodate a Train Halt to Serve the Port Lands



13.4 TRAFFIC IMPACT ASSESSMENT

This Section describes the methodology used to assess the impact of the traffic generated by the proposed development on the local road network. Based upon the guidance set out within the TII TTA guidelines and the information from the SFPC Vision 2041, the expected year of completion plus final tonnage target year were used to assess the traffic impact.

This traffic impact assessment considers that the construction of all of the following aspects is completed and operational by the year 2029:

- Jetty Construction & Berth 5 Reclamation;
- Phase 1 Durnish Lands;
- Phase 2 Durnish Lands;
- Phase 3 Durnish Lands.

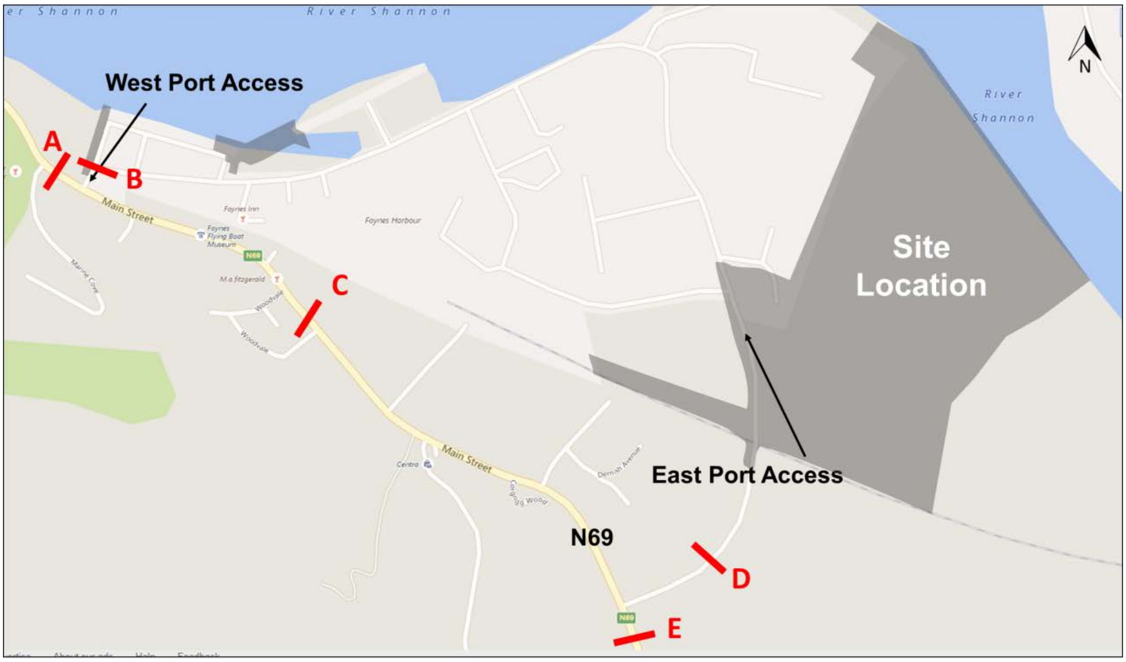
SFPC produced the 'Vision 2041' document which identified annual tonnage throughput targets for the port in 2011, 2025 and 2041. In accordance with the SFPC Vision 2041 tonnage targets provided by the port, the anticipated construction programme, as well as aligning with typical timeframes used within the TTA guidelines, the assessment years carried forward within the traffic impact assessment are as follows:

- 2017 Existing - Year network was surveyed;
- 2029 Proposed – 12 Years after Survey Year - Final year of the construction period; and
- 2041 Proposed – 24 Years after Survey Year - Final Year of the SFPC Vision 2041 and 12 years after the end of the construction period.

13.4.1 Existing Traffic Flows

In order to identify the existing levels of traffic on the network in the vicinity of the site during peak periods, new Automatic Traffic Count (ATC) surveys were undertaken between Monday 20th and Sunday 26th March 2017. **Figure 13.30** illustrates the location of the ATCs in the vicinity of the site.

Figure 13.30 – Location of ATCs



The ATC loop vehicle detectors are black tubes that are commonly seen on the road network, as illustrated in **Figure 13.31**.

Figure 13.31 – Method of Data Collection on the Location of the ATCs

Given that the level of traffic associated with the port was anticipated to be consistent during hours of operation, the port's accesses and external road network ATC data was assessed separately to ensure that peak activity aligned and identify if additional peak periods should be assessed to cater for the port activity.

ATC - Port Access Daily Profile

Figure 13.32 and **13.33** shows the traffic profile over a typical week at the port west and east accesses respectively.

It is evident from **Figure 13.32** and **13.33** that the access usage split is weighted more heavily to the east port access, with circa 80% of the existing port traffic utilising the east access and the remaining circa 20% using the west access. This is confirmed in **Table 13.2** below. The surveyed peak hour figure presented in **Appendix 13.4** shows that during the peak hour the Eastern Access carries 85-90% of the Port traffic, with the Western access accommodating the other 15-10%. Both accesses display a similar two-way vehicle arrival / departure pattern with a consistent flow of traffic during the ports hours of operation.

Table 13.2 – Volume of PCUs at the Western and Eastern Port Access

	West		**East**	
	PCU	**%**	**PCU**	**%**
Monday	373	20%	1493	80%
Tuesday	412	18%	1878	82%
Wednesday	419	20%	1641	80%
Thursday	446	22%	1558	78%
Friday	453	26%	1260	74%
Total Mon-Fri	**2103**	**21%**	**7830**	**79%**

Figure 13.32 – Port West Accesses ATC Data

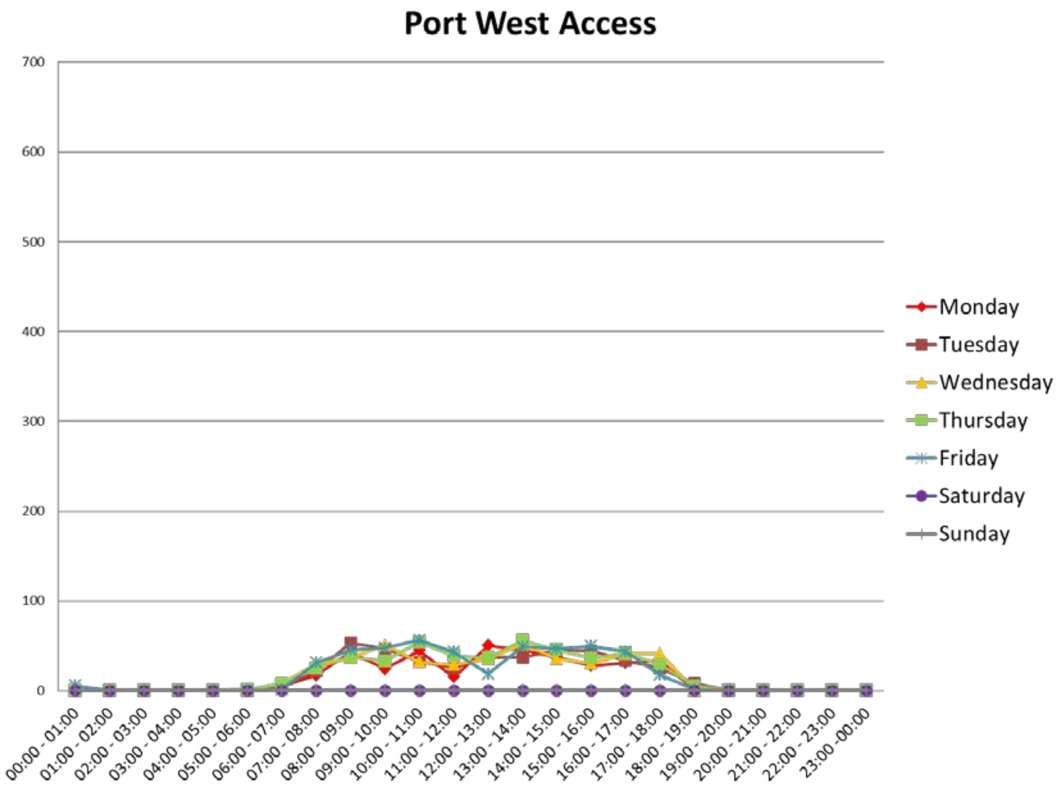
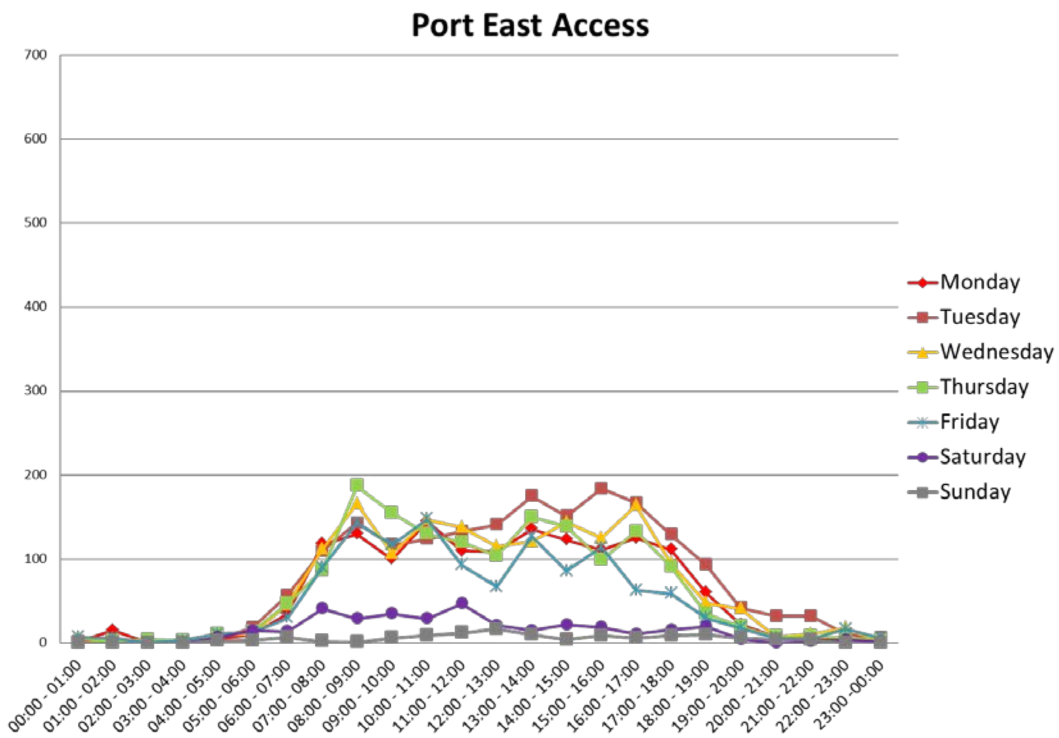


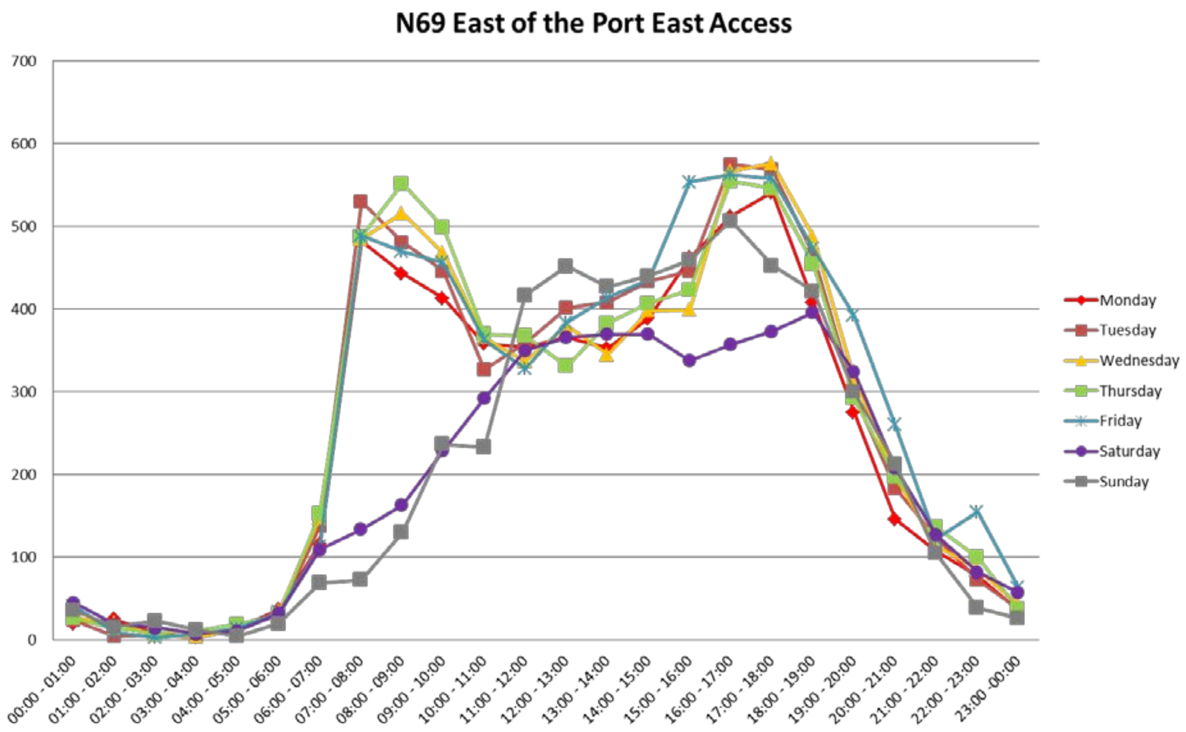
Figure 13.33 – Port East Accesses ATC Data



ATC - External Network Daily Profile

Figure 13.34 shows the daily two-way traffic on the N69 to the east of the port's east access.

Figure 13.34 – ATC Daily Traffic Profile on N69



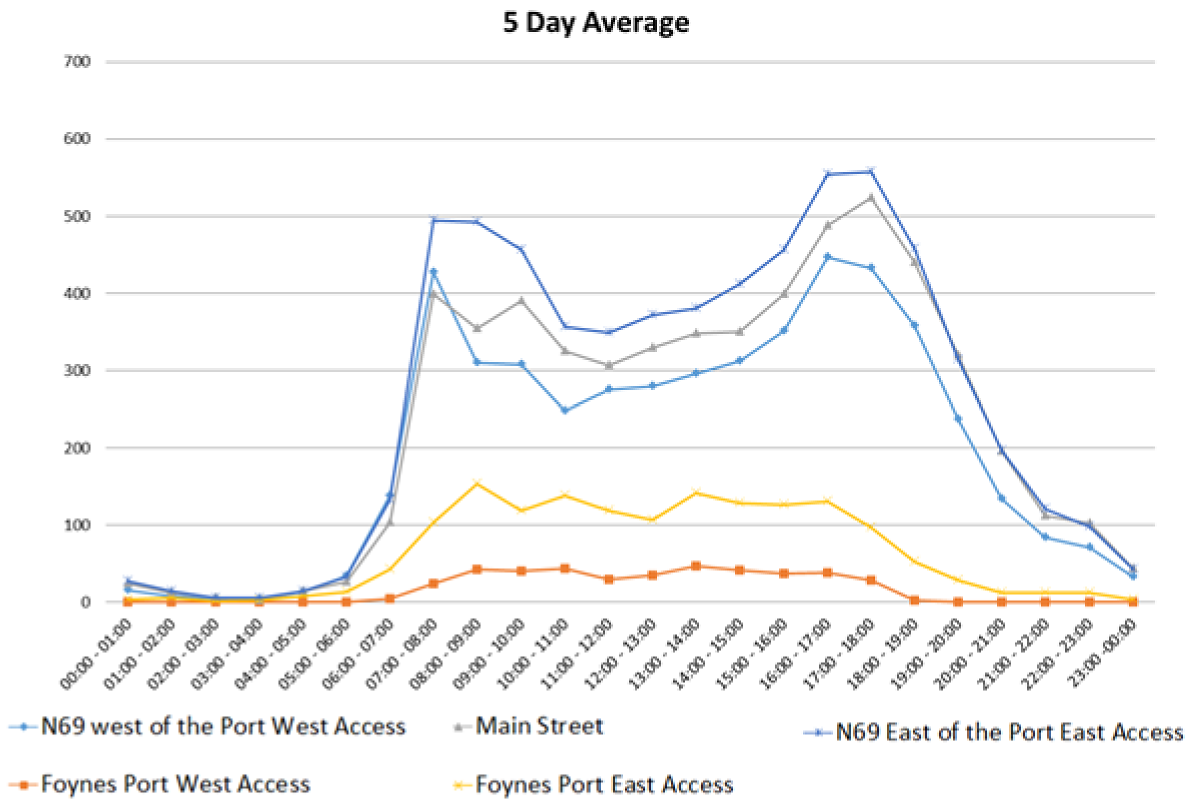
It can be seen from **Figure 13.34** that the daily two-way traffic profile on the N69 follows the characteristic morning and evening peak commuter patterns with usual morning and evening peak periods.

ATC - External Network + Port Traffic Daily Profile

An average daily traffic profile for all ATC survey locations within the Monday to Friday weekdays surveyed is indicated in **Figure 13.35**.

Figure 13.35 illustrates the two distinct patterns of the port traffic and the external network traffic in context with each other. The graph reflects defined opening hours and a constant level of movement that correlates with the ports operation and in contrast it reflects the distinct typical peaks associated with the external network traffic. When compared together the amount of port traffic is considerably less than the external traffic.

Figure 13.35 – 5 Day Average Two-way Traffic Profile at each ATC Survey Location

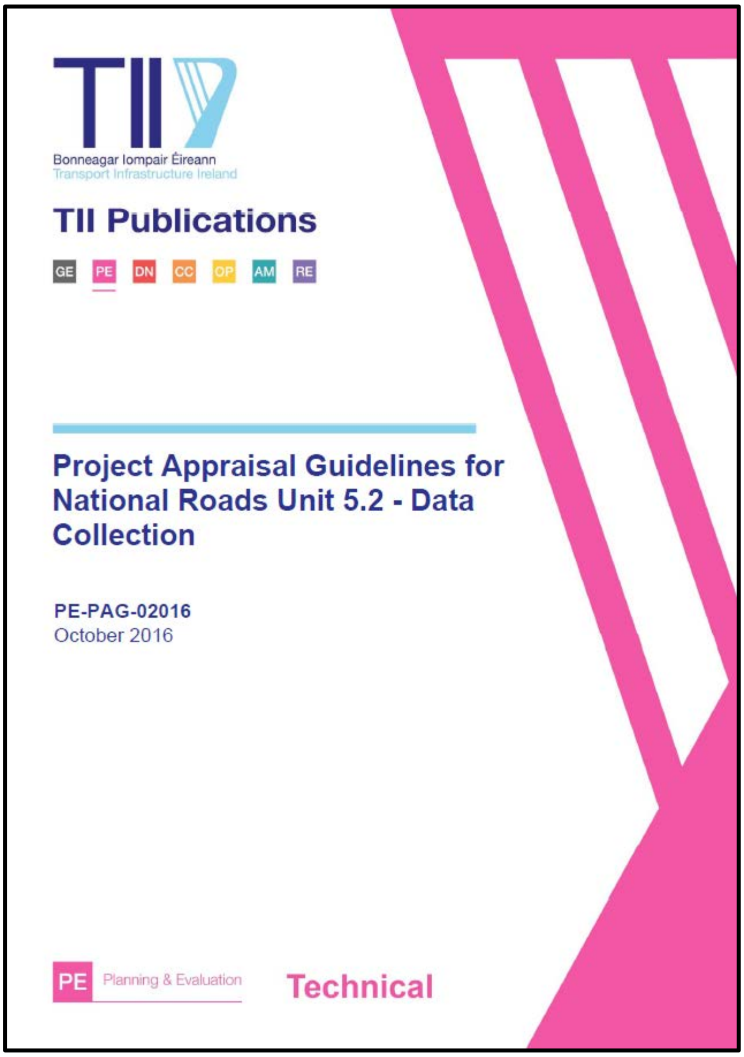


Classified Turning Counts

In order to determine the traffic flows in the vicinity of the site, new classified traffic turning count surveys were undertaken by MHC Traffic Ltd on Tuesday 21st March 2017 between 0600-0000 to cover the port's operational periods. The classified turning count surveys where carried out at the following junctions:

- **J1** - N69 / Port West Access priority junction;
- **J2** - Main Street / Brandon Cottages priority junction;
- **J3** - N69 / Port East Access priority junction; and
- **J4** - N69 / R521 priority junction.

The surveyed traffic flows were converted to Passenger Car Units (PCUs) using the conversion factors from the TII Project Appraisal Guidelines for National Roads Unit 5.2 – Data Collection, Oct 2016 (Page 8) as agreed by LCCC during the pre-application meeting. The conversion factors are included in **Table 13.3**.


TII
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Transport Infrastructure Ireland

TII Publications

GE PE DN CC OP AM RE

Project Appraisal Guidelines for National Roads Unit 5.2 - Data Collection

PE-PAG-02016
October 2016

PE Planning & Evaluation

Technical

Table 13.3 – PCU Conversion Factor – TII Project Appraisal Guidelines for National Roads Unit 5.2

Mode	PCU Value
Pedal cycle	0.2
Motorcycle	0.4
Passenger car	1.0
Light Goods Vehicles (LGV)	1.0
Medium Goods Vehicle (MGV/OGV1)	1.5
Buses and Coaches	2.0
Heavy Goods Vehicle (HGV/OGV2)	2.3

The existing traffic survey data in PCUs was compiled to determine the existing network morning and evening peak hour periods and is presented in **Table 13.4**.

Table 13.4 – Assessment of Network Peak Hour (PCUs)

Hourly Assessment	J1	J2	J3	J4	Total
06:00 - 07:00	140	0	267	0	407
06:15 - 07:15	220	83	377	161	840
07:00 - 08:00	449	468	700	852	2469
07:15 - 08:15	440	487	711	840	2478
07:30 - 08:30	418	460	681	792	2351
07:45 - 08:45	386	415	605	682	2088
08:00 - 09:00	354	385	523	576	1837
08:15 - 09:15	347	383	507	579	1816
08:30 - 09:30	354	447	511	559	1872
08:45 - 09:45	339	434	502	524	1799
09:00 - 10:00	319	422	508	529	1777
15:30 - 16:30	353	229	583	337	1503
15:45 - 16:45	373	346	651	587	1957
16:00 - 17:00	401	482	665	787	2335
16:15 - 17:15	435	505	665	803	2408
16:30 - 17:30	432	499	665	816	2412
16:45 - 17:45	430	486	625	742	2283
17:00 - 18:00	434	451	594	723	2202
17:15 - 18:15	418	451	625	743	2236
17:30 - 18:30	418	451	625	743	2236
17:45 - 18:45	365	437	533	656	1991
18:00 - 19:00	346	410	500	602	1857
18:15 - 19:15	307	277	415	405	1405
18:30 - 19:30	250	176	365	279	1071
18:45 - 19:45	233	73	345	127	779
19:00 - 20:00	212	0	312	0	524

From these surveys, it was determined that the morning and evening peak hours to be taken forward for detailed traffic impact assessment will be as follows:

- Morning Peak: 07:15-08:15; and
- Evening Peak: 16:30-17:30.

The morning and evening peak 2017 Existing Traffic Flows (in PCUs) are presented in **Appendix 13.4.**

13.4.2 Traffic Growth

The use of growth rates from TII's Project Appraisal Guidance (PAG) for National Roads Unit 5.3 – Travel Demand Projections (Oct 16) were considered within the traffic impact assessment. Table 5.3.2 of the PAG guidelines set out the criteria for projecting traffic growth. Given the description and the likely traffic impacts of the proposed development, the guidelines suggest that a link-based growth rate methodology should be applied. Table 5.3.2 extracted from the PAG guidelines shows that the proposed development sits within '*Region 5 – Mid-West'* and the corresponding growth rates should therefore be applied.

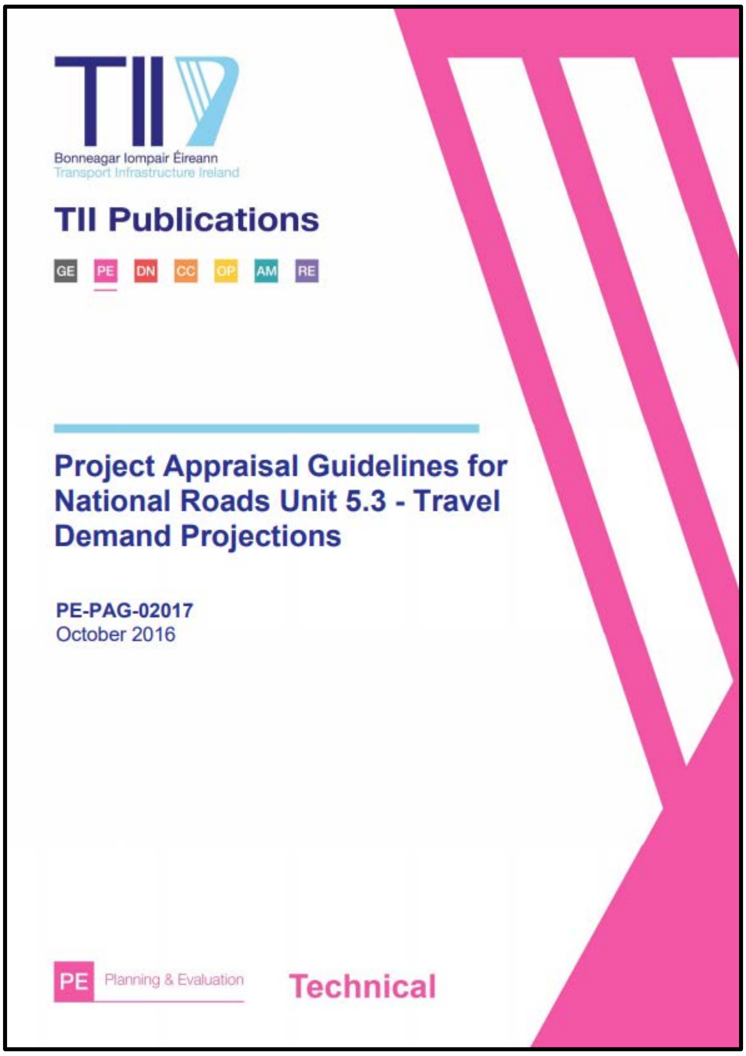


Figure 13.36 – Extracted PAG Link-Based Growth Rates: Table 5.3.2 - Annual Growth Factors

Region		Low Sensitivity Growth				Central Growth				High Sensitivity Growth			
		2013 - 2030		2030 - 2050		2013 - 2030		2030 - 2050		2013 - 2030		2030 - 2050	
		LV	*HV*	*LV*	*HV*	*LV*	*HV*	*LV*	*HV*	*LV*	*HV*	*LV*	*HV*
5	**Mid-West** *Limerick* *Clare* *North Tipperary*	1.0066	1.0221	0.9962	1.0135	1.0099	1.0237	1.0000	1.0176	1.0110	1.0242	1.0018	1.0195

For the purposes of this assessment, it is proposed to use PAG growth rates 'High Sensitivity Growth' in order to provide a more robust assessment of the network. It is assumed that the growth rate to be applied to the surrounding highway network will be the average of the Light Vehicle (LV) and Heavy vehicle (HV). Therefore, assuming High Sensitivity Growth this will be as follows:

- 2013 - 2030 (1.0110 + 1.0242) / 2 = 1.0176
- 2030 - 2050 (1.0018 + 1.0195) / 2 = 1.0107

The growth rates where then calculated for the future assessment years, centred on the 2017 surveyed base year, per annum using the appropriate annual growth rates identified from **Figure 13.36**, as indicated in **Table 13.5**.

Table 13.5 – PAG Growth Factor

Growth Factor	Base Year	Future Year	Factor
High Sensitivity Growth	2017	2029	1.230
		2041	1.410

13.4.3 Committed Development Flows

A review of the LCCC ePlan online planning application portal was undertaken to determine if there are any other significant generators of traffic within the vicinity of the proposed development site which have received planning approval but are yet to be constructed. The results of the search are shown in **Figure 13.37**, with a summary of the approved developments presented in **Table 13.6**.

