
Chapter 7

Biodiversity

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Biodiversity

7.1 Introduction

This chapter examines the ecology of the receiving environment within and surrounding the proposed Waterford City Public Infrastructure Project, Flood Defences West (“the proposed development”) and assesses the potential impacts of the proposed development on Biodiversity. The methods employed to establish the ecological baseline within and around the proposed development are described, together with the process followed to determine the nature conservation importance of the ecological features present. The ways in which habitats, species and ecosystems are likely to be affected by the proposed development are explained and the magnitude of the likely effects predicted, taking into account the conservation condition of the habitats and species under consideration. Mitigation and enhancement measures are also proposed, and any residual effects are identified and assessed, taking into account the mitigation and enhancement measures proposed.

7.1.1 Conservation Legislation and Planning

The European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended) (“the Habitats Regulations”) transposed into Irish law Directive 2009/147/EC (the Birds Directive) and Council Directive 92/43/EEC (the Habitats Directive), which list priority habitats and species of international (European Union) conservation importance and that require protection. This protection is afforded in part through the designation of areas that represent significant populations of listed species within a European context, i.e. Natura 2000 sites. An area designated for bird species is classed as a Special Protection Area (SPA), and an area designated for other protected species and habitats is classed as a Special Area of Conservation (SAC). Wild bird species in SPAs and habitats and species listed on Annexes I and II, respectively, to the Habitats Directive in SACs in which they are designated features have full European protection. Species listed on Annex IV to the Habitats Directive are strictly protected wherever they occur, whether inside or outside the Natura 2000 network. This protection is afforded to animal and plant species by Sections 51 and 52, respectively, of the Habitats Regulations. Annex I habitats outside of SACs are still considered to be of national and international importance and, under Article 27(4)(b) of the Habitats Regulations, public authorities have a duty to strive to avoid the pollution or deterioration of Annex I habitats and habitats integral to the functioning of SPAs.

The Wildlife Act, 1976 (as amended) (“the Wildlife Acts”) is the principle legislative mechanism for the protection of wildlife in Ireland. A network of nationally protected Nature Reserves, which public bodies have a duty to protect, was established under the Wildlife Acts. Sites of national importance for nature conservation are afforded protection under planning policy and the Wildlife Acts. Natural Heritage Areas (NHAs) are sites that are designated under the Wildlife Acts for the protection of flora, fauna, habitats and geological features of interest. Proposed Natural Heritage Areas (pNHAs) are published sites identified as of similar conservation interest to NHAs but have not been statutorily proposed or designated, but are nonetheless afforded some protection under planning policies and objectives. The Wildlife Acts also protect species of conservation interest from injury, disturbance and damage to them or to their breeding and resting places. All species listed in the Wildlife Acts must, therefore, be a material consideration in the planning process.

An additional important piece of national legislation for the protection of wild flora, i.e. vascular plants, mosses, liverworts, lichens and stoneworts, is the Flora (Protection) Order, 2015, which makes it illegal to cut, uproot or damage listed species in any way or to alter, damage or interfere in any way with their habitats.

Ireland's National Biodiversity Action Plan 2017-2021 (DAHG, 2017), in accordance with the Convention on Biological Diversity, is a framework for the conservation and protection of Ireland's biodiversity, with an overall objective to secure the conservation, including, where possible, the enhancement and sustainable use of biological diversity in Ireland and to contribute to collective efforts for conservation of biodiversity globally. Action 1.1.3 of the Plan states that "*all Public Authorities and private sector bodies move towards no net loss of biodiversity through strategies, planning, mitigation measures, appropriate offsetting and/or investment in Blue-Green infrastructure*". This is particularly relevant to proposed projects. The Plan is implemented through regional, county and local development plans, legislation and statutory instruments concerned with nature conservation.

The Waterford City Development Plan 2013-2019 (as extended) has as one of its Overall Goals "*To protect, restore and improve, where appropriate, areas of natural heritage value [and to] protect and promote the integrity of all Natura 2000 sites within the City [...]*" (POL 1.1.4). The Plan has as one of its heritage policies to "*Protect, conserve and where relevant, restore and enhance the environmental quality, character and distinctiveness of [...] flora and fauna, wildlife habitats [...] and riverscapes of national, regional and local importance*" (POL 10.0.2). This policy is consistent with the Regional Spatial & Economic Strategy (RSES) for the Southern Region. One of the biodiversity policies of the Plan is "*To conserve, manage and where possible enhance the City's natural heritage*" (POL 10.4.1). This is supported by the Plan's objective "*To support the green infrastructure concept in development proposals where feasible*" (OBJ 10.4.11), which is also consistent with both the RSES for the Southern Region and the National Biodiversity Action Plan.

7.1.2 Approach and Objectives

A habitat is the environment in which an animal or plant lives and is generally defined in terms of vegetation and physical structures. Habitats and species of ecological significance occurring or likely to occur within the defined **Zone of Influence** and **study area** of the proposed development were classified as **Key Ecological Receptors**.

In accordance with National Roads Authority (NRA) *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (2009), an impact assessment has been undertaken of Key Ecological Receptors within the Zone of Influence of the proposed development. While these guidelines were specifically designed for national road schemes, their guidance on how to assess ecological impacts is comprehensive and applicable to a wide range of different types of projects. According to these guidelines, the Zone of Influence is the "effect area" over which change resulting from the proposed development is likely to occur. The Key Ecological Receptors are defined as features of sufficient value as to be material in the decision-making process for which potential impacts from the proposed development are likely.

In the context of the proposed development, a Key Ecological Receptor is defined as any feature valued as being of one of the following levels of importance:

- International Importance
- National Importance
- County Importance

- Local Importance (Higher Value)

Features of Local Importance (Lower Value) and features of no ecological value and are not considered to be Key Ecological Receptors. The assessment does not consider effects on aspects of the environment other than Biodiversity.

This chapter quantifies the potential impacts on identified Key Ecological Receptors and prescribes mitigation measures required to avoid and reduce any likely significant effects.

Determining the ecological issues to be addressed for the assessment was informed by early engagement with relevant stakeholders. During this scoping process, selected consultees were provided the opportunity to input into the proposed development through preliminary discussions on Key Ecological Receptors that could potentially be affected; strategies to avoid negative impacts; and, where possible, compensation or enhancement measures. Further details of the consultation process, including a list of the statutory and non-statutory consultees contacted, can be found in Section 7.2.5.

On completion of scoping, a desk study was undertaken to review all available published data describing the ecological conditions within the greater area of the proposed development. The desk study cross-referenced this published data with publicly available maps and aerial orthophotography from Ordnance Survey Ireland (OSi), National Parks & Wildlife Service (NPWS) and Environmental Protection Agency (EPA) to identify Key Ecological Receptors. During preparation of this assessment, the statutory conservation agency, the NPWS, provided data on nature conservation designations, habitats and species of conservation interest. The baseline information obtained from the desk study was the first stage in defining the Zone of Influence of the proposed development.

Determining baseline ecological conditions allows an accurate prediction of the likely impacts of the proposed development on Key Ecological Receptors and an assignment of ecological significance to them.

The results of the multidisciplinary walkover surveys and habitat mapping undertaken in November 2016, September 2018 and April 2021 are presented in Figure 7.2 in Volume 3 of this EIAR. The detailed results (including biotope mapping) of specialist surveys of hard and soft intertidal benthos and shoreline habitats are presented in Appendix 7.1.

Where negative impacts were identified, detailed and specific mitigation measures have been proposed in accordance with the hierarchy of options suggested in the research for the European Commission publication *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). Preference was given to avoiding impacts at their source. Where this was not possible, the following approaches were adopted, in order of decreasing preference: reduce impacts at source, abate on site, and finally abate at receptor. These measures have been incorporated into the design of the proposed development.

The information provided in this chapter accurately and comprehensively describes the baseline ecological environment, provides an accurate prediction of the likely significant ecological impacts of the proposed development, prescribes specific mitigation as necessary and describes any residual ecological effects.

7.1.3 Terminology

The evaluation of Key Ecological Receptors and the terminology used to determine ecological value adheres to aforementioned guidance (NRA, 2009). The definitions of impacts follow the definitions in the EPA's *Draft Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA, 2017).

7.2 Methodology

This section describes the methodologies that were followed in collecting information, in describing the baseline ecological conditions and in assessing the likely impacts of the proposed development.

7.2.1 Guidelines on Environmental Impact Assessment

The process of identifying, quantifying and evaluating the potential impacts of the proposed development on habitats, species and ecosystems followed best practice guidance on ecological surveys and assessment, as well as recognised guidance on EIA. This provided for an appropriately defined scope and evaluation process. The main sources of guidance are as follows:

- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland. Version 1.1 - Updated September 2019*. Chartered Institute of Ecology and Environmental Management.
- EPA (2003) *Advice notes on Current Practice (in the preparation of Environmental Impact Statements)*. Environmental Protection Agency, Wexford.
- EPA (2017) *Draft Guidelines on the Information to be Contained in Environmental Impact Statements*. Environmental Protection Agency, Wexford.
- NRA (2006) *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*. National Roads Authority, Dublin.
- NRA (2008a) *Environmental Impact Assessment of National Road Schemes – A Practical Guide. Revision 1*. National Roads Authority, Dublin.
- NRA (2008b) *Guidelines for Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*. National Roads Authority, Dublin.
- NRA (2008c) *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes*. National Roads Authority, Dublin.
- NRA (2008d) *Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes*. National Roads Authority, Dublin.
- NRA (2009) *Guidelines for Assessment of Ecological Impacts of National Road Schemes*. National Roads Authority, Dublin.
- TII (2020) *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*. Transport Infrastructure Ireland, Dublin.

7.2.2 Establishing the Zone of Influence

The key factors to be taken into account when establishing the Zone of Influence for a proposed development are:

- The nature, scale, and location of the proposed development;
- The sensitivities of the ecological receptors in the receiving environment; and,
- The potential for cumulative or in-combination impacts.

For example, in the case of a proposed development connected to a river, it may be necessary to extend the Zone of Influence a significant distance upstream and/or downstream to capture all potential impacts on water-dependent ecological receptors.

On the basis of the above key factors, the Zone of Influence for the proposed Flood Defences West has been defined as the entire area within 500m of the proposed development, as well as the entire extent of the transitional waters of the River Suir upstream and downstream of the proposed development. This is considered to be the maximum extent over which ecological impacts may occur directly, indirectly or in combination with other plans or projects. The Zone of Influence is presented in Figure 7.1 in Volume 3.

7.2.3 Establishing the Study Area

The extent of the study area is defined by the ecological features likely to occur within an effects distance from the proposed development. The desk study area covered the entire Zone of Influence, as described in the preceding section. For the field study, however, it was not practical to carry out surveys over such a large area. Therefore, the field study area was limited to the area subject to direct impacts or immediate effects, i.e. the proposed development boundary plus a 150m buffer. This area was considered to be adequate to identify all ecological features which could potentially be subject to direct impacts from the proposed development or act as pathways for indirect impacts or effects to other features in the wider Zone of Influence.

7.2.4 Desk Study

The desk study undertaken for this assessment included a thorough review of the available ecological baseline data within the study area. The following resources were used:

- National Parks & Wildlife Service (NPWS) Designations Viewer was reviewed to determine the location of nationally and internationally designated sites within the Zone of Influence of the proposed development
- National Parks & Wildlife Service (NPWS) provided data on rare and protected species and habitats
- National Biodiversity Data Centre (NBDC) database provided information on species records in the study area
- Irish Wetland Bird Survey (I-WeBS) data from BirdWatch Ireland provided monthly counts for survey sub-sites on the River Suir
- Environmental Protection Agency (EPA) Unified GIS Application provided data in relation to the Water Framework Directive Risk/Status of waterbodies in the Zone of Influence
- Bat Fauna Study (Kelleher, 2014)
- R & H Hall Flour Mill, Ferrybank, Waterford City - Bat survey report (Harrington, 2017)
- IFI fish sampling for the Water Framework Directive (2010-2018)
- Environmental Impact Assessment Report and Natura Impact Statement for the River Suir Sustainable Transport Bridge (ROD, 2018a,b)
- Environmental Impact Assessment Report and Natura Impact Statement for the Waterford North Quays Development (Fogarty, 2020a,b)
- Hydraulic Modelling of the Flood Defences West Scheme River Suir Flood Wall (Hydro Environmental, 2021)

- Waterford Flood Defence West – Intertidal Survey (Brophy, 2021)

As with all desk studies, the data considered were only as good as the data supplied by the recorders and recording schemes. The recording schemes provide disclaimers in relation to the quality and quantity of the data they provide, and these were considered when examining outputs of the desk study.

7.2.5 Consultation

The statutory and non-statutory consultees listed in Table 7.1 were contacted and invited to submit any observations in relation to the proposed development. Consultees were also provided with indicative drawings of the proposed development.

The purpose of the consultations was to:

- Identify any relevant information that consultees held, including the presence of data on protected species or species of conservation concern;
- Identify any concerns that consultees may have in relation to the proposed development; and,
- Identify any issues that the consultees would like to see addressed during the ecological impact assessment process.

Organisations or individuals consulted in relation to ecology and nature conservation, together with a summary of responses, are listed in Table 7.1. In each case, only the responses relevant to this chapter have been included. Following initial consultation, meetings were held with the statutory consultees, the NPWS and IFI. All issues raised by the consultees have been addressed as fully as possible in this Chapter.

Table 7.1 Details of Consultations

| Consultee | Date | Summary |
|-----------------------------------|--|---|
| National Parks & Wildlife Service | 2 nd November 2020 (informal meeting) | NPWS noted the possibility that 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritima</i>)' (1330) may be present within the project extents. |
| | 14 th December 2020 | Following the meeting of 2 nd November 2020, comments were received via the Development Applications Unit: The NPWS acknowledged the necessity for the proposed development and reiterated the expected impacts that the proposed development will have on Annex I habitats and Qualifying Interests within the Lower River Suir SAC. |
| | 1 st February 2021 | Provided records of rare and protected species and habitats in the study area. |
| Inland Fisheries Ireland | 5 th November 2020 (informal meeting) | IFI expressed the view that, while the additional loss of mudflats is not ideal, on balance, the shorter construction programme facilitated by riverside piling may be preferable in terms of avoiding medium- or long-term impacts on recruitment/population structure of Twaites Shad and other species. IFI welcomes the proposed mitigation of an eco-wall or similar textured cladding to the outside of the sheet piles to facilitate faster colonisation of the |

| Consultee | Date | Summary |
|--|--|--|
| | | new hard intertidal substrate by encrusting organisms. |
| | 1 st December 2020 | IFI provided comments on the two feasible options for the proposed development and considered that Option B could be supported. This was selected as the preferred option. They highlighted that the proposed development will result in direct disturbance of migratory fish species, particularly Twaite Shad, and the loss of Annex I habitats within the Lower River Suir SAC. In addition to this, they advised that during construction, the barge craft should be positioned during high tide to minimise disturbance of benthic sediments and fauna. They also advised that piledriving should be carried out at low tide to minimise disturbance to fish species. It was also mentioned that noise and vibration effects are unavoidable but are likely to have minimal effects on fish species. |
| National Parks & Wildlife Service and Inland Fisheries Ireland | 23 rd March 2021 (informal meeting) | IFI stated that measures will be required to prevent entry of concrete or other construction materials to the River Suir during raising of the existing quay wall as part of remedial works where this intervention is proposed. NPWS expressed concerns relating to the permanent loss of an area (<100 m ²) of 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)' (1330), which is a qualifying interest of the Lower River Suir SAC, at Ch. 950, where the proposed sheet pile wall transitions back from riverside to landside. They also expressed concern about the permanent loss of c. 800m ² of 'Mudflats and sandflats not covered by seawater at low tide' (1140) as a result of riverside piling. It was stated that the conservation status of this habitat is inadequate nationally and that the policy of No Net Loss should apply. |

7.2.6 Ecological Survey Methodology

Field surveys were conducted adhering to the following guidelines:

- *Guidelines for Ecological Survey Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (NRA, 2008b)
- *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009)
- *Best Practice Guidance for Habitat Survey and Mapping* (Smith et al., 2011)

The multidisciplinary walkover survey classified habitats according to *A Guide to Habitats in Ireland* (Fossitt, 2000) and aimed to identify any habitats corresponding to types listed on Annex I to the Habitats Directive using the *Interpretation Manual of European Union Habitats* (EC, 2013).

7.2.7 Multidisciplinary Walkover Survey

The multi-disciplinary walkover surveys included habitat mapping, and aimed to detect the presence, or likely presence, of a range of protected species. The presence (or signs) of protected fauna, including birds, mammals, amphibians and reptiles was noted during the visits. The multi-disciplinary walkover surveys provided baseline information regarding the existing ecology of the study area and informed the need for further specialist survey work. Multi-disciplinary walkover surveys were undertaken on 9th November 2016, 25th September 2018 and 8th April 2021. The surveys were undertaken by ROD ecologists Patrick O'Shea MCIEEM, Owen O'Keefe MCIEEM, Kate Moore GradCIEEM and Calvin Townsend-Smyth QualCIEEM. Patrick is an ecologist with over 7 years' experience and holds a BA (Mod) Hons in Botany from Trinity College Dublin and an MSc in Ecological Management & Conservation Biology from Queen's University Belfast. Owen is an ecologist with over 5 years' experience and holds a BSc (Hons) in Ecology from University College Cork. Kate is an ecologist with over 5 years' experience and holds a BSc (Hons) in Environmental Biology from University College Dublin. Calvin is an ecologist with 2 years' experience and holds a BSc (Hons) in Wildlife Biology from the Institute of Technology, Tralee.

The desk study and walkover surveys identified Key Ecological Receptors in the study area. The following sections outline the methodologies followed during the ecological surveys.

7.2.8 Habitat Survey

Habitat surveys were conducted as part of the multidisciplinary walkover surveys and in accordance with best practice guidance (Smith et al., 2011). The whole site and an appropriate buffer were systematically and thoroughly walked, and all habitats present were assessed, classified and sketched onto field maps. Habitats were identified in accordance with Fossitt (2000).

7.2.9 Survey of Watercourses

The proposed development runs along the northern bank of the River Suir. An aquatic ecological assessment was undertaken for the proposed development during the multidisciplinary walkover surveys. A review of literature and IFI fish sampling data in relation to the aquatic environment of the River Suir catchment was undertaken. The survey targeted specifically the presence or suitability of the River Suir in the vicinity of the proposed development as habitat for fish and other aquatic species. The survey also aimed to confirm the presence or likely presence of qualifying interests of the Lower River Suir SAC such as Atlantic Salmon, Twaite Shad, Sea Lamprey, River Lamprey and Otter, as well as estuarine Annex I habitats.

7.2.10 Fisheries and Aquatic Fauna

The River Suir was assessed with regard to its potential to support fish, including but not limited to salmonids, lamprey and shads. A review of the literature relating to these species, including local studies, was conducted. This included a review of records from IFI's fish sampling, conducted under the Water Framework Directive (WFD) and as part of reporting requirements under Article 17 of the Habitats Directive. A review of the EPA Q-value status and WFD surface water quality and risk status for the River Suir was also undertaken. Given that the proposed development is located in and adjacent to the Suir Estuary, species which are limited to freshwater habitats, including Freshwater Pearl Mussel (*Margaritifera margaritifera*) and White-clawed Crayfish (*Austropotamobius pallipes*), were not deemed to be at risk and, therefore, focussed surveys for these species were not deemed appropriate.

7.2.11 Otter

The function of the Otter survey was to identify any sensitive features within the study area potentially of use for breeding, resting, foraging or commuting Otter and to identify any presence or likely presence of Otter. The Otter survey was conducted adhering to best practice guidance (NRA, 2008c) and involved a systematic search of the riverbanks for physical evidence of Otter e.g. spraints, prints, slides, trails, couches and holts. The survey methodology was also cognisant of the recommendations in the *Otter Threat Response Plan 2009-2011* (NPWS, 2009) which recognises the importance of the riparian buffer (10 m on both banks) for Otter.

7.2.12 Bats

Following a desk study of bat records and previous survey data from the vicinity of the proposed development, a bat suitability assessment was undertaken as part of the multidisciplinary walkover surveys to identify built or natural features in the study area with potential to support roosting bats. The bat suitability assessment was conducted adhering to best practice guidance (NRA, 2008b,c; Collins (ed.), 2016) and involved a visual assessment of suitable features on buildings capable of supporting roosting bats. There were no suitable trees within the vicinity of the proposed development. Built structures were assessed using the criteria in Collins (ed.) (2016). The locations of buildings that could provide low to high roosting potential were recorded with high-definition GPS. Linear landscape features with potential to provide important foraging and commuting habitat for bats were also recorded and geospatially referenced.

7.2.13 Badger

The badger survey was conducted as part of the multidisciplinary walkover surveys and aimed to identify the presence or likely presence of Badger (*Meles meles*) in the study area. The badger survey was conducted following best practice guidance (NRA, 2008b) and involved a systematic search for physical evidence of badgers, e.g. setts, latrines, and badger paths. The optimal period for badger surveys is during the seasonal peaks in territorial activity and when vegetation cover which may obscure signs is at a minimum (January to April and less pronounced peak in October).

7.2.14 Other Mammals, Reptiles and Amphibians

During the walkover survey the potential for the study area to support other protected mammals, reptiles and amphibians was assessed. Given that the study area is highly urbanised and subject to high levels of continuous disturbance, and that no evidence of such species was recorded, it was concluded that further species-specific surveys were not required.

7.2.15 Birds

Following the desk study, the multidisciplinary walkover surveys included identification of habitats and features likely to be of importance for birds and recording of all incidental observations of birds (by sight and song) during the surveys. As the final survey was undertaken in April, it was the most likely to identify any areas being used by breeding birds. Based on the results of the desk study and multidisciplinary walkover survey, it was determined that further surveys specifically for birds were not necessary in this case.

7.2.16 Invasive Alien Plant Species

During the walkover surveys, the presence of invasive species was recorded. The focus was on identifying species subject to restrictions under Section 49 of the Habitats Regulations. Target notes were taken on any invasive species identified. Information

recorded included the area of infestation, plant condition, height and location. Site features that could affect control measures such as adjacent land use, structures and services were also recorded.

7.2.17 Ecological Evaluation and Impact Assessment Methodology

The ecological evaluation and impact assessment within this chapter follows the methodology that is set out in the CIEEM, EPA and TII/NRA guidance documents listed in Section 7.2.1 above.

7.2.18 Evaluation of Ecological Resources

The criteria used for the ecological evaluation follows those set out in Section 3.3 of NRA (2009). These guidelines provide a methodology for evaluating the importance of ecological receptors on a geographic scale, as follows:

- International Importance
- National Importance
- County Importance
- Local Importance (Higher Value)
- Local Importance (Lower Value)

The guidelines set out the criteria by which each level of importance can be assigned. For example, Locally Important (Lower Value) receptors contain habitats and species that are widespread and of low ecological significance and only of importance in the local area. Conversely, receptors of International Importance are either designated for conservation as part of the Natura 2000 network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected fauna.

All habitats and species within the Zone of Influence and study area were assigned a level of importance on the above basis and, in line with the guidelines, receptors of Local Importance (Higher Value) or above were selected as Key Ecological Receptors.

7.2.19 Impact Assessment Methodology

The EPA (2017) guidelines were used to characterise and evaluate the likely impacts of the proposed development on the receiving environment. The parameters used to characterise impacts are:

- Magnitude - relates to the quantum of impact, for example the number of individuals affected by an activity;
- Extent - relates to the area over which the impact occurs;
- Duration - intended to refer to the length of time for which the impact is predicted to continue, until recovery or re-instatement;
- Reversibility - whether an impact is ecologically reversible, either spontaneously or through specific action; and,
- Timing/frequency of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and associated impacts) would take place can be an important determinant of the impact on receptors.

It is necessary to ensure that any assessment of impact takes account of construction and operational phases; direct, indirect and cumulative impacts; and, those that are temporary, reversible and irreversible. The most relevant criteria for assessment of

effect include quality and significance and these are defined in Tables 7.2 and 7.3. The following terms are defined when quantifying duration (EPA, 2017):

- Momentary – seconds to minutes
- Brief – less than 1 day
- Temporary – up to 1 year
- Short-term – 1 to 7 years
- Medium-term – 7 to 15 years
- Long-term – 15 to 60 years
- Permanent – more than 60 years

Table 7.2 Criteria for Assessing Impact Significance (EPA, 2017).

| Significance | Definition |
|------------------|--|
| No change | No discernible change in the ecology of the affected feature |
| Imperceptible | An impact capable of measurement but without noticeable consequences |
| Not Significant | An effect which causes noticeable changes in the character of the environment but without significant consequences |
| Slight | An impact which causes noticeable changes in the character of the environment without affecting its sensitivities |
| Moderate | An impact that alters the character of the environment that is consistent with existing and emerging trends |
| Significant | An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment |
| Very Significant | An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment |
| Profound | An impact which obliterates sensitive characteristics |

Table 7.3 Criteria for Assessing Impact Quality (EPA, 2017).

| Impact Type | Criteria |
|-------------|---|
| Positive | A change which improves the quality of the environment e.g. increasing species diversity, improving reproductive capacity of an ecosystem or removing nuisances |
| Neutral | A change which does not affect the quality of the environment |
| Negative | A change which reduces the quality of the environment e.g. lessening species diversity or reducing the reproductive capacity of an ecosystem |

Once the potential impacts are characterised, the significance of any such impacts on the identified Key Ecological Receptors is evaluated.

7.2.20 Process of Assessing Significance

The significance of impacts was evaluated following guidance set out in NRA (2009), whereby impacts are assigned a level of significance based on their characterisation, irrespective of the importance of the receptor, i.e. significance is determined by the effect on conservation status or ecological integrity, regardless of geographical level at which these would be relevant.

7.2.21 Mitigation

Through the options selection and iterative design process, the proposed development has been designed to avoid or reduce the likely impacts on Key Ecological Receptors. Where potential impacts on Key Ecological Receptors are predicted which cannot be avoided by design, mitigation has been prescribed to ameliorate such impacts.

The proposed best practice design and mitigation measures relating to biodiversity are set out in this chapter. These measures are both effective and realistic in terms of cost and practicality. Provided that these measures are implemented as prescribed herein, they have a high probability of success in terms of mitigating the likely impacts on Key Ecological Receptors.

The potential impacts of the proposed development were considered and assessed to ensure that all impacts on Key Ecological Receptors are adequately addressed and no significant residual impacts remain following mitigation.

7.2.22 Survey Limitations

Standard and widely accepted survey methods were followed. However, any biases or limitations associated with these methods could potentially affect the results collected. Whilst every effort was made to provide a comprehensive description of the study area and full assessment of the likely impacts on the receiving environment, fluctuations in habitat areas or species populations may not be fully reflected due to the instantaneous nature of the field surveys. Notwithstanding that, the combination of field survey data with the background knowledge provided by the desk study is considered to provide an accurate representation of the baseline for the habitats and species within the Zone of Influence.

Smith et al. (2011) states that the optimal time of year for habitat surveys is April to September, inclusive, as this is the growing season for most plants. Two of the multi-disciplinary walkover surveys were undertaken in April and September, i.e. at either end of the optimal season for habitats. The April 2021 survey was also undertaken during the optimal season for breeding birds. A third walkover survey was undertaken in November 2016, towards the beginning of the optimal survey period for wintering waterbirds. The November survey also covered the optimal survey period for terrestrial mammals and physical habitat features, as features are less likely to be obscured by vegetation. Therefore, the three surveys dates are considered to cover key seasonal periods for the aspects of biodiversity of concern in relation to the proposed development.

