Chapter 19
Mitigation Measures

ROD ROUGHAN & O'DONOVAN
Comhairle Cathrach & Contae Phort Láirge Waterford City & County Council
Údarás Náisiúnta Iompair National Transport Authority
Iarnród Éireann Irish Rail
Rialtas na hÉireann Government of Ireland
Tionscadal Éireann Project Ireland 2040

Chapter 19 Mitigation Measures

19.1 Introduction

Mitigation measures are the measures proposed in order to avoid, reduce or, where possible, remedy the significant adverse environmental effects of the proposed Flood Defences West. Mitigation measures have been incorporated into the design of the proposed bridge and will be applied during both the construction and operation phase where they have been assessed as necessary.

This chapter provides a summary of the mitigation measures for the Flood Defences West as contained within chapters 5 – 18 of the Environmental Impact Assessment Report (EIAR). This is a summarised version stating only the mitigation measures to be provided and does not discuss the requirement for the measure to be applied or the residual impacts. This chapter also deals only with mitigation measures to be applied to the Flood Defences West and does not address the avoidance or reduction mitigation which has been applied through the design development.

19.2 General Mitigation and Monitoring Measures

Table 19.1 General Mitigation and Monitoring Measures

No.	Description
4.1	**Piling** • The following general procedure will be followed for installation of both riverside and landside sheet pile walls: • 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, and shall not exceed 10 strikes in any one piling event • No more than two piling rigs shall operate simultaneously at any time. • The duration of any one 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. • Following every piling event, there shall be a quiet period of at least 30 minutes. • The above specifications apply to all piling activity for the proposed development, riverside and landside, daytime and night-time.
4.2	**Cladding** The section of the riverside sheet piles within the intertidal zone of the River Suir (the area between the low- and high-water mark) will be fitted with cladding in a form of an eco-seawall to enhance marine biodiversity.
4.3	**Utilities** Prior to excavation works, a segment of the ground will be surveyed via CAT scan and shallow slit trenches excavated in order to confirm the position of utilities.
4.4	**Drainage – construction of Surface Water Outfall Structures** • A dry works area will be created by placing sheet piling or similar into the river from the bank outwards to construct a cofferdam. • Prior to the commencement of any de-watering operations within the cofferdam, adequate and appropriate facilities for the treatment of silt laden water will be designed prior to discharge to ground or back to the River Suir. • Clean, debris free stone will be utilised for the creation of the stone mattress.

No.	Description
	The dry works area will remain in place until all in-stream works have been completed and all concrete material has had sufficient time to cure.
4.5	**Quarries** • Only those quarries that conform to all necessary statutory consents may be used in the construction phase by the appointed Contractor. For whatever quarry source, or sources, utilised for the fill material to be imported to the proposed road development, all will require suitable access routes for HGV traffic from their sites to the suitable main road network, in accordance with their planning approvals.
4.6	**Construction Traffic** • No construction traffic will be permitted to enter the site via Waterford City Centre. The access route to the main and the ancillary construction compound is the R448 Regional Road which has a direct connection to the N25 National Road.
4.7	**Environmental Operating Plan** The Environmental Operating Plan (EOP) 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 Contractors 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.

No.	Description
	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. It will be a condition of the Contract for the construction of the proposed development that the successful Contractor fully implement the EOP throughout the works. To oversee the implementation of the EOP, the Contractor will be required to appoint a responsible Site Environmental Manager (SEM) to ensure that the environmental commitments (as described above) and the EOP are fully executed for the duration of works, and to monitor whether the mitigation measures employed are functioning properly (i.e. are effectively addressing the environmental impact(s) which they were prescribed for).

19.3 Mitigation and Monitoring Measures for Traffic Analysis

Table 19.2 Mitigation and Monitoring Measures for Traffic Analysis

No.	Description
	There are no mitigation measures proposed for Chapter 5 Traffic Analysis as part of the Flood Defences West.