Figure 13.37 – Committed Development Locations

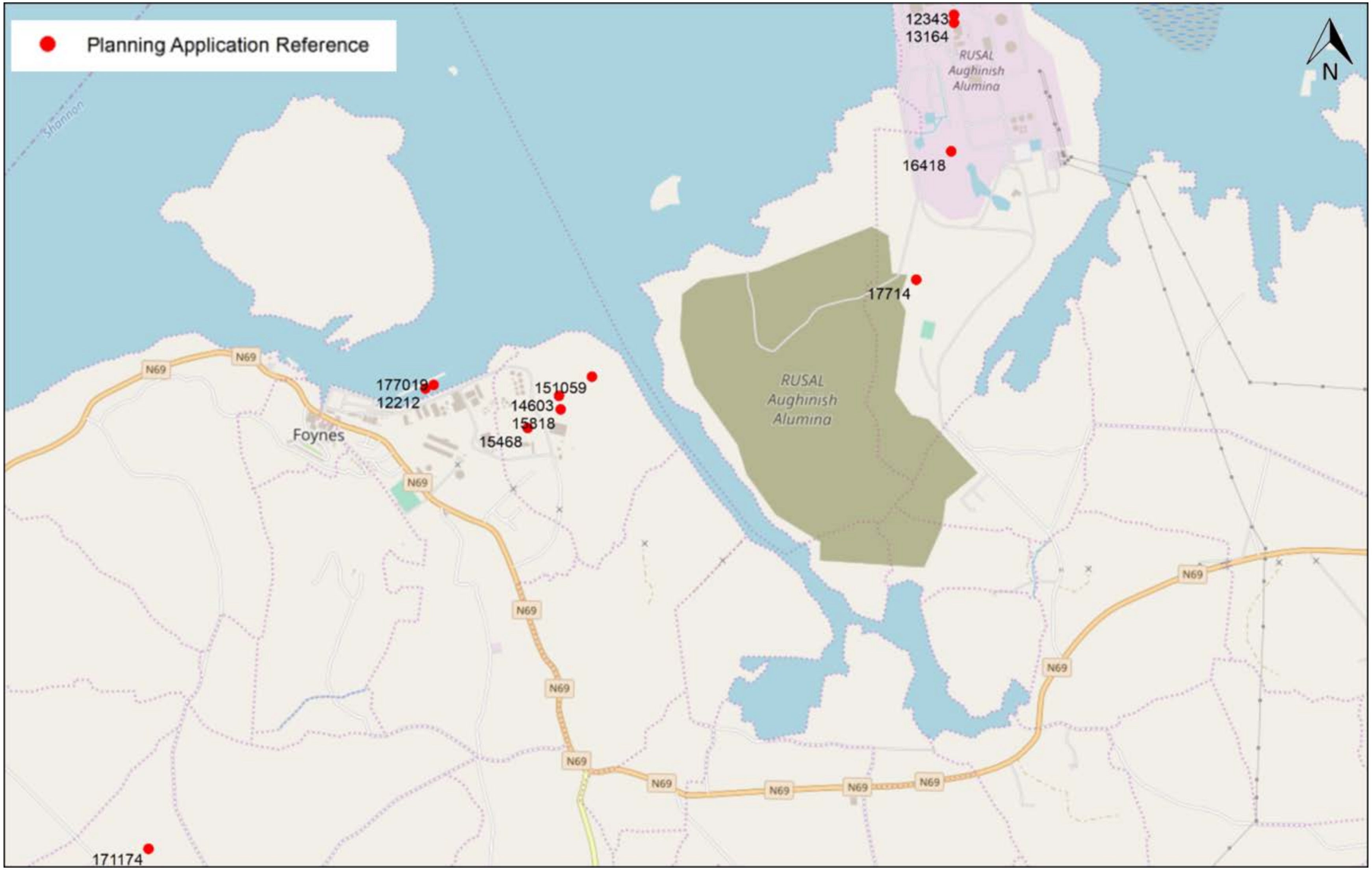


Table 13.6 – Summary of the Committed Developments

Planning Ref	Development Description	Development Impact	Decision	Address
177019 12212 15468 14603 15818 151059	Alterations and extensions to Shannon Foynes port	The traffic from any committed developments associated with SFPC are inherently included within this traffic impact assessment	Granted	Shannon Foynes Port, Foynes, Co. Limerick
171174	Solar farm consisting of construction & operation of solar PV arrays mounted on metal frames on a 18HA site	A solar farm's traffic generation after construction is minimal	Awaiting Decision	Ballynash (Bishop), Foynes, Co. Limerick.
17714 16418 13164 12343	Aughinish Alumina Ltd plant internal expansion	RUSAL Aughinish Alumina after construction minimal traffic generation as it is internal changes.	Granted	Aughinish East & West, Island Mc Teige & Glenbane West, Aughinish Island, Askeaton

The committed developments identified in **Table 13.6** were acknowledged as not having a significant impact on the external road network, and therefore, no committed developments were considered within the traffic impact assessment.

13.4.4 Proposed Development traffic generation

Traffic will be generated by the construction activities associated with the project and by the main site once operational. It is anticipated that the port will remain operational during construction, with the traffic generated by the proposed development once operational being more onerous than the construction phase. The construction traffic associated win the proposed development will be temporary and it is predicted that the constriction period will be completed by 2029. The following sections describe the traffic generated by each activity.

13.4.4.1 Construction Activity

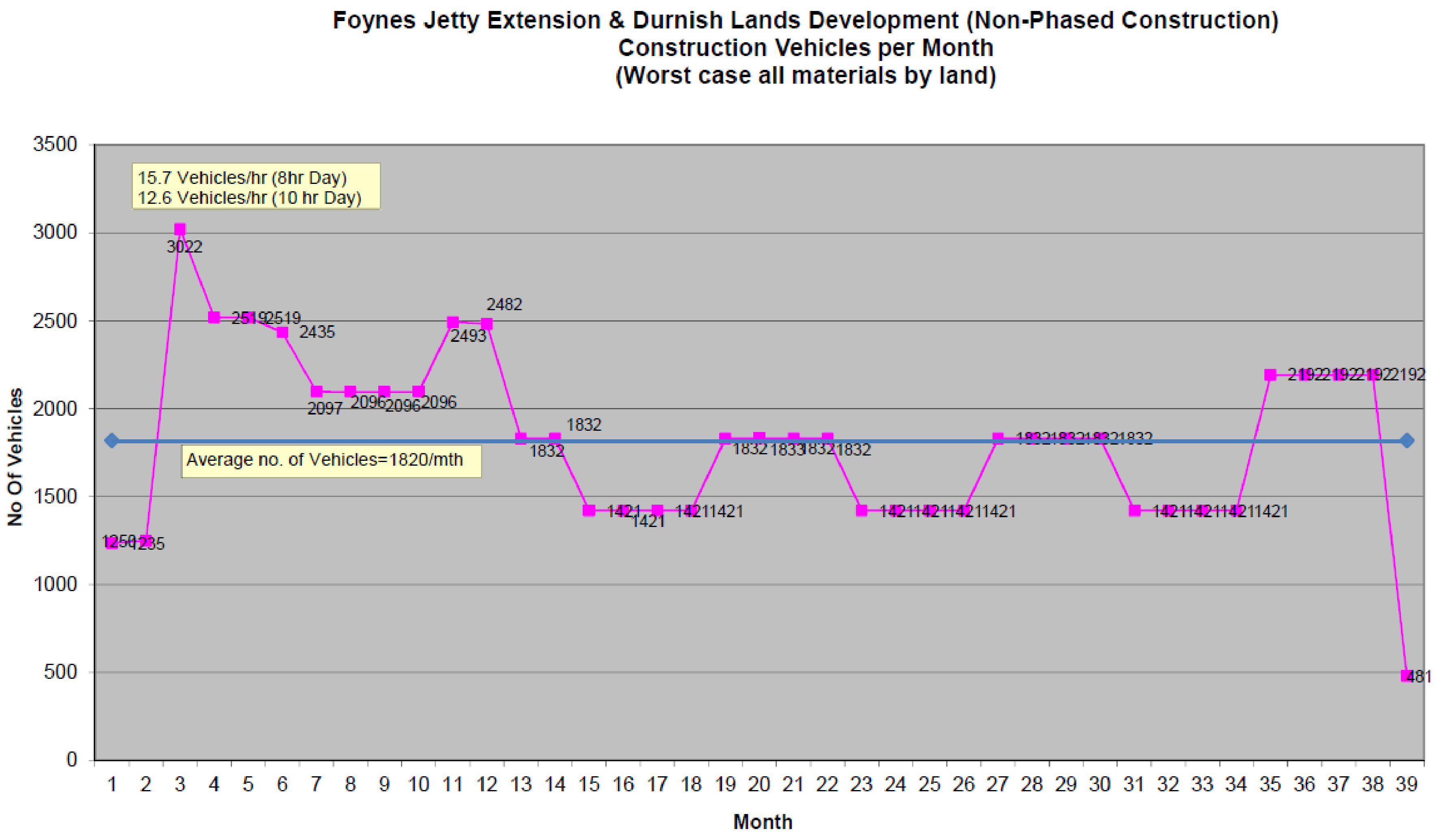
It is proposed that the construction activities which will give rise to vehicular movements associated with the following:

- Stripping of topsoil and stockpiling for use in boundary treatment;
- Raising of existing lands;

- Demolition of existing building;
- Bridge crossing structures over existing OPW drainage channel along Western boundary of developed lands;
- Hardstanding construction and appropriate surfacing for open and covered storage;
- Internal road and footpath construction;
- Provision of services (power supply, water, drainage, lighting);
- Erection of warehousing for covered storage;
- Planting of visual buffer along perimeter of developed lands.

An indicative construction schedule was prepared and presented **Figure 13.38**, which illustrates the level of traffic anticipated to be resulting from the construction phase of the development. In order to determine a worst case scenario for construction vehicles the worst month for traffic flows were applied to all traffic flows for assessment purposes.

Figure 13.38 – Proposed Construction Traffic



As a worst case estimate, the draft construction schedule in **Figure 13.38** demonstrates that there will be approximately 16 one-way vehicles on the external road network per hour during the peak construction activity. It should be noted that this a very robust figure to take through into the assessment.

Firstly, this assumes that construction occurs over an 8 hour working day. If construction occurred over a 10 hour working day the traffic would be reduced to 13 one-way vehicles per hour.

Secondly, as described above, the construction period could be over a maximum of 10 years. To provide a robust assessment for assessment purposes, the programme above considers a fast tracked construction period of just 39 months. The traffic volumes per hour would be reduced if the construction was spread over the 10 years.

Thirdly, this worst case spike only occurs during a localised period in about Month 3 when the number of construction vehicles per month is 3022. The average number of construction vehicles throughout the 39 month programme is 1820 per month as shown in **Figure 13.38**. This would lead to the following average hourly one-way vehicle profile:

- 1820 vehicles per month / 4 weeks = 455 vehicles per week
- 455 vehicles per week / 6 days = 76 vehicles per day
- 76 / 10 hours = 8 vehicles per hour
- 76/ 8 hours = 9 vehicles per hour

The calculation above shows that an average of 9 one-way construction vehicles per hour could have been carried through to the assessment, which also would have represented a robust assessment.

Within the context, it is demonstrated that the assessment based on 16 one-way construction vehicles per hour over an 8 hour working day within a 39 month fast tracked programme provides an additionally robust assessment. Note that based on the PCU conversion rates in **Table 13.3**, the 16 construction vehicles equates to (15.7 x 2.3) 36 PCUs. (In Sensitivity Test 3 which follows, this is increased to (15.7 x 3.0) equating to 47 PCUs)

Additionally, the worst case 36 PCU figure has been assessed up to and including the year 2029, which is the end of the construction period. This ensures that the worst case has been considered even though there is more construction activity at the start of the construction programme than at the end of the construction programme.

Construction Phase Haulage Route Access Options

Although it is impossible to determine where the construction traffic will originate to serve the construction phase of the development without planning permission secured and a main contractor in place, construction vehicles could potentially gain access via either port entrance. **Figure 13.39** illustrates all the quarries in the surrounding area that could possible serve the proposed development with material during the construction phase of the development.

Figure 13.39 – Existing Quarry Sites near Foynes (Geological Survey Ireland Public Data)

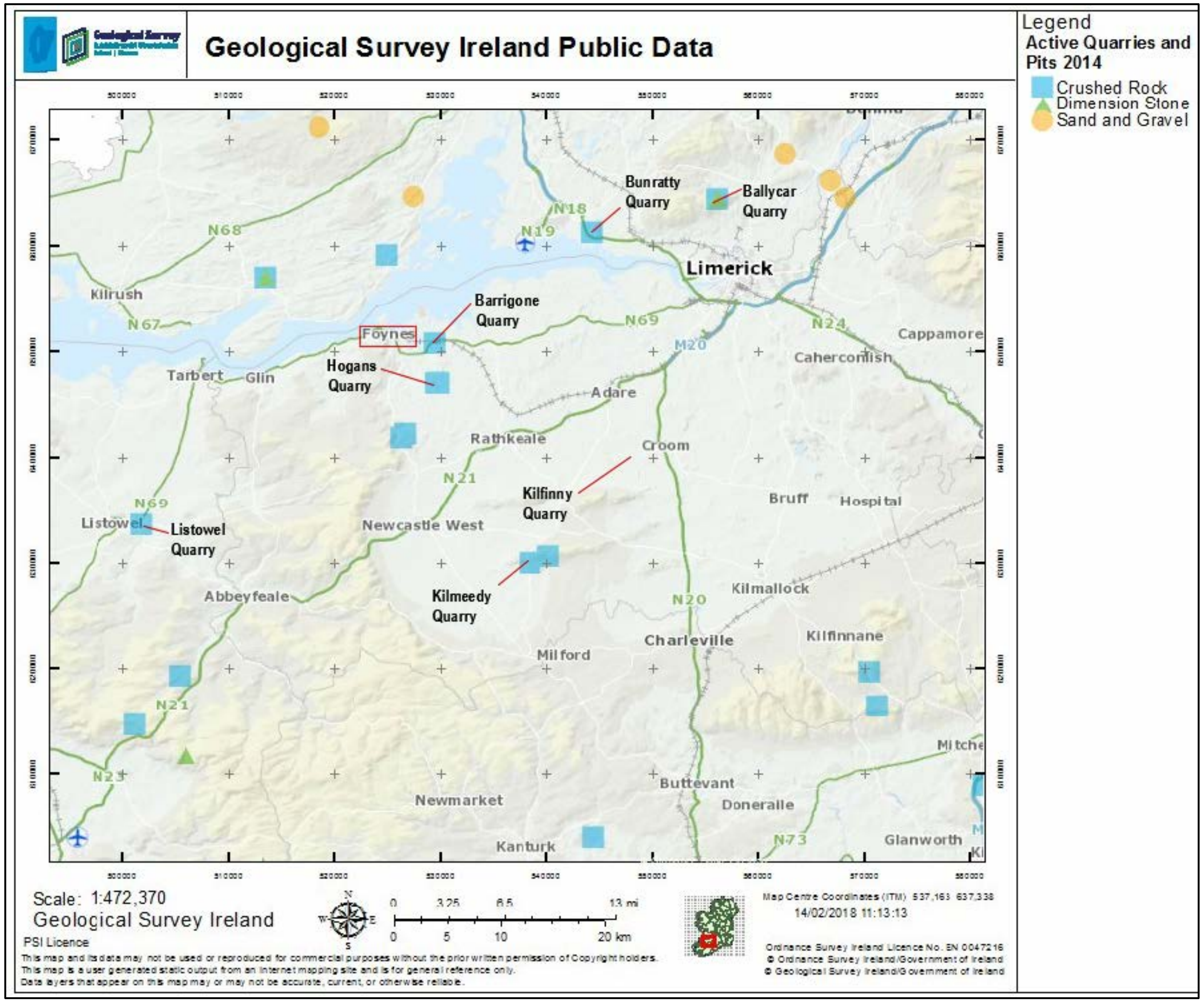
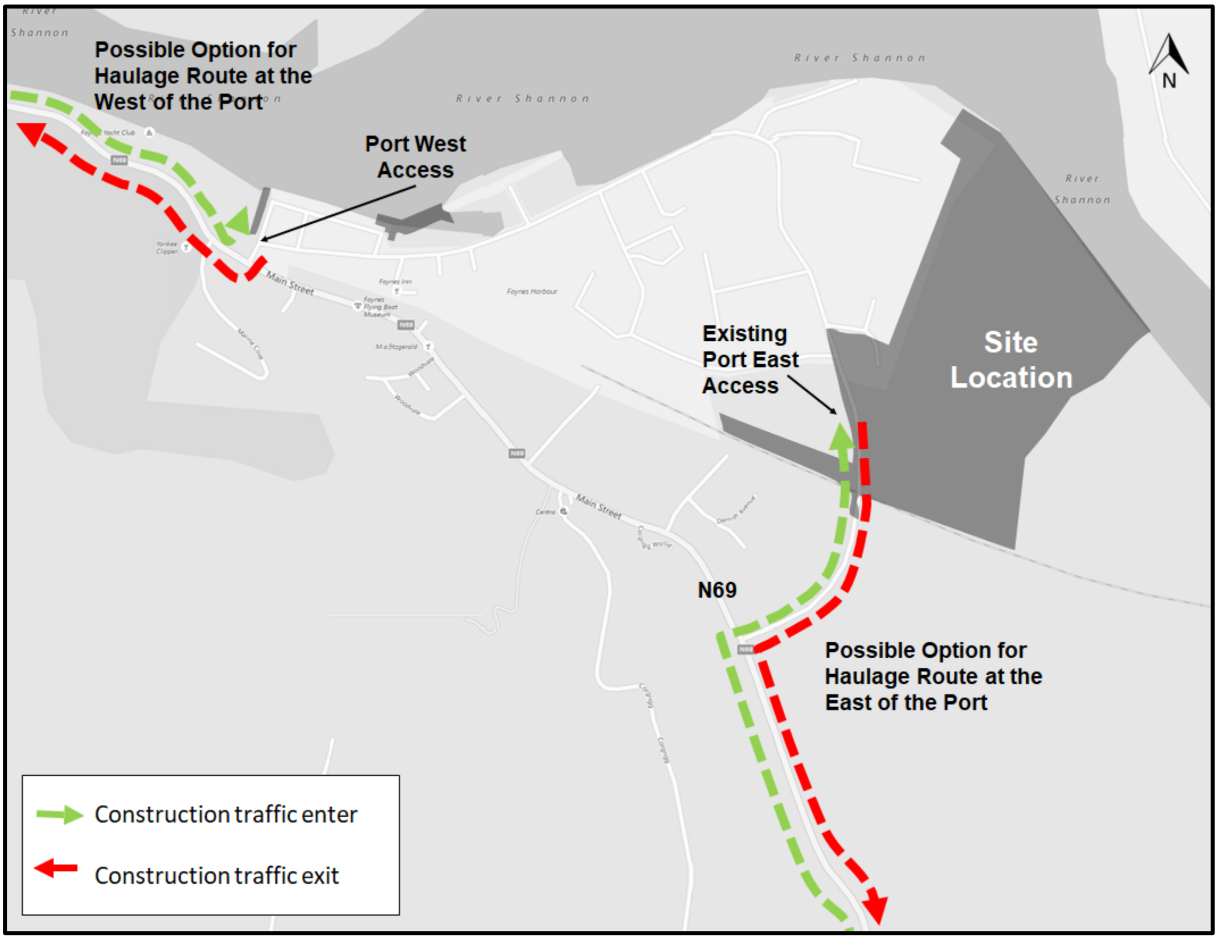


Figure 13.40 therefore illustrates the potential haulage routes for construction vehicles accessing to/from the site for assessment purposes within this TTA. These options ensure that both potential haulage routes have been contained in the assessment. It is anticipated, as illustrated in **Figure 13.40**, that there will be no construction vehicles accessing the site via Foynes town centre.

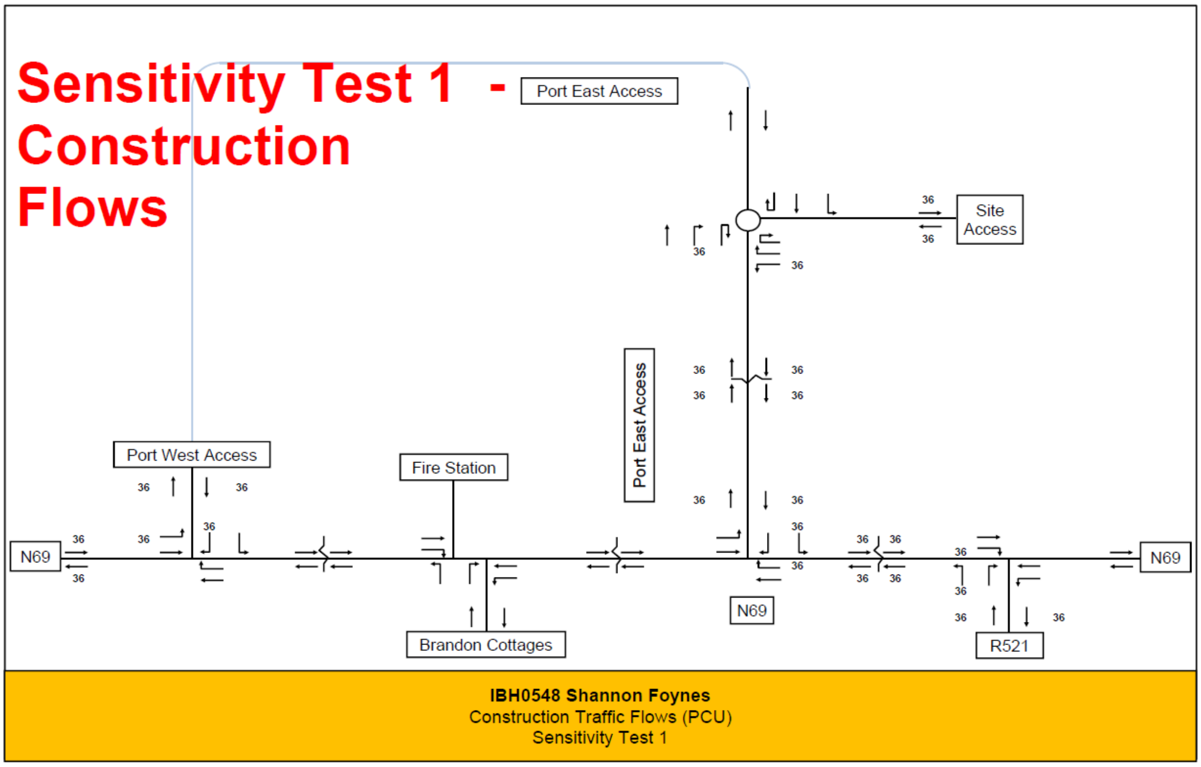
A predefined haulage route can be agreed with LCCC and the appointed contractor at construction stage, to be agreed through discussions with the relevant road authority section of the LCCC as is normal practice.

Figure 13.40 – Haulage Route Location Options for Construction Traffic



Hence, when considering construction traffic on the road network for the assessment, 36 PCUs have been assigned along both of the haulage routes illustrated above, to ensure that all possible routes have been assessed for both arriving and departing construction vehicles. This has been demonstrated in **Figure 13.41**.

Figure 13.41 – Illustration of how the Haulage Route and Worst Case Construction Traffic Flows have been incorporated into the Traffic Flow Diagrams



Construction Traffic Management

The construction related vehicles can be controlled by a Construction Traffic Management Plan (CTMP) to be developed and implemented by the Main Contractor. The CTMP will contain the usual suite of traffic management measures and can confirm the following information at construction stage:

- Location and operational organisation of the construction site and the construction site compound;
- Haulage route using either port entrance to access the construction site/compound;
- Expected numbers and nature of the construction vehicles;
- Site construction times and details of any time restrictions relating to construction vehicles on the adopted road network;
- Details of temporary warning signage that may be required; and
- Provision for wheel washing, roadside cleaning, load checking and general maintenance of larger vehicles.

13.4.4.2 Operational Activity

Vehicle trips

In order to establish the level of traffic likely to be generated as a result of the proposed development, classified traffic count surveys were undertaken at the existing site access to determine the level of traffic associated with the existing development during peak operating times. The resulting vehicle trip generation for the existing port is shown in **Table 13.7.**

Table 13.7 – Existing port vehicle trip generation

Port Access Location	Morning Peak (0715-0815)			Evening Peak (1630-1730)		
	Arrive	Depart	Two-way	Arrive	Depart	Two-way
West Access	22	3	**25**	7	21	**28**
East Access	157	76	**233**	64	114	**178**

The SFPC Vision 41 document presented combined tonnage aspirations. SFPC's targets for tonnage for the Foynes port only are indicated in **Table 13.8** below.

Table 13.8 – Shannon Foynes Port Tonnage Targets

Growth Factor	2011	2025	2041
Base Line	1,364,879	2,594,000	2,708,000
Mid Line	1,364,879	2,770,000	3,642,000
High Line	1,364,879	3,320,000	5,071,000

In order to provide a robust assessment, the High Line growth target of 5,071,000 tonnes by 2041 was carried forward within the traffic impact assessment. Based on the information presented in **Table 13.8**, a growth rate for port traffic established from a pro rata increase on existing traffic flows at the port access points, with the associated growth factor presented in **Table 13.9**.

Table 13.9 – Port Growth factor by Tonnage

Growth Factor	Base Year	Future Year	Factor
High Line	2017	2029	1.848
		2041	2.538

Applying the growth rates shown in **Table 13.9** result in a tonnage of 3,690,855 in 2029, and 5,071,000 in 2041. These are consistent with the High Line figures shown in the **Table 13.8**. These tonnages exceed the tonnages quotes in the Project Description in **Chapter 2**, and therefore provide an additionally robust assessment.

The growth rates in **Table 13.9** apply only to the port traffic, with the external traffic using the growth rates extracted from TII's guidelines. The proposed traffic flows (Port tonnage Grown Traffic + External PAG Grown Traffic) are included in **Appendix 13.5**.

13.4.5 Trip Distribution and Assignment

The trip distribution for traffic travelling to and from the site was determined from existing turning movements at the port access points. The SFPC Vision 2041 states:

"Up to 30% of the traffic exiting the port travel along the N69 and turn right onto the R521 in order to access the N21. However the recent opening of the Shannon Tunnel may have reduced the level of activity on this route, leading to a transfer of vehicular activity back to the N69."

A review of the traffic survey video footage was undertaken to validate the existing turning movements and to determine if the proposed distribution mirrored turning movement of the existing port traffic. A snapshot of the video footage reviewed at each access location and at the N69 / R521 priority junction is illustrated in **Figure 13.42** and in **Figures 13.43** to **13.45**.

Figure 13.42 – Footage Viewed Locations

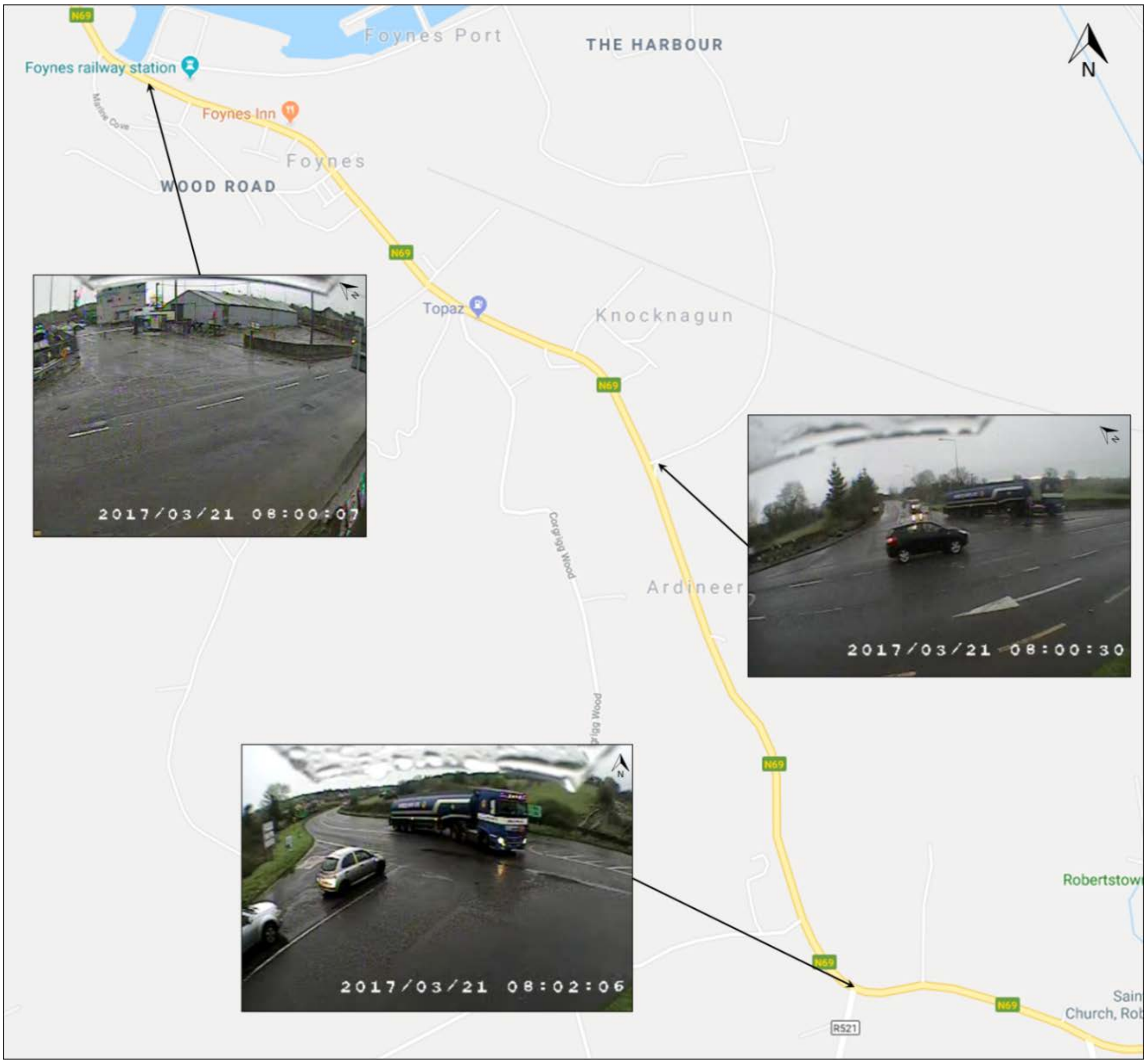


Figure 13.43 – Footage Screenshot from West Port Access Junction

Figure 13.44 – Footage Screenshot from East Port Access Junction

Figure 13.45 – Footage Screenshot from R521/ N69 Junction

The proposed traffic flows (Port Tonnage Grown Traffic + External PAG Grown Traffic) are included in **Appendix 13.5**.

13.4.6 Assessment of Generated Traffic

TII has published an approach for undertaking traffic impact assessments with their Traffic and Transport Assessment Guidelines (May 2014) document. These guidelines have been used as a basis for the assessment of the traffic generated by the proposed development on the external road network. Guidelines recommend that:

"The threshold approach should be used to establish the area of influence of the development. In general, the study area should include all road links and associated junctions where traffic to and from the development may be expected to exceed 10% of the existing traffic movements, or 5% in congested or other sensitive locations, including junctions with national roads."

A percentage impact analysis was undertaken to determine which of the junctions within the study area would need to be carried forward for detailed analysis. The percentage impact analysis confirmed that the following junctions be carried forward for detailed analysis, with the percentage impact analysis included in **Appendix 13.6**:

- N69 / Port West Access junction;
- N69 / Port East Access junction; and
- N69 / R521 junction.

