
Chapter 4

Description of the Proposed Development

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4.1 Introduction

This chapter provides a description of the proposed Waterford City Public Infrastructure Project - Flood Defences West hereafter referred to as the “proposed development”. The chapter details land requirements, the construction methodology and operational requirements of the proposed development.

It should be noted that surveys, assessments and information that form the basis of this Environmental Impact Assessment Report (EIAR) are based on the design of the project as described in this chapter, which has been developed to a stage that permits a fully informed Environmental Impact Assessment (EIA) to be carried out by the competent authority. While further detailing will be required to fully inform procurement and construction, no design changes will be permitted that have the potential to undermine the basis of the assessment of the environmental impacts undertaken in this EIAR.

4.2 Project Overview

The proposed development comprises c.1.1km of flood protection measures in the townlands of Mountmisery and Newrath in Co. Waterford, the townland of Newrath in Co. Kilkenny located along the north bank and within the foreshore of the River Suir in Waterford City, refer to Figure 1.1 in Volume 3 of this EIAR. The development extends for approximately 1km to the west and 100m to the east of the Waterford (Plunkett) Station, following the alignment of the existing quay wall and the Iarnród Éireann (IÉ) railway corridor located to the north of the proposed development.

The proposed flood defence measures are for the protection of critical infrastructure including the existing Plunkett Station, the railway line east and west of Plunkett Station and the Rice Bridge roundabout. The proposed development will also form a continuation of the flood protection measures, Flood Defences East proposed along the North Quays Strategic Development Zone (SDZ) as part of the Transport Hub Part 8 planning approval, eliminating the risk of flooding to the Transport Hub.

A design flood level of +4.0m OD (metres above Ordnance Datum Malin) is proposed for this development. The design flood level has been based on a flood with an annual exceedance probability of 0.5% and allowances for climate change and isostatic tilt as noted below.

The design (top-of-wall) level for the proposed flood protection measures is +4.30m OD (metres above Ordnance Datum Malin). The following allowances are integrated into the proposed height of the flood defence walls:

- 0.5% annual exceedance probability combined tidal-fluvial event (+3.45 m OD)
- An additional 0.55m to allow for climate change and isostatic tilt; and,
- 0.30m freeboard to the wall, including local wave wake effects.

An overview of the structural elements of the proposed development is provided from east to west below, and should be read in conjunction with Plate 4.1 and with Figures 4.1 to 4.6 in Volume 3 of this EIAR:

- Construction of c.365m of underground flood defences (an impermeable shallow trench approx. 0.35m in width and up to 3m in depth) from Ch.0.0 to Ch.365 to

cut off the potential groundwater seepage during high tide events. It is possible that parts of these underground flood protection measures may be omitted during detailed design (see Figures 4.2 and 4.3 in Volume 3) or may be implemented on a phased basis depending on the ongoing groundwater monitoring results.

- Total of c.185m of overground flood defences from Ch.0.40 to Ch.210 consisting of:
 - c.170m of glass flood barrier on the river side of the road edge vehicular parapets on Rice Bridge roundabout and along the 3 roundabout arms (R680 Rice Bridge, R448 Terminus St. and R711 Dock Rd).
 - c.15m of demountable flood barriers on the R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- Remedial works to the existing quay wall from Ch.285 to Ch.360 by raising its height by 0.6m to 1.2m to conform with the design top-of-wall level of +4.30m OD.
- Construction of a sheet pile flood defence wall from Ch.360 to Ch.1090, with the top of wall at +4.30 mOD, to protect against overground flooding and underground groundwater seepage:
 - From Ch.360 to Ch.900 the sheet pile wall will be installed within the foreshore from the riverside, 1m from the front face of the existing quay wall. The space between the sheet pile wall and the front face of the existing quay wall will be filled with clean imported granular fill. The intertidal zone of the sheet pile wall within the foreshore will be fitted with pre-cast concrete cladding material ("eco-seawall").
 - From Ch.900 to Ch.1090, the sheet pile wall will be installed on land from the landside, 1m behind the existing quay wall.
 - The demolition of minor localised section of existing quay wall (max length of 3m) will be required in order to connect the in-river sheet piles with the landside sheet pile walls at Ch.900.
- Construction of c.20m of underground isolation structure at Ch.1090, consisting of a sheet pile cut-off wall and a concrete capping beam. The concrete capping beam will facilitate the installation of temporary overground flood barriers (e.g. water filled inflatable flood barriers) should these be required to be implemented during a flood event.

Drainage works will be carried out for the entire extents of the proposed flood defence measures i.e., from Ch.0.0 to Ch.1090 as shown in Figure 4.11 to Figure 4.20 in Volume 3 of this EIAR:

- Remedial measures to the existing drainage outfalls to the River Suir from Ch.0.0 to Ch.1090 by extending them to reach an outlet within the new sheet pile wall, or to be retrofitted to pass through the new sheet pile wall, into the River Suir.
- In the vicinity of Plunkett Station, from Ch.0.0 to Ch.470, new trackside drainage and groundwater drains are included in the upgraded drainage works, which will include a pumping station (at approx. Ch.380) and a new surface water outfall structure in the River Suir at Ch.390.
- From Ch.370 to Ch.1090, new drainage system will be installed for trackside drainage and also to allow groundwater cut-off behind the sheet pile wall to drain to the River Suir with 2 No. new outfalls to the River Suir terminating at the front face of the proposed flood defence sheet pile wall (at Ch. 550 and Ch.900). The works will also include the construction of pumping stations at Ch.390 and Ch.550 respectively.

- Existing surface water outfalls at Ch.470 and Ch.490 which extend into the riverbed will be demolished to allow installation of the new flood defence wall; these will be replaced by new surface water outfall structures in the River Suir.
- Demolition of the existing quay wall to approximately 800mm below the existing ground level and removal of handrails from Ch.360 to Ch.900 where it is level with or above, the existing ground level. The demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level will be required in order to facilitate the construction of a surface water pumping station at Ch.390 (as shown in Figure 4.18 in Volume 3).
- All drainage outfalls (new and existing) will be fitted or retrofitted with non-return valves to prevent tidal water ingress.

Table 4.1 Overview of Proposed Flood Defences West

Chainage	Proposed Works
Ch.0.0 to Ch.365	Construction of an impermeable trench
Ch.0.40 to Ch.210	Construction of overground flood defences at Rice Bridge Roundabout.
Ch.285 to Ch.360	Remediation of existing quay wall
Ch.360 to Ch.1090	Construction of sheet pile flood defence wall
Ch.0.0 to Ch.1090	Drainage works

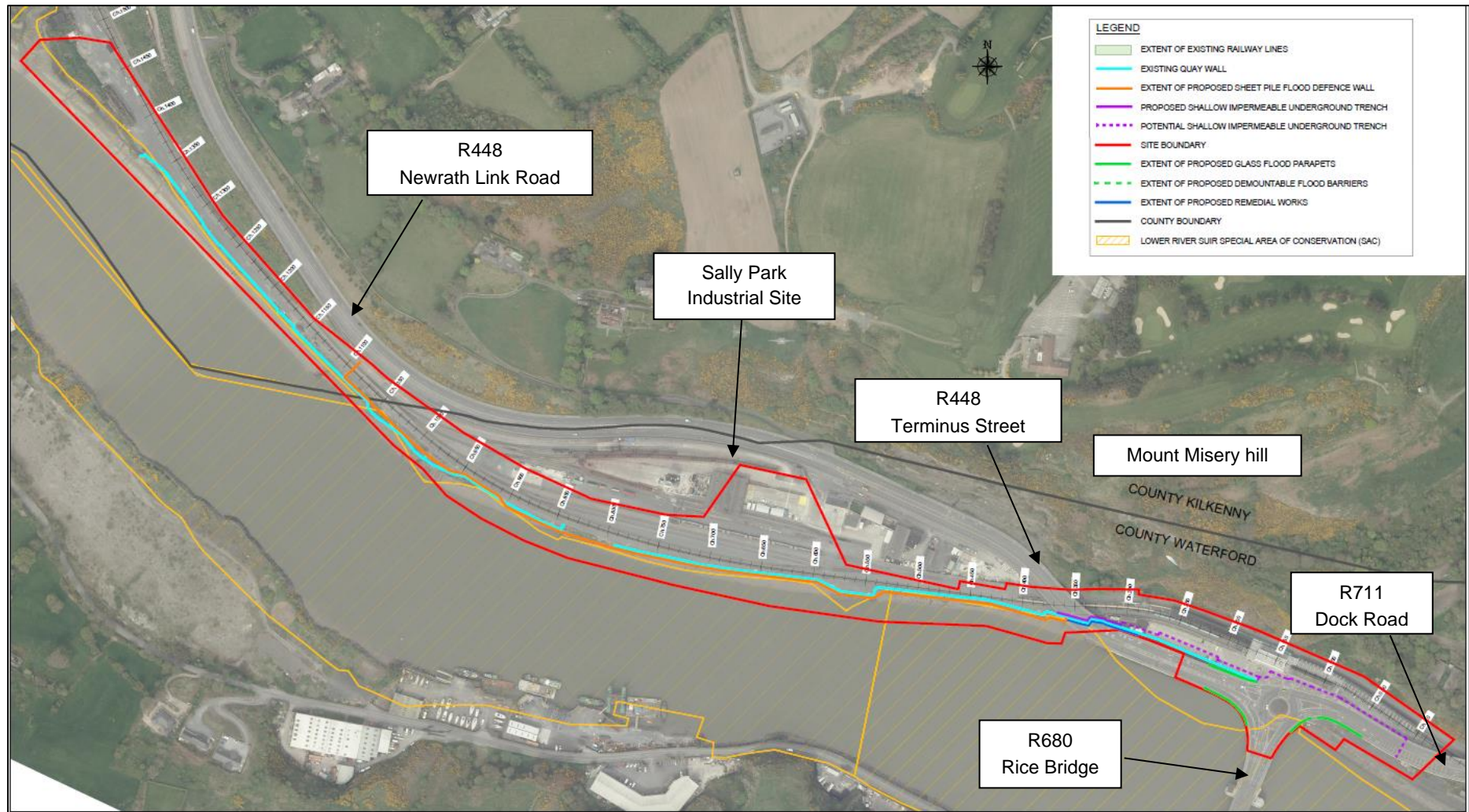


Plate 4.1 Location of proposed Waterford City Public Infrastructure Project - Flood Defences West (Scale: 1:1400)

4.3 Description of the Site of the Proposed Development

The site of the proposed development extends for approximately 1500 metres along the north (left) bank of the River Suir, which is designated as the Lower River Suir SAC and is hydrologically connected to the River Barrow and River Nore SAC, c. 9km downstream of the proposed development.

From Ch.0.0 to Ch.380 (see Figure 4.1 in Volume 3 of the EIAR), the site is characterised by transport infrastructure elements, namely by Plunkett Station with car parking area(s) located on both east and west sides of the main building, as well as the Rice Bridge roundabout; R711 Dock Road and R448 Terminus Street/Newrath Link Road, both of which are associated with complex construction elements such as viaducts and bridges. Plunkett Station is the terminus of the Dublin-Waterford line and has a through-platform for the extension to Belview Port. This eastern section of the site contains a considerable amount of buried/underground infrastructure mainly consisting of IÉ utilities in front of the Plunkett Station (see Chapter 16 Material Assets of this EIAR), and the obsolete remnants of historical infrastructure that include the existing quay wall and the old Newrath Road bridge foundations.

From Ch.380 to Ch.1090, the site is characterised by an existing quay wall, with one or more rail tracks parallel to the north of it, as well as ancillary rail infrastructure such as signalling and drainage. The IÉ lands occupy all of the lands between the existing quay wall and the R448 and include the rail tracks and the Sallypark industrial site.

Historical maps show that the predominant land use of the site between Ch.380 and Ch.1090 consisted of rail infrastructure and it has provided an industrial function for the past 160 years as shown in Plate 4.2 below.

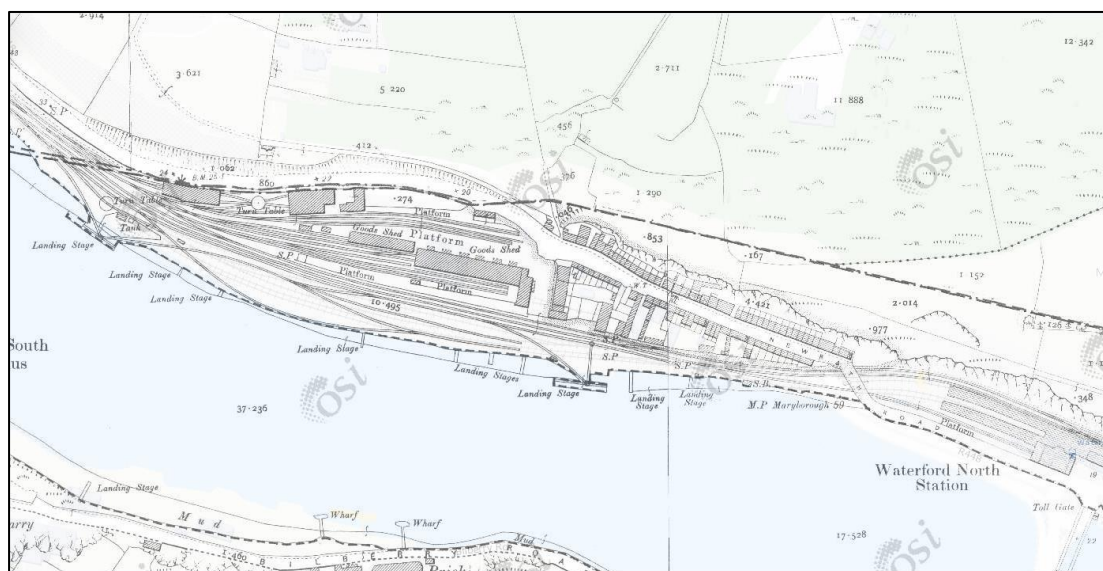


Plate 4.2 Land use within the northern banks of Waterford City between 1888 and 1913. Source: OSi historic map 25 inch (1888-1913) taken from <http://map.geohive.ie/>

The alignment of the existing quay wall remains largely unchanged throughout the years. Historically, some isolated landing stages projected into mudflats at different locations. Only the isolated remnants of wooden piles in mudflats are visible today. Historical maps from pre-industrial period (1840 and earlier) show the site to be an unoccupied coastal strip, with the extents of the westernmost half of the riverbank largely the same as currently visible. Historical maps however show that the eastern

section of the riverbank within the site of proposed development is slightly north of the existing bank. This implies that the area has been reclaimed locally in width of up to 10m during the construction of the rail infrastructure and is composed of non-engineered made ground fill, which has been confirmed by ground investigations.



Plate 4.3 Land use within the northern banks of Waterford City from 1837 - 1842. Source: OSi historic map 6-inch colour (1837-1842) taken from <http://map.geohive.ie/>

The topography of the site of the proposed development is flat, with typical elevation between +2.0mOD and +3.5mOD. The mudflats within the foreshore (in front of the existing quay wall) are typically at an elevation of +0.5mOD to -1.0mOD and slope gently towards the river centreline. To the north of the site, behind the rail tracks and the R448, the ground rises steeply up to level of +60 m OD. This geographical feature is known as Mount Misery hill, see Plate 4.1 above for approximate location.

4.3.1 Existing Drainage

The existing drainage catchment is shown on Figure 4.11 in Volume 3 of this EIAR. The site is bounded to the north by Mount Misery Hill and falls to the south, draining to the River Suir. The following paragraphs provide a description of the existing drainage network within the site of the proposed development, refer to Figures 16.7 to 16.12 in Volume 3 of this EIAR.

From Ch.0.0 to Ch.320 in the vicinity of Plunkett Station (Catchment A), the site is bounded to the north by a steep rock slope which is subject to rock stabilisation works as part of the overall Waterford City Public Infrastructure Project which was granted a Part 8 planning approval by WCCC in January 2019. As part of the Rock Stabilisation works, a cut-off ditch and drainage works are being provided to divert flows from the upper catchment away from the steep rock slope.

There are existing drainage networks in the vicinity of Plunkett Station. At Ch.0.0, an existing drainage network collects drainage from the railway track and platform located to the east of Plunkett Station and the eastern car parking area (below the R711 Dock Road viaduct), before discharging it into the River Suir east of Plunkett Station.

From Ch.160 to Ch.350, there are numerous existing drainage gullies in the western IÉ car park area (to the west of Plunkett Station and under the R448 road overbridge) which have numerous outfalls directly to the River Suir via the existing quay wall.

From Ch.350 to Ch.850, the site of the proposed development is bounded to the north by the remainder of the IÉ lands, the R448, and by the upper drainage catchment and the Sallypark rock cut slopes. The upper catchment drainage at Sallypark rock cut, identified on Figure 4.11 in Volume 3 of this EIAR, comprises a series of benching and rock traps, and rock trap collection channels which discharge into the R448 road drainage network. The R448 road drainage network transversely crosses the railway line at approx. Ch.490 and outfalls in the River Suir via an existing 600mm diameter outfall pipe located in the riverbed.

From Ch.350 to Ch.1090, there are existing drainage networks which collect flows from Sally Park industrial site located to the north of the railway line and some trackside areas which transverse the railway line and outfall to the River Suir. There are also numerous outfall pipes visible through the existing quay wall which may be remnants of old drainage networks or railway groundwater drainage measures.

From Ch.350 to Ch.1090, existing surface water flows from the railway line and adjacent flat areas, flow to the River Suir either through infiltration into the groundwater or over the edge of the existing quay wall in areas where there are significant gaps or cracks in the wall.

4.4 Design of the Proposed Development

The following paragraphs provide a detailed description of proposed flood defence measures and should be read in conjunction with Figures 4.1 to 4.20 of EIAR Volume 3.

4.4.1 Flood Defences in front of Plunkett Station

Underground Flood Protection

In front of the existing Plunkett Station building and adjacent to the parking areas (see Plate 4.4), starting from chainage Ch.0.0 and going westwards to approximately Ch.365, the ground conditions are such that the risk of flooding caused by underground seepage of waters from the River Suir during flood events are expected to be comparatively lower than within the rest of the proposed development area. It is envisaged that the potential risk from groundwater flooding is reduced due to this section being dominated by shallow bedrock and an abundance of built structures that pose obstructions to water flow, such as the historical quay walls and new boundary walls. However, with climate change and the risk of rising tide levels there is a risk of increased groundwater flooding at the low points in the railway line in front of Plunkett Station in the future. To prevent groundwater seepage at this location, it is proposed to construct an impermeable shallow trench (approximately 0.35m wide and up to 3m deep trench filled with lean mix concrete); blocking of disused drainage pipes; and retrofitting the other drainage pipes with non-return valves.



Plate 4.4 Western IÉ Car parking area in front of the Plunkett Station

It is noted that groundwater monitoring is currently ongoing as a part of the risk-based approach for this section, and it is possible that parts of these underground flood protection measures may be omitted during detailed design or may be implemented on a phased basis with ongoing monitoring of groundwater levels in the interim. However, for the purposes of the EIAR, a full length of impermeable trench is envisaged to be required, and therefore the worst-case impacts have been assessed as part of this EIAR, and separately the NIS.

The impermeable trench's depth and width have been designed on the basis of the local ground and groundwater model, and were determined using long-term monitoring and seepage design in accordance with IS EN 1997-1:2005 Eurocode 7: Geotechnical design General rules (Including Irish National Annex).

Overground Flood Protection

The ground levels at the Rice Bridge roundabout and the entrance to Plunkett Station (between chainages Ch.0.40 and Ch.210) are in parts lower than the design flood level of +4.0mOD. A system of overground flood protection measures is proposed for the Rice Bridge Roundabout and along the three roundabout arms; Rice Bridge (R680), Terminus St. (R448) and Dock Rd. (R711).

The overground flood defence measures will comprise of approximately 170m of glass flood barriers, 15m of demountable flood barriers, sealing of the roundabout and approach structure roadway movement joints, and the provision of flap valves on the existing road drainage outfall to the River Suir (see Section 4.4.4 Drainage for details).

The glass barriers will be located on the river side of the road edge vehicular parapets and will be supported off the existing concrete parapet edge beams (see Plate 4.5 as an example of a similar glass flood barrier).



Plate 4.5 Example of a glass flood barrier installed along a wall

Demountable slot-in flood barriers are required at the entrance on the Rice Bridge roundabout to the North Quays site to ensure access to these lands is maintained at all times (with the exception of at predicted estuary flood events). The demountable flood barriers require the installation of permanent below ground structural foundations at approximately two metre centres. The above ground elements (metal flood barrier posts and infill panels) will only be installed when the risk of flooding arises; the operational need for demountable barriers may only arise in the longer term when the impacts of climate change on tide levels leads to increased risk of flooding at this location. At present there is no record of flooding at this location, and the ground levels are above the current 0.5% AEP flood levels. In the shorter term (20-40 years) it is unlikely that the demountable barriers will be required to be deployed at this location.



Plate 4.6 Demountable Flood Barriers at Clancy Strand, Limerick (Source: www.floodgateireland.com)

The overground flood protection measures proposed will ensure that not only is Plunkett Station and the associated rail infrastructure protected from flooding, but the vital road network for access into Waterford City is also protected.

The proposed underground and overground flood protection measures in front of Plunkett Station will ensure that the Flood Defences West and Flood Defences East (which obtained planning approval in 2019) as part of Transport Hub Part 8 planning application are connected and that there is no gap in the flood defence measures. The Flood Defences East start at Ch.0.0 and continue eastwards. The Flood Defences East will be composed of landside sheet piles, installed south of the rail tracks and running parallel to them. The steel sheet piles will prevent both groundwater and overground flooding, except at Transport Hub development where the overground defence will be provided by the Transport Hub structural elements such as platform walls.

4.4.2 Remedial Works to the Existing Quay Wall

Between Ch.285 and Ch.360, the existing quay wall located in front of the car park (immediately to the west of the existing Plunkett Station) stretching c. 75m to the west under the R448 overbridge will be raised to add between 0.6m and 1.2m in height in order to attain the required height of +4.3mOD.

Between Ch.285 and Ch.300, the works will involve the construction of a reinforced concrete wall add-on, as the existing quay wall is reinforced concrete, and no significant defects were found in this segment of the wall during inspections. This is envisaged to be done as cast in-situ reinforced concrete, using chemically anchored reinforcing bars placed into the top of the existing wall to integrally connect the new add-on section and existing section of wall.

A similar solution will be applied to the existing quay wall between Ch.300 and Ch.360.

The wall add-on will be complemented, as stated in Section 4.4.1 above under the sub-heading of 'Underground Flood Protection', by an impermeable trench filled with lean mix concrete / grout. The impermeable trench will be constructed behind the existing quay wall to prevent the seepage through the deteriorating existing quay wall that is in poor condition at this segment of the wall.

4.4.2.1 Design Standard

The proposed remedial works involve building a reinforced concrete add-on wall on top of the existing quay wall to reach the design (top-of-wall) level of +4.30mOD. The new structure will be connected to the existing wall through chemically anchored reinforcing bars.

The design of the new wall and its connection to the existing structure follows the relevant design standards:

- I.S. EN 1992-1-1:2004+NA:2010 Eurocode-2 - Design of concrete structures - Part 1-1: General Rules and Rules for Buildings;
- I.S. EN 1992-4:2018 Eurocode-2 - Design of concrete structures - Part 4: Design of Fastenings for Use in Concrete;
- IS EN 1997-1:2005 Eurocode 7: Geotechnical design. General rules (Including Irish National Annex).

7 Biodiversity of this EIAR for more information). Example of an eco-seawall is shown in Plate 4.8 below.



a) Installation of an eco-seawall



b) Eco seawall submerged under high tide

Plate 4.8 Example of an eco-seawall. Source: product brochure from econcretetech.

Landside Flood Defences

Between Ch.900 and Ch.1090, the works will involve the construction of a sheet piled flood defence wall on land, 1m behind the existing quay wall, but in front of the rail tracks and will meet the IÉ clearance requirements. The landside sheet piles will be installed using a piling rig as detailed in Section 4.5.4. The permanent works will not encroach into the foreshore of the River Suir. Total height of sheet piles will be up to 10m for the landside works, with up to 8.5m of it embedded in the ground. As such, the sheet piles will project above the existing ground level by between 0.7m and 2.1m in order to attain the design (top-of-wall) level of +4.3 mOD.

For Health and Safety reasons and following IÉ standards, a steel handrail will be provided along the sheet pile wall where the distance between ground level at landside and the top of the sheet pile wall is less than 1.2m.

Underground Isolation Structure

The western end of the flood defences at Ch.1090 is set at a natural high point of the terrain and the rail track. The ground at this point is still slightly below the design flood level of +4.30mOD so an underground transverse isolation structure will be constructed in order to prevent both underground and overground flooding parallel to the rail line, i.e., it will create a cut-off return to complete the flood defences and protect from the floodwaters coming in from west to east along the rail lines. The underground isolation structure across and under the rail-line indicated at Ch.1090, will be approximately 20m in length. The underground isolation structure will consist of a sheet pile wall fully embedded in the ground, to a depth of approximately 6m below ground level. Where the sheet pile footprint is directly below rail tracks, a segment of the rail tracks will be temporarily removed to enable the piling and then reinstated back. The typical width of sheet pile profile is 450mm. The sheet pile wall proposed for the underground transverse isolation structure cannot protrude above ground at this location as its positioned directly below the existing rail tracks and would impede on the operation of the rail line. As such the sheet piles here will include a concrete

capping beam finished to existing ground level. The concrete capping beam will facilitate the installation of temporary overground flood barriers (e.g. water filled inflatable flood barriers) should these be required to be implemented during a flood event. The use of demountable barriers at this location is proposed to address the long-term residual risk of flooding (when the impact of climate change on the rising tide level begins to come into effect). The use of overground flood barriers will form part of a long-term strategy to address the flood risk which will include monitoring and operation and emergency planning to be put in place. At present there is no record of flooding at this location, and the ground levels are above the current 0.5% AEP flood levels. In the shorter term (20-40 years) it is unlikely that overground flood barriers will be required to be deployed at this location. Continuing flood defences further to the west of this point would require extending them further, to a minimum distance of 1km until the next natural topographical flood cut off, hence the selection of Ch.1090 for the westernmost end of the flood defences.