19.4 Mitigation and Monitoring Measures for Population and Human Health

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No.	Description
6.1	Develop and implement all mitigation measures detailed in Chapter 4 (Description of the Proposed Development) this is to include development of Construction Environmental Management Plan (CEMP) and associated traffic management proposals to address all modes of transport including the navigational channel and will be required to be agreed with WCCC prior to construction stage. • The CEMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties. • The CEMP will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points. • The contractor shall provide an appropriate information campaign for the duration of the construction works. • The CEMP should minimise disruption to economic, marine users and residential amenities to be agreed by WCCC prior to construction and ensure access is maintained along the R448 & R680 for vehicles, pedestrians, cyclists, and economic operators at all times and ensure marine navigation is maintained. The contractor will be required to develop and implement Stakeholder Management and Communication Plan and will be required to be agreed with WCCC prior to construction stage. • All stakeholders will be required to be agreed with WCCC prior to construction commencing.

No.	Description
	Details of the general construction process/phasing will be communicated to the relevant stakeholders prior to implementation to ensure local residents and businesses are fully informed on the nature and duration of construction works.
6.2	Noise and Vibration mitigation will be provided for during construction of the development. Measures to mitigate noise and vibration impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities including the application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures.
6.3	In order to minimise dust emissions during construction, a series of mitigation measures have been prepared as part of Chapter 13 Air Quality and Climate. Provided the dust minimisation measures are adhered to, the air quality impacts during the construction phase will not be significant. No further mitigation measures are required.
6.4	Emissions from the construction activities such as dust and risk of accidents were found to be potential short-term, negative impacts. It was found that noise emissions from construction activities, plant and machinery on site is likely to have a significant noise impact within the immediate area during distinct construction phases (i.e. piling activities) of the development.
6.5	Nightworks will also have a significant impact during the short duration they are required. All construction stage impacts will be temporary in nature and reduced and managed by CEMP and associated EOP and CDWMP and the range of mitigation measures of this EIAR.
6.6	All construction works will be temporary in nature and will be carried out in line with best practice thereby minimising the likely significant impacts to the community and human health impacts. The contractor will work within stringent construction limits and guidelines to protect surrounding populations and amenities.

19.5 Mitigation and Monitoring Measures for Biodiversity

Table 19.4 Mitigation and Monitoring Measures for Biodiversity

No.	Description
General Mitigation	
7.1	**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 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.
7.2	**Mitigation by Design** The proposed development has been developed 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

No.	Description
	provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment.
Specific Mitigation Measures – KER 1 River Suir, including Annex I 'Estuaries'	
This subsection describes 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 Receptor.	
7.3	**Habitat Loss, Fragmentation and Degradation** 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. 800 m^2 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 fringing 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

No.	Description
	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.
7.4	**Artificial Lighting** 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.
7.5	**Water Quality** As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and Construction Environmental Management Plan have been prepared for the Flood Defences West and are included in Appendix 4.1 and Appendix 1.4A, 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) • Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers • CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors • CIRIA C648 Control of Water Pollution from Constructional Sites • Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA, 2006)

No.	Description
	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 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 compound/storage facility will be fenced off at a minimum distance of 5 m from the top of the edge of the quay wall/river edge. Any works within the 10 m 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 (CEMP) 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 20 m 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; and, • 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.

No.	Description
	• 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; and, 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.
7.6	**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.
7.7	**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.
Specific Mitigation Measures - KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'	
7.8	**Habitat Loss, Fragmentation and Degradation** The direct loss of c. 800 m^2 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 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 Nett 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.
7.9	**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.
7.10	**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*.

No.	Description
	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.
Specific Mitigation Measures - KER 3 Fringing Habitats, including Annex I 'Atlantic salt meadows (Glauco-Puccinellietalia maritimae)'	
7.11	**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 impact of 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 impacts on the area of 106 m^2 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. 0+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 be 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'*.
7.12	**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.
7.13	**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 fringing 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.
7.14	**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*).

No.	Description
Specific Mitigation Measures - KER 4 Fish 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).	
7.15	**Habitat Loss** The only fish habitat will be lost is the c. 800 m^2 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 include 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.
7.16	**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 or 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 maritimae)', is further reduced/made positive.
7.17	**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.