The proposed new internal roundabout junction was also carried forward within the detailed traffic impact analysis to determine that the proposed design could cater for the existing and proposed traffic associated with the port.

13.4.7 Assessment scenarios

In order to assess the operation of the road network in relation to the proposals, the scenarios considered within the traffic impact assessment for weekday morning and evening peak periods were:

- 2017 Existing - Year network was surveyed;
- 2029 Proposed – 12 Years after Survey Year - Final year of the construction period; and
- 2041 Proposed – 24 Years after Survey Year - Final Year of the SFPC Vision 2041 and 12 years after the end of the construction period.

13.4.7.1 Basic level Assessment

As described in the **Section 13.4.2**, the basic level assessment considers the application of the PAG growth rates on the external traffic flows, and the high line SFPC growth tonnage rates on the Port related traffic flows for the future assessment years 2029 and 2041.

13.4.7.2 Sensitivity Tests

In order to provide a robust analysis of the junctions within the study area, a number of further sensitivity tests were identified to be carried forward within the traffic impact assessment.

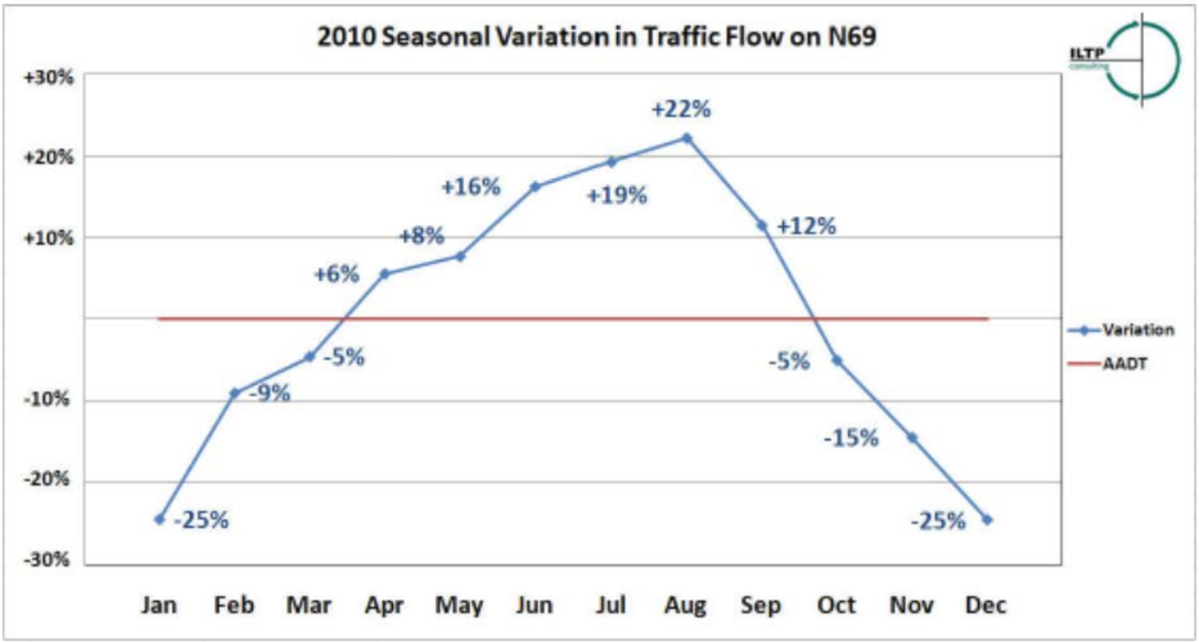
Sensitivity Test 1 - Construction Traffic

The construction phase will take place whilst the Port remains fully operational. A sensitivity analysis was undertaken to assess the impact of the port traffic on the network during the construction phase. To assess the volume of construction traffic on the network the worst case scenario was presumed as set out in **Section 13.4.4.1**. The worst case construction traffic was then added to proposed network in 2029, the final year of the construction period, to provide a more robust assessment. The construction traffic sensitivity flows are included in **Appendix 13.7.**

Sensitivity Test 2 - Seasonal Variation

It was identified within the SFPC Vision 2041 document that the existing traffic on the N69 is subject to seasonal variation, as shown in **Figure 13.46**.

Figure 13.46 – N69 Seasonal Variation (*Source SFPC Vision 2041)*



It can be seen from **Figure 13.46** that the peak seasonal traffic generally occurs in August. As the traffic surveys were undertaken in March, a neutral month, a seasonal adjustment factor was applied to the existing traffic flows in order to provide an additional robust sensitivity analysis, with the seasonal variation applied to the external traffic only. The seasonal variation flows are included in **Appendix 13.8.**

Sensitivity Test 3 – HGV Passenger Car Unit Factors

As stated above, the traffic flows were converted to Passenger Car Units (PCUs) using the conversion factors from the TII Project Appraisal Guidelines for National Roads Unit 5.2 – Data Collection, Oct 2016 (Page 8) as agreed by LCCC during the pre-application meeting. These rates have been applied to both the surveyed and the proposed traffic flows. The HGV Passenger Car Unit Factors flows are included in **Appendix 13.9.**

1 PCU = 5.75m on-road length.

Therefore, the road length assigned to a HGV or an OGV2 vehicle is 2.3m x 5.75m = 13.23m

Despite the guidelines being very clear from TII on the 2.3 conversion rates for an HGV / OGV2, and LCCC support for their use, some would try to suggest that this value should be increased to reflect longer HGV vehicles. This rational is often used at Ports due to the suggestion that freight vehicles related to Ports are towards the longer end of spectrum for the length of the vehicle.

To pre-empt and address the commonly raised issue, Sensitivity Test 3 has been carried out which considers that the PCU conversion rate for HGV / OGV2 is 3.0 rather than 2.3.

In Sensitivity Test 3 therefore, the road length assigned to a HGV or an OGV2 vehicle is 3.0m x 5.75m = 17.25m.

This comfortably accommodates the footprint of the 15.5m, or 16.5m, vehicles that are commonly referred to in slang as '40 footers'.

Hence, the additional Sensitivity Tests carried forward within the traffic impact assessment included:

2029 Assessment Year

- **Sensitivity Test 1** - 2029 Proposed + Construction traffic flows;
- **Sensitivity Test 2** - 2029 Proposed + Construction + Seasonal Variation traffic flows; and
- **Sensitivity Test 3** - 2029 Proposed + Construction + Seasonal Variation + PCU 3.0 traffic flows.

2041 Assessment Year

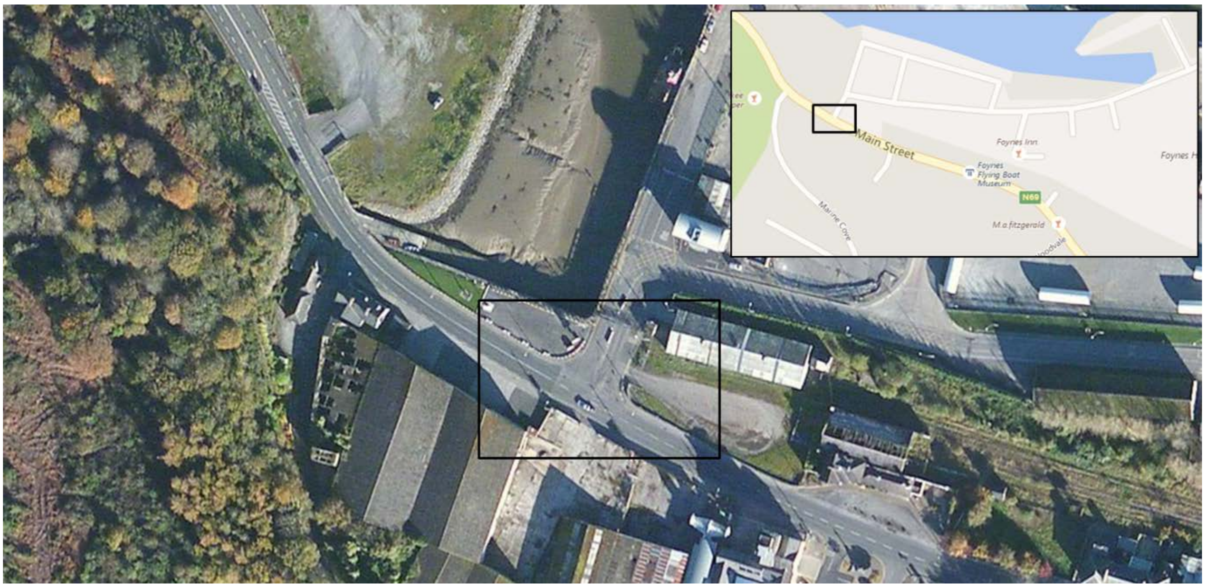
- **Sensitivity Test 2 -** 2041 Proposed + Seasonal Variation traffic flows; and
- **Sensitivity Test 3** - 2041 Proposed + Seasonal Variation + PCU 3.0 traffic flows.

There is no Sensitivity Test 1 for 2041 assessment year, as the construction period will have been complete in 2029.

13.4.8 Key modelling Results

Analysis of the performance of the priority and roundabout junctions was undertaken using the Transport Research Laboratory's (TRL) industry standard software JUNCTIONS 9, which is the approved software for predicting capacity and queuing at priority controlled junctions. The results of the analysis are presented in terms of Ratio of Flow to Capacity (RFC), with the corresponding queue. An electronic copy of the junction models, including associated geometric parameter drawings, is included within **Volume 9**. The 2017 existing scenario models were calibrated using observed queuing data from the traffic surveys.

13.4.8.1 N69 / Port West Access Priority Junction



This junction takes the form of a three arm priority junction. All feasible geometric parameters were measured from the background mapping presented in **Appendix 13.10**. The 2017 existing scenario model was then calibrated using observed queuing data from the new traffic surveys. The results are shown in **Table 13.10** for the morning and evening peak existing scenario, with the approach arms defined as follows:

- **Arm A**: N69 West;
- **Arm B**: Port West Access; and
- **Arm C**: N69 East.

Table 13.10 - N69 / Port West Access Priority Junction: 2017 Existing Scenario

Period of Assessment	Arm	Morning Peak			Evening Peak		
		RFC	Q	QS*	RFC	Q	QS*
2017 Existing	B-AC	0.01	0	0	0.06	0	0
	C-AB	0.03	0	0	0.02	0	0
Average queue observed from traffic surveys							

It can be seen from **Table 13.10** that, at present, the junction operates well within capacity.

The results of the capacity analysis for this junction with future year growth with the development traffic, together with the Sensitivity Tests 1-3 are provided in **Table 13.11**.

Table 13.11 - N69 / Port West Access Priority Junction: Future Year Proposed + Sensitivity Tests

Period of Assessment		Arm	Morning Peak		Evening Peak	
			RFC	Q	RFC	Q
2029 Proposed		B-AC	0.01	0	0.06	0
		C-AB	0.03	0	0.02	0
Sensitivity Test 1	2029 Proposed + Construction Traffic	B-AC	0.08	0	0.13	0
		C-AB	0.03	0	0.02	0
Sensitivity Test 2	2029 Proposed + Construction + Seasonal Variation	B-AC	0.09	0	0.14	0
		C-AB	0.03	0	0.02	0
Sensitivity Test 3	2029 Proposed + Construction + Seasonal Variation + PCU 3.0	B-AC	0.11	0	0.17	0
		C-AB	0.03	0	0.02	0
2041 Proposed		B-AC	0.01	0	0.09	0
		C-AB	0.04	0	0.02	0
Sensitivity Test 2	2041 Proposed + Seasonal Variation	B-AC	0.01	0	0.09	0
		C-AB	0.04	0	0.02	0
Sensitivity Test 3	2041 Proposed + Seasonal Variation + PCU 3.0	B-AC	0.02	0	0.09	0
		C-AB	0.05	0	0.02	0

The results presented in **Table 13.11** demonstrate that the existing N69 / Port West Access priority junction will continue to operate well within capacity for all scenarios, future year assessments and sensitivity tests with a maximum RFC value of 0.17 observed in the 2029 evening peak Sensitivity Test 3.

13.4.8.2 N69 / Port East Access Priority Junction

This junction takes the form of a three arm priority junction with a ghost island right turning lane and a N69 southbound merging slip lane provided. All feasible geometric parameters were measured from the background mapping presented in **Appendix 13.10**. The 2017 existing scenario model was then calibrated using observed queuing data from the new traffic surveys. The results are shown in **Table 13.12** for the morning and evening peak existing scenario, with the approach arms are defined as follows:

- **Arm A**: N69 North;
- **Arm B**: Port East Access; and
- **Arm C**: N69 South.

Table 13.12 - N69 / Port East Access Priority Junction: 2017 Existing Scenario

Period of Assessment	**Arm**	**Morning Peak**			**Evening Peak**		
		RFC	**Q**	**QS***	**RFC**	**Q**	**QS***
2017 Existing	B-C	0.10	0	0	0.12	0	1
	B-A	0.02	0		0.06	0	
	C-AB	0.18	0	0	0.09	0	0
**Average queue observed from traffic surveys*							

It can be seen from **Table 13.12** that, at present, the junction operates well within capacity.

The results of the capacity analysis for this junction with future year growth with the development traffic, together with the Sensitivity Tests 1-3 are provided in **Table 13.13**.

Table 13.13 - N69 / Port East Access Priority Junction: Future Year Proposed + Sensitivity Tests

Period of Assessment		**Arm**	**Morning Peak**		**Evening Peak**	
			RFC	Q	RFC	Q
2029 Proposed		B-C	0.19	0	0.23	0
		B-A	0.04	0	0.13	0
		C-AB	0.35	1	0.16	0
Sensitivity Test 1	2029 Proposed + Construction Traffic	B-C	0.24	1	0.28	1
		B-A	0.04	0	0.13	0
		C-AB	0.41	1	0.22	0
Sensitivity Test 2	2029 Proposed + Construction Traffic + Seasonal Variation	B-C	0.25	1	0.28	1
		B-A	0.04	0	0.14	0
		C-AB	0.43	1	0.22	0
Sensitivity Test 3	2029 Proposed + Construction Traffic + Seasonal Variation + PCU 3.0	B-C	0.33	1	0.34	1
		B-A	0.06	0	0.15	0
		C-AB	0.51	2	0.28	1
2041 Proposed		B-C	0.27	1	0.32	1
		B-A	0.06	0	0.19	0
		C-AB	0.50	2	0.23	1

Period of Assessment		Arm	Morning Peak		Evening Peak	
			RFC	Q	RFC	Q
Sensitivity Test 2	2041 Proposed + Seasonal Variation	B-C	0.28	1	0.33	1
		B-A	0.06	0	0.20	0
		C-AB	0.52	2	0.23	1
Sensitivity Test 3	2041 Proposed +Seasonal Variation + PCU 3.0	B-C	0.37	1	0.39	1
		B-A	0.09	0	0.23	0
		C-AB	0.61	3	0.29	1

It can be seen from **Table 13.13** that the junction is predicted to have an RFC value of 0.51 with a corresponding queue of 2 PCUs in the 2029 morning peak Sensitivity Test 3 assessment. An RFC value of 0.61 with a corresponding queue of 3 PCUs is predicted in the worst case 2041 Sensitivity Test morning peak scenario.

The results presented in **Table 13.13** demonstrate that the existing N69 / Port East Access priority junction will continue to operate within capacity for all scenarios, future year assessments and sensitivity tests.

Foynes to Limerick Road Improvement Scheme

The construction of the Foynes to Limerick Road Improvement Scheme will result in the N69 / Port East Access priority junction being upgraded to a four arm roundabout junction as shown in **Figure 13.47**.

Figure 13.47 – Proposed Road Improvement Scheme Roundabout

The Sensitivity Test 2 and 3 models were run for the prospect of this modification on the Port East Access junction. The geometric parameters for the proposed roundabout where provided by LCCC and are included in **Appendix 13.10**, with the results of the analysis presented in **Table 13.14**.

Table 13.14 - N69 / Port East Access / Limerick to Foynes Motorway Roundabout

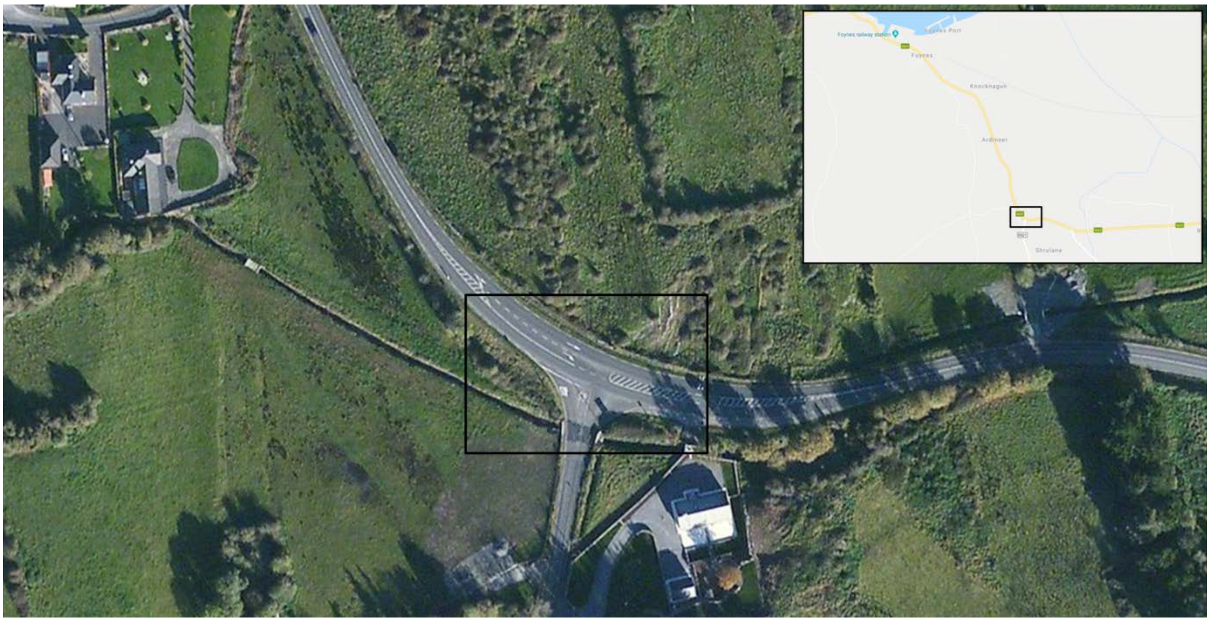
Period of Assessment		Arm	Morning Peak		Evening Peak	
			RFC	Q	RFC	Q
Sensitivity Test 2	2029 Proposed + Construction Traffic + Seasonal Variation	N69 North	0.27	0	0.32	1
		East Port Access	0.12	0	0.15	0
		N69 South	0.46	1	0.21	0
		Motorway	0.19	0	0.24	0
Sensitivity Test 3	2029 Proposed + Construction Traffic + Seasonal Variation + PCU 3.0	N69 North	0.30	1	0.35	1
		East Port Access	0.14	0	0.17	0
		N69 South	0.47	2	0.22	0
		Motorway	0.25	1	0.28	0
Sensitivity Test 2	2041 Proposed + Seasonal Variation	N69 North	0.31	1	0.37	1
		East Port Access	0.15	0	0.18	0

Period of Assessment		Arm	Morning Peak		Evening Peak	
			RFC	Q	RFC	Q
		N69 South	0.55	1	0.25	0
		Motorway	0.22	0	0.29	0
Sensitivity Test 3	2041 Proposed + Seasonal Variation + PCU 3.0	N69 North	0.35	1	0.40	1
		East Port Access	0.17	0	0.20	0
		N69 South	0.57	2	0.26	0
		Motorway	0.28	1	0.33	1

The results presented in **Table 13.14** demonstrate that the proposed N69 / Port West Access / Limerick to Foynes Motorway Roundabout is predicted to operate within capacity for the Sensitivity Tests assessed. It is predicted that this junction will operate within capacity, with a maximum RFC value of 0.57 and corresponding queue of 2 PCUs in the morning peak Sensitivity Test 3.

It should also be noted, however, that there is no formal design currently available for this proposed roundabout and the analysis above is based on the high level geometric parameters provided by LCCC, with narrow entry widths and short flare lengths observed, which would be unexpected for a large roundabout with an Inscribed Circle Diameter (ICD) of 65m.

13.4.8.3 N69 / R521 Priority Junction



This junction takes the form of a three arm priority junction with a ghost island right turn lane provided on the N69. All feasible geometric parameters were measured from the background mapping presented in **Appendix 13.10**. The 2017 existing scenario model was then calibrated using observed queuing data from the new traffic surveys. The results are shown in **Table 13.15** for the morning and evening peak existing scenario, with the approach arms defined as follows:

- **Arm A**: N69 South;
- **Arm B**: R521 and;
- **Arm C**: N69 North.

Table 13.15 - N69 / R521 Priority Junction: 2017 Existing Scenario

Period of Assessment	Arm	Morning Peak			Evening Peak		
		RFC	Q	QS*	RFC	Q	QS*
2017 Existing	B-C	0.11	0	0	0.07	0	1
	B-A	0.36	1	1	0.08	0	1
	C-AB	0.03	0	0	0.12	0	1

It can be seen from **Table 13.15** that, at present, the junction operates within capacity.

The results of the capacity analysis for this junction with future year growth and development traffic, together with the Sensitivity Tests 1-3 are provided in **Table 13.16**.

Table 13.16 - N69 / R521 Priority Junction: Future Year Proposed + Sensitivity Tests

Period of Assessment		ARM	Morning Peak		Evening Peak	
			RFC	Q	RFC	Q
2029 Proposed		B-C	0.11	0	0.09	0
		B-A	0.49	1	0.11	0
		C-AB	0.05	0	0.18	0
Sensitivity Test 1	2029 Proposed + Construction Traffic	B-C	0.29	1	0.15	0
		B-A	0.51	2	0.12	0
		C-AB	0.11	0	0.25	0
Sensitivity Test 2	2029 Proposed + Construction + Seasonal Variation	B-C	0.46	3	0.17	0
		B-A	0.66	5	0.16	0
		C-AB	0.11	0	0.29	0
Sensitivity Test 3	2029 Proposed + Seasonal Variation + PCU 3.0	B-C	0.56	4	0.19	0
		B-A	0.71	7	0.17	0
		C-AB	0.14	0	0.32	1
2041 Proposed		B-C	0.39	1	0.11	0
		B-A	0.59	3	0.14	0
		C-AB	0.06	0	0.24	0
Sensitivity Test 2	2041 Proposed + Seasonal Sensitivity	B-C	0.63	1	0.14	0
		B-A	0.79	3	0.19	0
		C-AB	0.07	0	0.28	0
Sensitivity Test 3	2041 Proposed + Seasonal Variation + PCU 3.0	B-C	0.69	8	0.15	0
		B-A	0.84	18	0.20	0
		C-AB	0.07	0	0.30	0

It can be seen from **Table 13.16** that this junction is predicted to have an RFC value of 0.71 with a corresponding queue of 7 PCUs in the 2029 Sensitivity Test 3 morning peak assessment. An RFC value of 0.84 with a corresponding queue of 18 PCUs is predicted in the worst case 2014 Sensitivity Test morning peak scenario.

The results presented in **Table 13.16** demonstrate that the existing N69 / R521 priority junction will continue to operate within capacity for all scenarios, future year assessments and sensitivity tests.

13.4.8.4 Proposed Eastern Access Port Roundabout

This junction takes the form of a three arm roundabout. The modelling results are presented for the morning and evening peaks respectively in **Table 13.17**.

Table 13.17 - Proposed Eastern Access Port Roundabout

Period of Assessment		Arm	Morning Peak		Evening Peak	
			RFC	**Q**	**RFC**	**Q**
2029 Proposed		To Port	0.06	0	0.09	0
		Site Access	0.06	0	0.05	0
		To N69	0.17	0	0.07	0
Sensitivity Test 1	2029 Proposed + Construction Traffic	To Port	0.07	0	0.10	0
		Site Access	0.07	0	0.07	0
		To N69	0.19	0	0.09	0
Sensitivity Test 2	2029 Proposed + Construction + Seasonal Variation	To Port	0.07	0	0.10	0
		Site Access	0.07	0	0.07	0
		To N69	0.19	0	0.09	0
Sensitivity Test 3	2029 Proposed + Seasonal Variation + PCU 3.0	To Port	0.08	0	0.11	0
		Site Access	0.09	0	0.08	0
		To N69	0.23	0	0.11	0
2041 Proposed		To Port	0.09	0	0.13	0
		Site Access	0.08	0	0.06	0
		To N69	0.24	0	0.10	0
Sensitivity Test 3	2041 Proposed + Seasonal Variation + PCU 3.0	To Port	0.12	0	0.15	0
		Site Access	0.10	0	0.08	0
		To N69	0.28	1	0.12	0

The results presented in **Table 13.17** demonstrate that the internal port roundabout will continue to operate well within capacity for all scenarios, future year assessments and sensitivity tests with the proposed development operational.

13.5 SUMMARY AND CONCLUSIONS

RPS Group was commissioned by SFPC to prepare a TTA for the proposed development of an extension to the current Shannon Foynes port lands.

The proposed jetty extension is located in the near shore region of Foynes Port between the existing East Jetty and the existing West Quay.

The Durnish Lands proposed for development are located on the eastern side of the main entrance road leading into the Shannon Foynes Port at Foynes, Co. Limerick. The development site is located approximately 1.5 kilometres east of the village of Foynes, and is within 500 metres of the N69 (Limerick to Tralee Road).

Existing Access to the proposed development is provided via the two existing priority junctions.

The proposals include a new roundabout to access the eastern side of the port which ties into the existing adopted road owned by LCCC. A Letter of Consent from LCCC allowing the roundabout to be shown on their lands for the planning application is attached. LCCC were also informed in writing at pre-application stage that the proposals will include the principle of the port barrier being relocated to an area within LCCC lands at the eastern side of the port south of the new roundabout.

An accessibility review was undertaken to assess opportunities for travel to the development by all relevant transport modes and review the surrounding walking, cycling and public transport provision. It should be noted that due to the location of the site and the nature of the existing and proposed development, access to the site by sustainable modes of transport is likely to be minimal.

In order to enhance walking and cycling sustainable travel options, the proposed scheme has been future-proofed to accommodate a possible future internal footway and cycle connection at the Port. The proposals include the provision of walkway / cycleways along the proposed roads within the Durnish Lands. In addition to the provision of the walkway / cycleways, cycle parking spaces will also be provided within the proposed development site at Durnish Lands.

The main bus operator serving the stops at the site is Bus Éireann Service 314, with the nearest existing bus stop located on the N69, adjacent to the Port's west access. This service provides a direct route from Foynes to Limerick and Tralee, including settlements of Askeaton, Talbert and Listowel. The bus stops at the site are served 5 times a day in both directions. It is proposed to facilitate a possible future bus stop to future-proof the possibility of the extension of the 314 Bus Service from the N69 along the eastern access road to serve the Durnish Lands.

Based on the percentage impact diagrams further analysis has been undertaken using approved traffic modelling software and robust assessment methods to ensure that the existing highway network can accommodate the traffic generations associated with the proposed development site.

Detailed junction capacity analysis was undertaken using approved traffic modelling software to ensure that the existing highway network can accommodate the traffic generations associated with the proposed development. The results demonstrated that the network functions well within capacity when the proposed traffic associated with the new development is added by the year 2041, the end of the Masterplan and 24 years from the survey year.

The construction of the Foynes to Limerick Road Improvement Scheme will provide further road capacity to the road corridor between Foynes and Limerick, and is currently at Planning Stage.

The construction of the Foynes to Limerick Road Improvement Scheme will result in the N69 / Port East Access priority junction being upgraded to a four arm roundabout junction. LCCC provided RPS with the dimensions of the proposed roundabout, which was modelled with the traffic flows derived in this report. The results showed that the proposed N69 roundabout will work comfortably within capacity for the year 2041.

An indicative construction schedule was prepared and presented in this report which illustrates the level of construction traffic generated the construction phase of the development. For the worst construction month, 16 one-way construction vehicles will be generated per hour based on an 8 hour working day, and 13 based on a 10 hour working day. On average throughout the construction period, 9 construction vehicles will be generated per hour based on an 8 hour working day, and 8 based on a 10 hour working day. For the purposes of assessment, the higher flows have been added into the junction modelling, and the results show that the existing junctions continue to operate within capacity for the year 2041.

Therefore it is concluded that the proposed development and related construction vehicle movements can be accommodated within the existing surrounding road network.

14 ARCHAEOLOGY AND CULTURAL HERITAGE

14.1 INTRODUCTION

The Archaeological Diving Company Ltd (ADCO) was appointed by RPS Group Ltd., on behalf of Shannon Foynes Port Company (SFPC), to undertake a non-disturbance archaeological impact assessment of three impact areas associated with the proposed Capacity Extension at Shannon Foynes. Please note that all figures and plates for this chapter are presented in Appendix 14 of this EIAR. Two locations lie within the existing confines of the port, and the third area is located across a greenfield site in Durnish Townland that borders the eastern side of the port estate (Figure 14.1).

Shannon Foynes Port is a Tier 1 port that is situated on the southern shoreline of the Shannon Estuary, 38km west of Limerick City, and comprises a major deep-water facility capable of accommodating vessels up to 198m in length with a maximum draft of 10.5m. The port specialise in bulk cargo with typical cargoes including energy products (liquid fuels, coal, etc.), agri-business inputs (feedstuff and fertilisers), recyclable materials, and green-energy components such as wind turbines.

The current development proposal facilitates the growth of Shannon Foynes Port, as provided in the Vision 2041 Strategic Development for the Port. The reclamation of the foreshore areas behind Berths 5 and 6 was consented under Limerick City and County Council Planning Permission 12/212.[1] Phase 1 of the development saw the reclamation of the foreshore behind Berth No. 6, completed in 2012. Phase 2 of the reclamation works is to reclaim the foreshore behind Berth No. 5, and will be carried out, under a separate application, as part of the current programme of port development works.