4.4.3.1 Design Standard

The proposed sheet pile wall will be executed as an embedded cantilevered retaining wall throughout its length. The top of the wall will be set at +4.30 mOD, to allow for the design flood level of +4.00mOD and 300mm of freeboard to protect from wave overtopping.

The design of the sheet pile wall follows the current design standards:

- IS EN 1997-1:2005 Eurocode 7: Geotechnical design. General rules (Including Irish National Annex); and
- I.S. EN 1993-5:2007+NA:2010 Eurocode–3 - Design of steel structures - Part 5: Piling (Including Irish National Annex)

The design covers the following ultimate and serviceability limit state design checks:

- Structure global stability (overturning)
- Wall steel section capacity (bending, shear)
- Groundwater seepage cut-off
- Horizontal displacements at the top of the wall

The wall design is verified for: both drained and undrained soil geotechnical conditions; the various temporary loading conditions during the construction stage; the permanent loading conditions once constructed (highest and lowest tidal events). The sheet pile embedment (toe level), steel section and steel grade have been selected to satisfy the limit design checks and loading conditions noted above. For durability, the loss in sheet pile wall thickness due to corrosion (over a 120-year wall design life) has been determined in accordance with the design standards and adopted in the selection of the appropriate sheet pile wall section.

Standard vertical rail loading of 150 kN/m' applied over sleeper width has been adopted in the design. The wall alignment was set such that in all locations the above ground section of sheet pile wall is at an adequate distance from the nearest track, in accordance with IÉ standards. In agreement with IÉ, the sheet pile wall is not designed for accidental impact loading (which may occur in the event of a train derailment).

The characteristics of the soil backfill behind the wall and sheet piling operations will conform to the relevant TII Specification for Road Works Standards and Notes for Guidance.

4.4.4 Remedial Works to the Existing Drainage System

Modifications to the existing drainage system will be required as part of the proposed development. The proposed drainage works are described in the following sections with reference to chainages shown in Figures 4.11 – 4.20 in Volume 3 of this EIAR. The existing drainage features are also shown in Figures 16.7 to 16.12 in Volume 3 of this EIAR and are described in Section 4.3.1 above.

There are existing drainage networks in the vicinity of Plunkett Station and the associated car parking area (at approx. Ch.0.0) which will have their outfall to the River Suir cut off by a sheet pile wall proposed as part of the separately approved Flood Defence East (part of the Part 8 planning application for SDZ Transport Hub). The existing drainage networks will be upgraded, and the associated flows will be directed into the new drainage network proposed as part of the Flood Defences West.

From Ch.160 to Ch.350, the existing gully outlets through the existing quay wall will be retrofitted with non-return valves to prevent water ingress during high tides. Existing drainage networks in this area will be diverted into the proposed surface water network which will outfall to the River Suir at the proposed drainage outfall at approx. Ch.390 (via a pumping station). See section 4.4.5 for more details on the new drainage system.

From Ch.350 to Ch.1090 the existing local drainage network draining into the River Suir will be upgraded with new outlets to enable drainage pipes to pass through the new sheet pile wall. Non return valves will also be provided to prevent water backflow up through the existing outfalls. Where required, existing drainage pipes will be extended to terminate at the front face of the new sheet pile wall.

Existing drainage outfalls which are located in the riverbed of River Suir (at Ch.470 and Ch.490) will be temporarily removed to allow installation of the sheet pile wall. These surface water outfalls will be re-instated in the riverbank to match their existing footprint / length and upgraded as part of the works. Further details are given in Section 4.4.5.

All manholes (see Figures 4.12- 4.17 in Volume 3) on existing drainage networks traversing the railway track will be provided with sealed manholes covers to prevent surcharging of these manholes during high tide events. It is likely that with climate change and rising tide levels, these existing drainage networks will require modification in the future to mitigate the increased surface water flood risk; however, such works are not included as part of this development but should be considered as part of a future catchment management plan. The proposed surface water drainage networks for this development are designed to take into account the impacts of climate change on tide levels.

Several other smaller surface water or land drainage outlets were noted along the existing quay wall during a visual inspection. The proposed drainage upgrade works will connect as many of these minor outfalls as possible into the proposed drainage network and a filter drain will collect sub-surface drainage. Where this is not feasible (due to water levels), these minor land drains will be extended to outfall through the new sheet pile wall.

All existing drainage outfalls will be fitted or retrofitted with non-return valves to prevent tidal water ingress.

4.4.5 New Drainage System

The provision of proposed flood defence measures will raise the level of the quay wall and will cut off the existing flow path of over the edge surface water drainage and the existing groundwater flows.

Therefore, additional drainage pipework such as filter drains will be provided and will run linearly behind the proposed flood protection measures to accommodate the surface water and the cut-off groundwater flows.

As part of the proposed development, no significant increase in impermeable areas or changes to the overall catchment is proposed. The upgrade of the drainage networks may facilitate faster run-off of surface water from the site, however the outfall peak flows will not be increased significantly post construction.

In the vicinity of Plunkett Station from Ch.0.0 to Ch.350, a new drainage network will be provided to collect flows from the trackside drainage and also from the low point at Plunkett Station at +2.15m OD. This will reduce the risk of pluvial flooding at this location.

4.4.5.1 Outfalls to River Suir

Outfalls Terminating at the New Sheet Pile Wall

The proposed outfalls to the River Suir at Ch.550 and Ch.900 will consist of an outfall pipe fitted flush with the proposed sheet pile wall and fitted with a flap valve or other non-return valve. Outfall levels will be above the existing mud flat levels.

At new surface water outfall locations which collect surface water run-off from the railway area, the surface water run-off shall pass through a Class 1 by-pass separator prior to discharge to the River Suir.

Outfalls Extending into the Riverbed of the River Suir

A proposed new outfall structure to the River Suir will be provided at approx. Ch.390 to discharge surface water run-off from the Plunkett Station area. This new surface water outfall structure will extend between 4m and 6m into the River Suir.

At the new surface water outfall location (Ch.390) which collects surface water run-off from the railway area, the surface water run-off shall pass through a Class 1 by-pass separator prior to discharge to the River Suir.

There are 2 no. existing outfall pipes which extend past the existing quay wall into the riverbed i.e., a 750mm diameter pipe at approx. Ch.470, and a 600mm diameter pipe at approx. Ch.490. As part of the proposed works, the existing sections of these pipes which are in the riverbed will be removed and replaced in order to facilitate the construction of the proposed sheet pile wall. The new section of pipe will penetrate the new sheet pile wall and extend into the riverbed the distance required to ensure the pipe outfall invert is above bed level., the distance required to ensure the pipe outfall invert is above bed level. Refer to Figure 4.20 in Volume 3 of this EIAR for details of proposed outfall structures to the River Suir.

All three outfalls will be provided with a headwall structure and a flap valve or similar non-return valve at the outlet (see Plate 4.9 for an example). The sections of pipe located in the riverbed will be provided with a piled foundation which will be further assessed at detailed design based on localised geotechnical information. At each outfall location a stone mattress will be placed in the riverbed to prevent erosion. The

stone mattress will require minor excavation works to a depth of approximately 500mm into the riverbed and will occupy an area of approximately 1.5m by 3.5m.

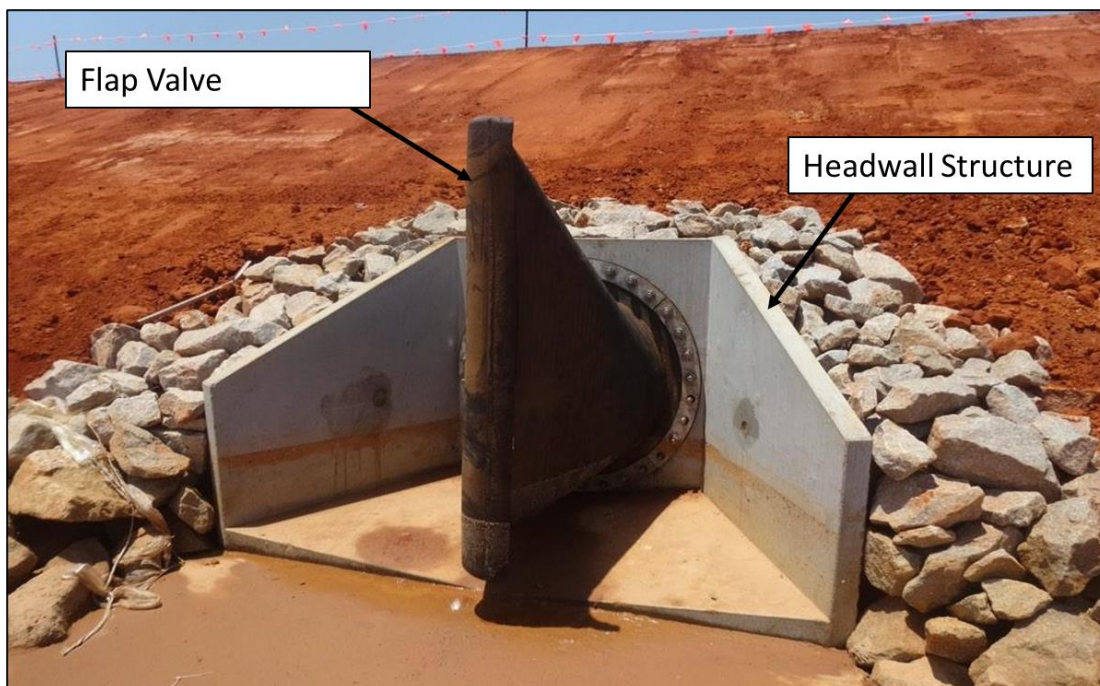


Plate 4.9 Example of a drainage outfall fitted with a flap valve protruding from a headwall structure

4.4.5.2 Surface Water Pumping Station

Surface water flows are designed to gravitate to the River Suir during normal operating and tide conditions. In the event of high tide where gravity flows are not possible, flows will pass through the proposed surface water pumping stations.

The proposed underground surface water pumping stations at approx. Ch.380 and Ch.550 are shown in Figures 4.18 and 4.19 in Volume 3 of this EIAR respectively. The pumping stations will operate in high tide events, where gravity flows are not possible by pumping the flow to the River Suir via rising mains out-falling through the sheet pile wall.

The pumping stations will discharge surface water flows from the proposed surface water network system which consist of trackside drainage and the groundwater flows cut-off by the proposed sheet pile wall. Existing surface water drainage networks (e.g. R448 road network (including the Sally Park Rock cut (upper catchment area (refer to Figure 4.11 in Volume 3)), the Sallypark Depot area surface water networks) are not included in the proposed pumping station catchment area.

The pumping station will be designed to cater for:

- A design Flood level of +4.0mOD;
- Surface water network flows for the 1 in 30-year return period, critical storm duration.

The design of the pumping stations shall be co-ordinated with IÉ to meet their requirements in relation to maintenance and access, as they are located in vicinity to an operational railway line.

Overflow Chamber

Surface water flows are designed to gravitate to the River Suir during normal operating and tide conditions. The hydraulic design of the surface water outfall at Ch.390 and Ch.550 will discharge under gravity, away from the pumping station to the River Suir so that any flood water or tidal influences do not cause damage to station equipment or loss of functionality. In the event of high tide where gravity flows are not possible, flows will pass through a 2D dynamic storm screen mounted on an overflow weir within the storm overflow chamber. These flows will then enter the wet well chamber whereby the storm pumps will operate, pumping flows to the River Suir via the proposed surface water outfall pipe. As proposed, ground levels along the surface water outfall pipe are below design flood level of +4.0mOD, and all manholes on the surface water outfall pipe shall be sealed. Telemetry and control equipment will be installed to facilitate the above sequence of operations.

Pumping Station Wet Well

The basic configuration of the pumps and motors will consist of a wet well and valve chamber arrangement with wet well submersible pump sets. There will be duty, assist/standby pumps as a minimum requirement complete with automatic switchover facilities.

Preliminary size of the pumping chambers are of circa 20m³ to 50m³ wet well storage volume.

The duty pump stop level will be above the top of the motor for submersible wet-well pumps. The duty pump start level will also be below the crest of the overflow weir.

No fixed man access system shall be provided into the wet well. However, consideration will be given for provision of permanent safe access to the wet well and equipment for essential maintenance purposes.

Site drainage gully covers and access covers for manholes, valve chambers and flow meter chambers will comply with IS EN 124.

Lifting equipment will be installed to facilitate safe operation and maintenance of the pumping station.

Kiosks and Cabinets

Insulated cabinets or kiosk housings will be provided for the housing of mechanical, electrical apparatus within the site. They shall be located outside any hazardous areas on the site.

Kiosks shall be installed on a plinth 150mm above ground level to prevent the ingress of water. Typical size of the kiosks shall be 1.2m length by 0.45m wide and approx. 1.4m high. Kiosks and access covers will be locked and secure in their own right.

4.4.5.3 Design Standards

The following Design Standards, *inter alia* will be used for the design of the drainage surface water network:

- Design Manual for Roads and Bridges – Volume 4 Section 2 based on HD33/16, HA 107/04 and HD45/09;
- CIRIA C753 – The SuDS Manual;
- the Greater Dublin Strategic Drainage Strategy (GDSDS), Chapter 3 'The Regional Drainage Policies'

Pipes crossing under the Iarnród Éireann railway line shall comply with :

- Iarnród Éireann CCE-TMS-344“Requirements for Undertrack Crossings and Pressure Pipelines”

Surface water drainage networks are designed for:

- 1 in 1 year return periods, critical storm duration -to be accommodated without surcharge;
- 1 in 30-year return periods, critical storm duration -to be accommodated without surcharge above chamber cover level (e.g. no flooding along the railway corridor);
- 1 in 100-year return period, 6-hour duration event to be accommodated in all storage structures;
- an allowance for climate change to be applied to the drainage design by increasing rainfall intensity by 20%;

The GSDS recommends that for the design of sewer (surface water) networks affected by river or tidal levels, that flood risk assessment is based on a pragmatic approach to joint probability analysis for combinations of events can be taken initially.

The following event combinations are proposed in the GSDS, based on providing combined return periods 30 years for flooding from sewerage systems affected by river or tidal levels.

Surface water drainage network system flooding evaluation, with tides (30 years):

- MHWS (mean high water spring tide) with 30-year drainage storm event;
- 1 year tide with 1 year drainage;
- 5-year tide with 0.25-year drainage.

Where the system flooding evaluation identifies a risk of surface water network flooding for the combined tidal\ fluvial and rainfall events; including an allowance for climate change; then it is necessary to provide attenuation storage or pumping systems on the surface water network.

All proposed new drainage networks are designed to gravitate to the River Suir during normal operating and tide conditions. The proposed outfalls from the new drainage networks will be provided with either attenuation storage volume for the 6hr event during high tide in accordance with CIRIA C753, or with an underground surface water pumping station.

As noted in the previous section, the proposed development will include 2 No. underground pumping stations located adjacent to the railway line for the proposed drainage networks within the railway corridor. Additionally, the proposed new outfall at Ch.900 will be provided with oversized pipes to provide attenuation during high tide events.

The protection of watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed works. The River Suir is located along the southern boundary of the site contains surface drainage channels conveying drainage to the river. The proposed development will be designed to protect the water quality of the River Suir and the drainage ditches which border the site. No routes of any natural drainage features will be permanently altered as part of the proposed

development. Drainage of the completed development will be directed to a new surface water drainage system and discharged to the River Suir. All new surface water outfalls to the River Suir will be provided with Class 1 by-pass petrol separators.

4.4.6 Demolition of the Existing Quay Wall

Following the construction of the sheet piled flood defence wall the following sections of existing quay wall (and associated handrails) will require demolition to approximately 800mm below the trackside ground level to facilitate the construction of the proposed below ground drainage network;

- The existing reinforced concrete quay wall between Ch.355 and Ch.435 (the top of which is approximately 1.3m above existing ground level (trackside));
- The existing reinforced concrete quay wall between Ch.435 and Ch.555 (the top of which is approximately at existing ground level (trackside));
- The existing stone masonry quay wall between Ch.555 and Ch.590 (the top of which is approximately at existing ground level (trackside)). The removed stone masonry will be salvaged;
- The existing quay wall (stone masonry wall with the top 600mm (approx.) in reinforced concrete) between Ch.590 and Ch.790, and between Ch.840 and Ch.900 respectively (the top of which is approximately at existing ground level (trackside)).

In addition, in the vicinity of Ch.390, the demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level will be required in order to facilitate the construction of a surface water pumping station (as shown in Figure 4.18 in Volume 3 of this EIAR).

In addition, the demolition of minor localised section of existing quay wall (max length of 3m) will be required in order to connect the in-river sheet piles with the landside sheet pile walls at Ch.900. The wall will be demolished in full height over this 3m wide section and the section to the west of the transition point will be rebuilt once sheet piles are installed. The remaining masonry material will be salvaged.

4.4.7 Effect of Flood Defences on Hydrodynamics of River Suir

Project-specific hydrodynamic modelling and analyses have been carried out on behalf of WCCC to assess the effects of the proposed Flood Defences West on hydrodynamics and hydromorphology of the River Suir. The report (see Appendix 10.2) has concluded that *“the hydrodynamic simulations both normal tidal conditions and extreme flood events show an increase in velocity magnitude along the middle section of the flood wall alignment on both ebb and flood flows and a reduction in velocity locally in the vicinity of the outfall structures. The higher increases in velocity between existing and proposed cases occur on the spring tides and on the flooding tide with a general local increase of 0.05m/s and larger increases along the toe of the Flood wall of 0.075 to 0.1m/s. These local changes are not significant in comparison to the computed baseline velocity magnitudes under the present existing situation. There is no perceptible change in flow velocities in the main, deeper channel section or at the opposite far bankside. The predicted upstream and downstream changes to the flow velocity magnitude at the near bank is local and not very extensive or significant”*. For more detailed discussion, refer to Chapter 10 Hydrology of this EIAR.

4.5 Construction Methodology

4.5.1 Potential Construction Procurement Method

It is envisaged that the construction of the proposed development will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer.

The advantage of the Employer Designed Works contract is that the design team who have undertaken the design and environmental assessment will continue with the detailed design and site supervision, ensuring a continuity of knowledge through the remaining phases of the project through to completion and handover.

4.5.2 Timescale for Construction

Subject to timely completion of the statutory procedures and availability of finance, it is anticipated that construction work could commence in 2022 with a 30 to 35-week construction programme. Table 4.2 at the end of Section 4.5.3 provides a summary of the construction sequence and programme.

4.5.3 Construction sequence

The envisaged construction sequence for the works is as follows:

- (i) Site Setup and establishment of construction compounds at locations described in Section 4.5.14;
- (ii) Excavation of trenches at Ch.0.0 to Ch.365 (or just in parts of this section, based on the groundwater monitoring and assessment) including:
 - (a) Relocation of underground utilities, where required;
 - (b) Excavation of material from trenches;
 - (c) Filling in trenches with lean mix concrete / grout and reinstatement of pavement.
- (iii) Installation of overground flood defences:
 - (a) Glass barriers on the river side of the road edge vehicular parapets on Rice Bridge roundabout and the 3 roundabout arms (R711 Dock Road, R448 Terminus Street, and R680 Rice Bridge).
 - (b) Underground foundations for the demountable flood barriers at R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- (iv) Remedial works for raising the height of the existing quay wall including:
 - (a) Setup of temporary dry (dewatered) working area in front of the wall using sandbags, Portadam system or waterfilled dams;
 - (b) Setup of temporary works such as formwork, scaffolding and granular base for scaffolding in mudflats;
 - (c) Anchoring and concrete pouring works;
 - (d) Decommissioning of temporary works, including removal of granular base from the mudflats, any building works spoil, and dewatering system.
- (v) Installation of permanent sheet pile walls on the riverside. Backfilling of the gap between the riverside sheet pile wall and the existing quay wall can take place simultaneously with sheet piling, after a short segment of the sheet pile wall (assumed 10-30 m) is piled (temporary transversal sheet pile may be installed at the end of segment to prevent fill from being washed out), or once full length of sheet piles is installed. Attaching of eco-seawall panels to the front face of the sheet piles.

- (vi) Partial demolition of existing quay wall (from Ch.360 to Ch.900) above ground and to a depth of 800mm below ground (where required) to enable installation of drainage works (to be complete in tandem with step (v) above to ensure demolition takes place before backfilling);
- (vii) Installation of landside sheet pile wall from Ch.900 to Ch.1090 to include:
 - (a) Demolition of the 3m wide section of the existing quay wall at Ch.900 to enable joining of the riverside and landside sheet piles;
 - (b) Installation of permanent landside sheet piles; and
 - (c) Installation of transversal underground isolation structure at Ch.1090.
- (viii) Drainage – Installation of drainage works from Ch.360 to Ch.1090 as follows:
 - (a) Installation of drainage works parallel to the new sheet pile wall in tandem with construction of the sheet piling (step v);
 - (b) Installation of surface water outfalls passing through the new sheet pile wall, and fitting of flap valves from the riverside on each outfall (in tandem with step v);
 - (c) Demolition of existing surface water outfalls in the riverbed and provision of temporary outfalls (e.g. over pumping) on existing outfalls during the works;
 - (d) Construction of new outfall structures in the riverbed (following installation of the sheet pile wall) within a sheet pile cofferdam (temporary works); the outfall structure will include a foundation structure to the outfall pipe (which may need pile supports), a headwall and erosion protection measures (including a stone mattress at the mouth of the outfall), headwall and erosion protection measures including a stone mattress at the mouth of the outfall;
 - (e) Construction of 2 No. underground pumping stations to include an overflow chamber, wet well and valve chamber;
 - (f) Installation of pumping station pumps, valves fitting and MEICA commissioning of pumping stations.
- (ix) Drainage – Installation of drainage works from Ch.0.0 to Ch.360 at Plunkett Station as follows:
 - (a) Installation of the new drainage system and associated railway undertrack crossings. All undertrack crossings will be carried out subject to IÉ agreement and where necessary, localised night-time possessions will be applied to facilitate installation,
 - (b) Remedial works to existing drainage networks including retrofitting of flap valves at outfalls.

Due to the linear nature of the works, it is assumed that the works under items (ii) to (ix) above can run in parallel. The list above thus does not indicate that one activity needs to fully finish for the next one to start. It is possible that the works will be done in separate sections. Some limitations however exist, and these are outlined below:

- The sheet pile wall needs to be installed at drainage outlet locations before the outlet can be completed. It is necessary for the drainage outlet to be completed before the backfilling to the sheet pile wall (above the underside of pipe level) can be completed.
- Impermeable trench / grouting in area behind the existing quay wall (where the wall will be raised with remedial works) to be done before the commencement of wall remedial works.

- The upper sections (down to 800mm below ground level) of the existing quay wall are to be demolished after the sheet piles are installed in that location and before the drainage is installed.
- The riverside sheet piles will be installed before the eco-seawall panels are attached to them.

4.5.4 Piling Methodology

Riverside (Ch.360 – Ch.900)

The installation of riverside sheet piles will be carried out from a jack-up barge positioned in river that will move as the work progresses. The typical dimensions of such a barge are 25m x 15m (length x width). The barge will carry a crane and/or long reach excavator equipped with a vibratory hammer that drives piles into the ground by vibration. The stack of sheet piles will be placed on an additional pontoon placed next to the barge, which can be tugged by a tugboat to the main construction compound area at Ch.1340 (see Section 4.5.14) to bring more sheet piles to the barge.

Works will be carried out by two piling rigs located on two separate barges. One barge will start from the east at Ch.360 and work westwards, while the other barge will start either at the western end (Ch.900) and work eastward or start from a suitable location in the middle.

The work process involves the barge anchoring and stabilising itself, after which a line of sheet piles is driven by a crane or excavator. The pile is lowered to a position and the vibrating clamp is attached to the head of the pile. The vibrations generated by vibratory hammer drive the pile into the ground. The vibration and noise generated by this process are continuous during the driving time but are less than those induced by impact driving. After the segment (a line of piles) is completed, the barge is then either self-propelled or tugged to the next position where the next segment is being driven. The barge is assumed to be anchored approximately 6m from the quay wall, to ensure that the barge is not positioned within the tidal mud flats and can move regardless of the tide level. The barge cannot be positioned within the mud flats as it will need to wait for high tide to be able to float to a new position. The barge can, however, be brought closer to the shoreline in some specific locations (to a minimum distance of 3m from the existing quay wall), if required.

The sheet pile alignment is set so that the back side of the sheet piles is at a distance of 1.0m from the front face of the existing quay wall. The front face of the wall includes the protruding blocks or slabs at or near the toe of the wall. This will ensure that the piling is not obstructed by the wall foundation and similar obstacles. Localised obstacles such as dislodged blocks in the mudflats will be removed by an excavator bucket. An allowance is made for localised minor in-situ realignment of the sheet pile where significant obstacles such as remnants of wooden piles of landing stages are present as described in Section 4.4.3.

The gap between the sheet pile wall and the existing quay wall will be backfilled with clean imported granular fill, TII Specification for Road Works Series 600 Class 6. The top of the fill is envisaged to be flush with existing ground level or up to 500mm lower. The backfilling can be carried out once the entire sheet pile wall has been installed or can progress simultaneously with sheet piling – once a short segment (10 - 30m) of sheet piles has been installed, the gap can be filled (subject to the installation of drainage works as outlined above). A temporary transversal pile can be installed at the end of each segment to prevent washout of the backfill. Alternatively, the fill can be placed once all piling is completed. Placing of fill will be coordinated with the drainage outlet works in either case.

The total height of the sheet piles will range between 14 and 21m. The sheet piles will be embedded in the ground over approximately 11 to 16m of total length. The difference in the total sheet pile height and embedment length is due to differences in local ground conditions and retained height encountered along the alignment. All sheet piles will meet the required top of wall level of +4.30 mOD.

The construction is assumed to be carried out during normal working hours (daytime), 6 days a week. The estimated timeframe for riverside sheet pile driving is approximately 12 weeks using two barges. This excludes set up and other activities on site, either prior to, or after pile driving. The piling will occur intermittently throughout the day, with the remainder of the time spent on ancillary processes such as setting up the barge, positioning the piles, checking tolerances, delivering material and personnel, and similar. Piling duration for the temporary and permanent piles at the three drainage outfall locations will take approximately 2 weeks.

While the riverside piling works will not require extended rail possessions and night works, localised short-term possessions may be required during the passage of trains for health and safety reasons where sheet piles alignment is in close vicinity of the rail tracks, such as at Ch.430.