No.	Description
	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.
7.18	**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 with 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.
7.19	**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.
7.20	**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 stell cofferdam in a partially saline environment, the use of electrofishing is not considered to be appropriate in this case.
Specific Mitigation Measures - KER 5 Otter	
7.21	**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.
7.22	**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.
Specific Mitigation Measures - KER 6 Bats	
7.23	**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

No.	Description
	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.
Specific Mitigation Measures - KER 7 Invasive Alien Species	
7.24	**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 7 m from all visible parts of the plant) at the outset and the access prohibited except for monitoring por 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.
7.25	**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

No.	Description
	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.
7.26	**Aquatic Species** The use of barges during the construction of the proposed development poses the risk of the introduction of 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 IAS 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 IAS 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.
Specific Mitigation Measures - KER 8 Nationally Designated Sites	
7.27	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 (IAS) 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.
Monitoring	
7.28	**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).

No.	Description
7.29	**Record of Habitats** In order to maintain an accurate and precise record of changes to intertidal and fringing 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).
7.30	**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.
Implementation	

7.31	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 Chapter 7 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:
	  o 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:
	  o 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:
	  o Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes.
	  o Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes.

No.	Description
	○ Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes. ○ Guidelines on the Management of Noxious Weeds on National Roads. ○ 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 Management Plans	
7.32	**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 Contractors 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:

No.	Description
	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.
7.33	**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 and 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.

No.	Description
	• Minimisation of artificial lighting and shading. • Management of risk from invasive alien species • Stockpiles. • Project procedures & method statements for: o Site clearance, site investigations, excavations o Diversion of services. o Excavation and blasting (through peat, soils & bedrock). o Piling. o Temporary hoarding & lighting. o Borrow Pits & location of crushing plant. o Storage and Treatment of peat and soft soils. o Disposal of surplus geological material (peat, soils, rock etc.). o Earthworks material improvement. o Protection of watercourses from contamination and silting during construction. o 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.
7.34	**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: o An analysis of the different waste streams expected to be generated; o 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; o Details of waste storage (e.g. skips, bins, containers) to be provided for different waste streams and collection times; o Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility; o Details of storage areas for waste materials and containers; o Details of how unsuitable excess materials will be disposed of, where necessary; and o 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;

No.	Description
	• 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.
7.35	**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.

No.	Description
	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.
7.36	**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 this NIS, the 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 Lower 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.
7.37	**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 Chapter 7 Biodiversity of the EIAR and in the NIS; • To highlight the sensitivity of 'Atlantic salt meadows (Glauco-Puccinellietalia maritimae)', 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.