The proposed development project comprises the construction of a new jetty structure between the existing East Jetty and West Quay, within Shannon Foynes Port, and the development of lands to the southeast of the port estate, within Durnish Townland. The study area encompasses subtidal, intertidal, and terrestrial components that extend across three areas of the project design, namely (Figure 14.1):

- **Area 1**, a 145m (north-south) x 38m (East-West) area of intertidal foreshore located to the west of West Quay.
- **Area 2**, a 130m (north-south) x 237m (east-west) area of intertidal foreshore and subtidal riverbed located between/behind the existing East Jetty and West Quay.
- **Area 3**, a 797m (north-south) x 547m (east-west) parcel of land (Durnish Td.) located immediately to the southeast of the eastern limit of the existing boundary of the port estate.

The onsite assessment was comprehensive and comprised the systematic non-disturbance assessment of the areas surrounding the proposed construction impacts (Areas 1-3, see Figure 14.11); extending significantly beyond the identified limits of each of those impacts. The assessment sought to provide a thorough background to the maritime/estuarine landscape present, record the

[1] The archaeological assessment and subsequent EIS contribution for this reclamation work was carried out by ADCO in 2010. Rex Bangerter and Niall Brady, Archaeological and Architectural Assessment, Foynes, Co. Limerick, Shannon Foynes Port Land Reclamation, ADCO Ltd; unpublished report 2010 and EIS Chapter 13, *Archaeology and Cultural Heritage, Shannon Foynes Port Land Reclamation project.*

general topography of the areas under assessment, assess the potential of deposits from those areas to retain archaeological material, and identify any material, features or structures of archaeological or historic significance that are present.

The archaeological assessment was carried out in accordance with Section 5 of the National Monuments Act (2004 Amendment), under licence from the Department of Culture, Heritage and the Gaeltacht (DCHG); licence numbers 17D0017 and 17R0012. Visual inspection of the Durnish greenfield site and the intertidal foreshore areas within the port was undertaken on the 13th February 2018. The underwater assessment of the sub-tidal area between the East Jetty and West Quay was carried out on 16th February 2017.

The following report addresses the known and potential archaeological environment; assesses the actual and proposed impacts on that environment from the works programme; and makes recommendations to resolve any further archaeological requirements prior to the works programme commencing.

14.2 PROPOSED DEVELOPMENT

14.2.1 East Jetty Extension

It is proposed to connect the existing East Jetty and West Quay structures by continuing the berthing lines of Berth 5 and Berth 3 to form one continuous structure. The proposed works will include:

- Removal and relocation of the existing small-craft landing pontoon to an area identified on the west side of the West Quay.
- Construction of an open pile jetty structure and suspended concrete deck between the East Jetty and West Quay, con-joining both structures to form one continuous berthing line.
- Construction of a transition slab to provide access from the open pile jetty structure to the Berth 5 reclamation area; the latter item being a separate development permitted under LCCC Planning Permission Ref. No. 12/212.

The open pile jetty structure, which is to create a new Berth 4, will measure 25m in width and is to be constructed using a series of tubular steel piles, measuring *c.* 1.219m in diameter, that are to be driven to rock-head level between -32.0mCD and -35.0mCD; to provide approximately 3m of penetration into the bedrock.

The tubular piles will support a series of pre-cast concrete beams/planks and an *in-situ* concrete deck will be poured over the superstructure to consolidate the underlying pre-cast concrete elements.

14.2.2 Greenfield Site, Durnish (Figure 14.3)

It is proposed to infill of the existing greenfield site with imported inert fill material to raise the existing ground levels above the floodplain and facilitate the construction of warehousing, open storage, and other port related infrastructure. The proposed development works on the Durnish site are to include:

- Stripping of 200mm of topsoil from the surface of the site
- Raising of the existing lands to a level of +4.44OD using imported fill
- Provision of two (2) bridge structures to allow access across the existing drainage channel that defines the west boundary of the site.
- Development of an internal road/footpath network.
- Appropriate surfacing for both open storage and covered storage.
- Erection of warehousing for covered storage.
- Provision of appropriate boundary treatment, drainage, fencing, lighting and services.

While development of this land is considered as a single-phase scheme within the project EIAR, a phased approach to the development has also been provided for in the project design and comprises the following (as indicated in Figure 14.3):

- *Phase 1*, development of *c.* 11.5ha of land with 1.2ha of covered storage and 2ha of open storage.
- *Phase 2*, development of *c.* 5ha of land with 3ha of covered storage and 2ha of open storage.
- *Phase 3*, development of 10ha of land with 5ha of covered storage and 5ha of open storage.

14.3 ASSESSMENT METHODOLOGY

A sequence of work has been completed to ensure that the archaeological assessment has been comprehensive and robust. The work has included a desktop study of known archaeological and architectural sources, a review of the geotechnical site investigation (land-based and marine testing) conducted for the project, and on-site inspections and surveys that have included walkover surveys of the terrestrial and foreshore elements, and archaeological dive inspection.

The desktop assessment included a review of historic mapping that can reveal the development of the landscape over time; an examination of existing archival information at the National Museum of Ireland (NMI) and the DCHG in relation to the known archaeological objects, features, and sites of archaeological and architectural interest; and a review of archaeological work conducted in the immediate vicinity of the project area, from published and unpublished sources. This information combines to establish a baseline data source. The principal findings of which are described in Section 14.4.

14.3.1 Consultations

A desk study of cartographic and archival information was conducted as a preliminary stage of archaeological assessment for the project. This included, but was not limited to the following consultations:

- *Cartographic sources*, including Admiralty Charts, Ordnance Survey First and Second Edition maps, Geological mapping (GSI). Historic and current topographical maps represent very important sources that can reveal the progress of natural erosion and human development across a landscape/seascape over time. Such mapping in Ireland is metrically accurate from the mid-late nineteenth century.

- The *Irish Antiquities Division of the National Museum of Ireland* (NMI) retains an extensive archive of small finds and objects discovered across Ireland and reported to the Museum and its predecessors since the nineteenth century. It represents a critical resource for archaeological research, where registered objects are recorded by townland in the Topographical Files. For the present project, the following townlands were assessed: Foynes, Dunrish, Corgrig, and Ardaneer.
- *Department of Culture, Heritage and the Gaeltacht* (DCHG) *Sites and Monuments Record files*. The information, which is also filed according to townland, provides details relating to specific monuments and sites of archaeological importance that survive or whose site area is recorded. The record generally includes only sites that pre-date *c.* 1750 AD.
- *DCHG's Historic Shipwreck Inventory files* and *Places and Ports archive*. This information relates to the archives maintained by the National Monuments Section's Underwater Archaeology Unit for shipwreck and other maritime sites of archaeological interest. The information is located with reference to the nearest topographic locator, such as a town or headland, as well as site-specific grid coordinates where known.
- *National Inventory of Architectural Heritage* provides an online register of historic buildings and features/street furniture that retain architectural interest and is maintained by the DCHG's architectural section. The Inventory is organized by place and townland. The Inventory complements the archaeological inventories by including buildings and features that date from the eighteenth century and more recently.
- *Excavations Bulletin* is an annual published list of licensed archaeological intervention work conducted across Ireland. It is arranged by county and then by townland and is currently completed to 2011.
- Planning Ref: G Pre00212/2017 letter from Yvonne Nolan, Development Applications Unit of the DCHG to Ruth Barr, RPS, and entitled 'Pre-planning enquiry for Shannon Foynes Port Company-Extension of Jetty Facilities and Extension of Port Estate', dated 20th November 2017.
- Relevant published sources.
- Relevant unpublished sources.
- Online sources.

14.3.2 Legislation

The following legislation, standards and guidelines were considered and consulted for the purposes of this evaluation:

- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000;
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, NRA;
- Guidelines on the information to be contained in Environmental Impact Statements, 2002, EPA;
- Heritage Act, 1995;

- National Monuments Acts, 1930-2004;
- Planning and Development (Strategic Infrastructure) Bill, 2006;
- Strategic Environmental Assessment (SEA) Pack, 2010 EPA;
- In the absence of a specific Code of Practice between the Marine Industry and the Minister of Culture, Heritage and the Gaeltacht, the following Codes of Practice that exist between industry and the Minister were consulted: Bord Gáis Éireann (2002); Coillte (no date); EirGrid (2009); ESB Networks (2009), Irish Concrete Federation (2009), National Roads Authority (no date), Railway Procurement Agency (2007).

The following county and local development plans were considered and consulted for the purposes of this evaluation:

- Limerick County Heritage Plan 2005-2011.
- Limerick County Development Plan 2010-2016.

<u>Limitations</u>

The current report is based on desktop review and non-disturbance on-site archaeological assessment only. This included a review of the geotechnical data gathered as part of the site investigation work undertaken. No intrusive archaeological investigations or excavations have been carried out.

14.3.3 Classification of Impacts

Impact/effect categories will typically have regard to those set out in the 'Guidelines on the information to be contained in Environmental Impact Statements', 2002, EPA; 'Advice notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA; Strategic Environmental Assessment (SEA), 2010; and Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, no date, National Roads Authority. Impacts/effects are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact.

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact:

Direct impact occurs when an item of archaeological or architectural heritage is located within the centreline of the proposed route alignment and entails the removal of part, or all, of the monument or feature.

Indirect impact may be caused where a feature or site of archaeological or architectural interest is located in close proximity of the proposed development.

No predicted impact occurs when the proposed route option does not adversely or positively affect an archaeological or architectural heritage site.

These impact categories are further assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect).

Negative Impact is a change that will detract from or permanently remove an archaeological or architectural monument from the landscape.

Neutral Impact is a change that does not affect the archaeological or architectural heritage.

Positive Impact is a change that improves or enhances the setting of an archaeological or architectural monument.

A significance rating for these impacts is then given i.e. slight, moderate, significant or profound.

Profound applies where mitigation would be unlikely to remove adverse effects. This is reserved for adverse, negative effects only. These effects arise where an archaeological or architectural site is completely and irreversibly destroyed by a proposed development.

Significant is an impact that, by its magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where the part of a site would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological or architectural feature/site.

Moderate is a moderate direct impact that arises where a change to the site is proposed which, though noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological or architectural feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.

Slight is an impact that causes changes in the character of the environment that are not significant or profound and do not directly impact or affect an archaeological or architectural feature or monument.

Imperceptible is an impact capable of measurement but without noticeable consequences.

In addition, the duration of Impacts is assessed and has been sub-divided into the following categories:

- **Temporary Impact**, where an Impact lasts for one year or less
- **Short-term Impacts**, where an Impact lasts one to seven years
- **Medium-term Impact**, where an Impact lasts seven to fifteen years
- **Long-term Impact**, where an Impact lasts fifteen to sixty years.
- **Permanent Impact**, where an Impact lasts over sixty years.

14.4 RECEIVING ENVIRONMENT

14.4.1 Overview[2]

Foynes lies on the south side of the Shannon estuary, west of Aughinish. The presence of Foynes Island, some 330m to the North presents a wide channel and a most suitable anchorage with protection from the winds, but with a strong ebb flow. Indeed an entry in Lewis's *Topographic Dictionary of Ireland* (1837) observes that:

This place [Foynes Island] has been recommended by Capt. Mudge, the Government engineer, as affording extensive and secure anchorage for shipping, and consequently as a proper situation for the construction of docks and quays; at present it is seldom resorted to by mariners, but the steamers plying between Limerick and Kilrush call off the island to take up passengers. There was formerly a battery of 24-guns on the island, erected for the protection of the shipping trade of the river. On the south side is a handsome marine villa, the summer residence of the Earl of Dunraven; and there are several neat cottage residences in different parts of the island.[3]

The suitability of establishing a harbour at Foynes was assessed by F. Burgoynes, Harry D. Jones, and Richard Griffith, as part of the 1837 Commission for the Improvement of the River Shannon. Following the commission's findings, harbour works began in 1846 with the construction of a masonry quay and associated breakwater. By 1885, an act of parliament imitated the transfer of ownership of Foynes Harbour from the Commissioners of Public Works to a newly established board of trustees; the Foynes Harbour Trustees. Transfer was completed in 1890 and several infrastructural improvements to the harbour area followed. A new timber jetty was constructed (sometime before 1898), extending from the terminus of the masonry quay, and concrete-built spur was added in 1915; positioned parallel to the original quayside. Further development took place in 1933 with the construction of a new jetty, designed to cater for larger vessels, up to 8,000 tons. Around this time the port also became the European base for a transatlantic flying-boat service, which operated out of Foynes for the following decade. The existing East Jetty was established in 1968 and subsequently extended on its west side in 1984. A photograph from the 1960s provides an aerial view of Foynes subsequent to the construction of an oil terminal, an ore unloading plant, and the aforementioned East Jetty (Plate 1). It also, shows sizeable reclamation of the foreshore undertaken as part of the above developments, approximately 153m (max.) north-south x 800m east-west area being reclaimed. The original shoreline is denoted by the aforementioned floodwater embankments which are still *in situ*.

A range of archaeological sites are identified on Foynes Island (Appendix 14). The presence of six *fualchta fiadha* or spreads of burned stone material, indicate a distinct prehistoric horizon of activity that is concentrated in the centre and along the north shore of the Island. These are a commonly occurring site and represent cooking and related activities, which are often associated with nearby settlements but can also occur in isolation, suggesting the re-use of more general hunting or fishing sites. The clustering of *fulachta fiafha* on Foynes Island carries the attention westwards along the estuary for prehistoric activity that has been identified on the tidal mudflats to the east at

[2] Where relevant, information has been included from ADCO's previous assessment, Rex Bangerter and Niall Brady, Archaeological and Architectural Assessment, Foynes, Co. Limerick, Shannon Foynes Port Land Reclamation, ADCO Ltd; unpublished report 2010 and EIS Chapter 13, *Archaeology and Cultural Heritage, Shannon Foynes Port Land Reclamation project*

[3] Samuel Lewis*, A topographic Dictionary of Ireland comprising the several Counties, Cities, Boroughs, Corporate, Market, and Post Towns with Historical and Statistical Descriptions* (London, 1837).

Carrigdirty, and to the north along the Fergus Estuary.[4] There is however an absence of known archaeological sites at Foynes itself. This is a low-lying area on which tidal mudflats developed to the west of the Robertstown River and Aughinish, which lie *c*. 150m east of the present-day Port. In many respects, the landscape presents an ideal environment for early prehistoric activity similar to that which has been identified further east, focused on the exploitation of marine resources through the use of fishtraps and other shore-based activities. However, the establishment of the pier and later port will have removed and/or buried such remains.

The survival of a medieval tower house to the south in Corgrig townland (RMP LI 010-007) indicates the presence of settlement in the more recent past, as does a nearby enclosure (RMP LI 010-009) in Durnish. RMP LI 010-009 lies outside the development area, located 85m to the west; reduced to 65m when including the archaeological buffer zone associated with the RMP site. The site comprises an ill-defined, roughly oval-shaped area enclosed by a collapsed stone wall, overgrown with a thicket of bushes and brambles.

However, it is the Napoleonic era battery on Foynes Island that most clearly reflects the degree to which the landing place of Foynes was regarded with some importance in the past. The battery site (LI 010-001) was an earthwork construction that held six 24-pounders and was part of the wider defences along the estuary constructed against the threat of invasion.[5] It was considered capable of commanding the full width of the river at this point, which is a mile wide from Battery Point across to the Co. Clare shore.

Today Foynes forms a linear settlement with the continuation of house-building along much of the N69 and new housing developments established on the south side of the conurbation. Shannon Foynes Port commands much of the shoreline, comprising a general-purpose terminal that caters for dry-bulk, break-bulk, liquid, and project cargoes. The port complex comprises of the West Quay, completed in 1999 (271m length), the East Jetty (295m length), associated warehousing, port services, and oil-dolphins located to the east of the site (Plate 2). Reclamation of the intertidal foreshore behind Berth 6, on the east side of the East Jetty, was competed in 2012.

14.4.2 Cartographic Information

The earliest map that depicts the River Shannon area surrounding at Foynes is from the Down Survey Mapping of 1656–58; *Barony of Connello* (Plate 3). While this map depicts Foyne's Island and the adjacent shoreline, no cartographic indicators of development within the area are shown. In contrast, the neighbouring *Parish of Loughill* is shown to contain a series of clearly defined field boundaries, along with a church, tower house, and number of dwelling houses that surround the settlement of '*Loughill'.* It is not until nineteenth century that a settlement of Foynes is established and any corresponding mapping produced. As such, the following section examines the OS Fist Edition map of 1844, and the subsequent OS 25-inch map of 1898; examination and discussion of these cartographic sources providing demonstrable insight into the development of Foynes during the nineteenth century. An extract from geological mapping of the Shannon Estuary, produced in the late nineteenth century and surveyed by G.H. Kinahan and F.J. Foot, has also examined and is discussed at the close of this section.

[4] Aidan O'Sullivan, *Foragers, farmers and fishers in a coastal landscape: an intertidal archaeological survey of the Shannon estuary*, Discovery Programme Monograph 5., (Dublin 2002), pp55, 93
[5] Paul Kerrigan, *Castles and fortifications in Ireland, 1485-1945* (Collins Press, Cork 1995), p. 211.

The OS First Edition (1844) map; Figure 14.4

The OS First Edition mapping of 1844 depicts Foynes village as a linear development of detached and semi-detached dwellings situated either side of a roadway (now part of the N69) which runs close to the upper foreshore on the south side of the river estuary. A '*Post Office*' and '*Police Barracks*' are depicted to the west of the settlement, and a '*National School'* is shown *c.* 200m to the southwest. A small quay structure, annotated '*Quay*', is shown on the upper foreshore, between the main street and the aforementioned post office (Map Item 1). Work began on redeveloping the port in the 1840s, and records relate the progress and list of implements used during 1847–49 relative to sinking foundations and costs of completion.[6].

The 1844 map also depicts the nature of the shoreline. In contrast to the rocky foreshore shown extending along the southern side of Foynes Island, the inter-tidal zone adjacent to Foynes Village is depicted as a wide expense of estuarine mud-flats; forming an intertidal foreshore that extends between 121m and 350m in width. Flood embankments are located along the upper foreshore, placed to protect farmland to the southeast of Foynes and fields to the north of Durnish Td (Map Item 2). Opposing flood embankments are also depicted along the extent of Robertstown River, delineating the High Water Mark within the townlands of Aughinish to the east and Durnish to the west (Map Item 3).

A '*Weir*' is shown running roughly north-south from the Low Water Mark, located parallel (west) to a small river that has cut a channel thought the inter-tidal zone (Map Item 4). This structure measures approximately 170m in length and has two equidistant arms that protrude at right angles from the west side of the structure; measuring *c*. 25m in length. This tidal fish-trap represents a sizable endeavour and highlights the exploitation of the estuarine environment as a natural resource in the nineteenth century and is one of many such sites observed along the Shannon estuary, continuing an age-old tradition of exploiting the seasonal migrations.

A collection of small rectangular buildings is located to the north of Durnish Td, annotated '*Durnish Cottage'* (Map Item 5). A narrow laneway, providing access to the cottage, transects scrubland to the west of the townland; running south to meet the main road into Foynes village. Another building is located approximately halfway along this access laneway, on its north side (Map Item 6). A short distance to the south, a circular enclosure (LI 010-009) is shown (Map Item 7). The townland of Durnish is depicted as a collection of irregular-shaped fields and scrubland with frequent bedrock outcrops present; the scrubland comprising *c.* 40% of the townland area.

A large house and associated formal gardens, annotated '*Corgrig Ho.*' is situated close to the townland boundary between Corgrig and Durnish Tds. (Map Item 8, NIAH: 21829031). Immediately to the west of Corgrig House, a '*Castle in ruins*' is also depicted (Map Item 9, RMP: LI 010-007).

The OS 25-inch Edition (1898) map; Figures 14.5-14.6

The OS 25-inch Edition Map of 1898 depicts a much developed Foynes. Of particular note is the establishment of a harbour area to the northwest, completed in 1853. This includes a *c.* 100m-long masonry quayside, delineating the east side of the harbour (orientated north-south), a dog-legged pier structure that extends from the quay's terminus, and the insertion of a *c.* 104m-long breakwater

[6] National Archives, reference OPW8/. See also Colin Breen and Claire Callaghan, 'Post medieval shipwrecks, harbours and lighthouses', in O'Sullivan, *Foragers, farmers and fishers*, pp 233-251, at p. 249.

that extends eastward from the west side of the harbour (Map Items 10-12, Plate 5). A small '*Slip'* is also positioned at the southwest corner of the inner the harbour (Map Item 13, Plate 6).

A railway line, constructed in 1858 to facilitate port activities, is also shown running along the Foynes shoreline (Map Item 14). The railway terminates a short distance to the east of the harbour area, where a '*Terminus*' and '*Goods Shed*' are also depicted (Map Items 15-16). Two photographs of Foynes from the early 1900s show the railway station, goods shed, and turntable-track adjacent to the historic harbour area (Plate 7). A sizeable flood embankment, as noted on the First Edition Map, is visible running along the upper foreshore, to the left-hand side of the picture.

A '*Saw Mill*' and associated buildings are shown immediately to the south of Foynes Harbour (Map Item 17, Plate 8). A number of these buildings survive today and are currently in use by SFPC. A hotel, annotated '*Monteagle Arms',* is situated immediately to the east of the aforementioned saw mill (Map Item 18). The hotel was built in 1860, on land leased from the Monteagle Estate. In 1938 the Department of transport acquired the building and it became the headquarters for Aviation Ireland, later being taken-over as offices for the Foynes Port Company. Today it houses the Foynes Flying Boat and Maritime Museum.

The OS 25-inch map also depicts the development of Foynes village, the settlement having expanded eastwards with the addition of dwelling houses along its approach road. In addition, a '*Bank*', '*Court Ho*.', '*Smithy'* and chapel, annotated '*St. Senan's R.C. Chaple*' are now shown (Map Items 19-22). A staggered '*Salmon Weir*' is depicted transecting the intertidal foreshore off Durnish Point, some 600m east of Foynes village (Map Item 23). It is orientated north-northwest to south-southeast and the mapping indicates that the structure measures *c.* 124m in length.

In contrast, there is little development indicated for the townland of Durnish; the area continuing to comprise a series of irregular-shaped pasture fields and scrubland. However, a series of drainage ditches and an associated '*Sluice*' structure are shown (Map Items 24-25), demonstrating attempts to improve the quality of this poorly-drained land. Durnish Cottage and Corgrig House (NIAH: 21829031) are also shown, as is the nearby enclosure site (RMP: LI 010-009). The most notable development within this area is the insertion of the Limerick-Foynes railway line (Map Item 26), which transects the southern part of Durnish in an east-southeast to west-northwest direction.

Geological Mapping of the Shannon Estuary, 1882; Figure 14.7

Comprehensive geological mapping of the Shannon Estuary was produced in the nineteenth century.[7] Sheet 142 form this map series covers Foynes and the surrounding townlands. While the mapping is primarily concerned with underlying geology of the area, other cartographic features have been included: general topography, field boundaries, place-names, and the road and rail networks, etc. The historic harbour and railway terminus in Foynes area clearly depicted, as is the '*Limerick and Foynes Railway'* line. The geology shown largely corresponds with present-day GSI mapping of the area; only minor variations in formation extent and changes to geological nomenclature being evident. The current study area is shown as being covered by a subsoil deposit of '*Bog Alluvium*' (estuarine sediments) which in turn overlies a sub-stratum of '*Shale'* and '*Limestone'*. In the 1960s, the underlying bedrock was re-classified and sub-dived into separate formations, localised to the area; Clare Shale Formation, Pasonage and Corgrig Lodge Formation, Shanagolden Formation, Durnish Formation, and the Rathkeale Formation. The Durnish Formation, which encompasses the townland of Durnish and beyond, comprises blue-black bioclastic-

[7] Sheet 142, Geological Map of Foynes, surveyed in 1882 by G.H. Kinahan and F.J. Foot.

limestones, which commonly contain bands or chert nodules parallel to the bedding plain. Abundant *in situ* corals beds and brachiopod bands are also present within this formation type.

14.4.3 Topographic Archive

The topographic archives held at the National Museum of Ireland contain lists of artefacts held at the museum or previously seen at the museum and returned to owner. The Museum's files present an accurate catalogue of objects reported to that institution from 1928. There is a computerised database of finds from the 1980s onwards. They are categorised by their location into county and further into townland, town, city, street or river where they come from. There are rarely any grid co-ordinates to precisely locate find-spots. The find-spots of artefacts can be an important indication of the archaeological potential of the related or surrounding area. The information is ordered according to townland. In assessing the information for Foynes, the following townlands were considered: Foynes Island; Durnish, Corgrig, and Ballynacragga North.

A single object is noted in the records of the National Museum of Ireland under these townlands. A long narrow axe-head made from silicified black mudstone, typical of the 'Clare Shales' of Cos. Clare and Limerick, and which outcrop at the east end of Foynes Island was recorded from the central area of Foynes Island. The axe head is 17.7cm long, 5cm wide at its blade, and up to 2.3cm thick. It is in private possession and represents a typical tool for cutting wood during early prehistory.

14.4.4 Known Sites and Monuments

The Record of Monuments and Places (RMP) is a list of archaeological sites based on the Sites and Monuments Record (SMR) files, maintained by the National Monuments Section at the DCHG. SMR entries include detailed descriptions of archaeological sites based on site visits and historic studies and associated mapping where available. The SMR focuses on sites that are pre-1700AD in date. While later buildings are not well represented in the archive, all structures that are more than 100 years old are considered as archaeological sites today.

A total of thirteen (13) RMP sites are listed for the townlands Foynes, although only one (1) is located in close proximity to the areas under assessment (Table 14.1, Figure 14.8). The listed sites range in date from the prehistoric to post medieval period and highlight the longevity of human activity within the area. The closest site, RMP LI 0101-009, is located 85m west of the proposed Durnish development site [Figure 14.8; Area 3]; 65m when including the RMP sites associated 20m archaeological buffer zone. The site forms a roughly oval-shaped area, enclosed by a collapsed stone wall and overgrown with a thicket of bushes and brambles. A full entry list of the RMP sites within the vicinity of Foynes (2km radius) is provided in Appendix 14.

Table 14.1 Known sites and monuments listed in the RMP within a 2km radius of the areas under assessment.

RMP Number	Location [NGR/Townland]	Site Type	Distance to nearest development area
LI 010-001	123938E, 152860N; Foynes Island	Battery, site of	1.37km NW of historic harbour; Area 1.
LI 010-002	124152E, 150566N; Leahys Td.	Ringfort, Rath	1.64km SW of proposed East Jetty Extension; Area 2.
LI 010-004	124512E, 150926N; Leahys Td.	Ringfort, Rath	1.14km SW of proposed East Jetty Extension; Area 2.
LI 010-005	124699E, 150641N; Ballynacragga Td.	Ringfort, Rath	1.26km SW of proposed East Jetty Extension; Area 2.
LI 010-006	125188E, 150591N; Ballynacragga	Ringfort, Rath	1.12km SW of proposed Durnish development land; Area 4.
LI 010-007	125651E, 151043N; Corgrig Td.	Tower House	611m SW of proposed Durnish development land; Area 4.
LI 010-009	126011E, 151356N; Durnish Td.	Enclosure	85m W (65m W to buffer zone) of proposed Durnish development land; Area 3.
LI 010-109	124259E, 152918N; Foynes Island	Fulachta Fiadh, possible	1.2km NW of northwest of historic harbour; Area 1.
LI 010-110001	124488E, 152745N; Foynes Island	Fulachta Fiadh	988m NW of northwest of historic harbour; Area 1.
LI 010-110002	124545E, 152711N; Foynes Island	Fulachta Fiadh, possible	930m N of northwest of historic harbour; Area 1.
LI 010-111	124682E, 152692N; Foynes Island	Fulachta Fiadh, possible	880m N of northwest of historic harbour; Area 1.
LI 010-135	124531E, 150669N; Ballynacragga Td.	Fulachta Fiadh	1.28km SW of proposed East Jetty Extension; Area 2.
LI 010-137	124483E, 150680N; Leahys Td.	Burnt Mound	1.2km SW of proposed East Jetty Extension; Area 2.

14.4.5 Shipwreck Inventory

The Historic Shipwreck Inventory maintained by the DCHG is a list of recorded instances of wrecking since 1750. The details provided describe the type of vessel, the journey it foundered on, and information on the ultimate plight of the vessel and its crew, where possible. In describing the wrecking event, the records will locate the incident in relation to the nearest headland or other topographic marker where known. This is not however a record of where the wreckage lies, since the historic records generally only deal with the vessel before it sunk. Such finer details emerge from other sources, such as fishermens' records of snag points and diver records of sites located underwater. These are included in the Inventory wherever possible but it is true to say that most entries lack this final level of data. While the Inventory provides a record of wrecking incidents since

1750, it does not claim to be a comprehensive record for earlier events, and therefore the medieval and prehistoric periods are not represented in this archive.

The shipwrecks recorded for the Shannon estuary have been examined.[8] Where it is possible to approximate the location of ship-wrecking events, one observes a fairly even distribution along both north and south shores of the estuary, with a particular concentration at Kilrush, no doubt because of the extensive fishing port that Kilrush represents. In assessing the pattern of wrecking at Foynes, the following topographical markers were noted: Durnish Point, Gammarel Point, Foynes Rock, Poultallin Point.

There are only two references to wrecking events at or close to Foynes. A sailing boat whose name was not recorded was reported as having wrecked 'near Foynes Island' on 12th August 1788. The boat was carrying three men form Limerick when it overturned in a squall. Two of the men drowned. The *Castleragget* was a turf-boat journeying from Limerick in October 1833 when she was hit by a brig near Foynes Island. Nine people died. One must conclude from this that the potential for observing wreck sites dating from *c*. 1750 AD is low.

