Chapter 4:
Description of the Proposed Development

ROUGHAN & O'DONOVAN

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4.1 Introduction

The proposed development will form a mixed-use development at the southern end of Wexford Quays on a brownfield site that has been vacant since 2001. The following sections will provide a detailed description of elements of the proposed development and the proposed construction process.

4.2 Location of Proposed Development

Trinity Wharf currently comprises a brownfield site, approximately 3.6 ha, located within the existing urban environment of Wexford town at the southern end of Wexford's quay-front. The site is currently accessed via a small side road from Trinity Street while the Dublin to Rosslare Railway line runs north south along the site's south-western boundary. Wexford Harbour adjoins the site on its north, east and southern boundaries.

The site consists of reclaimed land that extends into Wexford Harbour and was gradually reclaimed with the northern part reclaimed around 1832 initially as a dockyard area and then extended south-eastwards through the late 1800s and early 1900s. The northern part of the site changed from being a dockyard to a market and then a bacon processing plant (Clover Meats) which closed in the late 1980s leaving the site vacant. The southern part of the site developed as an ironworks which operated from 1911- 1964, following which it was used as a car assembly plant until the early 1980s, and then for manufacturing electronic components (Wexford Electronix) until 2001. The site is now disused and partly overgrown with most structures demolished, except for a masonry stone boundary. Plate 4.1 below shows the location of the existing Trinity Wharf site.

Plate 4.1 Location of the existing Trinity Wharf Site

4.3 Description of Proposed Development

The proposed development will provide a number of different land uses including; commercial leisure activities such as a hotel, marina, restaurants and bars, office space, residential housing and public realm including pedestrian & cycling facilities and a cultural centre.

4.3.1 Development Overview

The development comprises a mixed-use urban quarter redevelopment of a brownfield, derelict site, as well as development within the foreshore, including:

- A six-storey 120-bedroom hotel of c. 9,950 m2 gross floor area and height of c. 21.15m (Ground Floor to Roof Plant Level);
- A six-storey multi-storey car park of c.12,750 m2 gross floor area providing 462 car parking spaces (including 23 spaces designated for people with disabilities) with a height of c.18.15m (Ground Floor to Roof Plant Level). In addition, a further 47 parking spaces are provided at surface level around the site. In total, 509 parking spaces are provided;
- A five-storey residential building of c.6,820 m2 gross floor area providing 58 apartments (8 no. one bed, and 50 no. two bed) with a height of c.15m (Ground Floor to Roof Plant Level), and ancillary facilities (communal open space, bicycle and bin stores);
- Office Building A, five storey, c.5,450 m2 gross floor area, height of approx. 20.0m (Ground Floor to Roof Plant Level);
- Office Building B, five storey, c.6,105 m2 gross floor area, height of approx. 20.0m (Ground Floor to Roof Plant Level);
- Office Building C, five storey, c.4,990 m2 gross floor area, height of approx. 20.0 m (Ground Floor to Roof Plant Level);
- A two-storey cultural/performance centre of c.2,945 m2 gross floor area and height of c.10.0m (Ground Floor to Roof Plant Level) with event capacity for up to 400 people;
- A two-storey mixed-use restaurant/café/ specialist retail building of c.1,530 m2 gross floor area and height of c.8.0m (Ground Floor to Roof Plant Level);
- A single storey management building of c.57 m2 gross floor area with a height of c.3.2 m (Ground Floor to Roof Level) with associated landscaping works and retaining walls to the main vehicular entrance road;
- A new vehicular entrance road with a signalised junction on Trinity Street, widening of Trinity Street, a new railway level crossing and associated works;
- A new sheet-piled sea wall around the existing Trinity Wharf site (c.550m overall length) faced along the north-western section with precast concrete panels (c.81 m length) and rock armour (for c.62 m length) and along the south-eastern section with a rock armour revetment (c.187 m length) and exposed sheet-piled walling along the north-eastern side (c.220 m length) with ground level across the site raised to typically 3.5m OD Malin;
- Site infrastructure works including ground preparation works, installation of foul and surface water drainage, wastewater pumping station, services, internal roads, public realm and landscape including a public plaza with 1,000m2 open performance / events space. A total of 146 bicycle parking spaces throughout the development of which 90 spaces are dedicated to the residential development;

- A pedestrian/cycle boardwalk/bridge (c.187m long) connecting with Paul Quay, with gradual sloped access ramps (max. 1:20 gradient) of c.55m length on Paul Quay and c.24m at the Trinity Wharf development site;
- A 64 berth floating boom marina in Wexford Harbour; and
- All other ancillary works.

4.3.2 General Site Layout

The proposed development, centres around the existing reclaimed land of Trinity Wharf with the main element of the works being carried out on the brownfield site. All of the buildings are proposed to be constructed on this site as well as the public realm areas. A new sea wall will also be constructed around the coastal boundaries of the site through sheet piles and the placement of rock armour along sections of the northern and southern edges.

The footprint of the proposed development also requires the development of a section of vacant, brownfield site between Trinity Street and the Dublin to Rosslare Railway line which was also used for industry in the past and is currently owned by Wexford County Council. This area will form the new access point into the Trinity Wharf site directly from Trinity Street. There is currently no junction on Trinity Street to service the existing access to Trinity Wharf, therefore alterations to the existing road layout on Trinity Street will be required to accommodate a signalised junction into the Trinity Wharf site via a new access south of McMahons Hardware.

Paul Quay carpark is an existing carpark to the north of the site along the quay front which is also owned by Wexford County Council. Modifications will be required to this carpark also to accommodate the tie-in of a boardwalk proposed as part of the proposed development. This boardwalk will provide the main link between the town centre, the existing Wexford Harbour promenade and the pedestrian and cycleway facilities provided on the internal road network of Trinity Wharf.

A proposed 64 berth marina is to be located off the northern corner of the site and is to be connected to the northern corner of the development via a gangway. The marina will be sheltered by a floating breakwater on the seaward side, to the north of the Trinity Wharf site. Including the elements of the description as above, the total site area to be developed as part of the Trinity Wharf Development is in the region of 5.47 ha.

The internal road network of the development site, which is discussed in more detail in Section 4.3.6 of this EIAR, will be connected to Trinity Street via a new road to be constructed perpendicular to Trinity Street which will cross the railway line by means of a level crossing. This will be the main vehicular access to the site.

Plate 4.2 below and Figure 4.4 in Volume 3 illustrate the general layout of the site.

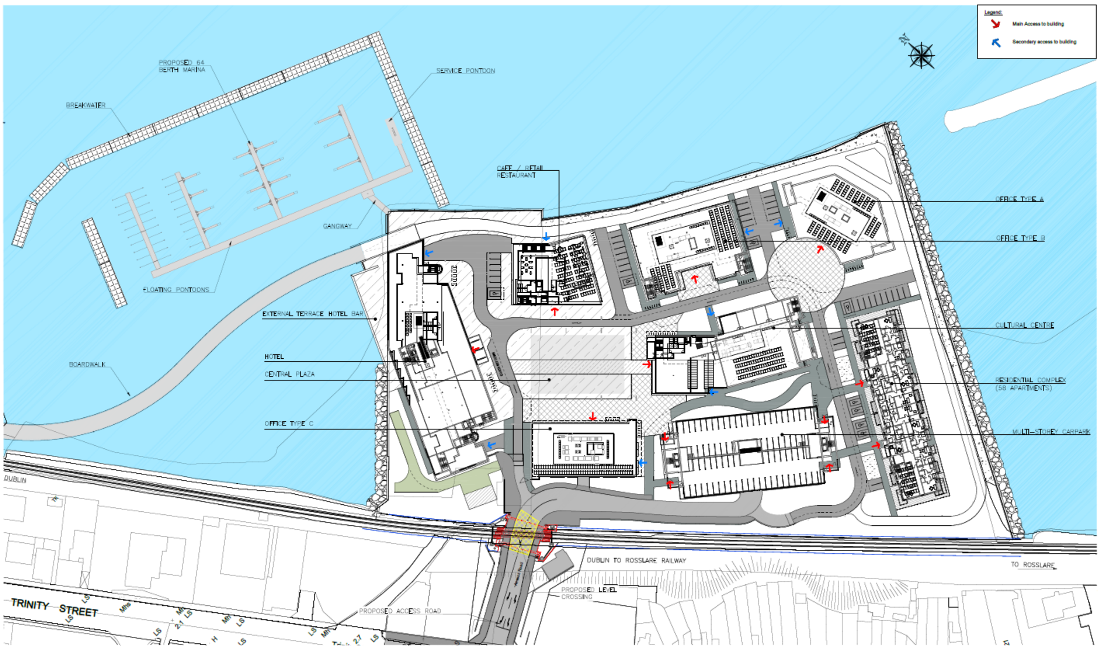


Plate 4.2 Site Layout (Refer to Volume 3 of this EIAR for A3 Figures)

4.3.3 Proposed Phasing of Development

The development is proposed to be carried out in several phases with the first phase of the works being procured and carried out by Wexford County Council and the following phases being privately developed. The following is the outline of the proposed phasing:

Phase 1 - Enabling Works

- Construct access road from Trinity Street to the Dublin Rosslare railway line;
- Construction of new CCTV level crossing (By Irish Rail);
- Bring site to formation level;
- Sea Wall;
- Construct services throughout the public realm areas of the site;
- Construct access roads, footpaths, public spaces and landscaping to Phase 1 areas and temporary car parking;
- Temporary car parking and temporary grassing of Phase 2 sites; and
- Boardwalk from Paul Quay to Trinity Wharf site.

Phase 2- Buildings & Marina

- Hotel;
- Office type B (on waterfront);
- Cultural & performance building;
- Marina;

Phase 3 – Buildings

- Roads, footpaths and public spaces and landscaping to remaining buildings;
- Remaining buildings.

The above proposed phasing is how the site is envisaged to be developed. The order of which may however be subject to change as development commences on site.

4.3.4 Services Development

4.3.4.1 Site Levels and Earthworks

A review of the previous flood risk assessments and the study carried out for this project has determined that a minimum ground floor level of 2.64mOD should be adopted for all buildings within the development. The local roads within the site should have a minimum level of 2.34mOD. These satisfy the requirements of the OPW's Flood Risk Management Guidelines for Local Authorities and the Wexford Town and Environs Development Plan. The review suggested that a 2.4m OD revetment/sea wall with a 1m parapet wall along the sea adjacent perimeter of the site is suitable to protect the development against storm surge and wave action. Therefore, the internal site levels have been set above the minimum level required and the perimeter level of the site has been set at 3.5mOD.

The existing levels across the site vary, however, are on average around 2.0mOD. The general finish level of the proposed development site will be raised over the existing by approximately 1.5m. The lowest proposed finished floor level for the development is 3.00mOD, while the lowest road level will be at 2.80mOD.

4.3.4.2 Parking Provision

The proposed development includes a multi-storey carpark with 462 spaces, including 23 accessible spaces. There will be 47 surface car parking spaces throughout the site which will include 8 accessibility spaces. This give a total onsite parking provision of 509 spaces, of which 31 spaces or 6% will be designated for people with disabilities.

A Car Park Management plan will be prepared to maximise the potential of dual use parking and this will include the use of parking permits and pay parking.

The construction of the new boardwalk will impact on approximately 21 no. parking spaces at the southern end of Paul Quay. The loss of these spaces is not considered critical as the nearby Sinnott Place multi-storey long-term car park currently has adequate capacity to facilitate the transfer of vehicles.

4.3.4.3 Cycle Parking Provisions

The provision for cycle parking in keeping with the policy statement in the Wexford Town and Environs Development Plan 2009-2015;

- CW5 to encourage the provision of secure bicycle parking in the Town Centre, at public facilities such as Schools, Libraries, the Train Station and in all new developments in accordance with standards set out in development management standards.

The Wexford Town and Environs Development Plan states that the National Manual for the Design of Cycle Facilities in Urban Areas will be the basis for informing the design of cycle facilities. The Wexford County Development Plan (*18.29.5 Cycling*) outlines that the council will have regard to the National Cycling Manual (NCM) in its assessment of the required cycle facilities.

The bicycle parking will consist of Sheffield stands and shelters in a convenient location close to the entrances of the various buildings. Each cycle stand will cater for two bicycles.

The proposed provisions are outlined in the table below.

Table 4.1 Cycle Parking Provisions

Building	Cycle Stands	No. of Spaces
Hotel	16	32
Office Building A	12	24
Office Building B	14	28
Office Building C	12	24
Cultural Quarter	12	24
Café / Retail/ Restaurant	7	14
Total General Public Use	73	146
Residential Complex		
Residents External Bicycle Stores	20	40
Resident Internal Bicycle Stores	10	20
Visitor	15	30
Total Residential Complex Bicycle Parking	45	90

The primary components of the mixed-use development requiring provisions for bicycle parking are the offices and the hotel, while the residential complex should have cycle parking set aside for residents use only. The café/ retail/ restaurant building is an ancillary component while the cultural/ performance centre can share the office parking in a dual use capacity during the evenings and at the weekends.

The NCM outlines that bicycle parking should be provided for 10% of employees in the offices. The hotel will be allocated with a small provision for staff. Hotel guests are unlikely to generate a large demand for bicycle parking because of the nature of the business. This equates to 76 spaces in accordance with the NCM plus an additional 10 spaces allocated for the hotel staff giving a total of 86.

The proposed provision allocated for general public use on the site is 146, which is 60 spaces more than recommended in the NCM. These spaces are provided in secure and shelter bicycle parking areas conveniently located near the main entrances to the buildings. Each of these buildings will provide end-of-trip bicycle facilities such as showers and locked storage facilities.

The NCM for a housing development is 2 private secure bicycle spaces per 100sq.m (net) plus 1 visitor space/ two housing units giving a total provision of 152 space. This allocation of cycle parking is high (roughly 2.6 spaces/ dwell) given that the CSO data indicates that only 2% of people in Wexford cycle to work. A rate of 1.5 spaces per dwell adopted in development plans in similar towns such as Wicklow and Dundalk give a more realistic and practical total of 87 spaces.

The development proposes to provide 90 bicycle parking spaces provided in secure and sheltered bicycle parking areas conveniently located internally and to the front of the building near the main entrances.

4.3.4.4 Surface Water Drainage

The surface water drainage for the development site comprises a Sustainable Drainage System (SuDS) based approach. This will consist of; blue/green roofs for all buildings, raingardens at the perimeter of buildings, swales/basins in soft landscaped areas and permeable paving. In areas of hardstanding where permeable paving is not proposed, such as the internal access road, runoff will drain by gravity to adjacent swales or permeable paving. This permeable paving will require regular maintenance as described in section 4.3.13. The provision of permeable paving within the development will negate the need to provide multiple petrol interceptors throughout the development. Treatment to runoff generated will be provided within the pavement layers through the processes of filtration, biodegradation, adsorption of pollutants and the settlement and retention of solids within the pavement layers.

The SuDS approach offers greater flexibility for the scheme and minimises the need for costly remediation, Plates 4.3 to 4.6 show typical details to the SuDS approach. The drainage network will attenuate and cleanse the surface water runoff from the site prior to discharge to the sea through a multiple of discharge locations.

The surface water drainage network will drain by gravity to outfall locations and will be designed to store the 1 in 100-year 6-hour rainfall event plus climate change (between tidal cycles). It is proposed that the uppermost 250mm of the general infill material (directly beneath the permeable paving, swales and the growing media required for landscaped areas) on the site will be comprised of compacted clay. This clay layer will prevent the infiltration of rainwater to underlying subsoil. Some limited infiltration will ultimately still occur, but this will represent a small fraction of total effective rainfall. Details of this design are shown in Figure 4.2 in Volume 3.

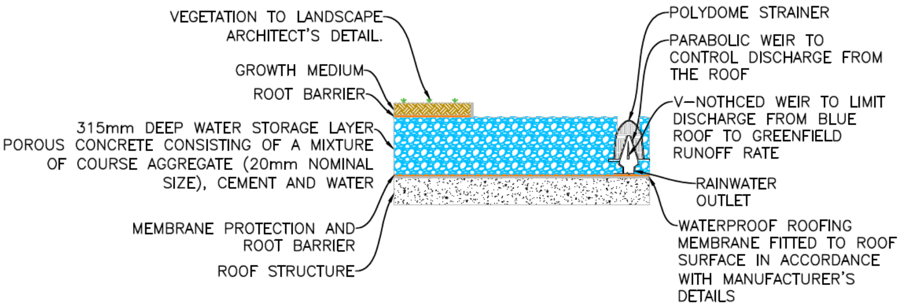


Plate 4.3 Green and Blue Roof build up for car parks

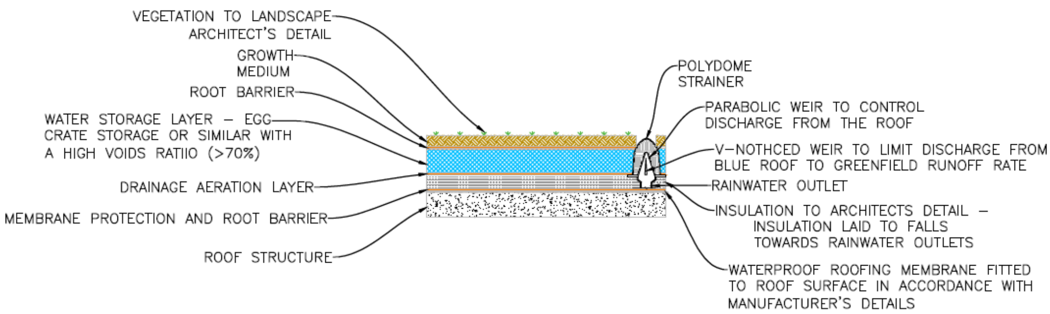


Plate 4.4 Green and Blue Roof build up for buildings

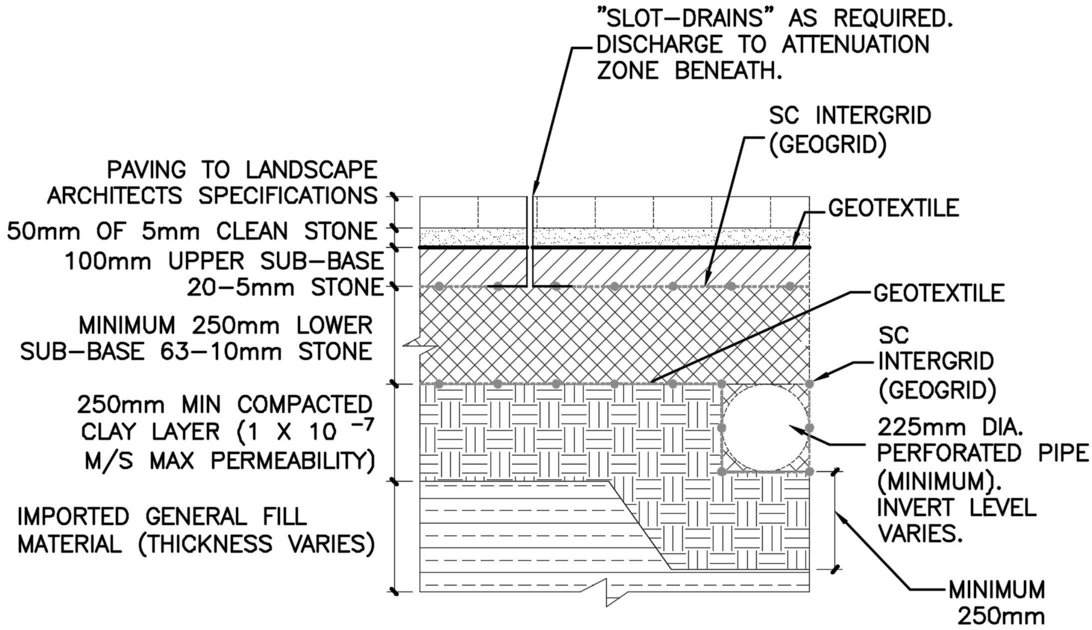


Plate 4.5 Typical Section Through Permeable Paving

The proposed drainage for the development has been strategically designed to incorporate multiple outfall locations around the perimeter of the site. Where temporary carparks are proposed throughout Phase 1, they will be constructed so that runoff will be temporarily drained to the nearest convenient swale or permeable paving area. Alternatively, temporary Class 1 full retention petrol interceptors can be provided to provide treatment to runoff from the temporary car parks prior to discharging to the estuary.

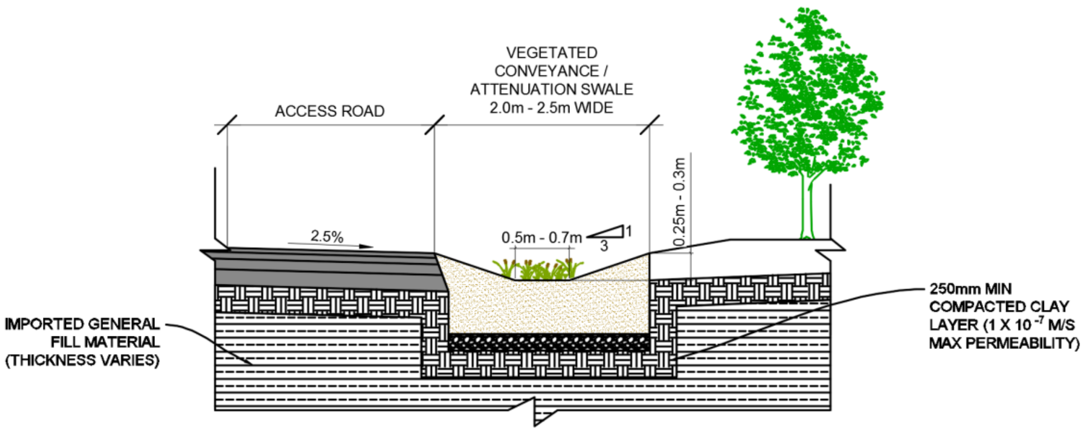


Plate 4.6 Typical Surface Water Conveyance Swale

4.3.4.5 *Wastewater*

A preliminary investigation of site constraints indicates that the foul waste from the site will be required to be pumped to the public wastewater infrastructure. Foul effluent will discharge from the proposed buildings by gravity to a large-scale public underground pumping station located at the north-west corner of the development site adjacent to the access road. Here, wastewater will ultimately be pumped to the existing public combined sewer network. The pumping station has been designed to provide 24-hour effluent storage in case of failure. Standby pumps will also be provided.

In addition, a class II petrol interceptor will be located beneath the multi-storey carpark ground floor slab together with a pumped manhole in order to convey detergent runoff from the carpark cleaning operations to the foul drainage network. Details of the foul water drainage network are shown in Figure 4.3 of Volume 3.

4.3.4.6 Water Supply

Water supply to buildings will be via a 150mm diameter watermain located adjacent to the main internal road of the site. The watermain will be connected to the main public network at Trinity Street via the main access road to the site. The exact details of the connection and extent of the potential upgrade works to the existing 100mm public main on Trinity Street are to be finalised by Irish Water.

The preliminary water supply design is shown in Figure 4.19 located in Volume 3.

4.3.4.7 Strategy to Link to Town Centre & Connected Development

A primary vehicular access to the site will be provided via Trinity Street and will cross the Dublin to Rosslare Railway line. In addition, a boardwalk, described in detail in Section 4.3.9, will connect the northern corner of the development site with Paul Quay, thereby establishing a pedestrian link between the Town Centre harbour front promenade and Trinity Wharf.

4.3.5 Buildings Design

4.3.5.1 General

One of the principal objectives of the Trinity Wharf Development is the construction of buildings for commercial investment. The following section describes the buildings and their purpose as part of the development.

The structural design of the buildings will typically comprise a reinforced concrete superstructure. The foundation design is proposed to consist of driven steel or concrete piles.

Section 4.3.1 above details the proposed building development and Figures 4.4, 4.5 and 4.6 in Volume 3 show the design layout of the buildings.

4.3.5.2 Cultural/Performance Centre

It is proposed that the central feature building on the site be the two-storey cultural/performance centre. The accommodation includes a small café, management, exhibition space and double height multi-purpose space with capacity for 400 people around tables, a raised stage area, and associated stores and service areas. The main entrance foyer and café open onto the southern side of the event space. The building is approached across the public space with the front elevation and scale of the building designed as a centrepiece of this space. The location provides flexibility for cultural/performance activities and events to use both indoor and outdoor spaces.

4.3.5.3 Hotel and Multi-purpose Public Space

The main public space is located at the centre of the site close to points of arrival, with access from Trinity Street across the railway line, and from the connection with Paul Quay.

The main public activities including the hotel, restaurant/cafe and cultural/performance uses are grouped around this space to provide activity throughout the day. The size and scale of the space is sized to accommodate potential out-door events and temporary structures while providing circulation around. The space is designed also as an attractive place for people to sit out with sunlight, planting and other features.

See Plate 4.7 below. The size and scale of the buildings around the space provide a sense of enclosure and protection from prevailing winds.

Plate 4.7 View of the Main Square with Proposed Hotel on right

The location and orientation of the hotel was carefully considered. It was initially proposed to orientate the hotel along the north-eastern sea wall. However, it was identified that this would limit connectivity and views of Wexford harbour from the central space. In addition, access to the proposed marina at the northern corner of the site would be restricted and there would be frequent service deliveries to the hotel across the public space.

Therefore, the hotel is located along the north-western edge of the site to face towards Paul Quay and the town centre. This provides active frontage (dining, bars, etc) along the waters-edge looking across the 'pool' towards Paul Quay and the town. The hotel service area is located close to the railway crossing which considerably reduces service vehicle movement around the central space.

4.3.5.4 Office Buildings

Three office buildings are proposed as part of the Trinity Wharf development. A five-storey office building is proposed to complete the south-western side of the main public space (Office Building C), while two further five-storey office buildings are proposed along the Wexford Harbour waterfront (Office Buildings A and B).

4.3.5.5 Residential Apartments

These buildings are all designed to provide highly efficient yet flexible modern accommodation that meets the requirements sought by innovative knowledge-based sectors and creative services (including financial-technology, software and systems development, etc.). Each office building is designed for maximum flexibility in terms of sub-division with central lift, stair and service core. This allows sub-letting of different floors, with areas suitable for innovation, start-up and training companies, as well as for established businesses. Office building A located at the eastern corner of the development site is designed with a curved frontage as a potential corporate HQ building. The curved frontage creates a defined circular public space with central entrance on axis with the corner of the cultural/performance building and the eastern corner of the site with views across Wexford harbour towards the Irish Sea.

A five-storey residential apartment building is proposed along the south-eastern side of the site with views across Good Tide Harbour. As stated above, this location was chosen because of its quieter location to provide a high quality environment for residents 58 apartments are proposed consisting of 8 no. one bed apartments and 50 no. two bed apartments. The apartments benefit from the public realm of the overall development, dedicated communal open space on their southerly side as well as private balconies and terraces. Secure covered bicycle parking and bin stores are located close to building entrances along with visitor parking. Further storage, meters and comms rooms are provided in the internal communal ground floor areas.

The apartments are designed in accordance with the following Government Policy Guidelines:

- Quality Housing for Sustainable Communities (DEHLG 2007)
- Sustainable Residential Development in Urban Areas - Guidelines for Planning Authorities (DEHLG 2009)
- Urban Design Manual - A Best Practice Guide (DEHLG 2009)
- Sustainable Urban Housing: Design Standards for New Apartments - Guidelines for Planning Authorities (DHPLG 2018)
- Design Manual for Urban Roads and Streets (DECLG/DTTS 2013)
- Building Regulations Technical Guidance Document L - Energy (2018)
- Building Regulations Technical Guidance Document M - Access and Use (2010)
- BS8300:2018 - Design of an Accessible and Inclusive Built Environment Part 1
- Site Layout Planning for Daylight and Sunlight: A Guide to Best Practice (BRE 1991)

Apartment room widths and areas are provided showing compliance with minimum standards. There is also flexibility in size and area for Apartment Type C to be re-planned as a three bedroom unit. As such the apartments are in accordance with the development standards set out the Wexford County Development Plan 2013-2019 and Wexford Town and Environs Development Plan 2009-2015 (as extended).

4.3.5.6 Car Parking

This building is ideally located towards the railway line, within close walking distance of all buildings and with direct vehicle access and egress from Trinity Street so that vehicular traffic within the development is minimised. The design of the building entails a rippled bronze-coloured, high-quality light-weight screen cladding system, designed to provide a sculpted elevational treatment during the day and to diffuse and soften internal lighting in the darker evenings and at night.

A total of 462 parking spaces are provided in the building including 23 spaces designated for people with disabilities, in compliance with the Building Regulations TGD Part M. This includes a potential 40 spaces in a designated area accessible by residents only with a further 10 spaces designated in a shared area. A further 9 residents parking spaces are provided in front of the apartments of which 4 are designated spaces for people with disabilities.

There are also several car parking clusters around the site for short-term use. There are 11 spaces between Office Building A and the apartment building, 11 spaces between Office Buildings A and B, 9 spaces between Office Building B and the restaurant/café building, and 7 spaces next to the retail unit/marina. Each of these clusters includes one space designated for people with disabilities. The total parking provision on site is 509 spaces, of which 31 spaces are designated for people with disabilities.

4.3.5.7 Building Materials and Finishes

An overall palette of materials and finishes is proposed for Trinity Wharf that responds and reflects to its waterfront location, including those for the boardwalk, sea wall and water's edge that relate to and enhance the context and setting of the development.

For buildings this generally consists of:

- Pale white polished reconstituted stone panelling system;
- Glazing System with PPC Aluminium Framing, Ventilation Louvres and Brise Soleil (Colour RAL 7006: Beige-Grey);
- Louvres and Rood Plant Enclosures- PPC Aluminium (Colour RAL 7006: Beige-Grey); and
- Glazed Balconies to Apartments.

As stated above, a rippled bronze-coloured, high-quality light-weight screen cladding system is proposed for the car park building. Full size mock-up samples of proposed materials and finishes are to be erected on site to assess suitability and weathering properties as part of design development.

Hard landscape materials and finishes are designed to assist people in wayfinding, with a variety of materials depending on the type of user. A soft landscaping strategy has also been designed and is set out in the Landscape Design Statement (Appendix 4.6). This also includes the boundary fencing and planting treatment alongside the railway designed to meet Irish Rail requirements.

Sea walls are generally sheet-piled clad with precast concrete panels around the base of the boardwalk landing points to Trinity Wharf and Paul Quay and around the hotel terrace. The sheet-piling is to be screened by rock armour in highly visible areas facing towards the Good Tide Harbour and between the railway embankment and hotel terrace. Where exposed, the sheet-piling is to have a durable paint finish (Colour RAL 7031: Blue-Grey).

The outer face of boardwalk is to be clad with a white aluminium panel system (RAL9006: White aluminium). The inner surfaces are to be lined and decked with either a timber finish or a poured resin surface (RAL Colour: 8004: Copper brown).

4.3.6 Buildings Services

The following describes the proposed servicing strategy for each of the buildings which has been designed in compliance with the incoming Near-Zero Energy Building (NZEB) standard which requires a reduction of at least 60% below the Part L 2008 benchmark with 20% of energy being derived from renewable sources.

Hotel

The proposed servicing strategy for the Hotel buildings comprises of the following systems:

- Heating is proposed to public areas and bedrooms using Variable Refrigerant Flow (VRF) air source heat pumps;
- Heating will be provided to other areas with condensing natural gas boiler and radiator system;

- Hot water is proposed to be heated by a highly efficient natural gas 100 kWe (with heat to power ratio of 1.3) Combined Heat and Power Plant (CHP) with insulated storage tanks incorporated in the system;
- Cooling will be provided by air source heat pumps and chillers for ventilation cooling/dehumidification;
- Ventilation will be provided by mechanical ventilation with heat recovery to all public and back of house areas;
- Constant air volume mechanical ventilation is proposed for kitchen areas with dedicated exhaust;
- Centralised extract ventilation will be provided to ensuite bathrooms;
- Natural ventilation will be used to ventilate bedrooms and circulation areas;
- Lighting will be provided by highly efficient LED luminaries in conjunction with occupancy control and photocell dimming controls; and
- Renewable energy contribution will be provided through the use of Combined Heat and Power plant (CHP) for hot water consumption.

It is anticipated that plant will be provided at both ground floor and at roof level as indicated in Plates 4.8 and 4.9.

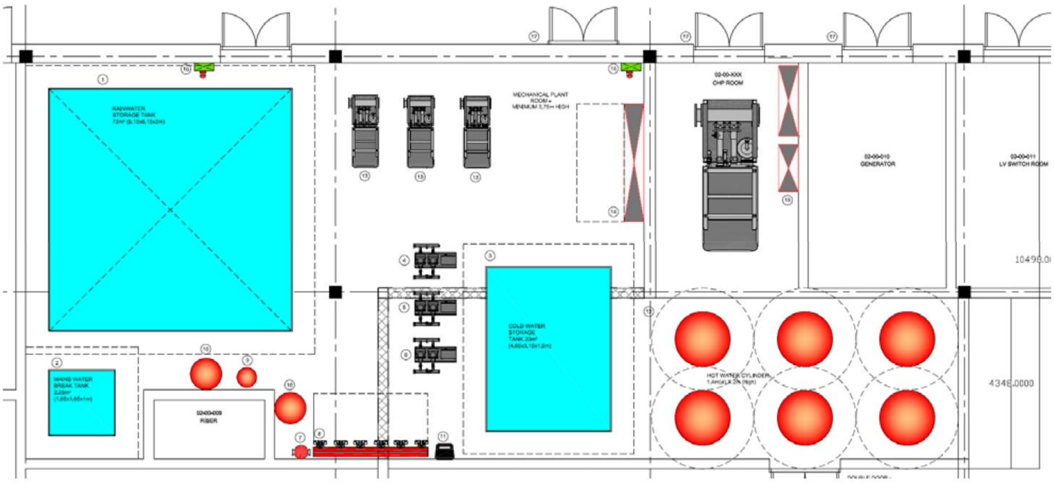


Plate 4.8 Proposed Hotel Ground Floor Plant Area

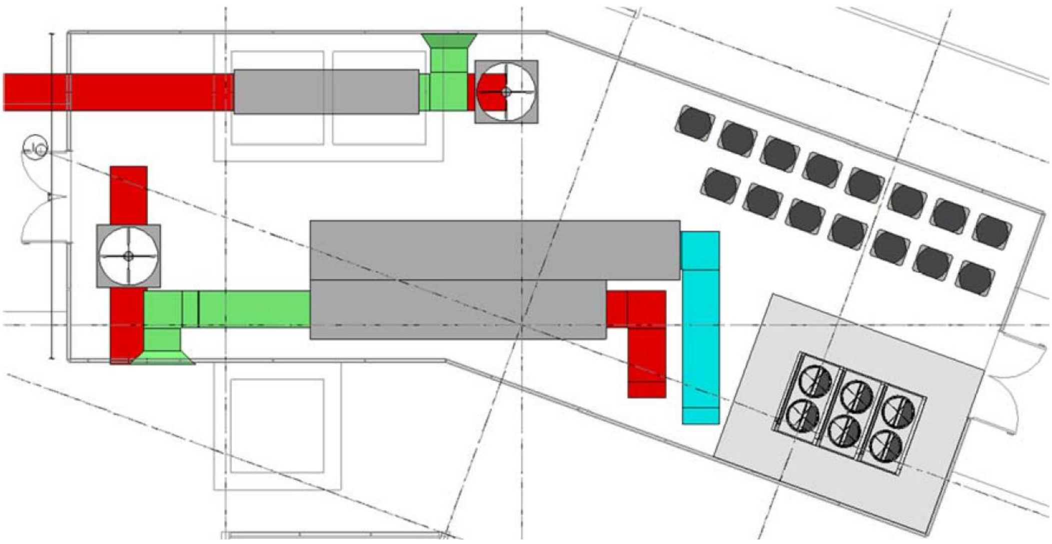


Plate 4.9 Proposed Hotel Roof Level Plant Area

Cultural Centre

The proposed servicing strategy for the Cultural Centre comprises of the following systems:

- Heating and hot water will be provided to all areas with condensing natural gas boilers with ventilation systems to conference room and a radiator system to other areas;
- Cooling will be provided by cooled chiller;
- Mechanical Ventilation with cooling and plate heat exchanger for recovery will be provided to the conference room, stage area and exhibition spaces;
- Mechanical Ventilation with heat recovery will be provided to changing rooms and staff areas.
- Constant air volume mechanical ventilation is proposed for kitchen areas with dedicated exhaust;
- Localised individual extract will be provided to small toilets;
- Natural ventilation will be used to ventilate studios, exhibition space. Office and back of house areas;
- Lighting will be provided by highly efficient LED luminaires with occupancy control and photosensitive diming controls;
- Renewable energy contribution will be provided by photovoltaic (PV) solar panels.

It is anticipated that plant will be provided at roof level as indicated in Plate 4.10.

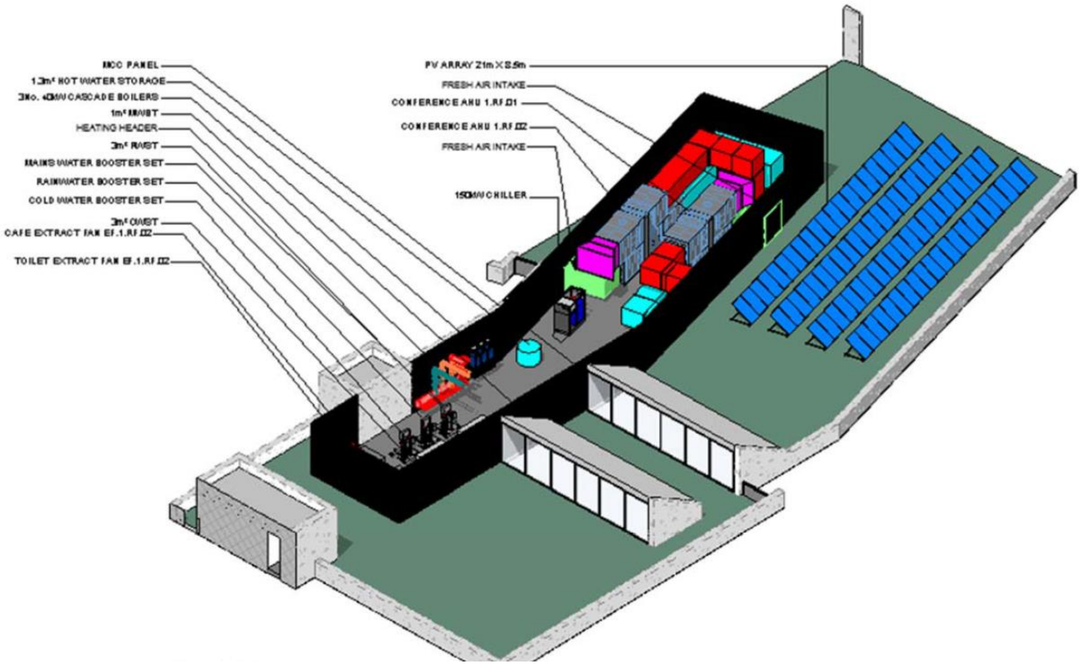


Plate 4.10 Proposed Cultural Centre Roof Level Plant Compound

Café, Retail and Restaurant

The proposed servicing strategy for the Café, Retail and Restaurant buildings comprise of the following systems:

- Heating will be provided to all areas with a highly efficient natural gas boiler and radiator system;

- Hot water is proposed to be heated by a highly efficient natural gas boiler and insulated storage calorifiers;
- It is envisaged that cooling will not be provided to the restaurant or café.
- A natural ventilation strategy is proposed for ventilation of Café and restaurant areas;
- Constant air volume mechanical ventilation is proposed for kitchen and servery areas with dedicated exhaust fans;
- Localised individual extract is proposed for toilets;
- Lighting will be provided by highly efficient LED luminaires with occupancy control and photocell diming controls;
- Renewable energy contribution will be provided by 150m2 photovoltaic (PV) solar panels; and
- Retail Space to be provided as shell and core, with 15m2 photovoltaic array to meet envisaged NZEB requirement in accordance with guidance within Part L 2017.

It is anticipated that plant will be provided at roof level as indicated in Plate 4.11.

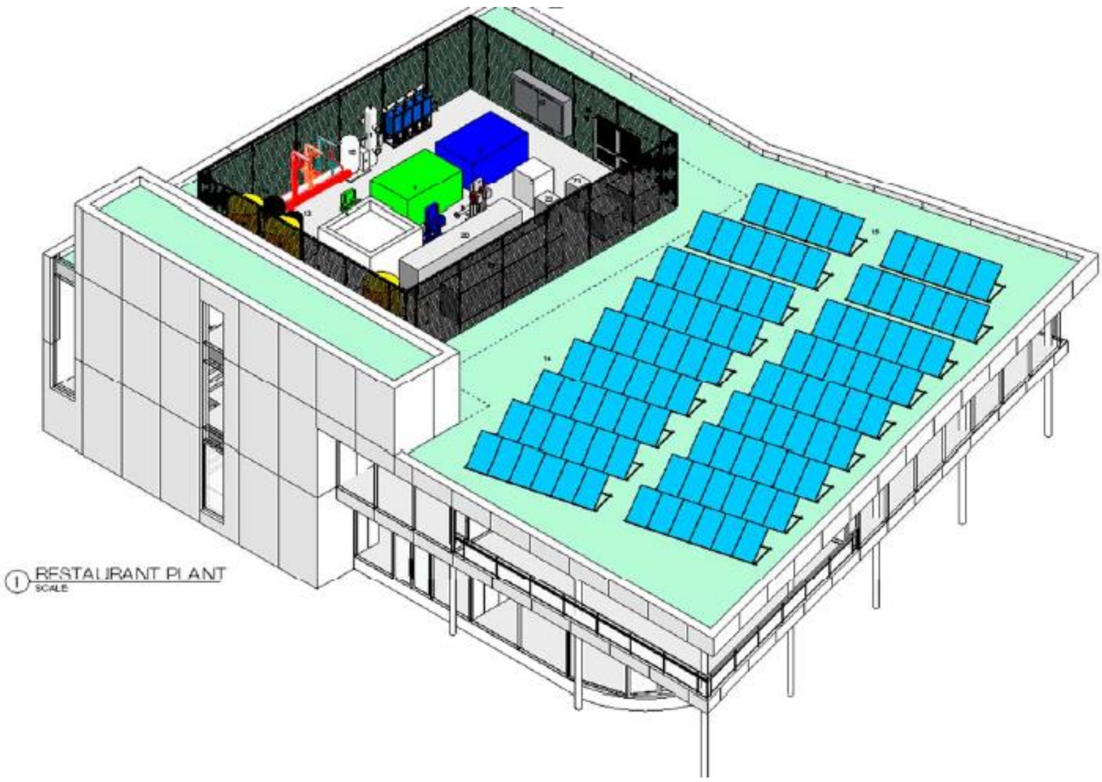


Plate 4.11 Proposed Café, Retail and Restaurant Roof Level Plant Area

Office Types A, B and C

The proposed servicing strategy for the Office buildings comprise of the following systems:

- Heating will be provided to office areas with 4-pipe fan coil units with a condensing natural gas boiler and radiator system to ancillary areas;
- Hot water is proposed to be heated by a highly efficient natural gas boiler and insulated storage system;

- Cooling will be provided by air cooled chillers;
- Ventilation will be provided to all office areas by mechanical ventilation with heat recovery using fan coil units for temperature control;
- Constant air volume mechanical ventilation is proposed for toilets;
- Localised individual extract will be provided to small individual toilets and storage areas;
- Natural ventilation will be used to ventilate core areas;
- Lighting will be provided by highly efficient LED luminaires with occupancy control and photosensitive diming controls; and
- Renewable energy contribution will be provided by Photovoltaic (PV) solar panels ranging between 100 – 120m2 for each of the three office blocks.

It is anticipated that plant will be provided at both ground floor and at roof level as indicated in Plates 4.12 to 4.15.