7.3 Desk Study Results

7.3.1 General Description and Context

The site of the proposed development begins c. 100m east of Plunkett Station and extends west for c. 1.5km along the northern bank and within the foreshore of the River Suir in Waterford City. The principal habitat types that exist along the footprint of the proposed development include mudflats, buildings and artificial surfaces, and a tidal river. The River Suir is designated as the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC, which is located c. 9km downstream of the proposed development.

'Estuaries' (1130) and 'Mudflats and sandflats not covered by sea water at low tide' (1140) are protected habitats listed on Annex I to the Habitats Directive and are present within the footprint of the proposed development, but are not Qualifying Interests of the

Lower River Suir SAC. These habitats support a range of benthic invertebrates and macroalgae, as well as other species which feed on them. In addition to this, the tidal river also hosts a number of rare and protected species, most of which are listed as Qualifying Interests of the Lower River Suir SAC, including lamprey species, Atlantic salmon, Twaite Shad and Otter. 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' (1330) are also present between the bottom of the existing quay wall and the high-water mark at one location.

7.3.2 Aquatic Environment

Water Quality

The WFD requires that each EU Member State protects and improves water quality in all waters so that good ecological status is achieved. Additionally, proposed actions (within discrete River Basin Management Plans) are also required, to secure national natural water resources for the future. The EPA is the competent authority responsible for monitoring, protecting and improving the water environment in the Republic of Ireland. In accordance with WFD guidelines, water quality 'Status' is assigned using a variety of available data on aquatic flora and fauna (including fish), the availability of nutrients, and aspects like salinity, temperature and pollution by chemical pollutants. Morphological features, such as quantity, water flow, water depths and structures of the riverbeds, are also taken into account.

The EPA water quality classification system (Quality Rating System (Q-values)) is also used to assess water quality in Irish rivers, taking into account aquatic macrophytes, phytobenthos and hydromorphology. The Q-value system has been shown to be a robust and sensitive measure of riverine water quality and has been linked with both chemical status and land-use pressures in catchments. Individual macroinvertebrate taxa are ranked for their sensitivity to organic pollution and the Q-value of the watercourse is based primarily on the relative abundance of these taxa within a biological sample. A review of both the Q-value status and WFD status for the watercourses was undertaken.

The online EPA Unified GIS Application provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters) or to groundwater. Table 7.4 shows the information recorded regarding water quality status at the location of the proposed development.

Table 7.4 EPA Water Quality Results

| Transitional Waterbody | WFD Status (2013-2018) | WFD Status (2010-2012) | WFD Risk (2020) |
|---|------------------------|------------------------|-----------------|
| Middle Suir Estuary | Poor | Poor | At Risk |
| Lower Suir Estuary (Little Island - Cheekpoint) | Good | Moderate | At Risk |
| Barrow Suir Nore Estuary | Moderate | Good | At risk |

The River Suir at Waterford City (Middle Suir Estuary Transitional Waterbody) had a WFD Status of 'Eutrophic' in the 2010-2012 reporting period and 'Poor' in 2013-2018. The 'Poor' Status is indicated to be as a result of poor Phytoplankton Status as per the EPA Catchments website. Additionally, there appears to have been a deterioration across some parameters from the 2010-2015 to the 2013-2018 monitoring periods,

these include Nutrient and Hydromorphological conditions. Further details on water quality are in Chapter 10: Hydrology of this EIAR.

Hydrodynamic Modelling

Hydrodynamic modelling was carried out by Hydro Environmental Ltd. (2021) in order to predict any hydraulic changes that the proposed flood defences would create within the River Suir. The hydrodynamic modelling report can be found in Appendix 10.1 to this EIAR and it concluded the following:

“Computed velocity increases from the proposed vertical sheet piled wall are relatively small and of insufficient magnitude to produce sufficient shear stress [...] that would result in any potential significant erosion of the permanent consolidated sediments on the channel bed and banks in the vicinity of the affected area. Fresher unconsolidated silts will be mobile under tidal ebb and flood conditions both for the proposed and existing cases and slight reduction in silt deposition adjacent to the sheet piled wall is anticipated.”

Considering this, the proposed flood defences do not pose a significant risk of creating hydraulic changes that will threaten intertidal mudflats or any other habitats located along the banks of the River Suir, as seen in plates 7.1 and 7.2 below.

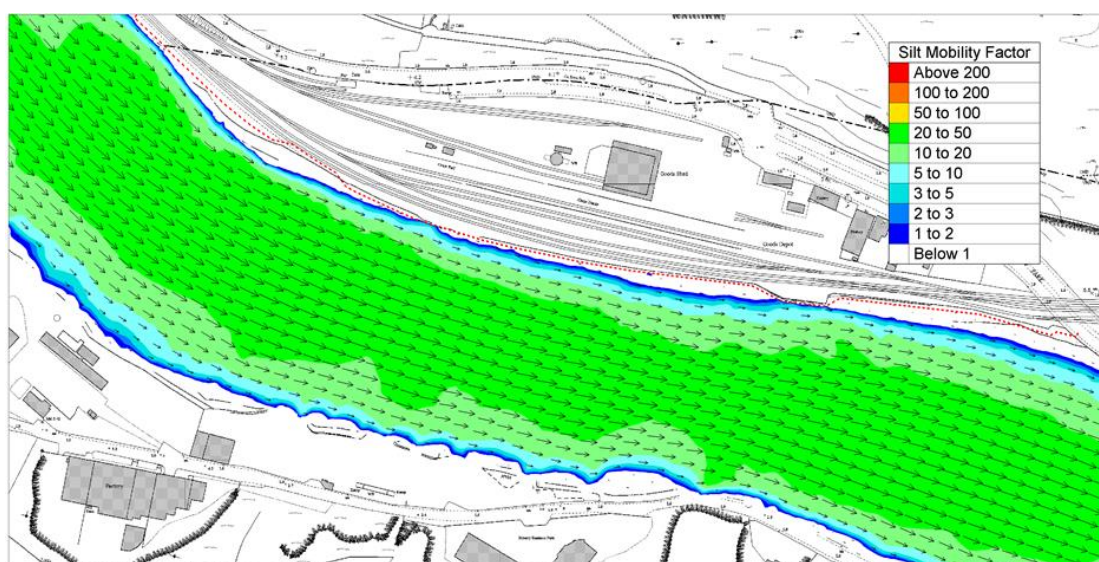


Plate 7.1 Fine silt mobility factor at mid-ebb spring tide – existing case (Hydro Environmental Ltd., 2021).



Plate 7.2 Fine silt mobility factor at mid-ebb spring tide – proposed case (Hydro Environmental Ltd., 2021).

Environmental Testing

Ground investigations specific to the proposed development were commissioned by ROD and carried out by IGSL Ltd in Q2 and Q3 of 2019. Waste Classification and Waste Acceptance Criteria (WAC) analysis were carried out in 2019 by ChemTest Laboratories, accredited Laboratory facility on 36 samples from across the proposed development area. The samples are tested for an array of geochemical determinants and the results compared to established limits, typically classifying samples as inert, exceeding inert and hazardous.

All samples were classified as non-hazardous. Traces of asbestos were detected in a single sample, but the sample is classified as non-hazardous as the level detected was <0.001%. This sample was taken at one of the historical landing stages at Ch. 570. Further details on the contamination assessment are in Chapter 8 Soils and Geology of this EIAR.

Benthic Habitats

An inshore benthic survey of Waterford Harbour was carried out for the NPWS by Atlantic RMS Ltd in July 2008 (Kennedy, 2008). Sample station 1, immediately downstream of the R680 Rice Bridge was the closest station to the proposed development. At this point the sediment was approximately 75% sand and 25% mud with gravel, cobbles and dredge spoil also being observed. The benthic habitat at the proposed development location was classified as level 5 biotope infralittoral fluid mobile mud in variable salinity. Records in the field described this habitat as laminated mud or sand layers deposited on the mud.

The benthic fauna was low in diversity and numbers, most likely due to the stress of the variable salinity, shallow water depth and associated resuspension of sediments by wind and tidal disturbance. This is typical for shallow infralittoral sediments that are exposed to wind driven and tidal disturbance. Six species were identified in the samples including a species of bivalve, a species of small crustacean and four species of worms and bristle worms.

Ground investigations were undertaken to characterise the riverbed in 2018 to inform the EIAR for the River Suir Sustainable Transport Bridge (ROD, 2018a). The riverbed is characterised by soft sediment, sands and gravel varying in thickness from 1.2m to

20.7m. The thickness of the alluvial material increases from north to south. Additionally, ground investigations specific to the proposed Flood Defences West were carried out in 2019 and are described in full in Chapter 8 Soils and Geology of this EIAR. At the eastern end of the proposed development, to the south of the Plunkett Station and below ancillary car parks, the quaternary sediments typically consist of dense granular made ground (gravels and cobbles) on top of shallow siltstone/shale bedrock. From the R448 Terminus Street bridge to the western end of the proposed development, the ground model is relatively homogenous, consisting of three major layers including made ground, alluvium and glacial overburden. In front of (to the south of) the quay wall, in the mudflats and the riverbed, the ground layer descriptions are similar except that no made ground is present. The thickness of alluvium varies within the mudflats and the riverbed, while the rockhead level continues to fall as you approach the centreline of the river.

Focussed surveys, sampling and analysis of the intertidal mudflats, existing quay wall and shoreline habitats along the extent of the proposed development were undertaken in March 2021 by Botanical, Environmental & Conservation (BEC) Consultants Ltd on behalf of WCCC. The results of these surveys are presented in Section 7.4 and the full report (Brophy, 2021) is presented in Appendix 7.1.

7.3.3 Habitats, Flora and Fauna

The desk study also identified which important habitats and species which historically occurred and, therefore, potentially occur within the Zone of Influence and study area. The following sections give an overview of the results of the desk study.

National Parks & Wildlife Service Data

Table 7.5 below lists the rare and protected species records obtained from the NPWS in February 2021.

Table 7.5 Records for rare and protected species. Source: NPWS (2021).

| Common Name | Scientific Name | Status* |
|----------------------------------|----------------------------------|-----------------------|
| Mammals | | |
| Badger | <i>Meles meles</i> | WA |
| Grey Seal | <i>Halichoerus grypus</i> | Annex II HD, WA |
| Hedgehog | <i>Erinaceus europaeus</i> | WA |
| Irish Hare | <i>Lepus timidus hibernicus</i> | Annex V HD, WA |
| Irish Stoat | <i>Mustela erminea hibernica</i> | WA |
| Otter | <i>Lutra lutra</i> | Annexes II, IV HD, WA |
| Pine Marten | <i>Martes Martes</i> | Annex V HD, WA |
| Red Squirrel | <i>Sciurus vulgaris</i> | WA |
| Amphibians & Reptiles | | |
| Common Frog | <i>Rana temporaria</i> | Annex V HD, WA |
| Common Lizard | <i>Zootoca vivipara</i> | WA |
| Fish | | |
| River Lamprey | <i>Lampetra fluviatilis</i> | Annexes II, IV HD, WA |
| Twaite Shad | <i>Alosa fallax</i> | Annexes II, IV HD, WA |

| Common Name | Scientific Name | Status* |
|---------------------------|------------------------------------|--------------------|
| Invertebrates | | |
| Freshwater Pearl Mussel | <i>Margaritifera margaritifera</i> | Annexes II, IV, WA |
| Plants | | |
| Basil Thyme | <i>Clinopodium acinos</i> | FPO |
| Betony | <i>Stachys officinalis</i> | FPO |
| Borrer's Saltmarsh-grass | <i>Puccinellia fasciculata</i> | FPO |
| Clustered Clover | <i>Trifolium glomeratum</i> | FPO |
| Cottonweed | <i>Achillea maritima</i> | FPO |
| Divided Sedge | <i>Carex divisa</i> | FPO |
| Green-winged Orchid | <i>Anacamptis morio</i> | FPO |
| Lesser Centaury | <i>Centaurium pulchellum</i> | FPO |
| Meadow Barley | <i>Hordeum secalinum</i> | FPO |
| Narrow-leaved Helleborine | <i>Cephalanthera longifolia</i> | FPO |
| Opposite-leaved Pondweed | <i>Groenlandia densa</i> | FPO |
| Perennial Glasswort | <i>Sarcocornia perennis</i> | FPO |
| Lichens | | |
| Reindeer Moss | <i>Cladonia portentosa</i> | Annex V HD |

*Status (listing conferring protection or describing conservation status) abbreviations: Annex II/IV/V (non-avian species) = Habitats Directive (HD); WA = Wildlife Act, 1976 (as amended); FPO = Flora (Protection) Order, 2015.

National Biodiversity Data Centre Database

Table 7.6 lists the rare and protected species records submitted to the NBDC for the hectads (10km x 10km grid squares) intersecting the study area. To avoid repetition, records of species already listed in Table 7.5 above have been removed from Table 7.6. Table 7.7 lists the invasive alien species recorded within these hectads.

Table 7.6 Records from within the Zone of Influence. Source: NBDC (2021).

| Common name | Scientific name | Status* |
|-------------------------|-----------------------------------|-----------------------|
| Mammals | | |
| Brown Long-eared Bat | <i>Plecotus auritus</i> | Annex IV HD, WA |
| Common Dolphin | <i>Delphinus delphis</i> | Annex IV, WA |
| Common Pipistrelle | <i>Pipistrellus pipistrellus</i> | Annex IV HD, WA |
| Daubenton's Bat | <i>Myotis daubentonii</i> | Annex IV HD, WA |
| Harbour Porpoise | <i>Phocoena phocoena</i> | Annexes II, IV HD, WA |
| Leisler's Bat | <i>Nyctalus leisleri</i> | Annex IV HD, WA |
| Long-finned Pilot Whale | <i>Globicephala melas</i> | Annex IV, WA |
| Minke Whale | <i>Balaenoptera acutorostrata</i> | Annex IV, WA |
| Natterer's Bat | <i>Myotis nattereri</i> | Annex IV HD, WA |
| Pygmy Shrew | <i>Sorex minutus</i> | WA |

| Common name | Scientific name | Status* |
|--------------------------------|------------------------------|--|
| Soprano Pipistrelle | <i>Pipistrellus pygmaeus</i> | Annex IV HD, WA |
| Amphibians and Reptiles | | |
| Smooth Newt | <i>Lissotriton vulgaris</i> | WA |
| Leatherback Turtle | <i>Dermochelys coriacea</i> | Annex IV HD, WA |
| Fish | | |
| European Eel | <i>Anguilla anguilla</i> | EC Regulation (Council Regulation 1100/2007) |
| Invertebrates | | |
| Marsh Fritillary | <i>Euphydryas aurinia</i> | Annex II HD |
| Plants | | |
| Chives | <i>Allium schoenoprasum</i> | FPO |
| Lesser Snapdragon | <i>Misopates orontium</i> | FPO |
| Birds | | |
| Barn Swallow | <i>Hirundo rustica</i> | Amber |
| Bar-tailed Godwit | <i>Limosa lapponica</i> | Annex I BD, Red |
| Black-headed Gull | <i>Larus ridibundus</i> | Amber |
| Black-tailed Godwit | <i>Limosa limosa</i> | Amber |
| Brent Goose | <i>Branta bernicla</i> | Amber |
| Common Gull | <i>Larus canus</i> | Amber |
| Cormorant | <i>Phalacrocorax carbo</i> | Amber |
| Curlew | <i>Numenius arquata</i> | Red |
| Dunlin | <i>Calidris alpina</i> | Annex I BD, Red |
| Fulmar | <i>Fulmarus glacialis</i> | Amber |
| Goldcrest | <i>Regulus regulus</i> | Amber |
| Golden Plover | <i>Pluvialis apricaria</i> | Annex I BD, Red |
| Goldeneye | <i>Bucephala clangula</i> | Red |
| Great Crested Grebe | <i>Podiceps cristatus</i> | Amber |
| Great Northern Diver | <i>Gavia immer</i> | Annex I BD, Amber |
| Greenfinch | <i>Carduelis chloris</i> | Amber |
| Grey Plover | <i>Pluvialis squatarola</i> | Red |
| Grey Wagtail | <i>Motacilla cinerea</i> | Red |
| Herring Gull | <i>Larus argentatus</i> | Amber |
| House Martin | <i>Delichon urbicum</i> | Amber |
| House Sparrow | <i>Passer domesticus</i> | Amber |
| Kestrel | <i>Falco tinnunculus</i> | Red |
| Kingfisher | <i>Alcedo atthis</i> | Annex I BD, Amber |
| Lapwing | <i>Vanellus vanellus</i> | Red |

| Common name | Scientific name | Status* |
|--------------------------|----------------------------------|-------------------|
| Lesser Black-backed Gull | <i>Larus fuscus</i> | Amber |
| Linnet | <i>Carduelis cannabina</i> | Amber |
| Little Egret | <i>Egretta garzetta</i> | Annex I BD |
| Little Gull | <i>Larus minutus</i> | Annex I BD, Amber |
| Mallard | <i>Anas platyrhynchos</i> | Amber |
| Meadow Pipit | <i>Anthus pratensis</i> | Red |
| Mute Swan | <i>Cygnus olor</i> | Amber |
| Oystercatcher | <i>Haematopus ostralegus</i> | Red |
| Peregrine Falcon | <i>Falco peregrinus</i> | Annex I BD |
| Pintail | <i>Anas acuta</i> | Amber |
| Purple Sandpiper | <i>Calidris maritima</i> | Red |
| Red-breasted Merganser | <i>Mergus serrator</i> | Amber |
| Red Kite | <i>Milvus milvus</i> | Annex I BD, Red |
| Red Knot | <i>Calidris canutus</i> | Red |
| Redshank | <i>Tringa totanus</i> | Red |
| Redwing | <i>Turdus iliacus</i> | Red |
| Ringed Plover | <i>Charadrius hiaticula</i> | Amber |
| Sandpiper | <i>Actitis hypoleucos</i> | Amber |
| Shag | <i>Phalacrocorax aristotelis</i> | Amber |
| Shelduck | <i>Tadorna tadorna</i> | Amber |
| Short-eared Owl | <i>Asio flammeus</i> | Annex I BD, Amber |
| Sky Lark | <i>Alauda arvensis</i> | Amber |
| Snipe | <i>Gallinago gallinago</i> | Red |
| Spotted Flycatcher | <i>Muscicapa striata</i> | Amber |
| Starling | <i>Sturnus vulgaris</i> | Amber |
| Swift | <i>Apus apus</i> | Red |
| Teal | <i>Anas crecca</i> | Amber |
| Turnstone | <i>Arenaria interpres</i> | Amber |
| Wheatear | <i>Oenanthe oenanthe</i> | Amber |
| Wigeon | <i>Anas penelope</i> | Amber |
| Willow Warbler | <i>Phylloscopus trochilus</i> | Amber |

*Status (listing conferring protection or describing conservation status) abbreviations: Annex II/IV/V (non-avian species) = Habitats Directive (HD); Annex I, II, III = Birds Directive (BD); WA = Wildlife Acts and Red/Amber = Birds of Conservation Concern in Ireland 2020-2026 (Gilbert et al., 2021).

**Table 7.7 Invasive alien species recorded within the Zone of Influence.
Source: NBDC (2021).**

| Common name | Scientific name |
|-----------------------|---------------------------------|
| American Mink | <i>Neovison vison</i> |
| Brown Rat | <i>Rattus norvegicus</i> |
| Common Cord-grass | <i>Spartina anglica</i> |
| Dace | <i>Leuciscus leuciscus</i> |
| Grey Squirrel | <i>Sciurus carolinensis</i> |
| Giant Hogweed | <i>Heracleum mantegazzianum</i> |
| Giant Knotweed | <i>Fallopia sachalinensis</i> |
| Giant-rhubarb | <i>Gunnera tinctoria</i> |
| Himalayan Balsam | <i>Impatiens glandulifera</i> |
| Himalayan Knotweed | <i>Persicaria wallichii</i> |
| Japanese Knotweed | <i>Fallopia japonica</i> |
| New Zealand Pigmyweed | <i>Crassula helmsii</i> |
| Rhododendron | <i>Rhododendron ponticum</i> |
| Sea-buckthorn | <i>Hippophae rhamnoides</i> |
| Sika Deer | <i>Cervus nippon</i> |
| Spanish Bluebell | <i>Hyacinthoides hispanica</i> |
| Three-cornered Garlic | <i>Allium triquetrum</i> |
| Water Fern | <i>Azolla filiculoides</i> |

Fisheries and Aquatic Fauna

The River Suir catchment is internationally important for the presence of fish species including Twaite Shad (*Alosa fallax*), Atlantic Salmon (*Salmo salar*), Lamprey species, European Eel (*Anguilla anguilla*) and European Smelt (*Osmerus eperlanus*). The status and occurrence of these species within the study area is described below.

Twaite Shad

Twaite Shad is a Qualifying Interest for the Lower River Suir SAC and the River Barrow and River Nore SAC. The River Suir at the location of the proposed development is used by juvenile Twaite Shad. Adult shad move from the sea into estuaries in spring and spawn just above the top of tidal waters in May and June. During the breeding season, large numbers of adult shad move up and down the estuary with the tide. Most adults return to the lower estuary within days of spawning and to sea by the end of the summer. Juvenile shad spend one or two years in the estuary, moving up and down with the tides and feeding on planktonic crustaceans and other invertebrates. Twaite Shad is classed as vulnerable to extinction in Ireland and anecdotal reports indicate a substantial decline in the River Suir (King et al., 2011).

As part of its national monitoring programme for Habitats Directive: Annex II and Red Data Book fish species, IFI has been studying the ecology and behaviour of Twaite Shad in the estuaries of the larger rivers in the South-East of Ireland since 2010. The following reports describe the methods used to survey for shads and their respective

degrees of success (a detailed review is presented in the Natura Impact Statement prepared for the proposed development):

- King, J.J. and Linnane, S.M. (2004) The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs. *Irish Wildlife Manuals* 14. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
- Kelly, F., Harrison, A., Connor, L., Matson, R., Morrissey, E., Feeney, R., Wogerbauer, C., O'Callaghan, R. and Rocks, K. (2011) *Sampling Fish for the Water Framework Directive – Summary Report 2010*. Inland Fisheries Ireland, Dublin.
- IFI (2011) *Sampling Fish for the Water Framework Directive – Transitional Waters 2010: Barrow, Nore and Suir Estuaries*. Inland Fisheries Ireland, Dublin.
- IFI (2012) *National Programme: Habitats Directive and Red Data Book Fish species. Executive Report 2011. IFI Report Number: IFI/2012/1-4103*. Inland Fisheries Ireland, Dublin.
- Rooney, S.M., O'Gorman, N.M., King, J.J. (2013) *National Programme: Habitats Directive and Red Data Book Species Executive Report 2012*. Inland Fisheries Ireland, Dublin.
- Rooney, S.M., O'Gorman, N.M., Cierpial, D. and King, J.J. (2014) *National Programme: Habitats Directive and Red Data Book Species Executive Report 2013*. Inland Fisheries Ireland, Dublin.
- O'Gorman, N.M., Rooney, S.M., Cierpial, D. and King, J.J. (2015) *National Programme: Habitats Directive and Red Data Book Species Executive Report 2014*. Inland Fisheries Ireland, Dublin.
- Rooney, S. and King, J.J. (2015) *A poster on acoustic tracking of twaite shad by the Habitats Directive and Red Data Book Species team presented at the 3rd International Conference on Fish Telemetry (ICFT) in Halifax, Nova Scotia in 2015*. Inland Fisheries Ireland, Dublin.
- Gallagher, T., O'Gorman, N.M., Rooney, S.M., Coughlan, B., and King, J.J. (2016) *National Programme: Habitats Directive and Red Data Book Species Executive Report 2015*. Inland Fisheries Ireland, Dublin.
- Gallagher, T., O'Gorman, N.M., Rooney, S.M., Coughlan, B., and King, J.J. (2017) *National Programme: Habitats Directive and Red Data Book Species Summary Report 2016*. Inland Fisheries Ireland, Dublin.
- Gallagher, T., O'Gorman, N.M., Rooney, S.M., Coughlan, B., and King, J.J. (2019) *National Programme: Habitats Directive and Red Data Book Species Summary Report 2017*. Inland Fisheries Ireland, Dublin.
- Gallagher, T., O'Gorman, N.M., Rooney, S.M., and King, J.J. (2020) *National Programme: Habitats Directive and Red Data Book Species Summary Report 2018*. Inland Fisheries Ireland, Dublin.
- IFI (2021a) *Twaite Shad* <<https://www.fisheriesireland.ie/fish-species/twaite-shad.html>> [Accessed 01/03/2021]. Inland Fisheries Ireland, Dublin.
- IFI (2021b) *Juvenile Shad Monitoring* <<https://www.fisheriesireland.ie/Habitats-and-Red-Data-Book/juvenile-shad-monitoring.html>> [Accessed 01/03/2021]. Inland Fisheries Ireland, Dublin.
- IFI (2021c) *Adult Shad Monitoring* <<https://www.fisheriesireland.ie/Habitats-and-Red-Data-Book/adult-shad-monitoring.html>> [Accessed 01/03/2021]. Inland Fisheries Ireland, Dublin.

Notwithstanding the significant ongoing survey effort in IFI's monitoring programme over the last 8 years, gaps remain in the understanding of the ecology and behaviour of Twaite and Allis Shad, particularly in relation to juveniles during their residency in estuaries, and anecdotal records from anglers and commercial netmen remain the most significant source of information. However, having thoroughly reviewed existing literature relating to this species, it was considered that sufficient information was available to inform the assessment of the proposed development in terms of the likely impacts on this species. Furthermore, having examined the survey methods used by IFI and others, it was considered that any additional surveys carried out to inform this assessment would not contribute any significant additional information regarding the distribution, densities and movement patterns of post-larval and juvenile Twaite Shad in the Lower Suir Estuary.

Salmonids

Atlantic Salmon is a Qualifying Interest of the Lower River Suir SAC and the River Barrow and River Nore SAC. While the River Suir at the location of the proposed development does not provide suitable spawning habitat for salmonids, e.g. Atlantic Salmon (*Salmo salar*) and Brown Trout (*S. trutta*), it is an important link between the estuarine, coastal and oceanic feeding grounds for these species and their spawning beds further upstream. Salmonid species may be present at the location of the proposed development at any time of the year but occur in most significant numbers during their upstream spawning migration (predominantly in autumn and winter) and out-migration of smolts (almost entirely in spring). In addition, sea or slob trout (Brown Trout with a marine or estuarine adult phase) may be present at any time of the year.

Lamprey

Sea Lamprey (*Petromyzon marinus*), River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*) are all listed as Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC. Sea Lamprey and River Lamprey are both likely to be present at the location of the proposed development in significant numbers during their upstream spawning migrations and downstream migrations following metamorphosis. The major upstream movements of Sea Lamprey occur in April, May and, to a lesser extent, June, while those of River Lamprey occur earlier, beginning in August and continuing over the winter and spring. The downstream migration of Sea Lamprey occurs in September and October, while that of River Lamprey occurs over an extended period from late winter to early summer. Salinity levels measured during the site investigations for the River Suir Sustainable Transport Bridge varied from 3.1 ppt to 18 ppt across 5 samples, which is not considered suitable for Brook Lamprey or juvenile lampreys of any species (ROD, 2018a).