14.4.6 National Inventory of Architectural Heritage

The National Inventory of Architectural Heritage (NIAH) is a county-by-county database that identifies, records, and evaluates the post-1700 architectural heritage of Ireland as an aid to the protection and conservation of the nations' built heritage. The NIAH surveys provide the basis for the recommendations of the Minister for the DCHG to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS).

A total of twenty-one (21) entries are located within the wider area (see Figure 14.9 and Appendix 14), with five (5) entries lying within or in proximity to the port development areas, as detailed in Table 14.4. Many are related to the settlements development in the mid- to late nineteenth century. Only entry lies within one of the proposed the development areas; historic harbour, NIAH No.: 21829004 [Area 1]. This is located on the west side of Shannon Foynes port, where it is proposed to relocate a small-craft landing pontoon.

Table 14.2 NIAH entries located in proximity to the proposed development areas.

NIAH Number	Location [NGR/Townland]	Description	Proximity to study areas
21829003	124798E, 151804N; Leahys Td.	Detached four-bay two-storey with dormer attic former saw mill and mill house, built in 1863; now SFPC office.	50m south of historic harbour [Area 1]
21829004	256995E, 1171149; Corgrig Td.	T-plan limestone pier with harbour, built *c*. 1847.	0m [within]; historic harbour [Area 1]
21829005	124864E, 151684N; Corgrig Td.	*Monteagel Arms Hotel*, site of. Detached gable-fronted two-bay three-storey former railway hotel, built c. 1870	100m southeast of historic harbour [Area 1]

[8] Breen and Callaghan, 'Post-medieval Shipwrecks'.

NIAH Number	Location [NGR/Townland]	Description	Proximity to study areas
21829006	124902E, 151749N; Corgrig Td.	Detached four-bay two-storey former railway station, built between 1856 and 1858.	211m southeast of proposed East Jetty Extension [Area 2]
21829031	125620E, 151088N; Corgrig Td.	*Corgrig House*; detached five-bay two-storey house, built *c.* 1800.	501m west of proposed Durnish development land [Area 3]

14.4.7 Licensed Archaeological Work

The *excavations bulletin* provides annual published and online summary of accounts of archaeological excavations undertaken throughout Ireland.[9] Summaries may also be submitted for inter-tidal survey, underwater assessments, and the archaeological monitoring of marine/ riverine dredging works. The majority of the entries relate to development-led archaeological work. Appendix 14 lists the entries relating to the townlands surrounding Foynes, comprising: Aughinish Island, Aughinish West, Ballynacragga, Corgrig, Durnish, Leahys and Foynes Harbour.

Eight sites of archaeological significance are listed and include: a Bronze Age stone fort (entry: 1975-0025), a Medieval Tower House and Bawn (entry: 1974-0028), an Enclosure site (entry: 1996: 0232, RMP: LI010-014), an Early Christian Ringfort (entry: 2004-0975, RMP LI010:082), and a series of *Fulacht Fiadh* and associated burnt mounds that were encountered as part of archaeological investigations carried for the Bord Gais Eireann Pipeline to the West. These latter observations complement the series of burned stone spreads observed on Foynes Island and serve to highlight further the prehistoric dimension that exists along this wider shoreline. Two entries relate to archaeological monitoring that has taken place within estuary at or close to Foynes, but in neither instance have materials of interest been observed. One entry (02E0469) refers to monitoring of backhoe dredging associated with the laying of a section of gas pipeline across the River Shannon between Leahys townland, Co. Limerick, and Shanakea townland, Co. Clare. The second entry (02E1767) relates to archaeological monitoring of maintenance dredging works at Foynes Port and is the first reference to licensed archaeological work occurring close to the development area. This project noted a series of previous dredging projects, including capital dredging within the port area but these projects took place before the need to archaeologically monitor such work, and no materials of archaeological significance were reported.

More recently, ADCO was appointed by RPS Group Ltd., on behalf of the Shannon Foynes Port Company Ltd (SFPC), to undertake an archaeological and architectural assessment as an Environmental Impact Assessment (EIA) for the Cultural Heritage and Architectural Heritage section of the project Environmental Impact Statement (EIS) for the Shannon Foynes Port Land Reclamation project. This work was undertaken in February 2011, under licence from the DCHG; licence numbers 10D033, 10R092.

The study area comprised the quayside, foreshore, and subtidal portion of a 290m (east-west) x 85m (north-south) area located immediately adjacent to the existing East Jetty at Shannon Foynes Port; this area being subject to proposed foreshore reclamation to improve storage and handling facilities

[9] Isabel Bennett (ed.) *Excavations Bulletin: Summary Accounts of Archaeological Excavations in Ireland* (various dates; also online at www.excavations.ie).

for bulk operations within the port. The proposed work would effectively seal the existing seabed with fill material and represented a direct impact on the existing foreshore surfaces. Proposed dredging activity associated with this work also represented a direct impact on the buried sediments of the foreshore, which has the potential to expose previously unseen material of archaeological significance.

The on-site assessment was comprehensive and extended outside the confines of the proposed reclamation impact zone. The assessment noted that there is an inherent archaeological potential associated with the foreshore areas surrounding the River Shannon Estuary. However, this potential had been limited for the section of foreshore under assessment; extensive foreshore reclamation undertaken at Foynes in the 1960s having served to remove much of the potential historical and archaeological material that may have been present along the original shoreline. In addition, the data review and interpretation of both the geophysical and geotechnical investigations did not yield any evidence to suggest the presence of archaeological horizons lying exposed within the proposed reclamation area. Despite this, the potential of buried *in situ* archaeologically remained. Therefore, ADCO recommended that all ground disturbances associated with the development were archaeologically monitored and that any stonework of architectural interest identified as part of the assessment be recovered for re-use in an appropriate location in future development within the Port.

The reclamation project commenced in 2015 with the infilling of an area of foreshore located behind Berth No. 6; undertaken under LCCC Planning Permission 12/212. Localised dredging was also undertaken to facilitate the reclamation works. Archaeological monitoring of this work was undertaken by Shanarc Ltd. in October of that year, Licence No.:15E0051. No archaeologically significant material, deposits, or structures were encountered as part of that monitoring process. In fulfilment of the EIS recommendation, architectural recording of a series of worked stone pieces from the adjacent flood embankment was completed as part of the construction phase archaeological mitigation. A total of seventy-three pieces of worked stone were recoded, with nine pieces being subject to recovery and possible re-use.

Another programme of archaeological monitoring was also completed within the port area in 2015, undertaken by Rubicon Heritage Services Ltd. at the Argosea Warehouse site, Foynes Harbour, Durnish Td.; Licence No. 14E0397. This work was commissioned by Punch Consulting Engineers on behalf of Argosea Services Ltd. The development involved the construction of five covered, bulk and general storage, warehouses and associated site works. No archaeological features or deposits were revealed during the monitoring of this endeavour.

14.4.8 Conclusion

The examination of the nineteenth-century cartographic sources has provided good insight into the development of the harbour area in Foynes and examination of other desktop material has sought to highlight the archaeological potential and historic value of those areas under assessment.

Maritime activity within the Shannon Estuary is documented from early prehistoric times. The study of the wider estuary indicates that the location of Shannon Foynes Port within a low-lying sheltered shoreline is an ideal situation for early human activities. The presence of remains on Foynes Island to the north and Aughinish to the east, as well as former fish weirs close by at Durnish Point, reinforces this observation. In addition, the presence of a cluster of ringfort sites and an enclosure site to the west of Durnish Td. also highlights continued activity throughout the early medieval period and later.

However, it is clear that the construction of the nineteenth-century pier and later port with its attendant development and reclamation works will have reduced the potential for archaeological recovery within the existing port area. There is, nevertheless, an inherent potential for foreshore archaeology to be revealed during new construction projects that are associated with fresh disturbance activities, where the ground surfaces are impacted directly. In such instances, there is a need for archaeological resolution strategies, to mitigate the possibility for new discoveries.

14.5 GEOTECHNICAL DATA REVIEW

A series of ground investigation works were undertaken across the proposed development areas in order to provide accurate sub-surface design information of the proposed development (Figure 14.10).[10] The onsite geotechnical work was completed in July 2017 and included the use of boreholes (both cable-percussive and rotary-core), trial pits, standard penetration testing, and cone penetration testing.

Borehole testing was carried out across sub-tidal, intertidal, and upper foreshore areas; gathering samples from a total of twenty-three (23) boreholes within the port. The majority of the boreholes were positioned between the existing West Quay and East Jetty, where it is proposed to extend the East Jetty (Area 2). A number also extended across the intertidal foreshore area behind Berth 5. Two (2) boreholes were also positioned adjacent to the masonry quay that delineates the east side of the historic harbour, where a small-craft landing pontoon is to be repositioned (Area 1). In addition, five (5) boreholes and nine (9) trial pits were positioned within Dunish Townland (Area 3). A single borehole was placed on the upper foreshore at Durnish Point.

The subsequent data from the geotechnical investigation was assessed from an archaeological perspective by ADCO. However, the borehole data sheets did not reveal any indicators to suggest the presence of submerged landscapes or buried peat horizons within the areas assessed.

14.6 ARCHAEOLOGICAL ASSESSMENT

Archaeological site work took place on 13th and 16th February 2017; carried out under DCHG licence numbers 17D0017, 12R0012. No limitations were experienced, and full access to the development areas was possible.

14.6.1 Survey Methodology

The assessment recorded the foreshore/riverbed topography present and sought to provide a detailed account of the existing shore-side environment. On-site work comprised systematic non-disturbance inspection of the intertidal and sub-tidal zones within the historic harbour area [Area 1] and the impact area associated with the East Jetty extension [Area 2]. Field-walking of the proposed port expansion lands in Durnish Td. [Area 3] was also carried out and included an intertidal survey of the adjoining foreshore along Robertstown River. The assessment extended outside the boundaries identified for each of the development locations (Figure 14.11), allowing a fuller picture of the foreshore environment to be gained and to provide a suitable archaeological buffer to the proposed development works.

[10] Foynes Port Ground Investigation, Factual Report, 17022-R-01-00, Gavin and Doherty Geosolutions Ltd./ ABCO Marine Ltd., unpublished report issued January 2018.

A Fisher *Aquanaut* 1280U metal-detector was used for the magnetometer survey of the foreshore areas. An XP Deus metal-detector was used for the shore-based surveys (Plate 9). A finds retrieval strategy dealing with conservation issues, cataloguing, and locational recording was in place to deal with any artefacts recovered during the survey. In addition, a DGPS unit was on-site to position-fix any features encountered as part of the survey (Plate 10).

Field-walking of the Durnish development land and the adjacent intertidal foreshore was undertaken by a team of three archaeologists. The intertidal and underwater assessment of the proposed development areas within the port itself was carried out by a team of four underwater archaeologists and a Dive Supervisor.

Dive operations were carried out to HSA/HSE standard using surface supplied equipment, supported with suitable boat cover and mobile/ VHF communications to the Harbour Master and SFPC port operations office, in accordance with the Safety in Industry (Diving Operations) Regulations 1981, SI 422 (Plate 11). An F089 application to conduct diving operations within Foynes Port was submitted to the SFPC and a notification to dive was submitted to the Health and Safety Authority (HSA) in advance of the dive work commencing.

14.6.2 Terminology

When referring to the degree of compaction observed for the intertidal/riverbed/field deposits under inspection, the terms loose, medium, and hard are relative and do not relate to the measured properties of these deposits. All dimensions in this report are provided in either millimetres or meters according to scale. When referring to sediment grain size, the Wentworth scale has been adopted, as detailed in Table 14.3.

Table 14.3 Sediment grain size categories as applied to the riverbed deposits discussed in this report

Size (mm)	Grade
>256	Boulder
>64	Cobble
>4	Pebble
>2	Granule (gravel)
>1	Very coarse sand
>1/2	Coarse sand
>1/4	Medium sand
>1/8	Fine sand
>1/16	Very fine sand
>1/32	Coarse silt
>1/64	Medium silt
>1/128	Fine silt
>1/256	Very fine silt
<1/256	Clay

14.6.3 Shannon Foynes Port and Durnish (Areas 1-3)

This work was undertaken in advance of the ground investigations works being undertaken, as detailed in Section 14.5. The intertidal survey of Areas 1-2 was undertaken on 13th February 2017 during a Spring Low Tide cycle. Field-walking of the Durnish Td. (Area 3) was also completed on the same day. The sub-tidal component of Area 2 was subsequently assessed on 16th February 2017. The following section describes the topography encountered, and details the findings from the visual inspection and accompanying magnetometer survey (Sub-sections 6.2-6.4). The extent of the onsite survey work undertaken by ADCO is detailed in Figure 14.11.

14.6.4 Topography

Area 1 is located on the west side of the port and lies adjacent to a nineteenth-century masonry quayside, forming the east side of the historic harbour area at Foynes; NIAH No. 21829004 (Plates 12-13). The intertidal zone extends across a *c.* 40m (east-west) x 100m+ (north-south) area and is delineated on its western a steep side wall of rock-armour protection (Plate 14). The foreshore is composed of a soft silty-sand (max depth of 200mm) overlying a compact clay-bed. Occasional boulders (< 300m size) are present across the foreshore extent, with small angular cobbles and sub-rounded gravel also present along the upper margins (Plate 15). The foreshore slopes gently towards the east side of the harbour area to a narrow/shallow (north-south) sub-tidal channel that lies parallel to the masonry quay wall.

Area 2 occupies the intertidal foreshore and sub-tidal riverbed between the western extent of the East Jetty and the east side of the West Quay (Plates 16-17). The intertidal zone extends *c.* 70m from the High Water mark to the Low Water Mark. It is composed of a soft-medium silty-sand (70%/30% mix) with sediment penetration depths (by hand) of between 300mm and 750mm being observed. Occasional gravel and fragmented shell inclusions were noted, with infrequent sub-rounded cobbles and boulders being scattered across its expanse. Rock-armour delineates the upper foreshore within this area, running between NGR: 12579E, 151780N and NGR: 123107E, 151786N (172m long section) (Plate 18).

The sub-tidal survey was undertaken across a 108m (east-west) x 52m (north-south) area located between the East Jetty and the West Quay. The seabed slopes at approximately a 30º angle from the Low Water mark for a distance of *c.*10m and is composed of silty-clay of medium compaction with a penetration depth of 200mm. This deposit is sterile in nature and represents seabed substratum that has become exposed within the area. Further to the north, where water depth increases, this deposit is overlain by deep deposits of soft silt, ranging in depth between 400mm and 1m+. The seabed surface is sterile of modern debris, any discarded objects having penetrated this layer of soft overburden.

Area 3 comprises four irregular-shaped fields located within Durnish Td. that abut the eastern boundary of the existing port estate (Plate 19). These fields appear to have been sporadically used as rough pasture (Plates 20-22). The proposed development area is defined by Robertstown River to the northeast, a railway line (disused) to the south, and a port-access roadway and boundary fence to the west (Plate 23). A hedgerow delineates the port access road and site boundary to the west. A large flood embankment runs along the upper foreshore of the Robertstown River Estuary, placed adjacent to the High Water Mark (Plate 24-25). The adjacent intertidal zone comprises silty-sand (70%/30% mix) of medium compaction with a hand-penetration depth of 120mm. This area extends 53m-86m between the upper foreshore and the Low water Mark. The townland of Ardaneer lies to the south of the Durnish lands, with Corgrig townland to the southwest.

The land within Area 3 is poorly-drained, although large, well-maintained, drainage ditches line both the northeast and western extents of the site (Plates 26-27). Smaller, v-shaped, ditches define the field-boundaries, which are also covered with small trees and low-lying vegetation. Water drained from these ditches is collected in an attenuation pond, situated at the northern corner of the site. A sluice structure is located a short distance to the east of the attenuation pond. This structure regulates the accumulated water, draining it into the adjacent river in order to minimise flooding. In addition, a narrow waterway, which has been artificially straightened to improve its drainage capability, is located a short distance to the south of the development area. This also drains into Robertstown River.

Despite the land drainage works, aerial images of Area 3 highlight the poor drainage still present; frequent pooling of water being visible across the site (Plates 28-29). In addition, these images emphasise a series of natural, undulating, features that cross the land; features that are often imperceptible from the ground. It is likely that this land, prior to the construction of the adjacent flood embankment in the nineteenth-century, formed a saltmarsh or similar intertidal environment. As such, the noted undulations are thought to have formed intertidal gullies and rivulets that once criss-crossed this estuarine landscape. Indeed, ground investigation works at Durnish have confirmed that much of Area 3 is covered in marine/estuarine sediments, of silts and clays, with glacial till, mainly of limestone origin, present across the south of the site.

The majority of the land comprising Area 3 is low-lying, although bedrock outcrops are located towards the west of the site, causing a natural rise in ground levels. The most notable of these is located at 126235E, 151454N (centre-point), where a linear section of exposed bedrock (measuring 40m length and rising to *c.* 3m in height) is present (Plate 30). Localised quarrying of this bedrock feature is evident, most likely undertaken in the mid to late nineteenth-century. Moving to the west of the development site, *c.* 65m, a more expansive section of bedrock is present. This area forms a large mound, measuring *c.* 110m x *c.* 100m, which is particularly steep-sided on its western side; a 1 in 1.4 drop being present. An enclosure site (RMP: LI 10-009) if located upon this elevated site, some 85m west of the proposed Durnish development area.

14.6.5 Visual Survey and Assessment

The visual survey was comprehensive and extended significantly beyond the limits of any intertidal foreshore/ subtidal impacts (Figures 14.11-14.12). The following section details the findings from the onsite assessment at Areas 1-3.

Area 1 is located within the historic harbour area at Foynes (NIAH No.: 21829004). Two lengths of masonry quay wall, composed of limestone ashlar blocks, define the eastern side and innermost (south) part of the harbour area. The innermost section of quay measures 105m length, with the east section measuring 75m length. An associated boat-slipway is located in the southwest corner of the harbour, positioned immediately adjacent to the inner quay wall. The original fabric of the slipway is not visible, the structure having been encased in poured mass-concrete. The slipway is orientated north-south, the lowest part of the structure being located to the south. The structure measures *c.* 40m length x *c.* 6.5m width.

Modern rock-armour delineates the western extent of the harbour, along a *c.* 104m section of the upper foreshore. The breakwater that once extended east-west from the western shoreline has been removed; no trace of this structure being visible today. A small folding anchor of Admiralty-type was located on the intertidal foreshore below this rock-armour, NGR: 124796E, 151865N, as indicated in Figure 14.10 (Plates 31-32). The anchor appears to be of nineteenth-century date and has been subject to modern intervention with the removal of one of its arms; the removal of this component allowing the anchor to function as a mud-anchor. The anchor measures 1.53m in total length (crown to ring), with a shank length of 1.41m and a stock length of 1.50m. The remaining arm measures 550mm in length and has a fluke length of 260mm and width of 210mm. The anchor was removed from its original location and redeposited at a safe location, outside of Area 1 at NGR: 124796E, 151882N (Plate 33), Figure 14.10). No further material, deposits, or structures of archaeological or historical significance were encountered within this area.

Area 2 is located between the East Jetty and West Quay, both of which comprise modern structures constructed using a series of tubular steel piles (aligned in rows of four) that support a mass-concrete superstructure (Plates 34-35). A floating, small-craft, pontoon is located on the south side of Area 2 at NGR: 125121E, 151791N (centre-point). The north end of the structure is supported on two piles which allow the pontoon to rise and fall with the tide (Plate 36). A metal access-gangway is anchored to the adjacent shoreline, positioned at a point *c.* 4m above the High Water Mark. The upper foreshore is delineated by a steeped-sided rock-armour embankment that extends across a *c.* 178m of the shoreline (Plate 37). The intertidal zone extends 66m (max.) from the base of the rock armour to the Mean Low Water Mark, roughly in line with the inner side of the existing jetty/quay structures. The intertidal area is composed of a deep deposit of soft silty-clay through which narrow channels have been cut from drainage/surface run-off that discharges from the base of the rock-armour embankment in a number of places (Plate 38). The sub-tidal component of this area slopes at approximately a 30º angle from the Low Water mark; extending for a distance of *c.*10m before flattening out. A good-holding content was observed for this area, although no surface material, deposits, or structures of archaeological or historical significance were encountered within this area.

Area 3 extends across a *c.* 820m x 490m portion of Durnish Td., located immediately to the east of the existing boundary of the port estate. A substantial flood embankment, as depicted on OS historic maps of the area, delineates the upper foreshore along the west side of townland (Plates 39-40). Systematic field-walking of the development area did not reveal any surface material, deposits, or structures of archaeological or historical significance. However, visual inspection of the adjacent intertidal foreshore, on the west side of Robertstown Estuary, did identify the presence of four substantial fishtrap structures (Figure 14.12; Features F01-F04).

Fishtrap F01 is located 84m (min.) to the east of Area 3 at NGR: 126584E, 151892N (centre-point). It forms a substantial structure that appears to remain in a very good state of preservation, remaining substantially buried with the estuary foreshore (compact deposit of silty-clay). The fishtrap comprises a curvilinear post-and-wattle structure that extends 43.2m (visible length) along the intertidal zone, running in a south-southwest direction from the low water mark (Plates 41-42). The structure comprises over sixty (60) vertically-set wooden posts (up to 80mm Ø) between which hazel rods have been inter-woven to from a post-and-wattle fence. It is likely that this fence-line extends further up the foreshore than is currently visible; buried within the estuarine clay. Only the topmost line of wattling is visible, with the associated timber posts protruding to a maximum height of 220mm from the surface of the foreshore (Plate 43). Many of the posts are angled to the north-northeast, appearing to have fallen forward (towards the river channel) slightly over time. The hazel rods (wattle) are irregular in size (length/diameter); ranging between *c.* 500m and *c.* 2m in length and 20mm-40mm in diameter.

Fishtrap F02 is located 72m (min.) to the east of Area 3 at NGR: 126635E, 151806N (centre-point). It is positioned immediately above the Low Water Mark, some 77m to the south of Fishtrap F01. In contrast to the previous fishtrap, only a *c.* 4m long section of the structure is visible, comprising twelve (12) vertically-set timber posts; aligned north-northeast to south-southwest (Plate 44). These measure 30mm-40mm in diameter and protrude up to 70mm from the foreshore. No associated wattling is evident, this component of the structure likely remaining buried at depth within the foreshore deposits at this location.

Fishtrap F03 is located 69m (min.) to the east of Area 3 at NGR: 126643E, 151793N (centre-point). It is positioned immediately above the Low Water Mark, *c.* 10m to the south of Fishtrap F02. As observed with the latter fishtrap (F02), the structures extent is limited; only *c.* 2.5m section being visible (Plate 45). It comprises seven (7) vertically-set wooden posts (30mmØ-40mmØ) that are aligned north-northeast to south-southwest. On the downstream side of the *in situ* post-line, a section of collapsed wattle panelling is visible. This panel appears to be lying on its side, having fallen north (downstream) of the original fence-line. The panel is partial exposed along its northeast side; the majority of the panel being covered by 30mm-50mm of silty-clay. As noted elsewhere, is likely that further substantial remains from this fishtrap remain buried within the foreshore at this location.

Fishtrap F04 is located 65m (min.) to the east of Area 3 at NGR: 126661E, 151761N (centre-point); positioned *c.* 12m to the south of Fishtrap F03 (Plate 46). It extends in a south-southwest direction (*c.* 25m) from the Low Water Mark and comprises twenty-seven (27) vertically-set wooden posts (Plate 47). These range between 40mm and 70mm in diameter, upstanding between 50mm and 100m from the surface of the foreshore. The terminal ends of a series of hazel rods, twenty-two (22) in total) are visible protruding from the foreshore. In addition, nine (9) wooden posts are located immediacy upstream of the post-alignment, protruding from the foreshore at a *c.* 45º angle, and appear to represent a collapsed section from the structure.

While the above fishtraps lie outside the proposed port development within Drunish Td., they do highlight the presence of prehistoric and/or later exploitation of the estuary environment surrounding this area. The use of this form of fishtrap, known as ebb wires, has been archaeologically proven in Ireland from the late Mesolithic onwards.[11] Indeed similar examples, dating to the Late Bronze age and Early Medieval periods have been recorded on the River Fergus Estuary.[12]

At present is it is not possible to provide a specific date range for the newly discovered fishtrap sites (F01-F04); this requiring test-excavation in order to further assess each structure and gather samples for subsequent laboratory testing, an endeavour that lies outside the present scope of archaeological work.

A listed enclosure site (RMP: LI 010-009), located some 85m to the west of Area 3, was also inspected as part of the field-walking exercise within Durnish Td. The site comprises a roughly oval-shaped enclosure, measuring *c.* 35m x 30m in extent. The partial remains of a drystone, upstanding in places to a maximum height of 500mm, are visible forming part of the enclosure sides. The site is located upon a large section of bedrock (approximately 110m x 100m area) which has a steep drop-off on its western side. The area is heavily overgrown with small tress and brambles. Bedrock is frequently visible protruding from the ground and it is estimated that more than *c.* 400mm (depth) of topsoil covers the bedrock substratum within this area.

14.6.6 Magnetometer Survey

A Fisher *Aquanaut* 1280U metal-detector was used to undertake the metal detection survey within Areas 1-3. An XP Deus metal-detector was used for Area 4. Metal-detection was undertaken to gain an understating of the degree of metallic debris located within each of the survey areas; a sample number of targets also being inspected to ascertain material type.

A low to medium target ratio of 1-2 hits per m² was encountered for Area 1. Many of the targets were visible on the on or protruding from the surface of the foreshore at this location; continuing larger jetsam from the vessels using the historic harbour area. Frequent re-bar and other modern debris associated with construction of the adjacent rock-armour protection was also evident. Small finds were limited to link-chain fragments, D-shackles, and miscellaneous mechanical parts.

A medium target ratio of 2-3 hits per m² was encountered for Area 2, attesting to the frequent presence of buried modern debris; inspected targets including pieces of re-bar, a wheel hub, short section of metal pipe, length of link-chain, etc. This is consistent with the target frequency and material type expected for an active harbour area. It is also anticipated, given the soft nature of the riverbed at this location, that considerable debris is present at depth within this deposit; located below the depth-range of hand-held metal detectors. No material, deposits, or structures of

[11] 06E0668, Excavations at Spencer Dock, North Wall Quay, Dublin.
[12] Aiden O'Sullivan, *Foragers, Farmers and Fishers*, Dublin, 2001.

archaeological or historical significance were encountered as part of the metal detection survey in this area.

Area 3 provided a target ratio of 1-2 hits per m², which is typical of land that has been used for agricultural purposes. The majority of inspected targets represented modern debris, barbed wire pieces, metal-drum fragments, nails, etc., although a number of historic coins were also recovered. These include: an Irish (1/2d) half-penny coin dated 1928, an Irish sixpence (2/6d) coin dated 1961, and two English half-pennies dated 1927 and 1938 (Plates 48-51).

14.6.7 Conclusion

The on-site assessment was comprehensive and extended outside the confines of the proposed port development areas.

While there is an inherent archaeological potential associated with the foreshore areas surrounding the River Shannon Estuary, this potential has been limited for the sections of foreshore within the port.

Extensive foreshore reclamation undertaken at Foynes in the 1960s has served to remove much of the potential historical and archaeological material that may have been present along the original shoreline.

The data review and interpretation of the geotechnical investigations did not yield any evidence to suggest the presence of archaeological horizons lying exposed within the proposed development areas.

While no surface archaeological indicators are present, the possibility of buried *in situ* archaeologically does remain.

The presence of an enclosure site (RMP: LI 010-0009) provides tangible evidence for medieval activity close by, while the presence of four newly-reported fishtraps (F01-F04) reflects at least the presence of historic fishing activities here, if not earlier. The enclosure site lies outside the development area, 85m to the west of Area 3; 65m to the west when including a 20m archaeological buffer zone for the site. Fisthtrap sites F01-F04 are located outside the development area, between 65m and 84m to the east of Area 3, extending across the intertidal foreshore on the west side of Robertstown River.

It is recommended that the removal of any foreshore/riverbed deposits and ground disturbance associated with the proposed project be archaeologically monitored to mitigate for this potential.

14.7 PROPOSED IMPACTS

A series of direct and indirect impacts associated with the proposed development will take place and have been itemised below. Archaeological mitigation arising from these impacts is presented in Table 14.4 below and in the following section (Section 14.8, Table 14.5). There are no impacts to known cultural heritage sites arising from the proposed development.

Table 14.4 Potential impacts to known or newly discovered archaeological sites within 100m of the proposed development and those features within development areas 1-3.

Site/ Area	Potential Impacts	Archaeological Mitigation
Area 1	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore.	• Pile impact locations have been subject to archaeological inspection. • Archaeological monitoring of the gangway installation to be undertaken.
Area 2	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore/riverbed.	• Archaeological monitoring of any ground disturbance works associated with the installation.
Area 3	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore/riverbed.	• Archaeological monitoring of any ground disturbance works to be undertaken.
NIAH: 21829004	• Slight, negative, permanent, impact to Masonry Quayside with insertion of pontoon gangway anchor points.	• Archaeological monitoring of the gangway installation to be undertaken.
RMP: LI010-009	• No Impact	• None required
Fishtrap F01	• No Impact	• None required
Fishtrap F02	• No Impact	• None required
Fishtrap F03	• No Impact	• None required
Fishtrap F04	• No Impact	• None required

Area 1: impacts associated with the relocation a small-craft landing pontoon are restricted to the three areas with the historic harbour area. Direct impact to the riverbed will take place with the insertion of two tubular steel piles to support the outer floating pontoon. An indirect impact is also anticipated where the access gangway is to be tied-into the adjacent masonry quayside.

Area 2: dredging of the foreshore/riverbed is not anticipated as part of the construction works associated with the proposed jetty extension; this section riverbed having been previously dredged to a declared depth of -12mCD as part of SFPC's ongoing maintenance dredging programme. Riverbed disturbances are restricted to a series of localised (direct) impacts arising from the placement open piles to support the jetty superstructure.