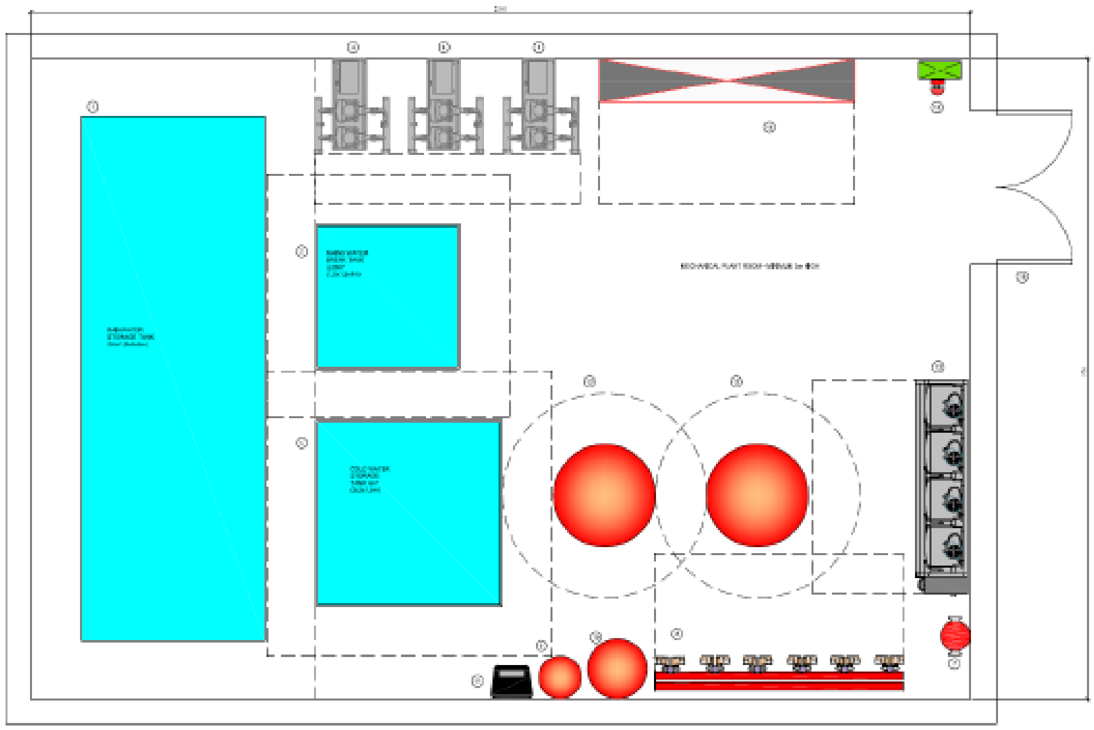


Plate 4.12 Typical Office Building Ground Floor Plant Area

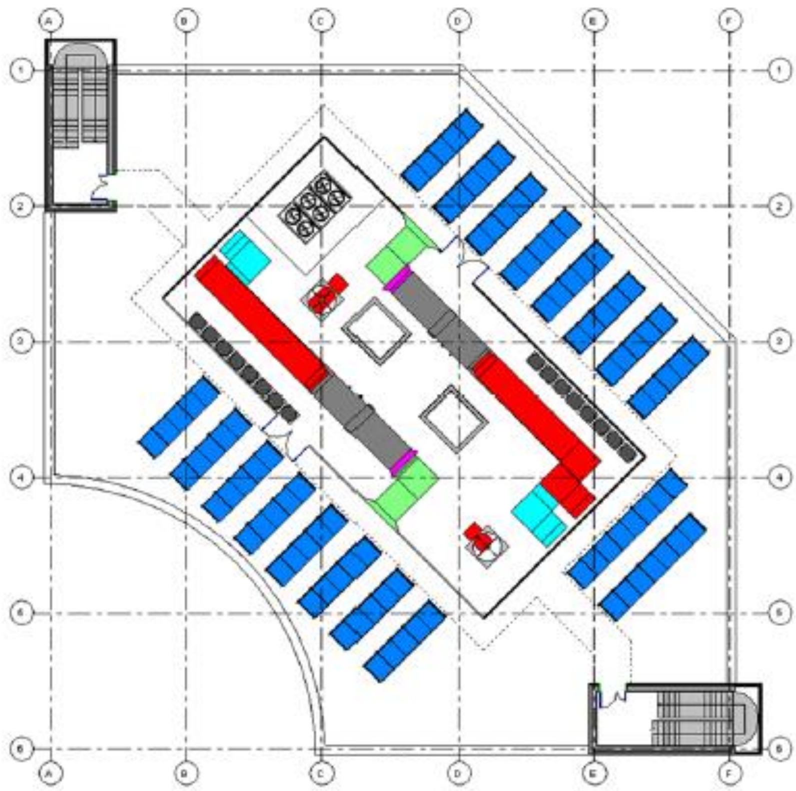


Plate 4.13 Office Building A Roof Level Plant Compound

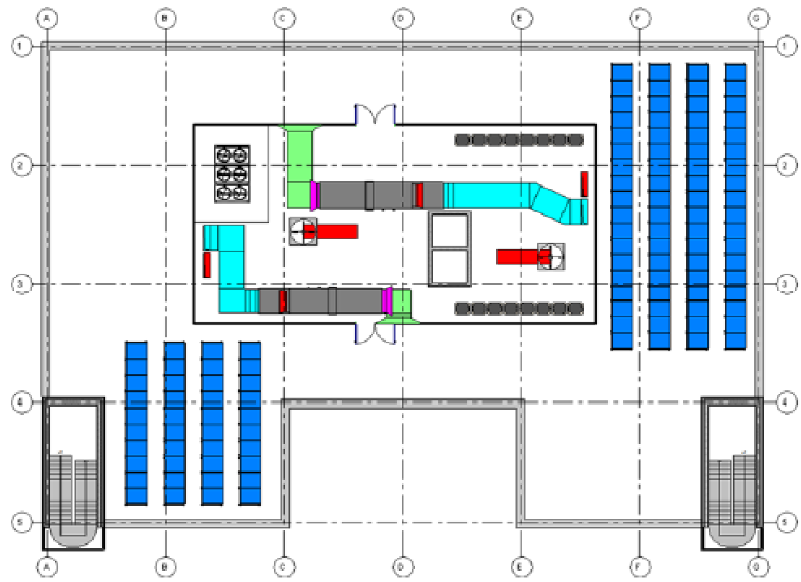


Plate 4.14 Office Building B Roof Level Plant Compound

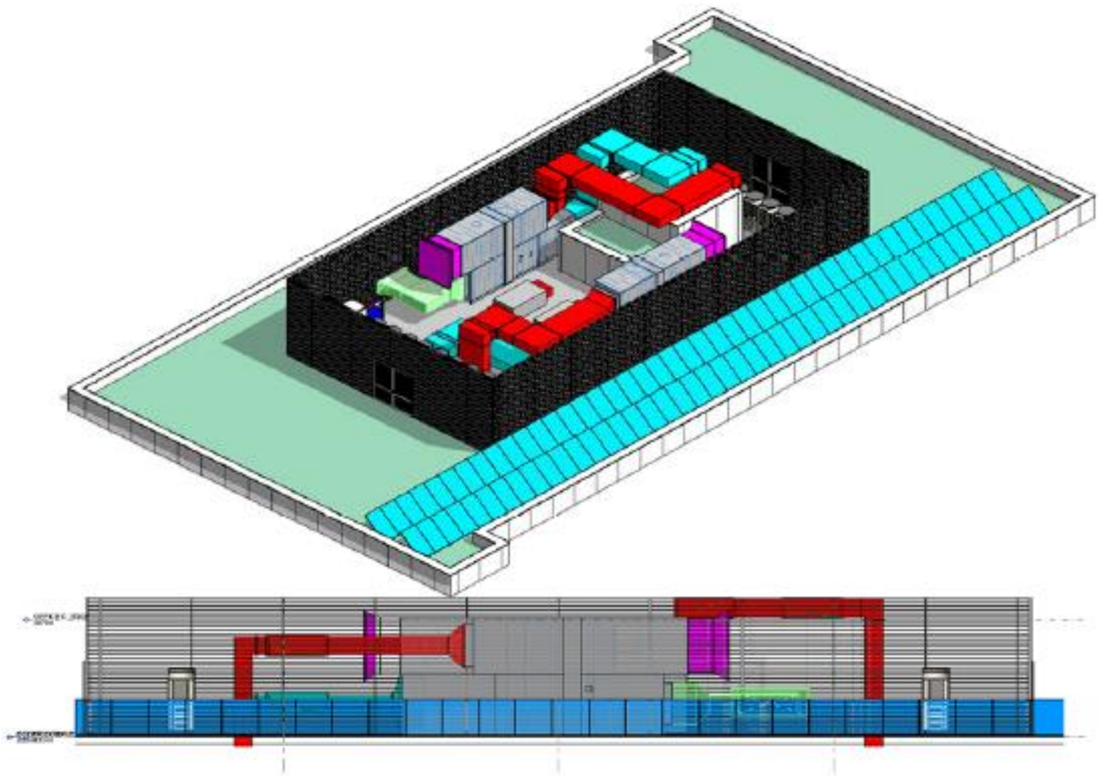


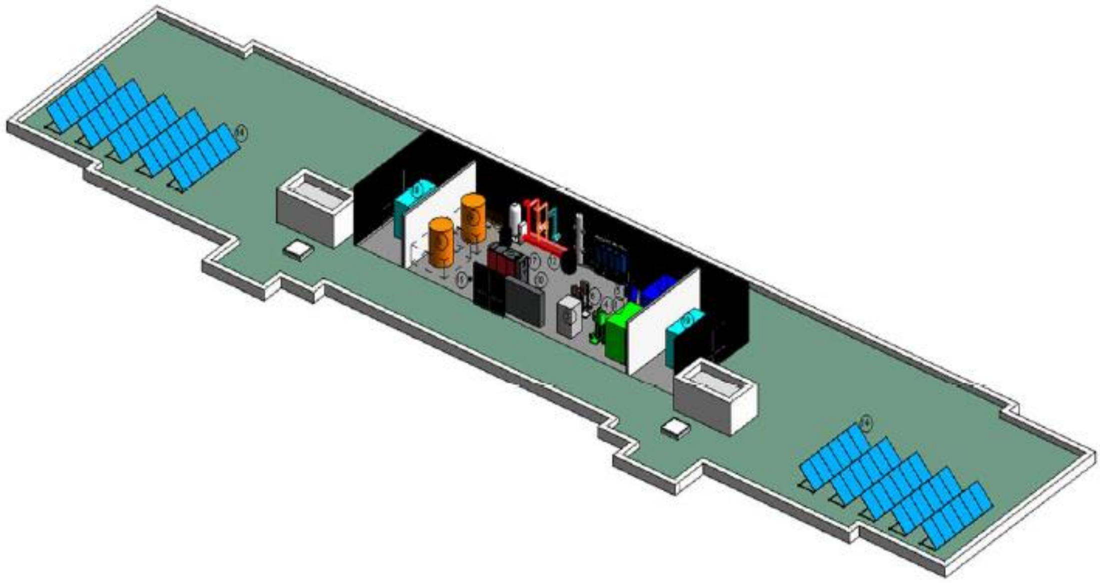
Plate 4.15 Office Building C Roof Level Plant Compound

Residential Apartment Building

The proposed low energy and servicing strategy for the Apartment building comprise of the following systems:

- Improved Building Fabric and glazing Thermal Transmittance (U-Value) performance;
- Reduced Air permeability;
- Thermal Bridging to Accredited Construction Details (ACD);
- Heat Recovery Ventilation (HRV) to each apartment (individual system);
- Natural Ventilation to Landlord areas;
- Centralised heating and hot water provided by Air Source Heat Pumps (ASHP) with back-up natural gas fired boilers, via heat interface units HIU's);
- Air Source heat pumps predicted to provide 55% of annual heating and hot water demand;
- 100% Low Energy Lighting; and
- Renewable technologies – Air Source Heat Pumps for heating and hot water supplemented with landlord photovoltaic (PV) Array instillation, with 1 No. PV panel per apartment (60 No. Total / 100m² approx.)

It is anticipated that plant will be provided at roof level as indicated in Plate 4.16.



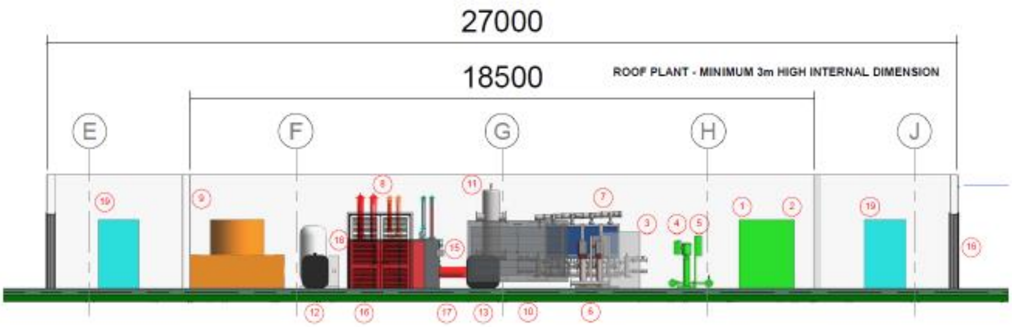


Plate 4.16 Apartment Building Roof Level Plant Compound

4.3.7 Public Realm and Landscaping

A wild and emergent landscape character is proposed to complement and celebrate the locations natural assets. This will include sparse planting to the water sides with glades of single species tree planting developing into mixed species buffer planting along the rail line. This approach will suit the exposed nature of the site by using trees with visual character, repetitive aesthetics but informality of layout.

Shrub planting will be sparsely populated within rock and gravel 'causeways' at the water side of the site becoming more formal and denser around buildings and towards the railway line. This approach will minimise the impact of salt laden air, contaminated ground conditions and saline water inundation from below.

A variety of tree and plant species have been considered favouring natives but reflecting the existing vibrant biodiversity emerging on the site.

Therefore, an appropriate and robust planting palette which considers the specifics of the site and can be established and maintained.
To achieve the above aims and guide the spatial design of the landscape, a number of public space principles/typologies have been developed for the site. These include:

- Coastal path – Pedestrian and cycle movement through the site should be encouraged to the waterside to take advantage of the sites unique setting. Exposed Aggregate concrete paths are proposed with Rip Rap hewn stone and levels used to mitigate the visual impact of flood walls on the experience. Pedestrian guardrails incorporated on the walls where required.

  Emergent and wild coastal planting is incorporated sparsely among the rocks on the building side of the path to add verticality, colour and visual interest. This includes salt tolerant tree species planted irregularly, specimen shrubs, smaller grasses and flowers.

Plate 4.17 **Coastal Path Conceptual Image**

- Arrival Space – The area where the new pedestrian bridge enters the site and the Marina is accessed from. I t will be a predominantly hard landscape area providing access to the water for pedestrians as well as seating opportunities for people to gravitate towards and gather. Reclaimed timber benches will echo the former pier structures and trees will provide a more hospitable environments for people.

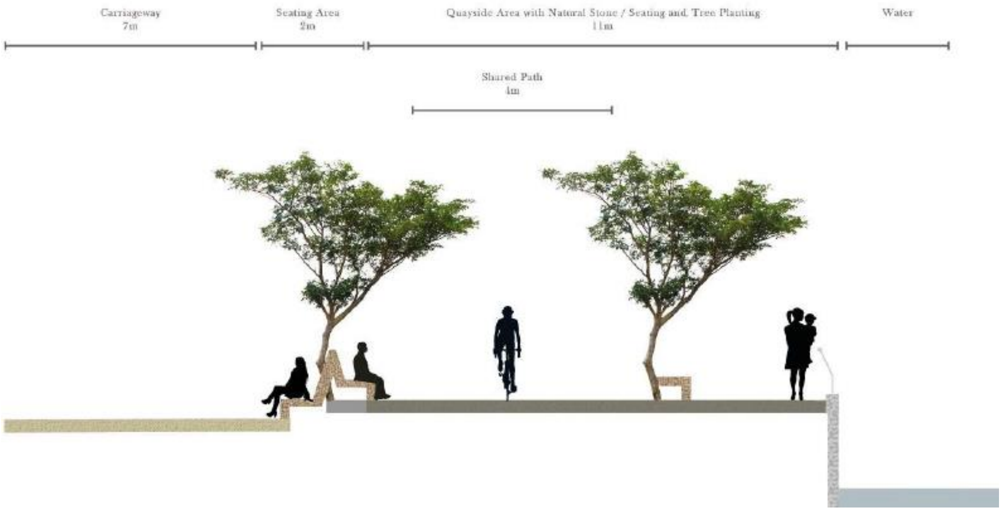


Plate 4.18 **Arrival Space Conceptual Image**

- Internal access road – The internal road will be a shared surface with shade tolerant shrub planting providing a setting to the buildings using colour and texture. Specimen trees will soften the building facades providing vertical interest and giving the planting beds a 3-dimensional impact. Trees with seasonal colour and floral displays have been selected to achieve this.

- Residential communal space – The residential units will be integrated into the public realm but also have communal open space which will be provide residents with seating and play facilities. These will be partially screened from the coastal path using a native hedge, defensive shrub planting and trees. At the railway side of the residential building the density and height of trees will increase to provide some screening.
- Central paths & carpark - The central paths will be flanked by ground cover planting and glades of tree planting. Small and shade tolerant species are proposed between arts centre and carpark to create a human scale to the space while between the carpark and rail line larger tree and shrub species are proposed for screening. Nurse species of planting such as birch will be used to create fast and effective screening and opportunities for a wider variety of planting to establish under.
- Rail line planting – Along the rail line side of the site Iarnród Eireann's requirements for planting and its control have been incorporated with a grass, wildflower and then shrub buffer being provided before a maintained hedge and small trees are planted for screening. Nurse species of planting such as birch will be used to create fast and effective screening and opportunities for a wider variety of planting to establish under.

Plate 4.19 Rail Line Planting Conceptual Image

Plate 4.20 below indicates the pedestrian movements and public realm typology principals. Details of the landscaping treatment and the public realm facilities are included in Figure 4.17 of Volume 3.

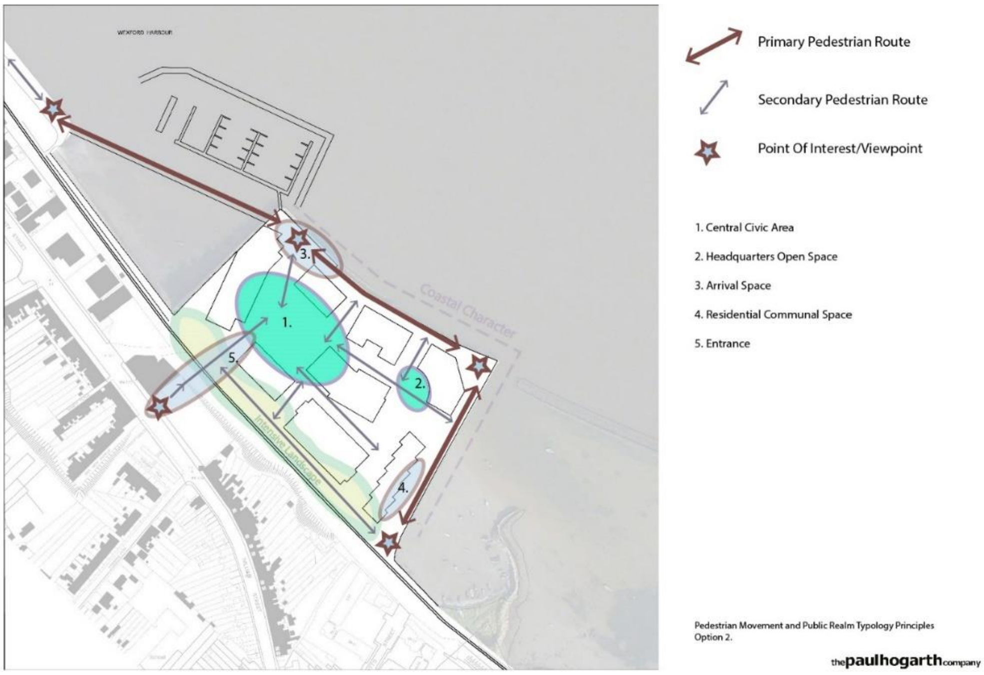


Plate 4.20 Pedestrian Movement and Public Realm Typology Principals.

4.3.8 Lighting

The design of the public realm and choice of surface finishes relates to the hierarchy and use of space. This is complemented by the lighting strategy, which is intended to provide comfortable external lighting appropriate to the use of space.

Low level downward facing bollard lighting (approx. 1m height) has been selected for pedestrian and cycle areas including along the seaward perimeter, as these direct light onto the pavement.

Low level Illuminated strip lighting is used in locations such as the boardwalk and to solid edges to provide a continuous surface light onto the walking surface, and to minimise light pollution. In shared space areas, street lights are generally 4.5m high standards. For the entrance street and main public space, the street lights are on 8m standards. All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will all reduce the impacts on bats and other wildlife. The proposed external lighting arrangement is shown in Figure 4.20 of Volume 3.

4.3.9 Boardwalk

The proposed boardwalk is to be located immediately to the north of the main development site in Wexford Harbour and will be a pedestrian/cycleway link bridge from Paul Quay to the northern corner of the development site (see Figure 4.4 of Volume 3 of the EIAR). The cycleway path provided by the boardwalk will enable a tie-in of cycleway facilities from the Wexford Town promenade to the Trinity Wharf Public Realm cycleway facilities. Plate 4.21 below shows a computer-generated image of the proposed boardwalk (for illustrative purposes only).

Plate 4.21 CGI of the proposed Boardwalk (for illustrative purposes only)

The total length of the boardwalk is 180m between end supports and will have an internal width of 6m between handrails to accommodate both pedestrians and cyclists. The northern end of the boardwalk will tie-in to the existing promenade of Paul Quay and the southern end will tie-in to the public space immediately adjacent to the proposed hotel at Trinity Wharf.

The boardwalk superstructure will be constructed above the maximum design water level and the expected significant wave height for storm with a return period of 1 in 200 years. This will ensure that small marine craft can pass under the boardwalk but also, pedestrians on the structure will be well protected in adverse weather conditions, however, provision will be made for potential closure of the boardwalk during storm conditions.

The foundations for the boardwalk structure are proposed to be driven steel tubular sections which will be installed to immediately beneath the soffit level of the boardwalk deck where an integral connection will be made. Cathodic protection systems will be installed to the steel tubular columns for corrosion protection. These supports will be placed at 15.0m centres. The north and south landings for the boardwalk will consist of reinforced concrete abutments where bearings will be provided for the deck.

The superstructure comprises two No. 2.4m high steel longitudinal girders which will be the main structural elements of the superstructure and additionally be the main parapet provision for the deck. Transverse steel plate girder will span between the longitudinal girders directly support the deck. The boardwalk deck is proposed to consist of perforated aluminium plates which will allow the deck to drain and also provide slip resistance for pedestrians and cyclists.

In order to accommodate the level difference between the proposed deck level and the existing promenade levels at Paul Quay, an approach ramp with a slope of 1 in 20 will be constructed at Paul Quay in the area where there are currently car parking facilities, Chapter 5 provides details of the effects on parking facilities. The approach ramps will comprise reinforced concrete channels, infilled with granular material.

Figures 4.7 and 4.8 in Volume 3 show the general arrangement and details of the preliminary design of the boardwalk. Plate 4.22 illustrates the plan view of the boardwalk.

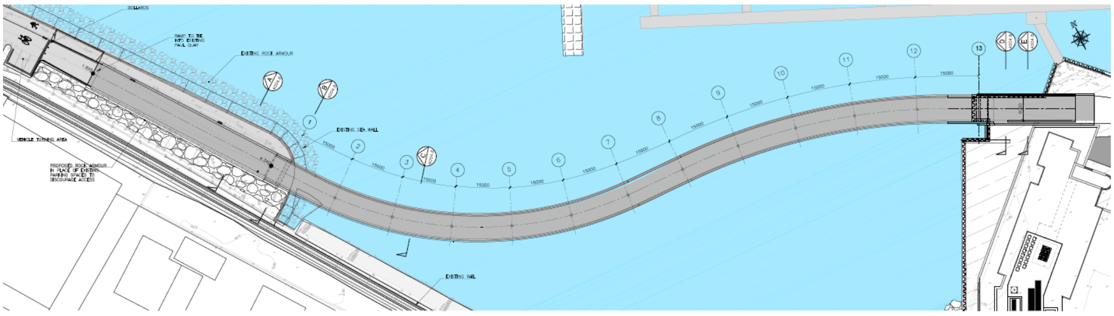


Plate 4.22 Plan view of proposed boardwalk

4.3.10 Traffic Provisions

4.3.10.1 Proposed Site Access

The proposed link road will typically consist of a 6m wide carriageway and 3m wide footpaths on both sides which will widen at the junction with Trinity Street for a right turn lane. The new access junction will form a 4-way signalised junction with Trinity Street and Seaview Avenue. A turning head facility will be provided on Seaview Avenue to facilitate the signalised junction. See Plate 4.23: Proposed Signalised Access Junction the plan of the junction.

Plate 4.23 Proposed Signalised Access Junction

The signalised junction will have two approach lanes on three arms and a single approach lane on Seaview Avenue. The junction geometry has been developed in accordance with the Department of Transport Design Manual for Urban Roads and Streets (DMURS) and the traffic signal layout is designed in accordance with the TII Design Manual for Roads & Bridges DN-GEO-03060 – Geometric Deign of Junctions. The proposed junction layout retains the on-street parking on the west side of the street except for approximately 4 spaces through the junction. Approximately 12 parking spaces will also be removed from the east side of Trinity Street. Kerb buildouts on both sides of Sea View Avenue will reduce the distance for crossing pedestrians and improve visibility for vehicles pulling out of Sea View Avenue. See Figure 4.9 in Volume 3 for details of the Junction design.

The turning head facility on Seaview Avenue consists of a 4m long x 3.3m wide pavement widening to prevent the current practice of vehicles reversing into or out of the lane from or onto Trinity Street. The turning head will ensure vehicles can perform a 3-point turn within the laneway and face the correct direction on the approach to the traffic signals. See Figure 4.21 in Volume 3 for details of the Turning Head.

The junction will primarily function on a four-stage cycle, including a stage for pedestrians. A fifth stage for Seaview Avenue will be incorporated into the cycle when a vehicle is detected on this leg via a vehicle activation device.

The proposed link road into the development site will form a new level crossing with the Dublin to Rosslare Railway Line. Iarnród Éireann have agreed in principal to the design of the level crossing which will consist of signalised automatic controlled boom barriers. The barriers will active for 3-minute intervals 8 times a day for passing trains from Mon through to Friday, while on Saturdays and Sundays the barriers will activate 6 times a day (according to the current Irish Rail timetable).

The boardwalk to be constructed between Paul Quay and Trinity Wharf provides a direct link to the Town Centre for pedestrians and cyclists. A consequence of the construction of this boardwalk will be the loss of approximately 21 car parking spaces on the southern end of Paul Quay where the approach ramp to the boardwalk is to be constructed.

The proposed pedestrian and cycling link is in-keeping with the following policy statements in the Wexford Town and Environs Development Plan;

- CW1 To continue the improvements, which facilitate pedestrian safety at various locations within the Town Centre
- CW2 To encourage the extension and widening of footpaths generally within the existing built up area.
- CW3 To continue to provide for and extend the system of safe pedestrian and cycle routes linking residential areas and the town centre with schools, shops, the train station and open spaces
- CW6 To ensure that roads and footpaths are designed and constructed to cater for the needs of the people with disabilities.

4.3.10.2 Internal Circulation

The public spaces and streets within the development are proposed as a pedestrian dominated public realm capable of holding outdoor events in the open spaces. The site will be permeable to pedestrians with footways provided on all desire lines. A 4m wide dual pedestrian / cyclist promenade will be provided on the north-east and south-east site boundaries with the coast.

The internal circulation routes are shown below in Plate 4.24.

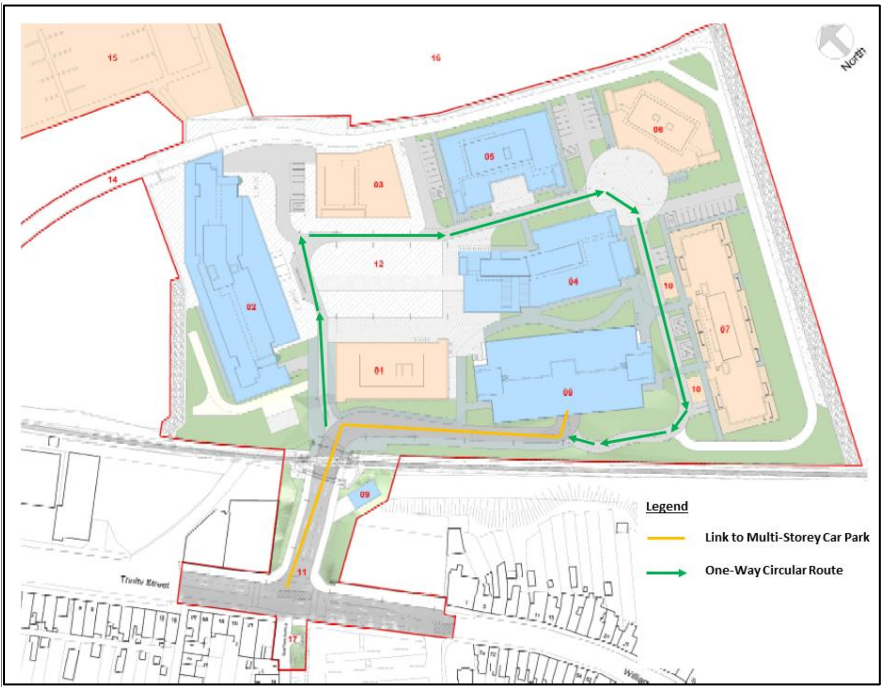


Plate 4.24 Internal Circulation Routes

A large proportion of vehicular traffic accessing the site (approximately 90%) are expected to drive directly to the multi-story carpark via the 6m wide access road. The multi-storey car parking has been located adjacent to the Trinity Street entrance to minimise traffic circulation through the development and prevent associated traffic severance of the public realm areas.

The circular route through the development is proposed as a pedestrian priority shared surface which will cater for one-way low-speed vehicular traffic. The one-way route is intended exclusively for service and emergency vehicles, pick-ups and drop-offs to the hotel and cultural / performance centre and traffic accessing the small number of surface car parking including accessibility bays. Vehicles intending to use the multi-storey carpark after making a drop off first can access the carpark via the one-way route.

The circular route will typically consist of a 5m wide delineated route for vehicles with flush/ dished kerbs on both sides and a mix of pavement materials to highlight the shared nature of the route. The section of the circular route passing the Central Plaza will narrow to 3m with pedestrians catered for by the pavement to the front of the hotel, the café/ restaurant building and the plaza. Street furniture along this section of the route will be set back appropriately to provide gaps where vehicles can temporarily set down to one side of the path without blocking traffic. Low traffic speeds will be achieved with entry and exit ramps, use of traffic calming pavement, street furniture and landscaping and narrow carriageway widths with tight corner radii in accordance with DMURS.

4.3.10.3 Service and Emergency Vehicles

Heavy goods vehicle (HGV) accessibility through the development has been analysed using AutoTrack (see Figure 4.11 in Volume 3) software to ensure service and emergency vehicles have access throughout the site including buildings, the marina and the promenade. The largest vehicle envisaged on the site is a 12m long rigid coach.

4.3.11 Marina Design

The marina is to be located off the northern corner of the Trinity Wharf Development site.

The design of the marina includes creating a sheltered marina area with 64 berths by constructing a series of high-end pre-fabricated 5-metre-wide floating breakwaters with skirts that will be tethered to the seabed. This design means that no dredging is required to achieve the desired minimum operating depth of -2.5m CD, thus minimising potential environmental impacts. Figure 4.12 in Volume 3 shows the layout of the proposed marina.

It is proposed that the floating pontoons of the marina will be constructed using industry standard modular pontoon and finer units. Pontoon berths and walkways will be restrained using tubular piles driven into the seabed or an alternative restraint system. Alternative methods which will be assessed comprise the use of helical anchors being drilled into the seabed or appropriately sized anchor blocks buried into the seabed. Either the helical or block anchors would be connected and secured to the pontoon berths and walkways by restraint chains. A single gangway that will be pivoted on the reclaimed deck and rested on the main walkway, providing access to the proposed marina area.

The location of the proposed marina has been selected to minimise navigational restrictions within the existing approach channel to Wexford Harbour, minimise sedimentation and impacts on the shellfish industry.

The following services will be provided to the marina:

Water

Potable water will be supplied to the proposed marina development from the proposed landside development via the underside of the access bridge and service channels along the marina pontoons.

Based on marina of similar sizes around Ireland, it is estimated that the potable water supply for the new marina facility at Trinity Wharf will be as follows:

- Less than $1m^3$ per hour at peak demand in summer
- Peak of $3m^3$ for daily usage in summer
- Peak of $1m^3$ for daily usage in winter

Sewerage Infrastructure

Waste from the designated waste pump-out station will be ejected through a weighted pipe by high pressure ejector system into sewage infrastructure of the proposed landside development. The weighted pipe will rest on the seafloor and enter the landside sewage infrastructure through the sheet piled perimeter of the site.

Electricity

The proposed marina development will be supplied with electricity from the local network provider. The pontoons will have individual electricity service pedestals and will be fed from the local electricity supply via the underside of the access bridge and service channels along the marina pontoons. There is provision within the proposed landside Trinity Wharf development to accommodate the power supply without causing disruption to other users.

Navigation

Solar powered navigation aids will be positioned on the new infrastructure within the marina. The exact characteristics (i.e. colour and flash frequency) of these navigation aids will be specified in accordance with the requirements of the Commissioners of Irish Lights.

4.3.12 Sea wall

The existing sea wall bounding the site comprises a combination of shallow rock armour along the southeast edge (see Plate 4.25), reinforced concrete wall along the northeast edge (see Plate 4.26) and stone masonry wall along part of the northeast edge and all of the northwest edge (see Plate 4.28) of the site.

The structural wall on the northeast and northwest edges show signs of deterioration throughout the reinforced concrete and masonry sections and has been assessed to be inadequate to be maintained or rehabilitated for the proposed development.

In addition, due to the flooding requirements described in section 4.3.4 above, the level of the development is required to be raised by approximately 1.5m above its current level. Utilising and modifying the existing sea wall for the purposes of this development is therefore unfeasible and as such a new sea wall must be constructed around the perimeter of the site.

Plate 4.25 Existing Sea Wall – Southeast edge

Plate 4.26 Existing Sea Wall – Northeast edge

Plate 4.27 Existing Sea Wall – Northwest edge

The proposed sea wall consists of a combination of a vertical sheet pile wall along the northeast and northwest edges of the site and a rock armour revetment along the southeast. Cathodic protection will be installed to the sheet pile wall in order to protect against corrosion. Figure 4.14 and 4.15 in Volume 3 show the preliminary design of the sea wall.

The sheet piled wall comprises steel sheet piles to be installed around the coastal perimeter of the site to create a coastal defence level of approximately 3.5mOD in order to retain the levels of the development site. The sheet piles will be vibratory installed and embedded into the stiff gravelly clay layer at approximately -10.5mOD. The sea wall design will consist of ground anchors or tie bars connected to a row of sheet piles driven into the made ground and located approximately 12m behind the retaining wall. A reinforced concrete capping beam will be constructed along the top of the wall throughout within which the anchor head will be located, and a 1.4 m high railing will be installed along the top of the capping beams.

Along the south-east edge of the site, rock armour will be placed on the sea bed immediately in front of the sheet pile wall to form a 1 in 1.5 sloped revetment. The purpose of this is to reduce the possibility of wave reflection to the moored vessels in the Goodtide Harbour.

Plate 4.28 below shows the typical proposed design of the sheet piled wall and Plate 4.29 shows the typical section of the sea wall along the South-East edge of the site.

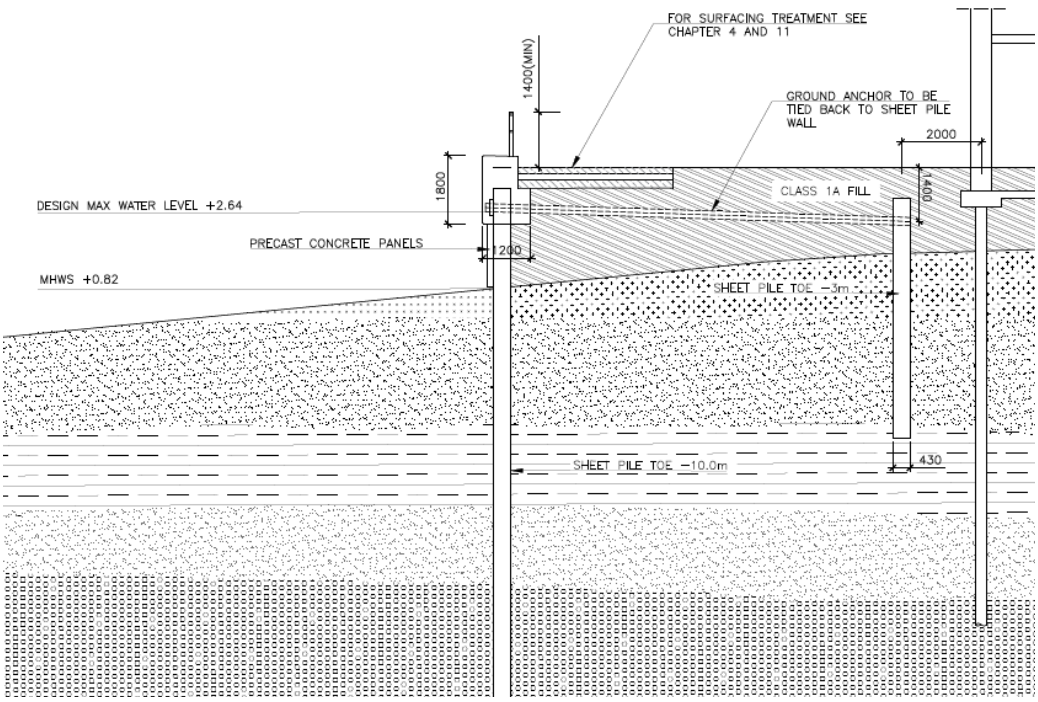


Plate 4.28 Sheet piled wall design

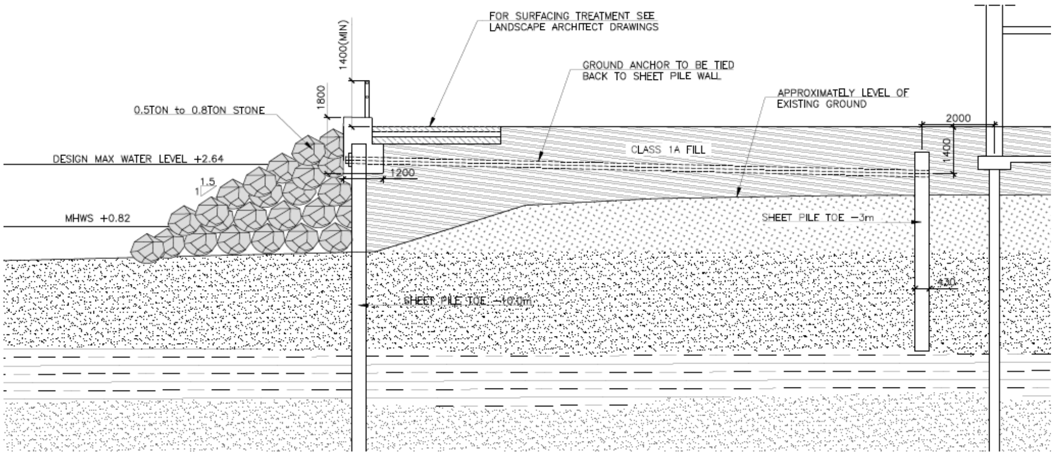


Plate 4.29 Rock armour revetment

4.3.13 Maintenance and Operation

The elements of the site which are envisaged to be operated and maintained by Wexford County Council are as follows:

- Landscaping maintenance – grass cutting and hedge trimming of all landscaping areas;
- Road sweeping and de-icing operations of the internal road network;
- Regular maintenance of the permeable pavements in the form of brushing and vacuuming;
- Resurfacing works of the internal road network; and
- Inspection and maintenance of civil infrastructure elements –
  - The boardwalk will be subject to a regular structural inspection regime and periodic replacement of bearings, and steel painting works.
  - The sea wall and capping beam will be subject to a regular structural inspection regime. Periodic checks will be required to ensure scour at the base of the wall does not become significant.

Waste disposal collection, which has been considered in the design of the internal road network and access points to the buildings, will be carried out by private companies be contracted directly by the building occupiers.

The maintenance and operation of the level railway crossing at the main site access road will be taken over directly by Iarnród Éireann including the operation of the signalling, and maintenance of the barriers and M&E equipment.

The maintenance and operation of each building will be undertaken by the individual private developers and will include the following:

- Maintenance of all M&E equipment located within each building;
- Internal and external cleaning

Maintenance and operation of the marina will be undertaken by Wexford County Council and will involve the following:

- Management of moored vessels; and
- Periodic inspection of all structural elements including breakwaters, restraint systems, and anchorage systems.

4.4 Construction Stage Methodology

4.4.1 Introduction

This section outlines the construction methodology for the main stages of construction works planned as part of the proposed development.

4.4.2 Main Construction Works

The main construction elements and activities of the development are as follows:

- **Site preparation including;** site clearance, asbestos processing and boundary security;
- **Establishment of site access routes;** construction of access road and level crossing at the railway;
- **Sea wall and revetment works;** the construction of the replacement sea wall consisting of driving steel sheet piles around the entire coastal boundary of the site with the addition of rock armour revetment placement along the south-east edge;
- **Earthworks and paving;** the import and placement of imported material to raise the level of the site, establishment of site utilities and services and the construction of the internal road network;
- **Boardwalk construction;** the construction of the structural steelwork footbridge including the construction of reinforced concrete approach ramps and modifications to Paul Quay Promenade;
- **Marina development**; the construction of the marina and the installation of floating breakwaters;
- **Building structures**; construction of reinforced concrete office buildings, hotel, retail buildings, cultural centre and residential buildings; and
- **Landscaping and finishes;** construction of public realm areas.

4.4.3 Proposed Construction Phasing and Programme

It is proposed that the overall construction of the development will be spilt into phases, with each phase being procured under separate contracts. The outline of the proposed phasing of the development is detailed in section 4.3.3.

The following is an envisaged indicative construction programme assuming that each construction phase will follow on from the previous. This proposed phasing is an outline as to how the site is envisaged to be developed. The order of which may however be subject to change as development commences on site.

The construction of the proposed development is expected to take place over a period of 80 months, with the key milestone activities taking place at the following stages (if scheduled consecutively);

Table 4.3 Envisaged Construction Program

Works element	Duration of task (approx.)	Completion
Completion of Site preparation works – Site clearance and boundary security	6 months	6 months
Establishment of site access; temporary level crossing establishment, permanent junction construction	2 months	8 months

Works element	Duration of task (approx.)	Completion
Installation of marina breakwaters	0.5 months	8.5 months
Construction of sheet piling wall and rock armour revetment along south-east boundary. (overlap with previous task)	4 months	12 months
Installation of boardwalk piling. (Overlap with previous)	3 months	13 months
Earthworks, drainage and services, and sheet pile wall anchorage installation throughout the site.	6 months	17 months
Boardwalk construction	4 months	21 months
Phase 2 Buildings Development	24 months	45 months
Marina Construction	2 months	47 months
Phase 3 Buildings Development	30 months	77 months
Public realm works, landscaping, construction of permanent level railway crossing.	3 months	80 months

4.4.4 Site Preparation Works

The site preparation works will likely be conducted through an advance works contract to be completed before construction commences on site.

Prior to any work commencing on the development site, boundary security will be required to be established around the site to prevent unauthorised access.

Non-intrusive investigations carried out to date of the site have found fragments of asbestos across the surface of the site, however the extent of which is still to be quantified. Further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site (as detailed below in Section 4.4.4.1 and 4.4.4.2 below). The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractor.

Once information from the site surveys is confirmed, the site clearance works will commence. The site clearance works will require the removal of all existing partially demolished structures which remain from the various industries which have occupied the site since the 1800s. Work will involve the clearance of the asbestos containing materials that are located above ground. This may include; loose rubble which has been left over from partial demolition of previous standing structures; and concrete and masonry walls.

All site clearance and excavation works will be required to follow the mitigation measures of this EIAR as well as any future mitigation measures to be detailed in the Remediation Strategy. For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the waste management legislation and include 'measures for working with asbestos' (Section 4.4.4.2 of this EIAR). Any ACMs discovered will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.

4.4.4.1 Asbestos Survey and Remediation Strategy

The 'Asbestos Survey and Remediation Strategy' are currently in progress at the time of writing this EIAR. The following sections detail the stages involved in undertaking the Asbestos Survey and Remediation Strategy, any recommendations or mitigation from these surveys and reports will be required to be incorporated into the CEMP at construction stages.