European Eel

Unlike salmonids and lampreys, European Eel has a catadromous life history, i.e. spawning occurs at sea and juveniles migrate into fresh waters to feed and mature. The major influx of juvenile eels ("elvers") occurs in early spring. Large numbers of elvers are expected to be present at the proposed development location during this time.

European Smelt

Another species known to use the River Suir at this location is European Smelt. This estuarine species is most likely to be present in significant numbers at the proposed development location during March and April.

Otter

There are frequent and widespread records of Otter throughout the study area according to data supplied by the NBDC (2021) and the NPWS (2021). Additionally, evidence of Otter in the form of spraints and prints was recorded during surveys carried out c. 500m downstream of the proposed development to inform the EIAR for the River Suir Sustainable Transport Bridge (ROD, 2018a). However, no holts or couches were observed. Nevertheless, records and data reviewed as part of the desk study strongly indicate that Otter are present at the location of the proposed development.

Bats

The brownfield site on the northern bank of the River Suir east of Plunkett Station was designated as a Strategic Development Zone (SDZ) by the Government of Ireland and WCCC is the planning agency for this site, known as the North Quays (Waterford) SDZ. In order to inform the Planning Scheme for the SDZ and related planning application, a number of ecological studies have been undertaken on the site, including bat studies.

A study of the bat fauna on the North Quays SDZ (Kelleher, 2014) included a desk study, details of which are outlined below. The existing bat records within 10km of the North Quays (sourced from BCI's National Bat Records Database) reveals that seven of the ten known Irish species have been observed locally. These include Common Pipistrelle (*Pipistrellus pipistrellus*) and Soprano Pipistrelle (*Pipistrellus pygmaeus*), Leisler's Bat (*Nyctalus leisleri*), Brown Long-eared Bat (*Plecotus auritus*), Daubenton's Bat (*Myotis daubentonii*), Natterer's (*Myotis nattereri*) and Whiskered Bat (*Myotis mystacinus*) as shown in Table 7.8. Roosts of some of these species are also known within this radius but none are in the vicinity of the proposed development.

Table 7.8 Status of Bat Species within 10 km of the North Quays. Source: Aardwolf Wildlife Surveys Bat Fauna Survey (Kelleher, 2014).

| Common name | Scientific name | Presence | Roosts | Source |
|------------------------|----------------------------------|----------------|---------|--------|
| Common Pipistrelle | <i>Pipistrellus pipistrellus</i> | Present | 3 known | BCI |
| Soprano Pipistrelle | <i>Pipistrellus pygmaeus</i> | Present | 1 known | BCI |
| Nathusius' Pipistrelle | <i>Pipistrellus nathusii</i> | Potential/rare | 0 known | BCI |
| Leisler's Bat | <i>Nyctalus leisleri</i> | Present | 4 known | BCI |
| Brown Long-eared Bat | <i>Plecotus auritus</i> | Present | 3 known | BCI |
| Lesser Horseshoe Bat | <i>Rhinolophus hipposideros</i> | Absent | N/A | BCI |
| Daubenton's Bat | <i>Myotis daubentonii</i> | Present | 0 known | BCI |
| Natterer's Bat | <i>Myotis nattereri</i> | Present | 1 known | BCI |
| Whiskered Bat | <i>Myotis mystacinus</i> | Present | 2 known | BCI |
| Brandt's Bat | <i>Myotis brandtii</i> | Potential/rare | 0 known | BCI |

Furthermore, a bat study was undertaken by Andrew Harrington on behalf of WCCC prior to the demolition of buildings on the North Quays in June and July 2017 (Harrington, 2017). During the surveys on 1st July (dusk) and 2nd July (dawn), only one bat was recorded on the North Quays.

A bat activity survey, to supplement the previous studies (Kelleher, 2014; Harrington, 2017) was undertaken to inform the EIAR for the River Suir Sustainable Transport Bridge (ROD, 2018a). The survey was carried out on 24th July 2018 in suitable weather

conditions. Bat activity during the survey was low. Two species of Bat, namely Common Pipistrelle (*Pipistrellus pipistrellus*) and Leisler's Bat (*Nyctalus leisleri*), were recorded during the survey.

In addition to this, pre-demolition emergence/re-entry surveys were carried out by ROD at six buildings located adjacent to the North Quays site in September and October 2020. This involved a total of 9 dawn re-entry surveys and 6 dusk emergence surveys. Species recorded during these surveys included Leisler's Bat, Common Pipistrelle, Soprano Pipistrelle and Nathusius' Pipistrelle. The general level of bat activity in the area was low to moderate and the more commonly observed species were Leisler's Bat and Common Pipistrelle.

Other Terrestrial Mammals

There have been a number of records for most native Irish mammals within the study area, including Badger, Irish Hare, Red Squirrel, Hedgehog and Irish Stoat. However, none of these records fall within or immediately adjacent to the proposed development. The location of the proposed development does not support suitable habitats for these species as they are highly modified lands which are subject to frequent disturbance from passing trains and boats.

Marine Mammals

A Marine Mammal Risk Assessment (MMRA) was undertaken by IWDG Consulting to inform the EIAR for the River Suir Sustainable Transport Bridge in 2018 (IWDG Consulting, 2018). The report states that most sightings of cetaceans (whale, dolphin and porpoises) were recorded in the estuary downriver of Waterford City. In reference to pinnipeds (seals), the MMRA reports that there were no Harbour Seal (*Phoca vitulina*) haul-out or breeding sites recorded near Waterford City, while pupping and haul out site for Grey Seal occur 40 km from the proposed development at Great Saltee Island.

The MMRA concluded that "*a number of marine mammals have been recorded in the River Suir, in and adjacent to Waterford city but their occurrence is so sporadic that it is extremely unlikely that any would be exposed to potential impacts from this development. No mitigation required*".

The MMRA for the Sustainable Transport Bridge is applicable to the proposed Flood Defences West as the two developments are located within 100m of each other and would give rise to the same type of impact on marine mammals (hydroacoustic impacts from pile driving). However, as explained in more detail further on in this chapter, such impacts from the Flood Defences West would be of a much lower magnitude.

Birds

The data retrieved from the NBDC database (Table 7.6 above) contains records of a considerable number of bird species within the Zone of Influence, all of which are Red-listed or Amber-listed in *Birds of Conservation Concern in Ireland 2020-2026* (Gilbert, G. et al., 2021) and some of which are listed on Annex I to the Birds Directive. Many of these birds are wetland species which spend the winter in the Suir-Barrow-Nore Estuary, while others are riparian species more likely to occur along the freshwater stretches of the River Suir, e.g. Kingfisher. Raptors such as Peregrine Falcon are also included, and have been recorded in Waterford City in the past.

BirdWatch Ireland provided Irish Wetland Bird Survey (I-WeBS) data for the three subsites close to the proposed development. The subsites and the years for which data was received are present in Table 7.9 below.

Table 7.9 I-WeBS sub-sites reviewed.

| Subsite name | Code | Years of surveys | Distance from the proposed development |
|----------------------------|-------|---|--|
| Fiddown Bridge (only) | OM303 | 2012/13 | 1 km upstream |
| Derrigal-Portnascully | OM361 | 2012/13; 2013/14; 2014/15; 2015/16; 2016/17; 2017/18; 2018/19 | 15 km upstream |
| Barrow Bridge-Passage East | OM496 | 2013/14 | 8 km downstream |

Subsite OM361 is situated along the River Suir, at least 15km upstream of Waterford City. This site consists of fields which provide habitat for wetland water birds. Nationally important numbers of Greylag Goose have been recorded here. No species have been recorded occurring in nationally or internationally important numbers at subsite OM303 or OM496, which are located 19km upstream and 8km downstream of the proposed development, respectively. There was no data available from subsite OM390 (Belview-Little Island-Faithlegg, c. 2.5km downstream) or OM498 (Barrow Bridge-Creadan Strand, c. 10 km downstream).

The I-WeBS data shows that subsite OM361 is used by large numbers of wintering birds. However, the location of the proposed development has been highly modified and is subjected to frequent disturbance from the passage of trains and boats, and does not provide suitable habitat for species that are present within the wider environment in significant numbers.

Invasive Species

During the invasive species survey carried out to inform the EIAR for the River Suir Sustainable Transport Bridge (ROD, 2018a), two species restricted under Section 49 of the Habitats Regulations, namely Common Cord-grass (*Spartina anglica*) and Japanese Knotweed (*Fallopia japonica*), were recorded on the bank of the River Suir c. 500m downstream of the proposed Flood Defences West. A number of examples of other invasive but not legally restricted species, including Butterfly Bush (*Buddleja davidii*) and Traveller's Joy (*Clematis vitalba*), were also recorded.

Chinese Mitten Crab (*Eriocheir sinensis*) was recorded in the Waterford Estuary in 2009 (Invasive Species Ireland, 2021) and is presumed to still be present there. This is the only record of this species in Ireland. However, it is much more widespread in Great Britain (NIEA, 2020) and remains a threat.

7.3.4 Designated Sites

The NPWS *Designations Viewer* was reviewed for the location of designated sites within the Zone of Influence. The proposed development traverses the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC, as well as 8 No. pNHAs which are listed in Table 7.10 below. The detailed Site Synopses, Natura 2000 data forms and Conservation Objectives for the Lower River Suir SAC and the River Barrow and River Nore SAC were reviewed as part of the assessment. Designated sites within the Zone of Influence are summarised in Table 7.10. The locations of the designated sites are displayed in Figure 7.1 in Volume 3.

Table 7.10 Designated sites within the Zone of Influence.

| Designated site (site code) | Distance from the proposed development | Description |
|---|--|--|
| European sites | | |
| Lower River Suir SAC (002137) | Immediate proximity | This site consists of the freshwater stretches of the River Suir immediately south of Thurles, the tidal stretches as far as the confluence with the Barrow/Nore immediately east of Cheekpoint in Co. Waterford. The Suir and its tributaries flow through the counties of Tipperary, Kilkenny and Waterford. The Lower River Suir contains excellent examples of a number of Annex I habitats, including the priority habitats alluvial forest and Yew woodland. The site also supports populations of several important animal species; some listed on Annex II of the Habitats Directive or listed in the Irish Red Data Book. The presence of two legally protected plants (Flora (Protection) Order, 2015) and the ornithological importance of the site adds further to the ecological interest and importance. |
| River Barrow and River Nore SAC (002162) | 9 km downstream | This site comprises the River Barrow and River Nore catchments from the source in the Slieve Bloom Mountains to Creadan Head in Waterford. Urban centres along the site include Portarlinton, Athy, Carlow, Kilkenny and New Ross. Overall, it is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the Habitats Directive. Furthermore, it is of high conservation value for its populations of a number of bird species listed on Annex I of the Birds Directive. The occurrence of several Red Data Book plant species and the endemic population of the hard-water form of the Freshwater Pearl Mussel (limited to a 10 km stretch of the Nore) add further value to this site. |
| Nationally designated sites | | |
| Ballyhack pNHA (000695) | 14.5 km downstream | No site synopsis available for this pNHA. See River Barrow and River Nore SAC. |
| Barrow River Estuary pNHA (000698) | 9 km downstream | No site synopsis available for this pNHA. See River Barrow and River Nore SAC. |
| Duncannon Sandhills pNHA (001738) | 18.6 km downstream | No site synopsis available for this pNHA. See River Barrow and River Nore SAC. |
| Fiddown Island pNHA (000402) | 19.3 km upstream | No site synopsis available for this pNHA. See Lower River Suir SAC. |
| King's Channel pNHA (001702) | 3.6 km downstream | An offshoot of the Suir Estuary below Waterford surrounding Little Island, where the southern shore is lined in places by a flat saltmarsh. The saltmarsh is best developed in Grantstown with a sequence of plant communities. The middle zone has a few clumps of protected (Flora Protection Order, 2015) Meadow Barley (<i>Hordeum secalinum</i>). |
| Lower River Suir (Coolfinn, Portlawn) pNHA (000399) | 12.6 km upstream | No site synopsis available for this pNHA. See Lower River Suir SAC. |

| Designated site (site code) | Distance from the proposed development | Description |
|--|--|--|
| River Suir Below Carrick-on-Suir pNHA (000655) | 25.1 km upstream | No site synopsis available for this pNHA. See Lower River Suir SAC. |
| Tibberaghny Marshes pNHA (000411) | 21.8 km upstream | No site synopsis available for this pNHA. See Lower River Suir SAC. |
| Waterford Harbour pNHA (000787) | 15.5 km downstream | No site synopsis available for this pNHA. See River Barrow and River Nore SAC. |

With regard to European sites, an Appropriate Assessment (AA) Screening was carried out by Waterford City and County Council, as the competent authority, for the proposed development in compliance with Article 6(3) of the Habitats Directive. As part of this assessment, the potential for the proposed development to have an effect on any European sites in the Zone of Influence was considered. The AA Screening concluded as follows:

“This AA Screening Report has examined the details of the project and the relevant European sites and has concluded, on the basis of objective information, that the proposed development, either individually or in combination with other plans or projects, is likely to give rise to impacts which would constitute significant effects in view of the Conservation Objectives of the Lower River Suir SAC and the River Barrow and River Nore SAC.”

Following the AA Screening determination, a Natura Impact Statement (NIS) has been prepared in respect of the proposed development, detailing the impacts predicted on the Lower River Suir SAC and River Barrow and River Nore SAC and prescribing appropriate measures to mitigate those impacts.

There are a number of pNHAs that are located within the Zone of Influence and are hydrologically connected to the proposed development as set out in Table 7.10 above. This hydrological connection between the proposed development and these nationally designated sites provides a pathway for water quality impacts to be carried to these sites. These pNHAs collectively support a range of rare and protected species and habitats, some of which are listed on Annex I to the Habitats Directive. Many of these species and habitats are also listed as qualifying interests of the Lower River Suir SAC and the River Barrow and River Nore SAC and are sensitive to water quality impact and changes in hydraulic regime and other hydromorphological processes.

7.4 Field Survey Results

7.4.1 Habitats

This section describes the habitats recorded during the field survey within the study area (the proposed development footprint and a 150m buffer). A total of 16 different Fossitt (2000) habitats and habitat mosaics were identified in the study area. These habitats are listed below and mapping of these habitats is presented in Figure 7.2 in Volume 3 of this EIAR:

- (Mixed) broadleaved woodland (WD1)
- Exposed siliceous rock (ER1)
- Scrub/Exposed siliceous rock (WS1/ER1)
- Siliceous scree and loose rock (ER3)

- Dry meadows and grassy verges/Scrub (GS2/WS1)
- Buildings and artificial surfaces (BL3)
- Scrub (WS1)
- Recolonising bare ground (ED3)
- Dry meadows and grassy verges (GS2)
- Wet grassland (GS4)
- Tidal rivers (CW2)
 - Sea walls, piers and jetties (CC1)
 - Lower salt marsh (CM1)
 - Upper salt marsh (CM2)
 - Mud shores (LS4)
 - Estuaries (MW4)
- Wet grassland/Scrub (GS4/WS1)

(Mixed) broadleaved woodland (WD1)

Some examples of '(Mixed) broadleaved woodland' are present at the top of the rock face north of the railway line in the vicinity of Plunkett Station. Other than the River Suir and adjacent saltmarshes, these small areas of woodland are the habitats of highest biodiversity value in the field study area. However, they are outside the proposed development boundary and will not be affected.

Exposed siliceous rock (ER1)

The exposed cliff face north of the railway line in the vicinity of Plunkett Station is an outcrop of the Ballylane geological formation and corresponds to the Fossitt (2000) habitat 'Exposed siliceous rock'. This feature provides suitable habitat for roosting bats and nesting birds, particularly Peregrine. Works to stabilise this cliff face have received planning permission (WCCC Part VIII) and are not part of the proposed development.

Scrub/Exposed siliceous rock (WS1/ER1)

Part of the cliff face described above is interspersed with Gorse (*Ulex europaeus*) and other shrubs, forming a mosaic of 'Scrub/Exposed siliceous rock'. This provides suitable habitat for nesting birds and other fauna. As noted above, works in this location have planning permission as part of the cliff stabilisation works and are not part of the proposed development.

Siliceous scree and loose rock (ER3)

Exposed rock on the cliff face north of Plunkett Station is subject to weathering which results in occasional rockfalls. The build-up of scree and loose rock at the bottom of the cliff corresponds to the Fossitt (2000) habitat 'Siliceous scree and loose rock'.

Dry meadows and grassy verges/Scrub (GS2/WS1)

The wide sloping road verge north of the R448 comprises dry grassland habitat with a mosaic of Gorse-dominated scrub. This habitat is of low-moderate biodiversity value and will not be affected by the proposed development as it is outside the site boundary and will not experience any disturbance as a result of the construction works.

Buildings and artificial surfaces (BL3)

Much of the land surrounding the proposed development, particularly on the northern side, is built land consisting of roads, railways, buildings and bridges. Further away from the river, the majority of the surrounding area comprises built areas including the urban centre of Waterford. Generally, built habitats are not considered to be of high ecological significance.



Plate 7.3 Buildings, railway tracks, roads, bridges, walls and other artificial surfaces make up a significant portion of the study area.

Scrub (WS1)

The main area of scrub in the field study area is immediately north of the railway and south of the R488 road (on the sloped embankment). This area comprises a narrow, elongated strip of low-growing trees and shrubs, including many non-native Sycamore and Butterfly Bush. This area extends northwest to the commercial estate near the Newrath level crossing. While this habitat is of some biodiversity value in terms of providing habitat for birds, bats and invertebrates, this is limited by its position almost entirely enclosed by buildings and artificial surfaces. Furthermore, no works or disturbance to this area is proposed as part of the proposed development.

Smaller areas of scrub are also present between the railway line and the River Suir. One very small area, comprising an immature Sycamore and some Hawthorn is found adjacent to the signal cabin at Ch.1155. A larger area is found adjacent to the proposed construction site compound at the north-western end of the site. This area is heavily infested with invasive alien species, most notably Japanese Knotweed, but also Butterfly Bush, Montbretia and Cotoneaster.

Recolonising bare ground (ED3)

Areas of railway ballast which are >5m from the track contain many species which are typical of ruderal vegetation, e.g. Nettle, Dandelion and other asters, willowherbs, and ragworts. Ivy, Ivy-leaved Toadflax and Wild Strawberry are also common, as well as Creeping Cinquefoil, Bramble and other opportunistic species. This habitat forms part of the transition from railway ballast to dry grassy verges to wet grassland to the quay wall. This habitat will be lost during construction but will recover during the operation of the proposed development.



Plate 7.4 'Recolonising bare ground' with horsetail (*Equisetum* sp.) at Ch. 950.

Dry meadows and grassy verges (GS2)

A number of small strips of grassy vegetation are found in the vicinity of the proposed development, generally at the sides of roads and also between the railway line and quay wall. Very small areas of this habitat will be lost during construction of the proposed development but will eventually recover.

Wet grassland (GS4)

This habitat is present between the railway line and the River Suir, mostly between Ch. 780 and Ch. 1.100. It is most notable where the existing quay wall has fallen onto the mud (the influence of the river at this point is not sufficient to promote the development of this habitat into saltmarsh). In the study area, there are only poor examples of this habitat, dominated by Common Couch with occasional Red Fescue and shrubs (including the invasive Butterfly Bush). Therefore, these habitats are of low biodiversity value.



Plate 7.5 'Wet grassland' at Ch. 850, with Butterfly Bush and Gorse visible.

Wet grassland /Scrub (GS4/WS1)

On the southern side of the River Suir, directly opposite the proposed development, the riverbank upstream of the boatyards comprises 'Wet grassland' interspersed with areas of Gorse, forming a grassland-scrub mosaic. This area will not be affected at all by the proposed development.

Tidal rivers (CW2)

The proposed development runs along the northern bank of the River Suir. The river within the extents of the proposed development is subject to the influence of the tides and is designated as part of the Lower River Suir SAC. This habitat class contains other habitat types within it, namely 'Sea walls, piers and jetties' (CC1), 'Lower salt marsh' (CM1), 'Upper salt marsh' (CM2), 'Mud shores' (LS4), and 'Estuaries' (MW4), which are discussed in the following paragraphs. Specialist surveys of these habitats were undertaken by BEC Consultants Ltd on 15th March 2021 (Brophy, 2021) and the results are included as relevant.



Plate 7.6 The River Suir at Ch. 960, comprising 'Tidal rivers', including 'Sea walls, piers and jetties', 'Lower salt marsh', 'Mud shores' and 'Estuaries'. More detailed photos of these habitats are presented in the Intertidal Survey Report (Brophy, 2021) in Appendix 7.1 to this EIAR.

Sea walls, piers and jetties (CC1)

This category is used for all coastal constructions that are partially or totally inundated by sea water at high tide. This habitat was recorded along footprint of the proposed development as a masonry and concrete sea walls. The banks of the river on the southern side of the River Suir opposite the location of the proposed development consists of a series of floating jetties where many vessels are moored.

Brophy (2021) surveys the hard intertidal surfaces within the extents of the new riverside flood defence wall in March 2021. Brophy's description of these habitats is reproduced below and the full data are presented in Appendix 7.1.

"The hard substrata biotopes of the study area were limited to artificial surfaces in the form of the historical retaining wall separating the estuary from the rail line. The biotopes here were typical of the sheltered location in a reduced salinity environment on an artificial substratum. The eastern end of the study area showed the most developed zonation of intertidal hard substratum biotopes. From bottom to top, this area included a band of 'Ascophyllum nodosum and Fucus vesiculosus on variable salinity mid eulittoral rock' (LR.LLR.FVS.AscVS) up to 1.5 m wide [...], 'Fucus ceranoides on reduced salinity eulittoral rock' (LR.LLR.FVS.Fcer) approximately 30 cm wide [...], sparse and intermittent 'Enteromorpha spp. on freshwater-influenced and/or unstable upper eulittoral rock' (LR.FLR.Eph.Ent) [...] and 'Yellow and grey lichens on supralittoral rock' (LR.FLR.Lic.YG) [...], which is similarly sparse and intermittent. Heading west, the LR.LLR.FVS.AscVS zone rapidly disappears, as the upper mud shore covers its potential substratum along the base of the retaining wall, leaving only the upper three biotopes. There is often

a strip of bare stone between the LR.LLR.FVS.Fcer and the LR.FLR.Eph.Ent above it.

The barnacle Austrominius modestus was recorded on some of the wooden posts found emerging from the mudflat [...] and occasionally on rocks on the mud."

The remaining supports of former landing stages along the proposed development extent and supports for the R448 flyover also fall into this habitat class. However, these areas are too small to be mapped at the scale required.

These habitats are considered to be of moderate biodiversity value as, while they are not species-rich or of a very natural or locally distinct character, they are one of the principal ecosystem features which define this part of the River Suir and support the integrity of habitats and species of conservation interest in the Lower River Suir SAC.



Plate 7.7 Existing quay wall surface with *Fucus* spp. community.

Lower salt marsh (CM1) and Upper salt marsh (CM2)

An area of 106m² of saltmarsh, comprising mostly 'Lower salt marsh' (CM1) with a smaller band of 'Upper salt marsh' (CM2) higher up the shore, was identified between the existing quay wall and the mudflats from Ch. 925 to Ch. 975. The species present in the lower zone included Common Saltmarsh-grass (*Puccinellia maritima*) and Sea Plantain (*Plantago maritima*), while the upper zone contained Creeping Bent (*Agrostis stolonifera*). Sea Aster (*Tripolium pannonicum*) was present in both zones. The invasive Common Cordgrass was not present at the time of survey. This habitat corresponds to the Annex I habitat 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' (1330), which is listed as a Qualifying Interest of the Lower River Suir SAC. Brophy (2021) noted that this saltmarsh has formed in the shelter provided by an outward projection of the existing quay wall.

A similar area was also observed further up the River Suir (northwest), adjacent to the proposed construction compound. However, this area is not within the works extent and will not be affected in any way.

Borrer's Saltmarsh-grass (*Puccinellia fasciculata*), which is listed as Near Threatened in *Ireland Red List No. 10: Vascular Plants* (Wyse Jackson et al., 2016) and protected under the Flora (Protection) Order, 2015, was not observed during any of the surveys.

While these are not "best examples" of saltmarsh habitats, they are considered to be of very high biodiversity value as they conform to a type listed on Annex I to the Habitats Directive and are Qualifying Interests of the Lower River Suir SAC.



Plate 7.8 Saltmarsh habitats at Ch. 925 to Ch. 975.

Mud shores (LS4)

Mud shores are formed primarily of very fine sediment and usually occur along the most sheltered sections of coastline. The silt/clay fraction of the sediment is typically

found in the upper reaches of estuaries. They are subject to variable, reduced or low salinity conditions. Mud shores are often characterised by elevated mudflats that are dissected by networks of shallow channels associated with flooding and drainage. This habitat is present in the intertidal areas of the River Suir, including within the footprint of the proposed development.

This habitat corresponds to the Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide' (1140). However, this habitat is not listed as a Qualifying Interest of the Lower River Suir SAC.

Brophy (2021) surveyed the mudflats within the extents of the new riverside flood defence wall in March 2021. Brophy's description of the mudflats is reproduced below and the full data are presented in Appendix 7.1.

"The intertidal mud of the study area is all classified as 'Tubificoides benedii and other oligochaetes in littoral mud' (LS.LMu.UEst.Tben) under the JNCC Marine Biotope Classification [...]. This biotope is species-poor and found in upper estuarine locations where the salinity is reduced, with wave exposure ranging from sheltered to extremely sheltered (Connor et al., 2004). The substratum is one of fine sandy mud, and extends from the lower shore to the upper shore (Connor et al., 2004). Within the study area, the nature of the mudflat in the upper shore differed from lower down. The upper shore along much of the length comprised firm, anoxic mud, with rubble and debris dumped onto it from the land side, with quite a steep profile [...]. Burrows were visible in this upper shore mud surface and Horned Wrack (Fucus ceranoides) was growing on rocks scattered along the shore. The lower shore was one of soft mud, with the anoxic layer often deeper than the 25 cm reached by the core and a flatter profile [...]."

*In the current survey, only four species were recorded across the five sampling locations [...]. The oligochaete worm *Baltidrilus costatus* was recorded at the uppermost sample station S1, which was located on the upper shore. The true fly (Diptera) larva of the Family Dolichopodidae was found at sample station S2, forming burrows in the upper shore. A single mayfly *Baetis rhodani* was recorded at sample station S3; this must have washed down from upstream as there is no suitable habitat present in the estuary for this species. Similarly, a larva of the water beetle *Esolus parallelepipedus* recorded at S5 must also have been washed down, as, again, no suitable habitat for this species is present within the estuary. No fauna were recorded from sample station S4. [...]*

The granulometric analysis classified all stations as 'Sandy Mud', with the mud content ranging from 59.6% (S3) to 79.3% (S1) [...]. Total Organic Carbon ranged from 7.37% (S2) to 8.20% (S5) [...]."

While the mudflat habitats at this location are very species-poor and do not represent best examples of this habitat type, they are the principal feature which defines this part of the River Suir and support the integrity of habitats and species of conservation interest in the Lower River Suir SAC, though they are not a Qualifying Interest in their own right. Therefore, they are considered to be of high biodiversity value.



Plate 7.9 'Mud shores' at the western end of the proposed extent of the new riverside flood defence wall.

Estuaries (MW4)

For the purposes of this assessment, the River Suir below the low-water mark has been classed as the Fossitt (2000) habitat type 'Estuaries' (MW4). In addition, the River Suir at this location corresponds to the Annex I habitat 'Estuaries' (1130) which is not listed as a Qualifying Interest of the Lower River Suir SAC. EC (2013) describes this habitat as the downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. Therefore, the Annex I type applies to the intertidal areas also, corresponding to the Fossitt (2000) habitat type 'Tidal rivers' (CW2).