Area 3: it is proposed to raise the existing ground levels across the Durnish site to +4.44mOD using imported inert fill material. This work is considered as a single phase operation, however, a phased approach has also been provided for in the project design, as detailed in Figure 14.3. Ground preparations, in the form of topsoil stripping (estimated 200mm removal depth) and seeding of stripped lands with a clover mix are required prior to commencement of the infilling works. This provides an opportunity to undertake monitoring of the site works to ensure that any potential archaeological features revealed as part of the topsoil stripping are dealt with in an appropriate archaeological manner. Whether a single or phased approach is adopted, there will be no change to the potential impacts and associated mitigation measures from an archaeological perspective.

14.7.1 In-Combination and Cumulative Impacts

In-combination and cumulative effects result from multiple actions on receptors and resources. The effects can be additive or interactive (synergistic) in nature and can result from incremental changes caused by other past, present, or reasonably foreseeable and made actions in combination with those identified for the present project.

The closet development to the current project is located along the intertidal foreshore behind Beth No. 5 (existing Berth No. 4), which is subject to foreshore reclamation under LCCC Planning Permission 12/212. Reclamation of the foreshore behind Berth No. 6 was completed in 2015 and the area was fully assessed by ADCO in 2010 as part of the EIS for the reclamation project. No in-combination of cumulative impacts are anticipated following the completion of the reclamation works and the planned extension of the East Jetty.

In addition, a desktop review of past, present, and planned development projects for Shannon Foynes Port and the wider Shannon Estuary area does not indicate any other in combination of cumulative impacts as a result of the current project proceeding.

14.8 ARCHAEOLOGICAL MITIGATION

No further archaeological mitigation is required prior to the construction phase of the Capacity Extension and Harbour Development project taking place. However, archaeological monitoring during construction is required, as detailed below.

14.8.1 Archaeological Monitoring

It is clear that the foreshore/riverbed and terrestrial areas under assessment all retain ground conditions/deposits capable of retaining archaeological material. In order to ensure that no sub-surface archaeological deposits, material, or structures are adversely impacted by the proposed works, archaeological monitoring is required during the construction phase of the project (see Table 14.5 below). This should be undertaken by an experienced, licensed, maritime archaeologist with a good knowledge of working within both the marine and intertidal environment. ADCO's recommendations are outlined in Section 9.0 of this report.

Table 14.5 Proposed development items (Areas 1-3) and recommended archaeological mitigation measures

Development Item	Potential Impacts	Archaeological Potential	Archaeological Mitigation
Area 1: relocation of small-craft pontoon to historic harbour area. Two tubular steel piles to be removed from seabed at existing location and driven into the seabed to secure the pontoon at new location.	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore.	• Medium	• Pile impact locations have been subject to archaeological inspection. • Archaeological monitoring of the gangway installation to be undertaken.
Area 2: open pile jetty to be constructed between the East Jetty and West Quay.	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore/riverbed.	• Medium	• Archaeological monitoring of any ground disturbance works associated with the installation.
Area 3: topsoil striping prior to infilling of Durnish development site to raise ground levels to +4.44mOD.	• No impact to known cultural heritage sites. • Potential negative impact to any unrecorded archaeological deposits or structures buried within the foreshore/riverbed.	• Medium to High	• Archaeological monitoring of any ground disturbance works to be undertaken.

14.9 RECOMMENDATIONS

14.9.1 Pre-Construction Measures

No further ameliorative measures are recommended in advance of the Capacity Extension at Shannon Foynes project taking place.

14.9.2 Construction Phase Measures

ARCHAEOLOGICAL MONITORING. Archaeological monitoring in accordance with the terms of Section 5 of the National Monuments Act (2004 Amendment) is recommended for any ground and seabed disturbance activities to be carried out by the proposed development, as detailed in Table 14.5. These measures will ensure that any sub-surface remains of archaeological or historic value are dealt with in an appropriate archaeological manner. The monitoring work should be undertaken by an experienced and suitably qualified maritime archaeologist retained by SFPC and working under licence from the National Monuments Service at the DCHG.

14.9.3 Management Measures

RETAINING AN ARCHAEOLOGIST/S. SFPC should appoint a competent and experienced maritime archaeologist to act as project archaeologist and carry out all archaeological resolution required. The archaeologists will prepare method statements in discussion with the design team, contribute to a Construction Environmental Management Plan (CEMP), acquire the necessary archaeological licensing and conduct on-site monitoring, resolution and reporting as needed.

THE TIME SCALE for the construction phase should be made available to the archaeologist, with information on where and when ground disturbances and/or dredging will take place.

Licence applications take a minimum of four (4) working weeks to be processed by the DCHG, and the archaeologist cannot present on site until the licences are granted. Licence applications require contact details of the landowners and planning reference numbers. Since 2017, Excavation Licence applications must be accompanied by a statement from the client on client letterhead that confirms ‘that sufficient funds and other facilities are available to [the archaeologist] to complete the archaeological excavation, post-excavation, and preliminary and final reports (including specialist reports)’.

SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of the construction works commencing. This will allow for prompt arrival on site to monitor the ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the statutory authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation. Given the maritime nature of the project, the archaeological team must include underwater/dive inspection capability operating in accordance with the HSA Diving at Work regulations.

SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.

FENCING of any such areas would be necessary once discovered and during excavation.

ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.

MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.

SPOIL should not be dumped on any of the selected sites or their environs.

PLEASE NOTE: All of the above recommendations are based on the information supplied for the proposed Capacity Expansion at Shannon Foynes project, Shannon Foynes Port, Co. Limerick. Should any alteration occur, further assessment may be required.

PLEASE NOTE: Recommendations are subject to the approval of The Department of Culture, Heritage and the Gaeltacht.

15 LANDSCAPE AND VISUAL

15.1 INTRODUCTION

This Landscape and Visual Impact Assessment (LVIA) has been undertaken by RPS to assess the proposed development at Foynes Port on the eastern side of the village of Foynes and the southern side of the Shannon Estuary.

This assessment seeks to:

a) Establish the baseline conditions -

Record and analyse the existing character, quality and sensitivity of the landscape and visual resource. This should include elements of the landscape such as;

- Landform;
- Land cover including the vegetation, the slopes, drainage, etc;
- Landscape character;
- Current landscape designations and planning policies; and
- Site visibility, comprising short, medium and long distance views.

b) Analyse baseline conditions -

Comment on the scale, character, condition and the importance of the baseline landscape, its sensitivity to change and the enhancement potential where possible.

A visual analysis (illustrated by photographic material) describing characteristics which may be of relevance to the impact of the design and to the method of mitigation.

c) Describe the proposed development

d) Identify the Impacts of the proposed development on the Landscape and Visual Resource -

Identify the landscape and visual impacts of the development at different stages of its life cycle, including:

- Direct & indirect *landscape impacts* of the development on the landscape of the site and the surrounding area; and
- *Visual impacts* including: the extent of potential visibility; the view and viewers affected; the degree of visual intrusion; the distance of views; and resultant impacts upon the character and quality of views.

e) Assess the significance of the landscape and visual impacts in terms of the sensitivity of the landscape and visual resource, including the nature and magnitude of the impact.

f) Detail measures proposed to mitigate significant residual detrimental landscape and visual impacts and assess their effectiveness.

g) Assess the ability of the landscape and visual resource to absorb the proposed development.

15.2 ASSESSMENT METHODOLOGY

15.2.1 General Approach

The methodology for the LVIA has been derived from *Guidelines for Landscape and Visual Impact Assessment,* Third Edition (The Landscape Institute and Institute of Environmental Management & Assessment, 2013) (GLVIA3) and EPA guidance.

The landscape has been appraised to allow it to be described and classified into landscape character areas that in turn enable the classification of landscape quality. The capacity of the landscape to accept change of the type proposed is assessed by determining the sensitivity of each landscape character area. Overall key landscape components are normally landform, vegetation and historical and cultural components. Landform relates to topography, drainage characteristics and geology. Historical and cultural components include historic landscapes, listed buildings, conservation areas and historic designed landscapes. Vegetation plays an important role in how the landscape and visual resources of an area are viewed and is an integral component of a landscape character.

Assessment has been undertaken through analysis of:-

- Up to date digital copies of OSI Discovery Series raster and OSI vector maps;
- Aerial photography;
- Limerick County Development Plan 2010 - 2016;
- Clare County Development Plan 2017-2023;
- Photomontages from selected viewpoints; and
- Detailed drawings of the proposed development including lighting proposals as described in Chapter 2: Project Description of the EIAR.

Site visits were undertaken to assess the existing environment, to establish the existing visual resource and to identify sensitive receptors, i.e., residential properties, scenic viewpoints. Site visits were also used to establish the perceived extent of landscape and visual impacts that may be associated with the proposed development.

The proposed development is then applied to this landscape and visual baseline and potential impacts predicted.

15.2.2 Identifying Effects

Assessing the significance of an effect is a key component of the LVIA and is an evidenced based process combining professional judgments on the nature of a landscape or visual receptor's sensitivity, their susceptibility to change and the value attached to the receptor. It is important to note that judgments in this LVIA are impartial and based on professional experience and opinion informed by best practise guidance.

The effects of the proposed development are of variable duration and are assessed as being either short-term or long-term, and permanent or reversible. Effects related to operations and infrastructure such as temporary construction compounds and stockpiling, apparent only during the construction period are considered to be short-term effects.

15.2.3 Assessment Criteria

The objective of the assessment process is to identify and evaluate the predicted significant effects arising from the proposal. Significance is a function of the:

- Sensitivity of the affected landscape and visual receptors; and
- Scale or magnitude of impact that they will experience.

These definitions recognise that landscapes vary in their capacity to accommodate different forms of development according to the nature of the receiving landscape and the type of change being proposed.

Significance is not graded in bands, and a degree of informed judgement is required. Even with the application of pre-defined criteria, interpretation may differ between individuals, but this allows the process of reaching these conclusions to be transparent.

15.2.4 Landscape Impact Assessment

The LVIA firstly assesses how the proposal would impact directly on any landscape features and resources. This category of effect relates to specific landscape elements and features (e.g. woods, trees, walls, hedgerows, watercourses) within the site that are components of the landscape that may be physically affected by the proposal. Physical effects are restricted to the area within the site boundary, and are the direct effects on the fabric of the site, such as the removal or addition of trees and alteration to ground cover and levels.

The LVIA then considers impacts on landscape character at two levels. Firstly, consideration is given to how the landscape character is affected by the removal or alteration of existing features and the introduction of new features. This is considered to be a direct impact on landscape character. Secondly, the indirect impacts of the proposal on the wider landscape are considered. The assessment of impacts on the wider landscape is discussed using the surrounding character areas identified in the relevant regional or county landscape character assessments and further refined by this LVIA. It is acknowledged there is an overlap between perception of change to landscape character and visual amenity, but it should be remembered that landscape character in its own right is generally derived from the combination and pattern of landscape elements within the view.

The significance of effects on landscape features and character is determined by cross referencing the sensitivity of the feature or landscape character with the magnitude of impact.

Consideration of the sensitivity of the landscape resource against the magnitude of impact caused by the proposal is fundamental to landscape and visual assessment and these two criteria are defined in more detail below.

15.2.5 Landscape Sensitivity

The determination of the sensitivity of the landscape resource is based upon an evaluation of each key element or characteristic of the landscape likely to be affected. The evaluation reflects such factors as its quality, value, contribution to landscape character and the degree to which the particular element or characteristic can be replaced or substituted.

For the purpose of this assessment, landscape quality is categorised as:-

Very High: Areas of especially high quality acknowledged through designation as Areas of Outstanding Natural Beauty (AONB) or other landscape based sensitive areas. These are of landscape significance within the wider region or nationally;

High Quality: Areas that have a very strong positive character with valued and consistent distinctive features that gives the landscape unity, richness and harmony. These are of landscape significance within the district;

Medium Quality: Areas that exhibit positive character but which may have evidence of alteration/degradation or erosion of features resulting in a less distinctive landscape. These may be of some local landscape significance with some positive recognisable structure; and

Low Quality: Areas that are generally negative in character, degraded and in poor condition. No distinctive positive characteristics and with little or no structure. Scope for positive enhancement.

As previously discussed, landscape sensitivity is influenced by a number of factors including value, condition and the type of change brought about by the proposal. In order to assist with bringing these factors together the following five point scale has been used as presented in **Table 15.1**. The table defines the criteria that have guided the judgement as to the Sensitivity of the Landscape Resource.

Table 15.1: Landscape Sensitivity

Definition		Sensitivity
Landscape Resource Sensitivity	**Landscape Resource Value**	
Exceptional landscape quality, no or limited potential for substitution. Key elements / features well known to the wider public. Little or no tolerance to change.	Nationally / internationally designated/ valued landscape, or key elements or features of national / internationally designated landscapes.	Very High

Definition		Sensitivity
Landscape Resource Sensitivity	**Landscape Resource Value**	
	Little or no tolerance to change	
Strong / distinctive landscape character; absence of landscape detractors. Low tolerance to change.	Regionally / nationally designated / valued countryside and landscape features. Low tolerance to change.	High
Some distinctive landscape characteristics; few landscape detractors. Medium tolerance to change	Locally / regionally designated / valued countryside and landscape features. Medium tolerance to change	Medium
Absence of distinctive landscape characteristics; presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Low
Absence of positive landscape characteristics. Significant presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Negligible

15.2.6 Magnitude of Landscape Impacts

Direct resource changes on the landscape character in the study area are brought about by the introduction of the proposal and its impact on the key landscape characteristics. The categories and criteria used are given in **Table 15.2** below:-

Table 15.2: Magnitude of Landscape Impact

Definition	Magnitude
Total loss or addition or/ very substantial loss or addition of key elements / features / patterns of the baseline, i.e., pre-development landscape and/ or introduction of dominant, uncharacteristic elements with the attributes of the receiving landscape.	Large
Partial loss or addition of or moderate alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and / or introduction of elements that may be prominent, but may not necessarily be substantially uncharacteristic with the attributes of the receiving landscape.	Medium
Minor loss or addition of or alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and or introduction of elements that may not be uncharacteristic with the surrounding landscape.	Small
Very minor loss or addition of or alteration to one or more key elements / features / patterns of the baseline, i.e., pre-development landscape and/or introduction of elements that are not uncharacteristic with the surrounding landscape	Negligible

Definition	Magnitude
approximating to a 'no-change' situation.	
No loss, alteration or addition to the receiving landscape resource.	No change

15.2.7 Visual Impact Assessment

The assessment of effects on views is an assessment of how the introduction of the proposal will affect views throughout the study area. Assessment of visual effects therefore needs to consider:-

- Direct impacts of the proposal upon views of the landscape through intrusion or obstruction;
- The reaction of viewers who may be affected, e.g., residents, walkers, road users; and
- The overall impact on visual amenity.

Viewpoints have been selected to meet the following criteria, with locations illustrated on **Figure 15.2:-**

- A balance of viewpoints from where main direction of view is towards the proposed development;
- A range of views of the proposed development covering the extent of the study area Zone of Theoretical Visibility (ZTV). Selected viewpoints have all been located within the study area associated with the proposed development;
- A proportion representing areas known to be available to the community where people may frequently congregate; and
- Locations of interest, e.g., settlements; amenity or recreation areas.

15.2.8 Photographs, Photomontages and Zone of Theoretical Visibility (ZTV)

As the site survey for the proposed development was limited to the footprint and immediate surrounds of the site it was necessary to acquire additional elevation data from the OSI to include all viewpoint locations selected for photomontage. Enhanced digital terrain model (DTM) was chosen for this purpose. A digital terrain model was prepared for the entire visual study area with a simplified 3D model of the proposed development for use in the field.

The photographer was equipped with a professional level SLR camera (Canon 5D Mark II). Specifically to meet the requirements of best practice this houses a full frame sensor and is fitted with a 50mm lens. A specialised panoramic head was fitted to the camera tripod for those viewpoints adjacent to the site. This enables the capture of multiple photographs in a linear sequence for the preparation of a panoramic image. Such imagery is required to include sufficient landscape context to depict the entire proposed development at close quarters. A mapping grade GPS (Trimble GeoXH) was used to record the precise coordinate position of the camera at each viewpoint (details below). This offers corrected accuracy typically in the range of +/- 30cm in the xy plane. In addition the photographer had all necessary information per viewpoint to capture the correct photographic detail – viewpoint map, photographic reference, Google Earth with a KMZ model of the proposed development (laptop), interactive topographic model of the proposed development and surrounding terrain (laptop). All photography was captured at a focal length of 50mm in RAW format for post-processing. The camera was consistently set up at 1.7m above ground level at each viewpoint location. The photography was captured in the clearest possible weather in the available time frame. This saw a mixture of broken cloud with sunny spells.

A completed 3D model of the proposed development was created. A full specification of finishes, textures and colours was provided in addition to reference photography and previous high quality renders. The photomontage team utilised all of the above to prepare a finished textured 3D model of the final design in 3D Studio Max.

The information captured at each viewpoint location was used to simulate a replica camera view in the 3D environment: Easting *(from GPS);* Northing *(from GPS);* Elevation *(calculated from the Enhanced DTM data from OSI; GPS does not offer an accurate z-value reading);* Angle of View *(specific to focal length and camera sensor size);* Direction of View *(from GPS coordinate info);* Date *(from photography meta-data);* Time of Day *(from photography meta-data);* Weather Conditions *(from photography and recorded on site).*

Draft renders were output and integrated into the photography for review. This was an iterative process involving tweaks to textures and lighting. Upon sign-off a full set of final calibrated renders were prepared ready for integration into the photography. The final renders were integrated into the photography with masking aided by detailed street maps and Google Earth photography. The final set of renders were formatted at A3 (dimensions 36cm x 24cm) for a recommended viewing distance of 50cm and are provided in **Appendix 15.1** of this EIAR.

The ZTV illustrates the extents from which a feature would theoretically be visible and defines the study area (see Figure 15.1).

The ZTV maps do not take account of the orientation of a viewer, such as the direction of travel and there is no allowance for attenuation of visibility with distance, weather or light. A further assumption of the ZTVs is that climatic visibility is 100% (i.e. visibility is not impeded by moisture or pollution in the air). Climatic conditions inevitably reduce visibility with increasing distance from the proposed development.

These limitations mean that the ZTV maps tend to overestimate the extent of the influence on the landscape and visibility of the proposed development and they should be considered only as a tool to assist in assessing the theoretical visibility of developments and not a measure of the visual impact. Nevertheless ZTVs are a useful tool in representing the worst-case scenario when predicting the likely visibility of a development. They are particularly useful as a basis for selecting viewpoints where there may be significant impacts for which further assessment is required.

15.2.9 Visual Sensitivity

Visual sensitivity is defined with reference to the landscape sensitivity of the viewpoint location and the view. Other factors affecting visual sensitivity include:-

- The location and context of the viewpoint;
- The expectations and occupation or activity of the receptor; and
- The importance of the view.

Although the interpretation of viewers' experience can have preferential and subjective components, there is generally clear public agreement that the visual resources of certain landscapes have high visual quality.

Viewer sensitivity, as set out in **Table 15.3** below, is a combination of the sensitivity of the human receptor (for example resident, commuter, tourist, walker, recreationist or worker, and the numbers of viewers affected) and viewpoint type or location (for example house, workplace, leisure venue, local beauty spot, scenic viewpoint, commuter route, tourist route or walkers' route).

Table 15.3: Viewer Sensitivity

Definition		Sensitivity
Visual Resource Sensitivity	**Visual Resource Value**	
Views of remarkable scenic quality, of and within internationally designated landscapes or key features or elements of nationally designated landscapes that are well known to the wider public. Little or no tolerance to change.	Observers, drawn to a particular view, including those who have travelled from around Ireland and overseas to experience the views. Little or no tolerance to change.	Very High
Views from residential property. Public rights of way, National Trails, long distance walking routes and nationally designated countryside/ landscape features with public access. Low tolerance to change.	Observers enjoying the countryside from their homes or pursuing quiet outdoor recreation are more sensitive to visual change. Little tolerance to change.	High
Views from local roads and routes crossing designated countryside / landscape features and 'access land' as well as promoted paths. Medium Tolerance to change.	Observers enjoying the countryside from vehicles on quiet/promoted routes are moderately sensitive to visual change. Medium tolerance to change.	Medium
Views from work places, main roads and undesignated countryside / landscape features. High tolerance to change.	Observers in vehicles or people involved in frequent or infrequent repeated activities are less sensitive to visual change. High tolerance to change.	Low
Views from within and of undesignated landscapes with significant presence of landscape detractors. High tolerance to change.	Observers in vehicles or people involved in frequent or frequently repeated activities are less sensitive to visual change. High tolerance to change.	Negligible

15.2.10 Magnitude of Visual Impacts

The magnitude of impact on the visual resource results from the scale of change in the view, with respect to the loss or addition of features in the view, and changes in the view composition. Important factors to be considered include: proportion of the view occupied by the proposal, distance and duration of the view. Other vertical features in the landscape and the backdrop to the proposed development will all influence resource change. Magnitude of visual impact is defined in **Table 15.4**.

Table 15.4: Magnitude of Visual Impact

Definition	Magnitude
Complete or very substantial change in view dominant involving complete or very substantial obstruction of existing view or complete change in character and composition of baseline, e.g., through removal of key elements	Large
Moderate change in view: which may involve partial obstruction of existing view or partial change in character and composition of baseline, i.e., pre-development view through the introduction of new elements or removal of existing elements. Change may be prominent, but would not substantially alter scale and character of the surroundings and the wider setting. Composition of the view would alter. View character may be partially changed through the introduction of features which, though uncharacteristic, may not necessarily be visually discordant	Medium
Minor change in baseline, i.e., pre-development view - change would be distinguishable from the surroundings whilst composition and character would be similar to the pre change circumstances.	Small
Very slight change in baseline, i.e., pre-development view - change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.	Negligible
No alteration to the existing view	No change

15.2.11 Significance of Effects

The purpose of this LVIA is to determine, in a transparent way, the likely significant landscape and visual effects of the proposal. It is accepted that, due to the nature and scale of proposed development, the proposal could potentially give rise to some notable visual and landscape effects.

GLVIA3 identifies that *'The Regulations require that a final judgment is made about whether or not each effect is likely to be significant. There are no hard and fast rules about what effects should be deemed 'significant' but LVIAs should always distinguish clearly between what are considered to be significant and non-significant effects'*.

Significance can only be defined in relation to each particular development and its specific location. The relationship between receptors and effects is not typically a linear one. It is for each LVIA to determine how judgements about receptors and effects should be combined to derive significance and to explain how this conclusion has been arrived at.

As a general guide it is considered that the following are likely to be considered effects of the greatest significance:-

- Major loss or irreversible negative effects, over an extensive area, on elements and/or aesthetic and perceptual aspects that are key to the character of nationally valued landscapes; or
- Irreversible negative effects on people who are particularly sensitive to changes in view, on recognised and important viewpoints or scenic routes, large-scale change which introduces non-characteristic, discordant or intrusive elements into the view.

The identification of significant effects would not necessarily mean that the effect is unacceptable in planning terms. What is important is that the likely effects on the landscape and visibility are transparently assessed and understood in order that the determining authority can bring a balanced, well-informed judgement to bear when making the planning decision.

The significance of effects on landscape, views and visual amenity are evaluated according to a six-point scale: Substantial, Major, Moderate, Minor, Negligible or None.

For those effects indicated as being Moderate to Major the assessor will exercise professional judgement in determining if the effect is considered significant.

For the purposes of this assessment those effects indicated as being of Substantial, Major to Substantial are considered significant as highlighted in **Table 15.5**, below. Effects of 'Moderate' and lesser significance have been identified in the assessment, but are not considered significant upon the character and quality of the landscape and on views although they remain worthy of consideration throughout the decision making process.

Table 15.5: Significance of Effects Matrix

Magnitude of Impact	**Sensitivity**				
	Negligible	***Low***	***Medium***	***High***	***Very High***
No Change	None	None	None	None	None
Negligible	Negligible	Negligible to Minor	Negligible to Minor	Minor	Minor
Small	Negligible to Minor	Negligible to Minor	Minor	Minor to Moderate	Moderate to Major

Medium	Negligible to Minor	Minor	Moderate	Moderate to Major	Major to Substantial
Large	Minor	Minor to Moderate	Moderate to Major	Major to Substantial	Substantial

Change can be adverse or beneficial. A conclusion that an effect is 'significant' should not be taken to imply that the proposal is unacceptable. Significance of effect needs to be considered with regard to the scale over which it is experienced.

15.2.12 Landscape & Visual Assessment Definitions

The following provides a list of landscape and visual definitions for the terms used within this assessment:-

- **Landscape Capacity:** The capacity of a particular type of landscape to absorb change without unacceptable adverse effects on its character;
- **Landscape Character Area:** Distinct types of landscape which are generic in character in that they may occur in different parts of the country, but wherever they are they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern. Landscape character area (LCA) names are generic, for example 'upland hills', 'river valley' and 'urban landscape';
- **Landscape Fabric:** Is the physical pattern of elements and features such as vegetation, landform and land use that combine to create landscape character. The effects of a development on landscape fabric are those that alter the physical pattern of elements. These effects are restricted to the landscape within which the proposal is located as it is within this area that the physical pattern will alter, for instance through loss of vegetation, re-contouring or changes to land use;
- **Landscape Quality (or Condition):** Is based on judgements about the physical state of the landscape, and about its intactness, from visual, functional, and ecological perspectives. It also reflects the state of repair of individual features and elements which make up the character in any one place;
- **Landscape Resource:** The combination of elements that contribute to landscape context, character and value;
- **Landscape Value:** The importance attached to a landscape (often as a basis for designation or recognition) that expresses national or local consensus, because of its quality, cultural associations, scenic or aesthetic characteristics;
- **Sensitivity:** Vulnerability of a sensitive receptor to change;
- **Sensitive Receptor:** Physical or natural resource, special interest or viewer group or observer that will experience an impact;

- **Magnitude:** Size, extent and duration of an impact;
- **Visual Amenity:** The value of a particular area or view in terms of what is seen;
- **Visual Character:** When a viewer experiences the visual environment, it is not observed as one aspect at a time, but rather as an integrated whole. The viewer's visual understanding of an area is based on the visual character of visible features and aspects and the relationships between them. The visual character is descriptive and not evaluative;
- **Visual Effect:** Is a change to an existing view as a result of development or the loss of particular landscape elements or features already present in the view;
- **Visual Resources:** The visual resources of the landscape are the stimuli upon which actual visual experience is based. They are a combination of visual character and visual quality;
- **Visual Quality:** Although the interpretation of viewers' experience can have preferential and subjective components, there is generally clear public agreement that the visual resources of certain landscapes have high visual quality. The visual quality of a landscape will reflect the physical state of individual features or elements. Due to the subjective value of the evaluation there is no comprehensive official process for identifying visual quality. The visual quality of this evaluation has been carried out by one Chartered Landscape Architect and verified by another; and
- **Zone of Theoretical Visibility (ZTV):** This represents the area over which a development could theoretically be seen. The ZTV usually presents a 'bare ground' scenario – i.e. a landscape without screening structures or vegetation.

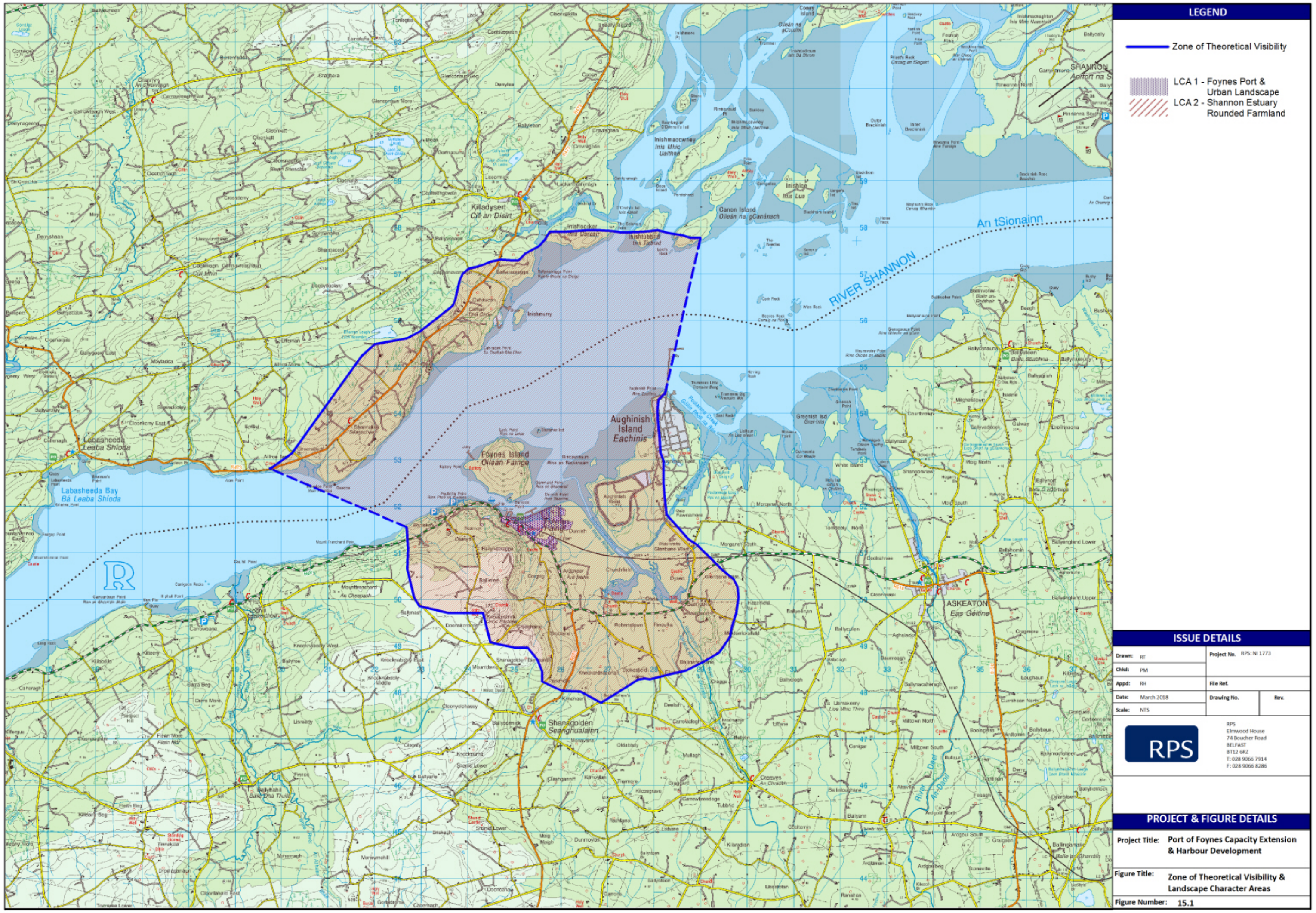


Figure 15.1 - Zone of Theoretical Visibility and (RPS) Landscape Character Areas

Figure 15.2 - Viewpoint Locations (See Appendix 15.1 for photomontages/photographs)

15.3 RECEIVING ENVIRONMENT

15.3.1 Scale and Character

Landscape is generally characterised by physical factors such as landform and land cover including topography, water, vegetation and settlements.