The Asbestos Survey and subsequent Remediation Strategy, as recommended by RSK (see Appendix 8.1 of this EIAR) will be required to be undertaken as follows:

1. Prior to the start of any construction works, a site specific intrusive asbestos survey will be undertaken by a suitably qualified, licenced and experienced contractor to work with asbestos – that is being progressed at the time of writing this EIAR. The aim of the asbestos survey report is to determine the full extent, type and location of all surface and near surface ACMs and will include representative sampling as appropriate. A number of stages will occur as recommended by RSK walkover survey (detailed in Appendix 8.1) and will occur in the following order:
    a. Undertake an intrusive investigation including representative sampling as appropriate to identify any potential sub-surface asbestos contamination within the demolition material stockpiled in various locations across the site.
    b. Undertake a target intrusive investigation comprising trial pits and / or slit trenches to determine the extent of any possible asbestos in fill material and below floor slabs across the site. The site investigation will be required to be scoped to cause minimal disturbance to any surface ACMs identified and all suitable control measure implemented to prevent exposure to asbestos throughout the works. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on site of this nature.
2. Develop a Remedial Strategy for the site on completion of the survey and investigations to detail the work required to mitigate the risks associated with asbestos contamination identified and to prevent the potential release of asbestos fibres during the proposed development works. The appointed contractor will be required to have the appropriately qualified and experienced to work with asbestos.
    a. A method statement and evidence of competencies will be required to be provided to WCC in advance of undertaking such the remedial strategy,
3. Remediation Verification Report: All mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.

4.4.4.2 Measures for Working with Asbestos

All construction works will be undertaken in line with the Control of Asbestos Regulations (CAR) 2012 which requires actions to ensure the protection of workers and general public from asbestos exposures relating to work activities. CIRIA SP168 "Asbestos in soil and made ground: A guide to understanding and managing risks" as well as all relevant waste management legislation will also be adhered to by contractors.

During the site clearance works and the construction stage of the proposed development, the following mitigation measures are to be implemented, which will be in addition to standard health and safety practices on construction sites:

- **Training** – All personnel removing, overseeing, directing, inspecting and/or disturbing ACMs and asbestos-contaminated soil will have, as a minimum and as appropriate to the activity, relevant training and experience in working with asbestos and/or asbestos in soils awareness.
- **Personal Protective Equipment (PPE)** – All personnel working with or in the vicinity of areas where asbestos is suspected or has been previously identified must wear personal protective equipment to include disposable category 5 coveralls.
- **Air monitoring** will be conducted during the disturbance of suspected ACMs as part of the site clearance works and during construction works. Where air monitoring is required it must be carried out by a UKAS accredited analyst in accordance with the method set out in HSG248 Asbestos; The Analysts' Guide for Sampling Analysis and Clearance Procedures.
- **Dust Suppressant** – Asbestos and Vehicle Management will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Where material is to be stored on site it will be kept covered with polyethylene sheeting or sprayed with sufficient amounts of water to prevent drying out and dust generation.
- **Access and Vehicle Management** – A site wide traffic management system will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Internal site routes will be agreed with the Main Contractor and asbestos contractor in advance of the works and all surfaces will be subject to regular inspection.

  Any haulage trucks transporting ACMs must be properly covered and sealed to ensure that no spillages can occur en-route. All haulage trucks must be inspected by the asbestos supervisor prior to transport and leaving site.
- **Decontamination of Plant -** All plant and machinery, which is to be used in the removal of surface ACMs or disturbance of soils containing asbestos, will be fully decontaminated before leaving the area. No plant will be allowed to leave the works area until it has been decontaminated and passed a visual assessment by a competent person.
- **Decontamination of Personnel -** It must be assumed that clothing and equipment that has come into contact with asbestos is contaminated and must be treated as such. A designated area with appropriate welfare facilities should be provided for personnel to change into PPE and RPE prior to any asbestos remedial works commencing.
- **Waste Management -** Any handpicked asbestos debris and used coveralls, disposable masks and filters will be double-bagged in red and clear bags, labelled appropriately and stored in a designated container on site. The container will be secured and kept locked at all times. All asbestos waste will be removed by an appropriately licensed waste contractor. All waste transfer documentation will be retained by the contractor and copies provided to the Project Manager and appointed environmental consultant. Any waste from the cleaning down and decontamination of plant and equipment will also be disposed of to a suitable licensed facility.
- **Unexpected discovery of asbestos -** If suspect asbestos-contaminated soils or materials are discovered during the construction phase in areas not previously identified or suspected, or in quantities not previously identified or suspected, the

contractor will stop work immediately and leave the area until specialist advice is sought by the appointed asbestos consultant that is suitably qualified, experienced and licenced. The area will be demarcated with barrier tape, or other means, and access restricted.

During the construction phase, these measures are to apply to elements of the works that are likely to encounter ACMs during its construction, such as the foul water pumping station, breaking up of the existing sea wall (where necessary) and the excavation works required to construct foul drains and other elements of the main site works.

4.4.4.3 Design Approach to Asbestos Risk Mitigation

The approach taken to the management of risk of ACMs on the Trinity Wharf site is to minimise exposure to ACM materials by design. In so far as is possible, the development has been designed, and will be detailed, to avoid disturbance of buried ACMs and to leave them in-situ.

Some design decisions that will achieve this aim are summarised as follows:

- Advance clearance works by a specialist asbestos contractor to remove all surface asbestos fragments;
- Cap the existing site with a barrier layer and fill above (to average total of c. 1.5m depth) with granular imported fill material;
- Foundations for all buildings will be constructed on driven piles, thereby avoiding exposure to potentially asbestos-contaminated arisings;
- Service trenches will be generally shallow and will be within the granular fill layer. During the detailed design stage, the locations of deeper trenches or chambers will avoid areas of asbestos contamination, where possible; and
- Pending receipt of intrusive investigation data, it is assumed that there is asbestos present below existing concrete floor slabs visible on the site. Therefore, it is proposed that these concrete slabs will be left in-situ, in so far as is possible, in order to minimise the potential health hazards involved in breaking the slab.

The asbestos surveys and the remediation strategy (described above) will confirm the required approach at detailed design stage. Where ACM disturbance is unavoidable, e.g. if buried ACMs are discovered at the location of the foul pumping station or deeper service trenches, excavation will be carried out by a suitably qualified, experience and licenced contractor under the supervision of the Site Environmental Manager (SEM) and the excavations made safe to prevent exposure of subsequent construction workers to ACM risk. In the event of ACMs having to be excavated, these will be dealt with in accordance with best practice standards by suitably qualified and trained personnel and disposed of to a licenced facility, as required.

4.4.5 Site Access Establishment

Currently the Trinity Wharf site is accessed via a small side road to the north west corner of the site. This access is locked with a gate to prevent the public accessing the railway line. Currently for any work required to be carried out on the site and for plant accessing the site, coordination is required with Iarnród Éireann for the gate to be unlocked, sleepers to be placed over the tracks and signal men to be in place for the duration of the operation.

The width of this access and the arrangements necessary for construction plant are inappropriate and as such the main permanent access will have to be established prior to commencement of any of the main construction works on the site. Similar arrangements to those described above are likely to be required during the construction phase until such time as the level crossing is operational, however this will be agreed with Irish Rail.

The design of the proposed development proposes the construction of a new access road leading from Trinity Street adjacent to McMahon Building supplies and a new permanent signal-controlled level crossing over the railway to be operated by Iarnród Éireann.

The construction of the road will therefore be the first construction works to take place with the demolition of the hard-standing area, structural walls, the excavation of the embankment immediately adjacent to the railway and the construction of the new approach road to the railway. Temporary works may be required to ensure the stability of the adjacent building during excavation and construction of the road. The road will then be connected to Trinity Street by the installation of a signal-controlled junction. As per the Japanese Knotweed management strategy, the area of Japanese Knotweed adjacent to these works will be managed by the Contractor during these works. Where eradication has not been achieved, further measures will be put in place by the Contractor to ensure no spreading of the invasive species occurs.

Following on, or continuing in parallel, with the construction of the road, a temporary level railway crossing will be established for the duration of the works. Towards the end of the construction phase, this crossing will be made permanent. Pavement works will have to be constructed on the railway and temporary accommodation arrangement for Iarnród Eireann flag man and look-out staff who will control the crossing for the duration of the works. Exact arrangements of this crossing will be agreed with Iarnród Éireann.

4.4.6 Temporary Traffic Measures

Temporary traffic management measures will be required for the construction of the access road which connects to Trinity Street and for the installation of the signal-controlled junction at the interface between the two.

Upon completion of the access road, however, all construction activities will be contained to within the Trinity Wharf Development site and as such temporary traffic management will be limited to temporary arrangements or traffic controllers for assisting with the ingress of large vehicles, for large plant arrival, prefabricated structure arrival and crane arrival etc., at the Junction between the access road and Trinity Street.

4.4.7 Sea Wall Works

The first main element of work to be constructed will be the sea wall around the coastal edge of the site. The sea wall will comprise the installation of steel sheet piles and a rock armour revetment along the south-east edge of the site.

A pile driving rig will mobilise and begin vibratory driving sheet piles immediately in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The design of the wall considers the use of granular fill material being compacted behind the sheet piles. Upon installation of the sheet piles, the existing sea wall will be broken up in-situ and left in place with granular backfill material being placed around this.

Along the south east edge of the site, a rock armour revetment is required to be constructed immediately in front of the sheet pile wall. Rock armour consisting of rocks of approximately 0.5 to 1 tonne will be placed on the sea bed to the required profile in parallel with the installation of the sheet pile wall such that at no point during the construction can waves reflecting off the vertical wall significantly affect the moored vessels at Goodtide Harbour.

The design of the sheet pile sea wall requires the use of tie backs, consisting of tie-bars and a row of smaller sheet piles to be installed up to 12m behind the sea wall. Once all sheet piles are installed around the boundary of the site, the tie-bars will be installed between the two rows and the reinforced concrete capping beam will be constructed to the sea wall. Once the sheet piles and associated anchorage system is in installed correctly, backfilling works can commence.

4.4.8 Marina Construction and Breakwaters

Fabrication of all the marina elements including breakwater units, floating pontoon, finger berths and the access gangway will be fabricated offsite by specialist marina manufacturers. The design performance including the design loads and other specified criteria of these elements will be specified during the detailed design phase of the proposed marina.

If piles are chosen as the preferred restraint system during detailed design, a pile driving barge will be used to drive pile sockets for the breakwater units and the pontoon walkways. Vertical steel piles will then be grouted into the pile sockets in order to ensure verticality of these and to give good line and plumbness.

Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units, pontoon walkways and finger berths. Depending on substrate conditions, restraint chains could also be anchored by appropriately sized anchor blocks buried into the seabed.

The actual method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to detailed ground investigations during detailed design phase. For purposes of the EIAR, the worst cases of both methods have been assessed in this EIAR.

Individual breakwater units and pontoon walkways will be transported to Trinity Wharf by road and then lifted from the quay into the water by a suitably sized mobile crane equipped with slings and chains. A workboat will be used to float the individual breakwater units and pontoon walkways into position. Individual breakwater and pontoon elements will then be connected and secured to pile/chains and bolted together using joints specified by specialist marina manufacturers.

Finger berths will be transported by and placed into position by a multicat barge. Individual finger berths will be secured to pontoon walkways using joints specified by specialist marina manufacturers (joints to include rubber washers).

The access gangway will be transported to site by lorry (and assembled on site if necessary). The gangway will then be installed using a suitable mobile crane.

This will be achieved by using a crane equipped with chains to lift the gangway at sling points identified in the manufacturer's drawings. The gangway itself will then be slowly lifted into position and guided by tag lines in order to align it correctly. Once it is connected and resting on the pontoon the crane will be unhooked and released.

Alternatively, the access gangway can be transported to site via a flat top barge and jacked into position before being connected and secured to the pontoon walkway and Trinity Wharf.

Marina services (water and electricity etc.) will be installed under the access gangway and throughout the service ducts within the pontoon walkways.

Safety stations and access ladders etc. will be placed in strategic places around the marina. Low level environmentally sensitive lighting as per the requirements outlined in Chapter 7 of this EIAR and service pedestals will also be installed on the pontoon walkway and finger berths. Indicative locations for these can be seen in Figure 4.12 of Volume 3.

4.4.9 Earthworks and Pavements

The current ground level will be increased for the development for purposes of flood protection, using imported granular material. The proposal is to leave the existing made ground in place and build up the level of the site to the desired finish floor level. The foundations for the buildings are intended to be piled and will be driven through the made ground material.

Despite the intention for the construction works to be carried out with the least feasible disturbance of soils by importing fill to cover the existing ground, some minor soil stripping or excavation can be expected, particularly relating to the installation of drainage and services and the construction of the foul water pumping station.

It is anticipated that pumping of foul water will be required from the development site to the existing foul/combined sewer network due to the site's distance from public wastewater infrastructure and topographical constraints. The anticipated depth of this pumping station will be approximately 4.5m below finished ground level and will therefore require approximately 2m of excavation below existing ground level (EGL) into the existing made ground. This will require consideration by the main contractor within the construction phase risk assessment and methodology for dealing with the excavated material which will likely be contaminated.

The proposed surface water drainage strategy will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through a diffuse system or point discharge (see section 4.3.4.4). Although the main purpose for this is due to the site being located in an area at risk of coastal and pluvial flooding, and due to its location in an urban centre served by well-established transport links with consequently high demand for residential and commercial development; this reduces the requirement for deep excavations to install traditional surface water drainage sewers by implementing the likes of blue/green roofs to all buildings, raingardens at the perimeter of buildings, permeable pavement to areas of hardstanding and swales/basins in soft landscaped areas.

The link road between Trinity Street and the multi-storey car park will have a typical cross-section of 3 x 3m traffic lanes and 3m footpaths on either side of the street for shared bicycle/pedestrian use. It is most likely that this will be constructed utilising a traditional bituminous road construction at the proposed site levels, tying in at existing levels on Trinity Street. The construction of this road will require extensive excavation in order to establish the required gradient of the road. As above, this excavated material will have to be disposed of adequately.

Internally, the development is provided with a 4.8 - 5.0m circulatory road which will provide access for hotel drop-off, disabled parking and service vehicles only. This road will be constructed as a hardstanding shared surface which will drain to adjacent permeable paving or swales.

4.4.10 Sourcing of Materials and Waste

Excavated material arising from the earthworks will be assumed to be contaminated and as such will not be adequate to be processed into acceptable fill material therefore all imported fill material will have to be imported from third party sources.

There are several registered/authorised quarries near the proposed development which may be utilised in the sourcing of the required imported granular fill material. These include but are not limited to:

- Roadstone, Kilinick, Co. Wexford – to the south of Wexford off the N25;
- Aidan Egan Sand & Gravel, Finchogue, Enniscorthy, Co. Wexford – north of Wexford Town to the east of Enniscorthy; and
- Boggan Sand & Gravel, Kilmacree, Drinagh, Wexford – immediately south of Wexford Town off the N25.

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

The hierarchy of waste management in accordance with the current best practice sets out the guiding principles in order of importance as follows:

(i) Reduction in amount of waste generated by the construction process;

(ii) Segregation of waste is a key concept that will be implemented during the course of the construction phase of the development to enable ease in re-use and recycling, wherever appropriate; and

(iii) Recycle waste material where feasible, including the use of excess excavations as fill material.

Typical construction waste which will be generated by the development is as follows:

- General Site Clearance Waste;
- Excavated Material;
- Surface Water Runoff; and
- Packaging and Waster Construction Materials generated during the course of the construction activities.

The purchasing manager shall ensure that all materials are ordered so that calculated quantities are delivered to avoid surplus construction waste and material.

All waste materials (where necessary, after in-situ reuse and recycling options have been fully considered) shall be disposed of offsite, under appropriate Duty of Care and subject to approvals/consents from the relevant statutory bodies. It is the responsibility of the main contractor to ensure than any company to whom waste is transferred is legal permitted to do so and that the facility they bring the waste to is licensing to hand that type of waste as outlined in The Waste Management Acts 1996-2006.

Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects were published in 2006 by the NCDWC (National Construction & Demolition Waste Council). 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.

Waste generated on the construction site will be identified and segregated according to their category as described by the European Waste Catalogue (EWC). In order to effect this, designated Waste Storage Areas (WSA's) will be created at the construction compounds 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 WSA and will be supervised by a Waste Management Co-ordinator (WMC) who will be appointed by the contractor. This will be the person responsible for the management of waste during the entire project. The number and sizing of containers will be agreed with Waste Contractors in advance of the commencement of the proposed project. 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 C&D wastes.

Under the Waste Management (Collection Permit) 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 (Movement of Hazardous Waste) Regulation, 1998 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 movement of material which includes Japanese Knotweed and three-cornered leek is subject to restrictions under Regulation 49 of the Birds and Natural Habitats Regulations 2011 (as amended). The contractor will ensure that the transport and movement of all waste are 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, incineration etc) 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. The disposal of Japanese knotweed and three-cornered leek material off-site requires two documents; a licence from the National Parks and Wildlife Service (NPWS) and a Waste Classification document (See the Outline Construction and Demolition Waste Management Plan in Appendix 4.2 for further details).

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 conductive to the creation of unnecessary waste. The contractor will be required to develop a programme in conjunction with the material suppliers showing the estimated delivery dates and quantities for each specific material associated with each element of work. Following a "just in time" approach improves cash flow, utilises storage space better, and reduces potential loss to theft and accidental damage as well as making the site safer.

It is essential that construction works planning is carried out closely with the waste management contractors, in order to determine the best techniques for managing waste and 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 reuse or 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. An Outline Construction & Demolition Waste Management Plan (C&DWMP) has been included in the Outline Environmental Operating Plan as part of this EIAR (see Appendix 4.2) and will be developed by each contractor prior to construction. The C&DWMP 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.

4.4.11 Boardwalk

The design of the boardwalk comprises structural steelwork supported by discrete steel piles and columns. Driven steel circular hollow piles are proposed to be installed into the sea bed to rock level at approximately 8 -10 below ground level. A marine piling rig will be utilised for the piling operations. The use of driven piles means that arisings created from the piling operations will be reduced to zero and will avoid the need of handling potentially contaminated material.

The boardwalk superstructure is proposed to be fabricated in large sections off-site, the steel sections will be transported to Trinity Wharf construction site by road and then lifted from the quay onto a construction barge by a suitably sized mobile crane equipped with slings and chains. The construction barge will be equipped with a suitably sized crane which will lift the individual steel sections into onto the circular hollow steel supported with bolted connection fixing the superstructure in place. Splice connections in the superstructure steel will be designed to allow the pre-fabricated sections of the deck to be transported from the fabricator and lifted safely into their final position and bolted on site. Welding on site will be avoided.

The boardwalk is proposed to be connected into Paul Quay Promenade to the existing footpath and a reinforced concrete channel is proposed to form the approach ramp to the superstructure. The construction of this ramp will mean that the existing car park will be excavated to the required formation level at which point piled foundations for the approach ramp will be constructed. A reinforced concrete channel will be constructed over the top of the piles and infilled using granular material. The abutment at the end of the ramp will be constructed and bearings installed prior to the landing of the superstructure. No construction in the sea is proposed for the construction of the boardwalk abutment or approach ramp.

For the approach ramp to the boardwalk at Trinity Wharf, the reinforced concrete structure will be required to be founded immediately behind the sheet pile wall and on the imported and compacted granular fill material used to raise the site levels.

4.4.12 Buildings Construction

The construction of the buildings across the site will commence upon completion of the earthworks. The level of the entire development will be raised to the required finished floor level across the site. The individual building sites will be set up and temporary fencing will be erected to demark the site extents of each building work site. The first phase of work will be the construction of the foundations for the tower cranes, which may be several for each building, according to the temporary works design. A piling rig will be set up to the drive the piles for both the tower crane foundations and the buildings. It is likely that the same type of steel driven piles will be used for the tower crane foundation as is to use for the building foundations. In cases where the concrete slab has been left in place, a rotary drill will be used to core through this concrete layer prior to the setting up of the piling rig. The use of driven piles will mean that no arisings will be generated from the piling operations which will eliminate the need for handling contaminated material and asbestos containing materials.

Upon completion of the pile driving operations, local excavations will be carried out around the driven piles to the extents and level required for constructing the reinforced concrete pile caps for both the buildings and the tower cranes. The local excavations will be carried out to the level of the pile cap ground beams formation level, at which point this level will be prepared and blinding concrete will be laid. The reinforced concrete pile caps will be constructed for the tower cranes and the building foundations and upon completion the tower cranes will be erected. Prior to the erection of the tower cranes, mobile cranes will be in use to transport equipment and materials around the site.

Upon completion of the reinforced concrete pile caps for the buildings, the reinforced concrete columns will be constructed by first fixing the steel reinforcement required and erecting the necessary formwork. Temporary scaffolding structures will be erected around the areas of the buildings in order to continue constructing the reinforced concrete beams and slabs for the buildings.

On completion of the structural frames for the buildings, cladding and windows will be installed to the exterior of the buildings with the fitting out of the buildings following on and installation of all M&E equipment, furnishings insulation etc., and connecting of building services such as foul water sewage, drainage and electrical connections.

4.4.13 Permanent Level Railway Crossing

Towards the end of the overall construction phase and upon completion of the buildings and landscaping, the temporary level railway crossing will be made permanent with a new CCTV controlled crossing with remotely operated barriers. The new level crossing XR162 will be constructed as follows:

- The railway boundary will be secured, and controlled access arrangements will be put in place to ensure safe access to and egress from the site;
- Underground railway radio and signalling cables will be identified and relocated if necessary;
- New signalling equipment will be installed at the remote-control centre where signalling personnel can monitor and control the level crossing in use and new equipment will be installed along the railway on each approach to the level crossing;
- Site clearance and earthworks activities will be progressed on each side of the railway to facilitate construction of the new road over the railway;
- Ducting for new services will be installed under the railway in possession including electrical, telecommunications, foul and surface water with associated access chambers;
- The foundation bases for railway furniture including barriers, cabinets, camera poles and telecoms cabin will be constructed;
- The road formation and drainage etc will be installed to underside of bound pavement layers each side of the railway;
- The primary equipment installation will be carried out by Iarnród Éireann with the support of the Contractor including barriers, telephones, telecoms equipment, CCTV, strail units, cattlegrids and equipment cabin;
- The permanent railings; fencing and will be installed to secure the railway;

- The roadworks on the approaches to the level crossing will be completed and the approach signage installed;
- At a suitable time, the new level crossing will be tested and commissioned.

4.4.14 Construction Materials

The construction of Trinity Wharf will require a significant quantity of material to be exported and imported to and from the site. Table 4.4 below gives an estimate of the material quantities required for the development construction.

Table 4.4 Construction Material Quantities

	Export			Import					
Works Element	**Concrete (m^3)**	**Stone & Rubble (m^3)**	**Excavation (m^3)**	**Granular fill (m^3)**	**Rock armour revetment (m^3)**	**Concrete (m^3)**	**Steel reinforcement (tn)**	**Structural Steelwork (tn)**	**Pavement (m^3)**
Site clearance (asbestos containing material + contaminated land)	-	6009	-	-	-	-	-	-	-
Main access road	150	-	2430	1152	-	186	47	-	672
Sea wall	-	-	-	-	3920	1231	185	2017	-
Earthworks (site levels)	-	-	-	83705	-	-	-	-	-
Internal roads	-	-	-	4655	-	497	124	-	2606
Boardwalk	-	-	-	639	-	263	53	471	316
Buildings	-	-	-	-	-	8002	1231	-	-
Total	**850**	**6009**	**2430**	**90151**	**3920**	**10179**	**1639**	**2488**	**3594**

4.4.15 Construction Traffic

The most dominant construction activities from a transport perspective are the earthworks and the delivery of large structural components such as the prefabricated steelwork elements for the boardwalk and the individual breakwater and pontoon elements for the marina.

The traffic generated by the construction of the development is anticipated to peak during the earthwork activities which will create the most long-term consistent movement of HGVs over the construction programme. It is proposed to raise the ground level of the site by an average in excess of 1.5m over a 6-month period which will require an estimated 83,700m^3 of imported fill material, or 10,500 HGV loads based on an average capacity of 8m^3 per HGV. This equates to 81 HGV loads per working day, or 162 HGV movements per working day.

The haulage route for the delivery of plant and construction materials during the construction phase of the development will be restricted to approaching the site from the south via the Rosslare Road Roundabout and the R730 in order to minimise these impacts (construction traffic prohibited from travelling through Wexford town), see Figure 4.18 in Volume 3 for proposed haulage routes. The access road, the temporary level crossing and a site compound will be constructed in advance of the main construction works to facilitate access to the site.

It is anticipated that in the order of 50 construction workers will typically be on site although this number will vary during different stages of the programme. Assuming they all travel in their own car, which is a worst-case scenario, 50 car movements will occur in the morning prior to works commencing and 50 after works cease on site on any given day.

Table 4.5 below show the estimated peak construction traffic.

Table 4.5 Peak Traffic Estimates Generated during Construction Phase of Development

Road Link	Existing AADT	Existing AADT HGVs	Additional ADDT HGVs during earthwork activities	Increase in HGVs	Increase in Total Traffic
Trinity Street	10,157	711	162	23%	2.6%
William Street Lower	10,029	682	162	24%	2.6%

4.5 Construction Environmental Plans

4.5.1 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 a construction project. An Outline Construction Environmental Management Plan has also been prepared as part of this EIAR, see 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 Construction Erosion and Sediment Control Plan (CESCP), Environmental Operating Plan (EOP) and the

Construction & Demolition Waste Management Plan (C&D WMP). The Contractors will be required to include details under the following headings:

- 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);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition & construction);
- Landscape management;
- Management of contaminated land including asbestos and assessment of risk for same by suitably qualified, trained and licenced personnel;
- Management of demolition of all structures and assessment of risks for same;
- Stockpiles;
- Project procedures & method statements for:
  - Site clearance, site investigations, excavations and working with asbestos containing materials (ACMS);
  - Management and removal of ACMs;
  - Demolition & removal of buildings, services, pipelines (including risk assessment and disposal);
  - Diversion of services;
  - Excavation and blasting (through peat, soils & bedrock);
  - Piling;
  - Construction of pipelines;
  - 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;
- Site Compounds.

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.

4.5.2 Environmental Operating Plan

The Environmental Operating Plan (EOP) is defined as 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 a construction project. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractors during the project 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 An Bord Pleanála's decision will be achieved. An Outline Environmental Operating Plan has been included in Appendix 4.2 of this EIAR and will be further developed by the Contractors. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.

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

- All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services as well as a method documenting compliance with the measures;
- A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and
- Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.

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

4.5.3 TII/NRA Environmental Construction Guidelines

The TII/NRA Environmental and Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction on National Road Schemes for the following:

- Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes;
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes;
- 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 Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes;
- 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;
- Guidelines for the Management of Waste from National Road Construction Projects; and
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

This is a non-exhaustive list and relevant guidance current at the time of construction will be followed. It is proposed to employ these guidelines, as and where relevant, on the Trinity Wharf project.

4.5.4 Construction & Demolition (C&D) Waste Management Plan

Included within the EOP will be the Construction & Demolition Waste Management Plan (C&D WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline C&D WMP has been prepared for the proposed road development. The C&D WMP is a live document that will be amended and updated to reflect current conditions on site as the project progress. The obligation to develop, maintain and operate a Waste Management Plan will form part of the contract documents for the project. The plan itself will contain (but not be limited to) the following measures:

- Details of waste storage to be provided for different waste;
- Details of where and how materials are to be disposed of - 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 oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

Appendix 4.1 Outline Construction Environmental Management Plan

ROD
ROUGHAN & O'DONOVAN

Prepared by
Roughan & O'Donovan
Arena House, Arena Road, Sandyford, Dublin 18
Tel: +353 1 2940800 Fax: +353 1 2940820
Email: info@rod.ie www.rod.ie

Outline Construction Environmental Management Plan

Trinity Wharf, Wexford | February 2019

ROD
ROUGHAN & O'DONOVAN

Trinity Wharf, Wexford

Outline Construction Environmental Management Plan

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1.0 INTRODUCTION

This document sets out the Outline Construction Environmental Management Plan (OCEMP) for the construction of the Trinity Wharf Development project on behalf of Wexford County Council.

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

As a contractor has not yet been appointed the Construction Environmental Management Plan (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 OCEMP and its associated and supporting documents (see below) provide 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 the OCEMP in developing their CEMP. The key environmental aspects associated with the construction of the Trinity Wharf Development Project, the appropriate mitigation and monitoring controls, are identified in the OCEMP and its supporting documentation.

The implementation of the requirements of the OCEMP will ensure that the construction phase of the project is carried out in accordance with the commitments made by Wexford County Council in the planning application process for the development, and as required under the conditions of the planning approval. Once commenced the CEMP is considered a living document that will be updated according to changing circumstances on the project 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 will be 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; and
- managing the preparation and implementation of method statements; and
- ensuring that the Site Environmental Manager reviews all method statements and that relevant environmental protocols are incorporated and appended.

1.1.2 Site Environmental Manager (SEM)

The responsibilities of 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;
- liaison with statutory and non-statutory bodies and third parties with an environmental interest in the scheme; and
- collection and collation of CEEQUAL evidence.

1.1.3 Engineering Staff

The engineering staff's 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. Monitor operatives for compliance, including sub-contract operatives;
- implementation of 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 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.

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Project Description

The Trinity Wharf proposed development will provide a number of different land uses including; commercial leisure activities such as a hotel, marina, restaurants and bars, office space, residential housing and public realm including pedestrian & cycling facilities and a cultural centre.

The description of the proposed development and its key elements are described below:

The development comprises a mixed-use urban quarter redevelopment of a brownfield, derelict site, as well as development within the foreshore, including;

- A six-storey 120-bedroom hotel;
- A six-storey multi-storey car park with a total of 509 parking spaces;
- A five-storey residential building providing 58 apartments;
- Office Building A, five storey;
- Office Building B, five storey;
- Office Building C, five storey;
- A two-storey cultural/performance centre with event capacity for up to 400 people;
- A two-storey mixed-use restaurant/café/ specialist retail building;
- A single storey management building;
- A new vehicular entrance road with a signalised junction on Trinity Street, widening of Trinity Street, a new railway level crossing and associated works;
- A new sheet-piled sea wall around the existing Trinity Wharf site and rock armour along the south-eastern section with a rock armour revetment along the north-eastern side;
- Site infrastructure works including ground preparation works, installation of foul and surface water drainage, wastewater pumping station, services, internal roads, public realm and landscape including a public plaza with 1,000m^2 open performance / events space. A total of 146 bicycle parking spaces throughout the development of which 90 spaces are dedicated to the residential development;
- A pedestrian/cycle boardwalk/bridge (c.187m long) connecting with Paul Quay, with gradual sloped access ramps (max. 1:20 gradient) of c.55m length on Paul Quay and c.24m at the Trinity Wharf development site;

- A 64 berth floating boom marina in Wexford Harbour; and
- All other ancillary works.

2.2 Construction

2.2.1 Pre-Construction Works

- Site clearance, including removal of all asbestos containing materials;
- Erection of hoarding;
- Treatment of invasive species in accordance with Invasive Species Management Plan and compliance with all recommended biosecurity measures.

2.2.2 Main Construction Works

The main construction works consist of the following:

- Establishment of site access; temporary level crossing establishment, permanent junction construction
- Construction of sheet piling wall and rock armour revetment along south-east boundary.
- Earthworks, drainage and services, and sheet pile wall anchorage installation throughout the site.
- Boardwalk (pedestrian bridge) construction
- Marina construction
- Buildings construction

Public realm works, landscaping, construction of permanent level railway crossing.

2.2.3 Site Preparation

The site preparation works will likely be conducted through an advance works contract to be completed before construction commences on site.

Prior to any work commencing on the development site, boundary security will be required to be established around the site to prevent unauthorised access.

Non-intrusive investigations carried out to date of the site have found fragments of asbestos across the surface of the site, however the extent of which is still to be quantified. Further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site (as detailed below in Section 4.4.4.1 and 4.4.4.2 below). The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractor.

Once information from the site surveys is confirmed, the site clearance works will commence. The site clearance works will require the removal of all existing partially demolished structures which remain from the various industries which have occupied the site since the 1800s. Work will involve the clearance of the asbestos containing materials that are located above ground. This may include; loose rubble which has been left over from partial demolition of previous standing structures; and concrete and masonry walls.

All site clearance and excavation works will be required to follow the mitigation measures of this EIAR as well as any future mitigation measures to be detailed in the Remediation Strategy. For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the waste management legislation and include 'measures for working with asbestos' (Section 4.4.4.2 of this EIAR). Any ACMs discovered will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.

2.2.4 Asbestos Survey and Remediation Strategy

The 'Asbestos Survey and Remediation Strategy' are currently in progress at the time of writing this EIAR. The following sections detail the stages involved in undertaking the Asbestos Survey and Remediation Strategy, any recommendations or mitigation from these surveys and reports will be required to be incorporated into the CEMP at construction stages.

The Asbestos Survey and subsequent Remediation Strategy, as recommended by RSK (see Appendix 8.1 of this EIAR) will be required to be undertaken as follows:

(1) Prior to the start of any construction works, a site specific intrusive asbestos survey will be undertaken by a suitably qualified, licenced and experienced contractor to work with asbestos – that is being progressed at the time of writing this EIAR. The aim of the asbestos survey report is to determine the full extent, type and location of all surface and near surface ACMs and will include representative sampling as appropriate. A number of stages will occur as recommended by RSK walkover survey (detailed in Appendix 8.1) and will occur in the following order:

   a. Undertake an intrusive investigation including representative sampling as appropriate to identify any potential sub-surface asbestos contamination within the demolition material stockpiled in various locations across the site.

   b. Undertake a target intrusive investigation comprising trial pits and / or slit trenches to determine the extent of any possible asbestos in fill material and below floor slabs across the site. The site investigation will be required to be scoped to cause minimal disturbance to any surface ACMs identified and all suitable control measure implemented to prevent exposure to asbestos throughout the works. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on site of this nature.

(2) Develop a Remedial Strategy for the site on completion of the survey and investigations to detail the work required to mitigate the risks associated with asbestos contamination identified and to prevent the potential release of asbestos fibres during the proposed development works. The appointed contractor will be required to have the appropriately qualified and experienced to work with asbestos.

   a. A method statement and evidence of competencies will be required to be provided to WCC in advance of undertaking such the remedial strategy,

(3) Remediation Verification Report: All mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.

2.2.5 Measures for Working with Asbestos

All construction works will be undertaken in line with the Control of Asbestos Regulations (CAR) 2012 which requires actions to ensure the protection of workers and general public from asbestos exposures relating to work activities. CIRIA SP168 "Asbestos in soil and made ground: A guide to understanding and managing risks" as well as all relevant waste management legislation will also be adhered to by contractors.

During the site clearance works and the construction stage of the proposed development, the following mitigation measures are to be implemented, which will be in addition to standard health and safety practices on construction sites:

- **Training** – All personnel removing, overseeing, directing, inspecting and/or disturbing ACMs and asbestos-contaminated soil will have, as a minimum and as appropriate to the activity, relevant training and experience in working with asbestos and/or asbestos in soils awareness.
- **Personal Protective Equipment (PPE)** – All personnel working with or in the vicinity of areas where asbestos is suspected or has been previously identified must wear personal protective equipment to include disposable category 5 coveralls.
- **Air monitoring** will be conducted during the disturbance of suspected ACMs as part of the site clearance works and during construction works. Where air monitoring is required it must be carried out by a UKAS accredited analyst in accordance with the method set out in HSG248 Asbestos; The Analysts' Guide for Sampling Analysis and Clearance Procedures.
- **Dust Suppressant** – Asbestos and Vehicle Management will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Where material is to be stored on site it will be kept covered with polyethylene sheeting or sprayed with sufficient amounts of water to prevent drying out and dust generation.
- **Access and Vehicle Management** – A site wide traffic management system will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Internal site routes will be agreed with the Main Contractor and asbestos contractor in advance of the works and all surfaces will be subject to regular inspection.
- Any haulage trucks transporting ACMs must be properly covered and sealed to ensure that no spillages can occur en-route. All haulage trucks must be inspected by the asbestos supervisor prior to transport and leaving site.
- **Decontamination of Plant –** All plant and machinery, which is to be used in the removal of surface ACMs or disturbance of soils containing asbestos, will be fully decontaminated before leaving the area. No plant will be allowed to leave the works area until it has been decontaminated and passed a visual assessment by a competent person.
- **Decontamination of Personnel –** It must be assumed that clothing and equipment that has come into contact with asbestos is contaminated and must be treated as such. A designated area with appropriate welfare facilities should be provided for personnel to change into PPE and RPE prior to any asbestos remedial works commencing.
- **Waste Management –** Any handpicked asbestos debris and used coveralls, disposable masks and filters will be double-bagged in red and clear bags, labelled appropriately and stored in a designated container on site. The container will be secured and kept locked at all times. All asbestos waste will be

removed by an appropriately licensed waste contractor. All waste transfer documentation will be retained by the contractor and copies provided to the Project Manager and appointed environmental consultant. Any waste from the cleaning down and decontamination of plant and equipment will also be disposed of to a suitable licensed facility.

- **Unexpected discovery of asbestos -** If suspect asbestos-contaminated soils or materials are discovered during the construction phase in areas not previously identified or suspected, or in quantities not previously identified or suspected, the contractor will stop work immediately and leave the area until specialist advice is sought by the appointed asbestos consultant that is suitably qualified, experienced and licenced. The area will be demarcated with barrier tape, or other means, and access restricted.

During the construction phase, these measures are to apply to elements of the works that are likely to encounter ACMs during its construction, such as the foul water pumping station, breaking up of the existing sea wall (where necessary) and the excavation works required to construct foul drains and other elements of the main site works.

2.2.6 Design Approach to Asbestos Risk Mitigation

The approach taken to the management of risk of ACMs on the Trinity Wharf site is to minimise exposure to ACM materials by design. In so far as is possible, the development has been designed, and will be detailed, to avoid disturbance of buried ACMs and to leave them in-situ.

Some design decisions that will achieve this aim are summarised as follows:

- Advance clearance works by a specialist asbestos contractor to remove all surface asbestos fragments;
- Cap the existing site with a barrier layer and fill above (to average total of c. 1.5m depth) with granular imported fill material;
- Foundations for all buildings will be constructed on driven piles, thereby avoiding exposure to potentially asbestos-contaminated arisings;
- Service trenches will be generally shallow and will be within the granular fill layer. During the detailed design stage, the locations of deeper trenches or chambers will avoid areas of asbestos contamination, where possible; and
- Pending receipt of intrusive investigation data, it is assumed that there is asbestos present below existing concrete floor slabs visible on the site. Therefore, it is proposed that these concrete slabs will be left in-situ, in so far as is possible, in order to minimise the potential health hazards involved in breaking the slab.

The asbestos surveys and the remediation strategy (described above) will confirm the required approach at detailed design stage. Where ACM disturbance is unavoidable, e.g. if buried ACMs are discovered at the location of the foul pumping station or deeper service trenches, excavation will be carried out by a suitably qualified, experience and licenced contractor under the supervision of the Site Environmental Manager (SEM) and the excavations made safe to prevent exposure of subsequent construction workers to ACM risk. In the event of ACMs having to be excavated, these will be dealt with in accordance with best practice standards by suitably qualified and trained personnel and disposed of to a licenced facility, as required.

2.2.7 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. These include but are not limited to:

- Roadstone, Kilinick, Co. Wexford – to the south of Wexford off the N25;
- Aidan Egan Sand & Gravel, Finchogue, Enniscorthy, Co. Wexford – north of Wexford Town to the east of Enniscorthy; and
- Boggan Sand & Gravel, Kilmacree, Drinagh, Wexford – immediately south of Wexford Town off the N25.

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

2.2.8 Working in the Special Area of Conservation (SAC)

Consultations

Consultation has taken place with the National Parks and Wildlife Services (NPWS) and the Inland Fisheries Ireland (IFI) and their comments/observations with regard to measures and controls for water quality protection have been adopted within this plan.

2.3 Project Programme

It is likely that the construction of the proposed development will be progressed as a single construction contract with the construction phase potentially lasting 80 months (6 – 7 years).

The development is proposed to be carried out in several phases with the first phase of the works being procured and carried out by Wexford County Council and the following phases being privately developed. The following is the outline of the proposed phasing:

Phase 1- Enabling Works

- Construct access road from Trinity Street to the Dublin Rosslare railway line;
- Construction of new CCTV level crossing (By Irish Rail);
- Bring site to formation level;
- Sea Wall;
- Construct services throughout the public realm areas of the site;
- Construct access roads, footpaths, public spaces and landscaping to Phase 1 areas and temporary car parking;
- Temporary car parking and temporary grassing of Phase 2 sites; and
- Boardwalk from Paul Quay to Trinity Wharf site.

Phase 2- Buildings & Marina

- Hotel;
- Office type B (on waterfront);
- Cultural & performance building
- Marina

Phase 3 – Buildings

- Roads, footpaths and public spaces and landscaping to remaining buildings;
- Remaining buildings

The above proposed phasing is how the site is envisaged to be developed. The order of which may however be subject to change as development commences on site.

3.0 OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The CEMP will be developed by the contractor to meet the requirements of ISO 14001 and all site works will be undertaken in compliance with the CEMP. The CEMP shall include details of the topics listed below, further information on which is given in the following section.

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

The Construction Environmental Management Plan (CEMP) details 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 Special Area of Conservation (SAC), Special Protection Area (SPA) and Water Quality. 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.

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 (SAC and SPA), 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 within the Environmental Impact

Statement, the Contract Documentation, Planning conditions imposed by the local authority, and conditions identified by Statutory Authorities with regards mitigation of potential 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 waterbodies. This includes dry drains and ditches capable of carrying water, for the protection against ingress of suspended solids or any pollutant.
- Air emissions;
- Noise & Vibration emissions;
- Light emissions;
- Sanitary and domestic sewage discharge;
- Waste generation;
- Treatment of contaminated materials;
- Treatment of Asbestos Containing Materials;
- Treatment of invasive species;
- Use of hazardous materials;
- Energy usage;
- Water usage;
- Discharge of waste water;
- Traffic generation;
- Biodiversity;
- Landscape and Visual impacts;
- Hydrogeology;
- Archaeology and Cultural Heritage;
- Architectural Heritage.

3.3 Project Organisation and Responsibilities

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

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

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

Project Manager

The Project Managers 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:

- Have regard to all legislation and guidance in relation to protection of the environment with particular focus on the habitats and species of the European protected sites.
- 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;
- Liaising with WCC on all Method Statements, any alternations 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, An Bord Pleanála and Planning Service 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 PP and the provision of information on environmental management during the construction of the Trinity Wharf Development Project;
- 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 woks are undertaken in accordance with the relevant legislation;
- 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 a 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 tool box 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 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.
- Have regard for best practice documentation including but not limited to the NRA/TII Environmental Assessment and Construction Guidelines.

Design Manager

The main duties and responsibilities of the Design Manger having regard to the implementation of the Construction Environmental Management Plan (CEMP):

- Be familiar with the CEMP and relevant documentation referred to within;
- 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.
- Attending Environmental review Meeting 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;

- 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;
- 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 projected meetings which follow a set agenda incorporating 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 Environmental Policy and Environmental Management Plan, goals and objectives;
- 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 constrains to specific jobs;
- Location of and sensitivity of Special Area of Conservations, Special Protection Areas, protected monuments, structures etc.;
- 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 particular to the Trinity Wharf Development, including the impact on bird populations and 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 EPA/Local Authority (LA) for regulator response. Identification of registered / accredited spill cleanup 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 were necessary the relevant Environmental Specialist. All method statements for works in, near or liable to impact on a waterway must have prior agreement with IFI and NPWS.

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 marinated by the SEM and his 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 Site Environmental Manager will undertake periodic inspections and complete an assessment of the projects 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 members of the pubic 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

The An Bord Pleanála (ABP) consent and all other licences and consents shall be complied with and enclosed in an Appendix to the CEMP. Chapter 18 of the EIAR which contains all of the mitigation measures contained within the EIAR along with any additional measures included at the Oral Hearing and contained in the Schedule of Commitments will be incorporated into the CEMP and appended to the CEMP.

4.0 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 outline 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 Section 6.1 details the key mitigation measures which are outlined in the NIS, while Section 6.2 details the key mitigation measures which are outlined in the EIAR.

4.1 Mitigation Measures – Natura Impact Statement

4.1.1 Water Quality

Construction Phase

The following mitigation measures relating to the protection of water quality shall apply during the construction of the proposed development.