19.6 Mitigation and Monitoring Measures for Soils and Geology

Table 19.5 Mitigation and Monitoring Measures for Soils and Geology

No.	Description
Mitigation by Design	
8.1	The construction works will be carried out with the least feasible disturbance of soils. The main flood defence elements, sheet pile wall and remedial works to the existing quay wall, directly avoid any requirement for excavation of in-situ ground and creation of waste.
8.2	The quantity of imported backfill for the gap between the sheet piles and the existing quay wall (where sheet piles are installed on the riverside), is minimised by design, as the alignment of the sheet pile wall was carefully selected as close as possible to the existing wall without compromising wall stability. Sheet piles were designed to be constructed on the landside of the existing wall wherever the width of cess allowed for safe day-time works without impact to rail operations, thus further minimising the backfill quantity.
8.3	The amount of waste from the excavations required for constructing the drainage system is minimised by reusing approximately a half of this material as a non-structural fill to even out the ground level across the site, wherever possible.
8.4	The potential impacts (ground displacement/settlement) on the Dublin to Waterford railway line have been mitigated by design, whereby the works are designed at a sufficient distance from the line, and are such that no temporary or permanent excavation in immediate proximity to the rail line is required, with the exception of shallow trenching for the construction of the drainage system. The potential impacts to the mudflats and riverbed from further deterioration of the existing masonry quay wall are also mitigated by design through the construction of the sheet pile wall and backfill in front of the quay wall at the most critical locations.
Specific Mitigation Measures	
8.5	The construction works will be carried out with the least feasible disturbance of the soils, minimising the amount of excavated soil with the inert excavated soil will be re-used on site insofar as possible.
8.6	Approximately 1,650m^3 of excavated ground material will be exported from the site. In addition to this, approximately 720 m^3 of construction and demolition waste will be generated during the demolition of the handrails and the upper parts of the existing quay wall which will be exported from site. The quantity is very small given the scale of the project, and will be disposed of by the Contractor who will ensure that all subsurface materials excavated during the construction phase of the proposed development are managed in accordance with the relevant waste management legislation. The successful Contractor will ensure that all subsurface materials are removed from the site and sent to authorised waste management facilities (i.e. which hold all relevant, valid permits / licences) which accept the corresponding types of waste. The contractor will be required to submit a Construction and Demolition Waste Management Plan (CDWMP) to the local authority for approval, which should address all types of material to be disposed of. The contractor will undertake the environmental testing of the material to be disposed of in order to determine the waste acceptability characteristics.
8.7	All imported material will be sourced from the nearest possible locations. A number of suitable active quarries with all necessary statutory consents exist across County Waterford and southwest County Wexford, such as Oaklands Quarry in Ballykelly, New Ross, Co. Wexford and Cappagh Quarry in Cappagh, Dungarvan, Co. Waterford. Both quarries are accessible from the N25 which links to the site of proposed development via the R448 Terminus Street.

No.	Description
8.8	A project-specific Construction Environmental Operating Plan (CEMP) will be prepared for the development by the Contractor for approval by WCCC. It will be maintained by the Contractor for the duration of the construction phase. The CEMP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP for the proposed development will be formulated in consideration of the standard best practice. The CEMP will include a range of site-specific measures which include: • Safety measures for working from barges in-river, including but not limited to risk of pollutants from the machinery stationed on the barge and operating with bulk materials such as backfill gravel on the barge; • Runoff will be controlled and treated to minimise impacts to groundwater and River Suir. • Temporary storage of any contaminated material on-site shall be carefully managed so as to limit any risk of contaminated surface water runoff leaving the site or infiltrating to groundwater. Runoff from the material shall be directed to a lined pond or temporary sewer/tank and the water shall be disposed of off-site for treatment at an appropriate licenced facility in accordance with the relevant waste management legislation. Alternatively, the material shall be covered while stored to remove the risk of surface water contamination. • All hazardous materials will be stored within secondary containment, designed to retain at least 110% of the storage contents. Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase. • The successful Contractor will ensure that spill kits and hydrocarbon absorbent packs are stored in the site compound, and that operators will be fully trained in the use of this equipment. • The successful Contractor will ensure that silt and sediment barriers are installed (and maintained in proper working order) at the perimeter of earthworks areas to limit transport of erodible soils to watercourses. • Where soils are being excavated and removed from site, the successful Contractor will ensure that dust generation will be avoided, by damping down material during excavation and loading onto trucks for off-site removal, if necessary. • Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction, including the usage of appropriate PPE. The successful Contractor will prepare an Incident Response Plan (IRP) which outlines measures to be implemented to prevent and address spillages of hazardous substances.

19.7 Mitigation and Monitoring Measures for Hydrogeology

Table 19.6 Mitigation and Monitoring Measures for Hydrogeology

No.	Description
9.1	A project-specific Environmental Operating Plan (EOP) and a Construction Environmental Management Plan (OCEMP) have been prepared and appended to Chapter 4 of this EIAR (see Appendix 4.1 and 4.1A respectively). They will be maintained by the Contractor for the duration of the construction phase. The EOP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the EOP for the proposed development will be

No.	Description
	formulated in consideration of the standard best practice. The EOP will include a range of site -specific measures that include: • The successful Contractor will ensure that spill kits and hydrocarbon absorbent packs are stored in the site compound, and that operators will be fully trained in the use of this equipment. • Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding. • Runoff will be controlled and treated to minimise impacts to surface and groundwater. • Temporary pumping of groundwater, if required, shall be treated by means of a temporary sedimentation tanks prior to discharge • All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents. • Temporary bunds for oil/diesel storage tanks will be used on the site during the construction phase. • Contaminated material will be disposed of off-site for treatment at an appropriate licensed facility in accordance with the relevant waste management legislation. Alternatively, the material shall be covered while stored to remove the risk of surface water contamination. • Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction. Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering the River Suir (refer to Chapter 10 'Hydrology' of this EIAR for details).