This site is located both within the current Foynes Port and also on greenfield lands immediately east of the Port and Foynes village on a portion of zoned industrial land. The proposed linking of the East Jetty and West Jetty is located at the heart of the existing Port with extensive port related facilities to the west, east and south including tall cranes, warehouses, large tanks and silo's. The Durnish lands to east consist of generally open agricultural fields with predominantly thin hedgerows. To the east and south of the Durnish lands there are undeveloped agricultural fields next to the Robertstown River - a tributary of the Shannon and extending south to the N69 road.

The Shannon Estuary and its coastline are the dominant landscape features within the study area. Scattered rural housing located along the existing road network is designed to take advantage of existing views. Across the expanse of the Shannon to the north, the coastline of Clare is sporadically visible. From the Clare coastline however, views to the Port, Foynes village and the site are largely obscured by the tree covered banks of Foynes Island. Additionally, such is the separation distance that where views are available, landscape/townscape features within and surrounding Foynes are largely indistinguishable.

Foynes Village itself is a significant feature in the local landscape. This is a model estate town with historic associations to trans-Atlantic transportation in the 19th and 20th Century. Today there is a growing tourist industry linked with this history, although the town continues to be recognised mainly for its Port facilities which are a core asset for the economic development of the region. The area surrounding the site is zoned industrial land and the landscape is accordingly dominated by warehousing and associated infrastructure. Crane structures, many of which are moveable/temporary represent significant vertical elements along the shoreline in the vicinity of the Port. North east of the proposed sites on the opposite side of Robertstown River lies Aughinish Alumina which is a significant land use in the area and a further economic driver for the region. Development, including tailings and vertical stacks associated with this facility, represents significant landscape features.

South of the railway line that dissects the zoned development limit of Foynes, an Architectural Conservation Area (see Figure 15.3 - below) is located on both sides of the N69 Road. This ACA is established to protect features including frequent buildings constructed of ashlar and rustic limestone, natural slate roofing and timber windows, some with cast iron sashes and a significant number of houses are lime rendered.

Having assessed the host landscape, RPS would define and describe the landscape character in the following terms:

Foynes Port and Urban Landscape:

The proposal is located on the north-eastern periphery of Foynes village. Industry associated with the port has grown significantly in modern times allowing Foynes to become one of the most important ports along the western coastline of Ireland. This is exhibited visually by the large ships and boats that use the port as well as by the support services necessary for the port - housed in large industrial style units. The harbour has a busy (working) appearance constantly on the move. Tall mast lighting and cranes are prominent and visible from the wider landscape. A large number of HGV's and transport containers use the port and are visually prominent on local roads. Commercial and industrial buildings related to the Port extend: east towards the N69; west as far as the confluence of the Shannon and Robertstown Rivers; and south as far as the railway line. The civic and domestic part of the village is centred on Main Street - south of the Port. Main Street is bound on both sides by a mix of residential, commercial and civic buildings. Although designs are varied in style, there are a number of attractive stone buildings and terraces which undoubtedly contribute to the areas conservation designation. The general topography in the area rises to the west of the village where residential development at Marine Cove occupies prominent locations.

The Foynes Port and Urban Landscape Character Area is assessed as having a low sensitivity to change.

Shannon Estuary Rounded Farmland

This LCA is comprised of a fairly refined portion of land to the south, east and west of the urban footprint of Foynes. The landscape is dominated by the southern shore of the Shannon River which is also the defining characteristic of the wider region as well as a somewhat unique natural asset in an Irish context. To the south of the N69 Road shallow tracts of forestry and occasionally steep landscape tracts partially obscure long distance views within the LCA. These natural features are notable in the landscape surrounding Foynes Village. Further south the landscape gradually rises into agricultural lands which in turn lead to the western hills of south-west Limerick. Field patterns, close to the estuary, are more irregular and less dominated by hedgerows than those located further south. The landscape of the estuary is unique in character in that it possesses both agricultural and maritime characteristics.

Shannon Estuary Rounded Farmland is assessed as a landscape with a high sensitivity to change.

RPS defined LCA are illustrated on Figure 15.1 - above - which also shows the Zone of Theoretical Visibility for the proposed development.

15.3.2 Planning Designations

This site is located within the village of Foynes which in turn is within the Limerick County Council area - where Limerick County Development Plan 2010-2016 provides the extant development plan framework.

Limerick County Development Plan 2010 – 2016

Foynes is described as a "Tier 3 Centre on a Transport Corridor" within the settlement hierarchy set out in the plan. Tier 3 Centres are described as providing a wide range of functions including important employment roles within their surrounding catchments. Foynes is acknowledged as, "one of the most important ports in Ireland and its characteristics as a sheltered deep water port ensures that it will play an important role in the future development of the County and the region as a whole." This site is within the development limit of Foynes on land zoned for marine industry.

An Architectural Conservation Area is designated within the settlement - refer to Figure 15.3 - below.

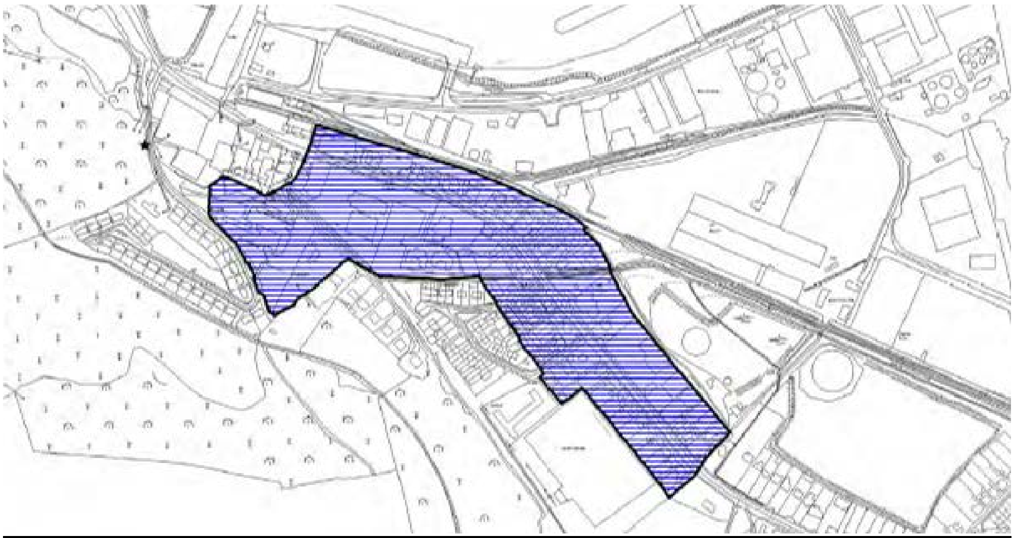


Figure 15.3 Foynes Architectural Conservation Area (Source: Limerick CDP 2010-2016)

Development Plan Objective EH 035 - Protection of Architectural Conservation Areas states that development will only be permitted where it is demonstrated that the development will not materially affect the special character of the area, its amenity and setting including streetscape and landscape.

Limerick County Development Plan (CDP) 2010 – 2016 came into effect on 29th November 2010 with the purpose of setting out the County Council's overall strategy for planning and development within the County until 2016 and beyond. This document has been reviewed to ascertain relevant land use designations to assist in the appraisal of important landscape and visual features and landscape quality.

It must be reiterated that the purpose of this assessment is not to provide a comprehensive planning appraisal of the proposal, the Port or the Shannon Estuary. As such - only those Plan Policies of relevance to the landscape and visual assessment of the proposed development are referenced within this assessment.

The Planning and Development Acts 2000 to 2010 require a new plan to set out an overall strategy for the proper planning and sustainable development of the applicable county. Proposals must be consistent with National Plans, Strategies and Policies, and include a number of mandatory objectives including:

- The preservation of the character of the landscape, including the preservation of view and prospects and the amenities of places and features of natural beauty or interest; and

- The protection of structures and preservation of the character of architectural conservation areas.

Landscape Character Areas

Chapter 7 of the CDP focuses on "Environment and Heritage." Plan Policy EH P2 states that;

"It is the policy of the Council to promote the distinctiveness and where necessary safeguard the sensitivity of Limerick's landscape types through the landscape characterisation process and also where possible to develop the means to successfully integrate differing kinds of development within them."

Plan Sections 7.3.3, 7.3.4, and Map 7.4 refer to Landscape Character Areas (LCA), defining a total of 10 within the Plan Area. The site and surrounding area is located within the Shannon Estuary Integrated Coastal Management Zone (ICMZ).

As described within the CDP, this zone comprises a large area of the northern part of the County bounded by the Shannon Estuary to the north and by gradually rising ground to the south - which in turn leads into an agricultural zone and western hills to the southwest. The estuary is described as the defining characteristic of the Region.

Within the Shannon ICMZ the landscape is described as enclosed farmland dominated by hedgerows with field patterns being less regular that elsewhere in the County.

Plan Objective EH 012 - Shannon Coastal Zone Landscape Character Area -sets out a series of 9 guiding principles for development within Shannon ICMZ, including:

- To protect views and prospects along the N69 as a priority for the Planning Authority. Only in exceptional circumstances will development be allowed between the road and the estuary.

This however does not apply within the settlements of the Shannon ICMZ where:

- Development shall be encouraged.

Views and Prospects

Map 7.6 of the CDP sets out protected views and prospects within the Plan Area. Plan Objective EH 017 -Scenic Views and Prospect - sets out a series of principles in respect of said designations including:

- It is the objective of the Council to safeguard the scenic views and prospects by integrating them into landscape character areas, which will ensure a more balanced approach towards landscape issues within the county.

The only designated Scenic View/Prospect within the Shannon ICMZ is located along the N69 - described as:

- Shannon Estuary from Foynes to Glin.

Section 9.3 of the CDP describes the unique context of the estuary landscape asserting its importance on a national and not just a County level. Regarding the area between Foynes and Glin, Section 9.4 of the CDP states that the extreme sensitivity from a visual and environmental perspective should be borne in mind when considering any new development proposals.

Clare County Development Plan 2017 – 2023

Given the relative proximity to County Clare and in the interest of thoroughness a review has taken place of the Clare County Development Plan (CDP) 2017-2023 to establish if there is any relevant landscape and visual related designations that may influence the assessment within the study area. Chapter 13 and Map C of the CDP set out a range of landscape zonings for the County summarised below.

Landscape Character Types and Areas

Chapter 13 in the CDP 2017-2023 describes both landscape character areas and types within the CDP Area. The LCA nearest to the site - and including the coastline on the northern side of the Shannon estuary - is LCA 18 - Shannon Estuary Farmlands. The Landscape Character Assessment of Clare County states that the key characteristics of this LCA are; *"prominent ridged landscape with linear hills; secluded areas interspersed with open views across the estuary; flatter coastal fringe; Scattery Island important focal point; and complex patterns of farmland."* The corresponding Landscape Character Type within the CDP is, "Farmed, Lowland Ridges."

Seascape Character Areas

The Landscape Character Assessment of County Clare identified 12 Seascape Character Areas. These are described within the CDP as comprising one or more of the following:

- Views from land to sea;
- Views from sea to land; or
- Views along the coastline.

The relevant area for the proposal is Seascape Character Area 11 - River Shannon, which runs tight to the coastline and is illustrated in Chapter 13 - Figure 13.3 of the CDP.

Living Landscape Types

The Plan divides the rural areas of Co. Clare into three types:

- Settled Areas where people work and live comprising the network of farmland, villages and towns in the County;

- Settled Landscapes or areas with a unique natural resource comprising two areas - 1. The Western Corridor between Ennis and Limerick and 2. the Shannon Estuary between Moneypoint and Ballynacragga Point excluding Clonderalaw Bay; and

- Heritage Landscapes – where natural and cultural heritage are given priority including Clonderalaw Bay

Each area is outlined in Map 3 of the CDP. The CDP sets out a series of objectives for new development within these areas. The area nearest to the proposal is defined as the Shannon Estuary Working Landscape. Objectives for this area include:

- Permitting development that will sustain the economic activity of regional and national significance; and

- Ensuring development proposals demonstrate that sites have been selected to avoid visually prominent locations where feasible.

Scenic Routes

Appendix 5 and Map 3 of the CDP set out protected views and prospects from Scenic Routes within the study area. The nearest Scenic Route to the proposal located on the northern shore of the Shannon estuary is SR 20, located along the R473 from outside Labasheeda to the T junction before Killadysert. Development Plan Objective 16.6 commits, "To ensure that proposed developments take into consideration their effects on views from the public road towards scenic features, or areas and are designed and located to minimise their impact."

15.4 LIKELIHOOD OF LANDSCAPE AND VISUAL IMPACTS

15.4.1 Landscape Character Area Impacts

As identified in the baseline assessment above -Section 15.3.1 - RPS has divided the extended host landscape into two landscape character areas:

- Foynes Port and Urban Landscape; and

- Shannon Estuary and Rounded Farmland.

The landscape impacts of the proposed development on these LCA is summarised in the following text.

Foynes Port and Urban Landscape

The East Jetty Extension is proposed on a brownfield site within the existing Foynes Port on the north-eastern edge of Foynes village. The development will therefore utilise lands within the existing built development limit of the urban fabric of the village and Port. The proposed East Jetty Extension is consistent with the character of the extended port area and the facility will blend in seamlessly with the existing infrastructure surrounding the site. New mobile cranes will be read with existing cranes. Additionally, the relatively low lying nature of the proposal will render it invisible throughout the majority of the Foynes urban area. From comparative highpoints in the west of the village views toward the site will be largely obscured by intervening urban infrastructure. The proposed development of the Durnish lands will not be located directly within this landscape and will have no indirect landscape effect as new development on the Durnish lands will be consistent with the Foynes Port and Urban landscape character.

The landscape at this location is identified as medium quality with a low sensitivity to change. The predicted magnitude of change in landscape resource is small and the significance of the landscape effect is assessed as negligible to minor.

<u>Shannon Estuary Rounded Farmland</u>

The development of the Durnish lands will be located directly within this landscape albeit in lands that lie directly adjacent to the Foynes Port and that have been zoned for marine related industry. The proposed development will raise the existing landform for flood protection purposes increasing the extent of influence of the marine related industry across this local part of the Shannon Estuary Rounded Farmland than would otherwise be the case if it was developed at existing grade levels. The new development will be prominent locally in the landscape towards the N69 and Robertstown Creek without mitigation.

However, the proposal will be an insignificant development within the context of the wider Shannon Estuary Rounded Farmland LCA due to the built form to the west and southwest and the Aughinish Alumina plant to the northeast. To a certain extent any new buildings on the Durnish lands will be consistent with the character of those west of the site and with suitable mitigation screen planting the proposed development will blend into the urban backdrop of a busy industrial and wider port area found at Foynes including existing fixed and movable plant and infrastructure.

The Shannon Estuary Rounded Farmland landscape is identified as high quality with a high sensitivity to change. The location of the proposed development directly within this landscape will result in the physical alteration of open agricultural fields to marine industrial use and a large landscape impact at a local level (<1-2km). The significance of landscape effect will be Major to Substantial negative without mitigation.

Beyond the local Shannon Estuary Rounded Farmland landscape (>1-2km) the proposed development will be read with the existing marine industrial uses and other commercial and industrial uses on adjacent lands and the undulating topography to the west, east and south quickly absorbs the proposed development to significantly restrict any potential change in landscape resource with a negligible landscape impact and a significance of landscape effect of minor.

The proposed East Jetty Extension will have no effect on this landscape character area due to the area that separates the proposal from this landscape that is dominated by Foynes Port development.

15.4.2 Planning Policy Designation Impacts

Impacts on relevant designations contained within the Limerick and Clare County Development Plans – as referred to above in Section 15.3.2 – are assessed below.

Limerick County Development Plan 2010 – 2016

Landscape Character

Chapter 7 and Map 7.4 in the County Development Plan 2010-2016 sets out the relevant landscape character areas within the study area. LCA 2 Shannon Integrated Coastal Management Zone described in the Development Plan is broadly consistent with the RPS delineated and described "Shannon Estuary Rounded Farmland LCA - described above. Consistent with the landscape impact described previously, the predicted landscape effect is negligible and not significant.

Views and Prospects

The proposal will have no impact on the majority of the protected views and prospects along the N69 east of Tarbert to Foynes due to the road alignment, distance of view and intervening topography and landscape features.

Theoretically views will be available as the N69 gets nearer to Foynes, given that it is elevated marginally above the existing village and port. From this location the intervening urban landscape of Foynes will largely screen views to the site. The separation distance means that where views are available the visual impact of the proposal will be negligible as the East Jetty Extension fully blends with the existing Foynes Port infrastructure.

Architectural Conservation Area

Overall the proposal will not have any negative landscape and visual impact on the Architectural Conservation Area that is located within the main core of Foynes village as it is well separated from this area by the built form of at the village and the port and there is no direct visual link. The significance of effect will be none.

Clare County Development Plan 2017 – 2023

Landscape Character Areas

The Shannon Estuary Farmlands (LCA18) described in the Clare CDP is that nearest to the site on the northern bank of the estuary. Given the separation distance to the proposed development, and existing backdrop at Foynes Port when viewed across the estuary the predicted landscape impact on this LCA will be negligible and not significant.

Seascape Character Areas

There are no specific objectives set out in the Plan for seascape character areas. The nearest area identified in the Plan to the proposal is Seascape Character Area 11 - River Shannon that runs tight to the coastline and is illustrated in Map 13.3 of the CDP. Due to the distance of the proposed development from this Seascape Character Area and the existing backdrop at Foynes Port when viewed across the estuary (See Viewpoints 9 and 10) the predicted landscape impact on the River Shannon Seascape Character Area on the Clare County coast will be negligible and not significant.

Living Landscape Types

The nearest Living Landscape Type to the proposal is the Working Landscape known as Shannon Estuary located between Moneypoint and Ballynacragga Point excluding Clonderalaw Bay as outlined in Map 13a of the CDP. The objectives set out in the CDP for this landscape type are focused on development within these areas which are not designated specifically due to landscape feature. The CDP requires that within this the Shannon Estuary Working landscape, development proposals avoid prominent locations if possible. As before, the extended separation distance across the Shannon Estuary will mitigate the impacts of the proposal from within this area. The significance of effect will be none.

Scenic Routes

The nearest scenic route on the County Clare coastline is SR 20, located along the R473 from outside Labasheeda to the T junction before Killadysert.

Whilst there is potential for long distance views of between 5-7km to be available towards the southern shoreline of the estuary, these are obscured along the western extents of the road by the intervening feature of Foynes Island. Nearer to Killadysert, views due south to the site are obscured by the distance and landscape features on including undulating topography and vegetation along roadsides and field boundaries. Overall no significant visual impacts are predicted along Scenic Routes designated in the Clare CDP. The significance of effect will be none for Scenic Routes on Clare CDP.

15.4.3 Zone of Theoretical Visibility (ZTV)

The ZTV for the project is illustrated in Figure 15.1. Within the ZTV, as the intervening distance to the site increases, generally the level of site and proposal visibility decreases significantly. This is contributed to by the relatively low lying nature of the coastal landscape within which the site is situated. The existing industrial context of the area within which the site is situated will also contribute to limiting views from the surrounding areas.

As stated above in Section 15.2.8, the delineation of the ZTV is dictated based on a worst case scenario. In reality, views of the site will be entirely obscured from a number of locations within this area such for example largely within the urban Foynes area with the exception of the lands immediately surrounding the site. Elsewhere within Foynes, the enclosed nature of the existing streetscape will render views to the site either impossible or - where available – insignificant.

The ZTV has been used to identify the locations where potential visual impacts may occur. The following text summarises the potential visual impacts on visual receptors within the ZTV.

Within the study area the landscape is generally well enclosed. The existing urban fabric of Foynes, the industrial host landscape and the nearby Port facilities combine to offset the potential visual impact where views are occasionally available. In these instances it will be difficult to discern the location of the site given the type of development proposed and the context within which it will be located.

There are occasional long distance vistas available in the direction of the site along an elevated portion of the N69 Coastal Road, located to the west. As the road approached Foynes the views are screened by intervening port facilities. Further west along the N69 the road becomes more elevated however its alignment and landscape features combine to obscure views from here.

To the southwest of Foynes the landscape becomes more elevated however views are restricted by existing roadside vegetation as well as a band of forestry surrounding the southern outskirts of the village. Any open views from this direction are long distance in nature and proposed development will be insignificant as it merges within the existing settlement and immediate industrial surroundings.

Immediately east of the site on the other side of the Robertstown Creek the landscape is largely devoid of significant undulations and only thin tree cover and accordingly views to the site will be available from the nearest public access points on local roads. Views along the Shannon Estuary from the east are obscured by the headlands and existing development present on Aughinish Island. Potential views across the Shannon from County Clare will be insignificant given the separation distance and backdrop to the site. Often these will be entirely obscured by the intervening land mass of Foynes Island.

The visual impact of the proposed development is assessed in greater detail in the following sections.

15.4.4 Visual Impacts on Residential Properties

There are a limited number of dwellings in the immediate proximity of the proposed development given its location within and adjacent to an existing marine industrial setting. Existing clusters of housing within Foynes constitute the nearest residential structures to the site including linear housing along and adjacent to Main Street/N69 and particularly at Dernish Avenue that is the nearest part of the village to the proposed development. As illustrated in Viewpoint 1 (see Appendix 15.1) in views from Dernish Avenue the East Jetty Extension is completely screened but there will be glimpse views especially in winter months towards taller parts of the proposed development on the Durnish lands. The viewer sensitivity is high. The predicted magnitude of visual impact will be small. The predicted significance of visual effect will be minor to moderate.

South of the Durnish lands there are several individual houses along the N69 that have potential rear views towards the proposed development (see Viewpoint 2 - see Appendix 15.1). The proposed raised landform and marine industrial uses will be directly visible without mitigation. The viewer sensitivity is high. The predicted magnitude of visual impact will be medium. The predicted significance of visual effect will be moderate to major.

East of the Durnish lands at Robertstown Creek there are several rural houses along narrow local roads that have potential front views towards the proposed development through thin intervening vegetation cover on flats lands west of the Creek (see Viewpoint 3 - see Appendix 15.1). The proposed raised landform and marine industrial uses will be partly visible without mitigation. The viewer sensitivity is high. The predicted magnitude of visual impact will be small. The predicted significance of visual effect will be minor to moderate.

The low lying topography throughout the village prevents long term views to the proposed sites from these residential areas. In addition those dwellings along Main Street and to the south at Woodvale are generally orientated to face away from the direction of the proposed sites.

More elevated parts of the village are located at the Marine Cove residential development that has views over the intervening urban fabric of Foynes and this restricts the significance of any visual impact associated with the proposed development at the East Jetty Extension with the Durnish lands well screened by intervening built form (see Viewpoint 6 - see Appendix 15.1). The viewer sensitivity is high. The predicted magnitude of visual impact will be small. The predicted significance of visual effect will be minor to moderate.

15.4.5 Viewpoint Assessment

A series of representative viewpoints have been selected from locations throughout the study area and subjected to specific assessment below. As stated before, the location of all viewpoints can be cross referenced using Figure 15.2 - above. Photomontages for Viewpoints 1 to 8 are included in Appendix 15.1 of this EIAR. Photographs only have been provided below for Viewpoints 9 – 10.

Viewpoint 1 – Dernish Avenue Foynes Village

Type and Sensitivity of receptor: This view is available from residential properties at Dernish Avenue in Foynes. The view is predominantly available to the local community. The viewer sensitivity is high.

Existing view: The view is from a cul de sac with a gap in adjacent houses permitting a view across grass fields in a northeast direction. While the existing Foynes Port is located in the direction of this view to the left it is completely screened by trees and vegetation located on either side of the old railway line. HGV's travelling on the port access road are visible for glimpse views. It is not possible to directly view either the Durnish lands or the site of East Jetty Extension.

Predicted view: It is predicted that the proposed East Jetty Extension will be fully obscured by the existing vegetation. The proposed development at the Durnish lands will be partially visible above existing trees and hedges particularly in winter months but will be well screened and not prominent. Taller components of the proposed container storage use will be visible including cranes and mast lights.

Magnitude of visual impact: The magnitude of visual impact will be small at this location.

Significance of visual effect: The predicted significance of visual effect is minor to moderate.

Viewpoint 2 – South of N69/Port Road Junction

Type and Sensitivity of receptor: This view is located along the N69 south of the junction with Port Road. Along this section of its route, the N69 is not designated as scenic within the Limerick CDP - 2010 - 2016. Prevalent traffic types along this route include: locals, Port users, and tourists and day trippers. The viewer sensitivity at this location is medium.

Existing view: This view - taken towards the north - is dominated completely by open agricultural fields. The land to the north and northeast is low lying, broken by mature vegetation set against the skyline. The main urban fabric of Foynes is obscured from this location but it is possible to view lighting columns on the existing port access road but the view is predominantly pastoral in character.

Predicted view: The low lying landscape setting at this location dictates that the proposed development of the raised Durnish lands will be noticeable above the adjacent landscape. The proposed development on the raised lands including proposed open storage area and warehousing and container storage area and high mast lighting will all be partially visible to some extent without mitigation.

Magnitude of visual impact: The magnitude of visual impact will be medium.

Significance of visual effect: The predicted significance of visual effect is moderate.

Viewpoint 3 – Robertstown Creek

Type and Sensitivity of receptor: This view is located along a local road at Robertstown Creek. The view is predominantly available to the local community. The viewer sensitivity at this location is high.

Existing view: This view - taken towards the northwest - is dominated completely by open agricultural fields and estuary. The land to the northwest is low lying, broken by mature vegetation set against the skyline. The main urban fabric of Foynes is well screened from this location but it is possible to view lighting columns on the existing port access road and tops of buildings but the view is predominantly pastoral in character.

Predicted view: The low lying landscape setting at this location dictates that the proposed development of the raised Durnish lands will be noticeable above the adjacent landscape without mitigation. The proposed development on the raised lands including proposed open storage area and warehousing and container storage area and high mast lighting will all be visible to some extent without mitigation although barely discernible at this distance.

Magnitude of visual impact: The magnitude of visual impact will be negligible.

Significance of visual effect: The predicted significance of visual effect is minor.

Viewpoint 4 – Corgrigg Wood Road

Type and Sensitivity of receptor: This view is located along a local road south of Foynes village. The viewer sensitivity at this location is high.

Existing view: This view - taken towards the northeast - is elevated and provides a view over the rooftops of houses at Foynes towards the port facilities at Foynes Port including visible cranes, tanks and silo's. The southern shoreline of County Clare is located in the background of the view.

Predicted view: The proposed development at Durnish lands will be completely screened from views at this location but the East Jetty Extension will be partly visible. However any cranes located at the East Jetty Extension will be read with existing adjacent cranes with low change in visual resource.

Magnitude of visual impact: The magnitude of visual impact will be negligible at this location.

Significance of visual effect: The predicted significance of visual effect is minor.

Viewpoint 5 – Corgrigg Wood Road

Type and Sensitivity of receptor: This view is located along a local road south of Foynes village. The viewer sensitivity at this location is high.

Existing view: This view - taken towards the northeast - is slightly elevated and provides a view over the rooftops of houses at Foynes towards the port facilities at Foynes Port including visible cranes and mast lighting.

Predicted view: The proposed development at Durnish lands will be well screened from views at this location but will be partly visible above trees particularly in winter months. Container storage and high mast lights will be features of the proposed development partly visible from this viewpoint. The East Jetty Extension will not be visible.

Magnitude of visual impact: The magnitude of visual impact will be small at this location.

Significance of visual effect: The predicted significance of visual effect is minor to moderate.

Viewpoint 6 – Marine Cove Housing Development - Foynes

Type and Sensitivity of receptor: This view - located within a residential cul-de-sac - is predominantly available to the local community (residents of the Marine Cove housing development). The viewer sensitivity is high.

Existing view: The elevated location of the viewpoint means there are quite open and expansive views towards the Shannon Estuary to the northeast. The southern shores of Foynes Island are visible in the River, to the extreme right of the view. The roofs of lower lying housing in the Marine Cove development are visible across the foreground of the view. The tops of cranes and boat masts are visible as they break the skyline in the direction of the docks and towards the application site. In the far distance the infrastructure at Aughinish East - associated with the aluminium facility - is barely visible.

Predicted view: The proposed development at Durnish lands will be directly visible in views at this location with the taller elements including container stacks, cranes and high mast lights visible but distant. Such elements will be read with existing port and urban development in the foreground that offsets visibility of the proposed development at Durnish lands. The East Jetty Extension will be directly visible. However, any cranes located at the East Jetty Extension will be read with existing adjacent cranes with low change in visual resource.

Magnitude of visual impact: The magnitude of visual impact will be small at this location.

Significance of visual effect: The predicted significance of visual effect is minor to moderate.