Sedimentation and surface water run-off

- In order to attenuate flows and minimise sediment input into Wexford Harbour in 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 Wexford Harbour.
- Sheet piling for the new seaward site boundary shall be installed prior to any excavation on the landward side (other than the access road and level crossing) and demolition of the existing wharf boundary. This will form an effective barrier to run-off from the site during construction.
- Any material stockpiled shall be located a minimum of 30 m from the seaward boundary of the site and shall also be covered and remain stockpiled for as short a time as possible.
- The Contractor shall provide method statements for weather and tidal/storm surge forecasting and continuous monitoring of water levels in the River Slaney and Wexford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events.

Cementitious materials

The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of input of cementitious material into Wexford Harbour during construction. However, the following measures shall also apply:

- All shuttering shall be securely installed and inspected for leaks prior to concrete being poured and all pouring operations shall be supervised monitored for spills and leaks at all times.
- In order to eliminate any remaining risk of input of cementitious material into the River Slaney, 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.
- In order to prevent input of cementitious materials into the River Slaney from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible.

- 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 such materials collected on these platforms shall be disposed of in accordance with the Construction & Demolition Waste Management Plan (C&D-WMP) (Appendix G to the NIS).

Hydrocarbons and other chemicals

The measures prescribed with regard to surface water run-off will also minimise the risk of input of hydrocarbons or other chemicals into Wexford Harbour during the construction. However, the following measures shall also apply:

- Land-based vehicles and plant shall be refuelled off-site, where possible.
- All land-based fuelling of machinery shall be undertaken on an impermeable base in bunded areas at least 50 m from the seaward boundary of the site.
- Marine based fuelling will only be undertaken using specifically designed nozzles to prevent spillages and spill kits will be available.
- All fuelling equipment shall be regularly inspected and serviced.
- Any petrol- or diesel-fuelled pumps or other machinery shall be located within temporary bunded units.
- Standing plant and machinery shall be placed on drip-trays.
- All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impermeable base which shall be bunded to 110% capacity and appropriately secured.
- All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery.
- Spill kits shall be available on site during construction, including on the jack-up barge during pile driving.
- All waste oils, empty oil containers and hazardous wastes shall be disposed of in accordance with the Waste Management Act, 1996 (as amended).
- Owing to the presence of contaminants within the construction site, excavation shall be limited to the absolute minimum necessary.

Painting of the boardwalk

- Paints containing organotin compounds, e.g. TBT, shall not be permitted.
- In order to minimise the risk of paint spillage into Wexford Harbour, the majority of the deck shall be painted over land, prior to be lifted into position over the estuary, and painting of the remaining sections (mostly at joining points) shall be carried out above bunded platforms which will capture any spilled paint.

Any construction-phase water quality impacts remaining following the inclusion of the above mitigation measures are considered to be slight to imperceptible and the risk of such impacts occurring is considered to be negligible. Therefore, given the full and proper implementation of these measures, construction of the proposed development will not give rise to any adverse effects in terms of water quality on the Conservation Objectives of the Slaney River Valley SAC or the Wexford Harbour and Slobs SPA.

Operational Phase

As explained in Section 4 of the NIS, the only element of the operation or maintenance of the proposed development with the potential to give rise to significant water quality impacts and is the repainting of the boardwalk. In order to eliminate the risk of such impacts, the measures prescribed in relation to painting of the boardwalk during the construction phase shall apply also to repainting during the operational phase.
In addition, in order to further reduce the risk to water quality in Wexford Harbour owing to the operation of the marina, sewage pump-out facilities and their associated pipes and equipment shall be regularly inspected and serviced. This measure will minimise the risk of a failure at these facilities, which could lead to input of waste water into the estuarine environment.

Given the full and proper implementation of these water quality protection measures, the operation and maintenance of the proposed development will not give rise to any adverse effects in terms of water quality on the Conservation Objectives of the Slaney River Valley SAC or the Wexford Harbour and Slobs SPA.

4.1.2 Noise and Vibration

Construction phase

Seasonal restriction of pile driving for the boardwalk, marina and sea wall

In accordance with the mitigation hierarchy, it is considered that the primary method of mitigating adverse effects on migratory fish species arising from noise and vibration impacts during the construction of the proposed development is to schedule construction activities with potential to give rise to such impacts, i.e. piling for the boardwalk, marina and sea wall, in the periods of least sensitivity for these species. The life and diel cycles of the migratory fish species listed as Qualifying Interests of the Slaney River Valley SAC are described in Section 4.2.2 of the NIS and also presented graphically in Table 4.1 below.

Table 4.1 Indicative migration periods for Sea Lamprey, River Lamprey, Twaite Shad and Atlantic Salmon in Wexford Harbour. Blue indicates predominantly nocturnal activity; orange indicates predominantly diurnal activity; shade indicates relative abundance.

Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sea Lamprey												
Upstream												
Downstream												
River Lamprey												
Upstream												
Downstream												
Twaite Shad												
Upstream												
Downstream (spent)												
Downstream (0+)												
Atlantic Salmon												
Upstream												
Downstream (kelts)												
Downstream (smolts)												

As illustrated in Table 4.1 above, every month of the year is a sensitive period for at least two of the migratory fish species concerned. However, the period from February to May, inclusive, is particularly sensitive as it covers the following:

- Most of the upstream migration of Sea Lamprey;
- A potentially significant portion of the upstream migration of River Lamprey and almost all of the downstream migration of that species;
- Potentially the entire upstream (spawning) migration of Twaite Shad (particularly sensitive as this species is predominantly diurnal); and,
- Almost the entire seaward migration of Atlantic Salmon smolts, a significant part of the upstream migration of spawning adult salmon and the second half of the seaward migration of kelts.

The remaining period, i.e. from June to January, inclusive, covers:

- A small part of the upstream migration of Sea Lamprey and the entirety of the downstream migration of this species;
- The majority of the upstream migration of River Lamprey and a small part of the downstream migration of this species (as well as potential residency of adults in the estuary);
- A very small portion of the upstream migration of Twaite Shad (in the event of late spawning), the entire downstream migration and estuarine shoaling of spent fish, the arrival of 0+ fish and residence of juveniles in the estuary; and,
- A significant part of the upstream migration of Atlantic Salmon grilse, the first half of the seaward migration of kelts and the tail end of the out-migration of smolts.

Owing to the relatively large size of the individuals of Sea Lamprey, River Lamprey and Atlantic Salmon likely to be present in the vicinity of the proposed development during the June-January period, the fact that these are hearing generalist species and that piling will take place during normal working hours (outside of the hours of greatest sensitivity for these nocturnal species), any residual effects on these species arising from hydroacoustic impacts are slight. However, further mitigation is recommended to ensure that any such effects are imperceptible and not significant.

However, juvenile Twaite Shad are likely to be present in the vicinity of the proposed development in significant numbers during construction. As these fish are diurnal, hearing specialists and of small body mass, they are particularly vulnerable to hydroacoustic impacts.

Restriction of pile driving hours for the boardwalk, marina and sea wall

Given the importance of the hours of darkness for the spawning migrations of Sea Lamprey, River Lamprey and Atlantic Salmon, driving of tubular piles for the boardwalk, marina and the vibratory piling of sheet piles around the perimeter of the site during the period from October to January, inclusive, shall be restricted to between 8:00 am and 6:00 pm. In order to provide relief from piling noise to fish migrating during daylight hours, such activities shall be restricted to weekdays only. These measures will ensure that almost no individuals of these species, i.e. lampreys and salmon, are halted in their migration for any period of time. Given these restrictions and the low sensitivity of these fish to noise impacts (given their relatively large body mass and the fact that they are hearing generalists), the effects on these species of any remaining hydroacoustic impacts are imperceptible.

These restrictions will also prevent impacts on Twaite Shad of all life stages which are present in or are passing through the vicinity of the proposed development during early mornings, late evenings and weekends. However, there remains a significant risk to individual shad present in the vicinity of pile driving operations and such operations may still provide for a barrier to the migration of shad during the day on weekdays. Therefore, further mitigation is required to ensure the health and continued passage of these fish during pile driving operations.

Breaks between pile drives for the boardwalk and marina

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, a gap of c. 1 hour can be expected until the next pile is commenced, during which there will be no noise impacts. Given that the affected area (in the worst-case scenario) covers the full width of the river from c. 713m upstream to c. 713m downstream of the pile being driven (a < 1.5km length of the river) and the cruising speed of Twaite Shad of c. 0.5 m/s (Clough et al., 2004), the majority of individuals will be able to traverse the affected area during the 1-hour gaps between pile drives (in reality, as fish will likely be moving with the tide, most will be able to clear the area much faster than this). Given that most piles are expected to take 1-2 hours to complete, each followed by a 1-hour break in piling noise, these breaks are considered sufficiently regular to allow near-natural movement of shad past the construction area. These measures pertain only to the marina and boardwalk driven piles in the river/harbour, as the sheet piled sea wall will be constructed using vibratory piling method with a significantly reduced acoustic effect. Therefore, the time between the sheet piles shall be that which is required for the set-up of each subsequent drive.

In order to guarantee these gaps in noise from the driving of piles for the boardwalk and marina, WCC shall appoint a Project Ecologist to supervise these piling activities and ensure that breaks in piling are of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, that these breaks are concurrent. This mitigation will ensure that hydroacoustic impacts arising from the construction of the proposed development will not form a significant barrier to the movements of Twaite Shad. This mitigation will also benefit other species which may be moving through the area during pile driving operations.

Soft-start/ramp-up procedure for piling for the boardwalk and marina

Apart from creating barriers to migration, noise and vibration impacts arising from pile driving also have the potential to directly affect, i.e. cause injury or death, to individual fish, potentially leading to effects on population structure (as discussed in Section 4.2.2 of the NIS). Given the mitigation prescribed above in respect of barriers to migration, the only species for which direct injuries to/mortality of individuals and consequent effects on population structure are potentially significant is Twaite Shad. Such impacts are likely to occur if individuals are so close to piling operations that they are subject to an SPL_{peak} above the threshold for injury/death or SEL_{cum} increases at a rate which is too fast to allow individuals to escape.

In order to minimise the risk of such impacts, it is common practice to use a "soft-start" or "ramp-up" procedure whereby the force of impact/vibration is gradually increased over a period of c. 30 minutes, affording noise-sensitive species to move away from the source of the impact and avoid injury/death. This procedure has been deemed to be effective following its widespread application in aquatic environments where there are acoustically sensitive receptors such as cetaceans or clupeid fishes. Therefore, a 30-minute soft-start/ramp-up procedure will apply to all pile driving for the boardwalk, marina (but not the sea wall which will use vibratory piling) and be supervised and enforced by the Project Ecologist. This will ensure that any direct impacts on individual shad will not give rise to significant effects on the population structure of Twaite Shad in the Slaney River Valley SAC.

The requirement for a soft-start/ramp-up procedure does not apply to vibratory piling, however, a risk assessment will be undertaken in line with the MMRA (Appendix H to the NIS), and if underwater noise levels from vibratory piling are expected to exceed an SPL_{peak} of 170 dB re 1 µPa at 1m, a soft start approach will be adopted.

European Otter

The mitigation prescribed for hydroacoustic impacts (above) are considered 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 such impacts on this species.

Harbour Seal

The principal mitigation measures recommended by the NPWS are:

- The presenc1e of a trained and experienced Marine Mammal Observer (MMO) with accreditation (as adapted for Ireland by the IWDGC) from the Joint Nature Conservation Committee (JNCC); and,
- The use of soft-start/ramp-up procedures.

It is expected that the person appointed by WCC as the Project Ecologist would fulfil the role of the MMO. The following mitigation measures have been recommended by the IWDGC (see MMRA in Appendix H to the NIS) and are based on *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014):

(1) A qualified and experienced MMO shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.

(2) Unless information specific to the location or proposed development is otherwise available to inform the mitigation process, e.g. sound propagation or attenuation data, and a distance modification has been agreed with the Regulatory Authority, pile driving activity shall not commence if marine mammals are detected within a 500 m radial distance of the sound source, i.e. within the Monitored Zone, following the recommendations in McKeown (2014).

Pre-start monitoring

3. Pile driving activities shall only commence in daylight hours and when effective visual monitoring has been as performed by the MMO. If, as determined by the MMO, effective visual monitoring is not possible, the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the works supervisor as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation from the MMO.
5. The MMO shall conduct pre-start constant-effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone.
6. This prescribed pre-start monitoring shall be followed by an appropriate ramp-up procedure, which should include continued monitoring by the MMO.

Ramp-up procedure

7. In commencing a pile driving activity (for the boardwalk, marina or outer sea wall) where the output SPL_{peak} exceeds 170 dB re 1 µPa at 1m, an appropriate soft-start/ramp-up procedure shall be used. The procedure shall be informed by the risk assessment undertaken, giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information.
8. Where it is possible, according to the operational parameters of the equipment and materials concerned, the hydroacoustic energy output shall commence from a lower energy start-up, i.e. an SPL_{peak} not exceeding 170 dB re 1 µPa at 1m, and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes.
9. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.
10. Where the measures outlined in steps 8 and 9 are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output.
11. In all cases where a ramp-up procedure is employed, the delay between the end of ramp-up and the full output must be minimised to prevent unnecessary high-level sound introduction into the environment.
12. Once an appropriate and effective ramp-up procedure commences, there is no requirement to halt or discontinue the procedure if weather or visibility conditions deteriorate or if marine mammals occur within the Monitored Zone.

Breaks in sound output

13. In the case of all breaks in sound output longer than 30 minutes, all pre-start monitoring and a ramp-up procedures must be undertaken.
14. For higher output pile driving operations which have the potential to produce injurious levels of underwater sound, as informed by the risk assessment, there is likely to be a regulatory requirement to adopt a shorter (5-10 minutes) break limit after which all pre-start monitoring and a ramp-up procedures must be undertaken.

Reporting

15. Full reporting on MMO operations and mitigation undertaken must be provided to the Competent Authority and the NPWS.

Seal Surveys

16. Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. T hese seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines.

Operational phase

The only adverse effect in terms of noise and vibration potentially arising from the operational phase of the proposed development is the effect of disturbance to Harbour Seal from increased marine traffic associated with marina. In order to mitigate this effect, information boards shall be erected in the vicinity of the marina to advise boat owners of the importance of the site for seals, safe operating distances and signs of disturbance which should act as a cue to move away.

Non-Qualifying Interest species

It is considered that the mitigation measures prescribed in this section will also prevent significant effects on important non-Qualifying Interest species present in Wexford Harbour, including European Bass (*Dicentrarchus labrax*) and Grey Seal (*Halichoerus grypus*).

Summary

In short, the following are the mitigation measures which will apply to all marine pile driving for the boardwalk, boardwalk and outer sea wall:

- There shall be no marine pile driving permitted in the period beginning on 1st February and ending on 31st May in any year.
- All pile driving shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.
- Pile driving shall be restricted to between 7:00 am and 7:00 pm from 1st June to 30th September, inclusive, and to between 8:00 am and 6:00 pm from 1st October to 31st January, inclusive.
- All breaks between pile drives (by impact hammer) shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent. This measure shall not apply to vibratory driven piles for the sea wall.
- A 30-minute soft-start/ramp-up procedure shall apply to each pile drive. This measure shall not apply to vibratory driven piles for the sea wall, as long as the SPL_{peak} is within 170 dB re 1 µPa at 1m, as described in the MMRA which is included in Appendix H to the NIS.
- A trained and experienced MMO shall be appointed to perform that function in accordance with DAHG (2014) and the MMRA.
- If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCC, the NPWS and IFI.
- All of the above measures shall be enforced by the WCC Project Ecologist and the SEM appointed by each Contractor.

4.1.3 Lighting and Shade

Migratory fishes

The likely effects of artificial lighting and shade on the migratory fish species listed as Qualifying Interests of the Slaney River Valley SAC are discussed in detail in Section 4.2.2 of the NIS. In short, light spill onto the water column 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. Owing to the nature and scale of the proposed development, there are no potential significant shading impacts.

Turning off construction lighting over the water outside of working hours will eliminate any risk of these impacts during these hours. This will eliminate the risk of lighting impacts occurring from April to September, inclusive, and restrict such impacts to between 7:00 am and 7:00 pm on weekdays and between 8:00 am and 4:30 pm on Saturdays from October to March, inclusive. This would ensure at least 12 hours free of artificial light every night of the year and more at weekends. The remaining level of artificial lighting is considered unlikely to result in the significant effects discussed above. However, the risk of such effects occurring can be minimised further still by ensuring that construction lighting is limited to the minimum area required, thereby minimising any light spill onto the estuary.

Therefore, subject to any Health & Safety or navigational requirements, all construction lighting over the estuary shall be turned off outside of working hours. In addition, all construction lighting shall be limited to the minimum area required and minimise light spill onto the estuary. The Project Ecologist will ensure that these measures are adhered to during the construction stage.

During the operational phase, lighting will be limited to the minimum area required to be lit and there will be no light spill onto the estuary. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths. All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550 nm (~3,000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on fish and other wildlife. This will prevent any effects of artificial lighting on the fish species which use the estuary.

European Otter

The mitigation prescribed above in respect of artificial lighting are considered adequate to eliminate any risk of such impacts on European Otter during the construction and operation of the proposed development. Therefore, no further mitigation is required in respect of lighting impacts on this species.

Harbour Seal

The mitigation prescribed for impacts of artificial lighting are also adequate to eliminate any risk of significant such impacts on Harbour Seal during the construction and operation of the proposed development. Therefore, no further mitigation is required in respect of lighting impacts on this species.

4.1.4 Other Measures

Biosecurity

Construction Phase

As discussed in Section 4.2.1 of the NIS, the use of construction vessels, e.g. the jack-up barge, poses a risk that coastal and marine invasive species could be introduced to or spread within Wexford Harbour. This has the potential to adversely affect the conservation condition of Annex I habitats, particularly "Estuaries" and "Mudflats and sandflats not covered by seawater at low tide", which are listed as Qualifying Interests of the Slaney River Valley SAC, and, "Wetland and waterbirds", which is listed as a Qualifying Interest of the Wexford Harbour and Slobs SPA. Therefore, the Contractor shall prepare a Biosecurity Method Statement detailing his/her proposed approach to ensuring that invasive species are not imported or spread during construction. This shall include compliance with the Invasive Species Management Plan already in place for the site. The Contractor's Biosecurity Method Statement will be approved by the Project Ecologist prior to its acceptance and implementation.

Operational Phase

The ongoing use of the marina by water craft also poses the risk that invasive species may be introduced or spread within Wexford Harbour. In order to effectively manage this risk, the following measures, which are based on *Biosecurity Guidelines for Marina Operators* (Invasive Species Ireland, 2018), shall be implemented:

- *Inspect, Remove, Dispose, Report*: Removing build-up of plants and animals from equipment and the hull of boats is effective at preventing the opportunity of colonisation by invasive species.
- Clean all parts of equipment, boats and trailer that come into contact with the water. Remove any visible plant, fish, animal matter and mud.
- Where possible, do not allow any rinse water to return to the aquatic environment (many organisms can remain viable in small or even microscopic quantities).
- Do not move fouled vessels or equipment from one waterbody to another.
- Keep records of when equipment and boats are due for anti-fouling.
- Remove all fouling prior to any long-distance journeys, especially if travelling to or from Great Britain or continental Europe.
- Watch out for hitchhikers on ropes and chains.
- Ensure proper handling of bilge water: Require that untreated bilge water not be discharged within the marina. Bilge water will contain toxic substances and may also contain invasive species.
- Ensure boats use rat guards. Rat guards prevent rats from accessing or leaving from boats via mooring lines. If rats are found on board, they should be humanely put down and not thrown overboard where they can swim to islands.

Invasive species identification guides shall be provided to marina users and updated at least annually. Relevant guides can be obtained from the following sources:

- The "Most Unwanted" section of the Invasive Species Ireland website;
- The NBDC website;
- The GB Non-native Species Secretariat; and,
- The Marine Life Information Network.

Any sightings of invasive species should be submitted to the National Biodiversity Data Centre. Any sightings of invasive species which are considered to be "high-risk" must be reported to the marina operator, who shall inform the NPWS and IFI.

It is in the interest of boat owners to keep fouling off of vessels and lines and, in doing so, protect the environment from harm caused by translocation of invasive species. The following measures help to minimise fouling of vessels:

- Keep boats in water for as short a time period as possible.
- Treat boats with appropriate anti-fouling that adheres to the boat manufacturer's recommendations.
- Ensure boats submit to yearly removal of fouling.
- When treating a boat, 100% surface cover with the chosen method is essential.
- Anti-fouling agents can be toxic to humans, aquatic organisms and terrestrial species. Any guidelines stipulated by the manufacturer must be strictly followed at all times.
- If mooring lines become heavily fouled, remove them from the water, dispose of fouling in a dustbin or skip (do not allow it to return to the aquatic environment) and allow the ropes to dry out for at least 48 hours.

The following are also recommended to achieve effective implementation:

- Display signs informing marina users of the importance of preventing the spread of invasive species and their responsibilities in this regard.
- Incorporate responsible boating practices into customer contracts and provide clear guidelines to marina users on to prevent the spread of invasive species.
- Ensure that users and the public are aware of the efforts being put in place to prevent the spread of invasive species and, thereby, protect the environment. This will help achieve compliance with the marina's biosecurity protocol.

Reuse of materials

Where feasible, any boulders, cobble or bedrock present along the shores of Trinity Wharf shall be included in the proposed rock armour or placed at the toe of the sheet pile wall along the eastern boundary of the quay as these will re-colonise more rapidly than new rock armour and will also provide an increase in habitat diversity, especially along the eastern side of Trinity Wharf.

4.1.5 Monitoring

Benthic habitat monitoring

In order to record any changes in the intertidal habitats, particularly mud habitats, in the vicinity of the Project, a photographic record shall be made of these habitats by the WCC Project Ecologist. This record shall cover the entire intertidal area from 300 m upstream of Trinity Wharf to 300 m downstream. All photographs shall be taken at low tide, every two months, beginning 6 months prior to commencement of construction and finishing 12 months after completion. This record shall be used to precisely quantify the reduction in area of "Estuaries", "Mudflats and sandflats not covered by seawater at low tide" and "Wetlands and Waterbirds" so as to inform the NPWS's reporting under Article 17 of the Habitats Directive and Article 12 of the Birds Directive.

Hydroacoustic monitoring

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 construction of the proposed development. This monitoring will establish the ambient underwater noise levels in the estuary and more accurately characterise the sound outputs in terms of SPL and SEL at different frequencies arising from the different methods of pile driving and different types and sizes of piles. This monitoring shall be undertaken on a continuous basis for the duration of construction and the results will be frequently reviewed (at least fortnightly) by the Project Ecologist, who may make appropriate adjustments/improvements to the mitigation in this NIS based on the results of this monitoring.

Water quality monitoring

Monitoring of water quality shall be undertaken in Wexford Harbour in the vicinity of the proposed development, 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:

- Total petroleum hydrocarbons (TPH), PAHs and PCBs;
- OCPs, e.g. lindane and HCB;
- Organotins, e.g. TBT;
- Heavy metals, including nickel, copper, lead, zinc, cadmium and arsenic;
- Ammonia, nitrates, nitrites and total nitrogen;

- Phosphates and total phosphorus;
- Dissolved oxygen and biological oxygen demand (BOD);
- Suspended solids and turbidity; and,
- Temperature and salinity.

Water quality 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. The final number and location of sampling points will be determined by the WCC Project Ecologist. 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 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 on an ongoing basis by the WCC Project Ecologist and Contractor's Site Environmental Manager 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 a result of the proposed development.

4.2 Implementation and Compliance

In order to ensure the full and proper implementation of the mitigation and monitoring prescribed in Section 5.2 of the NIS, it should be a condition of any consent granted in respect of the proposed development that this mitigation and monitoring be binding, during the construction phase, on the Contractors and, during operational phase, on the occupiers. All construction-phase mitigation and monitoring will be transposed into the relevant Contract Documents via a Construction Environmental Management Plan (CEMP), as per Section 4.2.1 below, and compliance with the same will be ensured by appropriate oversight, as per Section 4.2.2 below.

4.2.1 Construction Environmental Management Plan

Prior to the commencement of construction, demolition or excavation, each Contractor will be required to develop a Construction Environmental Management Plan (CEMP) in accordance with *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* (NRA, 2007). The CEMP will detail the Contractor's approach to managing environmental issues during the construction of the proposed development. In particular, the CEMP will detail how the Contractor intends to ensure full compliance with the following:

- The Schedule of Commitments.
- The mitigation prescribed in Section 5.2 of the NIS and Chapter 7 Biodiversity of the Environmental Impact Assessment Report (EIAR).
- Any conditions which might be attached to the proposed development's planning consent.
- Any requirements of stakeholders and statutory bodies, e.g. the NPWS, IFI and the IWDGC, including:
    - *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016);
    - *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014); and,

  - The MMRA prepared by the IWDGC in respect of the proposed development (see Appendix H to the NIS).
- All applicable legislative requirements in relation to environmental protection.
- All relevant construction industry guidelines, including:
  - *C744 Coastal and marine environmental site guide - 2nd ed.* (CIRIA, 2015).
  - *C532 Control of water pollution from construction sites: guidance for consultants and contractors* (CIRIA, 2001).
- The Invasive Species Management Plan (ISMP) in place for Trinity Wharf (see Appendix F to the NIS) and any other 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 Treatment of Badgers prior to the Construction of a National Road Schemes.*
  - *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.*
  - *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 Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes.*
  - *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.*
  - *Guidelines on the Management of Noxious Weeds on National Roads.*
  - *Guidelines for the Treatment of Noise and Vibration in National Road Schemes.*
  - *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.*
  - *Management of Waste from National Road Construction Projects.*
  - *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*

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

The CEMP will contain the following information of general importance:

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

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

- Management of waste arising from construction and demolition.
- Control of sediment, run-off, erosion and pollution.
- Minimisation of noise and vibration impacts.
- Minimisation of artificial lighting and shading.
- Management of risk from invasive alien species.
- Response to emergencies/other incidents, including environmental incidents.
- Awareness of the surrounding environment and the Contractor's environmental commitments among site personnel.
- Monitoring, inspection and auditing of the Contractor's compliance with his/her environmental commitments.

Other topics covered by the CEMP will include the management of construction traffic and Health & Safety issues.

All of the mitigation measures prescribed in Section 5.2 of the NIS must be effectively transposed into the appropriate sections of Contractor's CEMP. In addition, it must be acknowledged that the receiving environment is not static. Therefore, in preparing the CEMP, the Contractor must have due regard to the results of the pre-construction surveys described in Section 5.2.5 of the NIS.

The outline CEMP is included in Appendix G to the NIS. This outline CEMP will be provided to the Contractor and it will be his/her responsibility to develop his/her own CEMP based on the outline provided. Prior to its acceptance and implementation, the Contractor's CEMP will be subject to approval by the Site Environmental Manager (described in Section 5.3.2 below) and the Employer's Representative. It shall also be submitted to the NPWS, IFI and the IWDGC to ensure that all requirements of those bodies are satisfied.

4.2.2 Inspection and Monitoring

Site Environmental Manager

In order to ensure the successful development and implementation of the CEMP, each Contractor will appoint an independent Site Environmental Manager (SEM). The SEM 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 or management; and,
- Competency in the management of asbestos-related risks during construction.

The principal functions of the SEM are:

- To ensure that the mitigation and environmental commitments referred to in Section 4.2.1 above are fully and properly implemented in the development and implementation of the CEMP; and,
- To monitor the effectiveness of the various aspects of the CEMP and provide independently verifiable audit reports in respect of the same.

Separate from the on-going and detailed monitoring carried out by the Contractor, each SEM will carry out the following inspection and monitoring on behalf of WCC:

- Daily reporting on weather and tide/surge forecasting and continuous monitoring of water levels in the River Slaney and Wexford Harbour.
- Daily visual inspections of all outfalls from the construction site to surface waters and all surface waters in the vicinity of the site.
- Daily inspections of all construction site surface water treatment measures, e.g. ponds, tanks, mini-dams and sandbags.
- Daily inspections of material borrow/deposit areas while in operation and weekly inspections thereafter.
- Weekly inspections of the principal control measures described in the CEMP and reporting of findings to the Contractor.
- Weekly inspections of wheel-wash facilities.
- Weekly monitoring of stockpiles (daily during filling or emptying).
- Frequent (at least fortnightly) auditing of the Contractor's monitoring results.

The results of the SEM's inspections and monitoring will be stored in his/her monitoring file and will be made available for inspection or audit by WCC, the NPWS or IFI at any time.

Project Ecologist

In order to ensure the successful development and implementation of the CEMP, WCC will appoint an independent Project Ecologist to supervise the entire proposed development. The Project Ecologist 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;
- MMO accreditation from the JNCC, as adapted for Ireland by the IWDGC; and,
- Competency in invasive species management.

The principal functions of the Project Ecologist are:

- To develop and collect the necessary pre construction baseline information.
- To perform the role of MMO during all piling for the boardwalk, marina and outer sea wall and any other activities likely to give rise to noise and vibration impacts on marine mammals, i.e. seals, dolphins, porpoises and otters, in accordance with DAHG (2014) and the MMRA for the proposed development (Appendix H to the NIS); and,
- To carry out weekly inspections and report on the implementation of the existing ISMP (Appendix F to the NIS) and the Contractor's Biosecurity Method Statement.

During the preparation of each Contractor's CEMP, the SEM may, as appropriate, assign other duties and responsibilities to the Project Ecologist .

In exercising his/her functions, the Project Ecologist will be required to keep a monitoring file and this will be made available for inspection or audit by WCC, the NPWS or IFI at any time. In his/her capacity as MMO, the Project Ecologist will log all data and file reports using the standardised forms provided in Appendix 7 to DAHG (2014).

4.3 Mitigation Measures – Environmental Impact Assessment Reports

The mitigation measures from the EIAR are included in Appendix A herein. Note that this is a direct replication of Volume 2 Chapter 18 if the EIAR.

5.0 SUMMARY

This Outline CEMP is indicative only, however, it is expected that the final CEMP to be prepared by the Contractor will incorporate the items outlined above and ensure that all requirements identified as part of the planning consents will be included in the CEMP.

Appendix A - Chapter 18 Mitigation Measures (Volume 2 of EIAR)

Chapter 18 Mitigation Measures

18.1 Introduction

Mitigation measures are the measures proposed in order to avoid, reduce or, where possible, remedy the significant adverse environmental effects of the proposed Trinity Wharf Development. 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 Trinity Wharf Development as contained within chapters 4 – 17 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 Trinity Wharf Development and does not address the avoidance or reduction mitigation which has been applied through the design development.

18.2 General Mitigation and Monitoring Measures

Table 18.1 General Mitigation and Monitoring Measures

No.	Description
1.1	**Site Preparation Works** Prior to any work commencing on the development site, a boundary security will be required to be established around the site to prevent unauthorised access.
1.1.1	Further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site. The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractor.
1.1.2	All site clearance and excavation works will be required to follow the mitigation measures of this EIAR (Chapter 4 and 8) as well as any future mitigation measures to be detailed in the Remediation Strategy. For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the 'measures for working with asbestos'. Any ACMs discovered will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.
1.2	The '**Asbestos Survey and Remediation Strategy'** are currently in progress at the time of writing this EIAR. The following sections detail the stages involved in undertaking the Asbestos Survey and Remediation Strategy, any recommendations or mitigation from these surveys and reports will be required to be incorporated into the CEMP at construction stages. The Asbestos Survey and subsequent Remediation Strategy, as recommended by RSK (detailed in Appendix 8.1 of this EIAR) will be required to be undertaken as follows:
1.2.1	Prior to the start of any construction works, a site specific intrusive asbestos survey will be undertaken by a suitably qualified, licenced and experienced contractor to work with asbestos – that is being progressed at the time of writing this EIAR. The aim of the asbestos survey report is to determine the full extent, type and location of all surface and near surface ACMs and will include representative sampling as appropriate. A number of stages will occur as recommended by RSK walkover survey (detailed in Appendix 8.1) and will occur in the following order:

No.	Description
	a) Undertake an intrusive investigation including representative sampling as appropriate to identify any potential sub-surface asbestos contamination within the demolition material stockpiled in various locations across the site. b) Undertake a target intrusive investigation comprising trial pits and / or slit trenches to determine the extent of any possible asbestos in fill material and below floor slabs across the site. The site investigation will be required to be scoped to cause minimal disturbance to any surface ACMs identified and all suitable control measure implemented to prevent exposure to asbestos throughout the works. The investigation should only be undertaken and supervised by personnel suitably qualified to work with asbestos on site of this nature.
1.2.2	Develop a Remedial Strategy for the site on completion of the survey and investigations to detail the work required to mitigate the risks associated with asbestos contamination identified and to prevent the potential release of asbestos fibres during the proposed development works. The appointed contractor will be required to have the appropriately qualified and experienced to work with asbestos. a) A method statement and evidence of competencies will be required to be provided to WCC in advance of undertaking such the remedial strategy.
1.2.3	Remediation Verification Report: All mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.
1.3	**Measures for Working with Asbestos** All construction works will be undertaken in line with the Control of Asbestos Regulations (CAR) 2012 which requires actions to ensure the protection of workers and general public from asbestos exposures relating to work activities. CIRIA SP168 "Asbestos in soil and made ground: A guide to understanding and managing risks" as well as all relevant waste management legislation will also be adhered to by contractors. During the site clearance works and the construction stage of the proposed development, the following mitigation measures are to be implemented, which will be in addition to standard health and safety practices on construction sites: **Training –** All personnel removing, overseeing, directing, inspecting and/or disturbing ACMs and asbestos-contaminated soil will have, as a minimum and as appropriate to the activity, relevant training and experience in working with asbestos and/or asbestos in soils awareness. **Personal Protective Equipment (PPE)** – All personnel working with or in the vicinity of areas where asbestos is suspected or has been previously identified must wear personal protective equipment to include disposable category 5 coveralls. **Air monitoring** will be conducted during the disturbance of suspected ACMs as part of the site clearance works and during construction works. Where air monitoring is required it must be carried out by a UKAS accredited analyst in accordance with the method set out in HSG248 Asbestos; The Analysts' Guide for Sampling Analysis and Clearance Procedures. **Dust Suppressant** – Asbestos and Vehicle Management will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Where material is to be stored on site it will be kept covered with polyethylene sheeting or sprayed with sufficient amounts of water to prevent drying out and dust generation. **Access and Vehicle Management** – A site wide traffic management system will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Internal site routes will be agreed with the Main Contractor and asbestos contractor in advance of the works and all surfaces will be subject to regular inspection. Any haulage trucks transporting ACMs must be properly covered and sealed to ensure that no spillages can occur en-route. All haulage trucks must be inspected by the asbestos supervisor prior to transport and leaving site.

No.	Description
	Decontamination of Plant - All plant and machinery, which is to be used in the removal of surface ACMs or disturbance of soils containing asbestos, will be fully decontaminated before leaving the area. No plant will be allowed to leave the works area until it has been decontaminated and passed a visual assessment by a competent person. **Decontamination of Personnel** - It must be assumed that clothing and equipment that has come into contact with asbestos is contaminated and must be treated as such. A designated area with appropriate welfare facilities should be provided for personnel to change into PPE and RPE prior to any asbestos remedial works commencing. **Waste Management** - Any handpicked asbestos debris and used coveralls, disposable masks and filters will be double-bagged in red and clear bags, labelled appropriately and stored in a designated container on site. The container will be secured and kept locked at all times. All asbestos waste will be removed by an appropriately licensed waste contractor. All waste transfer documentation will be retained by the contractor and copies provided to the Project Manager and appointed environmental consultant. Any waste from the cleaning down and decontamination of plant and equipment will also be disposed of to a suitable licensed facility. **Unexpected discovery of asbestos** – If suspect asbestos-contaminated soils or materials are discovered during the construction phase in areas not previously identified or suspected, or in quantities not previously identified or suspected, the contractor will stop work immediately and leave the area until specialist advice is sought by the appointed asbestos consultant that is suitably qualified, experienced and licenced. The area will be demarcated with barrier tape, or other means, and access restricted. During the construction phase, these measures are to apply to elements of the works that are likely to encounter ACMs during its construction, such as the foul water pumping station, breaking up of the existing sea wall (where necessary) and the excavation works required to construct foul drains and other elements of the main site works.
1.4	**Design Approach to Asbestos Risk Mitigation** The approach taken to the management of risk of ACMs on the Trinity Wharf site is to minimise exposure to ACM materials by design. In so far as is possible, the development has been designed, and will be detailed, to avoid disturbance of buried ACMs and to leave them in-situ. Some design decisions that will achieve this aim are summarised as follows: • Advance clearance works by a specialist asbestos contractor to remove all surface asbestos fragments; • Cap the existing site with a barrier layer and fill above (to average total of c. 1.5m depth) with granular imported fill material; • Foundations for all buildings will be constructed on driven piles, thereby avoiding exposure to potentially asbestos-contaminated arisings; • Service trenches will be generally shallow and will be within the granular fill layer. During the detailed design stage, the locations of deeper trenches or chambers will avoid areas of asbestos contamination, where possible; and • Pending receipt of intrusive investigation data, it is assumed that there is asbestos present below existing concrete floor slabs visible on the site. Therefore, it is proposed that these concrete slabs will be left in-situ, in so far as is possible, in order to minimise the potential health hazards involved in breaking the slab. The asbestos surveys and the remediation strategy (described above) will confirm the required approach at detailed design stage. Where ACM disturbance is unavoidable, e.g. if buried ACMs are discovered at the location of the foul pumping station or deeper service trenches, excavation will be carried out by a suitably qualified, experience and licenced contractor under the supervision of the Site Environmental Manager (SEM) and the excavations made safe to prevent exposure of subsequent construction workers to ACM risk. In the event of ACMs having to be

No.	Description
	excavated, these will be dealt with in accordance with best practice standards by suitably qualified and trained personnel and disposed of to a licenced facility, as required.
1.5	**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 a construction project. An Outline Construction Environmental Management Plan has also been prepared as part of this EIAR, see Appendix 4.1. The CEMP will be prepared 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 Construction Erosion and Sediment Control Plan (CESCP), Environmental Operating Plan (EOP) and the Construction and Demolition Waste Management Plan (C&D WMP). The Contractors will be required to include details under the following headings: • 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); • Site run-off management; • Noise and vibration management to prevent nuisance (demolition & construction); • Landscape management; • Management of all contaminated land including asbestos and assessment of risk for same by suitably qualified, trained and licenced personnel; • Management of demolition of all structures and assessment of risks for same; • Stockpiles; • Project procedures & method statements for; o Site clearance, site investigations, excavations and working with asbestos containing materials (ACMS); o Management and removal of ACMs; o Demolition & removal of buildings, services, pipelines (including risk assessment and disposal); o Diversion of services; o Excavation and blasting (through peat, soils & bedrock); o Piling; o Construction of pipelines; o Temporary hoarding & lighting; o Borrow Pits & location of crushing plant; o Storage and Treatment of peat and soft soils; o Disposal of surplus geological material (peat, soils, rock etc.);

No.	Description
	o Earthworks material improvement; o Protection of watercourses from contamination and silting during construction; • Site Compounds. 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.
1.6	**Environmental Operating Plan** The Environmental Operating Plan (EOP) is defined as 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 a construction project. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractors during the project 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 An Bord Pleanála's decision will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment. Before any works commence on site, the Contractor will be required to prepare an Environmental Operating Plan (EOP) in accordance with the TII/NRA *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. The EOP will set out the Contractors approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include: • All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services as well as a method documenting compliance with the measures; • A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and • Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse 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.
1.7	The TII/NRA Environmental and Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction on National Road Schemes for the following: • Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes; • Guidelines for the Treatment of Bats during the Construction of National Road Schemes; • Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes; • Guidelines 1.6.1for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes; • Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes; • 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;

No.	Description
	• Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes; • Guidelines for the Management of Waste from National Road Construction Projects; • Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan. This is a non-exhaustive list and relevant guidance current at the time of construction will be followed. It is proposed to employ these guidelines, as and where relevant, on the Trinity Wharf project.
1.8	Included within the EOP will be the Construction & Demolition Waste Management Plan (C&D WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline C&D WMP has been prepared for the proposed road development. The C&D WMP is a live document that will be amended and updated to reflect current conditions on site as the project progress. The obligation to develop, maintain and operate a Waste Management Plan will form part of the contract documents for the project. The plan itself will contain (but not be limited to) the following measures: • Details of waste storage to be provided for different waste; • Details of where and how materials are to be disposed of - 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.

18.3 Mitigation and Monitoring Measures for Traffic and Transport

Table 18.2 Mitigation and Monitoring Measures for Traffic and Transport

No.	Description
2.1	**Transportation Mobility Management Plan** A Mobility Management Plan has been prepared for the proposed development. The purpose of the Mobility Management Plan is to assist the tenants achieve a modal shift away from single occupant vehicles as a means of getting to and from work. A modal shift will ease the pressure on traffic and car parking facilities surrounding the site. The primary elements of the Transportation Mobility Management Plan are; • An assessment of the development in terms of its accessibility by all modes of transport, • Recommendations consisting of physical measures and good working practices that encourage and make it easier for staff and visitors to travel to the site by public transport, car sharing, walking or cycling, • Setting modal split targets with on-going monitoring and assessment.
2.2	**An Accessibility Implementation Plan** will be prepared by the organisers if an event held at the cultural performance building coincides with office working hours. The objective of the Accessibility Implementation Plan is to ease transport and parking pressures on the site and on the surrounding network. The main elements of the Accessibility Implementation Plan will; • Implement the VMS system at the site entrance to provide real time information on the availability of parking within the site.

No.	Description
	• Provide details of alternative Town Centre car parks. The plan will ensure that event attendees are advised of other events in the town centre that may affect the availability of Town Centre car parking. • Notify attendees of the on-site parking limitations and encourage the use of alternative modes of transport such as public transport. The plan will ensure adequate public transport is scheduled to service the event. • Plan coach parking arrangements.
2.3	**A Construction Environmental Management Plan (CEMP)** in accordance with the Outline CEMP provided as Appendix 4.1 of this EIAR and an associated Construction Traffic Management Plan (CTMP) will be prepared by contractor(s) in consultation with the developer and Wexford County Council to confirm the nature of any and all mitigating road works; the programme for deliveries during the construction period; and, any and all mitigating traffic management measures, prior to commencing any works at the proposed development site. The CTMP will detail environmental measures aimed at minimising adverse environmental effects associated with traffic and transport during construction. Maintaining access for emergency services during the course of the construction programme will also be considered and included as part of the Construction Traffic Management Plan. It is acknowledged that the Construction Traffic Management Plan will include a requirement that the condition of the road infrastructure on the access routes to and from the site via the urban road network will be recorded before and after completion of the construction phase. 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, the access road and Trinity Street 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. Additional measures will also be required to minimise potentially significant environmental effects occurring from the transportation of construction materials such as: • Ensuring the proper transport of materials e.g. vehicle loads will be enclosed or covered with tarpaulin to restrict the escape of particulate matter; and • Proper servicing and maintenance of vehicles will be undertaken to avoid any leaks or spills of oil, petrol or concrete.