Character of Habitats

The site of the proposed development has been highly modified from its natural state over centuries of urbanisation, navigation, dredging and reclamation. Its character is typical of urbanised or industrialised estuarine environments.

Significance of Habitats

The habitats present on the site were assessed in accordance with NRA (2009). The River Suir itself, although highly modified, is the habitat with the highest biodiversity value within the site as it supports a number of habitats and species of conservation importance, some of which are Qualifying Interests of the Lower River Suir SAC and other connected sites. Therefore, these habitats are considered to be of moderate-high biodiversity value. Other habitats are of considerably lower significance.

7.4.2 Fauna

Terrestrial Mammals

Otter

During the three walkover surveys, signs of Otter activity were recorded within the study area. Evidence of Otter activity included prints along the mudflats outside the existing quay wall. No spraints or any potential holts or couches were recorded within 150 m of the proposed development.



Plate 7.10 Otter prints on the mudflats at Ch. 980.

Bats

The bat suitability assessment undertaken during the walkover surveys assessed the area within the proposed development boundary as being of Low-Moderate suitability for bats. This was based on an appraisal of the potential of specific features on the site

to support roosting bats, as well as the general site conditions in terms commuting and foraging habitat for bats. Table 7.11 below described the appraisal of these features with regard to their suitability for bats.

Table 7.11 Appraisal of the proposed development site for roosting, commuting and foraging bats (see Figures 4.1 to 4.6 in Volume 3 for chainage reference points).

| Feature*= = | Description | Suitability |
|--|--|--------------|
| R448 elevated roadway (Ch. 345 to Ch. 385) | The underside of this concrete structures contains a large number of gaps at expansion joints and along transverse grooves in the soffit structure (see Plate 7.11 below). While these do not provide ideal roosting habitat, particularly for maternity or hibernation, bats have been known to use such features in the past, even for hibernation. Features present on this structure could be used by bats due to their size, protection, height above the ground and dryness. However, these features are in an otherwise exposed (estuarine) environment, are unlikely to have a stable temperature during the winter and are subject to significant disturbance. Furthermore, there is poor connectivity to suitable foraging habitats in the vicinity. Therefore, this structure is very unlikely to support a roost of conservation importance. | Low-Moderate |
| Buildings (signal cabin at Ch. 1.155, small disused buildings at Ch. 1.470 and beyond) | These buildings are small, single-storey buildings, generally of wooden or other lightweight construction and uninhabited (see Plates 7.12 to 7.14 below). These buildings are in reasonably good condition, with little opportunity for bats to access the interior or voids in the roofs. While they may provide space for roosting by significant numbers of bats and are subject to much less disturbance due to their location away from the more urbanised parts of the site, their lightweight construction means that they are unlikely to maintain a stable temperature. They are also poorly connected to nearby foraging habitat. Therefore, they are unlikely to support a roost of conservation importance. | Moderate |
| Other buildings (Plunkett Station, Sally Park Depot) | These buildings are much larger and in constant use. They are in good repair with almost no opportunity for bats to gain entry to the interior spaces or voids in the roofs. As they are in constant use, they are likely to be too warm for hibernation and are also subject to human disturbance. While they are better connected to foraging habitat to the north of the proposed development, they are still in a relatively exposed environment adjacent to the River Suir. Therefore, based on the lack of roost features on these structures and the prevailing levels of disturbance, they are very unlikely to support a roost of conservation importance. | Low |
| Scrub, other vegetation and River Suir | Terrestrial habitat connectivity within the proposed development site is generally very poor, with most of the site being buildings and artificial surfaces and no continuous hedgerows or treelines running the length of the site. A narrow strip of scrub is present between | Low |

| Feature*= | Description | Suitability |
|---------------|---|-------------|
| | <p>the railway line and the R448 road from Ch. 1150 onwards, but this is a “dead end” and is subject to significant disturbance from the road, as well as light spill. Areas of grassland and scrub on the riverbank are isolated, being linked only by ruderal vegetation which is of little benefit to bats. The only continuous natural feature and the only feature which is well connected to the wider landscape is the River Suir. While rivers usually act as important commuting corridors for bats (and foraging habitats in the case of Daubenton’s Bat), the value of the River Suir at this location to commuting and foraging bats is limited by its significant exposure, which reduces its suitability for most Irish species, with the possible exception of Leisler’s Bat (Ireland’s largest bat and one of the more common species). There is no woodland or other habitat which is of high value for foraging bats and there are no known roosts in the immediate vicinity. Therefore, the proposed development site is of low suitability for commuting and foraging bats.</p> | |



Plate 7.11 Gaps in soffit of the R448 elevated roadway which could potentially be used by roosting bats.



Plate 7.12 Signal cabin (left) at Ch. 1155 with connection to the River Suir.



Plate 7.13 Disused building at the proposed location of the main construction compound.



Plate 7.14 Further disused buildings in the vicinity of the proposed location of the main construction compound.

Based on the results of the desk study and the bat suitability assessment above, and taking into account the nature and scale of the proposed development, further surveys focussing on bats, potential roost features, or suitable commuting or foraging habitats were deemed unnecessary.

Other Terrestrial Mammals (including Badger)

No evidence of badgers was recorded in the study area during the multidisciplinary walkover surveys, and there is very limited suitable habitat or connectivity to the same. Development projects will generally not involve significant impacts on populations of other highly mobile terrestrial mammals, nor are there particularly relevant/effective mitigation measures specific to any of these species. Thus, in most cases, further surveys of e.g. Badger or Hedgehog, over and above the field evidence collected during the multidisciplinary walkover survey would not be appropriate. This was the case with regard to the proposed development. Therefore, targeted surveys for such species were not carried out.

Marine Mammals

No sightings or evidence of any marine mammals (cetaceans or pinnipeds) were recorded during the surveys undertaken to inform this assessment.

Birds

The habitat assessment undertaken as part of the multidisciplinary walkover survey did not identify habitats that support important assemblages or significant populations of breeding or wintering birds. There is no Kingfisher nesting habitat in the study area and Kingfisher movement will not be restricted. Table 7.12 lists the birds that were recorded during the multidisciplinary walkover surveys.

Table 7.12 Bird species recorded during the surveys.

| Common name | Scientific name |
|-------------------|-----------------------------------|
| Grey Heron | <i>Ardea cinerea</i> |
| Buzzard | <i>Buteo buteo</i> |
| Goldfinch | <i>Carduelis carduelis</i> |
| Black-headed Gull | <i>Chroicocephalus ridibundus</i> |
| Hooded Crow | <i>Corvus cornix</i> |
| Rook | <i>Corvus frugilegus</i> |
| Herring Gull | <i>Larus argentatus</i> |
| House Sparrow | <i>Passer domesticus</i> |

Reptiles and Amphibians

The multidisciplinary walkover surveys did not record any evidence of Common Frog (*Rana temporaria*), Smooth Newt (*Lissotriton vulgaris*) or Common Lizard (*Zootoca vivipara*) within the study area. Further survey/assessment was not deemed necessary due to the lack of suitable habitat or previous records of these species in the area.

7.4.3 Flora

No species protected under the Flora (Protection) Order, 2015 were recorded within the study area. Table 7.13 below provides a list of plant species recorded during the multidisciplinary walkover surveys.

Table 7.13 Plant species recorded during the surveys.

| Common name | Scientific name |
|---------------------|---|
| Sycamore | <i>Acer pseudoplatanus</i> |
| Creeping Bent | <i>Agrostis stolonifera</i> |
| Lords-and-Ladies | <i>Arum maculatum</i> |
| Daisy | <i>Bellis perennis</i> |
| Sea Beet | <i>Beta vulgaris</i> subsp. <i>maritima</i> |
| Rape | <i>Brassica napus</i> |
| Butterfly Bush | <i>Buddleja davidii</i> |
| Pot Marigold | <i>Calendula officinalis</i> |
| Hairy Bittercress | <i>Cardamine hirsuta</i> |
| Red Valerian | <i>Centranthus ruber</i> |
| Spear-thistle | <i>Cirsium vulgare</i> |
| Traveller's Joy | <i>Clematis vitalba</i> |
| Scurvygrass | <i>Cochlearia</i> sp. |
| Cotoneaster | <i>Cotoneaster</i> sp. |
| Hawthorn | <i>Crataegus monogyna</i> |
| Montbretia | <i>Crocsmia</i> × <i>crocsmiiflora</i> |
| Ivy-leaved Toadflax | <i>Cymbalaria muralis</i> |

| Common name | Scientific name |
|------------------------|-----------------------------------|
| Wild Teasel | <i>Dipsacus fullonum</i> |
| Common Couch | <i>Elytrigia repens</i> |
| Willowherbs | <i>Epilobium</i> spp. |
| Horsetails | <i>Equisetum</i> spp. |
| Japanese Knotweed | <i>Fallopia japonica</i> |
| Wild Strawberry | <i>Fragaria vesca</i> |
| Cleavers | <i>Galium aparine</i> |
| Herb-Robert | <i>Geranium robertianum</i> |
| Crane's-bills | <i>Geranium</i> spp. |
| Ivy | <i>Hedera helix</i> |
| St John's Wort | <i>Hypericum</i> sp. |
| Holly | <i>Ilex aquifolium</i> |
| Red Dead-nettle | <i>Lamium purpureum</i> |
| Himalayan Honeysuckle | <i>Leycesteria formosa</i> |
| Common Mallow | <i>Malva sylvestris</i> |
| Winter Heliotrope | <i>Petasites fragrans</i> |
| Common Reed | <i>Phragmites australis</i> |
| Ribwort Plantain | <i>Plantago lanceolata</i> |
| Sea Plantain | <i>Plantago maritima</i> |
| Polypody | <i>Polypodium</i> sp. |
| Creeping Cinquefoil | <i>Potentilla reptans</i> |
| Primrose | <i>Primula vulgaris</i> |
| Cherry Laurel | <i>Prunus laurocerasus</i> |
| Common Saltmarsh-grass | <i>Puccinellia maritima</i> |
| Bramble | <i>Rubus fruticosus</i> agg. |
| Willow | <i>Salix</i> sp. |
| Groundsel | <i>Senecio vulgaris</i> |
| Smooth Sowthistle | <i>Sonchus oleraceus</i> |
| Rowan | <i>Sorbus aucuparia</i> |
| Dandelion | <i>Taraxacum vulgaria</i> |
| Wood Sage | <i>Teucrium scorodonia</i> |
| Sea Arrowgrass | <i>Triglochin maritima</i> |
| Sea Mayweed | <i>Tripleurospermum maritimum</i> |
| Sea Aster | <i>Tripolium pannonicum</i> |
| Bulrush | <i>Typha latifolia</i> |
| Gorse | <i>Ulex europaeus</i> |
| Common Nettle | <i>Urtica dioica</i> |
| Laurustinus | <i>Viburnum tinus</i> |
| Vetches | <i>Vicia</i> spp. |

7.4.4 Invasive Alien Species

One species restricted under Section 49 of the Habitats Regulations, namely Japanese Knotweed (*Fallopia japonica*), was recorded during the multidisciplinary surveys. One stand of this species was recorded between the IÉ property boundary and the river in the vicinity of the proposed main construction compound at the north-western end of the proposed development boundary (ITM Grid Reference: 659127, 613604). This stand covered an area of c. 40m² and was mostly between the fence and the river, though one plant was in at least its second year of growth in the railway ballast inside the fence at the southern corner of the abandoned iron bridge span.

This stand of Japanese Knotweed will require treatment prior to works commencing. Further stands are known from further up the railway line (beyond the level crossing which is proposed to be used as a haul route) but these are outside the proposed development boundary and not on haul routes.



Plate 7.15 Japanese Knotweed at the proposed location of the main construction compound.

A number of examples of other invasive but not legally restricted species, including Himalayan Honeysuckle, Butterfly Bush, Traveller's Joy, Cherry Laurel, Cotoneaster, Montbretia, and Winter Heliotrope were recorded within the study area.

7.4.5 Ecological Corridors

Article 10 of the Habitats Directive recognises the importance of ecological networks as corridors and steppingstones for wildlife, including for migration, dispersal and genetic exchange of species of flora and fauna. The Directive requires that ecological connectivity and areas of ecological value outside the Natura 2000 network are maintained and it recognises the need for the management of these areas through land use planning and development policies.

Ecological corridors are important in connecting areas of local biodiversity with each other and with nearby designated sites to prevent islands of habitat from becoming isolated. Ecological corridors include linear features such as treelines, hedgerows, disused railway lines, rivers, streams, canals and ditches. They are particularly important for mammals, especially bats, and small birds. The River Suir provides a number of important ecological corridors including an aquatic corridor and some associated shoreline terrestrial habitat corridors such as mudflats and saltmarsh. The River Suir provides a range of habitats and facilitate networks or linkages to the surrounding countryside for biodiversity, flora and fauna.

While ecological corridors are essential for the movement and conservation of native biodiversity, they can also act as conduits for the spread of invasive alien species. This is particularly the case for rivers and other aquatic corridors. Therefore, biosecurity is of paramount importance for development projects along ecological corridors, especially rivers.

7.5 Evaluation of Key Ecological Receptors

Table 7.14 below details the evaluation of the ecological receptors that were identified during the desk study and the subsequent field surveys and the evaluation of the importance of each receptor on a geographical scale. Receptors of Local Importance (Higher Value) or above were selected as Key Ecological Receptors.

The assessment of the likely impacts of the proposed development and subsequent proposal of mitigation measures and assessment of residual impacts focus on those receptors which were selected as Key Ecological Receptors in Table 7.14 below.

Table 7.14 Evaluation of Ecological Receptors for the Proposed Development

| KER | Description | Evaluation of importance, following NRA (2009) |
|---|--|--|
| River Suir, including Annex I 'Estuaries' | The proposed development runs along the northern bank of the River Suir. The river forms an integral part of the Lower River Suir SAC. The Qualifying Interests of this SAC include habitats and species likely to be impacted upon by the proposed development, such as Twaite Shad and Otter. The River Suir at the location of the proposed development corresponds to the Annex I habitat 'Estuaries'. The River Suir has also been identified as an important ecological feature and as an ecological corridor. The river channel will be permanently altered by the proposed development and there is a risk of pollution during the construction phase of the proposed development. | International Importance on the basis that this watercourse forms an integral part of the Lower River Suir SAC and hosts habitats and populations of species listed on Annexes I and II, respectively, to the Habitats Directive. Therefore, the River Suir, including Annex I 'Estuaries', has been selected as a Key Ecological Receptor (KER 1). |
| Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide' | Intertidal habitats in the vicinity of the proposed development include both hard and soft substrates, i.e. the existing quay wall and the mudflats, respectively. The mudflats represent examples of the Annex I habitat 'Mudflats and sandflats not covered by sea water at low tide' (1140). These habitats support a range of biological communities, comprising benthic macroalgae and invertebrates, as well as species which feed on them. Species supported by these intertidal habitats include rare and protected species, including species listed as Qualifying Interests of the Lower River Suir SAC, such as lamprey species, Atlantic salmon, Twaite Shad and Otter. | National Importance on the basis that intertidal habitats in the vicinity of the proposed development include an Annex I habitat (though not a "best example" of this habitat, which is not a Qualifying Interest of the Lower River Suir SAC) and provide support for populations of Annex II and IV species, which are Qualifying Interests of the Lower River Suir SAC. Therefore, intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', have been included as a Key Ecological Receptor (KER 2). |
| Shoreline Habitats, including Annex I 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)' | Shoreline habitats in the vicinity of the proposed development include Annex I 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)' (1330). This habitat covers a relatively small area (106 m ²) within the boundary of the proposed development and is listed as a Qualifying Interest of the Lower River Suir SAC. | International Importance on the basis that shoreline habitats in the vicinity of the proposed development include an Annex I habitat listed as a Qualifying Interest of the Lower River Suir SAC. Therefore, shoreline habitats, including Annex I 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)', have been included as a Key Ecological Receptor (KER 3). |
| Fish Species, including Annex II migratory species | Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon are all Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC. These species, as well as European Eel and Smelt, are likely to be present in the vicinity of the proposed development, at different times of the year and during critical periods during their life histories, e.g. migrations. | International Importance on the basis that these species are listed on Annexes II and IV to the Habitats Directive and are Qualifying Interests of the Lower River Suir SAC (and the River Barrow and River Nore SAC). Therefore, fish species, including Annex II migratory species, have been included as a Key Ecological Receptor (KER 4). |
| Otter | Otter is listed on Annexes II and IV to the Habitats Directive and is a Qualifying Interest of both the Lower River Suir SAC and the River Barrow and River Nore SAC. This species is known to occur in the vicinity of the proposed development. | International Importance on the basis that this species is listed on Annex II and IV to the Habitats Directive and is a Qualifying Interest of the Lower River Suir SAC (and the River Barrow and River Nore SAC). Otter has, therefore, been selected as a Key Ecological Receptor (KER 5). |

| KER | Description | Evaluation of importance, following NRA (2009) |
|---------------------------|---|---|
| Bat Species | All nine resident breeding bat species in Ireland are legally protected and roost sites (whether in use or not) are also protected under both European and Irish legislation. All bat species occurring in Ireland are protected under the Wildlife Acts and are listed in Annex IV to the Habitats Directive. A number of bat species are known to roost within 10 km of the proposed development and more common species, e.g. Leisler's Bat and Common Pipistrelle, are known to feed in low numbers in the vicinity of the proposed development. Linear features such as rivers are known to be of particular importance for bat feeding and commuting. | Local Importance (Higher Value) on the basis that the habitats in the vicinity of the proposed development support low numbers of common bat species, which are listed on Annex IV to the Habitats Directive and are protected under the Wildlife Act, but are very unlikely to support roosting bats. Therefore, bat species have been selected as a Key Ecological Receptor (KER 6). |
| Other Terrestrial Mammals | All native Irish mammals are protected under the Wildlife Act. However, no such species other than Otter (covered above) are listed as Qualifying Interests of the Lower River Suir SAC or are known to regularly occur in the vicinity of the proposed development. It is unlikely that terrestrial mammals are present at the site location due to the lack of suitable habitat. | Local Importance (Lower Value) on the basis that the site and surrounding area provide small areas of semi-natural habitat that could be of benefit to individual mammals, but not resident or regularly occurring populations. Therefore, other terrestrial mammals have not been selected as a Key Ecological Receptor. |
| Marine Mammals | All native marine mammals and those that migrate frequently through Irish waters are protected under the Wildlife Act and species such as Bottlenose Dolphin and Harbour Porpoise are listed on Annex II to the Habitats Directive. All cetaceans are listed on Annex IV to the Habitats Directive. Grey Seal and Harbour Seal are also listed on Annex II to the Habitats Directive. No marine mammals are Qualifying Interests of the Lower River Suir SAC and their presence at the location of the proposed development is infrequent and sporadic. | Local Importance (Lower Value) on the basis that the site and surrounding area provides limited suitable habitat for marine mammals and there are no resident or regularly occurring populations. Therefore, marine mammals have not been selected as a Key Ecological Receptor. |
| Birds | All bird species are protected under the Wildlife Act, and a number of species that have been recorded in the study area are listed on Annex I to the Birds Directive, e.g. Bar-tailed Godwit and Golden Plover. Additionally, some of these species are Red-listed in <i>Birds of Conservation Concern in Ireland 2020-2026</i> (Gilbert, G. et al., 2021), e.g. Curlew. The habitats in the vicinity of the proposed development include mudflats, which provide foraging habitat and a food source for wading birds in particular in the form of marine invertebrates. However, due to the narrow, constrain and urbanised setting of these habitats in Waterford City, and the frequent disturbance from passing road traffic, trains and boats, the value of these habitats to birds is very limited and few observations have been made at these locations. The multidisciplinary walkover surveys found no nesting habitat for species such as Kingfisher or Sand Martin, or any areas of woodland or scrub that could provide habitat for other breeding birds. | Local Importance (Lower Value) on the basis that habitats in the vicinity of the proposed development provide very limited suitable foraging habitat for birds and there are no resident or regularly occurring populations of conservation importance. Therefore, birds have not been selected as a Key Ecological Receptor. |

| KER | Description | Evaluation of importance, following NRA (2009) |
|-----------------------------|--|--|
| Invasive Alien Species | Invasive alien species which are restricted under Section 49 of the Habitats Regulations, e.g. Japanese Knotweed and Common Cordgrass, as well as other invasive but not legally restricted species, e.g. Butterfly Bush, are known to occur in the vicinity of the proposed development. High-impact aquatic invasives, such as Chinese Mitten Crab, have also been recorded in the vicinity in the past. Such species pose a threat to native biodiversity, including rare and protected habitats and species, and designated sites, if they are caused to spread. The introduction of new invasive alien species or export of these species to other sites is a significant threat to Biodiversity. | As invasive alien species are an aspect of Biodiversity which represents a threat to other aspects which are considered to be of conservation importance, they are not assigned a value on a geographical scale. However, it is important that the risks associated with invasive alien species, which can include significant impacts on receptors of International Importance, it is critical that they are considered in all parts of this assessment. Therefore, invasive alien species have been selected as a Key Ecological Receptor (KER 7). |
| Nationally Designated Sites | There are a number of pNHAs that intersect the Zone of Influence and are hydrologically connected to the proposed development. These sites include the King's Channel pNHA, Barrow River Estuary pNHA, Waterford Harbour pNHA, Ballyhack pNHA, Duncannon Sandhills pNHA, River Suir Below Carrick-On-Suir pNHA, Tibberaghny Marshes pNHA, Fiddown Island pNHA and Lower River Suir (Coolfinn, Portlaw) pNHA. | National Importance on the basis that these are nationally designated sites and likely support examples of Annex I habitats and populations of Annex II and other protected species. Given that all of these sites are remote from the proposed development and connected to it by the same pathway for impacts, i.e. the River Suir, they are assessed collectively. Therefore, pNHAs have been selected as a Key Ecological Receptor (KER 8). |

7.6 Description of Likely Impacts (Unmitigated)

7.6.1 Impacts on Designated Sites

The proposed Flood Defences West runs along the edge of and intersects with one European site, namely the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC. The NIS for the proposed development presents all the predicted impacts on these sites and their Qualifying Interests. The NIS also provides a detailed analysis and evaluation of these impacts in the context of the Conservation Objectives. The NIS prescribes mitigation to prevent adverse effects on the integrity of the SACs. The impacts on nationally designated sites (KER 8) are assessed below as a single Key Ecological Receptor.

7.6.2 General Impacts on Key Ecological Receptors

Construction Stage

Habitat Loss

During construction, there will be temporary loss of habitats as a result of areas of the River Suir being occupied by the cofferdams for the construction of the three drainage outfalls and the sandbags or aqua-dam beneath remedial works to the existing wall (as mitigation to prevent pollutants entering the river during these works). As only one cofferdam will be in place at any one time, the total temporary habitat loss at any time will be c. 35m² and there will be full recovery of these habitats almost immediately following removal of these temporary measures. Therefore, the temporary habitat loss during construction will not give rise to significant impacts on any receptors.

Habitat Connectivity

Given the very small extent of the sandbags or aqua-dam beneath remedial works to the existing quay wall, it will not give rise to any additional barrier to connectivity for fish species, otters or other receptors. With regard to the temporary cofferdams, these will extent c. 9m beyond the new sheet pile flood defence wall, cutting off the intertidal corridor. However, as these will be only c. 5m wide and are temporary (4 weeks each, 12 weeks in total), they will not present a significant barrier to connectivity for fish species, otters or other receptors.

Disturbance

The use of barges or vessels and sheet piling poses a risk of hydroacoustic impacts on fauna in the River Suir, most notably Twaite Shad, which is particularly sensitive to hydroacoustic impacts given that it is a hearing-specialist species and that juveniles are likely to be present in the estuary at all times of the year. The NIS contains a detailed analysis of the likely hydroacoustic impacts arising from sheet piling, which is the loudest of the proposed construction activities. This assessment considered the implications of using either one or two piling rigs, using mostly vibratory piling but also allowing for a number of strikes (maximum 200 strikes) from an impact hammer to achieve the required depth for some piles.

Artificial lighting poses a risk of negative impacts on biodiversity, particularly Otter, bats and fish, by fragmentation of commuting/foraging corridors, disruption of circadian rhythms and increased risk of predation. Over a prolonged period, such impacts can lead to reduced reproductive success/recruitment. The requirement for nightworks for parts of the construction of the proposed development poses a risk of such impacts. However, the risk is limited due to the short duration of these works. No structures, trees or other features with potential to support roosting bats will be removed or altered as part of the proposed development.

Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Suir or the species it supports.

Water Quality

Due to the use of barges and other construction machinery on and in close proximity to the River Suir, there is a risk of pollution to the river during construction. This could be in the form of spilled fuel, oil, concrete or grout or disturbance of contaminated ground. The aspects of the construction of the proposed development which pose the greatest risk of such impacts include:

- Delivery of piles by barge and driving of piles;
- Remedial works to the existing quay wall where these are proposed;
- Demolition of the existing quay wall at the tie-in points between the landside and riverside sections of the new wall and to 800mm below ground level from Ch. 360 to Ch. 900; and,
- Works to accommodate one new drainage outfall, as well as existing outfalls to the River Suir where these cross the proposed flood wall.

Given the naturally high sediment load in the River Suir at this location, sedimentation is not considered to pose a significant risk. However, the synergistic effects of the naturally occurring sediment with any pollutants must be considered. Any pollution incident could have significant negative impacts on aquatic and shoreline life depending on the severity of the pollution. Pollution can also have indirect negative impacts on water-dependent terrestrial habitats and species that are hydrologically connected to the source of the pollution.

Invasive Alien Species

Construction activities pose a risk of the spread of invasive non-native species to, from or within the vicinity of the works. A species of particular concern in this case is Chinese Mitten Crab, which could be spread within the Suir-Barrow-Nore Estuary by barges and other vessels associated with the construction of the proposed development. There is also a risk that poor siting of the construction compound or other construction-related activities could facilitate the spread of Japanese Knotweed, particularly along the railway line, where this species has been recorded.

Dust Deposition

Construction activities will result in the mobilisation of dust into the air. The main sources of dust include:

- Demolition of sections of the existing quay wall;
- Excavations for the proposed impermeable trench through the Plunkett Station car park;
- Excavations as part of drainage works;
- Earthworks (i.e. fill behind the riverside section of the new flood defence wall);
- Sheet piling on land; and,
- Movement of construction vehicles.

This dust will be deposited on the surrounding land, including habitats that are listed as Qualifying Interests of the Lower River Suir SAC. Dust deposition can have negative effects on the vegetation it covers as it reduces the ability of plants to photosynthesise. However, due to the very small quantities of demolition and

earthworks, the nature of the fill material (i.e. clean), the fact that construction routes will be on railway ballast rather than dust roads, and short duration of works, as well as the likely washing away of any dust deposited in the estuarine environment during spring tides (every fortnight), this impact will be imperceptible and temporary. Therefore, it does not warrant further consideration in terms of its effect on biodiversity.

Design and Operational Stage

Habitat Loss

The proposed development will result in the loss of c. 800m² of intertidal mudflats on the northern bank of the River Suir west of Rice Bridge. This habitat is of a type listed on Annex I to the Habitats Directive, namely 'Mudflats and sandflats not covered by seawater at low tide' (1140), and the area that would be lost is within the Lower River Suir SAC. While not listed as a Qualifying Interest of the SAC, intertidal mudflats are important for the achievement of the conservation objectives for Twaite Shad and other Qualifying Interests of the SAC.