19.8 Mitigation and Monitoring Measures for Hydrology

Table 19.7 Mitigation and Monitoring Measures for Hydrology

No.	Description
Construction Mitigation	
10.1	As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and Construction Environmental Management Plan will be prepared for the Flood Defences West and are included in Appendix 4.1 and Appendix 1.4 A, respectively. These will be developed 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 current drafts of 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) will be finalised 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 and Waterways Ireland.
10.2	During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.

No.	Description
	• *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites* (Eastern Regional Fisheries Board) • *Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers.* • *CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors.* • *CIRIA C648 Control of Water Pollution from Constructional Sites.* • *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (TII, 2006).* Based on the above guidance documents concerning the control of construction impacts on the water environment, the following outlines the principal mitigation measures that will be adhered to for the construction phase, in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts:
General Mitigation Measures	
10.3	Site works will be limited to the minimum required to undertake the necessary elements of the project.
10.4	Surface water flowing onto the construction area will be minimised through the provision of berms, diversion channels or cut-off ditches.
10.5	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.
10.6	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 runoff to watercourses.
10.7	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.
10.8	The anticipated site compound/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 runoff from the compound does not discharge directly to the watercourse. CEMP has been drafted and will need to be finalised by the appointed Contactor See the EOP and Construction Environmental Management Plan (CEMP) in Appendix 4.1 and 4.1 A of this EIAR for further detail.
10.9	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 the TII document "*Guidelines for the crossing of watercourses during the construction of National Road Schemes*". All chemical and fuel filling locations will be contained within bunded areas and set back a minimum of 20m from watercourses.
10.10	Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner, off site, to prevent pollution.
10.11	The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses.
10.12	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. The results of the water quality monitoring programme

No.	Description
	will be reviewed by the Site Environmental Manager and Ecological Clerk of Works 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 the this is deemed to be associated with the proposed development.
Specific Mitigation Measures – Concrete Works	
10.13	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: • 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 inclement 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 runoff prevented from entering the watercourse; • Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses; • On-site concrete batching and mixing activities will only be allowed at the identified construction compound areas; • 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 will 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; and 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 Waste Management Plan.
Flooding	
10.14	The Contractor will provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour. The Contractor will also provide method statements for the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk to persons working on the site as well as potential input of sediment or construction materials into the river during flood events.

19.9 Mitigation and Monitoring Measures for The Landscape

Table 19.8 Mitigation and Monitoring Measures for The Landscape

No.	Description
11.1	There are no mitigation measures proposed for Chapter 11 The Landscape as part of the Flood Defences West.

19.10 Mitigation and Monitoring Measures for Noise and Vibration

Table 19.9 Mitigation and Monitoring Measures for Noise and Vibration

No.	Description
12.1	With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2*. Whilst day-time construction noise and vibration impacts are expected to be minimal and well within the criteria set out in this document, there are night-time works that have the potential to cause a temporary, significant impact. The contractor will ensure that all best practice noise and vibration control methods will be used, where practicable in order to minimise emissions to external noise sensitive locations. In this regard, various mitigation measures can be considered and applied during the construction of the proposed development, such as: • No plant used on site will be permitted to cause an ongoing public nuisance due to noise; • The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations; • Where practicable vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order; • Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; • Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use; • All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures; Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted
12.2	Furthermore, it is envisaged that a variety of practicable noise and vibration control measures will be employed. These may include: • Selection of plant with low inherent potential for generation of noise and/ or vibration; • Erection of good quality site hoarding on the landward side of the main works which will act as a noise barrier to general construction activity at ground level; • Situate any noisy plant as far away from sensitive properties as permitted by site constraints Erection of localised barriers as necessary or where practicable around noisy items of plant such as generators or high duty compressors, which is of particular importance during construction works that take place during the night-time.
12.3	Where practicable it is recommended that noise and vibration from construction activities to off-site residences be limited to the values set out in Table 12.2 and 12.8 of the Noise and Vibration EIAR Chapter.