Landside (Ch.900 – Ch.1090, incl. transversal isolation structure)

The installation of landside sheet piles will be carried out by machinery (excavator with vibratory clamp) situated in the cress between the rail tracks and the existing quay wall. The width of the cress in the section from Ch.900 to Ch.1090 is in excess of 10m, therefore the works can be carried out during the daytime, behind a temporary fence installed at 3.0m distance from the nearest running track, with no rail possession required. Some isolated night-time work (full rail possession) may be required to fully set up the temporary fence, material, and machinery in the works area.

Total height of sheet piles will be 10m for the landside works, with up to 8.5m of it embedded in the ground.

The construction is assumed to be carried out during normal working hours (daytime), 6 days a week. The estimated timeframe for daytime landside sheet pile driving is approximately 4 weeks. This excludes set up and other activities on site carried out prior to or after pile driving. In each day, the piling will occur intermittently throughout the day.

The approximately 20m long transversal isolation structure will have to be constructed overnight in order to avail of full rail possession, as the structure will pass directly under the rail tracks. The nightworks are estimated to be carried out on Monday – Friday lasting approximately 1 to 2 weeks. Night-time working will also be required for the stretch of the landside sheet pile wall between Ch.900 and Ch.950, which was brought to landside to avoid impact on the Annex I Saltmarsh habitat. The works will require approximately 2 weeks of night-time piling works under full possession. A hoarding fence will be erected for these works around the rig's working area to reduce the noise impacts at night-time.

The total duration of landside piling works (Ch.900 to Ch.1090), including isolation structure) will be approximately 7-8 weeks.

Piling durations to satisfy environmental requirements

The following general procedure will be followed for any piling activities from riverside and landside (“piling event” means any period of continuous piling by one or two rigs; “quiet period” means any period in which there is no piling by any rig):

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

Based on the time expected to be required for the installation of each pile (including ancillary processes), the limits prescribed above will not prolong the proposed programme for riverside or landside piling.

4.5.5 Installation of an eco-seawall

Pre-cast concrete cladding panels (“eco-seawall”) will be installed to sections of the riverside sheet pile wall that are within the intertidal zone of the River Suir. The cladding panels of the eco-seawall will be mechanically attached onto the front (riverside) face of the installed sheet pile walls without the use of in-situ concrete. The cladding panels will be attached to the attachment points that will be welded to sheet piles prior to their driving (see Section 4.5.4 for piling methodology). The attaching of the cladding panels to the sheet pile wall will be carried out from a barge. Construction personnel will also be positioned close to the sheet pile wall either from a working platform cantilevered from the barge, or on mudflats to guide the cladding panels to attachment points. Works will be undertaken at low tide.

The height of cladding will be 2.5m on average, and the final height will depend on the mudflat level at the particular section. Installation of the “eco-seawall” to the sheet piles will require approximately 3 weeks.

4.5.6 Construction of Underground Flood Defences in Front of the Plunkett Station

Impermeable trenches will be constructed between Ch.0.0 to Ch.360 using the following methodology:

- (i) Traffic management to be set up;
- (ii) A segment to be surveyed via CAT scan and shallow slit trenches excavated in order to confirm the position of utilities;
- (iii) A main trench with width of 350mm will be excavated for the determined length of the segment (assumed up to 10m);

- (iv) Excavated material from the trench will be tested for contamination levels and taken off site for disposal at a suitably licensed facility;
- (v) The trench will be filled with lean mix concrete or grout.
- (vi) Points ii) to iv) above are repeated for the next segment.

The construction works are assumed to be carried out in two phases in order to minimise the inconvenience to Plunkett Station car park and station users. The first phase will take place from Ch.160 to Ch.365. This will close the western car park but will retain unimpeded usage of the station building and the eastern car park. The works will be undertaken during normal working hours, with a duration of approx. 2 weeks. From Ch.280 to Ch.365, in consultation with Iarnród Éireann, a temporary fence will be erected at 3.0m distance from the rail line for Health and Safety purposes.

Once works on this section are completed, the western car park will reopen, and the works will commence on the trench at Ch.0.0 to Ch.160. Works on this section are envisaged to be carried out over ten weekend shifts to minimise the effect to working day commuters. The eastern car park will be closed on weekends as a result. Short, localised night-time works may be required to finish the section at Ch.150 where the only entrance to both car parks is situated.

4.5.7 Construction of Overground Flood Defences in the Vicinity of Rice Bridge Roundabout

The installation of the glass flood barrier and support points for the demountable flood barrier will be carried out using the following construction methodology:

Glass flood barriers

- (i) Traffic management is set up to suit the location of each section of flood barrier;
- (ii) Access scaffolding is installed to the outer face of the existing concrete parapet edge beam or an underbridge access unit (vehicle) is setup on the traffic lane adjacent to the footway/ vehicular parapet;
- (iii) The glass barrier posts and associated base plates are fixed to the existing concrete parapet edge beams using a proprietary anchor system;
- (iv) The infill glass panels with structural steel surround are installed between the posts as the post installation progresses along the length of proposed flood barrier. A continuous seal is provided between the lower glass panel framing element and the existing concrete parapet edge beam to prevent any water ingress between the elements.
- (v) Points i) to iv) above are repeated for each section of barrier to be installed.

Demountable slot-in flood barrier

- (i) Traffic management is set up;
- (ii) The road pavement and footpath at the entrance to the North Quays site on the roundabout is surveyed via CAT scan in order to confirm the position of utilities;
- (iii) The road pavement and footpath at the proposed flood barrier support locations are excavated to the required depth to install the flood barrier post foundations/ support fixings;
- (iv) Remedial Works to the existing vehicular parapet at the start of the ramp at the entrance to the North Quays Site and the end of the parapet system on R711 Dock Road are undertaken to facilitate the joining of the permanent and temporary flood protection systems. The remedial works will consist of the following;

- a. The section of existing metal parapet railing adjacent to the northern end of the proposed glass flood barrier on Rice Bridge (R680) is cut back to the two adjacent existing parapet posts. Parapet ends are made good (painting etc). A new concrete pillar is constructed on top of the existing concrete parapet edge beam to provide a suitable form of construction to facilitate the interface of the glass barrier and demountable barrier system.
- b. A new concrete pillar is constructed on the top of the existing concrete parapet edge beam at the end of the metal parapet system on R711 Dock Road to provide a suitable form of construction to facilitate the interface of the glass barrier and demountable barrier system.

It is assumed that the construction works will be carried out in phases to minimise inconvenience to Plunkett Station and road users.

4.5.8 Remedial Works to the Existing Quay Wall (Ch.285 – Ch.360)

The remedial works to the existing quay wall (a mixture of masonry and concrete construction) will involve raising the wall height (by between 0.6m to 1.2m) to +4.3mOD.

The new raised section of wall is envisaged to be done using cast in-situ reinforced concrete construction.

The following construction methodology is envisaged:

- (i) The existing handrails will be removed from the top of the wall.
- (ii) The top of the existing quay walls will be suitably prepared to form a construction joint with the new wall section (i.e., thoroughly cleaned of any loose debris and the existing top of wall concrete surface scabbled (using a handheld three head scabber or equivalent)).
- (iii) Chemically anchored reinforcing bars will be placed into the top of the existing wall to integrally connect the new and existing sections of wall.
- (iv) The new wall section reinforcement will be placed
- (v) Formwork will be installed for the new wall section and will be supported off the existing sections of wall.
- (vi) The in-situ concrete will be poured, and the formwork struck once the concrete has hardened.

No permanent works encroachment into the River Suir SAC will be necessary for the works.

The majority of the works are expected to be undertaken from the landside, however temporary access scaffolding on the outer (river) side of the existing wall may be required during construction. The scaffolding may be supported off the existing quay wall or set up in the mudflats. To ensure the stability of any scaffolding set up in the mudflats, up to a 1m thick layer of coarse granular fill will be placed on top of the mudflats. This material will be fully removed following completion of the works. A temporary dewatering system, using sandbags or Portadam system (engineered above ground cofferdam system), will be set up in front of the wall to enable dry working conditions and shall ensure that no in-situ concrete material or any other building or waste material enters the River Suir.

Railway possessions and night-time works will not be required. The works will take place behind the temporary fence set up minimum 3.0m from the nearest IÉ rail track.

The communication and connectivity to the construction compound will be via the cess, parking lot and the R448 towards the ancillary construction compound at the Sallypark Industrial site, see section 4.5.14.

4.5.9 Drainage

Landside

Landside drainage works consist of:

- (i) Upgrading of existing surface water outfalls to River Suir system to be extended where necessary and fitted through the new sheet pile wall (works landside). These works will be carried out in sequence as the sheet piling moves from east to west. (Ch.360 to Ch.1090).
- (ii) Construction of filter drains positioned parallel to the proposed new sheet pile wall to collect groundwater flows and surface water run-off cut-off by the new wall.
- (iii) Construction of 3 No. new surface water drainage outfalls to the River Suir at approx. Ch.390 (involves both landside and riverside works) and new drainage outfalls at Ch.550 and Ch.900 which will terminate at the new sheet pile wall.
- (iv) Construction of 2 No. Surface Water Pumping Stations at proposed surface water drainage outfalls at Ch.390 and Ch.550 which will consist of:
 - Excavation and construction of an overflow chamber, wet well chamber and valve chamber;
 - Installation of associated pumps, motors, valves, chambers, fittings and pipework, hydraulic surge protection equipment and associated lifting equipment;
 - Installation of rising main and associated valves and secondary outfalls from the rising mains terminating at the sheet pile walls;
 - Insulation Stations, Kiosks and Cabinets and associated electrical equipment, instrumentation, telemetry, flow monitoring equipment, facility to connect mobile electrical generator and all mechanical and electrical equipment.

The construction of the filter drainage networks can be carried out without the necessity for railway possessions, behind a temporary fence installed at 3.0m distance from the nearest rail track. Trenches for drainage networks will typically be constructed using open cut using a mini excavator. Where required, adequate trench supporting systems will be installed. The construction methodology that will be employed for the majority of the proposed outfall (land-based section) will be conventional open cut methodology. Some isolated night-time work (full rail possession) may be required to fully set up the temporary fence, material and machinery in the works area.

The construction of several elements of the landside drainage works will require extended rail possessions (3-4 weeks of night works):

- Construction of drainage networks for the railway line for the area in front of Plunkett Station and along the railway track (carried out in a westbound direction from Ch.0 to Ch.540).
- Construction of drainage networks which cross the track at various locations from Ch. 540 to Ch.1090) Trenchless methods, such as pipe jacking and micro-tunnelling, will be used at crossings of railways (where required).

- Construction of the surface water pump stations at Ch.380 and Ch. 550. Precast pump sumps, petrol interceptor, valve unit and kiosks require the provision of a crane. Access is only possible from the landside.

Riverside (c. 800m)

Riverside drainage works consist of:

- (i) Upgrading of the existing surface water road gully outfalls at the Rice Bridge roundabout to retrofit non-return valves.
- (ii) Retrofitting non-return valves to existing surface water outfalls from the IÉ Car Park area west of Plunkett Station (Ch.180 to Ch.360).
- (iii) Installation of flap valves \ non-return valves on existing and proposed surface water outfall pipes (Ch.360- Ch.1090) penetrating through the new defence walls.
- (iv) Construction of Outfall Structures to/in the River Suir (Ch.390, Ch.470 and Ch.490) to include outfall headwall/riprap/stone mattress at the outfall mouth (refer to Section 4.5.9.2 below).

4.5.9.1 Outfall Structures

Upgrade of existing structures

Upgrade works to 2 no. existing drainage outfall structures located in the riverbed at approx. Ch.470 and Ch.490 are proposed to facilitate installation of the sheet pile wall, and replacement of the existing pipe and an upgrade to outfall mouth e.g., provision of non-return valve, headwall/riprap/stone mattress at the outfall mouth.

Construction of new outfall structures

Construction of 1 no. proposed surface water outfall structure at approx. Ch 390 in the riverbed including installation of outfall pipe and outfall structure to and in the River Suir to include outfall non return valve, headwall/riprap/stone mattress at the outfall mouth.

4.5.9.2 Construction activities for outfall structures

The construction of the 3 no. outfall structures for surface water drainage will be carried out from riverside i.e., within the foreshore. The proposed works within the foreshore will consist of the construction of the outfall pipe and outfall headwall/riprap/stone mattress at the outfall mouth and will be constructed within a temporary sheet pile cofferdam.

The pipe opening will be covered with a non-return valve and the pipe will be encased in suitable fill material overlaid with a two-layer geotextile high strength mattress, grouted with cement or concrete to provide erosion and pipe protection. This will then be bounded by rip rap type rock armour. The pipe opening will be imbedded in a concrete headwall with side walls and floor from the pipe with a steel guard rail positioned on top of this headwall (if required for maintenance).

The following procedure will be followed in order to create a dry working area to facilitate this phase of the construction works.

Construction of the Outfall structures (3 no.)

- (i) Existing outfall structures in the riverbed at Ch.470 and Ch.490 will be removed by excavator from the barge prior to the installation of the sheet pile wall\proposed outfall structures. A temporary outfall or over pumping of the flows will be implemented.

- (ii) Drive the permanent bearing piles for outfall and headwall. Tubular steel piles to be used, installed by vibratory equipment.
- (iii) A dry works area will be created by placing sheet piling or similar into the river from a jack-up barge to construct a temporary cofferdam. The sheet piling works will be carried out from riverside. Sealant will be used to make the cofferdam waterproof.
- (iv) 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.
- (v) Excavate to underside of pilecap level (further assessment will be carried out at detailed design to determine if piles are required or other suitable foundations are appropriate);
- (vi) Cut off any excess length at the top of permanent piles and construct the pilecap.
- (vii) The outfall headwall will be a pre-cast unit. This will be dropped in place from the riverside barge.
- (viii) The pipe will be fitted through the sheet pile wall and laid on the pilecap. The pipe will be encased in suitable fill material overlaid with a two-layer geotextile high strength mattress, grouted with cement or concrete to provide erosion and pipe protection.
- (ix) The pipe will be further protected from erosion by using rip rap type rock armour. The rock armour will be placed by a suitable plant all of which will be located within the designated working area.
- (x) A minimal amount of concrete will be poured on-site to secure the headwall.
- (xi) A stone mattress will be created surrounding the outfall and will extend approximately 1.5m x 3.5m into the Suir River.
- (xii) Minor excavations will be carried out to facilitate the stone mattress, extending approximately 500mm into the riverbed.
- (xiii) The stone mattress wire mesh cage will be mechanically fastened to the riverbank.
- (xiv) Clean, debris free stone will be utilised for the creation of the stone mattress.
- (xv) Remove the temporary cofferdam sheet piling (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).

4.5.10 Demolition Works

Existing Quay Wall

From approx. Ch.355 to Ch.950, the existing masonry quay wall shall be demolished above ground level and to a depth of approx. 800mm below ground level to facilitate installation of drainage pipelines and the pumping stations. In addition, in the vicinity of Ch.390, the demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level will be required in order to facilitate the construction of a surface water pumping station (as shown on Figure 4.18 in Volume 3). The demolition of the existing quay wall sections will be carried out using an excavator (16 tonne or similar) and a wheeled or track mounted dumper (12 tonne or similar).

Existing Outfall Structures

Existing surface water outfall structures and pipes in the river side at Ch.470 and Ch.490 will be demolished as part of the works to allow installation of the sheet pile wall. The methodology for the replacement of these outfall structures is outlined in

Section 4.5.9.2 above. Existing outfall structures in the riverbed will be removed by excavator from the barge prior to the installation of the sheet pile wall.

4.5.11 Summary of Construction Programme

Table 4.2 below provides the summary of the construction programme for the proposed Flood Defences West.

Table 4.2 Summary of Construction Programme

Construction Element	Chainage	Approx. Duration of task (in weeks)
Mobilisation, compound set up	Compound area	2 weeks
Remedial Works to existing quay wall	Ch.285 to Ch.360	4 weeks
Impermeable trench in front of the Plunkett Station	Ch.0.0 to Ch.160	2.5 months (10 weekends)
	Ch.160 to Ch.360	2 weeks
Works at Rice Bridge Roundabout – Installation of Glass barriers, movement joint sealing & the provision of flap valves on existing road drainage gullies	Ch.0.40 to Ch.210	6-8 weeks
Sheet-pile wall installation (two piling rigs on two barges operating simultaneously)	Ch. 360 to Ch.900 (Riverside)	12 weeks
	Attaching cladding to installed riverside piles	2-3 weeks
	Ch.900 to Ch.1090 (Landside, incl. transverse structure)	7-8 weeks
Drainage Works	Upgrade of existing drainage	9-12 weeks
	New Drainage network and proposed outfall structures	9-12 weeks
	Pumping Stations	9-12 weeks
Total Construction Phase		30 - 35 weeks
Notes: Due to linear nature of the works, the majority of the works will be able to be done in parallel. See section 4.5.3 for more details.		

4.5.12 Construction Materials

Steel sheet piles will be grade S355 steel complying with Irish Standard I.S. EN 10025. The steel sheet piles will be between 6 and 21m length. The total length of sheet pile wall, including transversal isolation structure, is assumed to be approximately 770m. Sheet pile section AZ20-700 is assumed throughout the length, with exception of two localities where section AZ42-700 is assumed. The total surface of the sheet piles is assumed to be approximately 11,000m² with the total tonnage of approximately 1,400 tonnes.

The imported backfill for placing between sheet pile wall and the existing quay wall will be imported granular Class 6 material in accordance with TII Specification for Road Works Series 600.

The concrete and steel reinforcement used to raise the height of the existing quay wall will be C35/45 in accordance with IS EN 206-1 and grade B500B in accordance with I.S. EN 10080 respectively. The chemical anchoring system to fix reinforcing bars into the existing quay wall will be a proprietary product complying with all relevant Irish standards.

The materials used for drainage works will be in accordance with TII Specification for Road Works Series 500.

Table 4.3 Resources to be used During Construction

Element	Resources
Earthworks	<p>Installation of a sheet pile wall will not require excavation of waste material. Imported material to fill the gap between the sheet pile wall and the existing quay wall will be clean granular material Class 6, totalling approximately 2000m³.</p> <p>Approximately 2,500m³ of clean imported granular fill material Class 6, will also be required for drainage works.</p>
Structural Works	<p>The project will require import of steel sheet piles for construction of new flood defence walls as well as material for in-situ concrete for remedial works on the existing quay wall. Total length of sheet pile wall will be approximately 770m, with height of piles between 10 and 21m. The total surface of the sheet piles is assumed to be approximately 11,000m² with the total tonnage of approximately 1,400 tonnes. Approximately 1,500 m³ of precast concrete eco-seawall panels (with depth of approximately 13 cm) will be attached to riverside sheet pile wall.</p> <p>Approximately 50 m³ of concrete will be used for remedial works (raising) to the existing quay wall. Minor quantity of reinforcement steel will also be imported. Up to approximately 350m³ of lean mix concrete / grout will be required to infill the impermeable trench.</p>
Drainage	<p>Drainage pipes (approx. 1,310m), valves, manholes, 2 No. precast pumping chambers, 3 No. precast headwalls, handrails, riprap, stone mattresses etc.</p> <p>70m³ fill of concrete surround for pump chambers of the pumping stations will be required.</p>
Construction and Demolition Waste	<p>The removal of the upper section of the existing wall to the level of 800mm below existing ground level will generate approximately 600 m³ of waste. Material excavated during demolition of a small section of the quay wall for the purpose of joining the riverside and landside sheet piles, will amount to approximately 50m³. Another approximately 70 m³ of wall will be demolished during the construction of a pumping station. All of this waste will be considered waste for disposal off-site. The waste will be disposed of in licensed landfills and will receive inert WAC and material exceeding inert WAC.</p> <p>Up to c.350m³ of waste material will be generated during shallow excavations for the impermeable trench. The material will undergo environmental testing to determine the level of potential contaminants and disposed off-site in the suitably licensed facility.</p> <p>Approximately 2,600m³ of in-situ ground and ballast will be excavated during the drainage outlet remediation works and other drainage works such as installation of filter drains, with approximately half of it expected</p>

Element	Resources
	to be used again as a backfill across the site for ground levelling purposes. As such, approximately 1,300m ³ of surplus excavation, will also have to be disposed off-site to a suitably licensed facility.

4.5.13 Sourcing of Imported Earthworks Materials and Disposal of Waste

The deficit of material for the construction of the earthworks, and the need for stone to establish haulage routes, will require quarried material to be sourced. All imported material will be sourced from the nearest possible locations. There are a number of commercial quarries in the vicinity of the proposed development, which may be utilised in the sourcing of this material including:

- Oaklands Quarry in Ballykelly, New Ross, Co. Wexford; and
- Cappagh Quarry in Cappagh, Dungarvan, Co. Waterford.

There may be other suitable quarries, in addition to those identified above, that the Contractor may select as the source for construction materials. 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 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. The haulage route for access into the proposed road development has been determined to be restricted to use of the national and regional roads that are connected to the site, and other unsuitable local roads may not be used for such traffic. In this context, traffic from all potential quarry sources as described above would have no more adverse effect on general traffic than as assessed in Chapter 5 Traffic Analysis of this EIAR.

4.5.14 Temporary Construction Compound Areas

The main temporary construction compound area is situated at Ch.1340, approximately 300 m northwest of the proposed development works, in a very wide cess area between River Suir and rail lines. The land is in C oras Impair  ireann (CI ) ownership and is operated by Iarnr d  ireann (I ). A public level crossing is situated nearby which facilitates access to the works area.

An ancillary site compound is proposed in the I 's Sally Park yard, currently used for material storage, situated across from the rail lines from Ch.640.

Refer to Figure 4.21 in Volume 3 of this EIAR for locations of the two temporary construction compound areas.

Impacts of such temporary sites have been assessed in this EIAR (refer to Chapter 6 Population and Human Health, Chapter 7 Biodiversity, Chapter 9 Hydrogeology, Chapter 10 Hydrology, Chapter 12 Noise and Vibration and Chapter 13 Air Quality and Climate) and will be subject to the control measures proposed in this EIAR in terms of dust control and noise, and night-time illumination, including at night-time, etc. The storage of fuels, other hydrocarbons and other chemicals within the construction compounds will comply with the protection / mitigation measures described in this EIAR, the NIS and the Environmental Operating Plan.

4.5.15 Enabling Works and Site Access

4.5.15.1 Site Access Routes

The material for the construction of sheet pile wall will be stored at the main construction compound located at Ch.1340. It will be loaded by crane to a barge. The main access route to the main construction compound is the R448 Regional Road which has a direct connection to the N25 National Road. A local road off the R448, near Newrath roundabout, goes directly to the assumed construction compound location.

An ancillary construction compound at Sally Park depot can be reached directly from the R448.

4.5.15.2 Construction Traffic Routing

No construction traffic will be permitted to enter the construction site via Waterford City Centre. Material and machinery for remedial works to the existing quay wall and impermeable trenching will be routed from the ancillary compound at Sally Park depot via R448 (Terminus Street) to the works area in front of the Plunkett station. It is envisaged that the loading of the pontoon with the steel sheet piles can be carried out by crane over the riverbank from the main construction compound area. From the main construction compound, the machinery can also track down the cess into the working area for the purpose of landside sheet piling and associated drainage works. Signal cables running on the surface perpendicular to the cess from a signal cabin at approximately Ch.1190 present an obstacle, but it is envisaged that movements will be minimised and that a suitable temporary crossing bridge/mechanism or usage of localised night-time possessions will be applied.

4.5.16 Working Hours

Daytime working hours will be Monday to Saturday, 07:00 to 19:00 hrs. Where works during full rail possessions are required, night-time works will be required and will be carried out from Monday evening to Friday morning, 21:30 to 05:30 hrs.

Works on Sundays and Bank Holidays will only be permitted with the approval of the Waterford City and County Council (WCCC) and within the hours of 08:00 to 16:30 hrs.

4.6 Operation of the Proposed Development

Drainage maintenance works will be required during the operation phase of the proposed development to include inspection of outfall structures and inspection of wall mounted flap valves and replacement where necessary. The exposed parts of sheet pile wall above the cladding will require periodical corrosion protection by painting (approximately every 10 years). No night-time works will be required for this.

4.7 Project Change and Decommissioning

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

4.8 Environmental Operating Plan

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

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

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

- All environmental commitments and mitigation stipulated in the planning documentation in respect of the proposed development, including sediment controls and other measures to ensure that water quality in the River Suir and Waterford Harbour is not degraded.
- Any requirements of statutory bodies such as the NPWS and IFI, including adherence to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- A detailed Biosecurity Protocol.
- A list of all applicable legislative requirements in relation to environmental protection and a method of documenting compliance with these requirements.
- Outline methods by which construction activities will be managed in such a manner as to avoid, reduce or remedy potential negative impacts on the environment.

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

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

Appendix A: Construction Environmental Management Plan (CEMP)

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

Appendix C: Incident Response Plan (IRP)

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

Construction Environmental Management Plan

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

The CEMP will contain the following information of general importance:

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

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

- Details of working hours and days.
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services.
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages).
- Details of construction plant storage, temporary offices.
- Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff).
- Dust management to prevent nuisance (demolition & construction).
- Control of sediment, run-off, erosion and pollution.
- Noise and vibration management to prevent nuisance (demolition & construction).
- Landscape management.
- Management of contaminated land and assessment of risk for same by suitably qualified, trained and licenced personnel.
- Management of waste arising from construction and demolition.

- Minimisation of artificial lighting and shading.
- Management of risk from invasive alien species
- Stockpiles.
- Project procedures & method statements for:
 - Site clearance, site investigations, excavations
 - Diversion of services.
 - Excavation and blasting (through peat, soils & bedrock).
 - Piling.
 - Temporary hoarding & lighting.
 - Borrow Pits & location of crushing plant.
 - Storage and Treatment of peat and soft soils.
 - Disposal of surplus geological material (peat, soils, rock etc.).
 - Earthworks material improvement.
 - Protection of watercourses from contamination and silting during construction.
 - Works from a barge, including protection of watercourses from contamination when working in-river
- Site Compounds.
- Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments.