18.4 Mitigation and Monitoring Measures for Population and Human Health

Table 18.3 Mitigation and Monitoring Measures for Population and Human Health

No.	Description
3.1	All mitigation measures detailed in Chapter 4 Description of the Proposed Development of this EIAR will be required to be implemented. A CEMP and an associated Construction Traffic Management Plan will be developed to address all modes of transport and will be agreed with Wexford County Council prior to the

No.	Description
	construction stage. The TMP will be required to maximise the safety of the workforce and the public and minimise traffic delays, disruption and maintain access to properties. • The Construction Traffic Management Plan will be required to maximise the safety of the workforce and the public and to minimise traffic delays, disruption and maintain access to properties; • The Construction Traffic Management Plan will also address temporary disruption to traffic signals, footpath access and the management of pedestrian crossing points; • The Construction Traffic Management Plan will be developed and agreed with Irish Rail; • The contractor will provide an appropriate information campaign for the duration of the construction works; and • The Construction Traffic Management Plan will be required to minimise disruption to economic amenities, marine users and residential amenities. The Plan will be approved by Wexford County Council prior to construction and will ensure access is maintained along Trinity Street for vehicles, pedestrians, cyclists and economic operators at all times.
3.2	Appropriate measures relating to working at heights and near water will be included as part of the EOP. Ringbuoys will be installed and maintained as part of construction design stage in consultation with search and rescue organisations in the area;
3.3	The CEMP will be prepared by the Contractor during the pre-construction phase to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the CESCP, EOP and the CDWMP;
3.4	A Transportation Mobility Management Plan will be developed and will address all modes of transport required as part of the construction stages i.e. road and Wexford Harbour. This will include details regarding haulage routes and construction compounds;
3.5	The contractor will be required to develop and implement a Stakeholder Management and Communication Plan which will be agreed with Wexford County Council prior to the construction stage. • All stakeholders will be required to be agreed with Wexford County Council prior to construction commencing; and • 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 of the nature and duration of construction works;
3.6	In order to minimise air quality impacts within the community, a Dust Management Plan will be implemented. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of this plan, as detailed in Chapter 13 Air Quality and Climate in this EIAR;
3.7	Noise and vibration mitigation measures are discussed in detail in Chapter 12 Noise and Vibration of this EIAR. A comprehensive Construction Management Plan, which includes adopting appropriate mitigation measures, will manage the risk of noise impacting the local community. The contractor will work within stringent construction limits and guidelines to protect residential and commercial amenities, including the application of binding noise limits and hours of operation. These measures will ensure that noise and vibration impacts will be reduced as far as possible.
3.8	The contractor will be required to implement a vibration monitoring programme at a select number of the nearest residential properties during the most critical phase(s) of construction e.g. pile driving.
3.9	An Accessibility Implementation Plan (AIP) will be prepared by the organisers if an event is held at the cultural performance building which coincides with office working hours. The objective of the AIP is to ease transport and parking pressures on the

No.	Description
	site and on the surrounding network. The AIP will involve a Variable Message Sign (VMS) system which can provide real time information on the availability of parking within the site and provide details of alternative car parks elsewhere. The plan will be required to ensure adequate public transport is scheduled to service the event.
3.10	A Transportation Mobility Management Plan will be developed in order to identify the measures that will be implemented to promote sustainable modes of transport and reduce the use of the private car in accordance with Smarter Travel Policy. This should include details of Workplace Travel Plans to encourage employers and employees to take steps to reduce dependency on the car and to take alternative transport options.
3.11	The recommended mitigation measures detailed in Chapter 10 Hydrology of this EIAR will be implemented to address the potential risk of flooding.

18.5 Mitigation and Monitoring Measures for Biodiversity

Table 18.4 Mitigation and Monitoring Measures for Biodiversity

No.	Description
4.1	**Mitigation by Avoidance** The proposed development minimises landtake 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 has followed the basic principles outlined below to eliminate the potential for ecological impacts on Key Ecological Receptors where possible and to minimise such impacts where total elimination is not possible. The proposed development has been selected to avoid, as far as possible, direct, in-direct or secondary adverse impacts on Natura 2000 sites or other sites designated for nature conservation. 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. All piling within the Harbour will be restricted to the periods between the 1st June and the 31st January to avoid impacts on migratory fish.
4.2	**Mitigation by Design** The proposed development has been developed having regard to European and national legislation and all relevant guidelines in relation to ecology and engineering best practice for the planning and construction of proposed developments. These guidelines and best practice provide practical measures that can be incorporated into the design to minimise the impact and protect the receiving environment. The following is an overview of the design measures that will be employed to minimise and avoid significant impacts on the ecological receptors within the Zone of Influence:
4.2.1	An Outline Construction and Environmental Management Plan (OCEMP) has been produced to ensure that the construction does not lead to any unanticipated negative impacts on the environment. A Construction Environmental Management Plan (CEMP) and Environmental Management Plan will be completed by each Contractor in line with Appendices 4.1 and 4.2 of this EIAR prior to construction works commencing.
4.2.2	Vibratory driven sheet piles forming the sea wall on the site perimeter and the option of tubular steel piles, screw piles (helical anchors), or, weighted anchors with chains for the foundation of the marina and boardwalk elements (to be decided during detailed design) have been selected as their installation minimises disturbance and landtake from benthic habitats and mudflats.
4.2.3	The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak

No.	Description
	wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.
4.2.4	Street lights will be located so that the rear shields are adjacent to the estuary and planted areas or optics are selected that stop back light.
4.2.5	The drainage has been designed to provide a high level of attenuation and water quality controls, as described in detail in Chapter 04: Description of the Proposed Development.
4.2.6	The buildings will have blue-green roofs. Species will include native coastal species and a variety of sedums which are pollinator friendly. The landscaping of the site will include trees, shrubs and a wildflower meadow which will provide opportunities for nesting and foraging birds. Details of the Planting Plan are in Appendix 4.6 which includes Drawing No. L-PP-01.
4.2.7	A suitably qualified Project Ecologist and Marine Mammal Observer (this can be the same person) will be appointed by Wexford County Council for the duration of the proposed development.
4.2.8	Each contractor will appoint a Site Environmental Manager to carry out environmental monitoring and to ensure that the mitigation measures proposed in this EIAR is followed.
Specific Mitigation Measures	
	Key Ecological Receptor 1 & 2 – Mudflats and Benthic Habitats & River Slaney/ Wexford Harbour Waterbody
4.3	**Habitat Loss** The loss of estuarine habitats cannot be mitigated for. In spite of the permanent loss of these habitats, this impact is considered insignificant given the total area is small (2302m^2 or <0.024% of these habitats within Wexford Harbour), has low faunal diversity (ASU, 2018) and is not an important area for wintering birds (Natura, 2016). Water will still be allowed to circulate underneath the marina and boardwalk and the new hard surfaces to which epifauna and seaweeds will attach, will add to the species diversity in the area (ASU, 2018).
4.4	**Water Quality** ***Construction Phase***
4.4.1	<u>*Sedimentation and surface water run-off*</u> • In order to attenuate flows and minimise sediment input into the River Slaney from site run-off, all surface water run-off from the construction site shall be directed to a temporary attenuation facility, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged. • Sheet piling for the new seaward site boundary shall be installed prior to any excavation on the landward side (other than the access road and level crossing) and demolition of the existing wharf boundary. This will form an effective barrier to run-off from the site during construction. • Any material stockpiled shall be located a minimum of 30 m from the seaward boundary of the site and shall also be covered and remain stockpiled for as short a time as possible. • The Contractors shall provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in Wexford Harbour and the removal of site materials, fuels, tools, vehicles and persons from flood zones in order to minimise the risk of input of sediment or construction materials into the river during flood events. • The placing of anchor blocks (if required) shall be undertaking so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed

No.	Description
	be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.
4.4.2	*Cementitious materials* The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the River Slaney from the landside elements of the construction. However, the following measures shall also apply: • All shuttering shall be securely installed and inspected for leaks prior to concrete being poured and all pouring operations shall be supervised monitored for spills and leaks at all times. • In order to eliminate any remaining risk of input of cementitious material into the River Slaney, 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. • In order to prevent input of cementitious materials into the River Slaney from the in-stream elements of the construction, concrete structural elements shall be pre-cast, wherever possible. • 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. • Any such materials collected on these platforms shall be disposed of in accordance with the Construction and Demolition Waste Management Plan (CDWMP) (Appendix 4.1).
4.4.3	*Hydrocarbons and other chemicals (See also Chapter 09 and 10 of this EIAR)* • Land-based vehicles and plant shall be refuelled off-site, where possible. • All land-based fuelling of machinery shall be undertaken on an impermeable base in bunded areas at least 50 m from the seaward boundary of the site. • Marine based fuelling will only be undertaken using specifically designed nozzles to prevent spillages and spill kits will be available. • All fuelling equipment shall be regularly inspected and serviced. • Any petrol- or diesel-fuelled pumps or other machinery shall be located within temporary bunded units. • All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. shall be stored in the construction site compound, on an impermeable base which shall be bunded to 110% capacity and appropriately secured. • All plant and construction vehicles shall be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery. • Spill kits shall be available on site during construction, including on the jack-up barge during pile driving. • All waste oils, empty oil containers and hazardous wastes shall be disposed of in accordance with the Waste Management Act, 1996 (as amended). • Owing to the presence of contaminants within the construction site, excavation shall be limited to the absolute minimum necessary.
4.4.4	*Painting of the boardwalk* • Paints containing organotin compounds, e.g. TBT, shall not be permitted. • In order to minimise the risk of paint spillage into Wexford Harbour, the majority of the deck shall be painted over land, prior to be lifted into position over the estuary, and painting of the remaining sections (mostly at joining points) shall be carried out above bunded platforms which will capture any spilled paint.

No.	Description
4.5	**Water Quality** *Operational Phase* The surface water drainage of the proposed development will include blue-green roofs, rain gardens at building perimeters and soft landscaping features such as vegetated swales. The surface water drainage design will allow for storage during a 1-in-100-year flood event. The surface water drainage for the development site comprises a Sustainable Drainage System (SuDS) approach. The surface water drainage network will drain by gravity to the outfall locations around the site and will be designed to store the 1 in 100-year 6-hour rainfall event plus climate change (between tidal cycles). Surface water run-off from the proposed multi-storey car park will pass through a hydrocarbon interceptor. Details of the drainage for the proposed development are presented in Section 4.3.4.4 of Chapter 04. The foul sewer will be directed to the public wastewater infrastructure. The risk to the River Slaney has been found to be low and the potential impact assessment is deemed to be imperceptible. See further impact assessment in Chapter 09 Hydrogeology. The bye-laws listed in the Wexford County Council Harbour and Piers Bye-Laws 2014 will apply to vessels using the proposed marina.
4.6	**Lighting and Shade** *Construction Phase* Turning off construction lighting over the river outside of working hours will eliminate any risk of these impacts outside of those hours. This will eliminate the risk of such impacts occurring during the months of April to September, inclusive, and restrict such impacts to before 7:00 pm and after 7:00 am on weekdays and before 4:30 pm and after 8:00 am on Saturdays during the months of October to March, inclusive. This would ensure at least 12 hours free of artificial light every night of the year and more at weekends. Construction lighting within 10m of the estuary shall be turned off outside of working hours. In addition, construction lighting will be limited to the minimum area required to be lit. The Project Ecologist will ensure that these measures are adhered to during the construction stage.
4.7	**Lighting and Shade** *Operational Phase* The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths, and onto the estuary (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife. Owing to the scale of the proposed development, neither its construction nor its operation has the potential to give rise to significant shading impacts on the River Slaney.
	Key Ecological Receptor 2 – Migratory Fish
4.8	***Noise and Vibration*** The following are the mitigation measures which will apply to all pile driving for the marina, boardwalk and outer sea wall: • There shall be no pile driving of the marina, boardwalk and sea wall permitted in the period beginning on 1st February and ending on 31st May in any year. • All pile driving of the marina, boardwalk and sea wall shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays. • Pile driving shall be restricted to between 7:00 am and 7:00 pm from 1st June to 30th September, inclusive, and to between 8:00 am and 6:00 pm from 1st October to 31st January, inclusive.

<table>
<tr><th>No.</th><th>Description</th></tr>
<tr><td></td><td>All breaks between pile driving of the marina and boardwalk shall be of at least 1 hour's duration and, in the case of multiple piling rigs being operational simultaneously, all such breaks shall be concurrent. This measure shall not apply to vibratory driven piles for the sea wall.
A 30-minute soft-start/ramp-up procedure shall apply to each pile drive. This measure shall not apply to vibratory driven piles for the sea wall.
A trained and experienced Marine Mammal Observer (MMO) shall be appointed by WCC to perform that function in accordance with DAHG (2014) and the MMRA which is included in Appendix 7.3.
If, for any reason, a derogation from any of the above is required, this shall only be permitted with the consent of WCC, the NPWS and IFI.
All of the above measures shall be enforced by the WCC Project Ecologist and the SEM appointed by each Contractor.</td></tr>
<tr><td></td><td>Key Ecological Receptor 3 – Otter</td></tr>
<tr><td>4.9</td><td>Pre-construction Otter Survey
Prior to any works being carried out, a pre-construction otter survey will be undertaken to ensure that no otters have taken up residence within 150m of the proposed development.</td></tr>
<tr><td></td><td>Key Ecological Receptor 4 – Marine Mammals</td></tr>
<tr><td>4.10</td><td>A qualified and experienced Marine Mammal Observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
Unless further information specific to the location and proposed development is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with WCC, NPWS and IFI, pile driving activity shall not commence if marine mammals are detected within a 500m radial distance of the pile driving sound source.
Pre-Start Monitoring
Pile driving activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.
The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.
This prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO.
Ramp-Up Procedure
In commencing a pile driving operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds 170 dB re: 1µPa @1m an appropriate Ramp-up Procedure (i.e., "soft-start") must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information (see section 3 of Appendix 7.3 of the EIAR).</td></tr>
</table>

No.	Description
	Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period. Where the measures outlined in the previous steps are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment. Once an appropriate and effective Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone. • **Breaks in sound output** If there is a break in pile driving sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken. For higher output pile driving operations which have the potential to produce injurious levels of underwater sound (see Appendix 7.3 MMRA sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up. • Reporting Full reporting on MMO operations and mitigation undertaken must be provided to the NPWS. • Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. These seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines. • Signage at the marina will provide information to boat owners about the importance of Wexford Harbour for seals. It will also give information on how to avoid disturbance and signs of disturbance (head up etc).
	Key Ecological Receptor 6 – Bats
4.11	Lighting during the construction phase will avoid direct illumination of the estuary. Follow the removal of vegetation within the sites, new areas will be planted which will include pollinator friendly, and therefore bat friendly species. The lighting plan has been designed to minimise impacts on biodiversity. Low level downward facing bollard lighting or illuminated strips have been selected along the seaward perimeter to minimise light spill outside of the footpaths (See Figure 4.19 in Volume 3). All luminaries will be LED which lack UV elements and will have peak wavelengths greater than 550nm (~3000°K). This will produce a warm white colour, and, in tandem with maintaining the minimum allowable lux levels, will reduce the impacts on bats and other wildlife.
	Key Ecological Receptor 7 – Invasive Species
4.12	• Prior to any works being carried out, a pre-construction invasive species survey will be undertaken to ensure that additional invasive have not been introduced to

No.	Description
	areas within or close to the proposed development footprint. The Invasive Species Management Plan that is currently in place is presented in Appendix 7.4. • Vessels associated with the construction of the sea walls, the boardwalk and the marina have the potential to introduce invasive species to Wexford Harbour. Vessels should adhere to the industry recommended guidelines for preventing the introduction of non-native marine species. UKMarineSAC (2009) recommends that vessels comply with International Maritime Organisation guidance wherever possible, seek guidance from the Wexford Harbour authority regarding areas where ballast water uptake should be avoided (e.g. near sewage outfalls), encourage the exchange of ballast water in the open ocean, and discourage/prohibit the unnecessary discharge of ballast water in the harbour area. • Signage will be put in place at the marina informing the public of the marine invasive species that are associated with small craft and marinas and the importance of boat maintenance.
	Key Ecological Receptor 8 – Birds
4.13	The protection of bird breeding habitats during the breeding season (1st March to 31st August, inclusive), are set out in the Wildlife Acts. Any removal of vegetation within this period will require the supervision of a suitably qualified and experienced ecologist to ensure no breeding birds are present. As part of the landscaping of the site, trees, shrubs, a hedgerow and a wildflower meadow will be planted (Appendix 4.6, Drawing No. L-PP-01 (Planting Plan). This will provide nesting and feeding opportunities for birds. Bird-friendly glass (e.g. www.ornilux.com), which will reduce the reflectivity of glass facades and windows, will be used on all buildings.
4.14	**Ecological Enhancements** • Eight No. 17A Schwegler Swift Nest Boxes (triple cavity) will be incorporated into the development. These will be positioned on the north faces of the buildings out of the prevailing wind and at least 4.5m high. The type and position should be confirmed by the Project Ecologist. *Notes on the Common Swift and Setting up nest boxes* (Linda Huxley, 2014) provides guidance on setting up swift boxes. • Ten bird boxes will be placed around the site. These should include boxes for a variety of species and should be placed out of direct sunlight and the prevailing wind. The positioning of the bird boxes should be decided by the Project Ecologist. • Signage with information relating to the biodiversity of Wexford Harbour will be installed at the proposed development location to encourage an understanding and respect for the natural environment of the area. This will refer specifically to disturbance by boats and loose dogs.

18.6 Mitigation and Monitoring Measures for Soils and Geology

Table 18.5 Mitigation and Monitoring Measures for Soils and Geology

No.	Description
5.1	Prior to the start of any construction works further asbestos surveys, intrusive asbestos surveys and site investigation and a Remediation Strategy will be developed prior to site clearance works and the subsequent construction of the site. The Asbestos Surveys and a Remediation Strategy will inform the site clearance strategy and removal of asbestos from the site. All site clearance works will be required to be undertaken by a suitably qualified, experienced and licensed asbestos contractors.
5.2	All site clearance and excavation works will be required to follow the mitigation measures of this EIAR in this Chapter and those (detailed in Chapter 4 and 8) as

No.	Description
	well as any future mitigation measures to be detailed in the Remediation Strategy (to be completed). For all site clearance works and excavation works suitably qualified, experienced and licensed personnel will be required to undertake this specialist work in accordance with the 'measures for working with asbestos'. Any ACMs discovered in areas required for excavation, will be required to be disposed of by a licenced contractor to a licenced waste facility in accordance with waste management legislation, as appropriate.
5.3	The 'Asbestos Survey and Remediation Strategy' will be undertaken prior to construction. All mitigation measures/ recommendations from these surveys and the remediation strategy will be required to be implemented as part of the proposed development.
5.4	Remediation Verification Report will be produced to demonstrate that all mitigation measures proposed by the contractor to prevent the spread of asbestos or risk of fibre release and all associated remedial works implemented will be independently validated prior to proceeding with the redevelopment of the site.
5.5	'Measures for working with asbestos' as detailed in Chapter 4 shall be implemented by contractors as appropriate as part of the construction phase.
5.6	The specialist contractor will ensure secure containment and transport of all contaminated materials to the appropriate licenced waste disposal facility.
5.7	Contractors shall be required to submit and adhere to a Construction Method Statement indicating the extent of areas likely to be affected and demonstrating that this is the minimum disturbance necessary to achieve the required works. All associated hazardous waste residuals will also be stored within temporary bunded storage areas prior to removal by an appropriate EPA approved waste management contractor for off-site treatment/recycling/disposal. Any other building waste will be disposed of within on-site skips for removal by a licensed waste management contractor. The contractor will be required to submit a Construction and Demolition Waste Management Plan to the Council for approval which will address all types of materials to be disposed and the location of the licenced waste disposal facilities that will be used, as appropriate.
5.8	Imported good-quality granular soils materials and rock armour revetment will be imported from local sources where possible. The nearest suitable licensed quarries are outlined in the Section 4.4.10 of the Chapter 4.
5.9	To minimise any impact on the underlying subsurface strata from material spillages, all fuels, oils, solvents and paints used during construction these will be stored within specially constructed temporary bunded areas or within dedicated bunded containers. Spill kits and hydrocarbon adsorbent packs will be stored on the site compound and operators will be fully trained in the use of this equipment. Fuel for vehicles will be stored in a mobile double skinned tank.
5.10	In order limit the risk to human health and the surrounding aquatic environment by exposure to contaminated material through excavation, it is proposed to retain the majority of the made ground in place. The current ground level across the entire site will be raised for the proposed development (1.5m raise on average), using imported good quality granular material. It is also proposed that the uppermost 250mm of this material will comprise of compacted clay with a low permeability of 1 x 10-7 ms-1 to limit infiltration to percolating water. A minor volume of excavated material planned to be excavated pertaining to the foul sewage pump-out station and any deep service trenches or chambers will be identified during detailed design. Temporary works design and monitoring will ensure that the there are no unacceptable ground movements and settlements of the adjacent ground. This material will be required to be tested for contaminants.
5.11	All buildings will rely on driven piles for foundations. This will minimise the need for the excavation and handling of the made ground layer and soft alluvial layers beneath it, as no in-situ ground needs to be displaced or handled during the execution of this type of piles.

No.	Description
5.12	Sheet piles forming the sea wall on the site perimeter and the option of either bored piles or tubular steel piles and screw piles (helical anchors) for the foundation of the marina and boardwalk elements (to be decided during detailed design) are also selected as their installation requires no excavation or dredging. A sheet-piled wall will provide a new sea wall for the site, raising the site level to meet flood requirements and providing a barrier to contain contaminated material within the site.
5.13	The rock armour revetment and the armour underlayer will be placed directly on in-situ riverbed silt, in order to avoid the need for the handling and removal of contaminated silt.

18.7 Mitigation and Monitoring Measures for Hydrogeology

Table 18.6 Mitigation and Monitoring Measures for Hydrogeology

No.	Description
6.1	A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors for the development in line with the Outline CEMP and EOP appended to this EIAR (see Appendices 4.1 and 4.2). For the phased elements, it will be maintained by the separate Contractors for the duration of the construction phase. The EOP CEMP will cover all potentially polluting activities and include an emergency Incident Response Plan procedure. All personnel working on the site will be trained in the implementation of the procedures. As a minimum, the CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice.
6.2	Earthworks shall be carried out such that surfaces promote runoff and prevent ponding and flooding.
6.3	Runoff will be controlled and treated to minimise impacts to surface and groundwater.
6.4	Prior to any works taking place on-site, a comprehensive and detailed ground investigation programme shall be undertaken to fully quantify the nature and extent of contaminated material present at the site
6.5	All material excavated at the site shall be assumed to be contaminated. Appropriate testing of this material by a suitably qualified and licenced waste contractor shall take place for all aspects of ground contamination and the material shall be disposed of off-site to a suitably licenced waste facility. Temporary storage of any contaminated material on-site shall be carefully managed so as to limit any risk of contaminated surface water runoff to the River Slaney Estuary. The material shall be stored at least 25m away from the high-water mark in the estuary. Runoff from the material shall be directed to lined pond or temporary sewer/tank and the water shall be disposed of off-site for treatment at an appropriate licenced facility. Alternatively, the material shall be covered while stored to remove the risk of surface water contamination.
6.6	Excavations into the existing ground for the installation of the foul drainage network, foul pumping station, deep service trenches and surface water drainage network serving the proposed access road off Trinity Street and the swale along the southern boundary of the site will be required. The material removed will be assumed to be contaminated and will be appropriately disposed of (as outlined in the point above). Suitable backfill material to the pipes will be imported to site. A 250mm layer of imported clay will be placed beneath the swale to prevent the infiltration of rainwater to the underlying subsoil and therefore prevent mobilisation of contaminants into the underlying gravels and weathered bedrock.
6.7	Where temporary pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap.

No.	Description
6.8	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.
6.9	Safe materials handling of all potentially hazardous materials will be emphasised to all construction personnel employed during construction.
6.10	Mitigation measures during the construction phase will include implementing best practice during excavation works to avoid sediment entering Wexford Harbour.

18.8 Mitigation and Monitoring Measures for Hydrology

Table 18.7 Mitigation and Monitoring Measures for Hydrology

No.	Description
7.1	A project-specific Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will be prepared by the contractors appointed for the development following the Outline CEMP attached as Appendices 4.1 and 4.2 to this EIAR. The CEMP will list any difficulties encountered and it will be maintained by each Contractor for the duration of the construction phase. The CEMP and 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 CEMP and EOP for the proposed development will be formulated in consideration of the standard best practice. The following will be implemented as part of this plan: • A draft Incident Response Plan detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance incident with any permit of 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 sea walls, boardwalk and marina works will be obtained prior to commencement of construction; and • Inform and consult with Inland Fisheries Ireland (IFI) and Waterways Ireland (WI). The draft CEMP and EOP will be developed by the selected construction contractors to suit the detailed construction methodology and allocate responsibilities to individuals in the construction team.
7.2	During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water. • Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board) • Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers. • CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors. • CIRIA C648 Control of Water Pollution from Constructional Sites. • Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA/TII, 2006).
7.3	Based on the above guidance documents concerning control of constructional impacts on the water environment, the following outlines the principal mitigation measures that will be prescribed for the construction phase in order to protect all catchment, watercourse and ecologically protected areas from direct and indirect impacts: • Exposure of contaminated material shall be minimised by placing the low permeability clay capping layer immediately following initial site grading and clearance works. Grading works shall progress in a manner which always allows

No.	Description
	runoff to be directed towards a temporary treatment facility without surface ponding. This will minimise contact time between the contaminated material and surface water and thus limit the opportunity for contamination to occur. Runoff which has been in contact with exposed contaminated material will be captured and directed to a temporary lined facility, where the flow will be attenuated and sediment allowed to settle, before passing through a hydrocarbon interceptor and being discharged to Wexford Harbour. • Should temporary dewatering be required during deep excavations within the contaminated material, strict control measures will be put in place for disposal of same. Water pumped from excavations within the contaminated material shall either be passed through the temporary surface water treatment/attenuation facilities before discharge to Wexford Harbour or discharged to a foul sewer. Should very heavily contaminated groundwater be encountered during deep excavations and pumping be required of same, temporary dewatering shall be either collected and discharged to a foul sewer via tanker or treated on-site by way of a temporary water treatment works. Groundwater samples shall be taken from boreholes across the site in advance of construction works taking place to determine which method of disposal is required. Specialist advice will be sought as to the most appropriate form of treatment required as determined by the pre-construction groundwater sampling results. The works shall be planned in an appropriate manner so as to minimise the need for construction dewatering. Where excavation into contaminated material does take place, control measures to limit or prevent surface water runoff from entering the excavation shall be incorporated. These measures may include shoring, sheet piling, benching/battering or embankment of the excavation perimeters. • All construction compound areas will be required to be set back a minimum of 50m from the seaward boundary of the site. Protection of waterbodies from silt load will be carried out through use of grassed buffer areas, timber fencing with silt fences or earthen berms to provide adequate treatment of runoff to watercourses. • In order to attenuate flows and minimise sediment input into Wexford Harbour 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 Wexford Harbour. An impermeable membrane overlaid with suitable fill will be provided to storage areas to prevent contamination or pollution of the groundwater. • Settlement ponds, silt traps and bunds will be used where appropriate and construction within watercourses will be minimised. Where pumping of water is to be carried out, filters will be used at intake points and discharge will be through a sediment trap. General Constructional Compounds will not be permitted within 50m of Slaney River Valley SAC and Wexford Harbour and Slobs SPA. It may, however, be necessary to locate temporary storage areas adjacent to the Slaney Estuary when the marina and flood protection works are being undertaken. Measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compound does not discharge directly to the estuary. This will primarily be in the form of silt fences which will be installed along the compound boundary to stop 'dirty' surface water runoff from entering the estuary without treatment. • 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 NRA/TII document "Guidelines for the crossing of watercourses during the construction of National Road Schemes". All chemical and fuelling locations will be contained within bunded areas and set back a minimum of 50m from watercourses. • All construction machinery operating in-stream should be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery shall be steam cleaned and

No.	Description
	checked prior to commencement of in-stream works to avoid spread of invasive species. • Oil booms and oil soakage pads should be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge. • No refuelling of construction plant shall be undertaken while the vehicles are in or adjacent to watercourses, as this could lead to contamination of the watercourse through spillage of fuel. In addition, all construction vehicles entering the watercourse should be in good condition, and be provided with drip trays to prevent pollution through dripping of oil or fuel from the vehicle. • Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution; • The construction discharge will be treated such that it will not reduce the environmental quality standard of the receiving watercourses; • Any surface water abstracted from a watercourse for use during construction will be through a pump fitted with a filter to prevent intake of fish. • 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 estuary shall be pre-cast, where possible. • 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. • The placing of anchor blocs (if required) shall be undertaken so as to minimise disturbance of sediment from the sea-bed. Should local excavation of the seabed be required it shall be carried out behind a geotextile screen and boom with oil barrier to prevent pollution of the river/estuary.
7.4	**Morphological Changes to Surface Watercourses & Drainage Patterns** SuDS components will convey runoff to the Lower Slaney Estuary, while attenuation will be provided for the 1 in 100 year 6-hour event. The conveyance of runoff to the Lower Slaney Estuary will generally follow the existing site topography. The implementation of these proposed mitigation measures reduces the impact to imperceptible.
7.5	**Hardstanding Runoff** As a result of the increase in hardstanding areas, runoff from the site will increase. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall. Whilst the base of the permeable paving and grassed swales will allow some limited percolation to the underlying subsoils, the portion percolating portion is expected to be minimal due to the incorporation of a low permeability clay layer across the entire site. The surface water drainage system will be designed to store the 1 in 100 year 6 hour-rainfall event plus a climate change factor (between tidal cycles). The OPW

No.	Description
	FSU Portal calculates this rainfall depth to be 80.76mm. Attenuation of surface water runoff will occur within a layer of coarse graded clean aggregate material installed below the permeable paving which will have a voids ratio of typically 30%. These proposed mitigation measures reduced the associated impact from hardstanding runoff from moderate/significant to slight. The provision of permeable paving within the development will negate the need to provide numerous individual petrol interceptors throughout the development. Treatment to runoff generated will be provided within the pavement layers through the processes of filtration, biodegradation, adsorption of pollutants and the settlement and retention of solids within the pavement layers.
7.6	**Foul Drainage Infrastructure** In the event of a pump failure at the proposed foul pumping station, mitigation measures have been proposed. The pumping station has been designed to provide 24-hour effluent storage in case of failure. Standby pumps will also be provided.
7.7	**Implications for Designated Sites** It is proposed that surface water from the proposed development discharges to the Slaney Estuary, which is an environmentally sensitive area. Mitigation measures that will be implemented include the design of a surface water drainage system to serve the proposed development. The proposed surface water drainage system will comprise predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to sea through multiple outfalls located along the extent of the proposed sea wall (with some limited percolation into the subsoil). The incorporation of a SuDS based approach will ensure that discharge will be controlled, and treatment of runoff will take place within the SuDS components. The implementation of these mitigation measures will reduce the associated impact from moderate/significant to imperceptible.
7.8	**Flood Risk Mitigation** The flood risk associated with the proposed development is deemed to be moderate to significant. As discussed in Section 10.4.3, the following minimum levels will be required within the site: • To satisfy the Wexford Town and Environs Development Plan 2009-2015 (as extended) all buildings as part of the proposed development must have a minimum floor level of 2.64mOD. • As per the OPWs Flood Risk Management Guidelines for Local Authorities (2009) "Less vulnerable developments" such as local transport infrastructure must have a minimum level of 2.34mOD. The lowest proposed finished floor level for the development is 3.3mOD, while the lowest road level will be at 2.80mOD (generally 3.5mOD). In addition to the flood risk measures above, a new steel sheet pile sea wall is to be provided along the northern, southern and eastern edges of the site as part of the development, while sections of the northern, eastern and southern sides will comprise a combined sheet pile/rock armour revetment wall. A sheet pile driving rig will mobilise and begin driving sheet piles in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The existing wall will remain in place until the sheet pile wall is correctly installed and only then will be demolished and removed from the site. Construction of the rock armour revetment will involve suitable boulders being placed directly onto the silt/sediment of the seabed. The marina will also be sheltered by a breakwater on the seaward side. This will involve driving pile sockets for the breakwater units and the pontoon walkways into the seabed. Vertical steel piles will then be grouted into the pile sockets to give good line and plumbness. Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units and pontoon walkways and finger berths.

No.	Description
	The actual method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to ground investigations during detailed design phase. The proposed marina breakwater, sea wall and rock armour revetment along the perimeter of the site will protect the development against storm surge and wave action.

18.9 Mitigation and Monitoring Measures for Landscape and Visual Analysis

Table 18.8 Mitigation and Monitoring Measures for Landscape and Visual Analysis

No.	Description
8.1	**Construction Phase** The measures proposed revolve around the implementation of appropriate site management procedures – such as the control of site lighting, storage of materials, placement of compounds, delivery of materials, car parking, etc. Visual impact during the construction phase will be mitigated somewhat through appropriate site management measures and work practices to ensure the site is kept tidy, dust is kept to a minimum, and that any publicly accessible areas are kept free from building material and site rubbish. Site hoarding will be appropriately scaled, finished and maintained for the period of construction of each section of the works as appropriate. To reduce the potential negative impacts during the construction phase, good site management and housekeeping practices will be adhered to. The visual impact of the site compound(s) and scaffolding visible during the construction phase are of a temporary nature only and therefore require no remedial action other than as stated above. General construction measures are outlined in the Outline Construction Environmental Management Plan and Outline Environmental Operating Plan as per Appendices 4.1 and 4.2 of this EIAR which must be undertaken by all contractors.
8.2	**Operational Phase** Mitigation measures were largely included in the design of the project. The design statement refers to the design rationale, and extensive analysis was undertaken to arrive at the proposed design. The design process analysed the buildings and streetscape in the vicinity of the site and design responses took into account the following; • The proposed development is in the context of the Wexford Quays Economic Action and Spatial Implementation Plan which aims to connect the site to the Crescent and Paul Quay area and has a number of aims for the surrounding town. • The scale and height of the buildings (5-6 storeys) was designed to relate to the existing buildings along Paul Quay, particularly when seen from the Ferrybank and Wexford Bridge areas. It was decided that buildings taller than this would have a greater visual effect on the overall harbour. • The scheme creates connectivity to the town centre and allow for public access by linking Trinity Wharf to Paul Quay via a boardwalk, and also proposed public realm improvements in the Paul Quay area. Other options which connected to the Trinity Wharf site along the railway line were considered but this would have required security fencing and barriers for the railway line, so the connection of a boardwalk at Paul Quay is considered to be preferable and results in a more visually attractive connection that maximises the waterfront location. • The design of the proposed hotel building was amended and re-oriented to maximise public access to the waterfront in the location with the most remarkable views on the site

No.	Description
	• The proposed design includes provision of public spaces and walkways including a waterside route and viewpoints, to enhance the views from the site and thus enhance a key characteristic of the site. • The landscape plan proposed to enhance the site's character with tree and shrub planting to emphasise the natural character and setting of the site and create a buffer of suitable and robust vegetation along the railway line to integrate development into wider landscape. The landscape design strategy included in Appendix 4.6 of the EIAR will be implemented as part of the design.

18.10 Mitigation and Monitoring Measures for Noise and Vibration

Table 18.9 Mitigation and Monitoring Measures for Noise and Vibration

No.	Description
9.1	It is recommended that the contract documents should clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS5228-1 2009. These measures will typically include:
9.1.1	No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
9.1.2	The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
9.1.3	All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
9.1.4	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.
9.1.5	Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
9.1.6	Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
9.1.7	Location of plant shall consider the likely noise propagation to nearby sensitive receptors.
9.1.8	During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 2 using methods outlined in BS5228:2009 Part 1.
9.2	**Working Hours** Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:00 Saturday. Works other than the pumping out of excavations, security and emergency works should be avoided outside of these periods.
9.3	**Emergency Work** The emergency work may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.
9.4	A suitable perimeter hoarding around the site on three sides will provide an effective method of reducing noise propagation from the site. This hoarding will need to be phased as it can only be constructed along the northern and southern boundaries once the sea wall and anchors in those locations have been constructed. It shall be erected along the railway boundary as soon as practicable during site setup. The hoarding shall be regularly inspected by the Site Environmental Manager and a Site

No.	Description
	Engineer to ensure the adequacy of the hoarding from a noise and visual perspective. Technical specifications on the acoustic performance of suitable hoardings can be found the UK's Design Manual for Roads and Bridges HA 66/95 which gives guidance on acoustic performance, forms of construction and physical properties of materials.
9.5	A vibration monitoring programme will be required to be adopted at a select number of the nearest residential properties during the most critical phase(s) of construction e.g. pile driving, etc.
9.6	A general noise management strategy will be required to be developed as part of the development and management of the marina and café/ restaurant uses including hours of operation, training for staff and signage to notify the public of the potential effect their activities, particularly at night, may have on nearby residents.

18.11 Mitigation and Monitoring Measures for Air Quality and Climate

Table 18.10 Mitigation and Monitoring Measures for Air Quality and Climate

No.	Description
10.1	**Air Quality** The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 13.3 and includes the following: • The specification and circulation of a dust management plan for the site and the identification of persons responsible for managing dust control and any potential issues; • The development of a documented system for managing site practices with regard to dust control; • The development of a means by which the performance of the dust management plan can be monitored and assessed; • The specification of effective measures to deal with any complaints received. At all times, the procedures within the plan 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.
10.2	**Climate** Construction traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term and temporary nature of these works, the impact on climate will not be significant. Nevertheless, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular the prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.
10.3	**Monitoring** Monitoring of construction dust deposition at nearby sensitive receptors (residential dwellings) during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the

No.	Description
	German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

18.12 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

Table 18.11 Mitigation and Monitoring Measures for Archaeological and Cultural Heritage

No.	Description
11.1	The avoidance of direct or indirect impacts on archaeological heritage is the preferred mitigation measures. Where this is not possible the following archaeological mitigation measures are proposed:
Pre-Construction Measures	
11.2	**Archaeological Testing or Monitoring** Dependent on the nature of foundations proposed for individual structures within the proposed development archaeological testing or archaeological monitoring may be required where sub-surface development works are to be undertaken. This is particularly important in the northern corner of the site where it is possible that the remains of the nineteenth century dock infrastructure still exist below the current ground surface and at the site of the holy well (RMP WX037-038) where it is possible that features survive below ground.
11.3	**Underwater Archaeological Impact Assessment** An underwater archaeology walkover inspection was undertaken by ADCO on the 11th December 2018 at Low Water. The mitigation measures included in their report are reproduced here while their full report is included in Appendix 14.3.
11.3.1	An Underwater Archaeology Impact Assessment (UAIA) of the area to be impacted by the proposed marina and boardwalk will be carried out prior to any construction works. Such work is licensed by the National Monuments Service. The work will be carried out as part of the required UAIA, which will inspect the known underwater archaeological elements adjacent to the development area.
11.3.2	In the event that the underwater assessment identifies features that will be impacted by the construction phase, further archaeological mitigation will be required and may include investigation and excavation.
11.3.3	An Archaeological Topographic Survey of the reclaimed land area and associated intertidal elements is required to capture a detailed pre-disturbance record of the existing land surfaces. The work will prepare detailed topographic mapping that enables metrically accurate 1:20 plan, elevation and section drawings. It will be necessary to capture an above ground stone-by-stone record of the dockyard walls and fabric. The record will serve as the permanent record of this element that will be destroyed or otherwise permanently buried by the development.
Construction Phase Measures	
11.4	A review of the site investigation logs to assess the nature of the buried strata will be undertaken.
11.5	**Archaeological Monitoring of Ground and Seabed Disturbance** Archaeological Monitoring of Ground and Seabed Disturbance activities during the construction phase and associated elements, with the proviso to fully resolve any archaeological features identified. Such work is licensed by the National Monuments Service.

No.	Description
11.6	**Archaeological Excavation and Preservation In Situ** Should the results of the mitigations outlined above indicate the requirement for archaeological excavation and/or preservation *in situ*; this will be undertaken as per best practice and in consultation with the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht.
Project Management Measures	
11.7	AN ARCHAEOLOGICAL CONSULTANT experienced in and specialising in maritime archaeology should be appointed to the project to advise the design team on archaeological matters, liaise with the state regulators, prepare archaeological licence applications and complete archaeological site work.
11.8	ARCHAEOLGICAL MONITORING is licensed by the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht. The application for such a licence requires a detailed method statement, outlining the procedures to be adopted to monitor, record and recover material of archaeological interest during such work. Licence applications take four (4) working weeks to be processed and must be granted before archaeological-related work can commence.
11.9	THE TIME SCALE for the project should be made available to the archaeologist, with information on where and when the various elements and ground disturbances will take place.
11.10	SUFFICIENT NOTICE. It is essential for the developer to give sufficient notice to the archaeologist/s in advance of works commencing. This will allow for prompt arrival on site to undertake additional surveys and to monitor ground disturbances. As often happens, intervals may occur during the construction phase. In this case, it is also necessary to inform the archaeologist/s as to when ground disturbance works will recommence.
11.11	DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeological features or material being uncovered during the construction phase, it is crucial that any machine work cease in the immediate area to allow the archaeologist/s to inspect any such material.
11.12	ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.
11.13	ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team, including an archaeological dive team, be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.
11.14	SECURE SITE OFFICES and facilities should be provided on or near those sites where excavation is required.
11.15	SECURE WET AND DRY STORAGE for artefacts recovered during the course of the monitoring and related work should be provided on or near those sites where excavation is required.
11.16	ADEQUATE FUNDS to cover excavation, post-excavation analysis, and any testing or conservation work required should be made available.
11.17	MACHINERY TRAFFIC during construction must be restricted as to avoid any of the selected sites and their environs.
11.18	SPOIL should not be dumped on any of the selected sites or their environs.

No.	Description
11.19	POST-CONSTRUCTION PROJECT REPORT AND ARCHIVE. It is a condition of archaeological licensing that a detailed project report is lodged with the DCHG within twelve (12) months of the completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland.
11.20	The recommendations listed above are subject to the approval of the National Monuments Service at the Department of Culture, Heritage and the Gaeltacht.

18.13 Mitigation and Monitoring Measures for Architectural Heritage

Table 18.12 Mitigation and Monitoring Measures for Architectural Heritage

No.	Description
12.1	Avoidance of architectural heritage is the preferred mitigation measure, however either direct or indirect impacts on architectural heritage is likely to occur as a result of the development where avoidance is not possible. Mitigation by architectural record involves the production of a written account generally supplemented by measured drawing and a photographic survey. The level of recording will depend on the significance of the structure in question. Any architectural features within the site including the former boundary wall (BH 10) running northeast-southwest through the site and the stone wall (BH 11) along the western boundary of the site should be subject to architectural recording prior to their removal.

18.14 Mitigation and Monitoring Measures for Material Assets and Land

Table 18.13 Mitigation and Monitoring Measures for Material Assets and Land

No.	Description
13.1	There are no specific mitigation measures in relation to Material Assets. The design of the development has accommodated the necessary improvements in infrastructure to service the site, without having impacts on infrastructure along Trinity Street. The provision of the proposed utilities and services will facilitate the required needs of the development without impacting on any existing utilities.

Appendix B - Planning Approval

To be added by Contractor subject to planning approval

Appendix C - Schedule of Commitments

To be added by Contractor subject to planning approval

Appendix D - Invasive Alien Species Management Plan (Envirico, 2017)

Invasive Alien Species Management Plan

Trinity Wharf, Wexford

[Nov, 2017]

Prepared by Envirico on behalf of Wexford County Council

www.envirico.com

Action	Personnel	Company	Date
Revision: 1 (Jan, 2018)			
Report Prepared By:	Dr. Amanda Greer	Envirico	Nov, 2017
Reviewed By:			

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1. INTRODUCTION

Envirico have been engaged by Wexford County Council to carry out an invasive alien species survey and prepare an invasive species management plan for Trinity Wharf and the footprint of the proposed Trinity Wharf Development. The survey was conducted as a walkover by land on 3rd November, 2017. Two invasive alien species listed in the Third Schedule of S.I. 477/2011 were recorded during the course of the survey – **Japanese Knotweed** (*Fallopia japonica*; 1,377m^2), and **Three-Cornered Leek** (*Allium triquetrum*; 245m^2).

This invasive alien species management plan (IASMP) has been prepared in accordance with current Irish best practice guidelines such as 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' – NRA (2010); Best Practice for Control of Japanese Knotweed *Fallopia japonia* – Inland Fisheries Ireland; Best Practice Management Guidelines Japanese Knotweed *Fallopia japonia* – Invasive Species Ireland (2008).

1.1 Site Manager/Owner:	Wexford County Council
1.2 Site Address:	Trinity Wharf Wexford

1.3 Site Description:

The survey area covered the both the Trinity Wharf itself and the section of Dublin to Rosslare railway track running along the southwestern boundary of the wharf, up to the boundary with residential and commercially owned properties. GPS co-ordinates are from N: 52.334411, E; -6.452088 at the north corner to N: 52.331829, E: -6.451053 in the south. The site is earmarked for significant development, with commercial units, hotel, and outdoor public amenity space planned. Access to the wharf is likely to be across the railway line at the north-western corner of the wharf.

1.4 Site Management Objectives and Threats to Objectives:

The site management objectives, threats to achieving those objectives and the planned strategies for minimising these threats are outlined in Table 1.

Table 1. Site management objectives, threats and mitigation for these threats.