Viewpoint 7 – N69 Coast Road – Northwest of Foynes

Type and Sensitivity of receptor: This view is available from the N69 on a Scenic Route as designated in the Limerick CDP. The view is predominantly available to the local community, tourists and day-trippers. The viewer sensitivity is high.

Existing view: The view is taken across the Harbour and Port area which dominate the scene from this comparatively elevated position. A number of small boats are visible moored in a marina in the foreground whilst Industrial buildings and infrastructure associated with the port are visible in the background.

Predicted view: The proposed development at Durnish lands will be fully screened from views at this location with only high mast lights potentially visible but difficult to discern from existing lights. The East Jetty Extension will be located directly in this view but ground level views of jetty are screened. Any cranes located at the East Jetty Extension will be read with existing adjacent cranes with low change in visual resource.

Magnitude of visual impact: The magnitude of visual impact will be small at this location.

Significance of visual effect: The predicted significance of visual effect is minor to moderate.

Viewpoint 8 – N69 St Robertstown Church

Type and Sensitivity of receptor: This view is located along a N69 road at St Robertstown Church. The view is predominantly available to the local community and commuters. The viewer sensitivity at this location is medium.

Existing view: This view - taken towards the northwest - is dominated completely by open agricultural fields and estuary. The land to the northwest is low lying, broken by mature vegetation set against the skyline. The main urban fabric of Foynes is well screened from this location but it is possible to view lighting columns on the existing port access road and tops of buildings but the view is predominantly pastoral in character.

Predicted view: The low lying landscape setting at this location dictates that the proposed development of the raised Durnish lands will be noticeable above the adjacent landscape without mitigation. The proposed development on the raised lands including proposed open storage area and warehousing and container storage area will all be partially visible to some extent without mitigation.

Magnitude of visual impact: The magnitude of visual impact will be negligible.

Significance of visual effect: The predicted significance of visual effect is negligible to minor.

Viewpoint 9 – Along R473 Scenic Route - County Clare

Type and Sensitivity of receptor: This view is taken along the R473 scenic route on the County Clare coast to the north of the Shannon Estuary. Given the local area plan designation and the associated tourist potential, the viewer sensitivity is assessed as high.

Existing view: The view is orientated towards the southeast. The foreground is dominated by agricultural fields interspersed by hedgerows and occasional semi mature trees. The Shannon is visible in the middle distance as is the significant landscape feature of Foynes Island. The infrastructure of the Port is visible on the far shoreline.

Predicted view: Although some of the existing infrastructure at Foynes Port is visible in the middle distance, Foynes Island partly obscures views of the actual site of the East Jetty Extension and fully obscures views of the Durnish lands from this location. Cranes at the proposed East Jetty Extension will blend with existing cranes with negligible change in visual resource.

Magnitude of visual impact: The magnitude of visual impact will be negligible at this location.

Significance of visual effect: The predicted significance of visual effect is minor.

Viewpoint 10 – Cahercon, County Clare

Type and Sensitivity of receptor: This view is predominantly available to the local community, tourists and day trippers from the R473 road that is designated as a Scenic Route. The viewer sensitivity is high.

Existing view: The view is available to the northwest of the site across the expanse of the Shannon Estuary and at a distance of approximately 5km. Rural and agricultural in nature, the foreground of the view is dominated by large fields defined by well-trimmed hedgerows and stone walls. The Shannon is visible in the middle distance, beyond the Limerick Coastline and Foynes Island is visible.

Predicted view: The proposal will not be visible due to the separation distance and the intervening landmass of Foynes Island.

Magnitude of visual impact: The magnitude of visual impact will be no change.

Significance of visual effect: The predicted significance of visual effect is no change.

15.4.6 Construction Phase Impacts

During the construction phase potential impacts include:

(i) Site preparation/enabling works and operations;

(ii) Site infrastructure and access;

(iii) Vehicular and plant movements; and

(iv) Dust emissions

A detailed description of the construction phase is provided in Chapter 2 of the EIAR. The programme for construction is likely to 39 months and therefore visual impacts during the construction phase will be of short term in nature. A worst case scenario has been assumed for the assessment of construction phase impacts that consists of all works at East Jetty Expansion and a single phase construction at the Durnish lands.

Works will be visible from within the ZTV during construction period to a varied extent that will be related to the construction activity at any given time. Trucks and construction vehicles coming and going via the N69 and port access roads will be similar in nature to existing port traffic with low levels of visual resource change.

Ground level construction activities at the site of the East Jetty Extension will be well screened from views throughout the construction phase due to adjacent port facilities and built form of Foynes. Port related activities will continue during the construction phase further detracting from the construction phase activities.

Ground level construction activities for the development of the Durnish lands will be more noticeable but not extensively so and will be limited to a local level by the nature and character of the landscape on the south and east side of Foynes that has a generally low-lying and gently undulating topography that will decrease the prominence of site works.

Due to distance and the broad scale of the landscape within which the works are located the change in landscape and visual resource will be small therefore the significance of landscape and visual impacts during the construction stage will be minor to moderate. There are limited residential dwellings in close proximity to the construction works and no significant visual impacts are predicted at this stage as a result.

15.4.7 Cumulative Impacts

When potential construction and operational stage cumulative landscape and visual effects are considered for the proposed development in combination with permitted and planned projects they will not result in any significant cumulative landscape and visual effects due to a combination of separation distance and the nature of the proposals. Construction stage activities involve an increase in construction traffic for all cumulative projects. HGV traffic is frequent feature of this marine industrial landscape and the N69 is a busy road with low potential for significant cumulative visual impacts as a result. The operational stage activities proposed as part of the proposed development are sufficiently separated from any permitted or planned projects to avoid potential cumulative effects.

15.5 SIGNIFICANCE OF LANDSCAPE & VISUAL EFFECTS

The potential effects on landscape character have been assessed in Section 15.5.1 above and the significance of effects can be summarised as follows:

Table 15.6: Significance of Landscape Character Effects

Landscape Character Area	***Predicted Significance of Effect (Without Mitigation)***
Foynes Port and Urban Landscape	Negligible to Minor and not significant
Shannon Estuary Rounded Farmland (local level <1-2km)	Major to Substantial and significant
Shannon Estuary Rounded Farmland (>1-2km)	Negligible and not significant

The potential landscape and visual effects on planning policy designations landscape character have been assessed in Section 15.5.2 above and the significance of effects can be summarised as follows:

Table: 15.7: Significance of Landscape & Visual Effects on Planning Policy Designations

Planning Policy or Designation	***Predicted Significance of Effect (Without Mitigation)***
Limerick CDP 2010 - 2016	
Landscape Character Areas – LCA 2 Shannon Integrated Coastal Management Zone	Negligible and not significant
Views and Prospects – N69 Tarbert to Foynes	Negligible and not significant
Architectural Conservation Area – Foynes Village	No change
Clare CDP 2017 - 2023	
Landscape Character Areas	Negligible and not significant
Seascape Character Areas	Negligible and not significant
Living Landscape Types	No change
Scenic Routes	No change

The potential visual impact on residential properties has been assessed in Section 15.5.4 above and the significance of effects can be summarised as follows:

Table: 15.8: Significance of Visual Effects on Residential Properties

Property Locations	***Predicted Significance of Effect (Without Mitigation)***
Properties at Dernish Avenue, Foynes	Minor to moderate and not significant
Properties south of Durnish lands on N69	Moderate to major and significant
Properties at Robertstown Creek	Minor to moderate and not significant
Properties at Main Street, Foynes	No Change
Properties at Marine Cove, Foynes	Minor to moderate and not significant

The potential visual impact from at a series of viewpoints from within the ZTV has been assessed in Section 15.5.5 above and the significance of effects can be summarised as follows:

Table: 15.9 Summary of Viewpoint Assessment

Viewpoint No.	***Viewpoint Name***	***Predicted Significance of Effect (Without Mitigation)***
1	View northeast from Dernish Ave, Foynes	Minor to Moderate and not significant
2	View north from location south of port access on N69	Moderate and not significant
3	View west from Robertstown Creek	Minor not significant
4	View northeast from Corgrigg Wood Road	Minor and not significant
5	View northeast from Corgrigg Wood Road	Minor to Moderate and not significant
6	1 View east from Marine Cove, Foynes	Minor to Moderate and not significant
7	View east from N69 Coast Road	Minor to Moderate and not significant
8	View west from N69 at St Robertstown Church	Negligible to minor and not significant
9	View south from R473, County Clare	Minor and not significant
10	View south from Cahercon, County Clare	No change

15.6 REMEDIAL & MITIGATION MEASURES

15.6.1 Landscape Mitigations Measures

Landscape mitigation measures are those taken to help reduce or remedy landscape and visual impacts or compensate for the loss of landscape value created by the redevelopment.

The aims of the landscape mitigations are:

- Screening to reduce the adverse visual impact of the proposal;
- Compensate for landscape impact where possible.

The design evolution of the proposed project has undertaken to enable incorporation of the following built-in design measures:

- Integration of constructed elements with existing elements such as existing roads and building sites and retention of trees
- Appropriate colour of fencing and structures
- As the cranes and gantries are predominantly read against the sky they will be mid-grey in colour rather than the usual blue or yellow
- Directional lighting

The existing port facilities and the openness of the harbour, and the size and the nature of the development at East Jetty Extension do not allow for sufficient scope of landscape mitigation by the implementation of soft landscape components to physically and visually integrate the proposed port development into the surrounding landscape. The proposal is fully waterside based; allowing vessels to dock, moving of cranes along the quay but the location of Foynes Island does offset potential views and in view from across the Shannon the proposals will appear to blend with existing port facilities.

The following specific landscape proposals have been put in place to reduce the landscape and visual effects identified above for Durnish lands:

- Retention and protection of hedgerows at the site boundaries during construction and enhancement and reinforcement of all retained hedgerows.
- Planting will be provided on the site boundary as set in detail on Figure 15.4 – Landscape Planting Plan (Volume 3 of EIAR).

15.7 RESIDUAL EFFECTS

This section of the chapter assesses the impact of the proposed development on the landscape character and visual receptors (previously identified in section 15.6 above), after the mitigation (described above in section 15.7) has been implemented.

Within the wider landscape the proposal will continue to blend with the existing port facilities around the site with no significant residual landscape character impacts as landscape mitigation matures. With regards to visual impact on sensitive receptors impact on existing views will be offset by the proposed mitigation measures but the proposed modified site will remain as a new feature for some viewpoints in very close proximity to the south and southeast but overall the visual impacts are limited through time and the proposals will blend within the local visual context.

The residual landscape impact on landscape character and the significance of effects can be summarised as follows:

Table 15.10 Significance of Residual Landscape Character Effects

Landscape Character Area	***Predicted Significance of Effect (Without Mitigation)***	**Predicted Significance of Effect (With Mitigation)**
Foynes Port and Urban Landscape	Negligible to Minor and not significant	Negligible and not significant
Shannon Estuary Rounded Farmland (local level <1-2km)	Major to Substantial and significant	Moderate to Major and not significant
Shannon Estuary Rounded Farmland (>1-2km)	Negligible and not significant	Negligible and not significant

The residual landscape & visual effects on Planning Policy Designations and the significance of effects can be summarised as follows:

Table: 15.11: Significance of Residual Landscape & Visual Effects on Planning Policy Designations

Planning Policy or Designation	**Predicted Significance of Effect (Without Mitigation)**	***Predicted Significance of Effect (With Mitigation)***
Limerick CDP 2010 - 2016		
Landscape Character Areas – LCA 2 Shannon Integrated Coastal Management Zone	Negligible and not significant	Negligible and not significant
Views and Prospects – N69 Tarbert to Foynes	Negligible and not significant	Negligible and not significant
Architectural Conservation Area – Foynes Village	No change	No change
Clare CDP 2017 - 2023		
Landscape Character Areas	Negligible and not significant	Negligible and not significant
Seascape Character Areas	Negligible and not significant	Negligible and not significant
Living Landscape Types	No change	No change
Scenic Routes	No change	No change

The residual visual impact on residential properties and the significance of effects can be summarised as follows:

Table: 15.12 Significance of Residual Visual Effects on Residential Properties

Property Locations	***Predicted Significance of Effect (Without Mitigation)***	**Predicted Significance of Effect (With Mitigation)**
Properties at Dernish Avenue, Foynes	Minor to moderate and not significant	Minor and not significant
Properties south of Durnish lands on N69	Moderate to major and significant	Moderate and significant
Properties at Robertstown Creek	Minor to moderate and not significant	Minor and not significant
Properties at Main Street, Foynes	No Change	No Change
Properties at Marine Cove, Foynes	Minor to moderate and not significant	Minor not significant

The residual visual impact from at a series of viewpoints from within the ZTV and the significance of effects can be summarised as follows:

Table: 15.13 Summary of Residual Viewpoint Effects

Viewpoint No.	*Viewpoint Name*	*Predicted Significance of Effect (Without Mitigation)*	**Predicted Significance of Effect (Without Mitigation)**
1	View northeast from Dernish Ave, Foynes	Minor to Moderate and not significant	Minor and not significant
2	View north from location south of port access on N69	Moderate and not significant	Minor to moderate and not significant
3	View west from Robertstown Creek	Minor and not significant	Minor and not significant
4	View northeast from Corgrigg Wood Road	Minor and not significant	Minor and not significant
5	View northeast from Corgrigg Wood Road	Minor to Moderate and not significant	Minor and not significant
6	View east from Marine Cove,Foynes	Minor to Moderate and not significant	Minor and not significant
7	View east from N69 Coast road	Minor to Moderate and not significant	Minor and not significant
8	View west from N69 at St Robertstown Church	Negligible to minor and not significant	Negligible and not significant
9	View south from R473 County Clare	Minor and not significant	Minor and not significant
10	View south from Cahercon, County Clare	No change	No change

15.8 CONCLUSION

This proposed development is located within the north-eastern of Foynes urban area on a zoned portion of marine industrial lands. In landscape character terms the wider study area has been classified as:

- Foynes Port and Urban Landscape; and
- Shannon Estuary and Rounded Farmland.

The proposed development is located directly in both landscape character areas. The proposed East Jetty Extension is consistent with the character of the extended port area and the facility will blend in seamlessly with the existing infrastructure surrounding the site. New mobile cranes will be read with existing cranes. The predicted magnitude of change in landscape resource is small and the significance of the landscape effect is assessed as negligible to minor.

The location of the proposed development directly within this landscape will result in the physical alteration of open agricultural fields to marine industrial use and a large landscape impact at a local level (<1-2km). The significance of landscape effect will be Major to Substantial negative without mitigation. Beyond the local Shannon Estuary Rounded Farmland landscape (>1-2km) the proposed development will be read with the existing marine industrial uses and other commercial and industrial uses on adjacent lands and the undulating topography to the west, east and south quickly absorbs the proposed development to significantly restrict any potential change in landscape resource with a negligible landscape impact and a significance of landscape effect of minor.

In accordance with the robust approach to LVIA which has been employed, the Zone of Theoretical Visibility (ZTV) has been established based on a "worst case scenario." It has already been established that from many locations within the ZTV views of the site will entirely be obscured by a combination of landscape and urban features. A series of 10 viewpoints have been assessed within the ZTV. No significant effects are predicted for any viewpoints.

There are limited dwellings in the immediate proximity of the proposal given its location within an existing industrial setting but for the nearest properties at Dernish Avenue in Foynes and along the N69 no significant visual effects have been predicted due to the limited visibility of the proposed development in conjunction with retention of existing hedgerows and proposed landscape planting. At locations further from the proposed development the low lying nature of the site of the proposed development, intervening features, separation distances and orientation of distance combine to ensure there are no residential dwellings within the ZTV predicted as being significantly affected.

The current Limerick and Clare County Development Plans have been examined. The proposal will have no significant effect on any relevant landscape or visual designations.

Overall, therefore, when the landscape and visual impacts are considered the proposal is acceptable and the surrounding landscape and its visual resources have the ability to accommodate the changes of the type associated with this development.

16 INTERACTIONS OF THE FOREGOING

16.1 INTRODUCTION

All environmental factors are inter-related and this chapter cross references the individual environmental assessment reports undertaken, including the proposed mitigation measures, having regard to current knowledge and methods of assessment. An indication is also given of the cumulative effects of the proposed development when considered with other permitted development in the area, not yet constructed.

In practice many impacts have slight or subtle interactions with other disciplines. This chapter highlights those interactions which are considered to potentially be of a significant nature. Discussions of the nature and effect of the impact is primarily undertaken within each of the relevant chapters, while this chapter identifies the most important potential interactions.

16.2 METHODOLOGY

Reference was made to the EPA Documents, *Guidelines on the Information to be contained in Environmental Impact Statements*, EPA 2002; *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*, EPA 2003 (EPA guidelines); and to the EPA published Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017). In addition to EPA documents regard was also had to the EU *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*.

At the screening stage in the preparation of the EIAR for the proposed development, the potential for significant cumulative and indirect impacts and interactions were examined and identified. Where the potential for significant cumulative and indirect impacts and interactions were identified such impacts and interaction of impacts were included in the scope and addressed in the baseline and impact assessment studies for each of the relevant environmental issues and aspects of the project. The cumulative and indirect impacts and interaction of impacts are presented in each of the EIAR chapters.

The matrix and expert opinion approaches, as outlined in the EU Guidelines, were used in the identification of the potential for significant cumulative and indirect impacts and interactions. Refer to Table 16.1 for the matrix of potential interactions.

	Population & Human Health	Flora Fauna & Biodiversity	Archaeology & Cultural Heritage	The Landscape	Land Soils & Hydrogeology	Water Quality & Flood Risk	Air & Climate	Noise & Vibration	Coastal Processes	Traffic & Transport
Population & Human Health		-	-	C	C	-	CO	CO	-	-
Flora Fauna & Biodiversity	-		-	C	C	O	-	CO	C	-
Archaeology & Cultural Heritage	-	-		-	-	-	-	-	-	-
The Landscape	CO	C	-		C	-	-	C	-	-
Land Soils & Hydrogeology	-	C	-	C		C	C	-	-	-
Water Quality & Flood Risk	CO	C	-	C	-		C	-	C	-
Air & Climate	CO	-	-	-	C	-		-		CO
Noise & Vibration	CO	CO	-	C	-	-	-			CO
Coastal Processes	-	C	-	-	-	C	-	-		-
Traffic & Transport	CO	-	-	CO	-	-	CO	CO	-	

C = Construction O = Operational '-' = No Impact

Table 16.1 Potential Interaction of Effects Matrix

16.3 DESCRIPTION OF THE INTERACTIONS

Each chapter of the EIAR details baseline information and identifies the significant potential and residual construction and operational effects/impacts of the proposed development. However, this Chapter details the significant interactive and inter-related effects/impacts. Table 16.2 indicates the key elements and activities of the proposed development during both the site preparation and operational phases and how they inter-act and inter-relate with the various environmental aspects considered in detail in Chapter 6.0 through to Chapter 15.0 of this EIAR.

The following Table 16.2, is indicative only and does not purport to contain or replace all or any of the issues raised in the main assessment sections of this EIAR. Their purpose is to demonstrate the main likely and significant inter-relationships and inter-actions between different environmental aspects considered. While many inter-relationships and inter-actions have been identified, it is anticipated that the mitigation measures included in the proposed development (and outlined in the other relevant sections of the EIAR) will also minimise or off-set potential for significant effects.

	Interaction With	Interaction
Population & Human Health	Landscape	The proposal has the potential to impact on the landscape and visual resources perceived by human beings. However, landscape proposals including planting of a substantial buffer area reduces any potential impacts.
	Land, Soils & Hydrogeology	Potential contamination could arise from importation of fill material. However, given that the fill comprises quarry material it is likely that no contamination should arise.
	Air & Climate	The construction and operational phases of the development have the potential to generate impacts in terms of air quality upon local population centres. Subject to the implementation of a comprehensive dust minimisation plan and mitigation measures proposed, no significant impacts occur.
	Noise & Vibration	Noise and vibration generated from the construction and operational phases of the development have the potential to impact upon local population centres. With the proposed mitigation measures in place the noise impacts will be similar to the existing situation.
Flora Fauna & Biodiversity	Land, Soils & Hydrogeology	Significant earthworks have the potential to impact on nearby watercourse but with the implementation of suitable mitigation measures no significant impacts are predicted.
	Water Quality & Flood Risk	Marine ecology is dependent on water quality and thus significant disruption in water chemistry or sediment levels has potential to impact on local flora and fauna. The project design has derived from close collaboration between the; designer, marine engineering and terrestrial and aquatic ecology specialist inputs. Chapter 7.0 Flora Fauna & Biodiversity have shown that significant impacts will not occur following implementation of mitigation measures.
	The Landscape	Vegetation is an important aspect with respect to providing wildlife corridors. However, where mature vegetation will be removed as part of the proposed redevelopment, it will be replaced and overall there will no significant impact. The proposed development contains buffer and landscaping proposals.
	Noise & Vibration	Noise from construction and operational phases of the development has potential to impact on the fauna in the vicinity of the proposed redevelopment. However, the ecology chapters of the EIAR have predicted that following suitable mitigation, no significant impacts will occur.

	Interaction With	Interaction
	Coastal Processes	There is an inter-relationship between coastal modelling and marine ecology impacts. There has been close cooperation between the designer, ecological and Coastal Processes consultants and following suitable mitigation measures no significant impacts on marine ecology has been predicted.
The Landscape	Population & Human Health	The proposals have the potential to impact on the landscape and visual resources perceived by human beings. However, the separation distance of the development, existing and proposed site levels and landscaping proposals will mitigate any significant impacts.
	Flora Fauna & Biodiversity	Vegetation is an important aspect with respect to providing wildlife corridors. However, where mature vegetation will be removed as part of the proposed development, it will be replaced. Furthermore, landscape buffers are proposed along the northern, southern and eastern site boundaries.
	Land, Soils & Hydrogeology	Imported soils and materials necessary to undertake landscaping have the potential to impact the landscape. Any necessary imported soils will be chemically analysed and screened against generic screening values for a commercial end use to ensure that it does not pose a risk to human health.
	Noise & Vibration	The use of noise attenuation measures as part of the construction and operational stages has potential implications for the landscape and visual impacts of the proposals. However, due to the landscaping proposals and the nature of mitigation measures no significant visual impacts are predicted.
Water Quality & Flood Risk	Population & Human Health	Without mitigation, which includes the filling of land, the proposed development would be subject to flooding and this could impact on human safety.
	The Landscape	The filling of land to address potential flood risk alters the existing landscape and visual appearance of the land. However, landscaping and mitigation is proposed which will mitigate any potential adverse impacts.
	Marine Ecology	Marine ecology is dependent on water quality. Disruption in water chemistry or sediment levels has potential to impact on local flora and fauna. Chapter 7.0 Flora Fauna & Biodiversity has shown that no significant impacts will occur following implementation of mitigation measures.

	Interaction With	Interaction
	Coastal Processes	There is a potential inter-relationship between water environment and coastal processes. However, Chapter 12.0 Coastal Processes has predicted that there will be no significant impacts.
Land, Soils & Hydrogeology	Landscape	Imported soils and materials necessary to undertake landscaping have the potential to impact the landscape. Any necessary imported soils will be chemically analysed and screened against generic screening values for a commercial end use to ensure that it does not pose a risk to human health.
	Flora Fauna & Biodiversity	Significant earthworks have the potential to impact on nearby watercourse but with the implementation of suitable mitigation measures no significant impacts are predicted. Any necessary imported soils will be chemically analysed and screened against generic screening values for a commercial end use to ensure that it does not pose a risk to human health.
	Water Quality & Flood Risk	The raising of the land, necessary for the mitigation of flood risk, will necessitate the importation of fill and which will alter ground conditions and could interfere with hydrogeology. However, Chapter 8.0 Land, Soils and Hydrogeology has indicated that there will be no significant impact.
	Air & Climate	Excavation works and exposure of soil during the construction phase can influence the microclimate in an area. The movement of soils during the construction phase may result in the spread of dust and mud onto surrounding land uses and public roads. The air quality assessment indicates that there is no significant impact associated with these matters.
Air & Climate	Population & Human Health	The construction and operational phases of the development have the potential to generate impacts in terms of air quality upon local population centres. Chapter 10.0 Air Quality does identify dust as a potential issue but puts forward mitigation and appropriate Dust Minimisation Plans to address the issue.
	Land, Soils & Hydrogeology	Excavation works and exposure of soil during the construction phase can influence the microclimate in an area. The movement of soils during the construction phase may result in the spread of dust and mud onto surrounding land uses and public roads. The air quality puts forward adequate mitigation and indicates that there is no significant impact associated with these matters.

	Interaction With	Interaction
	Traffic & Transport	Traffic generation has potential to result in impacts on Air Quality. Chapter 10 Air Quality & Climate has been prepared in close co-operation with the Traffic Consultant and has determined that no significant air quality impacts will occur due to traffic generation.
Noise & Vibration	Population & Human Health	Noise and vibration generated from the construction and operational phases of the development have the potential to impact upon local population centres. With the proposed mitigation measures in place the noise impacts will be similar to the existing situation.
	Flora Fauna & Biodiversity	Noise from construction and operational phases of the development has potential to impact on the fauna in the vicinity of the proposed redevelopment. However, Chapter 7.0 Flora Fauna & Biodiversity have predicted that following suitable mitigation, no significant impacts will occur.
	The Landscape	The use of noise attenuation measures as part of the construction and operational stages has potential implications for the landscape and visual impacts of the proposals. However, due to the nature of mitigation measures and the landscaping measures proposed no significant visual impacts are predicted.
	Traffic & Transport	Traffic generation has potential to result in noise related impacts. Chapter 11.0 Noise & Vibration has been prepared in close co-operation with the Traffic Consultant and has determined that no significant noise impacts will occur due to traffic generation.
Coastal Processes	Flora Fauna & Biodiversity	There is an inter-relationship between coastal modelling and marine ecology impacts, such that an altering of tidal flows can directly impact on marine habitat. However, there has been close cooperation between the designer, ecological and Coastal Modelling consultants and following suitable mitigation measures no significant impacts on marine ecology has been predicted.
	Water Quality & Flood Risk	There is a potential inter-relationship between water quality and coastal processes. However, the coastal processes chapter has predicted that there will be no significant impacts as the changes in tidal currents

	Interaction With	Interaction
		are restricted to the immediate vicinity of the jetty structure.
Traffic & Transport	Population & Human Health	Population and human health has the potential to be adversely impacted as a result of increased traffic flows having regard to noise and air quality factors. However, it has been demonstrated in Chapter 10 that there is adequate capacity in the road network to accommodate the proposed development, whilst Chapters 10 & 11 in relation to Air & Climate and Noise & Vibration confirm there will be negligible impacts arising from increased traffic.
	Air & Climate	Traffic generation has potential to impact on Air Quality. Chapter 10 Air Quality has confirmed that no significant air quality impacts will occur due to traffic generation.
	Noise & Vibration	Traffic generation has potential to result in noise related impacts. Chapter 11.0 Noise & Vibration has confirmed that no significant noise impacts will occur due to traffic generation

Table 16.2 Summary of Key Proposed Activities and Scheme Elements that Inter-Act and Cause Inter-Related Effects

16.4 CUMULATIVE EFFECTS

Cumulative effects address the long-term changes that may result from the construction and operation of the proposed development and the combined effect of this development with other developments in the area. This review is undertaken to ensure that the combined effects of the proposed development and other influences are assessed in total, and not as individual aspects of the environmental assessment.

SFPC has permission (planning reference 12/212) to carry out reclamation works between the rear of the existing East Jetty and the adjacent shoreline. The works will include dredging, importation of fill material, retaining wall construction, surfacing, drainage installation and site lighting. No buildings are proposed on the proposed reclaimed area which will be used for the storage and handling of cargo up to an anticipated height of approximately 7.7m.

In 2017, Aughinish Alumina were granted permission (planning reference 17/714) for development of a circa 4.5 hectare borrow pit located east of the proposed development, to extract circa 374,000m^3 of rock over a 10 year period.

Planning reference 15/468 relates to a smokeless and bio-mass based solid fuel manufacturing and packaging facility to be developed by Bord na Mona. The development includes for the cessation of the former coal bagging operation and the associated open storage of coal the site. It is noted that Bord na Mona has recently (March 2018) announced that the company does not intend to proceed with this consented development. Furthermore, the company announced the plan to close the existing coal storage facility within the port. Notwithstanding these changes, as this development is consented, the cumulative impact of the development was considered within this EIAR for completeness.

The cumulative impact of the proposed development and other committed neighbouring developments could have potential implications on environmental variables relating to traffic, noise, air quality & climate, flora fauna & biodiversity and the Landscape. These 'cumulative impacts' have been addressed in Chapter 13.0 Traffic; Chapter 11.0 Noise & Vibration; Chapter 10.0 Air Quality & Climate; and Chapter 15.0 The Landscape;

Each of the developments referred to in this section, including other commercial / industrial operations have been the subject of separate statutory procedures and planning applications and have been approved in their own right. In any case the overall cumulative impact of the proposed development will result in,

- An increase in economic activity in the local area region;
- A slight increase in traffic on the local road network which can be adequately managed;
- No significant environmental nuisance from an air quality perspective subject to implementation of the mitigation measures and adherence to good working practices;
- No significant landscape visual effects due to the limited visibility of the proposed development in conjunction with retention of existing hedgerows and proposed landscape planting.

- Acceptable noise levels within the 55dB $L_{Ar,T}$ daytime threshold limit at the nearest noise sensitive properties, following construction of a 4m acoustic barrier on the southern and western boundaries of the site.

16.5 REFERENCES

Environmental Protection Agency (1997) *BATNEEC Guidance Notes for the Extraction of Minera*ls EPA, Wexford

Environmental Protection Agency (2006) *Environmental Management Guidelines – Environmental Management in the Extractive Industry (Non Scheduled Minerals),* EPA, Wexford

Office for Official Publications of the European Communities (1990) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*.

Directive 97/11EC amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, Official Journal of the European Communities, 1997

Environmental Protection Agency (2017) *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*