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

Construction and Demolition Waste Management Plan

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

The finalised CDWMP will contain the following information:

- Material transport routes;
- Methods by which construction works shall be managed in accordance with the relevant legislative instruments, including but not limited to:
 - An analysis of the different waste streams expected to be generated;
 - A demolition plan, with the purpose of ensuring that demolition occurs in an orderly fashion so that the re-use and recycling of the resultant materials is given due priority;
 - Details of waste storage (e.g. skips, bins, containers) to be provided for different waste streams and collection times;
 - Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;
 - Details of storage areas for waste materials and containers;

- Details of how unsuitable excess materials will be disposed of, where necessary; and
- Details of how and where hazardous wastes, such as contaminated land, hydrocarbons and other hazardous substances, are to be stored and disposed of in a suitable manner;
- Estimates of waste management costs;
- Specific waste management objectives for the project;
- Identification of the roles and responsibilities of the relevant personnel regarding waste management;
- Procedures for communication and training in relation to on-site waste management;
- Record keeping procedures; and
- Details of an audit system to monitor implementation of the CDWMP.

The CDWMP is appended to the EOP (i.e. Appendix B of Appendix 4.1). The plan shall be finalised by the successful Contractor, in agreement with WCCC, and in accordance with TII's guidelines on *The Management of Waste from National Road Construction Projects* (2017), the TII *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* (2007) and the Department of the Environment, Housing and Local Government's *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006). This will be a live document, which will be amended and updated to reflect the policy context, as well as conditions on site, as the construction of the proposed development progresses.

Incident Response Plan

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

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

- Contact names and telephone numbers for the local authority, i.e. WCCC (all sections and departments), An Garda Síochána and ambulance and fire services; and,
- Method statements for weather forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour. The plan must outline how the Contractor will respond to forecasted flood events, including but not limited to, details of removal of site materials, fuels, tools, vehicles and persons from flood zones.
- The measures to be taken to avoid or reduce the incident risk potential;
- Reference to the method statement and management plans for construction activities, insofar as they are relevant for the purposes of mitigating against health and safety and pollution incidents;
- Procedures to be adopted to contain, limit and mitigate any adverse effects, as far as reasonably practicable, in the event of a health and safety or pollution incident;
- Persons responsible for dealing with incidents and their contact details;

- Procedures for alerting key staff, appropriate emergency services, authorities, the Employer's Representative and clean-up companies, where required, and contact details of same;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required, and contact details of same;
- Standby / rota systems; and
- The types and location of emergency response equipment available and appropriate personal protective equipment to be worn.

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

Implementation of the EOP

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).

Appendix 4.1 Environmental Operating Plan



WATERFORD CITY PUBLIC INFRASTRUCTURE PROJECT

FLOOD DEFENCES WEST

Environmental Operating Plan

October 2021



**WPIP-ROD-ENV-S1_AE-RP-EN-400045_[S3-P01] W
Flood Def EOP**

Client:
Waterford City & County Council
35 The Mall
Waterford

Waterford City Public Infrastructure Project

Flood Defences West

Environmental Operating Plan

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Purpose and Scope	1
1.2 Environmental Policy Statement.....	1
2.0 GENERAL PROJECT DETAILS	2
2.1 Concrete Works.....	2
2.1.1 Introduction	2
2.2 Construction Compounds.....	3
2.2.1 Introduction	3
2.2.2 Control Measures	3
2.3 Site Environmental Manager (SEM).....	4
2.4 Ecological Clerk of Works (ECoW).....	5
3.0 PLANNING CONSENT.....	6
4.0 SCHEDULE OF COMMITMENTS	7
5.0 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN	9
6.0 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN	10
7.0 INCIDENT RESPONSE PLAN	11
APPENDIX A Construction and Environmental Management Plan	
APPENDIX B Construction and Demolition Waste Management Plan	
APPENDIX C Incident Response Plan	

1.0 INTRODUCTION

This document is a project-specific Environmental Operating Plan (EOP). It is presented to inform and provide practical experience of developing, submitting, and maintaining an EOP for the Flood Defences West.

1.1 Purpose and Scope

This EOP sets out the mechanism by which environmental protection is to be achieved on the proposed Waterford City Public Infrastructure Project - Flood Defences West development. This EOP describes the Environmental Management System (EMS) of the proposed development, which will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems and developed in line with the NRA “*Guidelines for the creation and maintenance of an Environmental Operating Plan*”. This EOP will be complemented by General Procedures, Work Procedures and Operations Instructions. These documents will be in place within the site administration offices and appropriate site locations during works.

This EOP covers the activities of the [*Successful Contractor Name*] and that of its sub-contractors. It outlines the environmental commitments in relation to the construction works and how these commitments are to be managed, including details of the monitoring systems and mitigation measures to be employed by the successful contractor. It also assigns responsibilities for ensuring the effective implementation of this EOP.

1.2 Environmental Policy Statement

Environmental Management is fundamental to the successful operation of construction activities. Therefore, the Environmental Policy must, as a priority, be understood by all parties involved in the contract and adhered to throughout the course of the works to allow for legal compliance and continuous improvement.

[*Successful Contractor Name*] Environmental Policy Statement is detailed below.

[*Insert policy statement*]

2.0 GENERAL PROJECT DETAILS

This section will be completed by the successful contractor once appointed:

- Brief overview;
- Location of the Project;
- Location of compounds;
- Contact Sheets for site, employer and third party contacts;
- Register of all applicable legislation, including relevant standards, Codes of Practice and Guidelines;
- Organisational chart; and,
- Duties and responsibilities.

Project details which have been identified prior to appointment of the contractor are described in the subsequent subsections:

2.1 Concrete Works

2.1.1 Introduction

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. Alternate construction methods have been proposed where possible, e.g. use of pre-cast units, use of cofferdams/ diversions/ over pumping (or other) to place concrete in the dry, and permanent formwork will reduce the risks associated with concreting works. Where the use of in-situ concrete near and in watercourses cannot be avoided the following control measures will be employed:

- The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Washout from concrete mixing plant will be carried out only in a designated contained impermeable area.
- All shuttering shall be securely installed and inspected for leaks prior to cement being poured and all pouring operations shall be supervised monitored for spills and leaks at all times.
- All pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls shall be completed in dry weather.
- Any concrete used in or over the River Suir shall be pre-cast, where possible.
- All concrete pouring will be conducted under controlled conditions to prevent any potential runoff to the River Suir.
 - All shuttering will be adequately constructed and sealed to prevent leakage or spillage and will have sufficient capacity to support all poured concrete.
 - 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 wash out of concrete vehicles on site.
 - No discharge of water which may contain cement or residues will be permitted to any watercourses.
- Where concrete or other wet materials are to be used over water, appropriate bunded platforms shall be in place to capture any spilled concrete, sealants or other materials.

- A geotextile screen and boom with oil barrier will be required around such marine works to prevent runoff, silt, oil or other deposits generated by construction activities such as boring in overburden or rock from polluting the river.
- Any materials collected on these platforms shall be transferred to the landside construction areas and disposed of in accordance with the CDWMP.
- When working in or near the surface water and the application 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);
- There will be no hosing into surface water drains of spills of concrete, cement, grout or similar materials. 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 will not be permitted on site.
- In order to attenuate flows and minimise sediment input into River Suir through run-off, all surface water run-off from the construction site shall be directed to a temporary facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to River Suir. An impermeable membrane overlaid with suitable fill will be provided to storage areas to prevent contamination or pollution of the groundwater.

2.2 Construction Compounds

2.2.1 Introduction

It is likely that two construction compounds will be set up within lands in the ownership of Córas Impair Éireann (CIÉ) and operated by Iarnród Éireann (IÉ) as identified in the EIAR.

The construction compound(s) may include stores, offices, materials storage areas, material processing areas, plant storage, parking of site and staff vehicles, and other ancillary facilities and activities.

2.2.2 Control Measures

The compound will have appropriate levels of security to deter vandalism, theft and unauthorised access.

Surface runoff from the compound will be minimised by ensuring that the paved/ impervious area is minimised. All surface water runoff will be intercepted and directed to appropriate treatment systems (settlement facilities and oil trap) for the removal of pollutants prior to discharge. The site compound will be fenced off as part of the site establishment period.

Wastewater drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent water pollution and in accordance with the relevant statutory requirements.

The storage of all fuels, other hydrocarbons and other chemicals shall be within the construction compound only and shall be in accordance with relevant legislation and best practice. In particular:

- Fuel storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage.
- Storage tanks and associated provision, including bunds, will conform to the current best practice for oil storage and will be undertaken in accordance with *Best Practice Guide BPGCS005 – Oil Storage Guidelines* (Enterprise Ireland).

The Incident Response Plan shall include arrangements for dealing with accidental spillage and relevant staff shall be trained in these procedures.

2.3 Site Environmental Manager (SEM)

In order to ensure the successful development, implementation and maintenance of the EOP, the Contractor will be required to appoint an independent Site Environmental Manager (SEM).

He/she must possess training, experience and knowledge appropriate to the role, including a National Framework of Qualifications (NFQ) Level 8 qualification (or equivalent) or other acceptable qualification in Environmental Science, environmental Management, Hydrology or Engineering.

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

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

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

2.4 Ecological Clerk of Works (ECoW)

In order to ensure the successful development and implementation of the EOP, the Contractor will appoint an independent Ecological Clerk of Works (ECoW). 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.

3.0 PLANNING CONSENT

If planning permission is granted for the proposed development, the entire contents of the planning consent are inserted at this location.

[Waterford City and County Council / successful Contractor shall insert planning consent]

4.0 SCHEDULE OF COMMITMENTS

The Schedule of Commitments will comprise:

- (1) The mitigation measures as outlined in Chapter 19 Mitigation Measures of the EIAR for the proposed development, with the addition of any additional mitigation measures set out in the NIS for the proposed development;
- (2) Any commitments arising during the statutory planning process up to and including the Oral Hearing, and any conditions imposed by the Board on the approval of the proposed development;
- (3) Any relevant specifications and / or methodologies required to implement the prescribed measures / commitments properly; and
- (4) Any procedures for the monitoring of the implementation of the stated measures / commitments, which may identify whether (i) the measure / commitment will be implemented by the Contractors and (ii) once implemented, whether the measure/ commitment is effectively addressing the environmental impact it was prescribed to address.

The current Schedule of Commitments is as follows:

[Waterford City and County Council / successful contractor shall Insert Schedule of Commitments, as described above]

In addition, the Contract documents, the conditions imposed by An Bord Pleanála, the Schedule of Commitments, and relevant environmental legislation all prescribe environmental performance criteria.

The following table lists the complete suite of Environmental Commitments together with the relative specification and evidence of how each commitment will be met. An example of the layout of this table and potential entries is given below.

Table 1 Environmental Commitments

Environmental Commitment	Legislation / Specific Ref.	Action Owner	Evidence	Target Date	Close Date
Noise and Vibration	EIAR Volume 2, Chapter 12 Noise and Vibration; EIAR Volume 2, Chapter 19 Mitigation Measures	Env. Manager / Noise Specialist / Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data / Environmental Control Measure Sheet	Ongoing	End of contract
Biodiversity (Flora and Fauna)	EIAR Volume 2, Chapter 7 Biodiversity; EIAR Volume 2, Chapter 19 Mitigation Measures	Env. Manager/ Specialist Ecologist/ Env. Designer / Site Agent / Foreman	Method Statement / Ecological Walkover / Pre-surveys / agreement from IFI / Site Inspections	Ongoing	End of Contract

Environmental Commitment	Legislation / Specific Ref.	Action Owner	Evidence	Target Date	Close Date
Soils and Geology	EIAR Volume 2 Chapter 8 Soils and Geology; EIAR Volume 2, EIAR Volume 2, Chapter 19 Mitigation Measures	Env. Manager/ Specialist Ecologist/ Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract
Hydrology and Hydrogeology	EIAR Volume 2, Chapter 7 Biodiversity; EIAR Volume 2 Chapter 10 Hydrology; EIAR Volume 2, Chapter 9 Hydrogeology; EIAR Volume 2, Chapter 19 Mitigation Measures	Env. Manager/ Specialist Ecologist/ Env. Designer / Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract
Air Quality and Climate	EIAR Volume 2, Chapter 13 Air Quality and Climate; EIAR Volume 2, Chapter 19 Mitigation Measures;	Env. Manager/ Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract
Archaeology and Cultural Heritage	EIAR Volume 2, Chapter 14 Archaeological and Cultural Heritage; EIAR Volume 2, Chapter 19 Mitigation Measures;	Env. Manager/ Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract

5.0 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

The Construction Environmental Management Plan (CEMP) provides the environmental management framework for the appointed Contractors and Sub-contractors to ensure that the works are carried out with minimal impact on the environment.

The CEMP for the proposed development is contained in **Appendix A**. This document will need to be finalised by the Contractor prior to the commencement of the proposed works.

6.0 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

A Construction and Demolition Waste Management Plan (CDWMP) is prepared to ensure that waste arising during the construction and demolition phase of the development on site will be managed and disposed of in a way that ensures the provisions of the Waste Management (Amendment) Acts, 1996-2011 and associated Regulations (1996-2011) are complied with and to ensure that optimum levels of reduction, re-use and recycling are achieved.

The CDWMP, consistent with mitigation measures as contained within the EIAR and the Schedule of Commitments, at this time is contained in **Appendix B**.

7.0 INCIDENT RESPONSE PLAN

This document describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances.

An Incident Response Plan consistent with mitigation measures as contained within the EIAR and the Schedule of Commitments at this time is contained in **Appendix C**.

APPENDIX A

Construction and Environmental Management Plan

WATERFORD CITY PUBLIC INFRASTRUCTURE PROJECT

FLOOD DEFENCES WEST

Construction Environmental Management Plan

October 2021



**WPIP-ROD-ENV-S1_AE-RP-EN-400035_[S3-P01]
W Flood Def CEMP**

Client:
Waterford City & County Council
35 The Mall
Waterford

Waterford City Public Infrastructure Project

Flood Defences West

Construction Environmental Management Plan

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 Roles and Responsibilities	1
1.1.1 Site Manager	1
1.1.2 Site Environmental Manager (SEM)	2
1.1.3 Engineering Staff	2
1.1.4 Supervisors	2
1.2 Training and Induction	2
1.2.1 Site Induction	2
1.2.2 Specific Training and Awareness Raising.....	2
2. DESCRIPTION OF THE PROPOSED DEVELOPMENT	3
2.1 Project Description	3
2.2 Construction Programme Sequence	5
2.2.1 Sourcing of Materials	8
2.2.2 Construction Traffic Management.....	8
2.3 Operation Stage	9
3. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)	9
3.1 Environmental Policy	10
3.2 Environmental Aspect Register	10
3.3 Project Organisation and Responsibilities	11
3.4 Project Communication and Co-ordination.....	14
3.5 Training	14
3.6 Operational Control	14
3.7 Checking and Corrective Action	15
3.8 Environmental Control Measures	15
3.9 Complaints Procedure.....	15
3.10 Compliance with Project Consents.....	15
4. ENVIRONMENTAL COMMITMENTS.....	15
APPENDIX A	Natura Impact Statement Mitigation Measures
APPENDIX B	Chapter 19 Mitigation Measures (Volume 2 of EIAR)

1. INTRODUCTION

This Construction Environmental Management Plan (OCEMP) is prepared for the construction of the proposed Waterford City Public Infrastructure Project - Flood Defences West ("the Project") on behalf of Waterford City and County Council (WCCC).

This CEMP applies to all works associated with the construction of the proposed civil works and buildings works including the pre-construction site clearance works.

As a Contractor has not yet been appointed, this CEMP has not been formally adopted and further development and commitment to the CEMP will be undertaken following selection of Contractors and before commencement of site works.

The CEMP provides the environmental management framework for the appointed Contractors and Sub Contractors as they incorporate the mitigating principles to ensure that the work is carried out with minimal impact on the environment. The construction management staff as well as Contractors and Sub Contractors staff must comply with the requirements and constraints set forth in this CEMP in developing their Construction Environmental Management Plan (CEMP). The key environmental aspects associated with the construction of the proposed Flood Defences West, the appropriate mitigation and monitoring controls, are identified in the CEMP and its supporting documentation.

The implementation of the requirements of the CEMP will ensure that the construction phase of the Project is carried out in accordance with the commitments made by WCCC in the planning application process for the development, and as required under the planning approval. Once adopted, the CEMP is considered a living document that will be updated according to changing circumstances on the proposed development and to reflect current construction activities. The CEMP will be reviewed on an ongoing basis during the construction process and will include information on the review procedures.

1.1 Roles and Responsibilities

The Contractor is responsible to ensure that all members of the Project Team, including sub-contractors comply with the procedures set out in the CEMP. The Contractor will ensure that all persons working on site are provided with sufficient training, supervision and instruction to fulfil this requirement.

The Contractor will ensure that all persons allocated specific environmental responsibilities are notified of their appointment and confirm that their responsibilities are clearly understood. The principal environmental responsibilities for key staff can be identified as follows:

1.1.1 Site Manager

The Site Manager's environmental management responsibilities include, but are not limited to:

- Preparation and implementation of the CEMP;
- Close liaison with the Site Environmental Manager (SEM) to ensure adequate resources are made available for implementation of the CEMP;
- Ensuring that the risk assessments for control of noise and environmental risk are prepared and effectively monitored, reviewed and communicated on site;

- Managing the preparation and implementation of method statements; and
- Ensuring that the SEM reviews all method statements and that relevant environmental protocols are incorporated and appended.

1.1.2 Site Environmental Manager (SEM)

The responsibilities of the SEM include, but are not limited to:

- Maintaining environmental records;
- Providing guidance for the site team in dealing with environmental matters, including legal and statutory requirements affecting the works;
- Reviewing environmental management content of method statements;
- Reporting environmental performance to the Site Manager;
- Liaising with statutory and non-statutory bodies and third parties with an environmental interest in the proposed development; and
- Collecting and collating of CEEQUAL evidence.

1.1.3 Engineering Staff

The Engineering Staffs' environmental management responsibilities include but are not limited to:

- Reporting any operations and conditions that deviate from the CEMP to the Site Manager;
- Taking an active part in site safety and environmental meetings; and
- Ensuring awareness of the contents of method statements, plans, Supervisors' meetings or any other meetings that concern the environmental management of the site.

1.1.4 Supervisors

The Supervisors' environmental management responsibilities include but are not limited to:

- Ensuring all personnel affected by a method statement are briefed and fully understand its content;
- Monitoring operatives for compliance, including sub-contract operatives;
- Implementing environmental management activities required by the CEMP and works method statements; and
- Ensuring that all inspections are carried out as prescribed in the CEMP.

1.2 Training and Induction

1.2.1 Site Induction

All personnel involved in the proposed Flood Defences West development will receive environmental awareness training. The environmental training and awareness procedure will ensure that staff are familiar with the principles of the CEMP, the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

1.2.2 Specific Training and Awareness Raising

A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities will be produced by the Contractor. Training will be provided by the Contractor to ensure that all persons

working on site have a practical understanding of environmental issues and management requirements prior to commencing activities. A register of completed training is to be kept by the SEM. The Site Manager will ensure that environmental emergency plans are drawn up and the SEM will conduct the necessary training/inductions.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Project Description

The proposed development comprises c.1.1km of flood protection measures in the townlands of Mountmisery and Newrath in Co. Waterford, the townland of Newrath in Co. Kilkenny located along the north bank and within the foreshore of the River Suir in Waterford City, refer to Figures 1.1 in Volume 3 of this EIAR. The development extends for approximately 1km to the west and 100m to the east of the Waterford (Plunkett) Station, following the alignment of the existing quay wall and the Iarnród Éireann (IÉ) railway corridor located to the north of the proposed development.

The proposed flood defence measures are for the protection of critical infrastructure including the existing Plunkett Station, the railway line east and west of Plunkett Station and the Rice Bridge roundabout. The proposed development will also form a continuation of the flood protection measures, Flood Defences East proposed along the North Quays Strategic Development Zone (SDZ) as part of the Transport Hub Part 8 planning approval, eliminating the risk of flooding to the Transport Hub.

A design flood level of +4.0m OD (metres above Ordnance Datum Malin) is proposed for this development. The design flood level has been based on a flood with an annual exceedance probability of 0.5% and allowances for climate change and isostatic tilt as noted below.

The design (top-of-wall) level for the proposed flood protection measures is +4.30m OD (metres above Ordnance Datum Malin). The following allowances are integrated into the proposed height of the flood defence walls:

- 0.5% annual exceedance probability combined tidal-fluvial event (+3.45 m OD);
- An additional 0.55m to allow for climate change and isostatic tilt; and,
- 0.30m freeboard to the wall, including local wave wake effects.

An overview of the structural elements of the proposed development is provided from east to west below, and should be read in conjunction with Figures 4.1 to 4.6 in EIAR Volume 3:

- Construction of underground flood defences (an impermeable shallow trench approx. 0.35m in width and up to 3m in depth) from Ch.0.0 to Ch.365 to cut off the potential groundwater seepage during high tide events. It is possible that parts of these underground flood protection measures may be omitted during detailed design (see Figures 4.2 and 4.3 in Volume 3) or may be implemented on a phased basis depending on the ongoing groundwater monitoring results.
- Total of c.185m of overground flood defences from Ch.0.40 to Ch.210 consisting of:
 - c.170m of glass flood barrier on the river side of the road edge vehicular parapets on Rice Bridge roundabout and along the 3 roundabout arms (R680 Rice Bridge, R448 Terminus St. and R711 Dock Rd).

- c.15m of demountable flood barriers on the R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- Remedial works to the existing quay wall from Ch.285 to Ch.360 by raising its height by 0.6m to 1.2m to conform with the design top-of-wall level of +4.30m OD.
- Construction of a sheet pile flood defence wall from Ch.360 to Ch.1090, with the top of wall at +4.30 mOD, to protect against overground flooding and underground groundwater seepage:
 - From Ch.360 to Ch.900 the sheet pile wall will be installed within the foreshore from the riverside, 1m from the front face of the existing quay wall. The space between the sheet pile wall and the front face of the existing quay wall will be filled with clean imported granular fill. The intertidal zone of the riverside sheet pile wall will be fitted with pre-cast concrete cladding material ("eco-seawall").
 - From Ch.900 to Ch.1090, the sheet pile wall will be installed on land from the landside, 1m behind the existing quay wall.
 - The demolition of minor localised section of existing quay wall (max length of 3m) will be required in order to connect the in-river sheet piles with the landside sheet pile walls at Ch.900.
- Construction of c.20m of underground isolation structure at Ch.1090, comprising of a sheet pile cut-off wall and a concrete capping beam. The concrete capping beam will facilitate the installation of temporary overground flood barriers (e.g. water filled inflatable flood barriers) should these be required to be implemented during a flood event.

Drainage works will be carried out for the entire extents of the proposed flood defence measures i.e., from Ch.0.0 to Ch.1090 as shown in Figure 4.7 to Figure 4.11 in EIAR Volume 3:

- Remedial measures to the existing drainage outfalls to the River Suir from Ch.0.0 to Ch.1090 by extending them to reach an outlet within the new sheet pile wall, or to be retrofitted to pass through the new sheet pile wall, into the River Suir.
- In the vicinity of Plunkett Station, from Ch.0.0 to Ch.470, new trackside drainage and groundwater drains are included in the upgraded drainage works, which will include a pumping station (at approx. Ch.390) and a new surface water outfall structure in the River Suir at Ch.390.
- From Ch.370 to Ch.1090, new drainage system will be installed for trackside drainage and also to allow groundwater cut-off behind the sheet pile wall to drain to the River Suir with 2 No. new outfalls to the River Suir terminating at the front face of the proposed flood defence sheet pile wall (at Ch 550 and Ch.900). The works will also include the construction of pumping stations at Ch.390 and Ch.550 respectively.
- Existing surface water outfalls at Ch.470 and Ch.490 which extend into the riverbed will be demolished to allow installation of the new flood defence wall; these will be replaced by new surface water outfall structures in the River Suir.
- Demolition of the existing quay wall to approximately 800mm below the existing ground level and removal of handrails from Ch.360 to Ch.900 where it is level with or above, the existing ground level. The demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level will be required in order to facilitate the construction of a surface water pumping station at Ch.380 (as shown in Figure 4.18 in EIAR Volume 3).

- All drainage outfalls (new and existing) will be fitted or retrofitted with non-return valves to prevent tidal water ingress.
- All ancillary works.

Table 2.1.1 Overview of Proposed Flood Defences West

Chainage	Proposed Works
Ch.0.0 to Ch.365	Construction of an impermeable trench
Ch.0.40 to Ch.210	Construction of overground flood defences at Rice Bridge Roundabout.
Ch.285 to Ch.360	Remediation of existing quay wall
Ch.360 to Ch.1090	Construction of sheet pile flood defence wall
Ch.0.0 to Ch.1090	Drainage works

2.2 Construction Programme Sequence

The construction methodology is preliminary and subject to change following the detailed design and preparation of the CEMP by the appointed Contractor. Irish Rail operations will be maintained throughout the construction phase. However, there may be restrictions to Plunket station car park, and/or disruption to utilities during certain periods but these will be minimised to avoid significant impacts. These will be detailed as part of the CEMP which will be developed by the Contractor and agreed with WCCC at contract award stage.