Objective	Threat(s)	Mitigation
1. To prevent the spread of invasive species as a result of the construction works.	Movement of equipment and personnel throughout areas contaminated with invasive species Digging amongst invasive species or areas containing propagules Movement of contaminated clay	Before works begin, Japanese knotweed and Three-Cornered Leek will be treated with herbicides to the reduce their regenerative capacity. Strict biosecurity protocols will be implemented, as outlined in the IASMP. All machinery that is working in infested areas must be thoroughly washed down and certified as clean before leaving a designated zone. Japanese knotweed will be left in-situ wherever possible and subjected to ongoing treatment with herbicides. All contaminated clay will be treated according to the procedures outlined in the IASMP.
2. To enable construction to go ahead in a timely fashion without compromising objective 1.	Works may be delayed due to the implementation of biosecurity protocols, licence applications, waste classification, on-site treatment of or removal of contaminated spoil offsite.	Delays will be minimised by following the protocols laid out in this management plan.
3. To reduce the likelihood of the reintroduction of Japanese knotweed onto the site.	There is a significant amount of Japanese knotweed present close to the site along the Dublin to Rosslare railway line that forms a likely source of reintroduction to the site.	Iarnród Éireann will be engaged with and the merits of a comprehensive survey and treatment programme to all involved will be stressed. The aim is to establish an ongoing treatment and monitoring programme for this line to minimise the risk of reintroduction of Japanese Knotweed onto the Trinity Wharf Development Site.

2.1 Japanese Knotweed

Japanese Knotweed (*Fallopia japonica*) was introduced to Europe by the horticultural activities of Philippe von Siebold, who plucked the plant from the side of a Japanese volcano in the 1840s. It is a fast growing, perennial, herbaceous plant, native to East Asia (Japan, northern China, Taiwan and Korea). In its home range, the plant is not a threat because a host of native predators, fungi and herbivorous insects keep it in check. However, outside Japan it is classified as one of the World's Worst Invasive Species (World Conservation Union). The date of its first introduction to Ireland is not known, but is believed to be in the mid to late 19th century.

Japanese Knotweed can grow >3m high, with young shoots in spring growing up to 10 - 30cm per day, quickly resulting in dense stands that shade out other species. The leaves are a distinctive shape with a tapered tip and a flat base (up to 18cm long) and the mature hollow stems have nodes and look somewhat like bamboo canes. The underground rhizome system can be vast, extending up to 3m deep and 7m horizontally from the nearest visible growth. Japanese Knotweed produces small cream or white flowers in late summer or early autumn. There are only female plants in the UK and Ireland so sexual reproduction is negligible; however, hybrids with related plants can be produced (e.g. Giant knotweed; Russian Vine) and are found occasionally.

Even without sexual reproduction, the plant spreads at a rapid rate by rhizome extension. New plants can also grow from tiny fragments of rhizome (as little as 0.7 grams) or stems, which means that traditional control methods such as cutting or strimming will actually further spread a knotweed infestation. Some of the most likely routes for knotweed spread are via our roads, rivers and railway lines as tiny fragments are dragged along these routes enabling them to quickly colonise new areas. Knotweed is also often spread by the movement of contaminated soils offsite and the improper disposal of the weed in garden clearings. It can grow on a wide range of soil types, pH and salinity; has the ability to withstand droughts, heat, cold, sulphurous soil; and is tolerant towards heavy metals. This hardiness ensures a wide distribution across habitat types.

Japanese Knotweed's massive rhizome system and vigorous growth can seriously damage walls, foundations, roads and buildings, including historic sites. The plant can also disrupt the integrity of man-made flood defense structures, increasing costs in repair and maintenance. Railway tracks, roads, pavements, and other constructions are also frequently affected.

Other highly invasive knotweeds that occur in Ireland are Giant Knotweed, *Fallopia sachalinensis*, Himalayan Knotweed *Persicaria wallichii* and Bohemian Knotweed *Fallopia x bohemica*, which is a hybrid between Japanese and Giant Knotweed. These other knotweeds are increasingly found in Ireland, though still to a much lesser extent than the Japanese Knotweed.

In Ireland, Japanese Knotweed is classified as a High-Impact Invasive Species with a Risk Assessment Score of 20. It is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations) and spoil contaminated with Japanese Knotweed waste is classified as a vector material in Part 3 of the Third Schedule (see Section 3 for details of this legislation).

2.2 Three-Cornered Leek

Three-Cornered Leek (AKA Three-Cornered Garlic, White Bluebell) *Allium triquetrum* is a bulbous, perennial herb native to Mediterranean countries. It was introduced to the British Isles for cultivation in the 1750s and had become established in the wild on Guernsey & Jersey Islands by the 1850s. In Ireland, it is particularly prevalent along the south-eastern seaboard. This species thrives along road verges, at the base of hedges and in disturbed ground and is easily identified in springtime by its strong garlicky smell and pretty white flowers. Its green leaves are long and slender.

All parts of Three-Cornered Leek are edible, from flowers to leaves to bulbs, and all are strongly reminiscence of garlic. This plant can reproduce by dividing its bulbs or setting seed. Interestingly, its seeds are ant-dispersed. Three-Cornered Leek seeds have an appendage with oil attached, and the ants carry the seeds away in order to eat the oil. Then they discard the seed. Three-Cornered Leek is also sometimes planted by humans in the wild or can be spread accidentally by the movement of contaminated soil and garden waste. Where it becomes established this species can reduce biodiversity by growing earlier in the season than its native competitors and shading these native species out.

In Ireland, Three-Cornered Leek is classified as a Medium-Impact Invasive Species with a Risk Assessment Score of 15. This species is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations; see Section 3 for details of this legislation).

3. INVASIVE ALIEN SPECIES LEGISLATION

The Invasive Species Ireland project identified Japanese Knotweed as one of the highest risk (most un-wanted) non-native invasive species in Ireland. There is strict legislation surrounding Japanese Knotweed and Three-Cornered Leek in Ireland – namely under Irish Statuory Instrument 477/2011 and the Wildlife Acts (1976-2000). We have also ratified a number of international conventions that oblige the Government to address the issue of non-native invasive species, including the Convention on Biological Diversity, the Bern Convention and the International Plant Protection Convention

Irish Statutory Instrument 477/2011

The EC Birds and Natural Habitats Regulations introduced important legislation concerning invasive species in the Republic of Ireland. Japanese Knotweed and Three-Cornered Leek are both listed in Part 1 of the Third Schedule.

Article 49 prohibits the introduction, breeding, release or dispersal of certain species; and Article 50 prohibits dealing in and keeping certain species.

Article 49 (2) "Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence."

Article 49 (3) states that you can defend against allegations that you committed an offence under Article 49 (1) or (2) by proving that you took all reasonable steps and exercised all due diligence to avoid committing the offence:

Article 49 (3) "Subject to paragraph (4), it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

Article 50 (2) "Save in accordance with a licence granted under paragraph (7), a person shall be guilty of an offence if he or she imports or transports –

(a) an animal or plant listed in Part 1 or Part 2 of the Third Schedule

(b) anything from which an animal or plant referred to in Part 2 of the Third Schedule can be reproduced or propagated, or

(c) a vector material listed in Part 3 of the Third Schedule,

into or in or to any place in the State specified in relation to such an animal or plant or vector material in relation to that animal or plant or vector material in the third column of the Third Schedule."

The *Wildlife Amendment Act (2000)* of ***The Wildlife Act (1976)*** made it an offence to cause an exotic species of flora to grow in the wild anywhere in the state**:**

"Any person who plants or otherwise causes to grow in a wild state in any place in the State any (exotic) species of flora, or the flowers, roots, seeds or spores of flora, otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence."

4. SURVEY FINDINGS

A walkover survey was conducted on 3rd Nov, 2017. This survey confirmed the presence of two Third Schedule S.I. 477/2011 invasive alien species –Japanese Knotweed and Three-Cornered Leek. A significant amount of another medium invasive species - *Buddleia davidii* was noted to be present throughout the site; however, this species is not listed in S.I. 477/2011.

4.1 Japanese Knotweed

In total, nine distinct stands of Japanese Knotweed (JK) were recorded during the survey (see Appendix I – Drawings). Each knotweed stand was given a unique identifier or JK number. The details of each stand recorded are outlined in Table 2, including length, width, the average height of the canes, the maximum cane diameter, and any other notable features.

The total above ground area covered by Japanese Knotweed was 1,377m^2, with 1,030m^2 of this recorded along the railway lines and only 347 m^2 growing within Trinity Wharf. All of the JK surveyed appeared to have been growing at the same location for a number of years. JK01 to JK07 were all growing along the Dublin to Rosslare railway line on the western side of the tracks, while JK08 & JK09 were growing within Trinity Wharf. It was noted during the course of the survey that there was a substantial amount of Japanese knotweed present along the western side of the railway tracks continuing further east of the site and that this poses a significant threat for reintroduction (see Appendix II – Photographic Record).

Table 2. Details of each stand of Japanese Knotweed within the survey area

ID	Length (m)	Width (m)	Growth Stage	Avg. Stem Height	Max. Stem Diameter	Close to Water	Likely to Require Excavation
JK01	8.5	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK02	17.4	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK03	2.5	2	Dying Back	>2.5m	>2.5cm	No	No
JK04	15	5	Dying Back	>2.5m	>2.5cm	No	No
JK05	106	Up to 20m	Dying Back	>2.5m	>2.5cm	No	No
JK06	6	2	Dying Back	>2.5m	>2.5cm	No	No
JK07	6	2	Dying Back	1 – 2.5m	1 – 2.5m	No	No
JK08	49	5 to 15m	Dying Back	>2.5m	>2.5cm	Yes	Yes
JK09	9 to 4	10	Dying Back	>2.5m	>2.5cm	No	Yes
Total Coverage of Japanese Knotweed: 1377m^2							

*Areas may differ from length x width due to irregular polygon shapes

4.2 Three-Cornered Leek

There were two stands of Three-Cornered Leek (TCL) recorded on the site (see Appendix I – Drawings & Appendix II – Photographic Record). TCL01 was a 30m long and 1m wide strip of TCL running along the western edge of Trinity Wharf by the fence separating the Wharf from the railway tracks. The plants were approx. 20cm high and flowering/ in leaf. TCL02 ran in a 1 or 2m wide strip for 102m along the western side of the railway line. Most of these plants were 20cm high and in leaf.

5. MANAGEMENT PLANS

Please Note: Although medium-impact invasive species Buddleia was noted during the survey, as this species is not listed in the Third Schedule of S.I. 477/2011 there is no special legal requirement surrounding this species other than not to cause it to grow in the wild.

5.1 Management Plan for Japanese Knotweed

5.1.1 Summary

In order to reduce the regenerative capacity of the Japanese Knotweed present on-site, and the likelihood of reintroduction, all stands should be subject to an on-going herbicide treatment program.

Wherever possible, JK should be treated in-situ with a herbicide programme for a minimum of 5 years by a professional contractor.

Where excavation of JK is necessary due to the proposed works, strict biosecurity protocols must be adhered to. Haulage routes must be clearly defined and lined with an appropriate geo-textile to avoid ground contamination; and wash-down areas and procedures must be in place.

Two different options for the disposal of JK contaminated clay are outlined (subject to licenses/approval): 1. Off-Site Disposal; 2. Soil Screening and Bunding.

We strongly recommend that the client engage in a discussion with Iarnród Éireann and Envirico about the best strategy to tackle the significant Japanese knotweed infestations further along the railway lines in order to minimise the risk of reintroduction.

5.1.2 Herbicide Treatment

Wherever possible, JK should be treated in-situ with herbicides. For all JK stands to be left in-situ a comprehensive treatment programme should be carried out for a minimum of 5 years by a professional contractor. However, even stands that are planned for excavation should have herbicide treatment applied to them at each available opportunity before works commence, in order to reduce their regenerative capability.

All works must be carried out by a professional contractor with specialist knowledge of invasive species.

The Environment Agency (UK, 2013) recommends that wherever possible JK is treated in-situ using herbicides. In-situ treatment is the most environmentally-friendly option, and does not pose the same biosecurity risk as mechanical removal. A herbicide treatment programme is also the most cost-effective option; however, it can take 5 or more years to be completely effective and even after such time, the rhizomes cannot be assumed dead without undertaking viability testing. Therefore, not all JK stands recorded here will be suitable for treatment with herbicides alone.

Legislative Framework

All professional formulation plant protection products must only be applied by a Professional Pesticide User that is registered with the Department of Agriculture, Food and the Marine (as required by the Sustainable Use of Pesticides Directive, 2012). All herbicides will be applied in accordance with current legislation (Sustainable Use of Pesticides Directive, 2012), in compliance with the label, in appropriate weather conditions and following an environmental risk assessment. Application of pesticides near water must have prior approval from Inland Fisheries Ireland, be applied by appropriately trained personnel (PA6AW) and use only aquatic approved products.

Herbicides Effective Against Japanese Knotweed

Currently, the following active ingredients are considered to be the most effective treatment for Japanese knotweed available in the EU. Table 3 outlines some key features of these products.

Table 3. Herbicides currently licenced in Ireland that are effective against Japanese Knotweed. All herbicides are systemic (translocated).

Herbicide	*Licensed Product	PCS No.	Selectivity	Persistence	Timing of 1st Application	Aquatic Approved Product
Glyphosate	Roundup Biactive XL	04660	Non-selective	Non-persistent	Aug-Oct	Yes
Aminopyralid + Triclopyr	Icade Grazon Pro	04249 05182	Selective	Not assessed (not for use on animal feed for 1 year)	Apr-May	No
2-4D Amine	Depitox	02365	Selective	1 month	May	No

***** Only example licence products are displayed, others may be available.

Any chemical treatments for infestations close to water e.g. JK08 should use an aquatic-approved product.

In order for a chemical treatment programme to be successful, it is important that the initial leaves and stalks, and any regrowth remain as healthy as possible until the product is applied. A translocated herbicide is drawn into the plant from where it is applied, and moved to other plant organs incl. roots/rhizomes. Because of this mode of action, a translocated herbicide applied via a foliar spray will be most effective if it has a larger leaf area to cover, and the translocation of the product from the leaves down to the rhizomes will be most efficient if the plant is not damaged or water-stressed.

Table 5. Treatment Schedule

Site Visit	Action	Time	Year
1	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2018*
2	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2018*
3	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2019*
4	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2019*
5	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2020*
6	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2020*
7	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2021*
8	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2021*
9	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2022*

This schedule of works is an estimate only, as it may take fewer or additional site visits to ensure that eradication (no regrowth for 2 years) is achieved.

5.1.3 Excavation

In total there are four JK stands that *may* require excavation as part of the proposed works – JK01, JK02, JK08 & JK09. The above ground area covered by these stands totals 434m^2. When a 7m buffer is placed around these stands, there is a total area of 2,425m^2 that is potentially contaminated. The maximum lateral extent of rhizomes is typically considered 7m with a maximum depth of 3m. Therefore, the maximum volume of JK contaminated material if JK01, JK02, JK08 & JK09 require complete excavation is 7,275m^3. This figure is likely to be a gross over-estimation of the amount of clay containing JK material. A Certified Surveyor of Japanese Knotweed (CSJK) should supervise all excavations within contaminated areas and can restrict the material classified as contaminated to that which actually contains JK material. Under typical conditions, the JK rhizome network does not expand to its maximum possible extent. It is more usual to find the rhizome network contained within 3m lateral spread and 1.5m depth. Therefore, it is more likely that the amount of contaminated clay to be removed if JK01, JK02, JK08 & JK09 require complete excavation would be in the region of 2,718m^3 (calculated from typical rhizome extent of 3m, depth of 1.5m) if done under the supervision of a CSJK.

The volume of material to be excavated will depend on the final development plan and the extent of the development works that take place between the Iarnród Éireann and Wexford County Council boundaries. Depending on the final development plan, it may be that only a portion of the Japanese knotweed requires excavating. In this case, built structures can be protected by the installation of a root barrier membrane in order to keep the amount of excavated material down to a minimum.

Should it be necessary to obtain an accurate estimation of the amount of material to be removed, this can be provided by scraping back the top 25cm of top soil and digging a series of test pits within the buffer zone.

5.1.4 Biosecurity

Exclusion Zones

Any personnel or machinery entering within 7m of a Japanese Knotweed stand is entering a potentially contaminated area and as such must be subject to strict biosecurity protocols. This 7m is designated because the maximum lateral extent of the JK rhizome network is 7m from the nearest visible growth. Exclusion zones must be set up a minimum of 7m away from the nearest visible JK growth. Maps depicting the 7m buffer zones are provided in Appendix I – Drawings.

Exclusion zones should be clearly marked or fenced off in order to prevent accidental incursion.

All PPE, equipment, plant or machinery to enter an exclusion zone must be thoroughly clean before entering.

Routes within the exclusion zone should be overlaid with a geotextile that has a layer of sand on-top to protect it from being damaged by heavy machinery. The geotextile will prevent potentially contaminated clay from being transferred onto tracks, tyres or boots.

A designated wash-down area(s) lined with appropriate geo-textile will be set-up within each exclusion zone. At this/these locations all PPE, plant and equipment must be thoroughly cleaned before leaving the exclusion zone. They should be certified as clean by personnel competent at recognizing JK material incl. rhizome. Any material that has been washed off PPE, plant and equipment will be treated as contaminated and added to material to be removed for disposal or further treatment. Equipment such as a power-washer, buckets with clean soapy water, stiff brushes, hoof-picks, cloths will be available at all times at all wash-down areas.

The amount of traffic in and out of exclusion zones should be kept to a minimum at all times. Machinery should remain outside the zone where possible. For example, long-reach excavators may be utilized to dig material out of an exclusion zone and load it into a truck without having to track inside the exclusion zone at any time. The bucket and arm of the excavator that operated within the exclusion zone must be subject to the wash-down protocols out-lined above.

Loading Contaminated Material

All trucks to collect JK contaminated material should be lined with appropriate geotextile. Material will be loaded to within no more than 50cm of the top and then covered with geotextile for transport.

Banksmen should be in place during loading of contaminated material to watch for and immediately clean-up any material that is dropped during loading. This material will be added to the load to be transported.

Haulage routes should be lined with geotextile protected with a layer of sand on top and trucks will not deviate from these routes.

Trucks that have been used to transport contaminated material must be thoroughly washed down and certified as clean by a competent person before being put to an alternate use.

After Excavation

Following excavation of JK contaminated material, it must be disposed of appropriately. Currently Irish Waste legislation (Waste Management (Facility, Permit and Registration) Regulations 2007) only allows for disposal at a licensed landfill unless an exemption is granted by the EPA. However, this legislation is currently under review and may be altered in advanced of the proposed works commencing (EPA, *Pers. Comm*., 2017).

5.1.5 Option 1 – Disposal Off-Site

Disposal off-site is a quick and easy method to get rid of JK contaminated material. Currently, it is also the only way to remediate JK material without either obtaining a Waste license or an exemption from the EPA. However, it is very expensive, and the most environmentally damaging method of treating JK.

JK material that is removed off-site in Ireland is either taken to landfill and deep-buried – an unsustainable solution that uses valuable landfill space; or shipped to the Netherlands for incineration – another solution with a heavy carbon footprint.

Legislative Framework

Japanese Knotweed contaminated material can only be removed off-site by a licenced waste haulier and brought to a licenced waste facility. Under Statutory Instrument 477/2011 (Article 50(2)) it is an offence to transport Japanese knotweed contaminated material without first obtaining a licence from National Parks and Wildlife.

Documents Required for Removal of Japanese Knotweed Contaminated Waste

For disposal of Japanese knotweed material off-site two documents are required: a **licence from National Parks and Wildlife (NPWS)**; and a **Waste Classification document**.

Licence from National Parks and Wildlife Service

A licence application must include:

- As much information as possible on the removal, transportation and treatment of the species in question
- A detailed description of the biosecurity measures that will be in place
- A copy of the Knotweed Management plan
- Details of the timeframe for carrying out the work

Waste Classification Document

Japanese knotweed waste may only be transported offsite by a licenced haulier who will require a waste classification document. A soil test is required in advance. The soil can only be transported to a licenced waste facility that has been notified in advance of the nature of the waste and has agreed to accept the waste material.

5.1.6 Option 2 – Soil Screening & Bunding

*This option is subject to EPA approval.

Following excavation, trucks loaded with JK contaminated material will haul this materials along a pre-determined haulage route to a designated area on Trinity Wharf. Trucks will empty the contaminated material in an exclusion zone that is fenced off from the rest of the site and lined with geotextile. They will then move to a geo-textile lined wash-down area that has been set up adjacent to the unloading area for cleaning before they leave the exclusion zone.

The JK contaminated material will then be screened in a geo-textile lined designated area using a series of differently sized metal screens and conveyors that separate the plant material from the clay. Finally, a handpicking station will remove any remaining plant material. The screened clay will be used in the landscaping of a green area by being spread on top at a depth of no more than 0.5m. The plant material will be either removed off-site for incineration (license from NPWS required) by a licensed waste haulier; or incinerated on-site using a mobile incinerator (subject to EPA approval). This spoil used in the landscaping of the green area will be fenced off and subject to ongoing monitoring for 18 months to ensure that if any rhizomes remained after the screening process, they are eradicated as they grow. Following this time, if a layer of more suitable topsoil is required for planting, it can be added and sown.

Any machinery leaving the exclusion zone must be thoroughly washed and certified as clean by a competent person.

5.1.7 Preventing Reintroduction

Currently, there is a high likelihood that Japanese Knotweed will be reintroduced onto the site from further along the railway track if no action is taken to address the infestations present on the Dublin-Rosslare line. Given the significant investment Wexford County Council are making in the Trinity Wharf development, we strongly recommend that Wexford County Council and Iarnród Éireann arrange a meeting where stakeholders can express their concerns and come up with a mutually beneficial action plan. Envirico can attend to offer expert advice on the feasibility of measures discussed.

5.2 Management Plan for Three-Cornered Leek

5.2.1 Summary

Three-Cornered Leek should be left in-situ and subjected to an ongoing chemical treatment programme where possible. Where material that may contain this species needs to be excavated, this material must be removed to an EPA licenced waste facility. Strict biosecurity procedures (see Section 6) should be adhered to in order to minimise the risk of spread.

5.2.2 Herbicide Treatment

Three-Cornered Leek should be sprayed in April with a glyphosate-based herbicide. In order to increase the effectiveness of the herbicide application the leaves should be lightly bruised in advance of treatment. All herbicide treatments will need to be repeated every 2-3 months in order to treat whatever regrowth results from the seed and bulb bank left by this species.

5.2.3 Excavation

TCL01 will likely require excavation as part of the development works. The infestation and an area of up to 2m around and to a depth of 0.5m may contain TCL seeds and/or bulbs. This soil must be disposed of at an EPA licenced waste facility and not mixed with general spoil. It is not necessary to excavate TCL in order to prevent damage to structures that may be built. Placing concrete or any other significant structure on top of TCL will kill the plant.

6. BIOSECURITY PROTOCOLS

Persons entering an area infested with an invasive alien species must take certain precautions to prevent the spread of that species.

These guidelines are to be followed by all persons that enter an infested zone:

- All PPE, other equipment and machinery that enter an infested zone must be cleaned before entering.
- Before leaving an infested area, individuals must thoroughly inspect their clothing, PPE, any equipment and their footwear for rhizomes, or other plant fragments that may be stuck on.
- All personnel should carry a hoofpick or similar implement to thoroughly clean the treads of their footwear with. All footwear must be thoroughly cleaned before leaving an infested zone.
- All PPE, other equipment and machinery, clothing and footwear must be thoroughly cleaned with soapy water and a stiff bristled brush before leaving an infested zone.
- As good practice all staff should follow Inland Fisheries Ireland Biosecurity Protocols when they have entered water or a riparian zone.
- If machinery/plant has entered or worked in an infested zone, it must be thoroughly washed down before leaving the area or working in an uninfested location
- A power washer must be provided for effective cleaning of machinery, along with stiff bristled brushes.

7. CODES OF PRACTICE/SOURCES OF INFORMATION FOR INVASIVE KNOTWEED SPECIES

Ireland

- Invasive Species Ireland Horticultural Code of Good Practice (http://invasivespeciesireland.com/wp-content/uploads/2010/07/Horticulture-Code-Final.pdf)
- National Roads Authority – The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (http://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf)
- Invasive Species Ireland Japanese Knotweed Best Practice Management Guidelines (withdrawn since 1st Nov, 2016).
- Inland Fisheries Ireland – Best Practice Guidelines for the Control of Japanese Knotweed (http://invasivespeciesireland.com/wp-content/uploads/2012/01/Best-practice-control-measures-for-Japanese-knotweed.pdf)
- National Biodiversity Data Centre Invasive Species (http://www.biodiversityireland.ie/projects/invasive-species/)
- Invasive Species Ireland Website (http://invasivespeciesireland.com/)
- Sligo Institute of Technology Alien Species (http://staffweb.itsligo.ie/staff/dcotton/Alien_Species.html)
- Online Atlas of the British and Irish Flora (http://www.brc.ac.uk/plantatlas/) – *UK also*

UK

- Property Care Association Code of Practice for the Management of Japanese Knotweed (http://www.property-care.org/wp-content/uploads/2015/04/Code-of-Practice-for-the-Management-of-Japanese-knotweed_v2.7.pdf)
- Environment Agency – The Knotweed Code of Practice Version 3 (withdrawn since 11th Jul, 2016).
- Royal Institute of Chartered Surveyors – Japanese Knotweed and Residential Property (http://www.rics.org/uk/knowledge/professional-guidance/information-papers/japanese-knotweed-and-residential-property-1st-edition/)
- Department for Environment, Food and Rural Affairs Horticultural Code of Practice (http://www.botanicgardens.ie/gspc/pdfs/defra%20code%20of%20practice.pdf)
- GB Non-Native Species Secretariat (http://www.nonnativespecies.org)

8. ABOUT ENVIRICO

Envirico are an Irish ecological company that specialise in invasive species monitoring and control. We tackle invasive alien species found in domestic, commercial and amenity sites in terrestrial, riparian and freshwater habitats.

Our qualifications include:

- Ph.D. Ecology/Microbiology
- MSc Aquatic Ecology
- PCA Certified Surveyor of Japanese Knotweed
- PA1 – Safe use of chemicals
- PA6A – Operating hand-held pesticide equipment
- PA6AW – Operating hand-held applicators to apply pesticides near water
- PA6INJ – Operating hand-held pesticide injection equipment
- PA6MC – Operating other hand-held applicators
- Registered Professional Pesticide User of Pesticides
- SOLAS Safe Pass Certified
- CSCS Personnel
- PTS Certified
- Traffic Management
- HSE Commercial Divers
- National Powerboat Certificate (Level 2)

Our services include:

- Site-Specific, Best-Practice Management Plans
- Site Excavation and Management
- Chemical Control
- Post-Treatment Monitoring
- Completion Certificate
- Habitat Restoration
- Training in Biosecurity and Identification

Client:
Wexford County Council
Carricklawn
Wexford
Y35 WY93
Tel: +353 53 9196000

Consultant:

Envirico
Bonnettstown
Co. Kilkenny
R95 V2T4
Tel: +353 56 7801277
Email: info@envirico.com
Web: www.envirico.com

Drawing Title:
DRAWING 1:
INVASIVE SPECIES

Project Name: Invasive Alien Species Survey (Trinity Wharf Development)

Project Code:	*Drawn:*	*Approved:*
00082	AG	MB

Date:	*Drawing Number:*
14th Nov, 2017	*0082.1/Trinity Wharf/2017*

Source Background Digital Orthophoto:
Google Maps, 2017

Fig 1. JK01

Fig 2. JK02

Fig 3. JK03

Fig 4. JK04

Fig 5. JK05

Fig 6. JK06

Fig 7. JK07

Fig 8. JK08

Fig 9. JK09

Fig 10. TCL01

Fig 11. TCL02

JAPANESE KNOTWEED IDENTIFICATION SHEET

Three Cornered Leek Identification Sheet

White Flowers all pointing downwards

This herb has long, narrow green leaves

Flowers also have green lines inside

Appendix E - Marine Mammal Risk Assessment (IWDG, 2018)

MARINE MAMMAL RISK ASSESSMENT OF A PROPOSED DEVELOPMENT AT TRINITY WHARF, WEXFORD

Prepared by
Dr Simon Berrow

IWDG Consulting, Merchants Quay, Kilrush, Co Clare

1 | INTRODUCTION

The Irish Whale and Dolphin Group (IWDG) were contracted by the engineering and environmental consultants Roughan & O'Donovan to carry out a Marine Mammal Risk Assessment of the potential impact on marine mammals of the proposed Trinity Wharf Development in Wexford. The proposed construction site is within the Slaney River Valley SAC, which includes harbour seal as a qualifying interest. The proposed works will take place over a maximum of 80 months, with the works within the marine environment expected to be 10.5 months in duration, with potential for it to be condensed into less if the marina and boardwalk works are undertaken at the same time.

Figure 1. Trinity Wharf, Wexford, showing location

Proposed works

The main construction elements and activities of the development relevant to this MMRA are as follows:

- **Sea wall and revetment works:** the construction of the replacement sea wall will consist of driving steel sheet piles around the entire coastal boundary of the site with the addition of rock armour revetment placement along the south-east edge.
- **Increased boat traffic from the marina:** and potential to cause disturbance to seals, especially those hauled out in the vicinity.

The first main element of work to be constructed will be the sea wall around the coastal edge of the site. The sea wall will comprise the installation of steel sheet piles and a rock armour revetment along the south-east edge of the site with a smaller section along the northern section. The construction of the boardwalk / pedestrian link bridge from Paul Quay to the northern corner of Trinity Wharf will require the driving of 11 No. 700 mm diameter vertical tubular steel piles which will support the deck. The piles for the boardwalk (and potentially marina and breakwater) will be driven by impact hammer. This will overlap in programme with the sheet piling of the new sea wall.

A pile-driving rig will mobilise and begin vibro-piling sheet piles immediately in front of the existing sea wall to approximately -10.5mOD into the stiff gravelly clay. The design of the wall considers the use of granular fill material being compacted behind the sheet piles. Upon installation of the sheet piles, the existing sea wall will be broken up in-situ and left in place with granular backfill material being placed around this. Construction of sheet piling wall and rock armour revetment is planned to last 4 months with sheet piling will be continuous but piling for the foundations could be intermittent for this period.

Along the south east edge of the site, a rock armour revetment is required to be constructed immediately in front of the sheet pile wall. Rock armour consisting of rocks of approximately 0.5 to 1 tonne will be placed on the sea bed to the required profile in parallel with the installation of the sheet pile wall such that at no point during the construction can waves reflecting off the vertical wall significantly affect the moored vessels at Goodtide Harbour. The marina and floating breakwater units may also be restrained by vertical steel piles, but this has not yet been confirmed.

The design of the sheet pile sea wall requires the use of tie backs, consisting of tie-bars and a row of smaller sheet piles to be installed approximately 12m behind the sea wall. Installation of the earthworks, drainage and services and sheet pile wall anchorage walk is planned to last 6 months. Once all sheet piles are installed around the boundary of the site, the tie-bars will be installed between the two rows and the reinforced concrete capping beam will be constructed to the sea wall. Once the sheet piles and associated anchorage system is in installed correctly, backfilling works can commence.

2 | METHODS

The risk assessment was based on a review of the available literature and data sources. Maps of the distribution of cetacean sightings inside the sand dunes at the mouth of the Wexford Harbour, were prepared using data from the Irish Whale and Dolphin Group's casual sightings database (IWDG, accessed 25 November 2018).

3 | LEGAL STATUS

Irish cetaceans and pinnipeds are protected under national legislation and under a number of international directives and agreements which Ireland is signatory to. All cetaceans, as well as grey and harbour seals, are protected under the Wildlife Act (1976) and amendments (2000, 2005, 2010 and 2012). Under the act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected species (except under license or permit). The act applies out to the 12 nml limit of Irish territorial waters.

All cetaceans and pinnipeds are protected under the EC Habitats Directive. All cetaceans are included in Annex IV of the Directive as species 'in need of strict protection'. Under this Directive, the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) are designated Annex II species which are of community interest and whose conservation requires the designation of Special Areas of Conservation.

Ireland is also signatory to conservation agreements such as the Bonn Convention on Migratory Species (1983), the OSPAR Convention for the Protection of the Marine Environment of the northeast Atlantic (1992) and the Berne Convention on Conservation of European Wildlife and Natural Habitats (1979).

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Culture, Heritage and the Gaeltacht produced a '*Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters* (NPWS, 2007). These were subsequently reviewed and amended to produce '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*' (NPWS, 2014) which include mitigation measures specific to dredging. The guidelines recommend that listed coastal and marine activities (including dredging) be subject to a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process.

Once the listed activity has been subject to a risk assessment, the regulator may decide to refuse consent, to grant consent with no requirement for mitigation, or to grant consent subject to specified mitigation measures.

4 | BASELINE ENVIRONMENT

4.1 | Ambient Noise Levels

The ambient noise levels at the site are not known. Ambient noise in Wexford Harbour is expected to be dominated by environmental noise (e.g. tidal movement of water and sediment) and shipping noise, especially with peaks in noise due to recreational and fishing vessels transiting the harbour between Wexford town and the Irish Sea. Mussel fishing vessels are particularly common in Wexford Harbour with a large area of the harbour licenced under active Aquaculture licences.

The harbour is also known for recreational use, with the Wexford Harbour Boat and Tennis Club being located 2km north of the Trinity Wharf site and the Wexford Quays being a popular recreation area for locals. A weekend long Maritime Festival is held every year during the summer with multiple events being held on the water.

4.2 | Cetaceans

A review of cetacean (whale, dolphin and porpoise) records submitted to the IWDG provided only three validated records (Table 1). This consisted of one harbour porpoise sighting and one common dolphin *(Delphinus delphis)* sighting. A third sighting of a large group on 5 July were reported as harbour porpoise but the group size is large and were most likely dolphins, probably common dolphins (Table 1). Both of these latter sightings were closer to Rosslare Harbour.

Table 1. Cetacean sightings (including IWDG downgrades) recorded in Wexford Harbour and adjacent waters from 2000-2018.

Date	Species	No. animals	Observer
18 March 2017	harbour porpoise	1	Richie Conroy
05 July 2012	dolphin species, possibly harbour porpoise	15-20	Charlotte Steele
01 March 2004	common dolphin	2	Kevin McCormick

Figure 2. Map of all cetacean sightings submitted to the IWDG between 2000 to present (blue dots are harbour porpoise, green dots are dolphins)

Harbour porpoise are the most widespread and abundant cetacean in inshore Irish waters, with highest abundances in the Irish Sea (Berrow et al. 2010). Harbour porpoise are frequently sighted off southeast Wexford and are known to particularly associate with areas of strong tidal currents for foraging (Berrow et al. 2014). Common dolphins are distributed around the entire Irish coast with highest concentrations are off the south west and west coasts (Berrow et al. 2010). However, in the winter large numbers of common dolphins enter the Celtic sea to feed on schools of pelagic fish such as herring and sprat. Spawning grounds for herring occur off south Wexford with fish moving into inshore waters in December to February (Volkendandt et al. 2014).

4.3 | Pinnipeds

Grey and harbour seals are distributed around the entire Irish coast with grey seals being generally more abundant along the western seaboard and off the southwest coast (Cronin *et al.* 2004; O'Cadhla *et al.* 2007; O'Cadhla and Strong 2008). The conservation status of grey and harbour seals in Ireland has been assessed as favourable (NPWS 2008, 2013).

Harbour Seal (Phoca vitulina)

Wexford Harbour

Harbour seals have been reported in Wexford Harbour during National Parks and Wildlife Service (NPWS) surveys in 2003. Lockley (1966) reported an average of 10 Harbour (Common) seals in Wexford Harbour between 1964 and 1965. Cronin et al. (2004) reported 17 seals hauled out at two sites in Wexford Harbour on 19 August 2003 during an aerial survey.

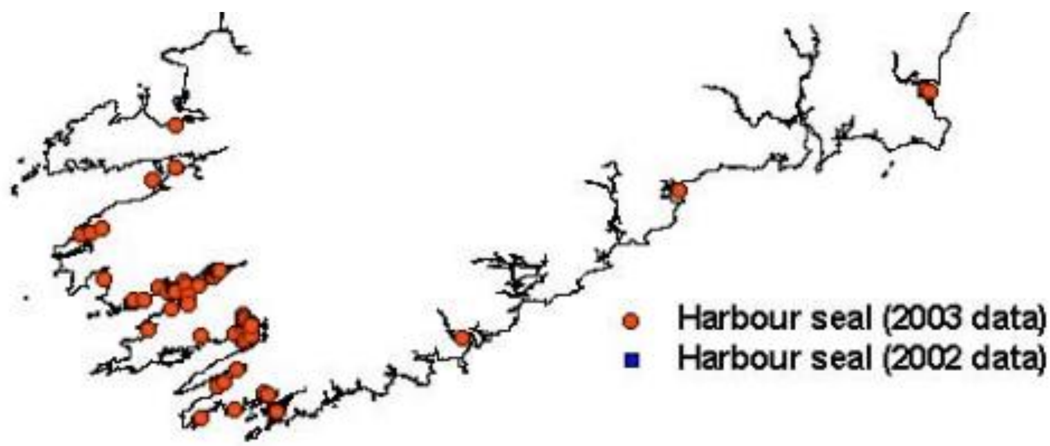

Figure 6. Map of the locations of groups of harbour seals recorded on the south coast of Ireland, August 2003 (from Cronin et al. 2004).

Slaney River Valley SAC

The Slaney River Valley SAC (Site Code 000781) hosts regionally significant numbers of Harbour Seal. Harbour seal occurs year-round in Wexford Harbour where several sandbanks are used for breeding, moulting and resting activity (NPWS 2011). NPWS report in their site synopsis that at least 27 individuals regularly occur within the site (Lockley 1966, Cronin et al. 2004) and unpublished National Parks and Wildlife Service records.

The Conservation Objectives for Harbour Seal in the Slaney River Valley SAC are:

- Species range within the site should not be restricted by artificial barriers to site use.
- The breeding sites should be maintained in a natural condition.
- The moult haul-out sites should be maintained in a natural condition.

- The resting haul-out sites should be maintained in a natural condition.
- Human activities should occur at levels that do not adversely affect the harbour seal population at the site.

According to NPWS (2011) haul out sites for harbour seals occur up to 2km from the proposed development (Figure 7).

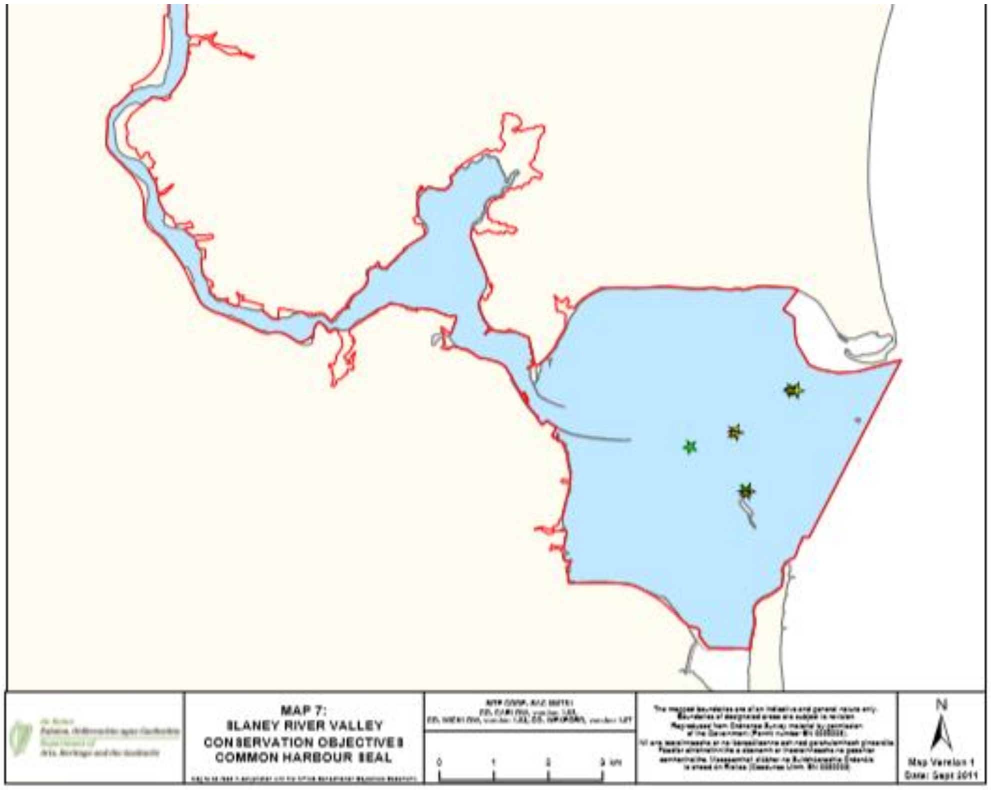

Figure 7. Harbour seal haul out sites (from NPWS 2011)

Grey Seal (*Halichoerus grypus*)

Grey seals are regularly reported hauled out on sandbanks in the mouth of Wexford Harbour and on the Raven sandbar. Kiely et al. (2000) carried out 14 surveys of the Raven Point between June 1997 and December 1998 and counted a mean of 75 grey seals hauled out. Numbers peaked in the summer but were consistently high during the breeding season and female moult period.

Cronin et al. (2004) reported 25 seals hauled out on 19 August 2003 during an aerial survey for harbour seals. A further 30 grey seals were reported at Carnsore Point and 17 on Tuskar Rock on the same day. O'Cadhla *et al.* (2007) reported 130 hauled out on the Raven spit and banks on 6 March 2007 during an aerial survey during the moulting period, which are numbers of national significance. Only 1 grey seal pup was reported during an aerial survey of grey seal breeding sites in 2005, suggesting the site is more important for moulting and resting than breeding.

The nearest protected site for seals in Great Saltee SAC off the south Wexford coast over 50km by sea from Wexford Harbour. Grey seals forage locally and may also range long distances and may occasionally swim upriver when foraging. Kiely et al. (2000) reported individual grey seals moving between colonies off southwest Wales and the Raven Point, suggesting some of the seals recorded during the high counts in the moulting period could originate from colonies outside Ireland.

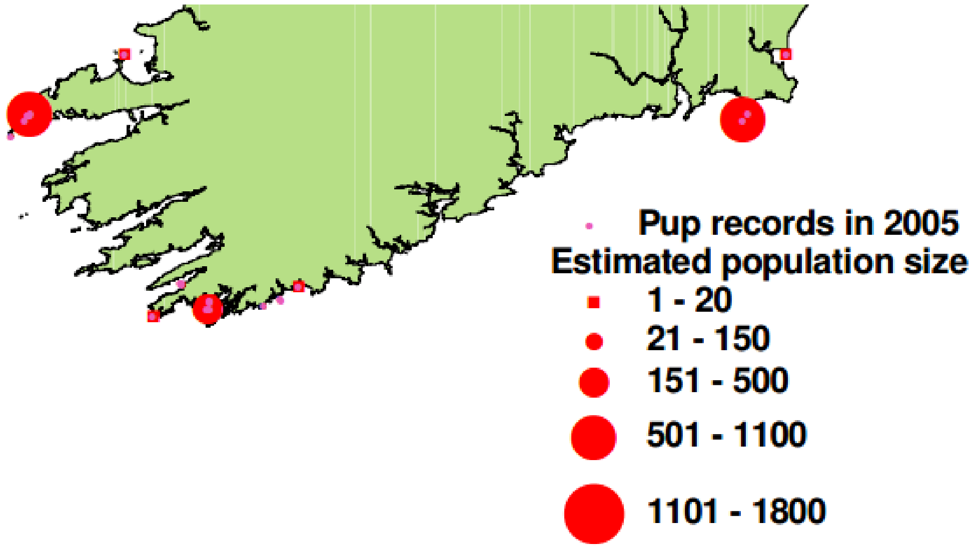

Figure 8. Map of the locations of grey seals pupping locations recorded on the south coast of Ireland in 2005 (from O'Cadhla et al. 2007).

5 | IMPACT ASSESSMENT

5.1 | Description of Activities

As part of the proposed site works piling and rock armour activities are most likely to impact on marine mammals, especially when considering the potential for acoustic trauma.

5.1.1 Piling Impacts

Pile driving is classed as a multi pulse source of impulsive sound. The potential impacts on marine mammals from piling activity include Permanent Threshold Shift (PTS), Temporary Threshold Shift (TTS) and behavioural disturbance; each of which have varying degrees of severity for exposed individuals.

If a marine mammal's received sound exposures, irrespective of the anthropogenic source (pulse or nonpulse), exceed the relevant criterion, auditory injury (PTS) is assumed to be likely. It is measured effects on marine mammals are largely based on work by Southall *et al.* (2007), who proposed a dual criterion based on peak sound pressure level (SPL) and sound exposure level (SEL), where the level that is exceeded first is what should be used as the working injury criterion (i.e. the precautionary of the two measures).