No.	Description
	This may be achieved by undertaking noise and vibration monitoring at locations representative of the closest sensitive receptors. Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise. Vibration monitoring should be conducted in accordance with BS 6472 for human disturbance and BS ISO 4866:2010 for building damage.

19.11 Mitigation and Monitoring Measures for Air Quality and Climate

Table 19.10 Mitigation and Monitoring Measures for Air Quality and Climate

No.	Description
13.1	The proactive control of fugitive dust will ensure the prevention of significant emissions. The key aspects of controlling dust are listed below. These measures will be incorporated into the overall Construction Environmental Management Plan (CEMP) prepared in respect of the proposed development. In summary, the measures which will be implemented will include: • Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic. • Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions. • Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads. • Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates. • Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary. • Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods. • During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. • During any demolition processes, water suppression should be used, preferably with a hand-held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays/local extraction should be used. • Drop heights from conveyors, loading shovels, hoppers and other loading equipment should be minimised, if necessary fine water sprays should be employed. At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

19.12 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

Table 19.11 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

No.	Description
Archaeology	
14.1	In order to ameliorate any negative impacts upon the archaeological resource, a full intertidal and wade/dive survey will be carried out along the sections of the existing quay wall to be directly impacted by the works and at the location of the upgraded and proposed outfalls. The survey will include a photogrammetry survey of the wall to be demolished (from Ch.350 to Ch.900), along with the mapping and recording of the former landing stages. All timber landing stages will be avoided during the course of works. The survey will also include a metal detecting survey and all works will be carried out by a suitably qualified underwater archaeologist, under licence to the National Monuments Service of the DoHLGH.
14.2	All ground disturbances associated with the works along the River Suir will be monitored by a suitably qualified underwater archaeologist. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH).
14.3	All ground disturbances associated with excavations within the car park associated with the existing train station will be monitored by a suitably qualified archaeologist. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the Department of Housing, Local Government and Heritage (DoHLGH).
Cultural Heritage	
14.4	The section of the iron railway bridge that currently occupies the works compound will be left in-situ and undisturbed by contractors.

19.13 Mitigation and Monitoring Measures for Architectural Heritage

Table 19.12 Mitigation and Monitoring Measures for Architectural Heritage

No.	Description
12.1	There are no mitigation measures proposed for Chapter 11 The Landscape as part of the Flood Defences West.

19.14 Mitigation and Monitoring Measures for Material Assets and Land

Table 19.13 Mitigation and Monitoring Measures for Material Assets and Land

No.	Description
16.1	During construction, the following mitigation measures are proposed for the Waterford Flood Defences West: • Measures to control the production of dust will be put in place by the Contractor (refer to Chapter 13 Air Quality and Climate which presents a series of measures to control dust);

No.	Description
	• Noise mitigation will be provided during construction of the development. Measures to mitigate noise impacts on sensitive receptors are detailed within Chapter 12 Noise and Vibration. The Contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities. • The upgrade works to the existing drainage system along the railway corridor west of Plunkett Station will be designed to ensure that the current drainage situation will not be impacted and there will be no increased risk of flooding as a consequence of the proposed development; • Prior to any excavation works, a segment of the ground will be surveyed via a CAT scan and a shallow slit trench will be excavated in order to confirm the position of utilities. • Any services that are interfered with as a result of the proposed development will be repaired / replaced without unreasonable delay. • A site plan will be prepared showing the location of all surface water drainage lines and proposed discharge points to surface water. This will also include the location of all existing and proposed surface water protection measures, including best practice measures such as monitoring points, sediment traps, settling basins, interceptors etc. All construction works will be temporary and will be carried out in line with best practice guidelines, thus minimising the impacts to the receiving communities. The Contractor will work within stringent construction limits and guidelines to protect surrounding amenities.