The anticipated construction duration for the proposed Flood Defences West will be 30-35 weeks. The construction of the proposed development is anticipated to take place in the following sequence:

The envisaged construction sequence for the works is as follows:

- (i) Site Setup and establishment of construction compounds;
- (ii) Excavation of underground trenches (or just in parts of this section, based on the groundwater monitoring and assessment) including:
 - (a) Relocation of underground utilities, where required;
 - (b) Excavation of material from trenches;
 - (c) Filling in trenches with lean mix concrete / grout and reinstatement of pavement.
- (iii) Installation of overground flood defences:
 - (a) Glass barriers on the river side of the road edge vehicular parapets on Rice Bridge roundabout and the 3 roundabout arms (R711 Dock Road, R448 Terminus Street, and R680 Rice Bridge).
 - (b) Underground foundations for the demountable flood barriers at R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- (iv) Remedial works for raising the height of the existing quay wall including:
 - (a) Setup of temporary dry (dewatered) working area in front of the wall using sandbags, Portadam system or waterfilled dams;

- (b) Setup of temporary works such as formwork, scaffolding and granular base for scaffolding in mudflats;
 - (c) Anchoring and concrete pouring works;
 - (d) Decommissioning of temporary works, including removal of granular base from the mudflats, any building works spoil, and dewatering system.
- (v) Installation of permanent sheet pile walls on the riverside. Backfilling of the gap between the riverside sheet pile wall and the existing quay wall can take place simultaneously with sheet piling, after a short segment of the sheet pile wall (assumed 10-30 m) is piled (temporary transversal sheet pile may be installed at the end of segment to prevent fill from being washed out), or once full length of sheet piles is installed. Attaching of eco-seawall panels to the front face of the sheet piles.
- (vi) Partial demolition of existing quay wall (from Ch.360 to Ch.900) above ground and to a depth of 800mm below ground (where required) to enable installation of drainage works (to be complete in tandem with step (v) above to ensure demolition takes place before backfilling);
- (vii) Installation of landside sheet pile wall from Ch.900 to Ch.1090 to include:
- (a) Demolition of the 3m wide section of the existing quay wall at Ch.900 to enable joining of the riverside and landside sheet piles;
 - (b) Installation of permanent landside sheet piles; and
 - (c) Installation of transversal underground isolation structure at Ch.1090.
- (viii) Drainage – Installation of drainage works from Ch.360 to Ch.1090 as follows:
- (a) Installation of drainage works parallel to the new sheet pile wall in tandem with construction of the sheet piling (step v);
 - (b) Installation of surface water outfalls passing through the new sheet pile wall, and fitting of flap valves from the riverside on each outfall (in tandem with step v);
 - (c) Demolition of existing surface water outfalls in the riverbed and provision of temporary outfalls (e.g. over pumping) on existing outfalls during the works;
 - (d) Construction of new outfall structures in the riverbed (following installation of the sheet pile wall) within a sheet pile cofferdam (temporary works); the outfall structure will include a foundation structure to the outfall pipe (which may need pile supports), a headwall and erosion protection measures (including a stone mattress at the mouth of the outfall), headwall and erosion protection measures including a stone mattress at the mouth of the outfall;
 - (e) Construction of 2 No. underground pumping stations to include an overflow chamber, wet well and valve chamber;
 - (f) Installation of pumping station pumps, valves fitting and MEICA commissioning of pumping stations.
- (ix) Drainage – Installation of drainage works from Ch.0.0 to Ch.360 at Plunkett Station as follows:
- (a) Installation of the new drainage system and associated railway undertrack crossings. All undertrack crossings will be carried out subject

to IÉ agreement and where necessary, localised night-time possessions will be applied to facilitate installation,

- (b) Remedial works to existing drainage networks including retrofitting of flap valves at outfalls.

Due to the linear nature of the works, it is assumed that the works under items (ii) to (ix) above can run in parallel. The list above thus does not indicate that one activity needs to fully finish for the next one to start. It is possible that the works will be done in separate sections. Some limitations however exist, and these are outlined below:

- The sheet pile wall needs to be installed at drainage outlet locations before the outlet can be completed. It is necessary for the drainage outlet to be completed before the backfilling to the sheet pile wall (above the underside of pipe level) can be completed.
- Impermeable trench / grouting in area behind the existing quay wall (where the wall will be raised with remedial works) to be done before the commencement of wall remedial works.
- The upper sections (down to 800mm below ground level) of the existing quay wall are to be demolished after the sheet piles are installed in that location and before the drainage is installed.
- The riverside sheet piles will be installed before the eco-seawall panels are attached to them.

Table 2.2.2 Draft Construction Program

Works element		Duration of task (approx.)
Start July 2023		
Mobilisation, site clearance and compound set up		2 weeks
Remedial works for raising the height of the existing concrete wall		4 weeks
Impermeable trenches Ch.0.0 to Ch.160 (eastern car park, in front of the Plunkett Station and the Rice Bridge Roundabout)		2.5 months (10 weekends)
Impermeable trenches Ch.160 to Ch. 360 (western car park and under Terminus Street Viaduct)		2 weeks
Works at Rice Bridge Roundabout – Installation of Glass barriers, movement joint sealing & the provision of flap valves on existing road drainage gullies		6-8 weeks
Sheet pile installation	Ch. 360 to Ch. 900 (riverside)	12 weeks (two rigs)
	Attaching cladding to installed riverside piles	2-3 weeks
	Ch.900 to Ch.1090 (Landside, incl. transverse structure)	7-8 weeks
Drainage works	Upgrade of existing drainage	9-12 weeks
	New drainage network and proposed outfall structures	9-12 weeks
	Pumping stations	9-12 weeks
Total Construction Phase		7 months approx.
End February 2023		

Works element	Duration of task (approx.)
Start July 2023	
Notes: Due to linear nature of the works, the majority of the works will be able to be done in parallel.	

2.2.1 Sourcing of Materials

There are several registered/authorised quarries near the proposed development which may be utilised in the sourcing of the required imported granular fill material, to include:

- Oaklands Quarry in Ballykelly, New Ross, Co. Wexford; and
- Cappagh Quarry in Cappagh, Dungarvan, Co. Waterford.

Only those quarries that conform to all necessary statutory consents will be used in the construction phase.

It is assumed that the Contractor will source the sheet piles directly from the manufacturer/supplier. While Irish-based sheet pile suppliers exist, the larger quantities of heavy sheet piles, typically required on large projects such as this one, are typically obtained from a number of large-scale manufacturers/suppliers that exist in the UK.

2.2.2 Construction Traffic Management

Temporary traffic management arrangements are to be implemented to facilitate ongoing access to construction access points throughout the works.

Some works will require night-time works when railway track possessions are needed.

As part of the Waterford City Public Infrastructure Project, it is likely that a number of infrastructure projects will take place concurrently. Traffic management and phasing of works and transport / haulage routes will be required to be co-ordinated by all stakeholder through the various construction stages.

The following restrictions will be adhered to unless agreed otherwise with Waterford City & County Council's Roads Department:

- The Contractor shall provide and maintain temporary traffic management in accordance with the Department of Transport Traffic Signs Manual.
- Access to local properties shall be maintained at all times. Works to any accesses shall be planned in consultation with the property owners to minimise disruption.
- Existing footways and cycle tracks shall be maintained at all times except where such footways and cycle tracks are at the point of being removed for the completion of the Works. In such circumstances, the Contractor shall provide temporary footpath or cycle track diversions, with sufficient advance signage informing people of the diversions.
- Fuel for vehicles will be stored in a mobile double skinned tank.
- The contractor will be required to submit a Construction and Demolition (C&D) Waste Management Plan Council to WCCC for approval which should address all types of material to be disposed of.

- Roads used by construction traffic will be monitored visually and a road sweeper used to remove debris from construction activities when required.
- Loads of materials leaving site shall be assessed and covered where necessary to reduce dust impacts.
- Development of a detailed construction programme that gives consideration to traffic flows and aims to avoid coincidentally high volumes of traffic using the same roads where possible.
- The Contractor shall allow for variable message signs (VMS) in accordance with Chapter 8 paragraph 8.2.4 of the Traffic Signs Manual on approach routes affected by traffic management measures, restrictions or road closures.
- The Contractor shall liaise with the Roads Authority in respect of any temporary road closures, lane closures, and other traffic management controls required to be carried out to ensure the safety of the workforce and the general public during the duration of the works.
- Where floodlighting of the works area is required in poor daylight conditions, the positioning of the lighting units must not be such as to cause glare to drivers.

Visual inspections will also be undertaken and recorded at regular, frequent intervals, to ensure that the existing road infrastructure remains in an acceptable condition throughout the duration of construction activities or should evidence of any defects arise during the construction period, remedial actions and/or works can be put in hand forthwith. Wheel washes for construction vehicles will be provided (if necessary) at the development site to prevent mud and dust being brought onto the public road. The site entrance and the immediate approach roads will be monitored and swept clean when necessary.

Construction vehicles and site personnel will be required to adhere to the approved access routes and timing restrictions. Construction plant, equipment and vehicles will be parked onsite. No vehicles associated with the proposed development will be parked on the public roads.

2.3 Operation Stage

The live rail line Dublin – Waterford will remain open at all times during the construction phase. Where railway possessions will be required for some elements of work, such as for landside sheet pile installation and for some drainage segments, night-time rail possessions will be arranged, that will not affect the normal train operations.

Once the development is constructed and handover completed, the live rail line will continue to operate according to the normal timetable.

3. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

This CEMP will be used to develop the CEMP by the Contractor to meet the requirements of ISO 14001 and all site works will be undertaken in compliance with the CEMP. The CEMP will include details of the topics listed below:

- Environmental Policy;
- Environmental Aspects Register;

- Project Organisation and Responsibilities;
- Project Communication and Co-ordination;
- Training;
- Operational Control;
- Checking and Corrective Action;
- Environmental Control Measures; and
- Complaints Procedure.

The CEMP will detail all the environmental aspects and impacts associated with this contract such as waste management, pollution prevention and protection of flora and fauna with particular emphasis on the nearby Special Area of Conservation (SAC), Special Protection Area (SPA), proposed Natural Heritage Area (pNHA) and water quality in the watercourses. The Register of Impacts provides the framework for identifying the potential environmental impacts generated by construction and the associated works. The Environmental Operational Control Procedures and activity-specific method statements will detail the working methods necessary for managing and mitigating these impacts, whether it is by prevention or mitigation. Prior to the commencement of construction activities, the Environmental Operational Control Procedures and activity-specific method statements will be completed so as to conform to precise site-specific requirements at the location of the proposed Flood Defences West.

3.1 Environmental Policy

The Contractor will complete an Environmental Policy with consideration for impacts on the natural and built environment. All project personnel will be accountable for the environmental performance of the Project and will be made aware of the Environmental Policy at induction. The environmental policy will consider and make commitments with regard to the protection of Natura 2000 sites, and any pNHA and/or Natural Heritage Area (NHA) sites, emissions to the atmosphere, maintenance of water quality, resource usage, energy consumption and waste management.

3.2 Environmental Aspect Register

Once appointed, the Contractor will prepare a register of all sensitive environmental features which have the potential to be affected by the construction works, together with details of commitments and agreements made during the EIAR planning process (i.e. commitments contained within the EIA Report and An Bord Pleanála conditions) and the Contract Documentation, with regards mitigation of potential environmental impacts.

The Environmental Aspects Register provides the relevant information for the preparation of construction method statements and will be regularly updated during the works.

The Environmental Aspects Register will consider sensitive environmental features as listed below (please note this list is not exhaustive and will be amended and expanded upon as required by the Contractor):

- Identification off all waterways and drainage outlets for the protection against ingress of suspended solids or any pollutant;
- Air emissions;

- Noise emissions
- Vibration emissions;
- Light emissions;
- Waste generation;
- Treatment of contaminated materials;
- Treatment of invasive species;
- Use of hazardous materials;
- Energy usage;
- Water usage;
- Discharge of wastewater;
- Traffic generation;
- Biodiversity (terrestrial and aquatic ecology);
- Landscape and Visual impacts;
- Soils, Geology and Hydrogeology;
- Hydrology; and
- Archaeology, Architectural and Cultural Heritage.

3.3 Project Organisation and Responsibilities

The adopted CEMP will define the roles and responsibilities of the project team. The overall responsibility lies with the Site Manager whose responsibility it will be to approve key personnel required for employment on the Project. He/She will liaise with the SEM.

The Project Manager will lead the works on site. He/She will be responsible for the management and control of the activities and will have overall responsibility for the implementation of the CEMP. He/She will be assisted by the SEM who will act as his/her deputy.

The SEM will prepare and implement all aspects of the CEMP.

Site Manager

The Site Manager's main duties and responsibilities in relation to the CEMP include liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP to individual members of the main Contractor's project staff.

Site Environmental Manager (SEM)

The main duties and responsibilities of the SEM include and are not limited to the following:

- Liaise with the Site Manager during the finalisation of the CEMP to assign individual duties and responsibilities bearing in mind the overall organisational structure, the nature of the Environmental Commitments and Requirements and the proposed Flood Defences West development specific characteristics;
- Ensuring that the CEMP is finalised, implemented and maintained;
- Liaising with WCCC's Environmental Manager on all Method Statements, any alterations to live documents and any other works to ensure protection of water quality;

- Being familiar with the information in the pre-construction surveys, construction requirements, the competent authority's decision and all relevant Method Statements;
- Being familiar with the contents, environmental commitments and requirements continued within the reference documentation listed in this CEMP;
- Being familiar with the baseline data collated during the compilation of the EIAR;
- Assisting management in liaising with the Engineers and WCCC and the provision of information on environmental management during the construction of the proposed development;
- Liaising with the Project Team in assigning duties and responsibilities in relation to the CEMP, to individual members of the main Contractor's project staff;
- Overseeing, ensuring coordination and playing a lead role in third party consultations required statutorily, contractually and in order to fulfil best practice requirements;
- Liaising with management in agreeing site specific Method Statements with Third Parties;
- Ensuring that all relevant works are undertaken in accordance with the relevant legislation in the Republic of Ireland;
- Bring any legal constraints that may occur during certain tasks to the attention of management;
- Hold copies of all permits and licenses provided by waste contractors;
- Ensuring that any operations or activities that require certificates of registration, waste collection permits, waste permits, waste licences, etc have appropriate authorization;
- Gathering and holding documentation with respect to waste disposal;
- Keeping up to date with changes in environmental practices and legislation and advising staff of such changes and incorporating them into the CEMP;
- Liaising with contactors and consultants prior to works;
- Procuring the services of specialist environmental contactors when required;
- Ensuring that all specialist environmental contactors are legally accredited and proven to be competent;
- Coordinating all the activities of the specialist environmental contractors;
- Ensuring that environmental induction training is carried out on all personnel on site and ensuring that toolbox talks include aspects of environmental awareness and training;
- Respond to all environmental incidents in accordance with legislation, the CEMP and company policy/procedures;
- The SEM is responsible for notifying the relevant statutory authority when environmental incidents occur and producing the relevant reports as required;
- Ensuring that all relevant works have (and are being carried out in accordance with) the required permits, licenses, certificates and planning permissions;
- Liaising with the designated licence holders and specific agent defined in the licence with respect to licences granted pursuant to the European Commission (EC) (Natural Habitats) Regulations 1997;

- Carrying out regular documented inspections of the site to ensure that work is being carried out in accordance with the Environmental Control Measures and relevant site-specific Method Statements;
- The SEM should prepare and be in readiness to implement at all times the Emergency Incident Response Plan;
- Responsible for reviewing all environmental monitoring data and ensuring that they all comply with stated guidelines and requirements; and
- Liaising with management in preparing and inspection of site-specific method statements for activities where there is a risk of pollution or adverse effects on the environment.

Design Manager

The main duties and responsibilities of the Design Manager having regard to the implementation of the CEMP:

- Be familiar with the CEMP and relevant documentation referred to within; and
- Participate in Third Party Consultations and liaising with third Parties through the SEM.

Section Managers and Agents

The Section Managers and Agents are responsible for the following:

- Ensuring Forepersons under his/her control adhere to the relevant Environmental Control Measures and relevant site-specific Method Statements, etc.;
- Ensuring that the procedures agreed during third party consultations are followed;
- Reporting immediately to the SEM any incidents where there has been a breach of agreed environmental management procedures, where there has been a spillage of a potentially environmentally harmful substance, where there has been an unauthorised discharge to ground, water or air, damage to habitat, etc.; and
- Attending environmental review meetings and preparing any relevant documentation as required by management.

Forepersons

The forepersons on site are responsible for the following:

- Ensuring personnel under his/her control adhere to the relevant environmental control measures and relevant site-specific Method Statements; and
- Reporting immediately to the site agents and SEM any incidents where there has been a breach of agreed procedures e.g., spillages and discharges.

All Project Personnel

All project personnel have the following responsibilities:

- Attend environmental training as required; and
- Reporting immediately to the Forepersons/Agents or SEM any spillage incidents or observations regarding adverse effects to the environment.

3.4 Project Communication and Co-ordination

Environmental issues and performance aspects will be communicated to the workforce on a regular basis. Weekly project meetings, which follow a set agenda incorporating the environment, will be held alongside overall management meetings.

All staff and sub-contractors involved in all phases of the Project will be encouraged to report environmental issues.

3.5 Training

All employees and subcontractors involved on site will be given a comprehensive induction prior to commencement of the works. This environmental training can be run concurrently with safety awareness training.

Training will include:

- Overview of the goals and objectives of the Environmental Policy and Environmental Management Plan;
- Awareness in relation to risk, consequence and methods of avoiding environmental risks as identified within the Register of Aspects and with the planning conditions;
- Awareness of roles and individual environmental responsibilities and environmental constraints to specific jobs;
- Location of and sensitivity of Special Area Conservation Special Protection Areas, protected monuments, structures etc.; and
- Location of habitats and species to be protected during construction, how activities may affect them and methods necessary to avoid impacts.

A record will be kept of a signed register on the project files of all attendees of the environmental induction.

Toolbox talks based on specific activities being carried out will be given to personnel by the nominated project representative. These will be based on specific activities being carried out and will include environmental issues, particularly due to the proposed development, including the impact on water quality namely:

- Oil/Diesel spill prevention and safe refuelling practice;
- Storage of materials including oil/diesels and cement;
- Emergency response processes used to deal with spills;
- Minimising disturbance to wildlife;
- Emergency response to include water pollution hotline to the Environmental Protection Agency (EPA) /WCCC for regulator response. Identification of registered / accredited spill clean-up company for oil etc.; and
- Consideration of importance of containment of vehicle washing, containments of concrete /cement / grout washout etc, bank protection using hessian to prevent excessive scour and mobilisation of suspended solids, maintenance of vegetation corridors etc.

3.6 Operational Control

Site works will be checked against the CEMP requirements. Any mitigation measures that have been agreed with the statutory authorities, or are part of planning

conditions, will be put into place prior to the undertaking of the works for which they are required, and all relevant staff will be briefed accordingly.

Method statements that are prepared for the works will be reviewed / approved by the Client Project Manager and where necessary the relevant Environmental Specialist. All method statements for works in, near or liable to impact on a waterway must have prior agreement with Inland Fisheries Ireland (IFI).

A Quality Management System (QMS) will also be put into operation for the Project. Document control will be in accordance with this QMS and copies of all audits, consents, licences, etc will be finalised by the SEM and their team and kept on site for review at any time.

3.7 Checking and Corrective Action

Daily inspections of the site and the works will be undertaken to minimise the risk of environmental damage and to ensure compliance with the CEMP. Any environmental incidents are to be reported immediately to the Site Foreman. The SEM will undertake periodic inspections and complete an assessment of the Project's environmental performance with regard to the relevant standards/legislation and the contents of the CEMP. Following these inspections, the SEM will produce a report detailing the findings which will be provided to the Client Project Manager and reviewed at the monthly project meeting.

3.8 Environmental Control Measures

Licensing requirements will be in place and specific procedures to manage the key environmental aspects of the Project will be developed by the Contractor prior to work commencing.

3.9 Complaints Procedure

A liaison officer will be available to allow for a member of the public or interested parties to make complaints about the construction works. The CEMP will contain details of the complaints procedures and a monitoring system will be implemented to ensure that any complaints are addressed, and satisfactory outcome is achieved for all parties.

3.10 Compliance with Project Consents

If planning permission is granted for the proposed development, the entire contents of the planning consent, and other consents and conditions, will be appended as received.

4. ENVIRONMENTAL COMMITMENTS

Project environmental mitigation has been set out in the application documentation, in the EIAR and NIS in particular, and will be detailed in the final Construction Environmental Management Plan (CEMP), in accordance with this CEMP. The final CEMP will provide a framework for compliance auditing and inspection to ensure that these construction practices and mitigation measures, as set out in the EIAR and NIS and the conditions in the planning approval, are adhered to. It should be noted that Appendix A of this CEMP details the key mitigation measures which are outlined in the NIS, while Appendix B details the key mitigation measures which are outlined in the EIAR.

APPENDIX A

Natura Impact Statement
Mitigation Measures

5. MITIGATION

5.1 Principles and Approach

Section 4.0 of this NIS identified adverse effects likely to arise from the proposed development on the specific Attributes and Targets which define the Conservation Objectives for a number of Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC. This section (Section 5.0) prescribes measures and a protocol to ensure their full and proper implementation aimed at mitigating these adverse effects, thereby protecting the integrity of these European sites during the construction and operation of the proposed development.

The mitigation measures prescribed in this NIS have been designed according to the principle of a mitigation hierarchy, as outlined in the European Commission's guidance document *Assessment of plans and projects significantly affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2001). According to this hierarchy, the following mitigation approaches were adopted, in order of decreasing preference:

1. Avoiding impacts at their source;
2. Reducing impacts at their source;
3. Abating impacts on site; and,
4. Abating impacts at their receptor.

As mitigation measures are related directly to impacts and only indirectly to receptors and as, in this case, all of the affected receptors have been identified as being affected the same set of impacts, to describe mitigation measures under the headings of the relevant receptors would lead to undue repetition. Therefore, the measures prescribed in this NIS are described under the headings of the types of impacts which they are intended to mitigate.

The mitigation measures are prescribed in Section 5.2 and a protocol to ensure their full and proper implementation is prescribed in Section 5.3. The significance of any residual effects following the inclusion of mitigation measures is evaluated in Section 5.4. As per the assessment of adverse effects in Section 4.0, this evaluation is made in view of the relevant Conservation Objectives.

5.2 Mitigation Measures

5.2.1 Habitat Loss and Fragmentation

The attachment of highly structured or bio-active pre-cast concrete cladding ("eco-cladding") to the river face of the new flood defence wall has been included as part of the ecological enhancement of the proposed development. The "rough" surface of the cladding, which will slightly reduce flow velocities immediately adjacent to the wall, safeguarding the saltmarsh habitats in the vicinity of the proposed flood wall from the effects of erosion. As the biological communities, particularly seaweeds, e.g. *Fucus* spp., develop on the cladding, the flow velocity moderation provided by the cladding will be enhanced, providing further protection against erosion.

Depending on the magnitude of this effect, over time, this may lead to an increased deposition of sediment immediately adjacent to the edge of the new riverside flood defence wall and upstream of the wall between Ch. 900 and Ch. 950, where the new alignment of the bank will form a light alcove. There is potential for this increased

sedimentation to eventually lead to a slight expansion of the 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' at this location.

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 NIS 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.

The flow velocity moderation provided by the cladding will also benefit small fish and other mobile species, including Twaite Shad and Otter, which are Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC. An additional benefit of this mitigation is that, 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 (including Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC) and also as a reservoir of larvae or "seed" for the colonisation of other hard intertidal substrates elsewhere in the estuary.

5.2.2 Water Quality

Construction Phase

As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and Construction Environmental Management Plan (CEMP) have been prepared for the proposed development and are included in Appendix A to this NIS. These will be developed by the 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 A) 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 the provision of the flood defences will be obtained prior to the commencement of construction.
- Inform and consult with Inland Fisheries Ireland.

During construction, regard will be had to the following guidance documents for construction work on, over or near water.

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

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

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

General 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 5m from the top of the edge of the quay wall/river edge. Any works within the 10m buffer zone will require measures to be implemented to ensure that silt-laden or contaminated surface water run-off from the compound does not discharge directly to the watercourse. See the EOP and CEMP in Appendix A to this NIS 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.
- The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses.

Specific Measures - Concrete Works

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

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

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

Operational Phase

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

5.2.3 Hydroacoustic Impacts

Fish Species

Seasonal Restrictions on Piling

As noted previously, at least one of the fish species of concern is likely to be present in significant numbers in the vicinity of the works at any time of the year, with by far the most sensitive fish hydroacoustic impacts, namely juvenile Twaite Shad, are present year-round, and other species being far less sensitive to the predicted impacts. Therefore, there is no specific benefit to or requirement for seasonal restrictions on piling activity.

Limits on Working Hours for Piling

The assessment in Section 4.2.4 above identifies a particular sensitivity with regard to night-time piling operations, which present an increased risk of impacts on juvenile Twaite Shad which are likely to shelter by the channel edge at night. This risk was also highlighted at the options appraisal stage and informed the decision to select the option which facilitated almost all piling taking place during the day. 3-4 weeks of night-time piling are still required due to other constraints, chiefly the need for railway possessions. However, as noted in Section 4.2.4, this piling will take place on land only. Based on the fact that this piling will take place on land and its short duration, it can be concluded beyond reasonable scientific doubt that it will not give rise to adverse effects on Twaite Shad or other Qualifying Interests of the Lower River Suir SAC or the River Barrow and River Nore SAC. Nonetheless, mitigation should be included to ensure that night-time piling is minimised and limited to landside works.

Breaks in Piling

There is a considerable amount of preparation required to ensure that piles are in the correct position etc. before driving begins. Therefore, once one pile is complete, it is estimated that it will take c. 35 minutes to prepare for the next pile, during which time there will be no piling noise. As detailed in Section 4.2.4 above, the area impacted by each pile drive is very small (less than the width of the channel), the impact (TTS) is of a low magnitude and fully recoverable, and fish are not stationary. Therefore, a quiet period of c. 30 minutes between periods of piling noise will be adequate to allow for recovery of fish and/or movement away from or through the affected area. This is based on a worst-case scenario of 55 minutes of continuous vibratory piling by a single piling rig or 28 minutes with two rigs operating simultaneously, or 200 strikes from an impact hammer (either one or two operating at any time). Mitigation specifying such quiet periods will be required to ensure that they are implemented.

In order to guarantee these gaps in piling noise, particularly if there is more than one piling rig in operation at the site, it shall be a requirement that all breaks between piling be of at least 30 minute's duration and, in the case of two piling rigs being operational simultaneously, that such breaks are concurrent. This mitigation will ensure that any hydroacoustic impacts will not give rise to a significant barrier to the movements of Twaite Shad or other species, or other significant effects on such species, in the Suir Estuary.

Soft-start/Ramp-up Procedure

Given the slow build-up of energy from vibratory piling, there is no requirement for the use of a soft-start or ramp-up procedure. Where impact piling is necessary to achieve the required depth for some piles, the vibratory piling preceding it will act as an effective soft-start or ramp-up procedure. Therefore, no specific measures are required to regulate the build-up of sound energy under water.

European Otter

The mitigation prescribed in this section in relation to hydroacoustic impacts are more than adequate to eliminate any risk of significant noise and vibration impacts on otters during the construction of the proposed development. Therefore, no further mitigation is required in respect of noise and vibration impacts on this species.

Summary

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

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

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

5.2.4 Lighting

Fish Species

The likely effects of artificial lighting on the migratory fish species listed as Qualifying Interests of the Lower River Suir SAC and the River Barrow and River Nore SAC are discussed in detail in Section 4.2.4 above. In summary, light spill onto the river channel during hours of darkness has the potential to form a barrier to the migration of nocturnal species and to encourage night-time activity of diurnal species, causing them to become more vulnerable to nocturnal predators.