As all marine mammals do not hear equally across all frequencies, the use of frequency weightings is applied to compensate for differential frequency responses of their sensory systems. The M-weighting (for marine mammals) is similar to the C-weighting for measuring high amplitude sounds in humans. At present there are no data available to represent the onset of PTS in marine mammals but Southall *et al.* (2007) estimated it as 6 dB above the SPL (unweighted) and 15 dB above the SEL (M-weighted according to the relevant marine mammal functional group, see Figure 1) based on the onset of TTS. Therefore, Southall *et al.* (2007) proposed SPL criteria of 230 dB re 1 µPa (peak broadband level) for PTS onset in cetaceans and 218 dB re 1 µPa for pinnipeds. They also recommended TTS can occur at 224 dB re 1 µPa (peak broadband level) for cetaceans and 212 dB re 1 µPa for pinnipeds (Southall *et al.* 2007; Bailey *et al.* 2010) (Table 2). While, the SEL criteria proposed by Southall et al. (2007) include TTS onset at 183 dB re 1 µPa^2 -s for cetaceans and 171 dB re 1 µPa2 -s for pinnipeds, and PTS onset is expected at 15 dB additional exposure (Bailey *et al.* 2010) (Table 3).

Table 2. M-frequency weightings for pinnipeds from Southall et al. (2007)

Functional hearing group	Estimated auditory bandwidth	Genera represented (Number species/subspecies)	Frequency-weighting network
Pinnipeds in water	75 Hz to 75 kHz	*Arctocephalus, Callorhinus, Zalophus, Eumetopias, Neophoca, Phocarctos, Otaria, Erignathus, Phoca, Pusa, Halichoerus, Histriophoca, Pagophilus, Cystophora, Monachus, Mirounga, Leptonychotes, Ommatophoca, Lobodon, Hydrurga,* and *Odobenus* (41 species/subspecies)	M_{pw} (pw: pinnipeds in water)
Pinnipeds in air	75 Hz to 30 kHz	Same species as pinnipeds in water (41 species/subspecies)	M_{pa} (pa: pinnipeds in air)

Table 3. Proposed injury criteria for seals from Southall et al. (2007)

Marine mammal group	Sound type		
	Single pulses	Multiple pulses	Nonpulses
Pinnipeds (in water)	Cell 10	Cell 11	Cell 12
Sound pressure level	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)
Sound exposure level	186 dB re: 1 µPa^2-s (M_{pw})	186 dB re: 1 µPa^2-s (M_{pw})	203 dB re: 1 µPa^2-s (M_{pw})
Pinnipeds (in air)	Cell 13	Cell 14	Cell 15
Sound pressure level	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)
Sound exposure level	144 dB re: (20 µPa)^2-s (M_{pa})	144 dB re: (20 µPa)^2-s (M_{pa})	144.5 dB re: (20 µPa)^2-s (M_{pa})

Most concerns of the effects of pile driving on marine mammals has been around the construction of offshore wind farms (Richardson *et al.* 2011). There has been limited work on the effects of piling during coastal and harbour works. Attenuation of sound pressure levels at coastal sites will be more rapid depending on the topography and nature of the bedrock. Recently, Graham *et al*. (2017) modelled the source levels estimated for impact piling from a single-pulse sound exposure level of 198 dB re 1 lPa2 s and, for a 192 dB re 1 lPa source level for vibration piling during harbour construction works. Predicted received broadband SEL values 812 m from the piling site were markedly lower than source level due to high propagation loss (133.4 dB re 1 lPa2 s (impact) and 128.9 dB re 1 lPa2 s (vibration). Simultaneous acoustic monitoring of bottlenose dolphins and harbour porpoises at the site showed they were not excluded from sites in the vicinity of impact or vibration piling; nevertheless, some small effects were detected with bottlenose dolphins spending a reduced period of time in the vicinity of construction works.

The maximum TTS in harbour seals, measured 1-4 minutes after exposure for 120 minutes to the 148 dB re 1 µPa noise band (187 dB SEL), was around 10 dB (i.e. hearing was 10 dB less sensitive than normal). Recovery to the pre-exposure threshold was estimated to be complete within one hour post-exposure. Significant TTSs (in this study of > 3 dB) occurred at SELs of ~170 and 178 dB re 1 µPa2s (Kastelein et al., 2011). Kastelein et al. (2011) also showed that the two young harbour seals used in this study were more vulnerable to noise-induced TTS than another older animal using a noise band centered at 2.5 kHz, found a TTS onset at a higher SEL of 183 dB re 1 µPa2s). To assess the effects of pile driving sounds on TTS, harbour seals were exposed to low-repetition rate pulses (playbacks of pile driving sounds) with an energy peak at 630 Hz (most energy was between 0.4 and 5 kHz) and with 90% of their energy within a 124 ms period. No measurable TTS was induced, probably because the received level was too low. If TTS did occur it was of such low magnitude that hearing probably recovered during the interval between the pulses. Behavioural observations showed that one of the seals swam away from the sound source during the first two sessions, and hauled out at a 2 dB higher level. The other seal did not swim away from the transducer when the pile driving sounds were played back, which demonstrates individual variation between animals in behavioural reactions to sounds. Behavioural response studies should involve as many animals as possible to gain insight into natural variation in responses to sounds (Kastelein et al, 2011). Harbour seal auditory threshold is at around 1 kHz and would ranges up to around 40 kHz (Richardson et al., 2011).

As the likelihood of any cetaceans being in the vicinity of the construction site is extremely low there is an insignificant risk of sound exposure and impact, however the likelihood of seals being in the water close to the site is high.

Although no modelling of attenuation has been carried out at the current site, McKeown (2014) carried out modelling of piling in Dublin Bay and the River Liffey associated with the Dublin Port ABR project. SPL averaged 140 dB whereas 500m upriver the SPL was 108 dB which was at background levels. The SEL at this location was 156 dB. 300m downriver the SPL was 127 dB and the SEL was 173 dB suggesting that noise from piling reduced to background levels somewhere between 300 and 500m from the source in Alexandra Basin. The predicted loss compared to the measured loss along the modelled transect indicate an over-estimate in the order of 12 dB at ranges in excess of 1 km. While the values are in general agreement, the relative transmission loss at ranges beyond 1 km are in good agreement. Given the complex environment that exists in Dublin Bay, the model can be used to provide accurate transmission loss estimates at long ranges. The modelling data is supported by site specific measurements confirming the relative transmission loss (McKeown, 2014).

Each site has different characteristics but given that Wexford Harbour is quite shallow attenuation would be expected to be greater. However, this study shows that the risk of disturbance to seals hauled out 2-5km away is very low, but the risk to seals in the water <500m away is high.

5.1.2 Rock armour and construction activities

Placement of rock armour at the revetment could produce sound into the intermediate to the site, but this noise will be of short duration and dominated by low frequencies to which seals are less sensitive. Sound exposure levels from construction activities are below that expected to cause disturbance, from the noise generated or from the physical presence of land and sea-based craft. Construction activities have the potential to cause lower level disturbance, masking or behavioural impacts, for example (NPWS, 2014). The construction activities may lead to a very localised increase in noise levels and due to the long duration of construction activities, could have cumulative effects.

5.1.3 Increased marine traffic

Increased vessel traffic during construction is restricted to local craft inspecting and surveying the site will be an insignificant increase over existing traffic. Small work vessels produce low frequency sounds (Table 4). After construction it is envisaged that around 50% of the berths will be occupied by vessels already within the harbour. This leaves the other half available for visiting vessels. Trinity Wharf Marina will be competing with other marinas in nearby towns and the long navigational channel that is required to travel through coming into Wexford Harbour, may discourage some vessels passing along the coast. However, an increase in the volume of boats and boating activity adjacent to the marina and its approaches should be anticipated.

Small vessels tend to produce broadband low frequency sound from 10 Hz to 2.5 kHz (Wyatt, 2008) which harbour seals would detect as their auditory sensitivity ranges from around 1-40 kHz (Richardson et al., 2011). Seals in the area are already accommodated to existing boat traffic, including recreational and fishing activity, and seals are known to be quite tolerant to boat traffic especially if it slowly builds up over time (Richardson et al., 2011).

Table 4. Estimated noise emissions from small workboat / tug (Wyatt, 2008)

Vessel Type	Displacement Tonne	Length m	Propulsion	Activity	Measurement	Measurement band kHz	Extrapolation dB re 1 μPa m peak to peak	Reference
Tug with Barge[55]	Tug Gross tonnage 104	19.5 (64 ft)	Main engine 1095 hp diesel	Unloaded Speed 7.4 knots	173 dB re 1 μPa @ 1 m Source level	0.01 to 20	182 Broadband 10 to 2500 Hz with broad peak between60 and 600Hz	(Zykov and Hannay 2006)

5.2 | NPWS Guidance and Assessment

The NPWS (2014) '*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014*' recommends that listed coastal and marine activities, undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. It is required that such an assessment must competently identify the risks according to the available evidence and consider (i) direct, (ii) indirect and (iii) cumulative effects of anthropogenic sound (NPWS, 2014). Excavation of coastal structures is not specifically listed in the NPWS (2014) guidelines but piling is covered and is of concern if large piles are to be driven and there is a risk of exposure to marine mammals.

The works are assessed for their potential to create increased noise disturbance and the receiving environment. A risk assessment, following NPWS Guidelines, was conducted based on the published literature, data from the IWDG sightings databases and knowledge of the study area.

5.3 | NPWS Assessment Criteria

1. **Do individuals or populations of marine mammal species occur within the proposed area?**

   The likelihood of cetaceans being in the area is very low. Only harbour porpoise and common dolphin have been reported from the area and only very occasionally. There are important haul out sites for both harbour and grey seal in the mouth of Wexford Harbour and on the Raven. The proposed development occurs wholly within a SAC with harbour seal as a qualifying interest. These haul out sites are typically >5km away from the construction site but individual seals are likely to forage within the harbour and thus occur in the water near the construction site. All cetaceans and grey seals are part of a larger population and very mobile, with records of movements of grey seals between southeast Ireland and west Wales. Harbour seals are more sedentary and generally forage within 20km of their haul out sites (Cronin *et al*. 2008); however, studies in the UK have shown that harbour seals travel further distances from haul out sites (over 100km) (Cunningham *et al*. 2009).

2. Is the plan or project likely to result in death, injury or disturbance of individuals?

The project will not cause injury or death but could cause disturbance to seals in the water from noise associated with the project, especially from piling.

Noise Impact

The activities proposed during this project consist of demolition and piling operations. TTS could occur to seals in the water if they were very close to the site when piling started. There is no risk of TTS from rock armour or general construction activities, but disturbance could occur. The construction of this marina is expected to increase boat traffic but slowly over an extended period, allowing for seals adjacent to the site to accommodate to this increase. Wexford Harbour is already a busy site with recreational and fishing activity, thus any increase in recreational traffic is against a back drop of current use and will not significantly increase long term disturbance of the haul-out sites.

Physical Impact

The risk of injury or mortality is considered very unlikely as marine mammals are rarely in the vicinity of the site.

3. Is it possible to estimate the number of individuals of each species that are likely to be affected?

No abundance estimates for cetaceans in Wexford Harbour are available but their presence is rare and intermittent. An abundance estimates for harbour porpoises from Carnsore Point of 87±36.3 calculated from a density estimate of 0.58 harbour porpoise per km^2 (Berrow et al., 2014).

NPWS (2011) report up to at least 27 harbour Seals regularly occur within the site. Up to 130 grey seals have been reported hauled out on the Raven and on sand spits in the mouth of the harbour and its likely some 10s of seals use the harbour for foraging.

4. Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?

Construction work is planned to last for 80 months and thus spans all seasons for marine mammals. Marine works are expected to occur for 10.5 months within this construction period. As cetaceans are rarely recorded at the site and there is no potential for disturbance but both grey and harbour seals are present throughout the year. The site is used by a small number of harbour seals for both pupping and resting/moulting and grey seals more for moulting than breeding with foraging in the harbour likely to occur throughout the year. There is no particular season or aspect of a seals life-cycle when they will be more vulnerable to disturbance.

5. Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?

There is no data to suggest that any particular harbour or grey seal gender or age group are more likely to forage at the site compared to other ages/sex and thus all must be expected to occur vicinity at the site.

6. Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?

While harbour porpoise and common dolphins have been reported in the area, they are rare and intermittent and thus, the harbour does not provide any important habitats. Wexford Harbour is designated as a SAC for harbour seals and a nationally important site for grey seals which occur mainly hauled out at the Raven and on sand banks in the mouth of the harbour. Seals are known to forage in the harbour and could be exposed to risk, especially from noise associated with piling.

7. How quickly is the affected population likely to recover once the plan or project has ceased?

While there may be temporary disturbance all seals in the immediate vicinity of the harbour and construction area are accommodated to human activities and are likely to recover quickly from any temporary disturbance within hours.

5.4 | Mitigation

Both harbour and grey seals could potentially be affected by the proposed operations, especially from the noise associated with piling. They regularly occur in small numbers adjacent to the construction site and in the mouth of Wexford Harbour and are the marine mammals most at risk from the proposed works. The mitigation measures recommended by the NPWS are for the presence of a trained and experienced Marine Mammal Observer (MMO) and the use of “ramp up” procedures for noise and vibration emitting operations. The proposed mitigation measures (Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters) recommended by the Department of Culture, Heritage and the Gaeltacht in 2014 are designed to mitigate any possible effects.

5.4.1 NPWS Guidelines

The following mitigation measures consistent with NPWS (2014) are proposed to minimise the potential impacts on seals and to allow animals to move away from the construction area:

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms.
2. Unless information specific to the location and/or plan/project is otherwise available to inform the mitigation process (e.g., specific sound propagation and/or attenuation data) and a distance modification has been agreed with the Regulatory Authority, pile driving activity shall not commence if marine mammals are detected within a 500m radial distance of the pile driving sound source, i.e., within the Monitored Zone, following the recommendations in McKeown (2014).

Pre-Start Monitoring

3. Pile driving activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

5. The MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence. Sound-producing activity shall not commence until at least 30 minutes have elapsed with no marine mammals detected within the Monitored Zone by the MMO.

6. This prescribed Pre-Start Monitoring shall subsequently be followed by an appropriate Ramp-Up Procedure which should include continued monitoring by the MMO.

Ramp-Up Procedure

7. In commencing a pile driving operation where the output peak sound pressure level (in water) from any source including equipment testing exceeds 170 dB re: 1µPa @1m an appropriate Ramp-up Procedure (i.e., "soft-start") must be used. The procedure for use should be informed by the risk assessment undertaken giving due consideration to the pile specification, the driving mechanism, the receiving substrate, the duration of the activity, the receiving environment and species therein, and other information (see section 3).

8. Where it is possible according to the operational parameters of the equipment and materials concerned, the underwater acoustic energy output shall commence from a lower energy start-up (i.e., a peak sound pressure level not exceeding 170 dB re: 1µPa @1m) and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes.

9. This controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

10. Where the measures outlined in steps 8 and 9 are not possible, alternatives must be examined whereby the underwater output of acoustic energy is introduced in a consistent, sequential and gradual manner over a period of 20-40 minutes prior to commencement of the full necessary output.

11. In all cases where a Ramp-Up Procedure is employed the delay between the end of ramp-up and the necessary full output must be minimised to prevent unnecessary high-level sound introduction into the environment.

12. Once an appropriate and effective Ramp-Up Procedure commences, there is no requirement to halt or discontinue the procedure at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

13. If there is a break in pile driving sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) must be undertaken.

14. For higher output pile driving operations which have the potential to produce injurious levels of underwater sound (see sections 2.4, 3.2) as informed by the associated risk assessment, there is likely to be a regulatory requirement to adopt a shorter 5-10 minute break limit after which period all Pre-Start Monitoring and a subsequent Ramp-up Procedure (where appropriate following Pre-Start Monitoring) shall recommence as for start-up.

Reporting

15. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority.

5.4.2 Monthly Seal Surveys

Monthly seal surveys of known and potential seal haul-out sites will be carried out immediately prior to and during the marine works. This is to ensure there are no changes in use of these sites and to provide the NPWS with useful monitoring data. These seal surveys will be carried out by the site MMO concurrent with implementing NPWS guidelines.

5.4.3 Voluntary Code of Conduct for recreational boat-users

The new facility at Trinity Wharf will provide the opportunity to educate recreational boat users on the potential for disturbance of seals hauled out. A centralised facility, which does not exist at present, enables a voluntary code of conduct to be developed in collaboration with the marina, informing boat users of minimum distances to haul-out sites, signs of disturbance (such as head-up) and promote best practice. Provision of such information will ensure disturbance is minimised and the importance of the site for seals disseminated leading to increased environmental awareness.

5.5 | Residual Impacts

With implementation of the above mitigation measures, it is very unlikely that there will be negative residual impacts from the proposed construction activity on marine mammals in the area. It is also very unlikely that any animals will be injured or killed as a result of the proposed works. Seal haul out sites are between 2 and 5km from the proposed construction site. Seals using the inner harbour will be accommodated to vessel noise and resident individuals will have habituated to current vessel traffic. No significant increase in traffic is expected post construction and any animals which might be displaced from the vicinity of the construction site can be expected to quickly re-establish use of the area following cessation of the works.

Cetaceans are not present within the harbour and are occur occasionally outside the harbour and are therefore very unlikely to be impacted on by the works.

5 | SUMMARY

Sightings of cetaceans are extremely rare at or adjacent to the proposed site but the harbour is an SAC with harbour seals as a qualifying interest. The proposed construction site is adjacent to important seal haul out and pupping sites. Due to extended time period (up to 10.5 months) during which activities such as pile driving are scheduled, the potential impacts on seals exposed to this is activity could be significant.

Mitigation is required during piling activities. The proximity of the proposed works to important haul out sites and the likelihood of seals foraging near the construction site requires mitigation during all piling activities, which could have a significant impact on marine mammals in the absence of mitigation. Recommended mitigation involves the use of a Marine Mammal Observer to ensure no seals are within an agree mitigation zone on start-up and regular seal surveys are carried out to monitor use of known seal haul out sites in the area.

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Appendix 4.2 Outline Environmental Operating Plan

ROD
ROUGHAN & O'DONOVAN

Prepared by
Roughan & O'Donovan
Arena House, Arena Road, Sandyford, Dublin 18
Tel: +353 1 2940800 Fax: +353 1 2940820
Email: info@rod.ie www.rod.ie

Outline Environmental Operating Plan

Trinity Wharf Development, Wexford | February 2019

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ROUGHAN & O'DONOVAN

Trinity Wharf, Wexford

Outline Environmental Operating Plan

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1.0 INTRODUCTION

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

1.1 Purpose and Scope

This outline EOP sets out the mechanism by which environmental protection is to be achieved on the Trinity Wharf 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 outline 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 insitu 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 estuary shall be pre-cast, where possible.
- 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 a suitably qualified Site Environmental Manager;
- 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 Wexford Harbour 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 Wexford Harbour. 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 construction compounds will be set-up within the Trinity Wharf site according to the construction phase, however the locations of these will be dependent on the appointed contractors.

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

All construction compound areas will be required to be set back a minimum of 50m from the seaward boundary of the site. 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) to provide independently verifiable audit reports.

The Site Environmental Manager must possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken, a Level Eight qualification recognised by the Higher Education and Training Awards Council (HETAC), or a University equivalent, or other qualification acceptable to the Employer, in Environmental Science or Environmental Management, Environmental Hydrology, Engineering or other relevant qualification acceptable to the Employer.

Separate from the on-going and detailed monitoring carried out by the contractor as part of the EOP; the SEM shall carry out the inspection/ monitoring regime described below, and report to the employer. The results will be stored in the SEM's Monitoring file and will be available for inspection/ audit by the Client, National Parks and Wildlife Service (NPWS) or Inland Fisheries Ireland (IFI) staff. All inspections/ monitoring/ results will be recorded on standard forms.

(i) Control measures for works at or near water bodies shall be inspected on a daily basis;

(ii) In-situ concrete operations at or near watercourses shall be supervised and designated chute washing out facilities shall be inspected on a daily basis;

(iii) Site compounds shall be inspected on a weekly basis.

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.

[*Insert planning consent*]

4.0 SCHEDULE OF COMMITMENTS

The Schedule of Commitments comprises the mitigation measures as outlined in Chapter 18 Mitigation Measures of the Environmental Impact Assessment Report and any additional commitments arising during the EIA process up to and including the Oral Hearing.

The current Schedule of Commitments is as follows:

[*Insert Schedule of Commitments*]

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 18 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 (Flora and Fauna); EIAR Volume 2, Chapter 18 Mitigation Measures; Figures 7.1-7.2	Env. Manager/ specialist ecologist/ Env. Designer / Site Agent / Foreman	Method Statement / Ecological Walkover / Pre-surveys / agreement from IFI / Site Inspections	Ongoing	End of Contract
Hydrology and Hydrogeology	EIAR Volume 2, Chapter 7; EIAR Volume 2 Chapter 10; EIAR Volume 2, Chapter 9; EIAR Volume 2, Chapter 18 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 12 Air Quality and Climate; EIAR Volume 2, Chapter 18 Mitigation Measures;	Env. Manager/ Site Agent / Foreman	Method Statement / Site Inspections / Monitoring Data	Ongoing	End of Contract

5.0 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.

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

6.0 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.

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

APPENDIX A
Outline Construction and Demolition Waste Management Plan

Prepared by
Roughan & O'Donovan
Arena House, Arena Road, Sandyford, Dublin 18
Tel: +353 1 2940800 Fax: +353 1 2940820
Email: info@rod.ie www.rod.ie

Outline Construction and Demolition Waste Management Plan

Trinity Wharf Development, Wexford | February 2019

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ROUGHAN & O'DONOVAN

Trinity Wharf Development, Wexford

Outline Construction and Demolition Waste Management Plan

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1.0 INTRODUCTION

This outline 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 Trinity Wharf Development 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 outline CDWMP has been prepared for the provision of waste management for the construction phase of the Trinity Wharf Development, considering 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;
- CIRIA document 133 Waste Minimisation in Construction;
- National Construction & Demolition Waste Council (NCDWC) 2006 *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects.*
- National Roads Authority (now Transport Infrastructure Ireland) (2008)– *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*

This plan is intended to be a working document and has been prepared to inform the Construction Stage 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 enough level of detail to inform the environmental impacts to be assessed. However, changes may occur during detailed design stages which will change the volumes of waste.

Excavated material arising from the earthworks will be assumed to be contaminated and as such will not be adequate to be processed into acceptable fill material therefore all imported fill material will have to be imported from third party sources.

There are several registered/authorised quarries near the proposed development which may be utilised in the sourcing of the required imported granular fill material. These include but are not limited to:

- Roadstone, Kilinick, Co. Wexford – to the south of Wexford off the N25;
- Aidan Egan Sand & Gravel, Finchogue, Enniscorthy, Co. Wexford – north of Wexford Town to the east of Enniscorthy; and
- Boggan Sand & Gravel, Kilmacree, Drinagh, Wexford – immediately south of Wexford Town off the N25.

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

Prior to the commencement of any construction works, a Waste Management Co-ordinator (WMC) 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 Trinity Wharf Development. The WMC will liaise with the Project Ecologist and the Environmental Manager. The CDWMP will follow the mitigation detailed in the planning application documents including and not limited to the Environmental Impact Assessment Report and the Natura Impact Statement.

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; and,
- 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;
- Details of how Japanese Knotweed and Three-cornered leek will be treated in accordance with the invasive species management plan (Envirico, 2017) (Appendix A to this document)

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 development comprises a mixed-use urban quarter redevelopment of a brownfield, derelict site, as well as development within the foreshore, including;

- A six-storey 120-bedroom hotel;
- A six-storey multi-storey car park with a total of 509 parking spaces;
- A five-storey residential building providing 58 apartments;
- Office Building A, five storey;
- Office Building B, five storey;
- Office Building C, five storey;
- A two-storey cultural/performance centre with event capacity for up to 400 people;
- A two-storey mixed-use restaurant/café/ specialist retail building;
- A single storey management building;

- A new vehicular entrance road with a signalised junction on Trinity Street, widening of Trinity Street, a new railway level crossing and associated works;
- A new sheet-piled sea wall around the existing Trinity Wharf site and rock armour along the south-eastern section with a rock armour revetment along the north-eastern side;
- Site infrastructure works including ground preparation works, installation of foul and surface water drainage, wastewater pumping station, services, internal roads, public realm and landscape including a public plaza with 1,000m^2 open performance / events space. A total of 146 bicycle parking spaces throughout the development of which 90 spaces are dedicated to the residential development;
- A pedestrian/cycle boardwalk/bridge (c.187m long) connecting with Paul Quay, with gradual sloped access ramps (max. 1:20 gradient) of c.55m length on Paul Quay and c.24m at the Trinity Wharf development site;
- A 64 berth floating boom marina in Wexford Harbour; and,
- All other ancillary works.

2.2 Construction Stage

The construction of the proposed development is expected to take place over a period of 80 months, with the key milestone activities taking place at the following stages (if scheduled consecutively);

Table 4.3 Envisaged Construction Program

Works element	Duration of task (approx.)	Completion
Completion of Site preparation works – Site clearance and boundary security	6 months	6 months
Establishment of site access; temporary level crossing establishment, permanent junction construction	2 months	8 months
Installation of marina breakwaters	0.5 months	8.5 months
Construction of sheet piling wall and rock armour revetment along south-east boundary. (overlap with previous task)	4 months	12 months
Installation of boardwalk piling. (Overlap with previous)	3 months	13 months
Earthworks, drainage and services, and sheet pile wall anchorage installation throughout the site.	6 months	17 months
Boardwalk construction	4 months	21 months
Phase 2 Buildings Development	24 months	45 months
Marina Construction	2 months	47 months
Phase 3 Buildings Development	30 months	77 months
Public realm works, landscaping, construction of permanent level railway crossing.	3 months	80 months

2.3 Construction Procurement

It is envisaged that the construction of the Trinity Wharf Development will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer, however the construction could also be carried out under a Public Works Contract for Civil Engineering Works Designed by the Contractor (Design & Build).

3.0 WASTE MANAGEMENT STRAGETY

3.1 Scope

The Contractor will develop a CDWMP that will detail:

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

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.

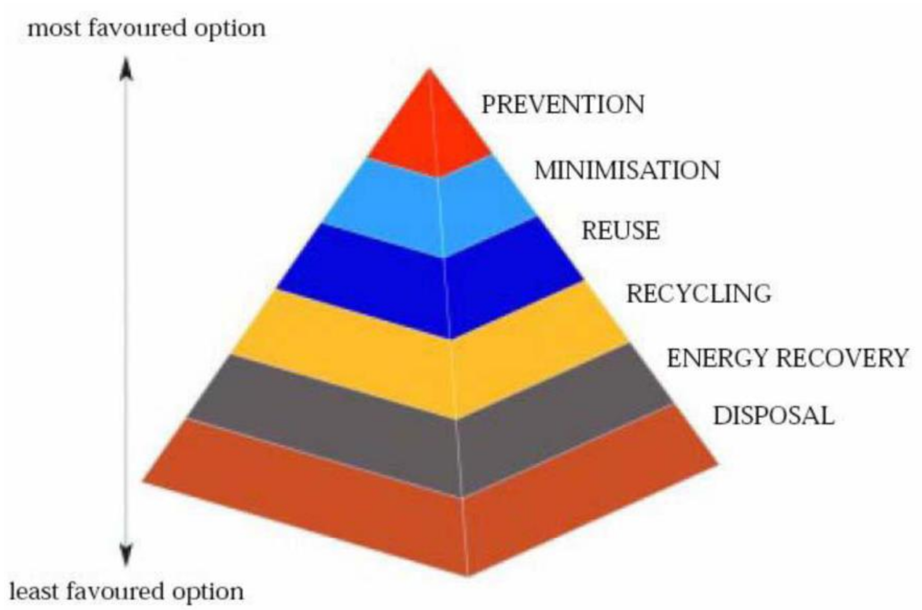

Figure 3.1 **The Waste Management Hierarchy [DEHLG (1998) *Changing Our Ways*. Department of the Environment, Heritage and Local Government, Dublin]**

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 effect this, designated Waste Storage Areas (WSA's) will be created at the construction compounds 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 WSA and will be supervised by a WMC, who will be appointed by the Contractor. This will be the person responsible for the management of waste during the construction of the entire project. 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.

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 and reduces potential loss to theft and accidental damage as well as making the site safer.

It is essential that the planning, construction works planning is carried out closely with the 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 earthwork's materials on site where possible;
- 100% recycling of surplus reinforcement and other metals, where possible; and,
- No contamination of skips, i.e. no additional costs due to inappropriate materials being placed in skips designated for particular waste streams.

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:

- Maximising the re-use of soils on site during the construction of the proposed development;
- 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 movement of material which includes Japanese Knotweed and three-cornered leek is subject to restrictions under Regulation 49 of the Birds and Natural Habitats Regulations 2011 (as amended). 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. The disposal of Japanese knotweed and three-cornered leek material off-site requires two documents; a licence from the National Parks and Wildlife Service (NPWS) and a Waste Classification document (See Appendix A to this document for further details).

4.2 Exclusion from Legislation

The Directive on Waste contains several 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 Trinity Wharf Development will require site clearance as part of the development. Advanced tree clearance, hedgerow clearance, invasive species removal, ground investigation and fencing contracts may be undertaken as these activities are dependent on the anticipated seasonal timing of the award of the main contract.

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;
- The location of any structures to be demolished;
- Statutory requirements;
- The prevalence of invasive species and the specific forms of treatment to prevent their spread within and outside the site (See Appendix A to this document); and,
- Specific environmental requirements and seasonal requirements, e.g. in respect of birds.

5.2 Site Offices, Construction Compounds and Security

A construction compound will be required along, or in the vicinity of the proposed development. The location, size and suitability of the compound will ultimately be at the discretion of the contractor once it is located within the landtake and site access is approved by the Local Authority. The location and layout of the construction compound selected by the contractor will have to incorporate the protection and mitigation measures outlined in the EIAR and conform to the requirements outlined in the Construction Environmental Management Plan (CEMP), Natura Impact Statement (NIS) and planning conditions.

Following completion of construction these areas will be cleared and re-instated, temporary buildings and containers, parking areas and material such as rubble, aggregates and unused construction materials will be removed as appropriate.

The storage of fuels, other hydrocarbons and other chemicals within the construction compounds will not be permitted within 50m of the seaward boundary. 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, these areas will be cleared and re-instated, 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

An estimate of the quantities of surplus construction waste and materials which will arise during the construction phase is not confirmed at the time of writing.

The Purchasing Manager shall ensure that all materials are ordered so that the calculated quantities are delivered to avoid surplus construction waste and material.

All waste materials (where necessary, after in-situ reuse and recycling options have been fully considered) shall be disposed of offsite, under appropriate Duty of Care and subject to approvals/consents from the relevant statutory bodies. It is the responsibility of the main contractor to ensure than any company to whom waste is transferred is legal permitted to do so and that the facility they bring the waste to is licensing to hand that type of waste as outlined in The Waste Management Acts 1996-2006.

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. While it is difficult at this stage to predict precise tonnage of these wastes expected from the proposed development, the Environmental Protection Agency (EPA) has produced figures for the construction and demolition waste recorded in the National Waste Database. This includes a percentage breakdown of each waste type in the construction and demolition stream (Table 5.2). A more detailed estimate of the anticipated quantities of these materials will be provided in the detailed CDWMP following appointment of the Contractor at construction stage.

Table 5.2 shows the breakdown of the construction and demolition waste types (from EPA data) produced on a typical site.

Table 5.2: Waste Materials Generated on a Typical Irish Construction Site

Waste Type	Proportion (%)
Soil and stones	51
Concrete, bricks, tiles, ceramic, plasterboard	39
Asphalt, tar and tar products	2
Metals	2
Other	6
Total Waste	**100**

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 clay, soil, and stones

Excavated soils, clay peat and rock will be loaded directly to vehicles for use within the Trinity Wharf Development as appropriate, *e.g*. as fill material. Where short-term temporary storage is unavoidable, the method of storage of such material will be key to its potential use as certain types of soils and clays are likely to degrade if left uncovered in wet weather due to its low plasticity and silty nature. Topsoil will be stored separately from other soil types and where possible clay mounds will not be more than 2m in height as they may damage the soil structures and limit its future use.

Concrete

Waste concrete is likely to arise during the construction phase of the Trinity Wharf Development. 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.

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 a 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

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.

The design of the proposed development takes into consideration the presence of asbestos at the site and where possible during construction, asbestos containing materials (ACMs) are to be left in place and not disturbed. Survey's completed to date have confirmed the presence of asbestos on site however the extent of which is still to be quantified. The site clearance works to commence prior to construction intends to clear all known asbestos containing materials that are located above ground. This may include; loose rubble which has been left over from partial demolition of previous standing structures; and concrete and masonry walls. Where possible, and subject to confirmation from detailed surveys, material which is does not contain asbestos will be processed and reused as fill material.

During the site clearance works, the following mitigation measures are to be implemented, which will be in addition to standard health and safety practices on construction sites:

- **Training** – All personnel removing, overseeing, directing, inspecting and/or disturbing ACMs and asbestos-contaminated soil will have, as a minimum and as appropriate to the activity, relevant training and experience in working with asbestos and/or asbestos in soils awareness.
- **Personal Protective Equipment (PPE)** – All personnel working with or in the vicinity of areas where asbestos is suspected or has been previously identified must wear personal protective equipment to include disposable category 5 coveralls.
- **Air monitoring** will be conducted during the disturbance of suspected ACMs as part of the site clearance works and during construction works. Where air monitoring is required it must be carried out by a UKAS accredited analyst in accordance with the method set out in HSG248 Asbestos; The Analysts' Guide for Sampling Analysis and Clearance Procedures.
- **Dust Suppressant** – Asbestos and Vehicle Management will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Where material is to be stored on site it will be kept covered with polyethylene sheeting or sprayed with sufficient amounts of water to prevent drying out and dust generation.
- **Access and Vehicle Management** – A site wide traffic management system will be incorporated for the site clearance works and construction works to minimise the potential for the spread of contamination. Internal site routes will be agreed with the Main Contractor and asbestos contractor in advance of the works and all surfaces will be subject to regular inspection.

- Any haulage trucks transporting ACMs must be properly covered and sealed to ensure that no spillages can occur en-route. All haulage trucks must be inspected by the asbestos supervisor prior to transport and leaving site.
- **Decontamination of Plant –** All plant and machinery, which is to be used in the removal of surface ACMs or disturbance of soils containing asbestos, will be fully decontaminated before leaving the area. No plant will be allowed to leave the works area until it has been decontaminated and passed a visual assessment by a competent person.
- **Decontamination of Personnel –** It must be assumed that clothing and equipment that has come into contact with asbestos is contaminated and must be treated as such. A designated area with appropriate welfare facilities should be provided for personnel to change into PPE and RPE prior to any asbestos remedial works commencing.
- **Waste Management –** Any handpicked asbestos debris and used coveralls, disposable masks and filters will be double-bagged in red and clear bags, labelled appropriately and stored in a designated container on site. The container will be secured and kept locked at all times. All asbestos waste will be removed by an appropriately licensed waste contractor. All waste transfer documentation will be retained by the contractor and copies provided to the Project Manager and appointed environmental consultant. Any waste from the cleaning down and decontamination of plant and equipment will also be disposed of to a suitable licensed facility.
- **Unexpected discovery of asbestos –** If suspect asbestos-contaminated soils or materials are discovered during the construction phase in areas not previously identified or suspected, or in quantities not previously identified or suspected, the contractor will stop work immediately and leave the area until specialist advice is sought by the appointed asbestos consultant. The area will be demarcated with barrier tape, or other means, and access restricted.

During the construction phase, these measures are to apply to elements of the works that are expected to encounter ACMs during its construction, such as the foul water pumping station, breaking up of the existing sea wall and the excavation works required to construct the main site access road.

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. 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.

Canteen Wastes

Staff canteens have the potential to generate food waste and packaging waste. Designated receptacles will be provided at the canteen 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.

Invasive Species

Two invasive species listed on the Third Schedule of Regulations 49 of the Birds and Natural Habitats Regulations 2011 are present on the site. Both the plants and material soils plant material require management to prevent the spread of these species within and outside the site. The contractor will develop a Biosecurity Protocol which will be subject to approval by the Employer. This will be based on the current invasive species management plan (Appendix A to this document). This will include the biosecurity measures and treatment methods to be used. This waste will be stored in a secure area clearly marked as material containing invasive species prior to being transported by a licenced haulier for disposal at a facility licenced to take this type of waste.

Other Wastes (Residual)

Waste material other than those outlined above can constitute a significant proportion of the total waste generated by a construction sites. This waste is normally made up of residual, non-recyclable waste such as soiled paper, cloth, cardboard or plastics, as well as canteen 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 (Wexford 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 sties 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 during 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 Trinity Wharf Development. It is intended that all waste soils, rock and concrete will be used within the project area where possible for infilling or landscaping. At this preliminary stage it is anticipated that the bulk of excavated material will be re-used on-site. It is anticipated that a certain (relatively low) percentage of the excavated material will not be suitable for use on-site. These materials will be recovered and disposed of off 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 Trinity Wharf Development, 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 proposed Trinity Wharf Development will develop their own CDWMP based on their detailed plans, the requirements of this outline plan, the requirements of the EIAR and NIS and any commitments given as part of the project approval process and the Employer's requirements and specifications for executing the Trinity Wharf Development.

APPENDIX A

INVASIVE SPECIES MANAGEMENT PLAN

Invasive Alien Species Management Plan

Trinity Wharf, Wexford

[Nov, 2017]

Prepared by Envirico on behalf of Wexford County Council

www.envirico.com

Action	Personnel	Company	Date
Revision: 1 (Jan, 2018)			
Report Prepared By:	Dr. Amanda Greer	Envirico	Nov, 2017
Reviewed By:			

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1. INTRODUCTION

Envirico have been engaged by Wexford County Council to carry out an invasive alien species survey and prepare an invasive species management plan for Trinity Wharf and the footprint of the proposed Trinity Wharf Development. The survey was conducted as a walkover by land on 3rd November, 2017. Two invasive alien species listed in the Third Schedule of S.I. 477/2011 were recorded during the course of the survey – **Japanese Knotweed** (*Fallopia japonica*; 1,377m^2), and **Three-Cornered Leek** (*Allium triquetrum*; 245m^2).

This invasive alien species management plan (IASMP) has been prepared in accordance with current Irish best practice guidelines such as 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' – NRA (2010); Best Practice for Control of Japanese Knotweed *Fallopia japonia* – Inland Fisheries Ireland; Best Practice Management Guidelines Japanese Knotweed *Fallopia japonia* – Invasive Species Ireland (2008).

1.1 Site Manager/Owner:	Wexford County Council
1.2 Site Address:	Trinity Wharf
	Wexford

1.3 Site Description:
The survey area covered the both the Trinity Wharf itself and the section of Dublin to Rosslare railway track running along the southwestern boundary of the wharf, up to the boundary with residential and commercially owned properties. GPS co-ordinates are from N: 52.334411, E; -6.452088 at the north corner to N: 52.331829, E: -6.451053 in the south. The site is earmarked for significant development, with commercial units, hotel, and outdoor public amenity space planned. Access to the wharf is likely to be across the railway line at the north-western corner of the wharf.

1.4 Site Management Objectives and Threats to Objectives:
The site management objectives, threats to achieving those objectives and the planned strategies for minimising these threats are outlined in Table 1.

Table 1. Site management objectives, threats and mitigation for these threats.

Objective	Threat(s)	Mitigation
1. To prevent the spread of invasive species as a result of the construction works.	Movement of equipment and personnel throughout areas contaminated with invasive species Digging amongst invasive species or areas containing propagules Movement of contaminated clay	Before works begin, Japanese knotweed and Three-Cornered Leek will be treated with herbicides to the reduce their regenerative capacity. Strict biosecurity protocols will be implemented, as outlined in the IASMP. All machinery that is working in infested areas must be thoroughly washed down and certified as clean before leaving a designated zone. Japanese knotweed will be left in-situ wherever possible and subjected to ongoing treatment with herbicides. All contaminated clay will be treated according to the procedures outlined in the IASMP.
2. To enable construction to go ahead in a timely fashion without compromising objective 1.	Works may be delayed due to the implementation of biosecurity protocols, licence applications, waste classification, on-site treatment of or removal of contaminated spoil offsite.	Delays will be minimised by following the protocols laid out in this management plan.
3. To reduce the likelihood of the reintroduction of Japanese knotweed onto the site.	There is a significant amount of Japanese knotweed present close to the site along the Dublin to Rosslare railway line that forms a likely source of reintroduction to the site.	Iarnród Éireann will be engaged with and the merits of a comprehensive survey and treatment programme to all involved will be stressed. The aim is to establish an ongoing treatment and monitoring programme for this line to minimise the risk of reintroduction of Japanese Knotweed onto the Trinity Wharf Development Site.

2.1 Japanese Knotweed

Japanese Knotweed (*Fallopia japonica*) was introduced to Europe by the horticultural activities of Philippe von Siebold, who plucked the plant from the side of a Japanese volcano in the 1840s. It is a fast growing, perennial, herbaceous plant, native to East Asia (Japan, northern China, Taiwan and Korea). In its home range, the plant is not a threat because a host of native predators, fungi and herbivorous insects keep it in check. However, outside Japan it is classified as one of the World's Worst Invasive Species (World Conservation Union). The date of its first introduction to Ireland is not known, but is believed to be in the mid to late 19th century.

Japanese Knotweed can grow >3m high, with young shoots in spring growing up to 10 - 30cm per day, quickly resulting in dense stands that shade out other species. The leaves are a distinctive shape with a tapered tip and a flat base (up to 18cm long) and the mature hollow stems have nodes and look somewhat like bamboo canes. The underground rhizome system can be vast, extending up to 3m deep and 7m horizontally from the nearest visible growth. Japanese Knotweed produces small cream or white flowers in late summer or early autumn. There are only female plants in the UK and Ireland so sexual reproduction is negligible; however, hybrids with related plants can be produced (e.g. Giant knotweed; Russian Vine) and are found occasionally.

Even without sexual reproduction, the plant spreads at a rapid rate by rhizome extension. New plants can also grow from tiny fragments of rhizome (as little as 0.7 grams) or stems, which means that traditional control methods such as cutting or strimming will actually further spread a knotweed infestation. Some of the most likely routes for knotweed spread are via our roads, rivers and railway lines as tiny fragments are dragged along these routes enabling them to quickly colonise new areas. Knotweed is also often spread by the movement of contaminated soils offsite and the improper disposal of the weed in garden clearings. It can grow on a wide range of soil types, pH and salinity; has the ability to withstand droughts, heat, cold, sulphurous soil; and is tolerant towards heavy metals. This hardiness ensures a wide distribution across habitat types.

Japanese Knotweed's massive rhizome system and vigorous growth can seriously damage walls, foundations, roads and buildings, including historic sites. The plant can also disrupt the integrity of man-made flood defense structures, increasing costs in repair and maintenance. Railway tracks, roads, pavements, and other constructions are also frequently affected.

Other highly invasive knotweeds that occur in Ireland are Giant Knotweed, *Fallopia sachalinensis*, Himalayan Knotweed *Persicaria wallichii* and Bohemian Knotweed *Fallopia x bohemica*, which is a hybrid between Japanese and Giant Knotweed. These other knotweeds are increasingly found in Ireland, though still to a much lesser extent than the Japanese Knotweed.

In Ireland, Japanese Knotweed is classified as a High-Impact Invasive Species with a Risk Assessment Score of 20. It is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations) and spoil contaminated with Japanese Knotweed waste is classified as a vector material in Part 3 of the Third Schedule (see Section 3 for details of this legislation).

2.2 Three-Cornered Leek

Three-Cornered Leek (AKA Three-Cornered Garlic, White Bluebell) *Allium triquetrum* is a bulbous, perennial herb native to Mediterranean countries. It was introduced to the British Isles for cultivation in the 1750s and had become established in the wild on Guernsey & Jersey Islands by the 1850s. In Ireland, it is particularly prevalent along the south-eastern seaboard. This species thrives along road verges, at the base of hedges and in disturbed ground and is easily identified in springtime by its strong garlicky smell and pretty white flowers. Its green leaves are long and slender.