A small area (106m²) of the Annex I saltmarsh habitat 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' (1330) is present at the bottom of the existing quay wall from Ch. 925 to Ch. 975. The riverside sheet pile flood defence wall was originally proposed to tie into the landside sheet pile wall at Ch. 950. However, in order to avoid any loss of this habitat, which is a Qualifying Interest of the Lower River Suir SAC, the design has been amended so that the new wall will now revert back behind the existing wall c. 50m earlier, at Ch. 900. This will avoid any direct loss of Annex I saltmarsh habitat.

A small area of hard intertidal substrate (i.e. the existing quay wall) and its associated biological communities will be permanently lost as a result of the proposed development. However, this habitat will be replaced by another hard intertidal surface (either steel sheet pile or highly structured or bio-active pre-cast concrete cladding) and there is potential for enhancement to result in a net increase in the total area and diversity of hard intertidal biodiversity at this location.

Habitat Connectivity

The proposed development also provides for reduced habitat connectivity along the intertidal mudflat corridor due to constriction of the habitat by c. 1.0m over a length of c. 540m and associated reduction in the portion of the tidal cycle when there is exposed mudflat. The loss and fragmentation of intertidal mudflat habitat associated with the proposed development are likely to be permanent. This presents a potential negative impact on species which move up and down this corridor, e.g. Otter.

Zonation and Habitat Heterogeneity

The loss of upper intertidal mudflat and c. 540m length of hard upper intertidal and splash zone habitat constitutes a potential reduction in habitat heterogeneity/zonation and, consequently, species diversity. However, there is scope for enhancement of the design to ensure that there is No Net Loss of biodiversity in terms of zonation and habitat heterogeneity.

Hydraulic Impacts

Hydrodynamic modelling (Hydro Environmental Ltd., 2021) indicated that there would be a slight increase in flow velocity immediately adjacent to the sheet piled wall, however the increased rate of flow is of insufficient magnitude to provide enough shear stress that would result in any significant erosion of consolidated sediments within or along the banks of the River Suir. Therefore, the proposed flood defences do not pose

a significant risk of creating hydraulic changes that will threaten intertidal mudflats or any other habitats located along the banks of the River Suir including the Annex I habitat 'Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)'. Nevertheless, a slight reduction in silt deposition adjacent to the flood will is anticipated.

Disturbance

There is no new artificial lighting or any other source of ongoing disturbance impacts proposed for the operational phase of the proposed development. Therefore, there will be no ongoing disturbance impacts.

7.6.3 Impacts on Key Ecological Receptors

Table 7.15 below describes the likely impacts from the proposed development on each of the Key Ecological Receptors.

Table 7.15 Characterisation and evaluation of likely impacts on Key Ecological Receptors, following EPA (2017) and NRA (2009).

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
|--|---|---|---|
| <p>KER 1 River Suir, including Annex I 'Estuaries'</p> | <p>Construction activities, particularly piling activities, which will involve the use of spud-can or jack-up barges, will disturb habitats and species in the River Suir, through noise, light and physical disturbance. Noise and light will impact on species including fish, otters and bats, and these impacts are discussed under KERs 4, 5 and 6 below. Physical disturbance to habitats will occur during the anchoring or jacking up of the barge. This will result in disturbance of subtidal sediments and benthic fauna in the immediate area around the anchors or jack feet and will be recovered within 24 hours of completion of these activities.</p> <p>Water quality impacts arising from any accidental pollution incident associated with the construction of the proposed development would likely affect the overall structure and function of the estuarine ecosystem. The characteristics of this impact would depend on the nature and quantities of pollutants and the timing and duration of their input into the River Suir. The impacts of pollution incidents on individual components of this Key Ecological Receptor, e.g. intertidal habitats, fish species etc., are discussed under KERs 2 to 5 below.</p> <p>The impacts of the importation or spread of invasive alien species associated with the construction of the proposed development are assessed under KER 7 below.</p> | <p>The presence of the proposed development will result in the permanent direct loss of c. 800 m² of habitats in the River Suir, including Annex I 'Estuaries'. At the National level, the most recent Article 17 report (NPWS, 2019) states that the total area of Annex I 'Estuaries' in Ireland is 761 km², 479 km² of which is within SACs. The overall conservation status of this habitat is Inadequate, on the basis that while its range and area are Favourable, its specific structure and functions are Inadequate, and its overall trend is deteriorating. The main pressures and threats are marine pollution and invasive alien species. The loss of 800 m² represents a 0.00011% reduction in the national habitat area (0.00016% of the area in SACs). Given the extremely small proportion of this habitat to be lost and the fact that reclamation is not one of the main pressures or threats to this habitat, the conservation status will not be significantly affected.</p> <p>Habitat connectivity, zonation and heterogeneity would also be reduced over the extents of the riverside sheet pile wall due to the constriction of the intertidal mudflat corridor and the replacement of the existing masonry quay wall with steel sheet piles, which support less diverse biological communities than other, more highly structured/textured materials.</p> | <p>The disturbance to the River Suir, including Annex I 'Estuaries', associated with the construction of the proposed development is considered to constitute a Temporary Slight-Imperceptible Negative Impact as it involves fully reversible impacts over a very small area and short duration.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur, as they would have the potential to significantly impact on sensitive receptors over a very wide area, but would likely recover in the short term.</p> <p>The permanent direct loss of estuarine habitats, including Annex I 'Estuaries' is considered to constitute a Permanent Significant Negative Impact on the River Suir. However, the impact of this loss at the National level will be Imperceptible for the reasons outlined in the preceding column.</p> <p>The reduction in habitat connectivity, zonation and heterogeneity would constitute a Long-term Slight-Moderate Negative Impact as habitat connectivity is only partially reduced (in the upper intertidal/during the higher portion on the tidal cycle) and zonation and heterogeneity would partially recover as the sheet pile wall is colonised by macroalgae and invertebrates.</p> |
| <p>KER 2</p> | <p>Construction activities will disturb intertidal habitats within the proposed development extents through noise, light and physical</p> | <p>The presence of the proposed development will result in the permanent direct loss of intertidal habitats, including c. 800 m² of Annex I</p> | <p>The disturbance to intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', associated with the</p> |

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
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| <p>Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'</p> | <p>disturbance. Noise/vibration and lighting will cause disturbance to invertebrate fauna on the hard and soft intertidal substrates while works are ongoing, but will recover almost immediately. Physical disturbance to such fauna from piling and other construction activities (including demolition of sections of the existing quay wall) may result in mortality of small numbers of individuals of these species. However, there will be no impacts at the population scale and these biological communities will recover fully within 1 year of the disturbance.</p> <p>Water quality impacts arising from any accidental pollution incident associated with the construction of the proposed development would likely affect the overall structure and function of the intertidal habitat. The characteristics of this impact would depend on the nature and quantities of pollutants and the timing and duration of their input into the River Suir, but could involve impacts such as pH stress in the event of spillage of cementitious material or contamination of soft sediments with hydrocarbons in the event of a petrol spill.</p> <p>The impacts of the importation or spread of invasive alien species associated with the construction of the proposed development are assessed under KER 7 below.</p> | <p>'Mudflats and sandflats not covered by seawater at low tide' and a c. 540 m length of upper intertidal quay wall. At the National level, the most recent Article 17 report (NPWS, 2019) states that the total area of Annex I 'Mudflats and sandflats not covered by seawater at low tide' in Ireland is 646 km², 313 km² of which is within SACs. The overall conservation status of this habitat is Inadequate, on the basis that while its range and area are Favourable, its specific structure and functions are Inadequate, and its overall trend is deteriorating. The main pressure and threat is marine pollution. The loss of 800 m² represents a 0.00012% reduction in the national habitat area (0.00026% of the area in SACs). Given the extremely small proportion of this habitat to be lost and the fact that reclamation is not one of the main pressures or threats to this habitat, the conservation status will not be significantly affected.</p> <p>Habitat connectivity, zonation and heterogeneity would also be reduced over the extents of the riverside sheet pile wall due to the constriction of the intertidal mudflat corridor by c. 1.5 m over a length of c. 540 m and the replacement of the existing masonry quay wall with steel sheet piles, which support less diverse biological communities than other, more highly structured/textured materials.</p> | <p>construction of the proposed development is considered to constitute a Short-term Slight-Moderate Negative Impact as it involves fully reversible impacts over a small area and short duration.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur, as they would have the potential to significantly impact on sensitive receptors over a very wide area, but would likely recover in the short term.</p> <p>The permanent direct loss of intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide' is considered to constitute a Permanent Significant Negative Impact in the River Suir. However, the impact of this loss at the National level will be Imperceptible for the reasons outlined in the preceding column.</p> <p>The reduction in habitat connectivity, zonation and heterogeneity would constitute a Long-term Slight-Moderate Negative Impact as habitat connectivity is only partially reduced (in the upper intertidal/during the higher portion on the tidal cycle) and zonation and heterogeneity would partially recover as the sheet pile wall is colonised by macroalgae and invertebrates.</p> |
| <p>KER 3 Shoreline Habitats, including Annex I 'Atlantic salt meadows (<i>Glauco-</i></p> | <p>Water quality impacts arising from any accidental pollution incident associated with the construction of the proposed development would likely affect the overall structure and function of shoreline habitats. The characteristics of this impact would depend on</p> | <p>There will be a very small quantity of direct and permanent loss of extremely narrow strips of vegetation (not representing examples of any Annex I habitat) at the bottom of the existing quay wall within the extents of the proposed</p> | <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur, as they would have the potential to significantly impact on sensitive receptors over</p> |

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
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| <i>Puccinellietalia maritimae</i> ' | <p>the nature and quantities of pollutants and the timing and duration of their input into the River Suir. Specifically, high water levels would be required to directly convey any such impacts to shoreline habitats. Contamination of groundwater or soft substrates may also represent a pathway for such impacts to shoreline habitats. Overall, these habitats are at a reduced risk of exposure to pollution compared with aquatic habitats.</p> <p>The impacts of the importation or spread of invasive alien species associated with the construction of the proposed development are assessed under KER 7 below.</p> | <p>riverside sheet pile wall. There will be no direct loss of any Annex I habitats.</p> | <p>a very wide area, but would likely recover in the short term.</p> <p>The permanent direct loss of shoreline habitats is considered to constitute a Permanent Slight-Imperceptible Negative Impact on the basis that the habitats which would be affected are not of conservation importance and the areas which would be lost are extremely small.</p> |
| KER 4 Fish Species, including Annex II migratory species | <p>The construction of the proposed development would cause hydroacoustic disturbance to fish species. The loudest element of the works is considered to be riverside piling and the most sensitive species by far is Twaite Shad. Based on the analysis in the NIS, startle or stress response by Twaite Shad would occur only within a 100 m radius of 20 minutes of continuous vibratory piling from one rig or 185 m from the same period of simultaneous piling by two rigs. Temporary injury thresholds for Twaite Shad would not be exceeded at more than 71 m from 20 minutes of continuous vibratory piling from one rig or 113 m from the same period of simultaneous piling by two rigs. Temporary injury thresholds for Twaite Shad would not be exceeded at more than 216 m from 200 strikes of an impact hammer. Given the extremely precautionary approach to the calculation of these effect distances, the fact that fish are not stationary, the 140 m width of the River Suir at its narrowest point within the extent of the proposed development, and the short duration of the works, the only risk to</p> | <p>The presence of the proposed development will result in the permanent direct loss of intertidal habitats, including c. 800 m² of habitats which support fish species. These comprise intertidal habitats of hard and soft substrate, hosting biological communities upon which fish species depend for food, e.g. planktonic larvae of encrusting invertebrates. These habitats also provide shelter for fish species, particularly small fish such as juvenile shad, as well as for migratory fish resting at the channel edge during the day between nightly movements upstream. The loss of these habitats represents a reduction in food availability and shelter for these species.</p> <p>Habitat connectivity, zonation and heterogeneity would also be reduced over the extents of the riverside sheet pile wall due to the replacement of the existing masonry quay wall with steel sheet piles, which support less diverse biological communities than other, more highly structured/textured materials. This</p> | <p>In the event of prolonged periods of continuous piling or where breaks between pile drives are not sufficiently long, the hydroacoustic impacts on Twaite Shad and other fish species would constitute a Short-term Moderate-Significant Negative Impact on the basis that injury may occur to fish species of conservation importance, including Qualifying Interests of the Lower River Suir (and River Barrow and River Nore SAC), potentially in numbers that could result in population-scale impacts.</p> <p>Given the short duration of the construction works and very short duration of nightworks, artificial lighting is considered to constitute a Temporary Slight Negative Impact on fish species, including Annex II migratory species.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur, as they would have the potential to</p> |

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
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| | <p>aquatic fauna would be where there are prolonged periods of continuous piling or where breaks between pile drives are not sufficiently long.</p> <p>Artificial lighting during construction, particularly during nightworks, will negatively impact on fish species by disruption of circadian rhythms and increased risk of predation. Over a prolonged period, such impacts can lead to negative effects at the population scale.</p> <p>Fish species are particularly sensitive to water quality impacts, which might arise from accidental pollution incident associated with the construction of the proposed development. The characteristics of this impact would depend on the nature and quantities of pollutants and the timing and duration of their input into the River Suir, but could involve significant physiological stress which could affect local populations.</p> <p>The impacts of the importation or spread of invasive alien species associated with the construction of the proposed development are assessed under KER 7 below.</p> | <p>would result in reduced connectivity for fish species by loss of slow-flow areas at the channel edge and reduced food availability due to the impoverished biological communities on the sheet pile wall.</p> | <p>significantly impact on sensitive receptors over a very wide area, but would likely recover in the short term.</p> <p>The loss of habitat and reduced habitat connectivity, zonation and heterogeneity are considered to constitute a Permanent Significant Negative Impact on the basis that there would be a permanently reduced food supply and lack of channel edge shelter for fish species, including Qualifying Interests of the Lower River Suir (and River Barrow and River Nore SAC).</p> |
| KER 5 Otter | <p>Noise and lighting associated with the construction of the proposed development will potentially cause disturbance to otters in the vicinity of the construction site. However, the effect on any otters disturbed will be limited due to the large area within the River Suir for otters to pass the construction site at a distance, as well as the ability of otters to habituate to human presence, as evidenced by their presence in many urban centres.</p> | <p>The direct and permanent loss of upper intertidal mudflat along a 540 m length represents a loss of commuting habitat for otters, as otters may walk along the mudflats to avoid high flow velocities during mid-ebb and mid-flood. However, the analysis in the NIS demonstrates that otters will be capable of swimming against these flows, so there is no significant barrier to commuting. The loss of access to terrestrial habitat behind the new quay wall will not be significant as the area is small and the habitat is sub-optimal for holting.</p> | <p>Disturbance of otters during the construction of the proposed development would constitute a Short-term Slight-Moderate Negative Impact on the basis that it is limited to the short duration of the works and due to the opportunity for otters to avoid these impacts within the River Suir, as well as otters' known tolerance for human presence in the urban environment.</p> |

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
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| | <p>Water quality impacts arising from any accidental pollution incident associated with the construction of the proposed development may impact otters indirectly, through reduced prey availability if populations of fish and other aquatic fauna, e.g. crustaceans and molluscs, are significantly impacted.</p> <p>The only foreseeable impact on otters from invasive alien species is competition with American Mink for prey. However, this species is extremely unlikely to be introduced or spread as a result of the proposed development.</p> | <p>The reduction in habitat quality for fish and other aquatic fauna poses a risk of indirect impacts on otters through reduced food availability.</p> | <p>Water quality impacts, if they were to occur, would constitute a Medium-term Slight Negative Impact on otters as they would result in reduced populations of prey species, but would be fully reversible in time.</p> <p>The loss of habitats on the northern edge of the River Suir would constitute a Permanent Slight Negative Impact on otters for the reasons outlined in the preceding column.</p> <p>The reduction in aquatic habitat quality would constitute a Permanent Slight-Imperceptible Negative Impact on otters through reduced food availability if populations of prey species were impacted, which would likely be of a very small magnitude. Otters are known to be able to switch prey items quickly in response to availability (Bailey & Rochford, 2006).</p> |
| <p>KER 6 Bat Species</p> | <p>The construction of the proposed development will involve noise and lighting impacts on the banks of the River Suir where bats are likely to commute and forage. This risk of disturbance to bats from noise and lighting is particularly high if nightworks are carried out during the warmer half of the year (April-October) when bats are more likely to be active. Based on the results of the desk study and bat suitability assessment, disturbance to any bat roosts is very unlikely.</p> <p>Bats are very unlikely to be subject to any water quality or invasive alien species impacts as a result of the proposed development.</p> | <p>The operation of the proposed development will not involve any habitat loss or ongoing impacts on bats through lighting or any other form of disturbance.</p> | <p>The impact of disturbance to bats during the construction of the proposed development is considered to constitute a Temporary Slight Negative Impact on foraging and commuting bats on the basis that the number of bats likely to be affected is very low and that, based on the assessment above, those bats are very unlikely to be rare species, e.g. Lesser Horseshoe. Furthermore, the disturbance will end once the construction programme is complete and bats will be able to use this area as before.</p> |
| <p>KER 7 Invasive Alien Species</p> | <p>Construction activities, particularly the haulage and export of equipment, plant and materials to and from the construction site, present a risk of</p> | <p>The operation of the proposed development does not itself provide for the instruction or spread of invasive alien species. However, the</p> | <p>The impacts of invasive alien species, if there were to be significant spread, could constitute Permanent Profound Negative Impacts on</p> |

| Key Ecological Receptor | Construction phase impacts | Operational phase impacts | Ecological significance if unmitigated |
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| | <p>the introduction or spread of invasive alien species in the vicinity of the proposed development. The impacts that these species can have on native biodiversity include competition for food and other resources, increased predation pressure, disease, and reduced habitat integrity (specific structure and function). These impacts can occur over large areas and over long durations (including permanently) and can include the local elimination of some habitats and species.</p> | <p>impoverished biological communities likely to develop on the steel sheet pile wall are more susceptible to invasion by such species (due to lower competition generally associated with the low diversity of these communities). Therefore, the nature of the steel sheet pile wall creates a weak point in the resilience of the habitats in the estuary against invasive alien species, increasing the ongoing risk of establishment and spread should an invasive species be introduced at some point in the future.</p> | <p>the basis that sensitive receptors of International Importance could be profoundly impacted, e.g. if Salmon Fluke (<i>Gyrodactylus salaris</i>) were to be introduced it could cause the local extinction of Atlantic Salmon from the Lower River Suir SAC.</p> |
| <p>KER 8 Nationally Designated Sites</p> | <p>Due to the distance between the proposed development and these nationally designated sites, there is no risk of disturbance impacts.</p> <p>The only sources and pathways from the construction of the proposed development to the sites in question relate to the water quality and invasive alien species impacts discussed above, which pose a risk of reductions in overall habitat quality and species populations in these sites.</p> | <p>There will be no direct or indirect habitat loss or reduction in habitat connectivity, zonation and heterogeneity in any of these sites as a result of the operation of the proposed development. However, there is a very small risk of indirect affects through ecological connections via species populations which might be affected by the operation of the proposed development.</p> | <p>All of the impacts on nationally designated sites relate to either water quality impacts, invasive alien species or ecological connections to impacts on the other receptors, which have already been assessed above. The significance of these impacts is up to Long-term Very Significant Negative Impacts (invasive alien species).</p> |

7.7 Mitigation

This section describes the measures proposed to mitigate any harmful or negative impacts associated with the proposed development on the Key Ecological Receptors, as described in the preceding sections. General mitigation measures included within the design of the proposed development are described first, with more specific measures to prevent or minimise impacts on the individual Key Ecological Receptors provided subsequently.

7.7.1 General Mitigation

Mitigation by Avoidance

The proposed development minimises land-take from ecologically sensitive areas and has been constraints-led from the initial phase, through an iterative design process, and into the final proposed development. The design of the flood defences has followed the basic principles outlined below to eliminate the potential for impacts on Key Ecological Receptors where possible, and to minimise such impacts where total elimination is not possible. The proposed development has been designed to minimise direct or indirect impacts on any habitats or species or other ecological features that were classified as being of Local Importance (Higher Value) or above. The alignment of the proposed flood defence wall has been designed to avoid, as far as possible, direct, indirect or secondary adverse effects on European sites and other designated sites for nature conservation. The final design of the flood defences has been developed with consideration of the following:

- Annex I habitat 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' was located under the original footprint of the proposed flood defences and has now been avoided through the iterative design process.
- Significant impacts on migratory fish species, particularly Twaite Shad, were reduced by selecting an option for the flood defences that required the least amount of night-works, which would result in a much longer construction programme and present significantly greater risks of medium- to long-term population-scale impacts.

Mitigation by Design

The proposed development has been designed having regard to European and national legislation and all relevant guidelines and engineering best practice for the planning and construction of developments. These guidelines and best practice provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment.

7.7.2 Specific Mitigation Measures

KER 1 River Suir, including Annex I 'Estuaries'

This subsection described the mitigation proposed for general impacts on biodiversity in and immediately adjacent to the River Suir. Mitigation specific to other individual Key Ecological Receptors is described separately in relation to each of the Key Ecological Receptors.

Habitat Loss, Fragmentation and Degradation

As discussed in the assessment of impacts above, the principal impact of the proposed development on the River Suir relates to the direct and indirect loss, fragmentation and degradation of intertidal and shoreline habitats. The direct loss of c. 800m² of intertidal habitat cannot be avoided through design. However, indirect loss can be avoided and

fragmentation and degradation mitigated through the ecological enhancement of the riverside sections of the new sheet pile flood defence wall.

This enhancement will be provided by the attachment of highly structured or bio-active pre-cast concrete cladding (“eco-cladding”) to the intertidal river face of the riverside sheet pile section of the new flood defence wall (see photomontages in Figures 11.1 and 11.2 in Volume 3 of this EIAR). The physical structure of this cladding will mitigate these impacts as follows:

- Any indirect loss of intertidal mudflats which might result from erosion associated with increased flow velocities immediately adjacent to the riverside sheet pile wall will be mitigated by the “rough” surface of the cladding, which will reduce flow velocities immediately adjacent to the wall. This will safeguard the remaining mudflats and shoreline habitats from the effects of erosion.
- The highly structured surface of the cladding will maximise the opportunity for biological communities of hard intertidal substrates to colonise the new wall. The structure and composition of these communities will depend on the structure of the wall and the communities already present in the River Suir, which will act as a source to “seed” the cladding with encrusting organisms, including macroalgae (“seaweeds”) and bivalve molluscs. The physical structure will also provide shelter/habitat for mobile species such as crabs and small fish.
- As the biological communities develop, particularly the seaweed, e.g. *Fucus* spp., the flow velocity moderation provided by the cladding will be enhanced, providing further protection against erosion for mudflats and shoreline habitats. Depending on the magnitude of this effect, over time, this may lead to an indirect recovery of a small portion of the mudflat habitat lost and, consequently, a slight increase in the area of saltmarsh (though this is unlikely to be significant).
- Once fully developed, the biological communities on the cladding would act as a source of food for a wide range of aquatic fauna in the River Suir and also as a reservoir of larvae or “seed” for the colonisation of other hard intertidal substrates elsewhere in the Suir Estuary.
- The flow velocity moderation provided by the cladding would also benefit fish and other mobile species, as discussed under *KER 4 Fish Species, including Annex II migratory species*. This addresses the habitat fragmentation impact.

The quantum of each benefit will depend on the final specification, e.g. the roughness of the surface and whether or not the cladding incorporates ledges or “shelves” to encourage shoreline vegetation at the top and/or accumulation of narrow strips of intertidal mudflats in the upper and mid-littoral zones. Incorporation of such features would further enhance the biodiversity value of the new flood defence wall through the provision of greater habitat zonation, heterogeneity and connectivity.

Assuming the specification of an appropriate cladding for the new riverside sheet pile wall, the replacement of intertidal mudflats (of high biodiversity value) and existing quay wall (of moderate biodiversity value) with a new sheet pile wall (of very low biodiversity value) would be mitigated as the cladding would increase the biodiversity of the new riverside flood defence wall to moderate-high (the as the overall value of the habitats being lost). While the loss of mudflat habitat is permanent and unmitigable, there would be No Net Loss of Biodiversity within the River Suir. Similarly, there would be no adverse effect on the conservation status of Annex I ‘Estuaries’.

This mitigation would also contribute to the achievement of the policies and objectives set out in the National Biodiversity Action Plan, the RSES for the Southern Region and the Waterford City Development Plan with regard to the protection and enhancement

of the biodiversity value of ecological features and the provision of green infrastructure (and blue infrastructure), particularly in urbanised environments.

Artificial Lighting

As discussed in the assessment of impacts above, artificial lighting associated with the construction of the proposed development poses a risk of potential negative impacts on habitats and species in and adjacent to the River Suir. Therefore, the following limits on construction lighting is proposed:

- Subject to any Health & Safety and/or navigational requirements, construction lighting over the river channel shall be turned off outside of working hours.
- Construction lighting shall be limited to the minimum area required to be lit and minimise light spill to areas not required for construction.
- In order to further limit any light spill, solid hoarding shall be erected around areas which will be subject to night-time construction activities.

Given the implementation of the above measures and the short duration of night-time construction activities (6-8 weeks), these works are unlikely to give rise to significant impacts beyond the duration of the works and, therefore, no additional mitigation is proposed in relation to these works.

As there will be no new artificial lighting associated with the operation of the proposed development, no mitigation is proposed in relation to lighting for the operational phase.

Water Quality

As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and Construction Environmental Management Plan (CEMP) have been prepared for the Flood Defences West and are included in Appendix 4.1 and Appendix 1.4A in this EIAR, respectively. These will be updated and finalised by the selected contractor to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team. In doing so, the measures detailed in the appended reports will be considered minimum requirements to be considered and improved upon. The level of detail provided within the Plans is sufficient to allow an assessment of the anticipated impacts including residual impacts.

The following will be implemented as part of this plan:

- An Incident Response Plan (see Appendix 4.1 C) detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance with any permit or license, or other such risks that could lead to a pollution incident, including flood risks.
- All necessary permits and licenses for in stream construction work for provision of the flood defences will be obtained prior to the commencement of construction.
- Inform and consult with Inland Fisheries Ireland.

During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.

- *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016)
- *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001)
- *CIRIA C648 C648 Control of water pollution from linear construction projects: technical guidance* (CIRIA, 2006)

- *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes* (NRA, 2006)

Based on the above guidance documents, the following principal mitigation measures will be adhered to for the construction phase:

General Mitigation Measures

- Site works will be limited to the minimum required to construct the necessary elements of the proposed development.
- Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels or cut-off ditches.
- Management of excess material stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be undertaken. This may involve allowing the establishment of vegetation on the exposed soil and bunding.
- Protection of waterbodies from silt load will be carried out through the use of gully silt/sediment filters and shallow berms in hardstanding areas to provide adequate treatment of run-off to watercourses.
- Settlement tanks, silt traps/bags and bunds will be used. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.
- The anticipated site compounds/storage facility will be fenced off at a minimum distance of 5m from the top of the edge of the quay wall/river edge. Any works within the 10m buffer zone will require measures to be implemented to ensure that silt-laden or contaminated surface water run-off from the compound does not discharge directly to the watercourse. See the EOP and Construction Environmental Management Plan in Appendix 4.1 and 4.1 A of this EIAR for further detail.
- Protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with NRA (2008d). All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 20m from watercourses.
- Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner, off site, to prevent pollution.
- The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses.