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 any 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.

European Otter

The mitigation prescribed in this section in relation to the impacts of artificial lighting are more than adequate to eliminate any risk of adverse effects in this regard on otters (including via prey availability) during the construction and operation of the proposed development. Therefore, no further mitigation is required in respect of lighting impacts on this species.

5.2.5 Invasive Alien Species

Terrestrial Plant Species

In order to minimise the risk of the introduction or spread of invasive alien plant species (IAPS) during construction, all land-based works shall be executed in accordance with best practice for biosecurity in construction. In particular, prior to commencement, the Contractor shall prepare a detailed Biosecurity Protocol describing his/her proposed approach to ensuring that IAPS are not imported or spread during the construction of the proposed development. The Contractor's Biosecurity Protocol shall be in accordance with *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance* (TII, 2020) and subject to approval by the Ecological Clerk of Works (ECoW) prior to its acceptance and implementation. The Biosecurity Protocol shall include, as a minimum, the following measures to prevent the spread of invasive species:

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

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

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

Pioneer Species

The invasive pioneer species Common Cordgrass (*Spartina anglica*) was previously recorded on intertidal mudflats in the River Suir within 500 m of the construction site. 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 Sustainable Transport Bridge and North Quays Development, without first having been inspected by the Ecological Clerk of Works (ECoW) and authorised by the Site Environmental Manager (SEM).
- Any material excavated from the mudflats, e.g. for the construction of drainage outfalls, shall be stored in a location where it is not at risk of colonisation by Common Cordgrass and shall be reinstated as quickly as possible.

Aquatic Species

The use of barges during the construction of the proposed development poses the risk of 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 invasive alien species and thereby avoid negative impacts on these habitats, the owner or operator of the barge or barges shall:

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

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

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

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

5.2.6 Other Measures

Fish Rescue

During de-watering of temporary cofferdams for the construction of drainage outfalls, any fish remaining within the cofferdams will be collected (by netting) and released into

the River Suir outside the cofferdams. These fish rescue operations shall be carried out under the supervision of IFI. Given the Health and Safety implications of working within a still cofferdam in a partially saline environment, the use of electrofishing is not considered to be appropriate in this case.

5.2.7 Monitoring

Water Quality

Monitoring of water quality shall be undertaken in the River Suir, with samples taken, monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored include, but are not limited to:

- Suspended solids and turbidity;
- Total hydrocarbons;
- Ammonia, nitrates, nitrites and total nitrogen;
- Phosphates and total phosphorus;
- Dissolved oxygen and biological oxygen demand; and,
- Temperature and salinity.

Samples shall be taken from at least two different locations, including at least one location at an appropriate distance upstream of the proposed development and at least one other at an appropriate distance downstream of the proposed development. The final number and location of sampling points will be determined by the Site Environmental Manager. Given the strong tidal influence at the location of the proposed development, the date and exact time at which each sample is taken, as well as the water level and direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions.

The results of the water quality monitoring programme 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 shall 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.

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 50m upstream of the new flood defence wall to 50m 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 B).

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 duration of the proposed development's construction during which piling activities will take place. This monitoring shall establish the ambient underwater noise levels in the estuary (and the rate of sound attenuation) prior to and after construction and more accurately characterise the sound outputs in terms of SPL_{peak} , SPL_{RMS} and SEL 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).

5.3 Implementation

In order to give effect to the mitigation prescribed in this NIS, 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 NIS 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 Biodiversity of the EIAR and in this NIS.
- Any conditions which might be attached to the proposed development's planning consent.
- Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:
 - *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- All applicable legislative requirements in relation to environmental protection.
- All relevant construction industry guidelines, including:
 - *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001).
- Any biosecurity requirements arising from the preceding points.
- The Transport Infrastructure Ireland (TII) and National Roads Authority (NRA) Environmental Assessment and Construction Guidelines, specifically:
 - *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*.
 - *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes*.
 - *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*.
 - *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*.

- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes.*
- *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.*
- *Management of Waste from National Road Construction Projects.*
- *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*

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

5.3.1 Environmental Operating Plan

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

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

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

- All environmental commitments and mitigation stipulated in the planning documentation in respect of the proposed development, including sediment controls and other measures to ensure that water quality in the River Suir and Waterford Harbour is not degraded.
- Any requirements of statutory bodies such as the NPWS and IFI, including adherence to *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- A detailed Biosecurity Protocol.
- A list of all applicable legislative requirements in relation to environmental protection and a method of documenting compliance with these requirements.
- Outline methods by which construction activities will be managed in such a manner as to avoid, reduce or remedy potential negative impacts on the environment.

To oversee the implementation of the EOP, the Contractor 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 A). This is a preliminary document, which will be updated and finalised by the successful Contractor. Appended to the EOP are the following constituent plans, also to be finalised by the Contractor:

Appendix A: Construction Environmental Management Plan (CEMP)

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

Appendix C: Incident Response Plan (IRP)

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

Construction Environmental Management Plan

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

The CEMP will contain the following information of general importance:

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

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

- Details of working hours and days.
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services.
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages).
- Details of construction plant storage, temporary offices.
- Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff).

- Dust management to prevent nuisance (demolition & construction).
- Control of sediment, run-off, erosion and pollution.
- Noise and vibration management to prevent nuisance (demolition & construction).
- Landscape management.
- Management of contaminated land and assessment of risk for same by suitably qualified, trained and licenced personnel.
- Management of waste arising from construction and demolition.
- Minimisation of artificial lighting and shading.
- Management of risk from invasive alien species
- Stockpiles.
- Project procedures & method statements for:
 - Site clearance, site investigations, excavations
 - Diversion of services.
 - Excavation and blasting (through peat, soils & bedrock).
 - Piling.
 - Temporary hoarding & lighting.
 - Borrow Pits & location of crushing plant.
 - Storage and Treatment of peat and soft soils.
 - Disposal of surplus geological material (peat, soils, rock etc.).
 - Earthworks material improvement.
 - Protection of watercourses from contamination and silting during construction.
 - Works from a barge, including protection of watercourses from contamination when working in-river
- Site Compounds.
- Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments.

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

Construction and Demolition Waste Management Plan

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

The finalised CDWMP will contain the following information:

- Material transport routes;
- Methods by which construction works shall be managed in accordance with the relevant legislative instruments, including but not limited to:

- An analysis of the different waste streams expected to be generated;
- A demolition plan, with the purpose of ensuring that demolition occurs in an orderly fashion so that the re-use and recycling of the resultant materials is given due priority;
- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste streams and collection times;
- Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of, where necessary; and
- Details of how and where hazardous wastes, such as contaminated land, hydrocarbons and other hazardous substances, are to be stored and disposed of in a suitable manner;
- Estimates of waste management costs;
- Specific waste management objectives for the project;
- Identification of the roles and responsibilities of the relevant personnel regarding waste management;
- Procedures for communication and training in relation to on-site waste management;
- Record keeping procedures; and
- Details of an audit system to monitor implementation of the CDWMP.

The CDWMP is appended to the EOP (see Appendix A of the NIS). The plan shall be finalised by the successful Contractor, in agreement with WCCC, and in accordance with TII's guidelines on *The Management of Waste from National Road Construction Projects* (2017), the *TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* (2007) and the Department of the Environment, Housing and Local Government's *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects* (2006). This will be a live document, which will be amended and updated to reflect the policy context, as well as conditions on site, as the construction of the proposed development progresses.

Incident Response Plan

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

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

- Contact names and telephone numbers for the local authority, i.e. WCCC (all sections and departments), An Garda Síochána and ambulance and fire services; and,
- Method statements for weather forecasting and continuous monitoring of water levels in the River Suir and Waterford Harbour. The plan must outline how the Contractor will respond to forecasted flood events, including but not limited to,

details of removal of site materials, fuels, tools, vehicles and persons from flood zones.

- The measures to be taken to avoid or reduce the incident risk potential;
- Reference to the method statement and management plans for construction activities, insofar as they are relevant for the purposes of mitigating against health and safety and pollution incidents;
- Procedures to be adopted to contain, limit and mitigate any adverse effects, as far as reasonably practicable, in the event of a health and safety or pollution incident;
- Persons responsible for dealing with incidents and their contact details;
- Procedures for alerting key staff, appropriate emergency services, authorities, the Employer's Representative and clean-up companies, where required, and contact details of same;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required, and contact details of same;
- Standby / rota systems; and
- The types and location of emergency response equipment available and appropriate personal protective equipment to be worn.

An IRP has been appended to the EOP (see Appendix A of this NIS). 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.

5.3.2 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 peak water levels in the River Suir.
- Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor.
- Daily inspections of surface water treatment measures.
- Daily inspections of all outfalls to watercourses.
- Daily visual inspections of watercourse to which there are discharges from the works and those in the vicinity of construction works.
- Weekly inspections of wheel-wash facilities.

- Daily monitoring of any stockpiles.
- Auditing at least six times per quarter of the Contractor's EOP monitoring results.

5.3.3 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 this 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 this 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.

APPENDIX B

Chapter 19 Mitigation Measures (Volume 2 of EIAR)

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	<p>Piling</p> <ul style="list-style-type: none"> 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	<p>Cladding</p> <p>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.</p>
4.3	<p>Utilities</p> <p>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.</p>
4.4	<p>Drainage – construction of Surface Water Outfall Structures</p> <ul style="list-style-type: none"> 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	<p>Quarries</p> <ul style="list-style-type: none"> • Only those quarries that conform to all necessary statutory consents may be used in the construction phase by the appointed Contractor. <p>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.</p>
4.6	<p>Construction Traffic</p> <ul style="list-style-type: none"> • 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	<p>Environmental Operating Plan</p> <p>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.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <i>Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters</i> (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. <p>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.</p>

No.	Description
	<p>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:</p> <p>Appendix A: Construction Environmental Management Plan (CEMP) Appendix B: Construction and Demolition Waste Management Plan (CDWMP) Appendix C: Incident Response Plan (IRP)</p> <p>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.</p> <p>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).</p>

19.3 Mitigation and Monitoring Measures for Traffic Analysis

Table 19.2 Mitigation and Monitoring Measures for Traffic Analysis

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

19.4 Mitigation and Monitoring Measures for Population and Human Health

Table 19.3 Mitigation and Monitoring Measures for Population and Human Health

No.	Description
6.1	<p>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.</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <ul style="list-style-type: none"> • 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	<p>Mitigation by Avoidance</p> <p>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.</p>
7.2	<p>Mitigation by Design</p> <p>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</p>

No.	Description
	provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment.
<p>Specific Mitigation Measures – KER 1 River Suir, including Annex I ‘Estuaries’</p> <p>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.</p>	
7.3	<p>Habitat Loss, Fragmentation and Degradation</p> <p>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 m² 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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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. <i>Fucus</i> 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 <i>KER 4 Fish Species</i>, including Annex II migratory species. This addresses the habitat fragmentation impact. <p>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.</p> <p>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</p>

No.	Description
	<p>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'.</p> <p>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.</p>
<p>7.4</p>	<p>Artificial Lighting</p> <p>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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>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.</p>
<p>7.5</p>	<p>Water Quality</p> <p>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.</p> <p>The following will be implemented as part of this plan:</p> <ul style="list-style-type: none"> • 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. <p>During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.</p> <ul style="list-style-type: none"> • 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
	<p>Based on the above guidance documents, the following principal mitigation measures will be adhered to for the construction phase:</p> <p><u>General Mitigation Measures</u></p> <ul style="list-style-type: none"> • 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. <p><u>Specific Mitigation Measures - Concrete Works</u></p> <p>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:</p> <ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • 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, <p>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.</p>
7.6	<p>Operational Phase</p> <p>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.</p>
7.7	<p>Invasive Alien Species</p> <p>Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under <i>KER 7 Invasive Alien Species</i>. 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.</p>
<p>Specific Mitigation Measures - KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'</p>	
7.8	<p>Habitat Loss, Fragmentation and Degradation</p> <p>The direct loss of c. 800 m² 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.</p>
7.9	<p>Water Quality</p> <p>The measures described under <i>KER 1 River Suir, including Annex I 'Estuaries'</i> 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.</p>
7.10	<p>Invasive Alien Species</p> <p>Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under <i>KER 7 Invasive Alien Species</i>.</p>

No.	Description
	<p>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.</p>
<p>Specific Mitigation Measures - KER 3 Fringing Habitats, including Annex I 'Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)'</p>	
<p>7.11</p>	<p>Habitat Loss</p> <p>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.</p> <p>Any direct losses of saltmarshes and other shoreline habitats of high biodiversity value, including Annex I 'Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)', have been largely avoided through the iterative design process. In particular, direct impacts on the area of 106 m² of Annex I 'Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)' 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 <i>KER 1 River Suir, including Annex I 'Estuaries'</i>, will further safeguard saltmarsh habitats from future erosion by reducing flow velocities along the shoreline. There are no other areas of Annex I saltmarsh within the extents of the proposed development.</p> <p>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 <i>KER 1 River Suir, including Annex I 'Estuaries'</i>.</p>
<p>7.12</p>	<p>Disturbance</p> <p>In order to provide further protection for 'Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>)' 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.</p>
<p>7.13</p>	<p>Water Quality</p> <p>The measures described under <i>KER 1 River Suir, including Annex I 'Estuaries'</i> 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 (<i>Glauco-Puccinellietalia maritima</i>)', arising from accidental pollution associated with the proposed development would not give rise to significant effects on those habitats in terms of habitat degradation.</p>
<p>7.14</p>	<p>Invasive Alien Species</p> <p>Mitigation relating to biosecurity and the management of the risks associated with the spread of invasive alien species described under <i>KER 7 Invasive Alien Species</i>. 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 (<i>Glauco-Puccinellietalia maritima</i>)', in terms of the introduction or spread of invasive alien species, especially Common Cordgrass (<i>Spartina anglica</i>).</p>

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<p>Specific Mitigation Measures - KER 4 Fish Species</p> <p>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).</p>	
<p>7.15</p>	<p>Habitat Loss</p> <p>The only fish habitat will be lost is the c. 800 m² 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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>
<p>7.16</p>	<p>Hydraulic Impacts</p> <p>Predictions made from the hydrodynamic model for the proposed flood defences show that there would be a slight increase in flow velocity immediately adjacent to a sheet piled wall. While this will not lead to significant effects in the form of erosion of habitats within or on the banks of the River Suir, the rate of deposition will be slightly decreased. The measures described under <i>KER 2 Intertidal Habitats, including Annex I 'Mudflats and sandflats not covered by seawater at low tide'</i> relating to installation of eco-cladding will ensure that the impact on shoreline habitats, including Annex I 'Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)', is further reduced/made positive.</p>
<p>7.17</p>	<p>Hydroacoustic Impacts</p> <p>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):</p> <ul style="list-style-type: none"> • 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 <i>vibratory</i> 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 <i>impact</i> piling event shall not exceed 200 strikes from one piling rig (or 200 strikes from <i>each</i> 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.

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	<p>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.</p> <p>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.</p>
7.18	<p>Artificial Lighting</p> <p>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.</p>
7.19	<p>Water Quality</p> <p>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.</p>
7.20	<p>Fish Rescue</p> <p>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.</p>
Specific Mitigation Measures - KER 5 Otter	
7.21	<p>Disturbance (Lighting and Noise)</p> <p>The mitigation proposed under <i>KER 1 River Suir, including Annex I 'Estuaries'</i>, for lighting impacts, and under <i>KER 4 Fish Species, including Annex II migratory species</i>, 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.</p>
7.22	<p>Prey Biomass Availability</p> <p>The measures described under <i>KER 1 River Suir, including Annex I 'Estuaries'</i> 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.</p> <p>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.</p>
Specific Mitigation Measures - KER 6 Bats	
7.23	<p>Disturbance (Lighting and Noise)</p> <p>The mitigation proposed under <i>KER 1 River Suir, including Annex I 'Estuaries'</i>, for lighting impacts, and under <i>KER 4 Fish Species, including Annex II migratory species</i>, for noise impacts, are considered sufficient to eliminate any risk of significant direct</p>

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	<p>Terrestrial Plant Species</p> <p>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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>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 or treatment purposes. All site staff shall be made aware of the Contractor's Biosecurity Protocol and receive training in the importance of good site biosecurity.</p>
7.25	<p>Pioneer Species</p> <p>The invasive pioneer species Common Cordgrass (<i>Spartina anglica</i>) 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):</p> <p><i>"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."</i></p> <p>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:</p> <ul style="list-style-type: none"> • 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
	<p>by the Ecological Clerk of Works (ECoW) and authorised by the Site Environmental Manager (SEM).</p> <p>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.</p>
<p>7.26</p>	<p>Aquatic Species</p> <p>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:</p> <ul style="list-style-type: none"> • 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. <p>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:</p> <ul style="list-style-type: none"> • Boarding the vessel; • Speaking with the skipper; • Inspecting the relevant documents; and, • Carrying out a final inspection of the vessel. <p>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.</p>
<p>Specific Mitigation Measures - KER 8 Nationally Designated Sites</p>	
<p>7.27</p>	<p>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.</p>
<p>Monitoring</p>	
<p>7.28</p>	<p>Hydroacoustic Impacts</p> <p>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).</p>

No.	Description
7.29	<p>Record of Habitats</p> <p>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.</p> <p>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).</p>
7.30	<p>Water Quality</p> <p>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.</p>
Implementation	
7.31	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ 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: <ul style="list-style-type: none"> ○ 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: <ul style="list-style-type: none"> ○ Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. ○ Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes.

No.	Description
	<ul style="list-style-type: none"> ○ 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. <p>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.</p>
Environmental Management Plans	
7.32	<p>Environmental Operating Plan</p> <p>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.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <i>Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters</i> (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. <p>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.</p> <p>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:</p>

No.	Description
	<p>Appendix A: Construction Environmental Management Plan (CEMP) Appendix B: Construction and Demolition Waste Management Plan (CDWMP) Appendix C: Incident Response Plan (IRP)</p> <p>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.</p>
7.33	<p>Construction Environmental Management Plan</p> <p>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).</p> <p>The CEMP will contain the following information of general importance:</p> <ul style="list-style-type: none"> • 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. <p>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:</p> <ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Minimisation of artificial lighting and shading. • Management of risk from invasive alien species • Stockpiles. • Project procedures & method statements for: <ul style="list-style-type: none"> ○ Site clearance, site investigations, excavations ○ Diversion of services. ○ Excavation and blasting (through peat, soils & bedrock). ○ Piling. ○ Temporary hoarding & lighting. ○ Borrow Pits & location of crushing plant. ○ Storage and Treatment of peat and soft soils. ○ Disposal of surplus geological material (peat, soils, rock etc.). ○ Earthworks material improvement. ○ Protection of watercourses from contamination and silting during construction. ○ Works from a barge, including protection of watercourses from contamination when working in-river • Site Compounds. • Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments. <p>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.</p>
7.34	<p>Construction and Demolition Waste Management Plan</p> <p>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.</p> <p>The finalised CDWMP will contain the following information:</p> <ul style="list-style-type: none"> • Material transport routes; • Methods by which construction works shall be managed in accordance with the relevant legislative instruments, including but not limited to: <ul style="list-style-type: none"> ○ An analysis of the different waste streams expected to be generated; ○ A demolition plan, with the purpose of ensuring that demolition occurs in an orderly fashion so that the re-use and recycling of the resultant materials is given due priority; ○ Details of waste storage (e.g. skips, bins, containers) to be provided for different waste streams and collection times; ○ Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility; ○ Details of storage areas for waste materials and containers; ○ Details of how unsuitable excess materials will be disposed of, where necessary; and ○ Details of how and where hazardous wastes, such as contaminated land, hydrocarbons and other hazardous substances, are to be stored and disposed of in a suitable manner;

No.	Description
	<ul style="list-style-type: none"> • 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. <p>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 <i>The Management of Waste from National Road Construction Projects</i> (2017), the <i>TII Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan</i> (2007) and the Department of the Environment, Housing and Local Government's <i>Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects</i> (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.</p>
7.35	<p>Incident Response Plan</p> <p>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.</p> <p>The Contractor will finalise the IRP prior to the commencement of the proposed works to include the following information, at a minimum:</p> <ul style="list-style-type: none"> • 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
	<p>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.</p>
<p>7.36</p>	<p>Site Environmental Manager</p> <p>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.</p> <p>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.</p> <ul style="list-style-type: none"> • 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. <p>Auditing at least six times per quarter of the Contractor's EOP monitoring results.</p>
<p>7.37</p>	<p>Ecological Clerk of Works</p> <p>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:</p> <ul style="list-style-type: none"> • 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. <p>The principal functions of the ECoW are:</p> <ul style="list-style-type: none"> • 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 (<i>Glauco-Puccinellietalia maritimae</i>)', 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. <p>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.</p>

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	<p>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:</p> <ul style="list-style-type: none"> • 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. <p>The successful Contractor will prepare an Incident Response Plan (IRP) which outlines measures to be implemented to prevent and address spillages of hazardous substances.</p>

19.7 Mitigation and Monitoring Measures for Hydrogeology

Table 19.6 Mitigation and Monitoring Measures for Hydrogeology

No.	Description
9.1	<p>A project-specific Environmental Operating Plan (EOP) and a Construction Environmental Management Plan (CEMP) 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</p>

No.	Description
	<p>formulated in consideration of the standard best practice. The EOP will include a range of site -specific measures that include:</p> <ul style="list-style-type: none"> • 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. <p>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).</p>

19.8 Mitigation and Monitoring Measures for Hydrology

Table 19.7 Mitigation and Monitoring Measures for Hydrology

No.	Description
Construction Mitigation	
10.1	<p>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.</p> <p>The following will be implemented as part of this plan:</p> <ul style="list-style-type: none"> • 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. <p>Inform and consult with Inland Fisheries Ireland and Waterways Ireland.</p>
10.2	<p>During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water.</p>

No.	Description
	<ul style="list-style-type: none"> • <i>Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites</i> (Eastern Regional Fisheries Board) • <i>Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers.</i> • <i>CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors.</i> • <i>CIRIA C648 Control of Water Pollution from Constructional Sites.</i> • <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (TII, 2006).</i> <p>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:</p>
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 " <i>Guidelines for the crossing of watercourses during the construction of National Road Schemes</i> ". 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
	<p>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 this is deemed to be associated with the proposed development.</p>
Specific Mitigation Measures – Concrete Works	
10.13	<p>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:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>
Flooding	
10.14	<p>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.</p>

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	<p>With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) <i>Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2</i>. 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:</p> <ul style="list-style-type: none"> • 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; <p>Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted</p>
12.2	<p>Furthermore, it is envisaged that a variety of practicable noise and vibration control measures will be employed. These may include:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>
12.3	<p>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.</p>

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

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	<p>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.</p> <p>In summary, the measures which will be implemented will include:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>

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	<p>During construction, the following mitigation measures are proposed for the Waterford Flood Defences West:</p> <ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> • 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. <p>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.</p>

APPENDIX B

Construction and Demolition Waste Management Plan

WATERFORD CITY PUBLIC INFRASTRUCTURE PROJECT

FLOOD DEFENCES WEST

Construction and Demolition Waste Management Plan

October 2021



**WPIP-ROD-ENV-S1_AE-RP-EN-400050_[S3-P01] W
Flood Def CDWMP**

Client:
Waterford City & County Council
35 The Mall
Waterford

Waterford City Public Infrastructure Project

Flood Defences West

Construction and Demolition Waste Management Plan

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT	2
2.1 Project Description	2
2.2 Construction Stage	4
2.3 Construction Procurement.....	4
3.0 WASTE MANAGEMENT STRAGETY	5
3.1 Scope	5
3.2 Waste and Recycling Management.....	5
3.3 Waste and Recycling Targets	7
3.4 Waste and Recycling Opportunities	7
4.0 WASTE DISPOSAL LICENSING	8
4.1 Licensing Requirements	8
4.2 Exclusion from Legislation.....	8
5.0 PROPOSED CONSTRUCTION METHODOLOGY AND MATERIAL USAGE ..	9
5.1 Site Preparation.....	9
5.2 Site Offices, Construction Compounds and Security.....	9
5.3 Material Quantities	10
5.4 General Construction and Demolition Works	10
6.0 ASSIGNMENT OF RESPONSIBILITIES.....	13
7.0 TRAINING	14
8.0 WASTE RECORDS.....	14
9.0 SUMMARY OF THE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN	14

1.0 INTRODUCTION

This Construction and Demolition Waste Management Plan (CDWMP) has been developed to ensure that waste arising on-site during the construction and demolition phase of the Waterford City Public Infrastructure Project - Flood Defences West will be managed and disposed of in a way that ensures the provisions of the Waste Management Acts, 1996-2011 and associated Regulations (1996-2011) are complied with and to ensure that optimum levels of reduction, re-use and recycling are achieved.

This CDWMP has been prepared for the provision of waste management for the construction phase of the Flood Defence West, taking into account the many guidance documents on the management and minimisation of construction and demolition waste, including:

- DEHLG (2006) *Best Practice Guidelines on the Preparation of Waste Management Plans for construction and Demolition Projects*. Department of Environment, Heritage and Local Government, Dublin;
- Provisions of the Waste Management Acts, 1996-2011 and associated Regulations;
- Construction Industry Research and Information Association (CIRIA) document 133 Waste Minimisation in Construction;
- TII (2014) *Guidelines for the Management of Waste from National Road Construction Projects*. Transport Infrastructure Ireland, Dublin; and,
- National Construction & Demolition Waste Council (NCDWC) 2006 *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*.

This plan is intended to be a working document and has been prepared to inform the Construction and Demolition Waste Management Plan which, in turn, will form an integral part of the Environmental Operating Plan (EOP) for the proposed development.

This document is preliminary in nature as it has been prepared at a stage when quantities are based on the design developed to a sufficient level of detail to inform the environmental impacts to be assessed in the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS). However, changes may occur during detailed design stages which may alter the volumes of waste.

All materials used during construction will be imported. Minimal quantities of soils will be excavated during construction.

Prior to the commencement of construction works, a Waste Management Co-ordinator (WMC) (who may also be the Site Environmental Manager) will be appointed by the Contractor to assume responsibility for the further development of the CDWMP and the management and treatment of all waste materials created during the construction of the Flood Defences West.

The Contractor's CDWMP must contain (but not be limited to) the following measures:

- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times;

- Details of where and how materials are to be disposed of, i.e. landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of, where necessary;
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner; and
- Details of locations.