Specific Mitigation Measures - Concrete Works

Remedial works to the existing masonry quay wall and increasing its height will require the use of in-situ concrete. The use and management of concrete in or close to watercourses must be carefully controlled to avoid spillage which has a deleterious effect on water chemistry and aquatic habitats and species. As the use of concrete cannot be avoided, the following control measures will be employed:

- Sandbags or an aqua-dam will be in place for the duration of remedial works to the existing quay wall to effectively isolate the area beneath these works from the River Suir and thereby control the risk of pollutants entering the river. This mitigation shall be removed once the remedial works are complete.
- Hydrophilic grout and quick-setting mixes or rapid hardener additives shall be used to promote the early set of concrete surfaces exposed to water.

- When working in or near the surface water and the application of in-situ materials cannot be avoided, the use of alternative materials such as biodegradable shutter oils shall be used.
- Any plant operating close to the water will require special consideration on the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.
- Placing of concrete in or near watercourses will be carried out only under the supervision of the Ecological Clerk of Works (ECoW).
- The weather forecast will be consulted prior to commencing concrete pours. No such works will be undertaken if wet weather is forecast such that precipitation may make it difficult to maintain a dry working area.
- There will be no spills of concrete, cement, grout or similar materials hosed into surface water drains. Such spills shall be contained immediately and any run-off shall be prevented from entering the watercourse.
- Concrete waste and wash-down water shall be contained and managed on site to prevent pollution of all surface watercourses.
- On-site concrete batching and mixing activities shall only be permitted within the identified construction compounds.
- Washout from concrete lorries, with the exception of the chute, will not be permitted on site and will only take place at the construction compound (or other appropriate facility designated by the manufacturer).
- Chute washout shall be carried out at designated locations only. These locations will be signposted. The concrete plant and all delivery drivers will be informed of their location with the order information and on arrival to site.
- Chute washout locations will be provided with an appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks. The clear water from the settlement tanks shall be pH corrected prior to discharge (which shall be by means of one of the construction stage settlement facilities) or alternatively disposed of as waste in accordance with the Contractor's Construction and Demolition Waste Management Plan.

Operational Phase

The only potential water quality impacts associated with the operational phase relate to accidental spillage of paint which will be used in the periodic (approximately every 10 years) repainting of the exposed sections of the new sheet pile flood defence wall. In order to control this risk, the paint specified for this purpose shall not contain lead or tributyltin (TBT) or shall be otherwise approved for use near water.

Invasive Alien Species

Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under *KER 7 Invasive Alien Species*. Given the full and proper implementation of that mitigation, the proposed development does not pose a significant risk to Biodiversity in the River Suir in terms of the introduction or spread of invasive alien species.

KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'

Habitat Loss, Fragmentation and Degradation

As discussed under *KER 1 River Suir, including Annex I 'Estuaries'*, the direct loss of c. 800m² of intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', cannot be avoided through design. However, indirect loss can be avoided and fragmentation and degradation mitigated through the provision of a highly structured or bio-active pre-cast concrete cladding, such as that described in relation to KER 1, to the outside of the riverside sheet pile wall. While the loss of mudflat habitat is permanent and unmitigable, there would be No Net Loss of Biodiversity with regard to the intertidal habitats at this location and the effect on the conservation status of Annex I 'Mudflats and sandflats not covered by seawater at low tide' would be imperceptible at the National level.

Water Quality

The measures described under *KER 1 River Suir, including Annex I 'Estuaries'* relating to the protection of water quality during the construction of the proposed development will ensure that the impact on intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', arising from accidental pollution associated with the proposed development would not give rise to significant effects on those habitats.

Invasive Alien Species

Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under *KER 7 Invasive Alien Species*. Given the full and proper implementation of that mitigation, the proposed development does not pose a significant risk to intertidal habitats in terms of the introduction or spread of invasive alien species.

KER 3 Shoreline Habitats, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)'

Habitat Loss

A number of small areas of rough grassland habitats between the railway line and the River Suir will be lost as a result of the proposed development. Given the isolation of these habitats from the River Suir by the new flood defence wall and other habitats to the north by the railway line, it was not deemed appropriate to reinstate or improve these habitats as there is a risk to fauna, e.g. Otter, crossing the railway line to access them. Thus, the loss of these habitats is permanent, but is of low magnitude given the low biodiversity value of these habitats and their small extents.

Any direct losses of saltmarshes and other shoreline habitats of high biodiversity value, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)', have been largely avoided through the iterative design process. In particular, direct loss of the area of c. 106m² of Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' has been avoided entirely through moving the western tie-in point of the new flood defence wall, which was originally to transition back behind the existing quay wall at Ch. 950 (within this habitat), to its new position at Ch. 900, which is 25m further east than the most westerly point of the Annex I saltmarsh. Furthermore, the proposed eco-cladding described under *KER 1 River Suir, including Annex I 'Estuaries'* will further safeguard saltmarsh habitats from future erosion by reducing flow velocities along the shoreline. There are no other areas of Annex I saltmarsh within the extents of the proposed development.

Other shoreline habitats include extremely narrow strips of ruderal vegetation on the existing quay wall and at the bottom of the same in places. This vegetation will be lost, but can be fully replaced through specification of an appropriate eco-cladding as described under *KER 1 River Suir, including Annex I 'Estuaries'*.

Disturbance

In order to provide further protection for 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' from disturbance during the construction stage, the areas of confirmed or potential Annex I saltmarsh habitats identified in this EIAR shall not be included within the lands made available to the Contractor and it shall be made clear on all contract drawings that these areas contain sensitive habitats and shall not be disturbed. The Site Environmental Manager (SEM) and Ecological Clerk of Works (ECoW) shall also highlight the sensitivity of these habitats (and need to avoid disturbance of the same) during tool-box talks and other relevant communications with site personnel.

Water Quality

The measures described under *KER 1 River Suir, including Annex I 'Estuaries'* relating to the protection of water quality during the construction of the proposed development will ensure that the impact on shoreline habitats, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)', arising from accidental pollution associated with the proposed development would not give rise to significant effects on those habitats in terms of habitat degradation.

Invasive Alien Species

Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under *KER 7 Invasive Alien Species*. Given the full and proper implementation of that mitigation, the proposed development does not pose a significant risk to shoreline habitats, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)', in terms of the introduction or spread of invasive alien species, especially Common Cordgrass (*Spartina anglica*).

KER 4 Fish Species, including Annex II migratory species

Mitigation measures prescribed for fish species below are relevant for nocturnal and diurnal fish species, fish of small body size and hearing specialists (fish with highly specialised auditory organs). The rationale for this mitigation is fully detailed in the NIS for the proposed development (included as part of this Planning Application).

Habitat Loss

The only fish habitat will be lost is the c. 800m² of intertidal habitats on the left (north) bank of the River Suir where these are being reclaimed by the new flood defence wall. The mitigation which is being provided for the loss of these habitats includes the provision of eco-cladding, which is described in detail above in relation to *KER 1 River Suir, including Annex I 'Estuaries'*. The positive effects of the eco-cladding are relevant to fish species as follows:

- It will provide the physical habitat conditions for quick establishment of biological communities of hard intertidal substrates, supporting macroalgae ("seaweeds"), crustaceans and fish. The establishment of such communities and consequent production of planktonic larvae will provide food for fish, including species of conservation importance, e.g. Twaite Shad.
- It will mitigate against increased flow velocities at the channel edge resulting from the presence of the new sheet pile wall, which will facilitate movement against the tide by fish, especially small fish such as juvenile Twaite Shad.

Hydraulic Impacts

Predictions made from the hydrodynamic model for the proposed flood defences show that there would be a slight increase in flow velocity immediately adjacent to a sheet piled wall. While this will not lead to significant effects in the form of erosion of habitats within or on the banks of the River Suir, the rate of deposition will be slightly decreased. The measures described under *KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'* relating to installation of eco-cladding will ensure that the impact on shoreline habitats, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)', is further reduced as the textured cladding will aid in slowing the rate of flow.

Hydroacoustic Impacts

The mitigation for hydroacoustic impacts is as follows ("piling event" means any period of continuous piling by one or two rigs; "quiet period" means any period in which there is no piling by any rig):

- Night-time piling shall be limited to the minimum number of shifts possible and shall only be permitted for landside piling.
- In-stream (riverside) piling shall be restricted to daytime shifts only.
- Vibratory piling shall be the standard method for the installation of all piles. Impact piling shall only be employed where the required depth below ground cannot be achieved by vibratory piling.
- No more than two piling rigs shall operate simultaneously at any time.
- The duration of any *vibratory* piling event shall not exceed 55 piling minutes, i.e. the duration of piling by one rig or the sum of the duration of piling by two rigs shall not exceed 55 minutes.
- The length of any *impact* piling event shall not exceed 200 strikes from one piling rig (or 200 strikes from *each* of two piling rigs, if piling simultaneously).
- Following every piling event, there shall be a quiet period of at least 30 minutes. Only following 30 minutes of no piling whatsoever can the cumulation of piling minutes be re-zeroed.
- The above limitations apply to all piling activity for the proposed development, riverside and landside, daytime and night-time, permanent and temporary.

Based on the expected time required for the installation of each pile (including ancillary processes), as described in Section 4.2.4, the limits prescribed above will not prolong the proposed programme for riverside or landside piling. Therefore, they are feasible within the proposed construction methodology and do not give rise to any additional effects on fish through extension of the total duration of impacts.

Based on the detailed hydroacoustic impact assessment presented in the NIS, there is no necessity for daily/nightly or seasonal restrictions on piling activities or the use of soft-start/ramp-up procedures.

Artificial Lighting

The measures described under *KER 1 River Suir, including Annex I 'Estuaries'* relating to the artificial lighting during the construction of the proposed development will ensure that the impact on fish species, including Annex II migratory species, arising from artificial lighting from the proposed development will not give rise to significant effects

on the populations of those species. There are no lighting impacts associated with the operational phase.

Water Quality

The measures described under *KER 1 River Suir, including Annex I 'Estuaries'* relating to the protection of water quality during the construction of the proposed development will ensure that the impact on fish species, including Annex II migratory species, arising from accidental pollution associated with the proposed development will not give rise to significant effects on the populations of those species.

Fish Rescue

During de-watering of temporary cofferdams for the construction of drainage outfalls, any fish remaining within the cofferdams will be collected (by netting) and released into the River Suir outside the cofferdams. These fish rescue operations shall be carried out under the supervision of IFI. Given the Health and Safety implications of working within a still cofferdam in a partially saline environment, the use of electrofishing is not considered to be appropriate in this case.

KER 5 Otter

Disturbance (Lighting and Noise)

The mitigation proposed under *KER 1 River Suir, including Annex I 'Estuaries'*, for lighting impacts, and under *KER 4 Fish Species, including Annex II migratory species*, for noise impacts, are considered sufficient to eliminate any risk of significant direct and indirect disturbance of otters during the construction of the proposed development. There are no sources of disturbance to otters arising from the operational phase.

Prey Biomass Availability

The measures described under *KER 1 River Suir, including Annex I 'Estuaries'* relating to the protection of water quality during the construction of the proposed development will ensure that the impact on fish and other prey species for otters which might arise from accidental pollution associated with the proposed development will not lead to any reduction in the prey biomass available for otters.

Furthermore, the implementation of the general mitigation of impacts on the River Suir and intertidal habitats, i.e. the proposed eco-cladding for the riverside flood defence wall, will likely lead to a slight increase in the total biomass available to otters in the long term.

KER 6 Bats

Disturbance (Lighting and Noise)

The mitigation proposed under *KER 1 River Suir, including Annex I 'Estuaries'*, for lighting impacts, and under *KER 4 Fish Species, including Annex II migratory species*, for noise impacts, are considered sufficient to eliminate any risk of significant direct and indirect disturbance of bats during the construction of the proposed development. There are no sources of disturbance to bats arising from the operational phase.

KER 7 Invasive Alien Species

Terrestrial Plant Species

In order to minimise the risk of the introduction or spread of invasive alien plant species (IAPS) during construction, all land-based works shall be executed in accordance with best practice for biosecurity in construction. In particular, prior to commencement, the Contractor shall prepare a detailed Biosecurity Protocol describing his/her proposed

approach to ensuring that IAPS are not imported or spread during the construction of the proposed development. The Contractor's Biosecurity Protocol shall be in accordance with *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance* (TII, 2020) and subject to approval by the Ecological Clerk of Works (ECoW) prior to its acceptance and implementation. The Biosecurity Protocol shall include, as a minimum, the following measures to prevent the spread of invasive species:

- Good construction site hygiene will be employed to prevent the introduction and spread of problematic IAPS (especially Japanese Knotweed) by thoroughly washing vehicles prior to leaving any site.
- All plant and equipment employed on the construction site (e.g. excavators, piling equipment etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of IAPS.
- All washing must be undertaken in areas with no potential to result in the spread of IAPS, as detailed in the Construction Environmental Management Plan.
- Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any IAPS and where it is confirmed that none are present.

If possible, the known stand of Japanese Knotweed at the location of the proposed main construction compound should be eradicated prior to commencement of construction. Given the proximity of this stand to habitats of conservation importance, i.e. habitats within the Lower River Suir SAC, preference should be given to physical removal rather than chemical control.

If for programme or other reasons the known stand of Japanese Knotweed cannot be eradicated prior to construction, it should be fenced off (at a distance of 7m from all visible parts of the plant) at the outset and the access prohibited except for monitoring or treatment purposes. All site staff shall be made aware of the Contractor's Biosecurity Protocol and receive training in the importance of good site biosecurity.

Pioneer Species

The invasive pioneer species Common Cordgrass (*Spartina anglica*) was previously recorded on intertidal mudflats in the River Suir within 500 m of the construction site (in the vicinity of the North Quays Development site and Sustainable Transport Bridge). According to the *Saltmarsh Monitoring Project 2007-2008* (McCorry & Ryle, 2009):

"A general policy of active Common Cordgrass control in Irish saltmarshes is not recommended. [...] It is recommended that instead of attempting to control or manage established populations of Common Cordgrass in Ireland, the primary policy should be that any available resources should be used to prevent the spread of this species to new sites."

In addition to the measures detailed below in relation to aquatic species, the following shall apply to all works on and adjacent to the mudflats:

- Vehicles, vessels, plant, equipment, PPE, construction materials or excavated material shall not be moved directly from areas known to contain Common Cordgrass, e.g. the mudflats in the vicinity of the approved Sustainable Transport Bridge and North Quays Development site, without first having been inspected by the Ecological Clerk of Works (ECoW) and authorised by the Site Environmental Manager (SEM).

- Any material excavated from the mudflats, e.g. for the construction of drainage outfalls, shall be stored in a location where it is not at risk of colonisation by Common Cordgrass and shall be reinstated as quickly as possible.

Aquatic Species

The use of barges during the construction of the proposed development poses the risk of introducing invasive alien species to the aquatic environment both in the vicinity of the works and in the wider Suir-Barrow-Nore Estuary. This has the potential to significantly affect the integrity of aquatic and intertidal habitats in the Zone of Influence. In order to minimise the risk of either the introduction or spread of aquatic invasive alien species and thereby avoid negative impacts on these habitats, the owner or operator of the barge or barges shall:

- Provide documentary evidence (in the form of a completed and signed Marine Institute “*Cleaning and Disinfection Declaration Form*”) that the vessel was fully de-fouled within the 6 months immediately preceding its engagement in the construction of the proposed development; and,
- Submit travel records relating to the vessel’s movements during, at a minimum, the 6 months immediately preceding its engagement in the construction of the proposed development.

In order to ensure full compliance with the above, authorisation to move the vessel to the construction area shall only be granted once the Ecological Clerk of Works (ECoW) has satisfied him/herself that the vessel does not pose a significant risk of importing aquatic invasive alien species to the Suir-Barrow-Nore Estuary. He/she shall do so by:

- Boarding the vessel;
- Speaking with the skipper;
- Inspecting the relevant documents; and,
- Carrying out a final inspection of the vessel.

In relation to other construction activities, including pre-construction surveys and any other site inspections, the principles and appropriate measures in the IFI guidance document *Biosecurity Protocol for Field Survey Work* (IFI, 2010) shall be followed and shall form part of the Contractor’s Biosecurity protocol.

KER 8 Nationally Designated Sites

As explained in the assessment of impact above, due to the distances between the proposed development and the pNHAs in the Zone of Influence, the only complete source-pathway-receptor chains are those relating to water quality impacts, invasive alien species and migratory or highly mobile species, i.e. fish species and Otter. The mitigation measures proposed in relation to each of those is already described in detail under KERs 1, 4, 5 and 7 above and are deemed sufficient to eliminate any risk of such impacts on these sites.

7.7.3 Monitoring

Hydroacoustic Impacts

In order to allow for greater accuracy in the assessment of future plans and projects, it is recommended that hydroacoustic monitoring be undertaken for the full duration of the proposed development’s construction. This monitoring should establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) and more accurately characterise the sound outputs in terms of both peak and root-mean-squared sound pressure level, as well as sound exposure level, at different frequencies

arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be carried out by specialist underwater noise surveyors and the results will be frequently reviewed (at least fortnightly) by the Ecological Clerk of Works (ECoW).

Record of Habitats

In order to maintain an accurate and precise record of changes to intertidal and shoreline habitats, particularly mudflats and saltmarshes, a photographic record shall be made of these habitats. This record shall cover both sides of the river from 150m upstream of the new flood defence wall to 300m downstream. All photographs shall be taken at low tide, every 2 months, beginning 6 months prior to commencement of construction and finishing 12 months after completion.

In addition, in order to accurately and precisely record any change in the structure and composition of biological communities of hard and soft intertidal substrates, sampling and analysis of these habitats shall be carried out at 6 months, 1 year, 2 years and 5 years post-construction. To facilitate meaningful comparative analysis and evaluation of the impacts of the proposed development, the sampling and analysis should follow the methodology employed by BEC Consultants Ltd in carrying out the pre-planning benthic surveys on 15th March 2021 (see Brophy (2021) in Appendix 7.1).

Water Quality

Water quality monitoring will be undertaken in the River Suir, with monthly samples being taken from at least 6 months prior to commencement of construction until at least 24 months post-completion. Water samples will be taken from at least two locations. The final number and location of sampling points will be determined by the Site Environmental Manager (SEM). The results of the water quality monitoring programme will be reviewed by the SEM and the ECoW on an ongoing basis during construction. In the event of any non-compliance with regulatory limits for any of the water quality parameters monitored, an investigation will be undertaken to identify the source of this non-compliance and corrective action will be taken where this is deemed to be associated with the proposed development.

7.7.4 Implementation

In order to give effect to the mitigation prescribed in this EIAR, it should be a condition of any consent granted in respect of the proposed development that all of the mitigation, including monitoring and enforcement, prescribed in this EIAR be binding, during the construction phase, on the Contractor and, during operational phase, on WCCC. Accordingly, all of the mitigation prescribed herein shall be transposed into the Contract Documents for the construction of the proposed development.

During construction, all works must comply with relevant legislation and guidelines in order to reduce and minimise environmental impacts and to protect all ecological receptors. In particular, there must be full compliance with the following:

- The Schedule of Commitments.
- The mitigation prescribed in this Chapter of the EIAR and in the NIS.
- Any conditions which might be attached to the proposed development's planning consent.
- Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:
 - *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016)

- All applicable legislative requirements in relation to environmental protection.
- All relevant construction industry guidelines, including:
 - *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001)
- Any biosecurity requirements arising from the preceding points.
- The Transport Infrastructure Ireland (TII) and National Roads Authority (NRA) Environmental Assessment and Construction Guidelines, specifically:
 - *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*
 - *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes*
 - *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*
 - *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*
 - *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*
 - *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes*
 - *Management of Waste from National Road Construction Projects*
 - *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan*

This list is non-exhaustive. All environmental commitments/requirements and relevant legislation and guidelines which are current at the time of construction will be followed.

Environmental Operating Plan

Appendix 4.1 of this EIAR contains the Environmental Operating Plan (EOP) which shall be finalised by the Contractor, in agreement with Waterford City and County Council, prior to the commencement of the construction phase.

The EOP is a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of developments. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractor during the construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of the Board's decision (if approving the proposed development) will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.

Before any works commence on site, the Contractor will be required to prepare an Environmental Operating Plan (EOP) in accordance with the TII/NRA Guidelines for the Creation and Maintenance of an Environmental Operating Plan. The EOP will set out the Contractor's approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include, as a minimum:

- All environmental commitments and mitigation stipulated in the planning documentation in respect of the proposed development, including sediment

controls and other measures to ensure that water quality in the River Suir and Waterford Harbour is not degraded.

- Any requirements of statutory bodies such as the NPWS and IFI, including adherence to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- A detailed Biosecurity Protocol.
- A list of all applicable legislative requirements in relation to environmental protection and a method of documenting compliance with these requirements.
- Outline methods by which construction activities will be managed in such a manner as to avoid, reduce or remedy potential negative impacts on the environment.

To oversee the implementation of the EOP, the Contractors will be required to appoint a person to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.

The EOP has been appended (Appendix 4.1). This is a preliminary document, which will be updated and finalised by the successful Contractor. Appended to the EOP are the following constituent plans, also to be finalised by the Contractor:

Appendix A: Construction Environmental Management Plan (CEMP)

Appendix B: Construction and Demolition Waste Management Plan (CDWMP)

Appendix C: Incident Response Plan (IRP)

Each of these plans is discussed in the following sections. The obligation to develop, maintain and implement the EOP and all of the above-listed plans will form part of the contract documents for the construction phase.

Construction Environmental Management Plan

Prior to any demolition, excavation or construction a Construction Environmental Management Plan (CEMP) will be produced by the successful contractors for each element of the proposed development. The CEMP will set out the Contractor's overall management and administration of the construction project. A Construction Environmental Management Plan has also been prepared as part of this EIAR, see Appendix A of Appendix 4.1. The CEMP will be developed by the Contractors during the pre-construction phase, to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the Environmental Operating Plan (EOP).

The CEMP will contain the following information of general importance:

- An overview of the proposed development.
- An organisational chart illustrating the structure of the Contractor's project team and the duties and responsibilities of the various members.
- The Contractor's communications strategy.
- The contact details of relevant persons/entities, e.g. the Safety Officer, the Site Environmental Manager and the emergency services.
- A list of the documents which will have informed the CEMP, including all relevant legislation and construction/environmental guidelines.

In relation to environmental management, the CEMP will provide a full list of the Contractor's environmental commitments and will detail the Contractor's approach to the following:

- Details of working hours and days.
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services.
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages).
- Details of construction plant storage, temporary offices.
- Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff).
- Dust management to prevent nuisance (demolition & construction).
- Control of sediment, run-off, erosion and pollution.
- Noise and vibration management to prevent nuisance (demolition & construction).
- Landscape management.
- Management of contaminated land and assessment of risk for same by suitably qualified, trained and licenced personnel.
- Management of waste arising from construction and demolition.
- Minimisation of artificial lighting and shading.
- Management of risk from invasive alien species
- Stockpiles.
- Project procedures & method statements for:
 - Site clearance, site investigations, excavations
 - Diversion of services.
 - Excavation and blasting (through peat, soils & bedrock).
 - Piling.
 - Temporary hoarding & lighting.
 - Borrow Pits & location of crushing plant.
 - Storage and Treatment of peat and soft soils.
 - Disposal of surplus geological material (peat, soils, rock etc.).
 - Earthworks material improvement.
 - Protection of watercourses from contamination and silting during construction.
 - Works from a barge, including protection of watercourses from contamination when working in-river
- Site Compounds.

- Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments.

The production of the CEMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.

Construction and Demolition Waste Management Plan

The CDWMP sets out the Contractor's strategy (and measures required) to ensure that waste arising during the construction and demolition phase of the proposed development will be managed and disposed of in a way that ensures the provisions of European and Irish waste legislation (particularly the Waste Management Acts 1996 – 2011) are complied with, and to ensure that waste is managed in accordance with waste hierarchy insofar as possible.

The finalised CDWMP will contain the following information:

- Material transport routes;
- Methods by which construction works shall be managed in accordance with the relevant legislative instruments, including but not limited to:
 - An analysis of the different waste streams expected to be generated;
 - A demolition plan, with the purpose of ensuring that demolition occurs in an orderly fashion so that the re-use and recycling of the resultant materials is given due priority;
 - Details of waste storage (e.g. skips, bins, containers) to be provided for different waste streams and collection times;
 - Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;
 - Details of storage areas for waste materials and containers;
 - Details of how unsuitable excess materials will be disposed of, where necessary; and
 - Details of how and where hazardous wastes, such as contaminated land, hydrocarbons and other hazardous substances, are to be stored and disposed of in a suitable manner;
- Estimates of waste management costs;
- Specific waste management objectives for the project;
- Identification of the roles and responsibilities of the relevant personnel regarding waste management;
- Procedures for communication and training in relation to on-site waste management;
- Record keeping procedures; and
- Details of an audit system to monitor implementation of the CDWMP.

The CDWMP is appended to the EOP (i.e. Appendix B of Appendix 4.1). The plan shall be finalised by the successful Contractor, in agreement with WCCC, and in accordance with TII's guidelines on *The Management of Waste from National Road Construction Projects* (2017), the *TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* (2007) and the Department of the Environment, Housing and Local Government's *Best Practice Guidelines on the*

Preparation of Waste Management Plans for Construction and Demolition Projects (2006). This will be a live document, which will be amended and updated to reflect the policy context, as well as conditions on site, as the construction of the proposed development progresses.

Incident Response Plan

The Incident Response Plan (IRP) describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts during the construction stage of the proposed development are prompt, efficient, and appropriate to particular circumstances.

The Contractor will finalise the IRP prior to the commencement of the proposed works to include the following information, at a minimum:

- Contact names and telephone numbers for the local authority, i.e. WCCC (all sections and departments), An Garda Síochána and ambulance and fire services; and,
- Method statements for weather forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour. The plan must outline how the Contractor will respond to forecasted flood events, including but not limited to, details of removal of site materials, fuels, tools, vehicles and persons from flood zones.
- The measures to be taken to avoid or reduce the incident risk potential;
- Reference to the method statement and management plans for construction activities, insofar as they are relevant for the purposes of mitigating against health and safety and pollution incidents;
- Procedures to be adopted to contain, limit and mitigate any adverse effects, as far as reasonably practicable, in the event of a health and safety or pollution incident;
- Persons responsible for dealing with incidents and their contact details;
- Procedures for alerting key staff, appropriate emergency services, authorities, the Employer's Representative and clean-up companies, where required, and contact details of same;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required, and contact details of same;
- Standby / rota systems; and
- The types and location of emergency response equipment available and appropriate personal protective equipment to be worn.

An IRP has been appended to the EOP (i.e., Appendix C of Appendix 4.1). The document in its current form will be finalised by the successful Contractor prior to the commencement of the construction phase of the proposed development.

Site Environmental Manager

To ensure the successful development, implementation and maintenance of the EOP, the Contractor will appoint an independent Site Environmental Manager (SEM). He/she must possess training, experience and knowledge appropriate to the role, including a National Framework of Qualifications (NFQ) Level 8 qualification (or equivalent) or other acceptable qualification in environmental science, environmental management, hydrology or engineering. The principal functions of the SEM will be to

ensure that the mitigation prescribed in the NIS, this EIAR, the CEMP, the EOP and the CDWMP, is fully and properly implemented and to monitor the construction stage from an environmental perspective. The SEM will also provide independently verifiable audit reports.

Separate from the on-going and detailed monitoring carried out by the Contractor as part of the EOP, the SEM will carry out the inspection and monitoring described below on behalf of WCCC. The results will be stored in the SEM's monitoring file and will be available for inspection or audit by WCCC, the NPWS or IFI.

- Daily reporting on weather and flood forecasting and daily reporting on the monitoring of water levels in the River Suir.
- Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor.
- Daily inspections of surface water treatment measures.
- Daily inspections of all outfalls to watercourses.
- Daily visual inspections of watercourse to which there are discharges from the works and those in the vicinity of construction works.
- Weekly inspections of wheel-wash facilities.
- Daily monitoring of any stockpiles.
- Auditing at least six times per quarter of the Contractor's EOP monitoring results.

Ecological Clerk of Works

In order to ensure the successful development and implementation of the CEMP, an independent Ecological Clerk of Works (ECoW) will be appointed. The ECoW must possess training, experience and knowledge appropriate to the role, including:

- An NFQ Level 8 qualification or equivalent or other acceptable qualification in ecology or environmental biology; and,
- Demonstrable experience in the protection of European sites.

The principal functions of the ECoW are:

- To provide ecological supervision of the construction of the proposed development and thereby ensure the full and proper implementation of the mitigation prescribed in this Chapter 7 and in the NIS;
- To highlight the sensitivity of 'Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)', and the need to avoid disturbance of the same, during tool-box talks and other relevant communications with site personnel.
- To regularly review the outcome of the ongoing monitoring during construction (as described in Section 5.2.7 of the NIS);
- To carry out inspections of all vehicles, vessels, plant, equipment, PPE, construction materials or excavated materials prior to their movement from areas known to contain invasive alien species; and,
- To carry out weekly inspections and reporting on the implementation of the Contractor's Biosecurity Protocol.

During the preparation of the Contractor's EOP, the SEM may, as appropriate, assign other duties and responsibilities to the ECoW. In exercising his/her functions, the ECoW will be required to keep a monitoring file and this will be made available for inspection or audit by WCCC, the NPWS or IFI at any time.

7.8 Residual Impacts on Key Ecological Receptors

Table 7.16 below assesses the significance of the residual impacts on the Key Ecological Receptors following the inclusion of the mitigation measures described in Section 7.7.

Table 7.16 Assessment of significance of residual impacts, following EPA (2017) and NRA (2009).

| Key Ecological Receptor | Pre-mitigation impacts | Ecological significance following mitigation |
|--|--|---|
| <p>KER 1 River Suir, including Annex I 'Estuaries'</p> | <p>The disturbance to the River Suir, including Annex I 'Estuaries', associated with the construction of the proposed development is considered to constitute a Temporary Slight-Imperceptible Negative Impact.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts if they were to occur.</p> <p>The permanent direct loss of estuarine habitats, including Annex I 'Estuaries', is considered to constitute a Permanent Significant Negative Impact on the River Suir. However, with regard to the impact of this loss at the National level will be Imperceptible.</p> <p>The reduction in habitat connectivity, zonation and heterogeneity would constitute a Long-term Slight-Moderate Negative Impact.</p> | <p>Disturbance to the River Suir, including Annex I 'Estuaries', from the construction of the proposed development will still constitute a Temporary Slight-Imperceptible Negative Impact.</p> <p>The mitigation described in Section 7.7 will significantly reduce the risk of accidental pollution, eliminating all of the most serious risks, including input of cementitious materials or hydrocarbons to the River Suir. Furthermore, any water quality impacts which could arise in the unlikely event of accidental pollution would constitute Temporary Slight-Imperceptible Negative Impacts, if they were to occur at all.</p> <p>The change in the nature of estuarine habitats constitutes a Permanent Slight Positive Impact on the River Suir. The impact on the conservation status of Annex I 'Estuaries' at the National level will be Imperceptible.</p> <p>The impact on habitat connectivity, zonation and heterogeneity would constitute a Long-term Neutral Impact.</p> |
| <p>KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'</p> | <p>The disturbance to intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', associated with the construction of the proposed development is considered to constitute a Short-term Slight-Moderate Negative Impact.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur.</p> <p>The permanent direct loss of intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide' is considered to constitute a Permanent Significant Negative Impact in the River Suir. However, with regard to the impact of this loss at the National level will be Imperceptible.</p> <p>The reduction in habitat connectivity, zonation and heterogeneity would constitute a Long-term Slight-Moderate Negative Impact.</p> | <p>The disturbance to intertidal habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide', associated with the construction of the proposed development will still constitute a Short-term Slight-Moderate Negative Impact.</p> <p>The mitigation described in Section 7.7 will significantly reduce the risk of accidental pollution, eliminating all of the most serious risks, including input of cementitious materials or hydrocarbons to the River Suir. Furthermore, any water quality impacts which could arise in the unlikely event of accidental pollution would constitute Temporary Slight-Imperceptible Negative Impacts, if they were to occur at all.</p> <p>The permanent change in the nature of intertidal habitats is considered to constitute a Permanent Slight Positive Impact in the River Suir. The impact on the conservation status of Annex I 'Mudflats and sandflats not covered by seawater at low tide' at the National level will be Imperceptible.</p> |

| Key Ecological Receptor | Pre-mitigation impacts | Ecological significance following mitigation |
|--|---|--|
| | | The impact on habitat connectivity, zonation and heterogeneity would constitute a Long-term Neutral Impact . |
| KER 3 Shoreline Habitats, including Annex I 'Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)' | <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts, if they were to occur.</p> <p>The permanent direct loss of shoreline habitats is considered to constitute a Permanent Slight-Imperceptible Negative Impact.</p> | <p>The mitigation described in Section 7.7 will significantly reduce the risk of accidental pollution, eliminating all of the most serious risks, including input of cementitious materials or hydrocarbons to the River Suir. Furthermore, any water quality impacts which could arise in the unlikely event of accidental pollution would constitute Temporary Slight-Imperceptible Negative Impacts, if they were to occur at all.</p> <p>The permanent direct loss of shoreline habitats is considered to constitute a Permanent Not Significant Negative or Neutral Impact. Depending on the final specification of the eco-cladding, e.g. whether or not ledges or shelves are included, particularly at the high-water mark, this impact could be changed to a net Positive impact.</p> |
| KER 4 Fish Species, including Annex II migratory species | <p>In the event of prolonged periods of continuous piling or where breaks between pile drives are not sufficiently long, the hydroacoustic impacts on Twaite Shad and other fish species would constitute a Short-term Moderate-Significant Negative Impact.</p> <p>Given the short duration of the construction works and very short duration of nightworks, artificial lighting is considered to constitute a Temporary Slight Negative Impact.</p> <p>Water quality impacts which could arise in the event of accidental pollution from the proposed development could constitute Short-term Significant Negative Impacts if they were to occur.</p> <p>The loss of habitat and reduced habitat connectivity, zonation and heterogeneity are considered to constitute a Permanent Significant Negative Impact.</p> | <p>The hydroacoustic impacts on Twaite Shad and other fish species would constitute a Short-term Slight-Imperceptible Negative Impact.</p> <p>The impacts of artificial lighting would constitute a Temporary Slight-Imperceptible Negative Impact.</p> <p>The mitigation described in Section 7.7 will significantly reduce the risk of accidental pollution, eliminating all of the most serious risks, including input of cementitious materials or hydrocarbons to the River Suir. Furthermore, any water quality impacts which could arise in the unlikely event of accidental pollution would constitute Temporary Slight-Imperceptible Negative Impacts, if they were to occur at all.</p> <p>Depending on the final specification of the eco-cladding, the change in the physical structure and biological composition of the intertidal habitats could potentially constitute a net Permanent Slight Positive Impact.</p> |
| KER 5 Otter | <p>Disturbance of otters during the construction of the proposed development would constitute a Short-term Slight-Moderate Negative Impact.</p> <p>Water quality impacts, if they were to occur, would constitute a Medium-term Slight Negative Impact.</p> | <p>Disturbance of otters during the construction of the proposed development would constitute a Short-term Slight Negative Impact.</p> <p>The mitigation described in Section 7.7 will significantly reduce the risk of accidental pollution, eliminating all of the most serious risks, including</p> |

| Key Ecological Receptor | Pre-mitigation impacts | Ecological significance following mitigation |
|--------------------------------------|--|---|
| | <p>The loss of habitats on the northern edge of the River Suir would constitute a Permanent Slight Negative Impact.</p> <p>The reduction in aquatic habitat quality would constitute a Permanent Slight-Imperceptible Negative Impact.</p> | <p>input of cementitious materials or hydrocarbons to the River Suir. Furthermore, any water quality impacts which could arise in the unlikely event of accidental pollution would constitute Temporary Slight-Imperceptible Negative Impacts, if they were to occur at all.</p> <p>The loss of habitats, particularly the intertidal commuting corridor, on the northern edge of the River Suir would constitute a Permanent Slight Negative Impact.</p> <p>Depending on the final specification of the eco-cladding, e.g. the structure or texture of the cladding surface, the change in the biological composition of the intertidal habitats could potentially constitute a Permanent Slight Positive Impact.</p> |
| KER 6 Bat Species | The impact of disturbance to bats during the construction of the proposed development is considered to constitute a Temporary Slight Negative Impact . | The impact of disturbance to bats during the construction of the proposed development will constitute a Temporary Slight-Imperceptible Negative Impact . |
| KER 7 Invasive Alien Species | The impacts of invasive alien species, if there were to be significant spread, could constitute Long-term Very Significant Negative Impacts . Without the implementation of an appropriate Biosecurity Protocol the risk of introduction or spread is considered to be High . | While the impacts associated with the introduction or spread of invasive alien species are unlikely to be significantly reduced, the implementation of an appropriate Biosecurity Protocol will ensure that the risk of introduction or spread occurring is Negligible . |
| KER 8 Nationally Designated Sites | All of the impacts on nationally designated sites relate to water quality impacts, invasive alien species or ecological connections to impacts on the other receptors, which have already been assessed above. The significance of these impacts is up to Permanent Profound Negative Impacts (invasive alien species). | Given the residual impacts above in relation to water quality impacts, invasive alien species or ecological connections to impacts on the other receptors, residual impacts on nationally designated sites are considered unlikely to exceed Long-term Imperceptible Negative Impacts in a worst-case scenario. |

7.9 Assessment of Cumulative Impacts

7.9.1 Introduction and Methodology

The geographical boundary of 15km was selected for the assessment of cumulative impacts. This comprises a viable study area holding potential for feasible cumulative impacts whilst excluding those areas which are non-viable because of issues such as topography and distance. Significant projects known to WCCC that are not yet within the planning system but have the potential to interact with the proposed development are also considered.

Cumulative impacts result from incremental changes caused by other past, present or reasonably foreseeable projects together with the proposed Flood Defences West. Cumulative impacts were assessed by looking at previous plans and projects, current plans and projects in planning and proposed future plans and projects within 15km of the proposed development from 2010 to the present. There is too much uncertainty associated with development proposals beyond 5 years into the future and this EIAR can only be based on data that is readily available. This cumulative assessment has considered cumulative impacts that are:

- (a) Likely;
- (b) Significant; and,
- (c) Relating to a future event which is reasonably foreseeable.

The following data sources have been consulted to identify the plans and projects within the 15km boundary:

- Waterford City and County Council;
- Kilkenny County Council;
- Wexford County Council;
- EIA Portal;
- An Bord Pleanála website (planning searches);
- Web search for major infrastructure projects in Waterford City and County and Co. Kilkenny;
- Waterford City Development Plan 2013-2019 (as extended);
- Waterford County Development Plan 2011-2017 (as extended);
- Draft Kilkenny County Development Plan 2021-2027;
- North Quays SDZ Planning Scheme 2018; and,
- Ferrybank Belview Local Area Plan 2009-2020 (including Amendment 1).

7.9.2 Potential Cumulative Impacts

The following projects were identified as having potential, in the absence of appropriate mitigation or controls, to give rise to significant impacts on Biodiversity in combination with the proposed Flood Defences West (the distances stated below are approximate distances from the proposed development):

- Port of Waterford Company – Dumping at Sea / Dredging (EPA Licence No. S0012-03) (distance: c. 15m)
- Waterford-New Ross Greenway (distance: 1.1km)
- River Suir Sustainable Transport Bridge (distance: c. 350m)

- Falcon Real Estate Development Ireland Limited SDZ Planning Application (distance: 0m)
- SDZ Transport Hub (distance: 0km)
- Rock Stabilisation and Rock Protection measures Plunkett Railway Station (distance: c. 10m)
- SDZ Access and Public Road Infrastructure (distance: 0m)
- Suir Shipping Ltd (distance: 5.4km)
- Bellvue Port Services (Waterford) Ltd (distance: 6.2km)
- Upgrade of Rail line east of Plunkett train Station to the Proposed Transport Hub (distance: 0m)

These projects were identified as having potential to result in cumulative impacts with the proposed Flood Defences West due to their nature, proximity to the proposed development, and likelihood of being implemented during approximately the same timeframe as the proposed development. The potential cumulative impacts of concern relate to habitat disturbance, underwater noise, artificial lighting, hydrological and water quality impacts, and invasive alien species. However, given the mitigation and control measures proposed as part of these projects and the proposed development, significant cumulative impacts are unlikely.

The complete assessment of the potential cumulative impacts between the proposed Flood Defences West and other plans and projects is presented in Chapter 17 Interactions and Cumulative Impacts.

7.10 Conclusion

This chapter has assessed the ecological impacts of the construction and operation of the proposed Flood Defences West on Biodiversity. The assessment described herein has examined the receiving natural environment and identified eight Key Ecological Receptors likely to be impacted upon by the proposed development, namely:

- River Suir, including Annex I 'Estuaries'
- Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'
- Shoreline Habitats, including Annex I 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)'
- Fish Species, including Annex II migratory species
- Otter
- Bat Species
- Invasive Alien Species
- Nationally Designated Sites

Each Key Ecological Receptor was characterised and its ecological importance was evaluated on a geographical scale. This Chapter has analysed the potential impacts of the proposed development on the Key Ecological Receptors, characterised them in terms of their magnitude, extent, duration, frequency and reversibility, and assessed their significance on a geographical scale. Where negative impacts were identified, mitigation measures have been proposed to avoid or minimise these impacts. In addition, enhancement measures have been proposed to maximise the Biodiversity

value of the proposed development, in accordance with national, regional and local policy, and ensure that there will be No Net Loss of Biodiversity as a result.

Provided that the proposed development is constructed and operated in accordance with the mitigation measures described in this Chapter and the NIS, there will be no significant residual impacts on ecological receptors which are of Local (Higher Value), County, National or International Importance, either from the proposed development individually or in combination with other past, present or reasonably foreseeable plans or projects. While there will be a permanent loss of c. 800m² of two Annex I habitats, namely 'Estuaries' and 'Mudflats and sandflats not covered by seawater at low tide' (which are not Qualifying Interests of the Lower River Suir SAC), there will be no effect on the conservation status of these habitats nationally.

Based on the assessment of the pre- and post-mitigation impacts from the proposed development, including the ecological enhancement measures described, the overall conclusion is that there will be No Net Loss of Biodiversity within the Zone of Influence as a result of the proposed development. Furthermore, appropriate final specification of the design for the eco-cladding presents an opportunity to achieve an overall Net Gain for Biodiversity in relation to the Flood Defences West.

The NIS for the proposed development concluded, in view of best scientific knowledge and the Conservation Objectives of the relevant European sites, that the Flood Defences West, either individually or in combination with other plans or projects, will not adversely affect the integrity of the Lower River Suir SAC, the River Barrow and River Nore SAC, or any other European site.

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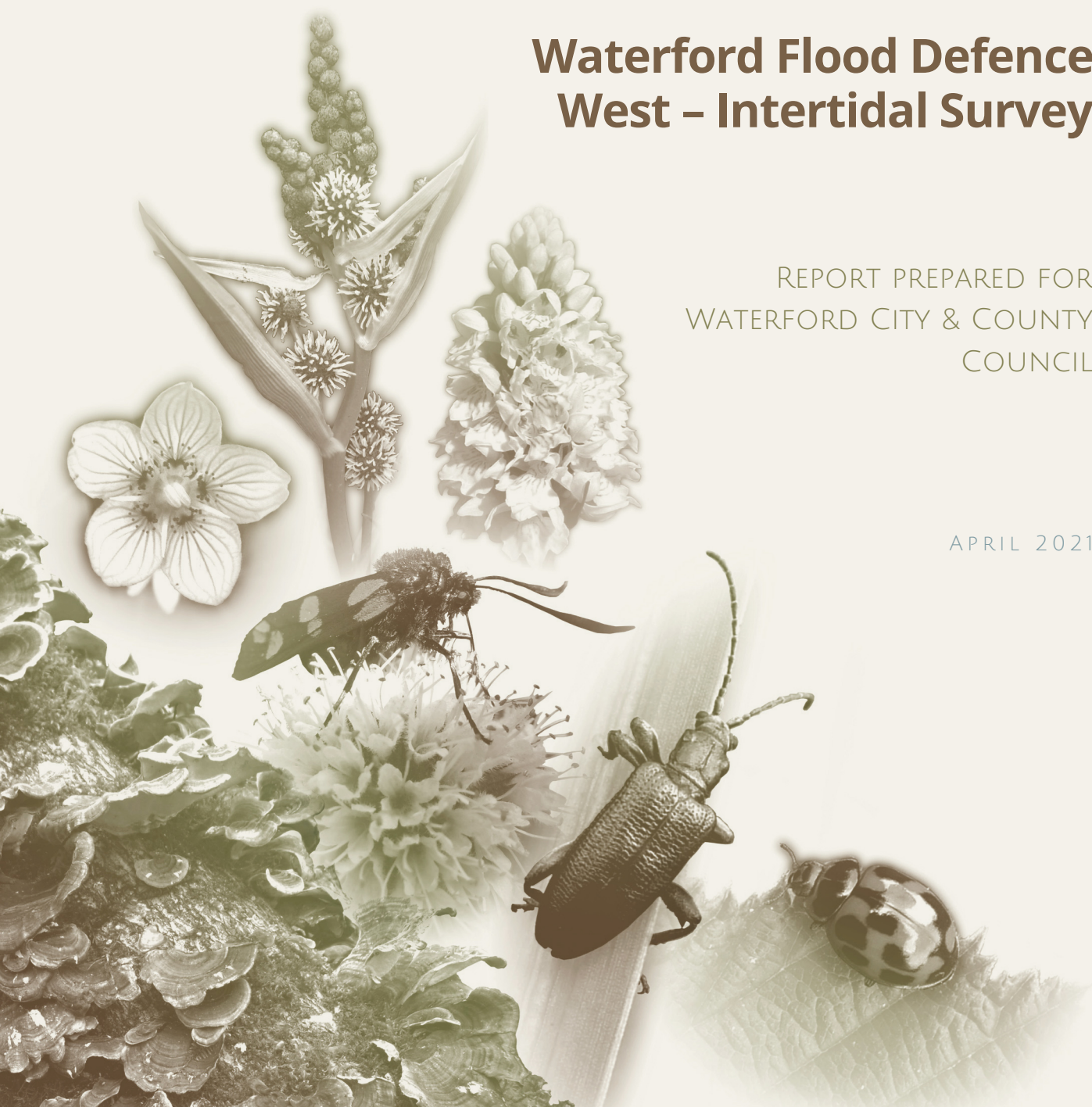
Appendix 7.1

Intertidal Survey Report

Waterford Flood Defence West – Intertidal Survey

REPORT PREPARED FOR
WATERFORD CITY & COUNTY
COUNCIL

APRIL 2021



Waterford Flood Defence West – Intertidal Survey

April 2021



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1 Introduction

BEC Consultants Ltd was contracted by Roughan & O'Donovan on behalf of Waterford City & County Council to carry out an intertidal survey in relation to the Waterford Flood Defence West project.

2 Project description

The proposed development aims to develop flood defence measures for the protection of critical infrastructure including the existing Plunkett Train Station, the railway line east and west of Plunkett Station and the future SDZ Transportation Hub which will provide a connection to the North Quays SDZ site via the railway line. The project will involve the installation of sheet piles approximately 1 m in front of the existing quay wall along much of the study area, and the gap backfilled.

3 Study area

The study area was the northern bank of the River Suir estuary upstream of Rice Bridge, Waterford City, Co. Waterford. The survey area is within the Lower River Suir Special Area of Conservation (SAC) (Site code: 002137) (Figure 1).

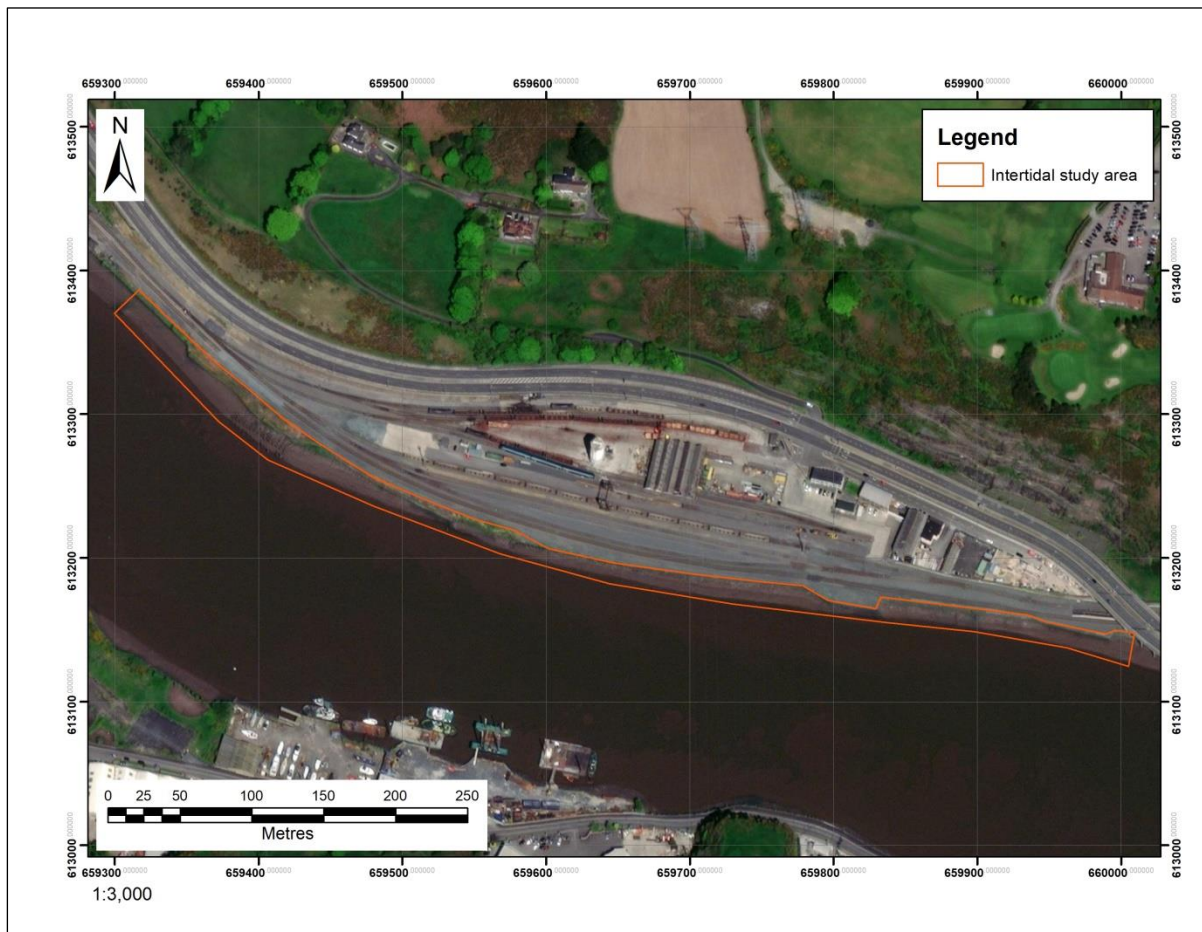


Figure 1. Waterford Flood Defence West intertidal survey study area within the River Suir Estuary

3.1 Lower River Suir SAC

The Lower River Suir SAC is one of the Natura 2000 sites designated to fulfil Ireland's obligations under the Habitats Directive (92/43/EEC) which is transposed into Irish legislation by the European

Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. 477/2011). The site is designated for a number of terrestrial, freshwater and coastal habitats and species, which are listed in Table 1.

Table 1. Qualifying interests of the Lower River Suir SAC (NPWS, 2017)

| EU habitat/species | EU code |
|---|----------------|
| <i>Margaritifera margaritifera</i> (Freshwater Pearl Mussel) | 1029 |
| <i>Austropotamobius pallipes</i> (White-clawed Crayfish) | 1092 |
| <i>Petromyzon marinus</i> (Sea Lamprey) | 1095 |
| <i>Lampetra planeri</i> (Brook Lamprey) | 1096 |
| <i>Lampetra fluviatilis</i> (River Lamprey) | 1099 |
| <i>Alosa fallax fallax</i> (Twaite Shad) | 1103 |
| <i>Salmo salar</i> (Salmon) | 1106 |
| Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) | 1330 |
| <i>Lutra lutra</i> (Otter) | 1355 |
| Mediterranean salt meadows (<i>Juncetalia maritimi</i>) | 1410 |
| Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation | 3260 |
| Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels | 6430 |
| Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles | 91A0 |
| <i>Taxus baccata</i> woods of the British Isles | 91J0 |
| Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) | 91E0 |

4 Methodology

An intertidal field survey was carried out on 15th March 2021 during low water spring tides by John Brophy and Simon Barron of BEC Consultants Ltd.

4.1 Intertidal mudflat survey

Intertidal core samples were taken in soft sediment using a 0.01 m² core to a depth of 25 cm at five locations. The methodology for the survey generally followed that of the Marine Monitoring Handbook (Davies *et al.*, 2001). Sample stations were chosen to provide a spread of sites from the along the length of the project area across the upper and lower shore (Figure 2).

Three replicate cores were taken at each sample station. Each replicate was sieved through a 1 mm sieve and the residue retained for macroinvertebrate analysis. The samples were preserved in 70% industrial methylated spirits and placed in containers labelled inside and out, before being returned to the laboratory for sorting, identification and enumeration. One small core to a depth of 10 cm was taken for sediment analysis, placed in a labelled container and stored in a cooler box before being returned to the laboratory where the samples were frozen prior to analysis for Particle Size Analysis (PSA) and Total Organic Carbon (TOC).