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects were published in 2006 by the National Construction & Demolition Waste Council (NCDWC). These Guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion. These Guidelines have been followed in the preparation of this report.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Project Description

The proposed development comprises c.1.1km of flood protection measures in the townlands of Mountmisery and Newrath in Co. Waterford, the townland of Newrath in Co. Kilkenny located along the north bank and within the foreshore of the River Suir in Waterford City, refer to Figures 1.1 in Volume 3 of the EIAR. The development extends for approximately 1km to the west and 100m to the east of the Waterford (Plunkett) Station, following the alignment of the existing quay wall and the Iarnród Éireann (IÉ) railway corridor located to the north of the proposed development.

The proposed flood defence measures are for the protection of critical infrastructure including the existing Plunkett Station, the railway line east and west of Plunkett Station and the Rice Bridge roundabout. The proposed development will also form a continuation of the flood protection measures, Flood Defences East proposed along the North Quays Strategic Development Zone (SDZ) as part of the Transport Hub Part 8 planning approval, eliminating the risk of flooding to the Transport Hub.

A design flood level of +4.0m OD (metres above Ordnance Datum Malin) is proposed for this development. The design flood level has been based on a flood with an annual exceedance probability of 0.5% and allowances for climate change and isostatic tilt as noted below.

The design (top-of-wall) level for the proposed flood protection measures is +4.30m OD (metres above Ordnance Datum Malin). The following allowances are integrated into the proposed height of the flood defence walls:

- 0.5% annual exceedance probability combined tidal-fluvial event (+3.45 m OD);
- An additional 0.55m to allow for climate change and isostatic tilt; and,
- 0.30m freeboard to the wall, including local wave wake effects.

An overview of the structural elements of the proposed development is provided from east to west below:

An overview of the structural elements of the proposed development is provided from east to west below, and should be read in conjunction with Figures 4.1 to 4.6 in EIAR Volume 3:

- Construction of c.365m of underground flood defences (an impermeable shallow trench approx. 0.35m in width and up to 3m in depth) from Ch.0.0 to Ch.365 to cut off the potential groundwater seepage during high tide events. It is possible that parts of these underground flood protection measures may be omitted during detailed design (see Figures 4.2 and 4.3 in Volume 3) or may be implemented on a phased basis depending on the ongoing groundwater monitoring results.
- Total of c.185m of overground flood defences from Ch.0.40 to Ch.210 consisting of:
 - c.170m of glass flood barrier on the river side of the road edge vehicular parapets on Rice Bridge roundabout and along the 3 roundabout arms (R680 Rice Bridge, R448 Terminus St. and R711 Dock Rd).
 - c.15m of demountable flood barriers on the R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- Remedial works to the existing quay wall from Ch.285 to Ch.360 by raising its height by 0.6m to 1.2m to conform with the design top-of-wall level of +4.30m OD.
- Construction of a sheet pile flood defence wall from Ch.360 to Ch.1090, with the top of wall at +4.30 mOD, to protect against overground flooding and underground groundwater seepage:
 - From Ch.360 to Ch.900 the sheet pile wall will be installed within the foreshore from the riverside, 1m from the front face of the existing quay wall. The space between the sheet pile wall and the front face of the existing quay wall will be filled with clean imported granular fill. The intertidal zone of the riverside sheet pile wall will be fitted with pre-cast concrete cladding material (“eco-seawall”).
 - From Ch.900 to Ch.1090, the sheet pile wall will be installed on land from the landside, 1m behind the existing quay wall.
 - The demolition of minor localised section of existing quay wall (max length of 3m) will be required in order to connect the in-river sheet piles with the landside sheet pile walls at Ch.900.
- Construction of c.20m of underground isolation structure at Ch.1090, consisting of a sheet pile cut-off wall and a concrete capping beam. The concrete capping beam will facilitate the installation of temporary overground flood barriers (e.g. water filled inflatable flood barriers) should these be required to be implemented during a flood event.

Drainage works will be carried out for the entire extents of the proposed flood defence measures i.e., from Ch.0.0 to Ch.1090 as shown in Figure 4.7 to Figure 4.11 in EIAR Volume 3:

- Remedial measures to the existing drainage outfalls to the River Suir from Ch.0.0 to Ch.1090 by extending them to reach an outlet within the new sheet pile wall, or to be retrofitted to pass through the new sheet pile wall, into the River Suir.
- In the vicinity of Plunkett Station, from Ch.0.0 to Ch.470, new trackside drainage and groundwater drains are included in the upgraded drainage works,

which will include a pumping station (at approx. Ch.390) and a new surface water outfall structure in the River Suir at Ch.390.

- From Ch.370 to Ch.1090, new drainage system will be installed for trackside drainage and also to allow groundwater cut -off behind the sheet pile wall to drain to the River Suir with 2 No. new outfalls to the River Suir terminating at the front face of the proposed flood defence sheet pile wall (at Ch 550 and Ch.900). The works will also include the construction of pumping stations at Ch.390 and Ch.550 respectively.
- Existing surface water outfalls at Ch.470 and Ch.490 which extend into the riverbed will be demolished to allow installation of the new flood defence wall; these will be replaced by new surface water outfall structures in the River Suir.
- Demolition of the existing quay wall to approximately 800mm below the existing ground level and removal of handrails from Ch.360 to Ch.900 where it is level with or above, the existing ground level. The demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level will be required in order to facilitate the construction of a surface water pumping station at Ch.380 (as shown in Figure 4.18 in EIAR Volume 3).
- All drainage outfalls (new and existing) will be fitted or retrofitted with non-return valves to prevent tidal water ingress.

Table 2.1 Overview of Proposed Flood Defences West

Chainage	Proposed Works
Ch.0.0 to Ch.365	Construction of an impermeable trench
Ch.0.40 to Ch.210	Construction of overground flood defences at Rice Bridge Roundabout.
Ch.285 to Ch.360	Remediation of existing quay wall
Ch.360 to Ch.1090	Construction of sheet pile flood defence wall
Ch.0.0 to Ch.1090	Drainage works

2.2 Construction Stage

It is anticipated that the construction of the proposed development will be progressed as a single construction contract with the construction phase lasting approximately 30 to 35 weeks.

2.3 Construction Procurement

It is envisaged that the construction of the proposed development will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer.

3.0 WASTE MANAGEMENT STRATEGY

3.1 Scope

The Contractor will develop a CDWMP that will detail:

- Licensing of Waste Disposal;
- Site clearance;
- Excavations and disposal of materials;
- Measures to protect water quality;
- Importation, stockpiling and placing of fill;
- Management of drainage works to ensure no pollution of the River Suir;
- Construction vehicle management; and,
- Dust and noise abatement measures.

3.2 Waste and Recycling Management

The management of construction and demolition waste will reflect the waste management hierarchy, with waste prevention and minimisation being the first priority, followed by reuse and recycling. During site clearance and construction works, there are numerous opportunities for the beneficial reuse and recycling of materials. The subsequent use of recycled materials in reconstruction works also reduces the quantities of waste which ultimately needs to be consigned to landfill sites.

The Contractor will develop and implement a plan and manage all waste with a goal of achieving the waste hierarchy in accordance with the relevant statutory provisions as shown in Figure 3.1.

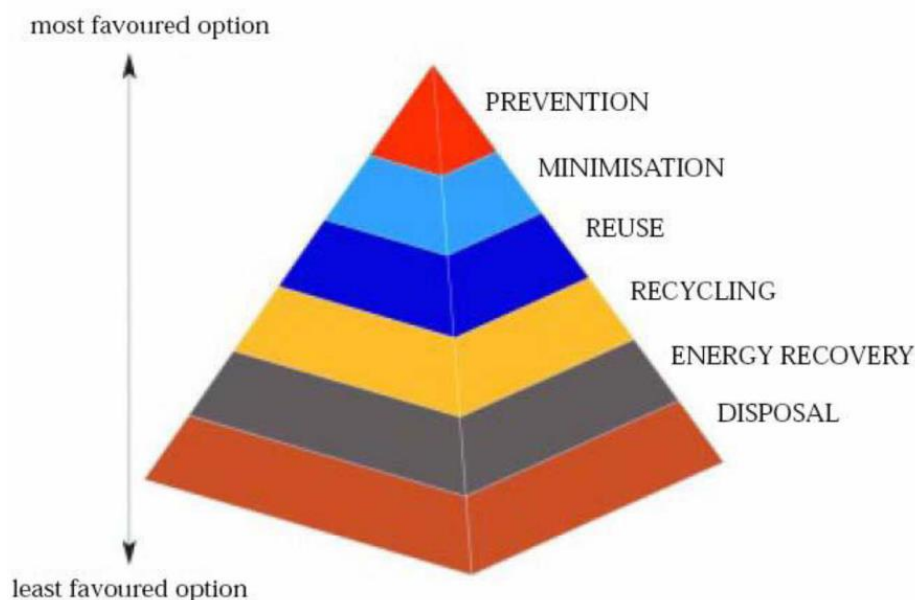


Figure 3.1 The Waste Management Hierarchy [DEHLG (1998) *Changing Our Ways*. Department of the Environment, Heritage and Local Government, Dublin]

Source Segregation

Wastes generated on the construction site will be identified and segregated according to their respective categories, as described by the European Waste Catalogue (EWC). Where possible, metal, timber, glass and other recyclable material will be segregated and removed off-site to a permitted/licensed facility for recycling.

In order to achieve this, designated waste storage areas will be created at the construction compound or other suitable locations for the storage of segregated wastes prior to transport for recovery/disposal at suitably licensed/permitted facilities. Suitably sized containers for each waste stream will be provided within the waste storage area and will be supervised by the WMC, who will be appointed by the Contractor. This will be the person responsible for the management of waste during the construction of the Flood Defences West. The number and sizing of containers will be agreed with Waste Contractors in advance of construction works commencing. Source segregation of waste will result in cost savings to the project as well as providing an environmentally sound route for the management of all construction and demolition wastes.

Re-use

Possibilities for re-use of clean, non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. During Ground Investigations (GI), samples were taken from exploratory holes and were tested at the Chemtest Accredited Laboratory in the UK. All samples have been classified as non-hazardous, falling within either inert WAC limits or increased inert WAC limits for non-hazardous landfills, except two samples which exceeded inert WAC limits and would classify for hazardous landfill. Some localised elevated levels of total organic carbon (TOC), chloride and heavy metals (Antimony, Mercury) were recorded, in specific locations close to rail tracks and the old landing stages. Asbestos was detected in a single sample with level detected <0.001% which is Non-Hazardous. Where excavated material is not to be reused within the works, the Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable. The Contractor will ensure that, if required, any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.

Material Management

In order to prevent and minimise the generation of waste, the Contractor will be required to ensure that raw materials are ordered so that the timing of delivery, the quantity delivered, and the storage is not conducive to the creation of unnecessary waste. The Contractor, in conjunction with the material suppliers, will be required to develop a programme showing the estimated delivery dates and quantities for each specific material associated with each element of construction and demolition works. Following a "just-in-time" approach improves cash flow, better utilises storage space, reduces risk of environmental pollution events and reduces potential loss to theft and accidental damage as well as making the site safer.

It is essential that the planning, construction and demolition works are undertaken in close collaboration with waste management contractors, in order to determine the best techniques for managing waste and to ensure a high level of recovery of materials for recycling. The Contractor will be required to continuously seek to improve the waste management process on-site during all stages of construction and maximise opportunities for re-use and recycling where they exist. For example, in relation to waste packaging, the Contractor will seek to negotiate take-back of as much packaging waste as possible at source to ensure maximum recycling. The

CDWMP will be included as an agenda item at the weekly construction meetings. In addition, the plan will be communicated to the whole team (including the Client) at the monthly meetings. This will include any updates to earlier versions of the document.

Waste Auditing

The Contractor will record the quantity (in tonnes) and types of waste and materials leaving the site during the construction phase. The name, address and authorisation details of all facilities and locations to which waste and materials from the construction phase are delivered will be recorded along with the quantity of waste (in tonnes) delivered to each facility. Records will show all material recovered and disposed of.

The waste management strategy for the project will follow the accepted waste hierarchy and the Contract will implement the following types of measures to reduce waste and maximize opportunities for recycling:

- Wherever possible, materials for construction activities will be ordered as to require the minimum possible storage time;
- Materials will be ordered, where possible, in sizes to prevent wastage;
- Appointment of a WMC, who will be responsible for handling, storage and delivery of materials to the proposed development;
- Ensure that stored material is protected from damage from plant and environmental factors such as rain and wind;
- Secure storage areas to prevent unauthorised access;
- Establish a waste management compound to handle incoming waste from construction activities – this should facilitate the segregation of key waste streams to maximise the opportunity to re-use, recycle and return wastes generated on-site;
- Provide a separate secured area for dealing with hazardous waste; and,
- Provide separate facilities for the storage of fuels and chemicals.

3.3 Waste and Recycling Targets

The Contractor's CDWMP, waste handling and proposed construction methods should endeavour to achieve the following targets

- The re-use of all earthworks materials on site where possible;
- 100% recycling of surplus reinforcement and other metals, where possible; and,
- No contamination of skips.

3.4 Waste and Recycling Opportunities

The Contractor will seek opportunities, wherever possible, to reduce the amount of waste generated on site and maximize the potential for recycling materials in accordance with the waste hierarchy through the following:

- Storing materials in designated areas and separate from wastes to minimise damage;
- Returning packaging to the producer where possible;
- Segregating construction and demolition wastes into reusable, recyclable and non-recyclable materials;

- Reusing and recycling materials on site during construction where practicable;
- Recycling other recyclable materials through appropriately permitted/licensed contractors and facilities; and,
- Disposing of non-recyclable wastes to licensed landfills.

4.0 WASTE DISPOSAL LICENSING

4.1 Licensing Requirements

Under the Waste Management (Collection Permit) (amended) Regulations, 2016, a waste collection permit for appropriate EWC Code(s) and designations is required by a waste haulier to transport waste from one site to another. Compliance with the Waste Management (Shipments of Hazardous Waste in Ireland exclusively) Regulation, 2011 is also required for the transportation of hazardous waste by road. The export of waste from Ireland is subject to the requirements of the Waste Management (Shipment of Waste) Regulations, 2007. The Contractor will ensure that the transport and movement of all waste is carried out in compliance with these requirements.

Waste may only be treated or disposed of at facilities that are licensed to carry out that specific activity, e.g. chemical treatment, landfill or incineration, for a specific waste type. Records of all waste movements and associated documentation will also be held on-site. Generally, operators of waste management sites will facilitate a site visit and inspection of documentation if deemed necessary. Prior to any on-site recovery process, including the operation of mobile plant, an operator must apply to the governing local authority for a waste facility permit under the Waste Management (Facility Permit and Registration) Regulations, 2007. It is planned that waste activities at the site will comprise of source segregation, storage and collection and, therefore, it is highly unlikely that any waste licensable or waste permissible activity will be undertaken.

4.2 Exclusion from Legislation

The Directive on Waste contains a number of exclusions which make clear that certain materials are not subject to its requirements. A key exclusion affecting construction projects such as this development is set down in Article 2(1)(c). This states that the requirements of the EU legislation do not apply to:

"uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated"

This provision is repeated in the Waste Management Acts, as amended by the European Communities (Waste Directive) Regulations, 2011 (SI No. 126/2011). Should materials generated by construction activities fall within this provision, they are not then subject to the other requirements of the EU or national waste legislation. This means that, for example, such materials are not defined as "waste", do not need to be handled by duly authorised waste collectors and do not need to pass to disposal or recovery facilities that are subject to waste licences or other equivalent form of statutory authorisation. In addition, the requirements of the Waste Hierarchy do not apply.

5.0 PROPOSED CONSTRUCTION METHODOLOGY AND MATERIAL USAGE

5.1 Site Preparation

The construction of the Flood Defences West will require site clearance as part of the development, mostly for setting up the temporary compounds. Any site clearance works will however be minimal as the works area typically consist of levelled rail cess and built-up area (car parks). Also, a significant portion of works includes driving sheet piles in river/mudflats for which minimal site preparation is required. For the construction of impermeable trench at Plunkett station, the works may include minor diversion or protection works of services and utilities, such as public lighting, power services, watermains, rising main, storm water, electricity, telecommunications, gas mains and traffic light services. Due to the nature of works it is envisaged that it will only be possible during the main construction works.

The Contractor's CDWMP will take the following into account:

- The extent of the areas to be cleared and the potential types and volumes of arisings;
- Statutory requirements; and
- Specific environmental requirements and seasonal requirements, e.g. in respect of Shad, Salmon and Lamprey.

5.2 Site Offices, Construction Compounds and Security

A construction compound will be required in the vicinity of the proposed development and is proposed and assessed as being located in the widened rail cess area approximately 300m northwest of the flood defences' westernmost point, in vicinity of the rail level crossing. An ancillary compound is proposed at the Sally Park depot under ownership of Iarnród Éireann. The location, size and suitability of the compound will ultimately be at the discretion of the contractor once it is located within the project boundary and site access is approved by the Local Authority. For the purpose of the Environmental Impact Assessment Report (EIAR), it has been anticipated that the construction compound will be located in the widened rail cess area as described above. The location and layout of the construction compound selected by the contractor will however have to incorporate the protection and mitigation measures outlined in the EIAR and conform to the requirements outlined in the Natura Impact Statement (NIS) and planning conditions.

The compound will include stores, offices, material storage areas, plant storage and parking for site and staff vehicles. This site is proposed to remain in place for the duration of the contract but may be scaled up or down during particular activities on site.

The storage of fuels, other hydrocarbons and other chemicals within the construction compounds will not be permitted within 10m of the River Suir. All fuel storage areas will be bunded to 110% of storage capacity to prevent spills and provide sufficient additional capacity in the event of rainfall occurring simultaneously. The compounds will also have appropriate levels of security to limit potential vandalism, theft and unauthorised access within the compounds.

Following completion of construction, the compound will be cleared and reinstated in the original form. Temporary buildings and containers, parking areas and waste material such as rubble, aggregates and unused construction materials will not be

permitted to remain exposed on these sites and will need to be removed and disposed of appropriately.

5.3 Material Quantities

Table 5.1 below provides the estimated material quantity requirements for the proposed Flood Defences West.

Table 5.1 Resources to be used During Construction

Element	Resources
Earthworks	<p>Installation of a sheet pile wall will not require excavation of waste material. Imported material to fill the gap between the sheet pile wall and the existing quay wall will be clean granular material Class 6, totalling approximately 2000m³.</p> <p>Approximately 2,500m³ of clean imported granular fill material Class 6, will also be required for drainage works.</p>
Structural Works	<p>The project will require import of steel sheet piles for construction of new flood defence walls as well as material for in-situ concrete for remedial works on the existing quay wall. Total length of sheet pile wall will be approximately 770m, with height of piles between 10 and 21m. The total surface of the sheet piles is assumed to be approximately 11,000m² with the total tonnage of approximately 1,400 tonnes. Approximately 1,500 m³ of precast concrete eco-seawall panels (with depth of approximately 13 cm) will be attached to the riverside sheet pile wall.</p> <p>Approximately 50 m³ of concrete will be used for remedial works (raising) to the existing quay wall. Minor quantity of reinforcement steel will also be imported. Up to approximately 350m³ of lean mix concrete / grout will be required to infill the impermeable trench.</p>
Drainage	<p>Drainage pipes (approx. 1,310m), valves, manholes, 2 No. precast pumping chambers, 3 No. precast headwalls, handrails, riprap, stone mattresses etc.</p> <p>70m³ fill of concrete surround for pump chambers of the proposed pumping stations will be required.</p>
Construction and Demolition Waste	<p>The removal of the upper section of the existing wall to the level of 800mm below existing ground level will generate approximately 600 m³ of waste. Material excavated during demolition of a small section of the quay wall for the purpose of joining the riverside and landside sheet piles, will amount to approximately 50m³. Another approximately 100 m³ of wall will be demolished during the construction of a pumping station.</p> <p>Up to c.350m³ of waste material will be generated during shallow excavations for the impermeable trench.</p> <p>Approximately 2,600m³ of in-situ ground and ballast will be excavated during the drainage outlet remediation works and other drainage works such as installation of filter drains, with approximately half of it expected to be used again as a backfill across the site for ground levelling purposes. As such, approximately 1,300m³ of surplus excavation will be generated.</p>

5.4 General Construction and Demolition Works

Quantities of general construction and demolition wastes are made up of waste such as wood, packaging, metals, plastics, bricks, blocks, canteen waste, some hazardous waste, e.g. oils, paints and adhesives. Site clearance and residual waste will be generated during the construction phase, primarily from the construction of the

proposed development. A detailed estimate of the anticipated quantities of these materials will be provided in the detailed CDWMP following appointment of the Contractor at construction stage. The majority of the waste material generated on site of proposed development, however, will be reused.

An overview of the methods to manage the primary waste streams expected is presented below. The main types of construction waste produced will be:

Excavated material

Where short-term temporary storage is unavoidable, the method of storage of material will be key to its potential use as certain types of materials mud are likely to degrade if left uncovered in wet weather due to its low plasticity and silty nature.

Concrete

Waste concrete is likely to arise during the construction phase of the Flood Defences West, primarily through the demolition of a section of an existing masonry flood defence wall. It is proposed that waste concrete generated will be returned to the supplier for re-use. For every tonne of concrete waste that is recycled for aggregate in new concrete, significant savings are made in energy and carbon dioxide emissions. It also saves money by avoiding disposal costs, which continue to increase. Residual concrete waste will be source segregated and stored in designated containers at the waste storage area for subsequent separation and recovery at a remote facility.

Metals

Metal waste has a significant scrap value. Although it is now common practice for sites to segregate metals for reuse and recycling, there are still sites where metal is thrown away with general rubbish. One of the primary sources of metal waste is steel reinforcement. Wastage of steel reinforcement will be reduced by ordering made to measure steel from the manufacturer and detailed scheduling of all reinforced concrete structural elements. Steel reinforcement requirements are likely to be limited for the proposed development.

Skip hire companies may provide free skips for the storage of scrap metal on sites and this will be investigated prior to construction commencing. When metal storage containers are full, they will be removed by the waste storage contractor and sent to a metals recycling facility.

Timber

Timber waste will be stored separately as it is readily contaminated by other wastes and if it is allowed to rot will reduce the recyclability of other stored wastes. Any pallets will be returned to the supplier for re-use. Off-cuts and trimmings will be used in formwork where possible. A container for waste wood will be covered where possible and will be placed in the waste storage area. The waste wood will be collected by a waste contractor who will forward it to a wood recycling facility for chipping.

Treatment of timber with chemicals and the overuse of nails will be minimised and avoided as this will make it difficult to reuse/recycle the timber afterwards. The utilisation of reclaimed timber products will also be investigated.

Packaging and Plastic

Packaging waste can become a major problem on construction sites. Double handling will be avoided by segregating packaging wastes immediately after unwrapping. Many suppliers are now prepared to collect their own packaging for recycling, and this will also be investigated prior to works commencing. It is intended that, where possible, materials with recycled packaging will be purchased. Waste packaging will be segregated and stored in separate containers, preferably covered, in the waste storage area for collection by the waste management contractor and distribution to packaging recycling facilities.

Blocks, Bricks and Tiles

The careful storage of these raw materials will significantly reduce the volume of these wastes arising on site. The most likely wastes produced will be off-cuts, trimmings and waste arising from breakages. Every effort will be made to use broken bricks and off-cuts

Hazardous Wastes

All of the waste generated from construction phase of proposed development is likely to be of a non-hazardous origin, however there is potential to encounter hazardous waste on site due to the industrial history of the area. One area with potential for being characterised as hazardous is the excavated material below the car park, which will be excavated for the purpose of constructing the impermeable trench.

Prior to removal from the site, any hazardous waste identified will undergo a comprehensive waste assessment and classification by a suitably qualified person in accordance with the European Waste Catalogue and Hazardous Waste List. It should be noted that if non-hazardous waste becomes contaminated with hazardous waste the entire load will be considered hazardous. It is, therefore, critical to ensure that waste segregation areas are provided and are used properly to separate out hazardous, non-hazardous and inert waste arising. Hazardous wastes will be identified, removed and kept separate from other construction and demolition waste materials in order to avoid cross-contamination. Specific method statements detailing the necessary mitigation measures required during excavation, handling transportation and disposal of hazardous wastes encountered on the site will be prepared as required.

The likely disposal/treatment options for any hazardous wastes available to the Contractor will depend on the nature of the hazardous material and the concentration of parameters of concern. The costs associated with treatment and disposal will similarly vary depending on the concentration of parameters of concern and on the tonnage involved. There are several operators/facilities in operation within Ireland that could potentially accept the contaminated material depending upon the results of the Waste Acceptance Criteria testing or assist in the export of the material abroad for special treatment where required. Full details of the disposal route for hazardous wastes will be provided in the detailed CDWMP following the appointment of the contract and completion of the further investigations required.

Hazardous Liquids (Oils, Paints, Chemicals)

Hazardous liquid waste arising from the construction process will require careful handling. Oils, paints, bitumen, adhesives and chemicals will be kept in a separate contained storage area which will be locked when not in use. Hazardous liquids will be stored at least 10m from the River Suir. Lids will be kept on containers in order to avoid spillage or waste by evaporation. Waste oils, paints and chemicals, including

the containers, will require careful handling and disposal. These will be stored in a containment tray with a capacity to contain 110% of the volume of the largest container.

Fuels and chemical will be stored in double-skinned containers or within a bund, i.e. an impervious structure with the capacity to contain 110% of the volume of the largest tank stored within it. All containers will be carefully labelled.

Food Wastes

Site staff generate food waste and packaging waste. Designated receptacles will be provided to allow for the segregation and storage of individual waste streams. These will include receptacles for food waste, e.g. brown bin for waste foods and peelings, dry recyclables, e.g. green bin for packaging, plastics, metals, wood, paper, cardboard and tetrapack, and residual bin, e.g. black bin for mixed food and packaging waste. Separate receptacles for the recyclable fractions may be provided such as plastics, metals, glass and this will be designed and detailed by the WMC in consultation with the selected waste management contractor.

Other Wastes (Residual)

Waste material other than those outlined above can constitute a significant proportion of the total waste generated by a construction site. This waste is normally made up of residual, non-recyclable waste such as soiled paper, cloth, cardboard or plastics, as well as food waste and general waste found on the site, including plastic bottles, bags, cans etc. Given the heterogeneous nature of this material, it is most important that residual waste is kept separate from the other waste streams to avoid contamination. This material will be stored in a dedicated container in the waste storage area. Container size and collection frequency will be assessed with waste management contractors as works proceed. All residual wastes will be dispatched to a suitably licensed facility for disposal. Other construction and demolition waste material will be collected in receptacles with mixed construction and demolition waste materials for subsequent separation and disposal at a segregation facility.

6.0 ASSIGNMENT OF RESPONSIBILITIES

A WMC will be appointed who will have overall responsibility for waste management on the site. The Employer (Waterford City and County Council) will receive summaries of any audit reports, which will be completed within three months of the end of each calendar year. The effectiveness and accuracy of the documentation may also be monitored on a regular basis via routine site visits. Following appointment of the preferred Contractor, the CDWMP will be updated in accordance with the final design and copies of the plan will be distributed to the Employer, the Site Manager and the site sub-contractors. The WMC appointed by the Contractor will be appropriately trained and experienced in all aspects of waste management. In addition he/she and the site crew must be in a position to:

- Distinguish reusable materials from material suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on best locations for stockpiling reusable material;
- Separate material or recovery; and,
- Identify and liaise with operators of recovery outlets.

The WMC will be responsible for educating all site staff, sub-contractors and suppliers about the available alternative to conventional waste disposal. Training will also be given to all site staff in materials management on sites. The WMC will continually identify waste minimisation actions on sites and this will be updated in the plan.

7.0 TRAINING

Copies of the CDWMP will be made available to all personnel on-site. All site personnel and sub-contractors will be instructed about the objectives of the plan and informed of the responsibilities that fall upon them as a consequence of its provisions. This is traditionally carried out during the induction process for new staff members. Where source segregation and material re-use techniques apply, each member of staff will be given instructions on how to comply with the CDWMP. Site notices will be designed to reinforce the key messages within the plan and will be displayed prominently for the benefit of staff.

8.0 WASTE RECORDS

When establishing the system for managing the details of all arisings, movement and treatment of construction and demolition waste in the CDWMP, the use of electronic tools should be considered to provide for convenient recording of information in a useful format such as "Smart – waste".

The Contractor will be required to arrange for full details of all arisings, movements and construction and demolition waste to be recorded during all stages of the proposed development. Each consignment of construction and demolition waste removed from the site will be documented in the form of a Waste Movement Record form, which will ensure full traceability of the material to its final destination. Separate record forms will be completed in respect to each waste transfer that takes place. The Contractor will also receive printed documents/records from waste disposal companies employed, quantifying the exact amount of waste material removed from site. The sheet from the disposal company also identifies how much material went to landfill and how much went for recycling. All such records will be retained in a designated location and made available for auditing of the CDWMP.

9.0 SUMMARY OF THE CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

Waste will inevitably be generated during the construction and demolition phase of the Flood Defences West. It is intended that all steel and concrete will be imported for use within the project area. At this stage, it is anticipated that there will be excavated material for re-use on-site.

Other than spoil material from excavations, waste arisings during the construction phase will be minimised by the purchasing manager, who will time the ordering of materials so as to reduce the likelihood of over-purchase or damage during storage. Construction and demolition waste fractions will be segregated and stored on-site in designated areas or containers in the waste storage area prior to transport by licensed hauliers to facilities for segregation recycling and disposal.

A WMC will be appointed to ensure that the CDWMP is followed. Training will be given to all staff so that they are aware of the CDWMP and know their responsibilities.

Records will be kept to trace the inputs and outputs of the construction works at the site and this should allow the Employer to make informed decisions regarding waste management in the future. These records will be made available to the relevant local authorities and the EPA should it be required.

The design and implementation of the detailed CDWMP, in conjunction with the EOP for the Flood Defences West, will provide for the optimum planning/management and handling of waste generated by the project and will ensure that there will be no worse than a neutral or imperceptible impact from waste management practices during construction.

The contractor appointed to undertake the construction of the Flood Defences West will develop their own CDWMP based on their detailed plans, the requirements of this plan, the requirements of the EIAR, the requirements of the NIS and any commitments given as part of the project approval process and the Employer's requirements and specifications for executing the Flood Defences West.

APPENDIX C

Incident Response Plan



WATERFORD CITY PUBLIC INFRASTRUCTURE PROJECT

FLOOD DEFENCES WEST

Incident Response Plan

October 2021



**WPIP-ROD-ENV-S1_AE-RP-EN-400055_[S3-P01] W Flood
Def IRP**

Client:
Waterford City & County Council
35 The Mall
Waterford

Waterford City Public Infrastructure Project

Flood Defences West

Incident Response Plan

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 OBJECTIVE OF PLAN.....	1
3.0 RESPONSIBILITY	1
4.0 OTHER PLANS	1
5.0 OUTLINE INCIDENT RESPONSE PLAN.....	2
6.0 EXTERNAL CONTACTS.....	4
7.0 INTERNAL (CONTRACTORS) CONTACTS.....	5
8.0 CHEMICAL PRODUCT AND WASTE INVENTORY.....	5
9.0 POLLUTION PREVENTION EQUIPMENT INVENTORY	6
10.0 DRAWINGS.....	6
11.0 RESPONSE PLANNING	6
11.1 Incident Response Plan	6
11.2 The Incident Response Plan will include the following, as appropriate:	6
11.3 Monitoring.....	7
APPENDIX A Figure 1	

1.0 INTRODUCTION

This Incident Response Plan (IRP) describes the guidelines for procedures, lines of authority and processes that should be followed to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances. It has been developed to provide the information that each employee may need to respond to an emergency and to handle it effectively.

2.0 OBJECTIVE OF PLAN

The primary objective of this document is to:

- Ensure the health and safety of workers and visitors along the site;
- Minimise any impacts to the environment and to ensure protection of the water quality and the aquatic species dependant on it;
- Protect property and operations at the proposed site and to minimise the impact on the continuity of business; and,
- Establish procedures that enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property and the environment.

3.0 RESPONSIBILITY

It is the responsibility of the Environmental Manager to maintain and update this IRP as required.

This IRP will be reviewed on an ongoing basis and amended, as necessary, when one or more of the following occur:

- Applicable regulations are revised;
- The Plan fails in an emergency;
- The project changes in its design, construction, operation, maintenance, or other circumstance in a way that materially increases the potential for impacts on the environment, workers or visitors to the site; and/or,
- Amendments are required by a regulatory authority.

4.0 OTHER PLANS

In 2019, Health Service Executive (HSE) prepared an Emergency Plan for the South East Region in accordance with the Government's Major Emergency Management Framework which include counties of Carlow, Kilkenny, Tipperary, Wexford and Waterford. This plan is available ONLINE at:

<https://www.hse.ie/eng/services/list/3/emergencymanagement/area-mep/hse-emergency-management-area-5-emergency-plan.pdf>

It details the initial contact that should be made in case of an emergency incident as well as those responsible for following up once an emergency event is declared. This plan may be referred to during both the construction and operation phases.

5.0 OUTLINE INCIDENT RESPONSE PLAN

Name and address of the Client:

Waterford City & County Council
35 The Mall
Waterford

The contact within the Client organisation is Peter Keane (tel. 0761 10 2788).

Site Location:

The proposed development comprises c.1.1km of flood protection measures in the townlands of Mountmisery and Newrath in Co. Waterford, the townland of Newrath in Co. Kilkenny located along the north bank and within the foreshore of the River Suir in Waterford City (see Appendix A Figure 1).

Overview of the activities on site:

The construction programme for the proposed development is 30 – 35 weeks.

An overview of the structural elements of the proposed development is provided from east to west below, and should be read in conjunction with Figures 4.1 to 4.6 in EIAR Volume 3:

- Site Setup and establishment of construction compounds within IÉ lands;
- Relocation of underground utilities, where required.
- Construction of c.365m of underground flood defences from Ch.0.0 to Ch.365
- Construction of c.185m of overground flood defences from Ch.0.40 to Ch.210 consisting of:
 - c.170m of glass flood barrier on the river side of the road edge vehicular parapets on Rice Bridge roundabout and along the 3 roundabout arms (R680 Rice Bridge, R448 Terminus St. and R711 Dock Rd).
 - c.15m of demountable flood barriers on the R680 Rice Bridge for the section leading to the North Quays Strategic Development Zone.
- Remedial works to the existing quay wall from Ch.285 to Ch.360 by raising its height by 0.6m to 1.2m.
- Construction of a sheet pile flood defence wall from Ch.360 to Ch.1090:
 - From Ch.360 to Ch.900 the sheet pile wall will be installed within the foreshore from the riverside, 1m from the front face of the existing quay wall. The space between the sheet pile wall and the front face of the existing quay wall will be filled with clean imported granular fill. The intertidal zone of the riverside sheet pile wall will be fitted with pre-cast concrete cladding material (“eco-seawall”).
 - From Ch.900 to Ch.1090, the sheet pile wall will be installed on land from the landside, 1m behind the existing quay wall.
 - The demolition of minor localised section of existing quay wall (max length of 3m) will be required in order to connect the in-river sheet piles with the landside sheet pile walls at Ch.900.
- Construction of c.20m of underground isolation structure at Ch.1090, consisting of a sheet pile cut-off wall and a concrete capping beam. The concrete capping beam will facilitate the installation of temporary overground flood barriers (e.g. water filled inflatable flood barriers) should these be required to be implemented during a flood event.

Drainage works will be carried out for the entire extents of the proposed flood defence measures i.e., from Ch.0.0 to Ch.1090 as shown in Figure 4.7 to Figure 4.11 in EIAR Volume 3:

- Remedial measures to the existing drainage outfalls to the River Suir from Ch.0.0 to Ch.1090 by extending them to reach an outlet within the new sheet pile wall, or to be retrofitted to pass through the new sheet pile wall, into the River Suir.
- In the vicinity of Plunkett Station, from Ch.0.0 to Ch.470, new trackside drainage and groundwater drains are included in the upgraded drainage works, which will include a

pumping station (at approx. Ch.390) and a new surface water outfall structure in the River Suir at Ch.390.

- From Ch.370 to Ch.1090, new drainage system will be installed for trackside drainage with 2 No. new outfalls to the River Suir terminating at the front face of the proposed flood defence sheet pile wall (at Ch 550 and Ch.900). The works will also include the construction of pumping stations at Ch.390 and Ch.550 respectively.
- Existing surface water outfalls at Ch.470 and Ch.490 which extend into the riverbed will be demolished to allow installation of the new flood defence wall; these will be replaced by new surface water outfall structures in the River Suir.
- Demolition of the existing quay wall to approximately 800mm below the existing ground level and removal of handrails from Ch.360 to Ch.900. The demolition of approx. 25m of the existing quay wall to a level of between 2 to 4m below existing ground level to facilitate the construction of a surface water pumping station at Ch.380 (as shown in Figure 4.18 in EIAR Volume 3).
- All drainage outfalls (new and existing) will be fitted or retrofitted with non-return valves to prevent tidal water ingress.
- All ancillary works.

Description of the proposed development and surrounding area:

The proposed development is located within the townlands of Mountmisery and Newrath in Co. Waterford, the townland of Newrath in Co. Kilkenny along the north bank of the River Suir in Waterford City, Co. Waterford. The R680 Rice Memorial Bridge and the Waterford railway station, Plunkett Station are located at the easternmost extent of the site of proposed development, while the Iarnród Éireann (IÉ) rail corridor and the Sallypark industrial site bound the development to the north. The River Suir and the existing quay wall run along the south of the site.

The proposed development consists of flood defence measures for the protection of critical infrastructure including the existing Plunkett Train Station, the railway line east and west of Plunkett Station and the Rice Bridge roundabout. The proposed development will also form a continuation of the flood protection measures, Flood Defences East proposed along the North Quays Strategic Development Zone (SDZ) as part of the Transport Hub Part 8 planning approval. The design flood level of the proposed flood protection measures is +4.0m OD (metres above Ordnance Datum), with the top-of-the-wall flood protection measures of +4.30m OD.

An overview of the structural elements of the proposed development is provided from east to west below, and should be read in conjunction with Figures 4.1 to 4.11 in EIAR Volume 3.

Chainage	Proposed Works
Ch.0.0 to Ch.365	Construction of an impermeable trench
Ch.0.40 to Ch.210	Construction of overground flood defences at Rice Bridge Roundabout.
Ch.285 to Ch.360	Remediation of existing quay wall
Ch.360 to Ch.1090	Construction of sheet pile flood defence wall
Ch.0.0 to Ch.1090	Drainage works

Potential Incidents:

Potential incidents requiring emergency response procedures:

- Fuel and oil spills;
- Road traffic accidents involving chemical or biological spills;
- Rail accidents whilst carrying out landside sheet pile installations within the Waterford to Dublin rail corridor
- Earth slippages;
- Extreme rainfall events, causing swelling of the River Suir

<ul style="list-style-type: none"> • Fires; • Activities resulting in noise and vibration, air pollution, hazardous substances or impacts on water; • Working within and in vicinity of River Suir • Waste management; and, • Discharge of effluent. <p>The Contractor will update the list of potential incidents based on their proposed construction methods and programme for the development of Flood Defences West and include, as a minimum, the following:</p> <ul style="list-style-type: none"> • The measures to be taken to reduce the risk potential; • Procedures to be put in place to deal with the risk; • Person responsible for dealing with incidents; • Procedures for alerting key staff; • Standby/rota systems; • Clearly defined roles and responsibilities; • Names of staff and contractors trained in incident response; • The types and location of emergency response equipment available and appropriate personal protective equipment to be worn; • A system of response coordination; • Off-site support; and, • Particular emergency service or persons to be notified in case of incident. 		
Date and version of the plan: April 2021		Name or position of person responsible for compiling/approving the plan: Barry Corrigan Roughan & O'Donovan
Review Date:		Date of next exercise:
Objectives of the IRP: To carry out the construction works in such a way as to avoid injury, health hazards or pollution incidents. However, should any such incident occur, procedures and measures will be implemented to contain, limit and mitigate the effects as far as reasonably practicable.		
List of external organisations consulted in the preparation of the IRP: TBC by Contractor when preparing IRP		
Distribution of the IRP		
Recipient	No. of copies	Version

6.0 EXTERNAL CONTACTS

External Contacts		
Contact	Office Hours	Out of Hours
Waterford City Fire Station	(051) 849 982	(051) 849 982
Gardaí: Emergency	999 / 112	999 / 112

External Contacts		
Contact	Office Hours	Out of Hours
Gardaí: Waterford Divisional Headquarters Garda Station	(051) 305 300	(051) 305 300
University Hospital Waterford	(051) 848 000	(051) 848 000
EPA Regional Inspectorate Kilkenny	(056) 779 6700	-
Waterford City and County Council Emergency Planning Department	076 102020	0761 102020
ESB Networks	(021) 238 6555	1850 372 999
Bord Gáis	051 302 500 / 1850 20 50 50	1850 20 50 50
Waste Management Contractor	TBC	
Specialist Advice	TBC	
Specialist Clean up Contractor	TBC	
Waterford City and County Council	076 110 2020	0761 102020
Inland Fisheries Ireland		To be agreed with IFI
National Parks & Wildlife Service		To be agreed with NPWS

7.0 INTERNAL (CONTRACTORS) CONTACTS

Internal Contacts		
Contact	Office Hours	Out of Hours
Names and positions of staff authorised/trained to activate and coordinate the IRP	TBC	
Other Staff	TBC	
Managing Director	TBC	
Site Manager	TBC	
Health & Safety Manager	TBC	

8.0 CHEMICAL PRODUCT AND WASTE INVENTORY

Inventory of Chemical Products and Wastes						
Trade Name / Substance	Solid / liquid / gas or powder	UN number	Maximum amount	Location marked on site plan	Type of containment	Relevant health and environmental problems

Inventory of Chemical Products and Wastes						
Trade Name / Substance	Solid / liquid / gas or powder	UN number	Maximum amount	Location marked on site plan	Type of containment	Relevant health and environmental problems

9.0 POLLUTION PREVENTION EQUIPMENT INVENTORY

Inventory of Pollution Prevention Equipment (on- and off-site resources)			

10.0 DRAWINGS

Drawings of the proposed development are included in **Appendix A**.

Site Plan
Figure 4.1 - Location Plan

11.0 RESPONSE PLANNING

11.1 Incident Response Plan

The Contractor's Environmental Operating Plan (EOP) will include an Incident Response Plan, which will detail the controls to be adopted to manage the risk of pollution incidents and procedures to be followed in the event of any pollution incidents.

11.2 The Incident Response Plan will include the following, as appropriate:

- Reference to the Method Statements and Management Plans for other 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;
- Details of spill clean-up companies appropriate to deal with pollution incidents associated with the materials being used or stored on site.

- Procedures to be followed and appropriate information to be provided in the event of any incident, such as a spillage or release of a potentially hazardous material;
- Procedures for notifying appropriate emergency services, authorities, the Employer's Representative and personnel on the construction site;
- Procedures for notifying relevant statutory bodies, environmental regulatory bodies, local authorities and local water and sewer providers of pollution incidents, where required;
- Maps showing the locations, together with address and contact details, of local emergency services facilities such as police stations, fire authorities, medical facilities and other relevant authorities; and,
- Contact details for the persons responsible on the construction site and within the Contractor's organisation for pollution incident response.

11.3 Monitoring

The Contractor will investigate and provide reports on any health and safety or pollution incidents to the Employer's Representative, including, as appropriate:

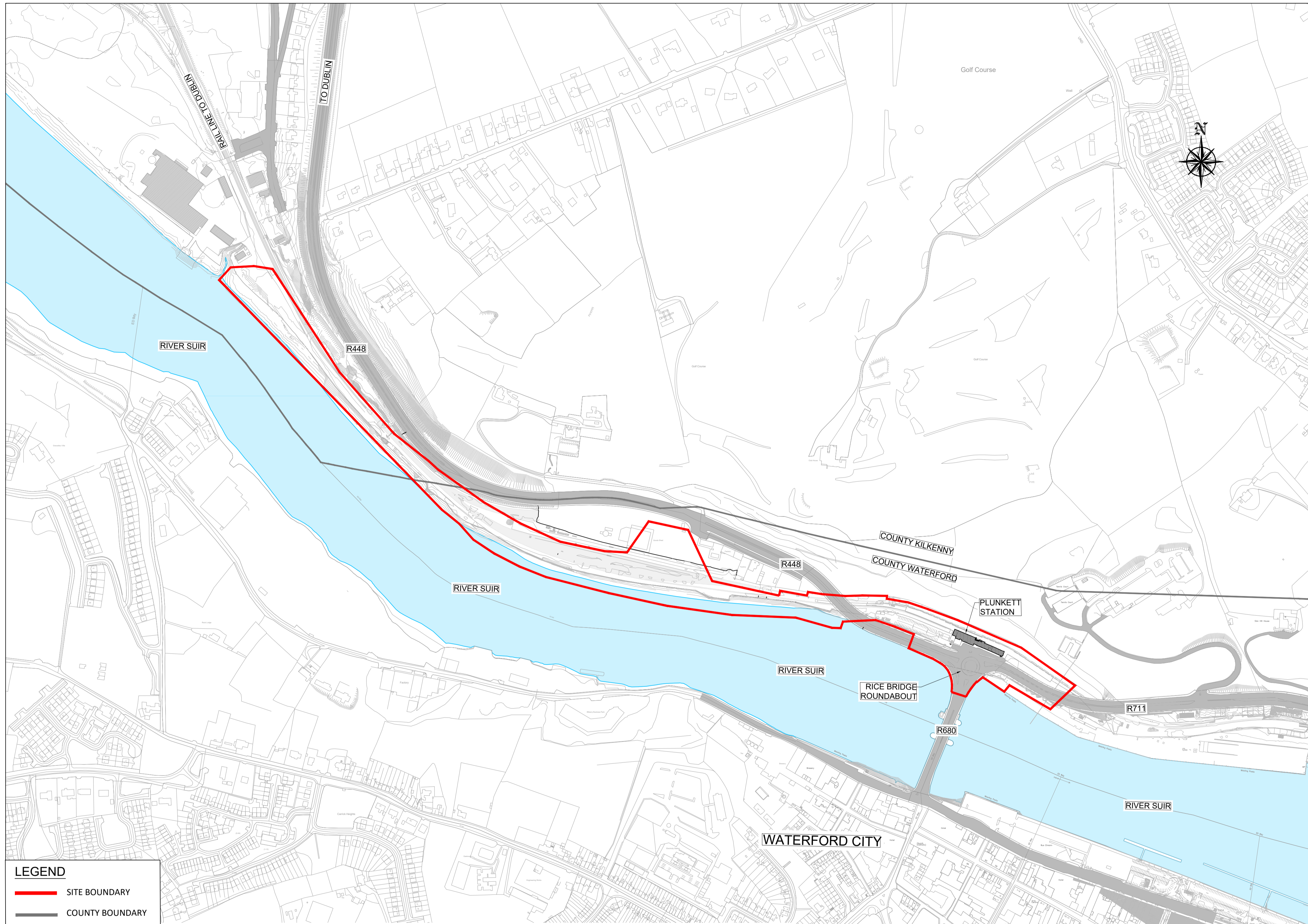
- A description of the incident;
- Contributory causes;
- Adverse effects;
- Measures implemented to mitigate adverse effects; and,
- Effectiveness of measures implemented to prevent pollution.

The Contractor will undertake appropriate monitoring of the procedures and measures set out in the management plans for construction activities required to prevent health and safety or pollution incidents to ensure they are being adequately implemented.

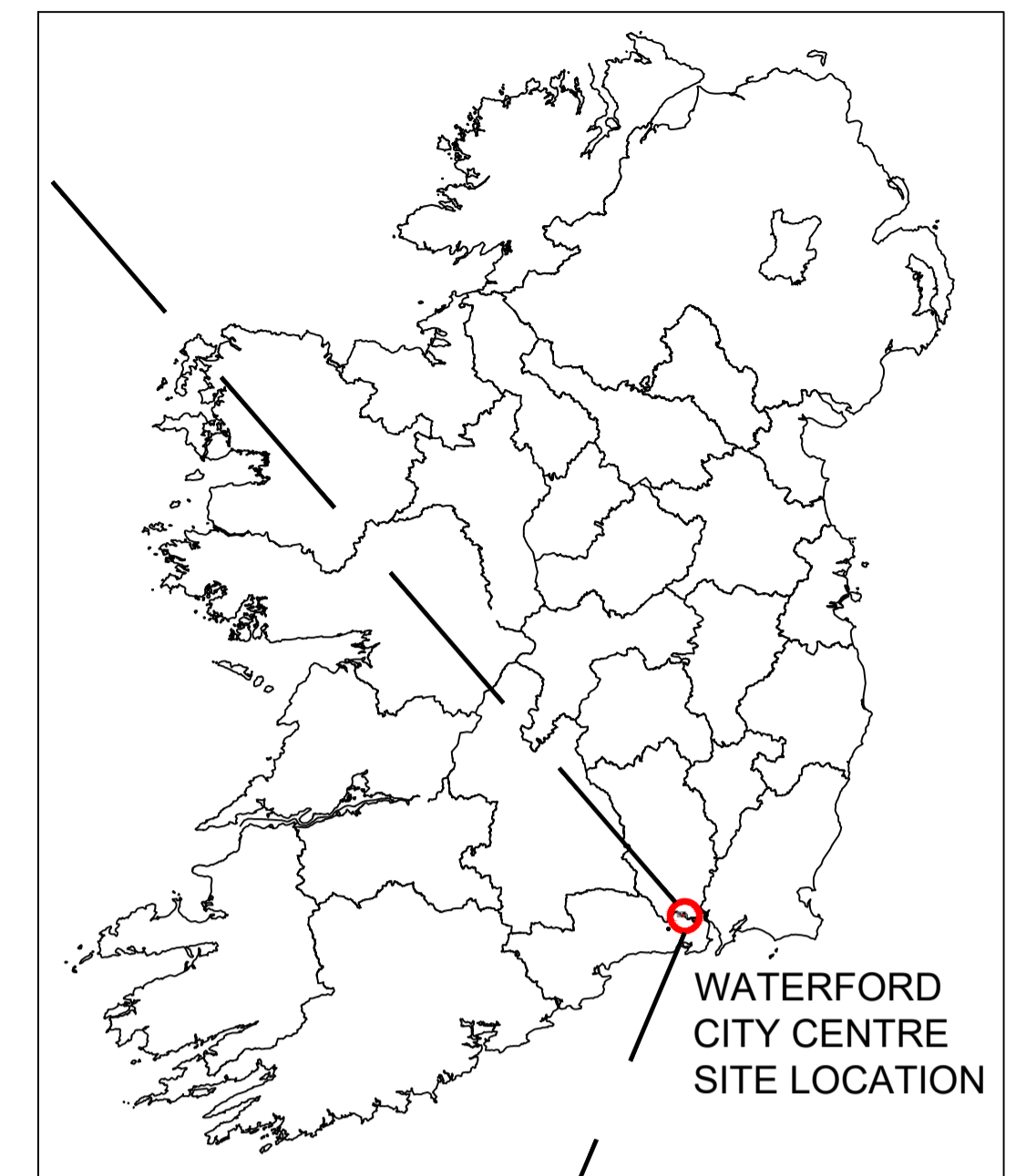
The Contractor will monitor the effectiveness of the procedures and measures implemented in the event of an incident and the effectiveness of the response procedures set out in the Incident Response Plan to identify any areas where improvement is required.

APPENDIX A

Figure 1



LEGEND
 — SITE BOUNDARY
 — COUNTY BOUNDARY



LOCATION MAP
N.T.S.

EIAR NOTE:
 The design has been developed to a stage to permit a fully informed Environmental Impact Assessment to be carried out on the proposed development. Modifications may be made to avail of opportunities to improve the design at the detailed design stage in light of experience on the ground or other innovations, provided this has no significant adverse environmental impacts over and above those considered in the current Environmental Impact Assessment.

LOCATION PLAN
 A1 SCALE 1:7000
 A3 SCALE 1:3500

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Project Title
WATERFORD CITY PUBLIC INFRASTRUCTURE PROJECT FLOOD DEFENCES WEST

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Drawing Title:
 Location Plan of Proposed Development

Designed: YB	File: 18_141	Status: E.I.A.R.
Drawn: IM	Job No: 18_141	
Checked: BC	Scale: AS SHOWN	Drawing No: FIG 1.1
Approved: TD	Date: OCTOBER 2021	Rev: -

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