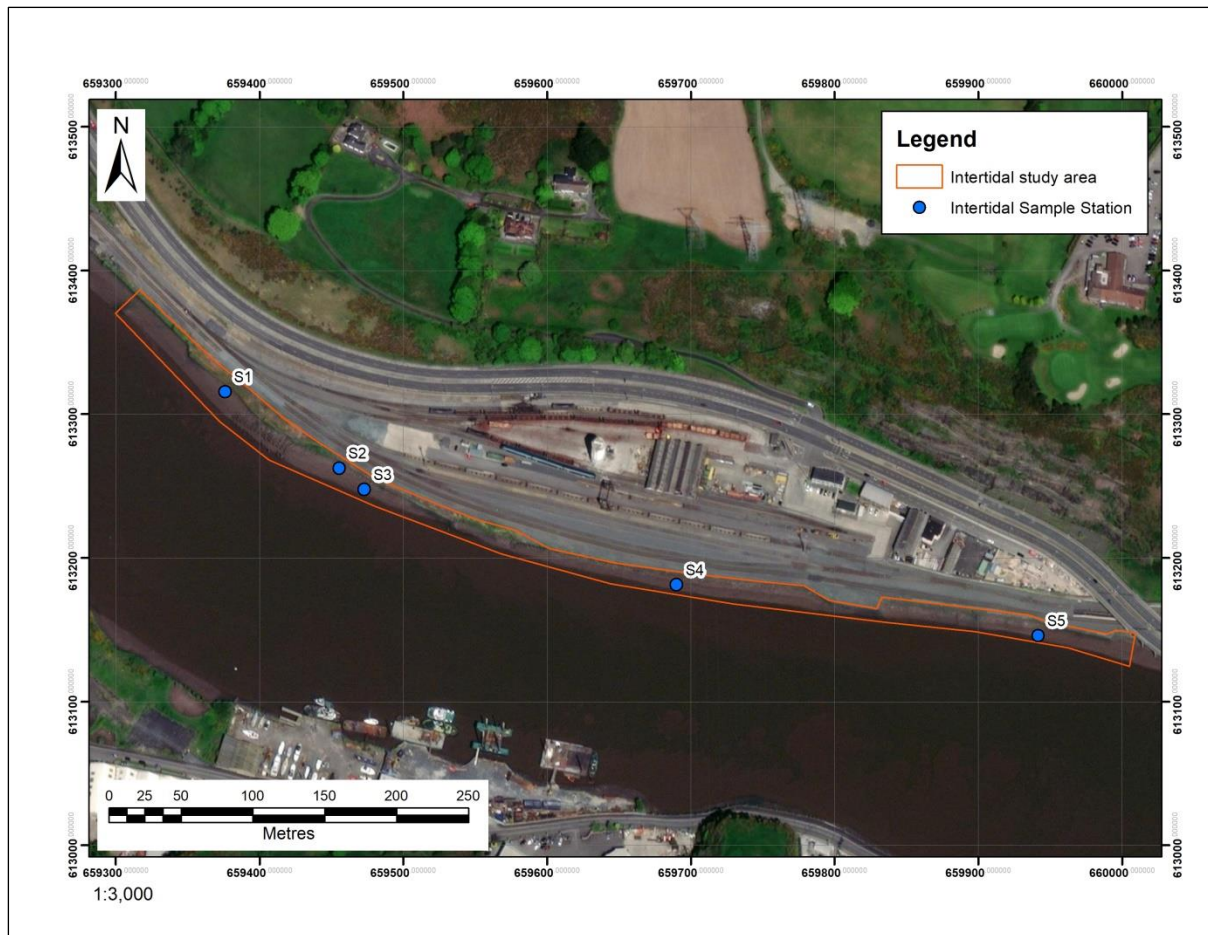


Figure 2. Map showing location of intertidal sample stations within the Waterford Flood Defence West study area.

The following data was recorded on standard field sheets at each sample station:

- Location
- Surveyors
- Sampler type
- Weather
- Date
- Time
- Station
- Irish Grid Reference
- Exposure
- Sieve size (mm)
- Core depth (cm)
- Sediment description
- Photo reference numbers

The mudflat biotope was assigned based on the fauna and sediment type recorded following the JNCC Marine Habitat Classification for Britain and Ireland (Connor *et al.*, 2004).

4.2 Intertidal hard substratum survey

Intertidal hard substrata biotopes were recorded during a walkover survey following the JNCC Marine Habitat Classification for Britain and Ireland (Connor *et al.*, 2004). The biotopes were mapped in the

field onto recent satellite imagery and digitised using ArcGIS 10.0 on return to the office. A handheld GPS was used to locate features and record target note locations. Photographs were taken to provide a visual record of the existing habitats.

4.3 Saltmarsh survey

The survey area was walked and any areas conforming to Annex I saltmarsh habitat were mapped in the field onto recent satellite imagery and digitised using ArcGIS 10.0 on return to the office. A handheld GPS was used to locate features and record target note locations. Photographs were taken to provide a visual record of the existing habitats.

4.4 Macroinvertebrate analysis

Samples were sorted in a white tray, with macroinvertebrates being transferred to labelled containers and preserved with 70% IMS prior to identification. The species list was checked against the Pan-European Species directory Infrastructure (PESI, 2021).

Identification was carried out using stereoscopic and compound microscopes and appropriate keys.

4.5 Sediment sample analysis

Sediment analysis for PSA and TOC (by Loss on Ignition (LOI)) was carried out by Nautilus, Dublin.

5 Existing environment

5.1 Intertidal Mudflats

The intertidal mud of the study area is all classified as '*Tubificoides benedii* and other oligochaetes in littoral mud' (LS.LMu.UEst.Tben) under the JNCC Marine Biotope Classification (Appendix I, Figure A1-A3). This biotope is species-poor and found in upper estuarine locations where the salinity is reduced, with wave exposure ranging from sheltered to extremely sheltered (Connor *et al.*, 2004). The substratum is one of fine sandy mud, and extends from the lower shore to the upper shore (Connor *et al.*, 2004). Within the study area, the nature of the mudflat in the upper shore differed from lower down. The upper shore along much of the length comprised firm, anoxic mud, with rubble and debris dumped onto it from the land side, with quite a steep profile (Appendix II, Plate 1). Burrows were visible in this upper shore mud surface and Horned Wrack (*Fucus ceranoides*) was growing on rocks scattered along the shore. The lower shore was one of soft mud, with the anoxic layer often deeper than the 25 cm reached by the core and a flatter profile (Appendix II, Plate 2 & 3).

In the current survey, only four species were recorded across the five sampling locations (Appendix III, Table A1). The oligochaete worm *Baltidrilus costatus* was recorded at the uppermost sample station S1, which was located on the upper shore. The true fly (Diptera) larva of the Family Dolichopodidae was found at sample station S2, forming burrows in the upper shore. A single mayfly *Baetis rhodani* was recorded at sample station S3; this must have washed down from upstream as there is no suitable habitat present in the estuary for this species. Similarly, a larva of the water beetle *Esolus parallelepipedus* recorded at S5 must also have been washed down, as, again, no suitable habitat for this species is present within the estuary. No fauna were recorded from sample station S4. Sample station environmental data are presented in Appendix III, Table A2.

The granulometric analysis classified all stations as 'Sandy Mud', with the mud content ranging from 59.6% (S3) to 79.3% (S1) (Appendix III, Table A3). Total Organic Carbon ranged from 7.37% (S2) to 8.20% (S5) (Appendix III, Table A4).

5.2 Intertidal hard substrata

The hard substrata biotopes of the study area were limited to artificial surfaces in the form of the historical retaining wall separating the estuary from the rail line. The biotopes here were typical of the sheltered location in a reduced salinity environment on an artificial substratum. The eastern end of the study area showed the most developed zonation of intertidal hard substratum biotopes. From bottom to top, this area included a band of '*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock' (LR.LLR.FVS.AscVS) up to 1.5 m wide (Appendix II, Plate 4), '*Fucus ceranoides* on reduced salinity eulittoral rock' (LR.LLR.FVS.Fcer) approximately 30cm wide (Appendix II, Plate 5), sparse and intermittent '*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock' (LR.FLR.Eph.Ent) (Appendix II, Plate 5) and 'Yellow and grey lichens on supralittoral rock' (LR.FLR.Lic.YG) (Appendix II, Plate 5), which is similarly sparse and intermittent. Heading west, the LR.LLR.FVS.AscVS zone rapidly disappears, as the upper mud shore covers its potential substratum along the base of the retaining wall, leaving only the upper three biotopes. There is often a strip of bare stone between the LR.LLR.FVS.Fcer and the LR.FLR.Eph.Ent above it.

The barnacle *Austrominius modestus* was recorded on some of the wooden posts found emerging from the mudflat (Appendix II, Plate 6) and occasionally on rocks on the mud.

5.3 Saltmarsh habitat

A small area (approximately 100m²) of saltmarsh habitat was recorded within the study area (Appendix I, Figure A1-A2. Appendix II, Plate 7). This saltmarsh formed in the shelter provided by an outward projection of the retaining wall. The saltmarsh was mainly lower saltmarsh, dominated by Common Saltmarsh-grass (*Puccinellia maritima*), with Sea Plantain (*Plantago maritima*), with the strip closest to the sea wall dominated by Creeping Bent (*Agrostis stolonifera*), making it more of an upper fringe saltmarsh. There were dead stems of what was most likely last year's Sea Aster (*Aster tripolium*) present in both zones. Flood debris in the form of Common Reed (*Phragmites australis*) covered much of the saltmarsh. There was no *Spartina* spp. present.

Based on the species present, the area corresponds to the Annex I habitat Atlantic salt meadows (1330), which is a qualifying interest for the Lower River Suir SAC.

The remaining grassy areas within the study area, including along the area of collapsed retaining wall, were dominated by Couch Grass (*Elytrigia repens*), with occasional Butterfly-bush (*Buddleja davidii*), Gorse (*Ulex europaeus*) and Bramble (*Rubus fruticosus* agg.) (Appendix II, Plate 8).

6 Discussion

The biotopes and species of the study area are typical of upper estuarine areas around Ireland, and are indicative of a variable salinity environment, with a strong freshwater influence. The low species richness is the result of the challenges relating to life in the upper estuary, with salinity varying with tidal cycle and river flow conditions. The two infaunal species that were found to be living within the mudflat biotope of the study area (*Baltidrilus costatus* and Family Dolichopodidae), were found in the upper shore, where conditions are more stable. The remaining fauna recorded were single specimens washed down from true freshwater habitat upstream.

The more stable and firm sandy mud of the upper shore had been impacted by deposited waste in the form of stone and metal, scattered along the shore. The anoxic layer of the upper shore was very close to the surface, due to its stable nature preventing oxygen penetration. This contrasted with the soft sandy mud of the lower shore, where the anoxic layer began much deeper. This is likely due to the water currents stirring up the mud and the fact that it is covered by water for more of the tidal cycle.

The hard substratum biotopes found within the study area are common around the Irish coast, particularly in sheltered areas with a strong freshwater influence, where there is rock available for colonisation. They are also low in species richness.

A notable presence within the study area is the patch of Annex I saltmarsh habitat Atlantic salt meadows (1330). While this area is small in size (approximately 100m²), the habitat is a qualifying interest for the Lower River Suir SAC. The establishment of this area of saltmarsh was facilitated by an outward turn in the existing retaining wall, which provided shelter from the river current. Due to its small size, the full development of saltmarsh zonation could not be achieved, and so it consists of a Creeping Bent-dominated upper saltmarsh community on the landward side of a Common Saltmarsh-grass-dominated lower saltmarsh community.

Brophy *et al.* (2019) recorded 19.34 hectares of Atlantic salt meadows within the Lower River Suir SAC. Based on this figure, the area of Atlantic salt meadows within the study area is 0.05% of the total area of the habitat within the SAC.

In summary, the study area has low species richness and contains biotopes common in upper estuarine areas around Ireland, which are indicative of a variable salinity environment, with a strong freshwater influence. The most notable feature is the small area of Annex I Atlantic salt meadow habitat along the retaining wall; a habitat that is a qualifying interest for the Lower River Suir SAC.

7 References

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Appendix I – Map

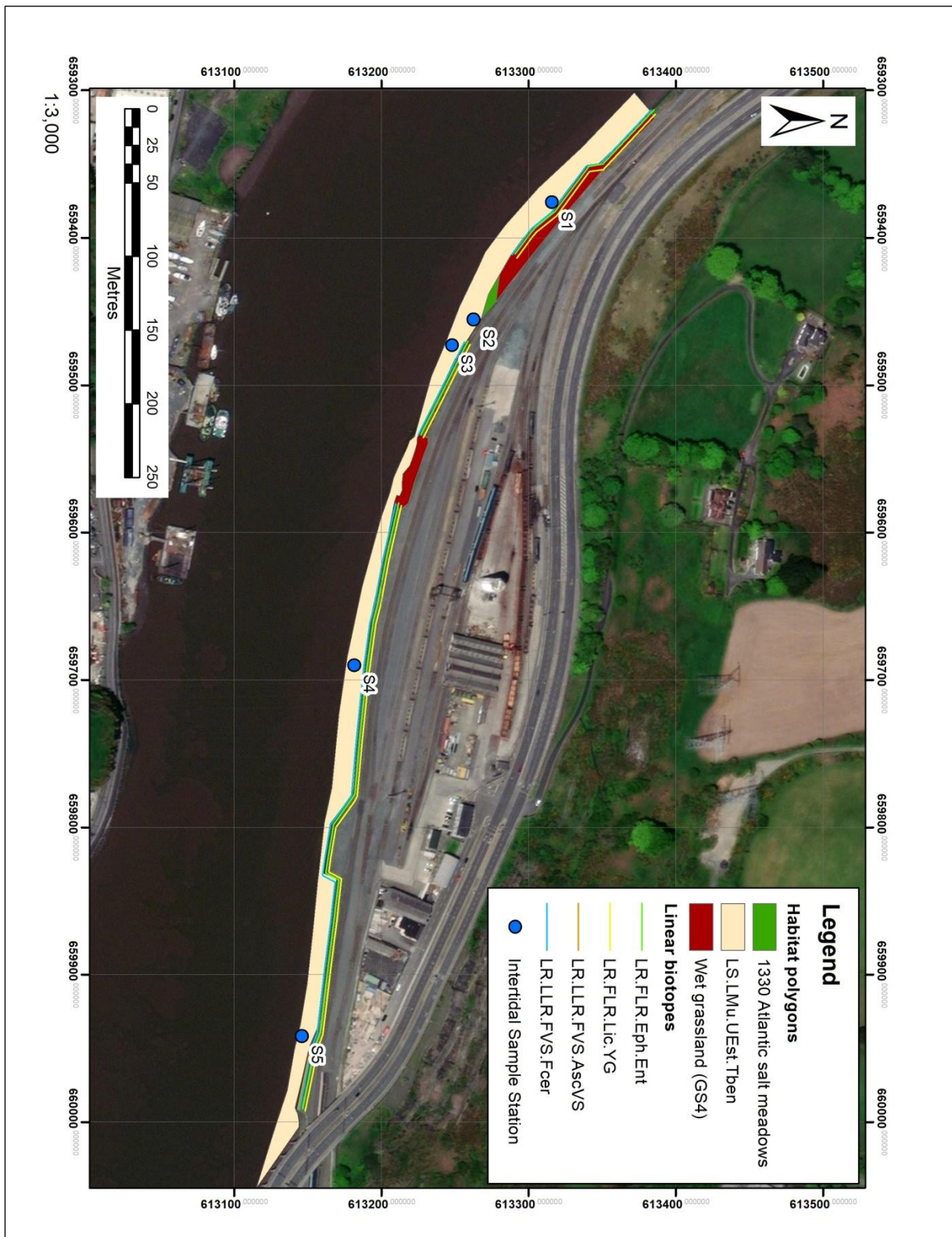


Figure A1 Overview biotope/habitat map of the intertidal zone within the study area on the River Suir estuary, Waterford City, Co. Waterford. Linear biotopes on near vertical surfaces are necessarily schematic.

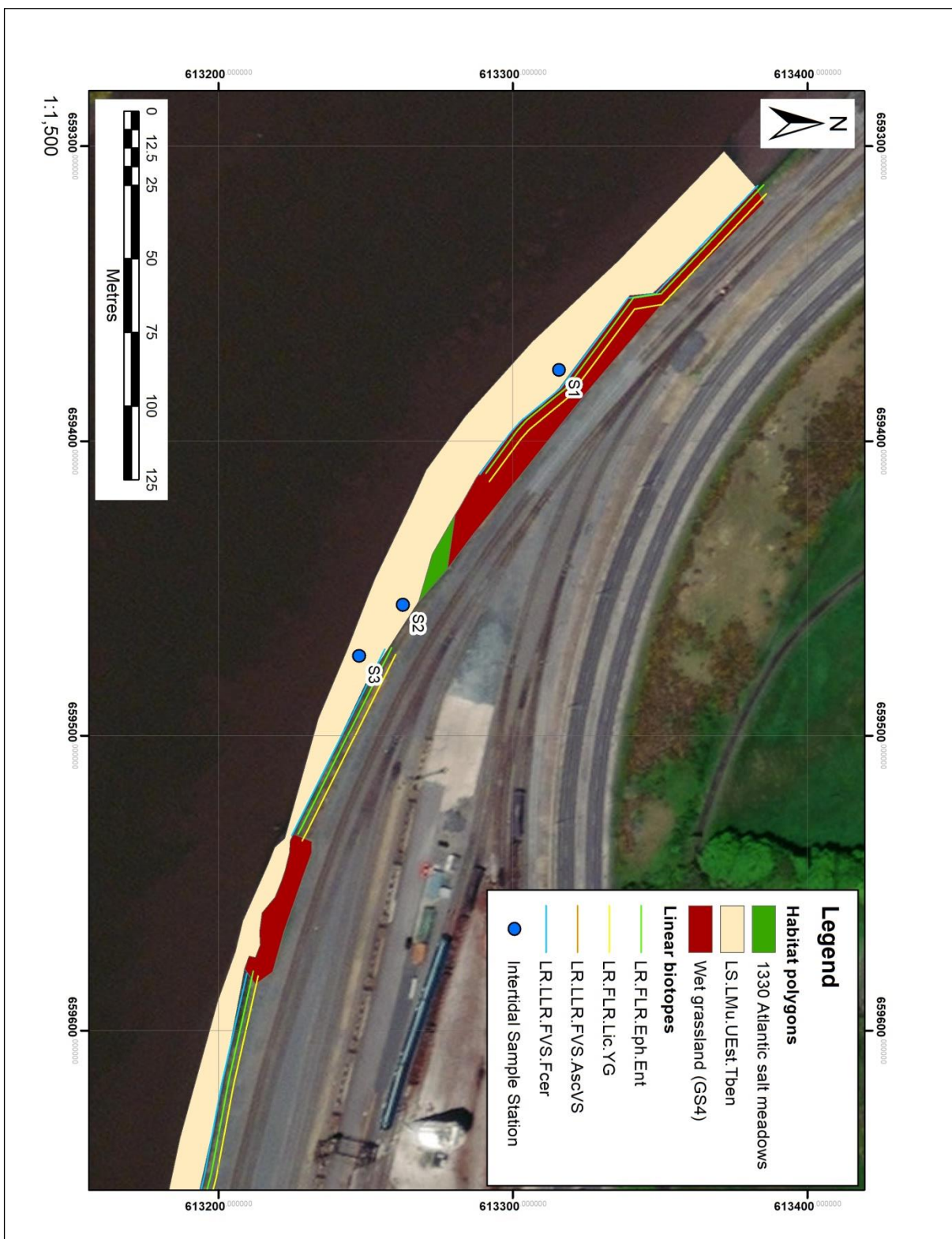


Figure A2 Western section of biotope/habitat map of the intertidal zone within the study area on the River Suir estuary, Waterford City, Co. Waterford. Linear biotopes on near vertical surfaces are necessarily schematic.

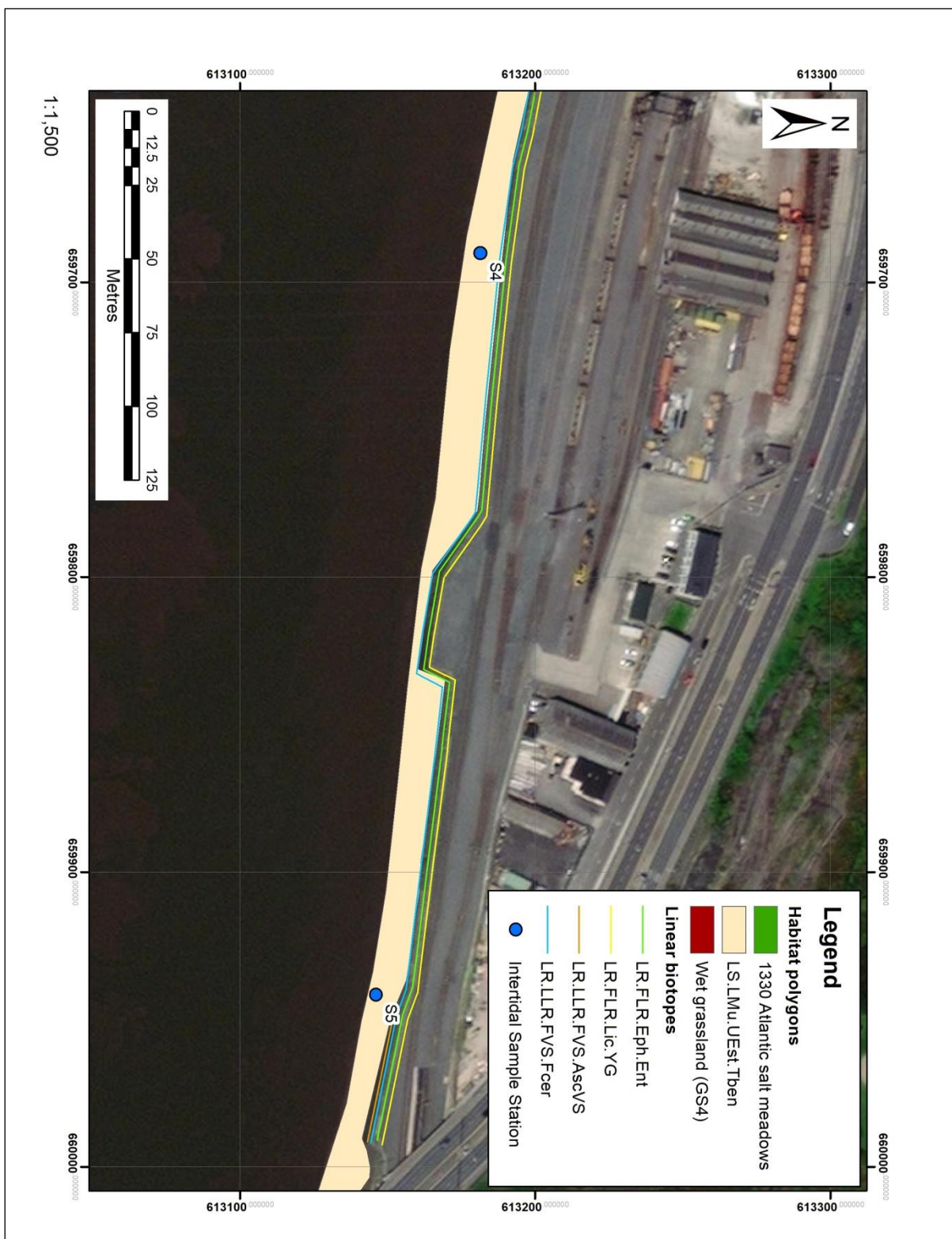


Figure A3 Eastern section of biotope/habitat map of the intertidal zone within the study area on the River Suir estuary, Waterford City, Co. Waterford. Linear biotopes on near vertical surfaces are necessarily schematic.

Appendix II – Plate







| | |
|---|---|
|  |  |
| <p>Plate 1. Upper shore of firm mud and rubble/stone</p> | <p>Plate 2. Lower shore with soft mud</p> |
|  |  |
| <p>Plate 3. Soft mud surface at S5</p> | <p>Plate 4. The biotope LR.LLR.FVS.AscVS on the retaining wall at the southern end of the study area</p> |
|  |  |
| <p>Plate 5. The biotopes LR.LLR.FVS.Fcer, LR.FLR.Eph.Ent and LR.FLR.Lic.YG on the retaining wall</p> | <p>Plate 6. The barnacle <i>Austrominius modestus</i> on a wooden post, with <i>Fucus ceranoides</i></p> |



Plate 7. Area of 1330 Atlantic salt meadows



Plate 8. Grassland areas above retaining wall alongside railway

Appendix III – Tables

Table A1. Results of intertidal core survey carried out in the River Suir Estuary, Waterford City, Co. Waterford on 15/03/2021

| Station | S1 | | | S2 | | | S3 | | | S4 | | | S5 | | | Total | |
|--|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| | Replicate | A | B | C | A | B | C | A | B | C | A | B | C | A | B | | C |
| ANNELIDA | | | | | | | | | | | | | | | | | |
| Oligochaeta | | | | | | | | | | | | | | | | | |
| <i>Baltidrilus costatus</i> | 3 | 30 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | 38 |
| INSECTA | | | | | | | | | | | | | | | | | |
| Ephemeroptera | | | | | | | | | | | | | | | | | |
| <i>Baetis rhodani</i> | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| Diptera | | | | | | | | | | | | | | | | | 0 |
| Dolichopodidae | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Coleoptera | | | | | | | | | | | | | | | | | 0 |
| <i>Esolus parralelepipedus</i> (larva) | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 |
| Total individuals | 3 | 30 | 5 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 41 |
| Total species | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |

Table A2. Environmental data collected at sample stations on the River Suir Estuary, Waterford City, Co. Waterford on 15/03/2021

| Station | Time | Sampler type | Core depth (cm) | Sieve size (mm) | Weather | ITM_X | ITM_Y | Exposure | Sediment description* |
|---------|-------|---------------|-----------------|-----------------|-------------|--------|--------|-----------|---|
| S1 | 15:52 | Sediment core | 25 | 1 | Dry, bright | 659328 | 613355 | Sheltered | SM, 3, 5, 1, n/a, 5 burrows (upper shore) |
| S2 | 15:15 | Sediment core | 25 | 1 | Dry, bright | 659456 | 613263 | Sheltered | SM, 5, 5, 1, n/a, 5 burrow (upper shore) |
| S3 | 14:52 | Sediment core | 25 | 1 | Dry, bright | 659473 | 613253 | Sheltered | SM, 3, 4, 4, n/a, 3. No casts |
| S4 | 13:47 | Sediment core | 25 | 1 | Dry, bright | 659690 | 613189 | Sheltered | SM, 3, 4, 4, n/a, 3 No casts |
| S5 | 13:03 | Sediment core | 25 | 1 | Dry, bright | 659941 | 613155 | Sheltered | SM, 4, 4, 4, n/a, 1 No casts |

*Sediment Type: Mud(M), Sandy Mud (SM), Muddy Sandy (MS), Sand (S), Gravelly Sand (GS), Sandy Gravel (SG), Gravel (G).

*Site features: (1-5 scale): Surface relief (even-uneven), firmness (firm-soft), stability (stable-mobile), sorting (well-poor), black layer (1 = not visible, 2 = >20 cm, 3 = 5-20 cm, 4 = 1-5 cm, 5 = <1 cm)

Table A3. Results of particle size analysis carried out on samples from the River Suir Estuary, Waterford City, Co. Waterford on 15/03/2021

| Station | % Coarse sand | % Medium sand | % Fine sand | % Very fine sand | % Mud |
|-----------|---------------|---------------|-------------|------------------|-------|
| S1 | 0.0 | 0.1 | 0.4 | 20.1 | 79.3 |
| S2 | 0.1 | 0.1 | 0.4 | 21.2 | 78.3 |
| S3 | 0.0 | 0.1 | 1.7 | 38.6 | 59.6 |
| S4 | 0.0 | 0.1 | 1.7 | 28.6 | 69.6 |
| S5 | 0.0 | 0.1 | 1 | 25.0 | 73.8 |

Table A4. Results of Loss On Ignition analysis carried out on samples from the River Suir Estuary, Waterford City, Co. Waterford on 15/03/2021

| Station | % Loss on Ignition |
|-----------|--------------------|
| S1 | 7.83 |
| S2 | 7.37 |
| S3 | 7.41 |
| S4 | 7.91 |
| S5 | 8.20 |



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