All parts of Three-Cornered Leek are edible, from flowers to leaves to bulbs, and all are strongly reminiscence of garlic. This plant can reproduce by dividing its bulbs or setting seed. Interestingly, its seeds are ant-dispersed. Three-Cornered Leek seeds have an appendage with oil attached, and the ants carry the seeds away in order to eat the oil. Then they discard the seed. Three-Cornered Leek is also sometimes planted by humans in the wild or can be spread accidentally by the movement of contaminated soil and garden waste. Where it becomes established this species can reduce biodiversity by growing earlier in the season than its native competitors and shading these native species out.

In Ireland, Three-Cornered Leek is classified as a Medium-Impact Invasive Species with a Risk Assessment Score of 15. This species is listed in Part 1 of the Third Schedule of Statutory Instrument 477/2011 (Birds and Natural Habitats Regulations; see Section 3 for details of this legislation).

3. INVASIVE ALIEN SPECIES LEGISLATION

The Invasive Species Ireland project identified Japanese Knotweed as one of the highest risk (most un-wanted) non-native invasive species in Ireland. There is strict legislation surrounding Japanese Knotweed and Three-Cornered Leek in Ireland – namely under Irish Statuory Instrument 477/2011 and the Wildlife Acts (1976-2000). We have also ratified a number of international conventions that oblige the Government to address the issue of non-native invasive species, including the Convention on Biological Diversity, the Bern Convention and the International Plant Protection Convention

Irish Statutory Instrument 477/2011

The EC Birds and Natural Habitats Regulations introduced important legislation concerning invasive species in the Republic of Ireland. Japanese Knotweed and Three-Cornered Leek are both listed in Part 1 of the Third Schedule.

Article 49 prohibits the introduction, breeding, release or dispersal of certain species; and Article 50 prohibits dealing in and keeping certain species.

Article 49 (2) "Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence."

Article 49 (3) states that you can defend against allegations that you committed an offence under Article 49 (1) or (2) by proving that you took all reasonable steps and exercised all due diligence to avoid committing the offence:

Article 49 (3) "Subject to paragraph (4), it shall be a defence to a charge of committing an offence under paragraph (1) or (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

Article 50 (2) "Save in accordance with a licence granted under paragraph (7), a person shall be guilty of an offence if he or she imports or transports –

(a) an animal or plant listed in Part 1 or Part 2 of the Third Schedule

(b) anything from which an animal or plant referred to in Part 2 of the Third Schedule can be reproduced or propagated, or

(c) a vector material listed in Part 3 of the Third Schedule,

into or in or to any place in the State specified in relation to such an animal or plant or vector material in relation to that animal or plant or vector material in the third column of the Third Schedule."

The *Wildlife Amendment Act (2000)* of ***The Wildlife Act (1976)*** made it an offence to cause an exotic species of flora to grow in the wild anywhere in the state**:**

"Any person who plants or otherwise causes to grow in a wild state in any place in the State any (exotic) species of flora, or the flowers, roots, seeds or spores of flora, otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence."

4. SURVEY FINDINGS

A walkover survey was conducted on 3rd Nov, 2017. This survey confirmed the presence of two Third Schedule S.I. 477/2011 invasive alien species –Japanese Knotweed and Three-Cornered Leek. A significant amount of another medium invasive species - *Buddleia davidii* was noted to be present throughout the site; however, this species is not listed in S.I. 477/2011.

4.1 Japanese Knotweed

In total, nine distinct stands of Japanese Knotweed (JK) were recorded during the survey (see Appendix I – Drawings). Each knotweed stand was given a unique identifier or JK number. The details of each stand recorded are outlined in Table 2, including length, width, the average height of the canes, the maximum cane diameter, and any other notable features.

The total above ground area covered by Japanese Knotweed was 1,377m^2, with 1,030m^2 of this recorded along the railway lines and only 347 m^2 growing within Trinity Wharf. All of the JK surveyed appeared to have been growing at the same location for a number of years. JK01 to JK07 were all growing along the Dublin to Rosslare railway line on the western side of the tracks, while JK08 & JK09 were growing within Trinity Wharf. It was noted during the course of the survey that there was a substantial amount of Japanese knotweed present along the western side of the railway tracks continuing further east of the site and that this poses a significant threat for reintroduction (see Appendix II – Photographic Record).

Table 2. Details of each stand of Japanese Knotweed within the survey area

ID	Length (m)	Width (m)	Growth Stage	Avg. Stem Height	Max. Stem Diameter	Close to Water	Likely to Require Excavation
JK01	8.5	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK02	17.4	3	Dying Back	>2.5m	>2.5cm	No	Yes
JK03	2.5	2	Dying Back	>2.5m	>2.5cm	No	No
JK04	15	5	Dying Back	>2.5m	>2.5cm	No	No
JK05	106	Up to 20m	Dying Back	>2.5m	>2.5cm	No	No
JK06	6	2	Dying Back	>2.5m	>2.5cm	No	No
JK07	6	2	Dying Back	1 – 2.5m	1 – 2.5m	No	No
JK08	49	5 to 15m	Dying Back	>2.5m	>2.5cm	Yes	Yes
JK09	9 to 4	10	Dying Back	>2.5m	>2.5cm	No	Yes
Total Coverage of Japanese Knotweed: 1377m^2							

*Areas may differ from length x width due to irregular polygon shapes

4.2 Three-Cornered Leek

There were two stands of Three-Cornered Leek (TCL) recorded on the site (see Appendix I – Drawings & Appendix II – Photographic Record). TCL01 was a 30m long and 1m wide strip of TCL running along the western edge of Trinity Wharf by the fence separating the Wharf from the railway tracks. The plants were approx. 20cm high and flowering/ in leaf. TCL02 ran in a 1 or 2m wide strip for 102m along the western side of the railway line. Most of these plants were 20cm high and in leaf.

5. MANAGEMENT PLANS

Please Note: Although medium-impact invasive species Buddleia was noted during the survey, as this species is not listed in the Third Schedule of S.I. 477/2011 there is no special legal requirement surrounding this species other than not to cause it to grow in the wild.

5.1 Management Plan for Japanese Knotweed

5.1.1 Summary

In order to reduce the regenerative capacity of the Japanese Knotweed present on-site, and the likelihood of reintroduction, all stands should be subject to an on-going herbicide treatment program.

Wherever possible, JK should be treated in-situ with a herbicide programme for a minimum of 5 years by a professional contractor.

Where excavation of JK is necessary due to the proposed works, strict biosecurity protocols must be adhered to. Haulage routes must be clearly defined and lined with an appropriate geo-textile to avoid ground contamination; and wash-down areas and procedures must be in place.

Two different options for the disposal of JK contaminated clay are outlined (subject to licenses/approval): 1. Off-Site Disposal; 2. Soil Screening and Bunding.

We strongly recommend that the client engage in a discussion with Iarnród Éireann and Envirico about the best strategy to tackle the significant Japanese knotweed infestations further along the railway lines in order to minimise the risk of reintroduction.

5.1.2 Herbicide Treatment

Wherever possible, JK should be treated in-situ with herbicides. For all JK stands to be left in-situ a comprehensive treatment programme should be carried out for a minimum of 5 years by a professional contractor. However, even stands that are planned for excavation should have herbicide treatment applied to them at each available opportunity before works commence, in order to reduce their regenerative capability.

All works must be carried out by a professional contractor with specialist knowledge of invasive species.

The Environment Agency (UK, 2013) recommends that wherever possible JK is treated in-situ using herbicides. In-situ treatment is the most environmentally-friendly option, and does not pose the same biosecurity risk as mechanical removal. A herbicide treatment programme is also the most cost-effective option; however, it can take 5 or more years to be completely effective and even after such time, the rhizomes cannot be assumed dead without undertaking viability testing. Therefore, not all JK stands recorded here will be suitable for treatment with herbicides alone.

Legislative Framework

All professional formulation plant protection products must only be applied by a Professional Pesticide User that is registered with the Department of Agriculture, Food and the Marine (as required by the Sustainable Use of Pesticides Directive, 2012). All herbicides will be applied in accordance with current legislation (Sustainable Use of Pesticides Directive, 2012), in compliance with the label, in appropriate weather conditions and following an environmental risk assessment. Application of pesticides near water must have prior approval from Inland Fisheries Ireland, be applied by appropriately trained personnel (PA6AW) and use only aquatic approved products.

Herbicides Effective Against Japanese Knotweed

Currently, the following active ingredients are considered to be the most effective treatment for Japanese knotweed available in the EU. Table 3 outlines some key features of these products.

Table 3. Herbicides currently licenced in Ireland that are effective against Japanese Knotweed. All herbicides are systemic (translocated).

Herbicide	*Licensed Product	PCS No.	Selectivity	Persistence	Timing of 1st Application	Aquatic Approved Product
Glyphosate	Roundup Biactive XL	04660	Non-selective	Non-persistent	Aug-Oct	Yes
Aminopyralid + Triclopyr	Icade Grazon Pro	04249 05182	Selective	Not assessed (not for use on animal feed for 1 year)	Apr-May	No
2-4D Amine	Depitox	02365	Selective	1 month	May	No

***** Only example licence products are displayed, others may be available.

Any chemical treatments for infestations close to water e.g. JK08 should use an aquatic-approved product.

In order for a chemical treatment programme to be successful, it is important that the initial leaves and stalks, and any regrowth remain as healthy as possible until the product is applied. A translocated herbicide is drawn into the plant from where it is applied, and moved to other plant organs incl. roots/rhizomes. Because of this mode of action, a translocated herbicide applied via a foliar spray will be most effective if it has a larger leaf area to cover, and the translocation of the product from the leaves down to the rhizomes will be most efficient if the plant is not damaged or water-stressed.

Table 5. Treatment Schedule

Site Visit	Action	Time	Year
1	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2018*
2	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2018*
3	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2019*
4	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2019*
5	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2020*
6	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2020*
7	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2021*
8	Monitor for growth and apply systemic herbicide as necessary	*Jul - Oct*	*2021*
9	Monitor for growth and apply systemic herbicide as necessary	*Apr - Jun*	*2022*

This schedule of works is an estimate only, as it may take fewer or additional site visits to ensure that eradication (no regrowth for 2 years) is achieved.

5.1.3 Excavation

In total there are four JK stands that *may* require excavation as part of the proposed works – JK01, JK02, JK08 & JK09. The above ground area covered by these stands totals 434m^2. When a 7m buffer is placed around these stands, there is a total area of 2,425m^2 that is potentially contaminated. The maximum lateral extent of rhizomes is typically considered 7m with a maximum depth of 3m. Therefore, the maximum volume of JK contaminated material if JK01, JK02, JK08 & JK09 require complete excavation is 7,275m^3. This figure is likely to be a gross over-estimation of the amount of clay containing JK material. A Certified Surveyor of Japanese Knotweed (CSJK) should supervise all excavations within contaminated areas and can restrict the material classified as contaminated to that which actually contains JK material. Under typical conditions, the JK rhizome network does not expand to its maximum possible extent. It is more usual to find the rhizome network contained within 3m lateral spread and 1.5m depth. Therefore, it is more likely that the amount of contaminated clay to be removed if JK01, JK02, JK08 & JK09 require complete excavation would be in the region of 2,718m^3 (calculated from typical rhizome extent of 3m, depth of 1.5m) if done under the supervision of a CSJK.

The volume of material to be excavated will depend on the final development plan and the extent of the development works that take place between the Iarnród Éireann and Wexford County Council boundaries. Depending on the final development plan, it may be that only a portion of the Japanese knotweed requires excavating. In this case, built structures can be protected by the installation of a root barrier membrane in order to keep the amount of excavated material down to a minimum.

Should it be necessary to obtain an accurate estimation of the amount of material to be removed, this can be provided by scraping back the top 25cm of top soil and digging a series of test pits within the buffer zone.

5.1.4 Biosecurity

Exclusion Zones

Any personnel or machinery entering within 7m of a Japanese Knotweed stand is entering a potentially contaminated area and as such must be subject to strict biosecurity protocols. This 7m is designated because the maximum lateral extent of the JK rhizome network is 7m from the nearest visible growth. Exclusion zones must be set up a minimum of 7m away from the nearest visible JK growth. Maps depicting the 7m buffer zones are provided in Appendix I – Drawings.

Exclusion zones should be clearly marked or fenced off in order to prevent accidental incursion.

All PPE, equipment, plant or machinery to enter an exclusion zone must be thoroughly clean before entering.

Routes within the exclusion zone should be overlaid with a geotextile that has a layer of sand on-top to protect it from being damaged by heavy machinery. The geotextile will prevent potentially contaminated clay from being transferred onto tracks, tyres or boots.

A designated wash-down area(s) lined with appropriate geo-textile will be set-up within each exclusion zone. At this/these locations all PPE, plant and equipment must be thoroughly cleaned before leaving the exclusion zone. They should be certified as clean by personnel competent at recognizing JK material incl. rhizome. Any material that has been washed off PPE, plant and equipment will be treated as contaminated and added to material to be removed for disposal or further treatment. Equipment such as a power-washer, buckets with clean soapy water, stiff brushes, hoof-picks, cloths will be available at all times at all wash-down areas.

The amount of traffic in and out of exclusion zones should be kept to a minimum at all times. Machinery should remain outside the zone where possible. For example, long-reach excavators may be utilized to dig material out of an exclusion zone and load it into a truck without having to track inside the exclusion zone at any time. The bucket and arm of the excavator that operated within the exclusion zone must be subject to the wash-down protocols out-lined above.

Loading Contaminated Material

All trucks to collect JK contaminated material should be lined with appropriate geotextile. Material will be loaded to within no more than 50cm of the top and then covered with geotextile for transport.

Banksmen should be in place during loading of contaminated material to watch for and immediately clean-up any material that is dropped during loading. This material will be added to the load to be transported.

Haulage routes should be lined with geotextile protected with a layer of sand on top and trucks will not deviate from these routes.

Trucks that have been used to transport contaminated material must be thoroughly washed down and certified as clean by a competent person before being put to an alternate use.

After Excavation

Following excavation of JK contaminated material, it must be disposed of appropriately. Currently Irish Waste legislation (Waste Management (Facility, Permit and Registration) Regulations 2007) only allows for disposal at a licensed landfill unless an exemption is granted by the EPA. However, this legislation is currently under review and may be altered in advanced of the proposed works commencing (EPA, *Pers. Comm*., 2017).

5.1.5 Option 1 – Disposal Off-Site

Disposal off-site is a quick and easy method to get rid of JK contaminated material. Currently, it is also the only way to remediate JK material without either obtaining a Waste license or an exemption from the EPA. However, it is very expensive, and the most environmentally damaging method of treating JK.

JK material that is removed off-site in Ireland is either taken to landfill and deep-buried – an unsustainable solution that uses valuable landfill space; or shipped to the Netherlands for incineration – another solution with a heavy carbon footprint.

Legislative Framework

Japanese Knotweed contaminated material can only be removed off-site by a licenced waste haulier and brought to a licenced waste facility. Under Statutory Instrument 477/2011 (Article 50(2)) it is an offence to transport Japanese knotweed contaminated material without first obtaining a licence from National Parks and Wildlife.

Documents Required for Removal of Japanese Knotweed Contaminated Waste

For disposal of Japanese knotweed material off-site two documents are required: a **licence from National Parks and Wildlife (NPWS)**; and a **Waste Classification document**.

Licence from National Parks and Wildlife Service

A licence application must include:

- As much information as possible on the removal, transportation and treatment of the species in question
- A detailed description of the biosecurity measures that will be in place
- A copy of the Knotweed Management plan
- Details of the timeframe for carrying out the work

Waste Classification Document

Japanese knotweed waste may only be transported offsite by a licenced haulier who will require a waste classification document. A soil test is required in advance. The soil can only be transported to a licenced waste facility that has been notified in advance of the nature of the waste and has agreed to accept the waste material.

5.1.6 Option 2 – Soil Screening & Bunding

*This option is subject to EPA approval.

Following excavation, trucks loaded with JK contaminated material will haul this materials along a pre-determined haulage route to a designated area on Trinity Wharf. Trucks will empty the contaminated material in an exclusion zone that is fenced off from the rest of the site and lined with geotextile. They will then move to a geo-textile lined wash-down area that has been set up adjacent to the unloading area for cleaning before they leave the exclusion zone.

The JK contaminated material will then be screened in a geo-textile lined designated area using a series of differently sized metal screens and conveyors that separate the plant material from the clay. Finally, a handpicking station will remove any remaining plant material. The screened clay will be used in the landscaping of a green area by being spread on top at a depth of no more than 0.5m. The plant material will be either removed off-site for incineration (license from NPWS required) by a licensed waste haulier; or incinerated on-site using a mobile incinerator (subject to EPA approval). This spoil used in the landscaping of the green area will be fenced off and subject to ongoing monitoring for 18 months to ensure that if any rhizomes remained after the screening process, they are eradicated as they grow. Following this time, if a layer of more suitable topsoil is required for planting, it can be added and sown.

Any machinery leaving the exclusion zone must be thoroughly washed and certified as clean by a competent person.

5.1.7 Preventing Reintroduction

Currently, there is a high likelihood that Japanese Knotweed will be reintroduced onto the site from further along the railway track if no action is taken to address the infestations present on the Dublin-Rosslare line. Given the significant investment Wexford County Council are making in the Trinity Wharf development, we strongly recommend that Wexford County Council and Iarnród Éireann arrange a meeting where stakeholders can express their concerns and come up with a mutually beneficial action plan. Envirico can attend to offer expert advice on the feasibility of measures discussed.

5.2 Management Plan for Three-Cornered Leek

5.2.1 Summary

Three-Cornered Leek should be left in-situ and subjected to an ongoing chemical treatment programme where possible. Where material that may contain this species needs to be excavated, this material must be removed to an EPA licenced waste facility. Strict biosecurity procedures (see Section 6) should be adhered to in order to minimise the risk of spread.

5.2.2 Herbicide Treatment

Three-Cornered Leek should be sprayed in April with a glyphosate-based herbicide. In order to increase the effectiveness of the herbicide application the leaves should be lightly bruised in advance of treatment. All herbicide treatments will need to be repeated every 2-3 months in order to treat whatever regrowth results from the seed and bulb bank left by this species.

5.2.3 Excavation

TCL01 will likely require excavation as part of the development works. The infestation and an area of up to 2m around and to a depth of 0.5m may contain TCL seeds and/or bulbs. This soil must be disposed of at an EPA licenced waste facility and not mixed with general spoil. It is not necessary to excavate TCL in order to prevent damage to structures that may be built. Placing concrete or any other significant structure on top of TCL will kill the plant.

6. BIOSECURITY PROTOCOLS

Persons entering an area infested with an invasive alien species must take certain precautions to prevent the spread of that species.

These guidelines are to be followed by all persons that enter an infested zone:

- All PPE, other equipment and machinery that enter an infested zone must be cleaned before entering.
- Before leaving an infested area, individuals must thoroughly inspect their clothing, PPE, any equipment and their footwear for rhizomes, or other plant fragments that may be stuck on.
- All personnel should carry a hoofpick or similar implement to thoroughly clean the treads of their footwear with. All footwear must be thoroughly cleaned before leaving an infested zone.
- All PPE, other equipment and machinery, clothing and footwear must be thoroughly cleaned with soapy water and a stiff bristled brush before leaving an infested zone.
- As good practice all staff should follow Inland Fisheries Ireland Biosecurity Protocols when they have entered water or a riparian zone.
- If machinery/plant has entered or worked in an infested zone, it must be thoroughly washed down before leaving the area or working in an uninfested location
- A power washer must be provided for effective cleaning of machinery, along with stiff bristled brushes.

7. CODES OF PRACTICE/SOURCES OF INFORMATION FOR INVASIVE KNOTWEED SPECIES

Ireland

- Invasive Species Ireland Horticultural Code of Good Practice (http://invasivespeciesireland.com/wp-content/uploads/2010/07/Horticulture-Code-Final.pdf)
- National Roads Authority – The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (http://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf)
- Invasive Species Ireland Japanese Knotweed Best Practice Management Guidelines (withdrawn since 1st Nov, 2016).
- Inland Fisheries Ireland – Best Practice Guidelines for the Control of Japanese Knotweed (http://invasivespeciesireland.com/wp-content/uploads/2012/01/Best-practice-control-measures-for-Japanese-knotweed.pdf)
- National Biodiversity Data Centre Invasive Species (http://www.biodiversityireland.ie/projects/invasive-species/)
- Invasive Species Ireland Website (http://invasivespeciesireland.com/)
- Sligo Institute of Technology Alien Species (http://staffweb.itsligo.ie/staff/dcotton/Alien_Species.html)
- Online Atlas of the British and Irish Flora (http://www.brc.ac.uk/plantatlas/) – *UK also*

UK

- Property Care Association Code of Practice for the Management of Japanese Knotweed (http://www.property-care.org/wp-content/uploads/2015/04/Code-of-Practice-for-the-Management-of-Japanese-knotweed_v2.7.pdf)
- Environment Agency – The Knotweed Code of Practice Version 3 (withdrawn since 11th Jul, 2016).
- Royal Institute of Chartered Surveyors – Japanese Knotweed and Residential Property (http://www.rics.org/uk/knowledge/professional-guidance/information-papers/japanese-knotweed-and-residential-property-1st-edition/)
- Department for Environment, Food and Rural Affairs Horticultural Code of Practice (http://www.botanicgardens.ie/gspc/pdfs/defra%20code%20of%20practice.pdf)
- GB Non-Native Species Secretariat (http://www.nonnativespecies.org)

8. ABOUT ENVIRICO

Envirico are an Irish ecological company that specialise in invasive species monitoring and control. We tackle invasive alien species found in domestic, commercial and amenity sites in terrestrial, riparian and freshwater habitats.

Our qualifications include:

- Ph.D. Ecology/Microbiology
- MSc Aquatic Ecology
- PCA Certified Surveyor of Japanese Knotweed
- PA1 – Safe use of chemicals
- PA6A – Operating hand-held pesticide equipment
- PA6AW – Operating hand-held applicators to apply pesticides near water
- PA6INJ – Operating hand-held pesticide injection equipment
- PA6MC – Operating other hand-held applicators
- Registered Professional Pesticide User of Pesticides
- SOLAS Safe Pass Certified
- CSCS Personnel
- PTS Certified
- Traffic Management
- HSE Commercial Divers
- National Powerboat Certificate (Level 2)

Our services include:

- Site-Specific, Best-Practice Management Plans
- Site Excavation and Management
- Chemical Control
- Post-Treatment Monitoring
- Completion Certificate
- Habitat Restoration
- Training in Biosecurity and Identification

Client:
Wexford County Council
Carricklawn
Wexford
Y35 WY93
Tel: +353 53 9196000

Consultant:

Envirico
Bonnettstown
Co. Kilkenny
R95 V2T4
Tel: +353 56 7801277
Email: info@envirico.com
Web: www.envirico.com

Drawing Title:
DRAWING 1:
INVASIVE SPECIES

Project Name: Invasive Alien Species Survey (Trinity Wharf Development)

Project Code:	*Drawn:*	*Approved:*
00082	AG	MB

Date:	*Drawing Number:*
14th Nov, 2017	*0082.1/Trinity Wharf/2017*

Source Background Digital Orthophoto:
Google Maps, 2017

Fig 1. JK01

Fig 2. JK02

Fig 3. JK03

Fig 4. JK04

Fig 5. JK05

Fig 6. JK06

Fig 7. JK07

Fig 8. JK08

Fig 9. JK09

Fig 10. TCL01

Fig 11. TCL02

JAPANESE KNOTWEED IDENTIFICATION SHEET

Three Cornered Leek Identification Sheet

White Flowers all pointing downwards

This herb has long, narrow green leaves

Flowers also have green lines inside

Envirico Ltd. trading as **Envirico**. CRO: 598399 *Bonnettstown, Co. Kilkenny, R95 V2T4* www.envirico.com

APPENDIX B
Outline Incident Response Plan

Prepared by
Roughan & O'Donovan
Arena House, Arena Road, Sandyford, Dublin 18
Tel: +353 1 2940800 Fax: +353 1 2940820
Email: info@rod.ie www.rod.ie

Outline Incident Response Plan

Trinity Wharf, Wexford | January 2019

ROD
ROUGHAN & O'DONOVAN

Trinity Wharf, Wexford

Outline Incident Response Plan

TABLE OF CONTENTS

1.0 INTRODUCTION

This outline Incident Response Plan (oIRP) 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 outline IRP as required.

This outline 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

Wexford County Council has a Major Emergency Plan prepared in accordance with the Government's Major Emergency Management Framework. This plan is available ONLINE at:

https://www.wexfordcoco.ie/sites/default/files/content/Emergency/Major%20Emergency%202016.pdf

It details the initial contact that should be made the 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:
Wexford County Council
Newtown Rd,
Carricklawn,
Wexford,
Y35 WY93

The contact within the Client organisation is Brian Galvin.

Site Location:
The proposed development is located to the south of Wexford Town Centre on the opposing side of the railway from Fisher's Row on the R730.

Overview of the activities on site:
The proposed development is likely to be constructed in four phases over a time period of 80 months. These phases are outlined below;

Phase 1 - Enabling Works

- Construct access road from Trinity Street to the Dublin Rosslare railway line;
- Construction of new CCTV level crossing (By Irish Rail);
- Bring site to formation level;
- Sea Wall;
- Construct services throughout the public realm areas of the site;
- Construct access roads, footpaths, public spaces and landscaping to Phase 1 areas and temporary car parking;
- Temporary car parking and temporary grassing of Phase 2 sites; and
- Boardwalk from Paul Quay to Trinity Wharf site.

Phase 2- Buildings & Marina

- Hotel;
- Office type B (on waterfront);
- Cultural & performance building;
- Marina.

Phase 3 – Buildings

- Roads, footpaths and public spaces and landscaping to remaining buildings;
- Remaining buildings.

Description of the proposed development and surrounding area:

- The development comprises a mixed-use urban quarter redevelopment of a brownfield, derelict site, as well as development within the foreshore, including;
- A six-storey 120-bedroom hotel;
- A six-storey multi-storey car park with a total of 509 parking spaces;
- A five-storey residential building providing 58 apartments;
- Office Building A, five storey;
- Office Building B, five storey;

- Office Building C, five storey;
- A two-storey cultural/performance centre with event capacity for up to 400 people;
- A two-storey mixed-use restaurant/café/ specialist retail building;
- A single storey management building;
- A new vehicular entrance road with a signalised junction on Trinity Street, widening of Trinity Street, a new railway level crossing and associated works;
- A new sheet-piled sea wall around the existing Trinity Wharf site and rock armour along the south-eastern section with a rock armour revetment along the north-eastern side;
- Site infrastructure works including ground preparation works, installation of foul and surface water drainage, wastewater pumping station, services, internal roads, public realm and landscape including a public plaza with 1,000m2 open performance / events space. A total of 146 bicycle parking spaces throughout the development of which 90 spaces are dedicated to the residential development;
- A pedestrian/cycle boardwalk/bridge (c.187m long) connecting with Paul Quay, with gradual sloped access ramps (max. 1:20 gradient) of c.55m length on Paul Quay and c.24m at the Trinity Wharf development site;
- A 64 berth floating boom marina in Wexford Harbour; and,
- All other ancillary works.

Potential Incidents:

Potential incidents requiring emergency response procedures:

- Fuel and oil spills;
- Road traffic accidents involving chemical or biological spills;
- Rail accidents whilst crossing the Dublin–Rosslare railway line to access the site
- Earth slippages;
- Extreme rainfall events, causing swelling of the Slaney Estuary
- Fires;
- Activities resulting in noise and vibration, air pollution, hazardous substances or impacts on water;
- Waste management; and,
- Discharge of effluent.
-

The Contractor will update the list of potential incidents based on their proposed construction methods and programme for the Trinity Wharf Development and include, as a minimum, the following:

- 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: October 2018 V1		**Name or position of person responsible for compiling/approving the plan:** Stephen Harper / 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**
Wexford Fire Station	(053) 919 6585	999 / 112
Gardaí: Emergency	999 / 112	999 / 112
Gardaí: Wexford Garda Station	(053) 916 5200	(053) 916 5200
Wexford General Hospital	(053) 91 53000	(053) 91 53000
EPA Regional Inspectorate Wexford	(053) 916 0600	-
Wexford County Council Emergency Planning Department	053-9196101	053-9196101
ESB	1850 372 757	1850 372 999
Bord Gáis	1850 200 694 / 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	053 919 6000	1890 666 777
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**

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 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 4.3 Trinity Wharf Marina Feasibility Study

ROUGHAN & O'DONOVAN

RPS

Trinity Wharf Marina

Feasibility Study

Final

IBE1115/D04 November 2018



rpsgroup.com/ireland


Trinity Wharf Marina

Feasibility Study

Document Control Sheet

Client:	Wexford County Council
Project Title:	Trinity Wharf Marina
Document Title:	Feasibility Study
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Text Pages:	91	Appendices:	6 No.

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D04	Final	28th Nov 2018	KC SM	K. Calder	RB	Ruth Barr	AKB	

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EXECUTIVE SUMMARY

This study has been undertaken in order to investigate the feasibility of developing an attached marina facility in an area of land at Trinity Wharf that has been recently acquired by Wexford County Council with the aim of creating a focal point that would enhance existing plans of developing a Financial Services Centre at the site.

RPS developed a series of conceptual marina layouts that could be implemented at several locations of the seaward boundary of Trinity Wharf. An initial assessment of these options ruled out developing an attached marina on either the north western or south eastern boundary due to extensive capital dredging requirements in these areas. Several options that involved developing different breakwaters on the north eastern boundary and northern corner were brought forward.

The study used state of the art computational modelling techniques to assess and quantify the performance and potential environmental impact of each of the shortlisted. Based on the findings of these modelling efforts the shortlist of potential options were refined in conjunction with feedback from the consultation process to develop a preferred conceptual layout.

The preferred conceptual layout includes the provision of a 61 berth attached marina constructed from industry standard modular pontoon and finger units. This particular option is considered very advantageous due to the lack of capital dredging works required to achieve the desired minimum operating depth of -2.5m, thus avoiding potential environmental issues. A series of pre-fabricated floating breakwaters will create a sheltered marina environment whilst a suitably sloping revetment will provide effective flood and erosion protection to the redeveloped site at Trinity Wharf.

The proposed option represents a technically feasible solution in relation to physical, environmental and legislative constraints and is therefore suggested for further consideration. The budget cost estimate for the construction of this option is €1.77 M euros ±5% excluding VAT.

Consultation with local stakeholder groups has shown that the proposals for a new marina are broadly supported. It is generally considered that development of the marina project will provide an improvement to the public realm in the Trinity Wharf area and will lead to greater use and therefore, opportunities for new business in the vicinity of the proposed development.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Wexford County Council is considering the development of its recently acquired landholdings at Trinity Wharf into a Financial Services Centre. The site, adjacent to the Dublin-Rosslare railway and extending over 3.92 hectares, includes an area of reclaimed land, formerly occupied by industrial premises. The site is located in a desirable position, close to Wexford town centre and affords views across Wexford Harbour. The council wish to investigate the feasibility of enhancing the site's potential by developing a marina attached to the site, which would act as a focal point for the rest of the development. A key aspiration of the Council is for the marina to be designed to include disabled access where possible.

1.2 EXISTING COASTAL ENVIRONMENT

Trinity Wharf is situated to east of Wexford Harbour on the western extent of the area commonly referred to as the "Slobs" as illustrated in Figure 1.1 overleaf. Wexford Harbour is subject to semi-diurnal tides meaning that there are generally two high waters and two low waters each day. Mean spring high and low water levels are approximately 2.00m and 0.50m above Chart Datum respectively; the tidal regime at Wexford Harbour is therefore considered macro tidal (<2m spring tidal range). Tidal currents in the Slobs area of Wexford Bay are generally low; ranging between 0.05 – 0.40 m/s, however at Wexford Harbour where the training walls act to accelerate the flow coming in from the River Slaney tidal currents can reach 0.80 m/s.

Figure 1.1: Location and extent of the proposed development site at Trinity Wharf, Co. Wexford, Ireland.

The bathymetry of Wexford Bay is extremely heterogeneous. Approaching low tide, water is drained from the bay via a series of relatively deep channels that span several hundred metres wide to expose an extensive network of intertidal flats. Given the dynamic nature of the coastal processes in this area the position and morphology of the intertidal flats and sand banks in Wexford Bay are continuously shifting and evolving which makes navigating within the area particularly challenging.

Wexford Harbour is situated within the lowermost part of the River Slaney; a major river that drains much of the south-east region. The River Slaney is an important feature of the area due to its freshwater input and the subsequent stratifying effect in the Slobs estuary. The River Slaney also has an important role in the local aquaculture industry which supports over 40 sites within the harbour waters.

The site at Trinity Wharf is generally well protected from direct wave attack due to a number of factors including:

- The headlands at Greenore Point to the south and Raven Point to the north create a well sheltered semi-enclosed bay in which Trinity Wharf is situated.
- The entrance to Wexford Bay is littered with sand banks that are continuously shifting and evolving over time (see Figure 1.2). These sand banks are found up to 5km from the coastline of Rosslare Strand.
- The menagerie of mud flats and sand banks within Wexford Bay dissipates incident wave energy as waves propagate across the bay.
- Rosslare Strand which is at the entrance of Wexford Bay acts to draw in prevailing waves due to the shoaling bathymetry and dissipate a significant degree of wave energy before the waves can enter the bay.
- The man-made training walls that extend from Wexford Harbour into Wexford Bay provides significant protection to Trinity Wharf and Wexford Harbour from waves propagating across the bay for the north east and south east.

Figure 1.2: An overview of the complex network of channels and sand banks in Wexford Bay in September 2012.

1.3 AIMS AND OBJECTIVES

The fundamental aim of this Technical Feasibility Study as expressed in the project brief is to determine the feasibility of developing an attached marina option that would enhance the area of land known as Trinity Wharf by acting as a focal point for the rest of the development. In order to achieve this aim RPS' Coastal team have set the following study objectives:

1. Provide a synopsis of the bathymetry, sediment sampling, flow measurements and other field surveys undertaken as part of this study.

2. Develop a range of conceptual marina options based on the Coastal team's expertise, knowledge from previous studies in the area together with accepted industry guidelines standards for marina design and operation.

3. Undertake an initial assessment of the conceptual options to create a shortlist of preferred marina options.

4. Utilise computational modelling techniques to assess and quantify the performance and potential impact of each of the shortlisted marina options on existing coastal processes.

5. Assess the environmental impact of each option and provide a detailed description of the consultation process held with all relevant stakeholders.

6. Develop a refined conceptual marina option based on the results of the hydraulic modelling and consultation process to determine initial capital and maintenance costs for the proposed facility.

7. Provide technical drawings of the preferred marina option and design information relating to the marine construction works along the boundary of the Trinity Wharf site.

8. Advise on the landside requirements for the operation of the marina; and

9. Present conclusions regarding the overall feasibility of developing an attached marina facility at Trinity Wharf and associated coastal defences designed to protect the development.

As the contracted consultant for this project, RPS have undertaken the elements of work noted above and developed a range of marina concepts that were then assessed via an extensive numerical programme. Furthermore, RPS have consulted with various related public and private bodies regarding the results of the numerical modelling and the feasibility of proposed options. The findings of these efforts have been presented in this technical feasibility study.

2 SITE DESCRIPTION

2.1 HISTORY OF THE SITE

It is believed that the northern part of the site begun to be reclaimed around 1832 and originally operated as a dockyard for the town. The smaller original dock area is shown on the 1873 Admiralty Chart and historical OS mapping in Figure 2.1 below.

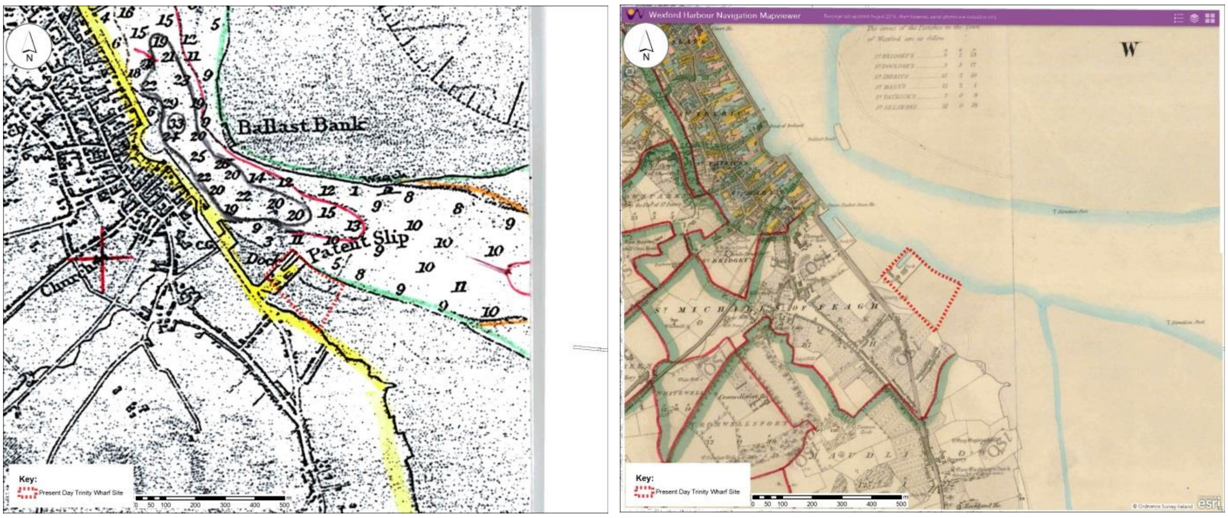


Figure 2.1: Trinity Wharf, as shown on 1873 Admiralty chart (left) and OSI historical 6 inch map[1] (right) 1842-1937.

The site was gradually expanded southwards by reclamation through the late 1800s and early 1900s. The 1894 Admiralty chart (not pictured) shows the docks area unchanged from that shown in Figure 2.1 above, however it does include the “fish pier” which remains in situ today as does the stone breakwater to the south of Trinity Wharf. An enlarged reclamation area can be seen in the 1932 Admiralty chart and historical OSI 25 inch mapping 1888-1913 (see Figure 2.2 overleaf) however it appears that the final footprint of the site was not established until after 1932.

The northern part of the dockyard gradually transitioned from a dockyard into a farmers market which then evolved into a bacon plant which included a slaughtering area by the foreshore and a shop front facing the street. The bacon processor later became known as Clover Meats, which remained on site processing pork and beef at this location until it closed in the mid-late 1980s, leaving the site vacant.

The southern part of the site developed into an ironworks (Star ironworks) which operated from 1911-1964. In 1964 the site was taken over and was subsequently used as a car assembly plant (for Renault – also known as Smiths car assembling plant) until the early 1980s. Around 1986 the site switched from assembling whole cars to manufacturing electronic components such as wiring harnesses for cars instead, under the name Wexford Electronix. Wexford Electronix went into receivership in 2001 and the site has been vacant since 2002.

[1] historical OSI mapping taken from Wexford Harbour Navigation Mapviewer http://wexford.maps.arcgis.com/

The site has no history of hazardous processes, however due to the former usage of the site for general industrial processes, there is a small risk of sediments adjacent to the site having accumulated levels of contaminants such as PCBs, particularly if any waste or waste water was being discharged from the site onto the foreshore. Consequently, sampling and analysis of sediments recovered from the foreshore has been undertaken as part of this feasibility study (see Section 2.6).

The site has no history of flooding.

Figure 2.2: Trinity Wharf, as shown on 1932 Admiralty chart (left) and OS historical 25 inch map (right) 1888-1913.

2.2 PRESENT DAY

In the present day, the site is brownfield and all previous structures have been removed (see Image 2.1), with the exception of a masonry stone boundary wall dividing the former Clover meats compound from the former Wexford Electronix compound which can be seen in Image 2.2 overleaf.

Repairs and remedial works are required to stabilise and rehabilitate the perimeter. The original shape of the site is preserved, but some of the old timber supports and fenders have decayed (see Image 2.3). The sea wall has suffered some damage from wave action leading to some erosion and exposure of the sub-structure and site fill, evident in Image 2.4.

Image 2.1: Site viewed from South East Corner (2015).

Image 2.2: View east across development area from North Corner (2015).

Image 2.3: Timber Supports and Fenders on North East side of Development Area (2015).

Image 2.4: View South East along North East boundary of Development Area showing Wave Damage (2015).

2.3 SURVEYS AND INVESTIGATIONS

In order to inform hydrodynamic and engineering assessments, Hydrographic Surveys Ltd undertook a range of bathymetric and sediment sampling surveys together with flow and suspended sediment monitoring surveys in 2016. The results of these surveys are summarised in the following sections of this chapter.

2.4 BATHYMETRIC SURVEY

A digital echo sounder was used to obtain seabed level readings within the immediate vicinity of Trinity Wharf. The resolution of the survey data ranged between 20m – 50m along survey lines that had a maximum spacing of 50m perpendicular to the coastline. An overview of the location and extent of the survey data is presented in Figure 2.3 below

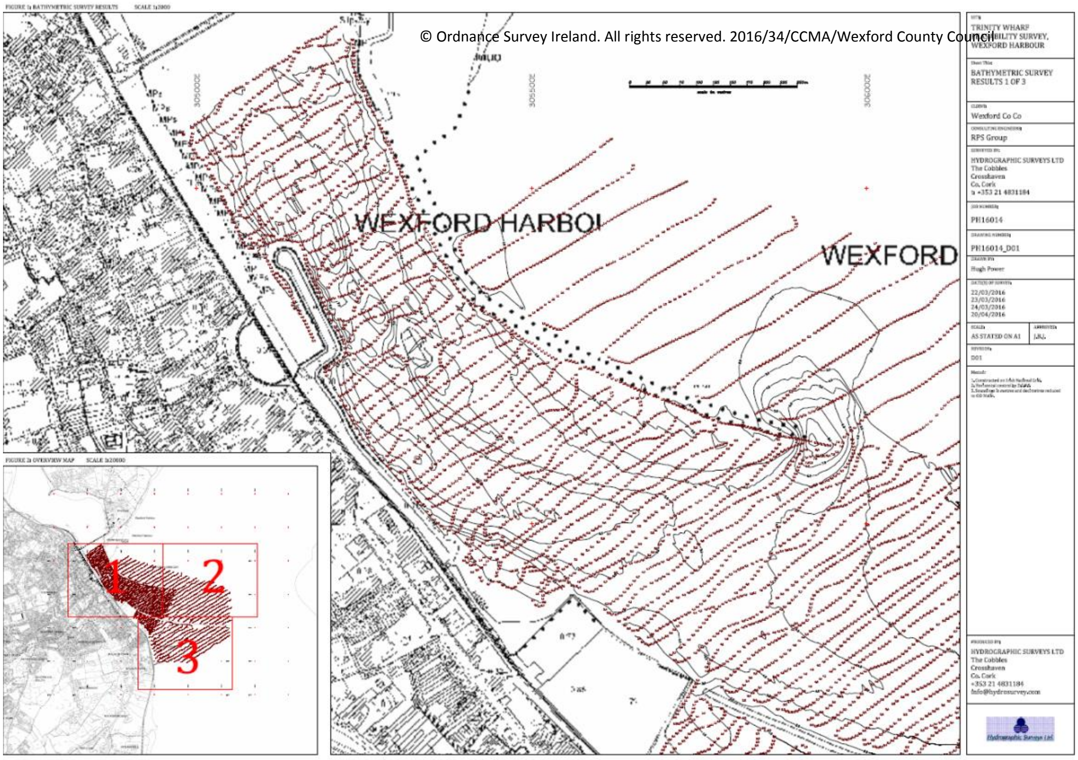


Figure 2.3: Extent of the bathymetric survey of Wexford Harbour undertaken by Hydrographic Surveys Ltd in March 2016.

The seabed levels were required for a number of reasons:

- To assist with hydrodynamic modelling of harbour layout options;
- To provide the dataset used to produce seabed profiles for the preliminary design of the harbour layout options; and
- To determine the extent of dredging required in order to achieve suitable water depths for marina berthing.

The survey results indicated that seabed levels in the immediate vicinity of Trinity Wharf varied significantly and that some of the boundaries of the site actually dry at spring low water tides.

2.5 FLOW AND SUSPENDED SEDIMENT MONITORING

Two Acoustic Doppler Current Profiler (ADCP) devices were used to record tidal current speeds and directions at two different locations in the approach channel to Wexford Harbour. The ADCPs were set up to record information at 1 – 2m intervals over a continuous 1 month period which encompassed two complete spring and neap tidal cycles. An overview of the deployment location of the two devices in relation to Trinity Wharf is presented in Figure 2.4 below.

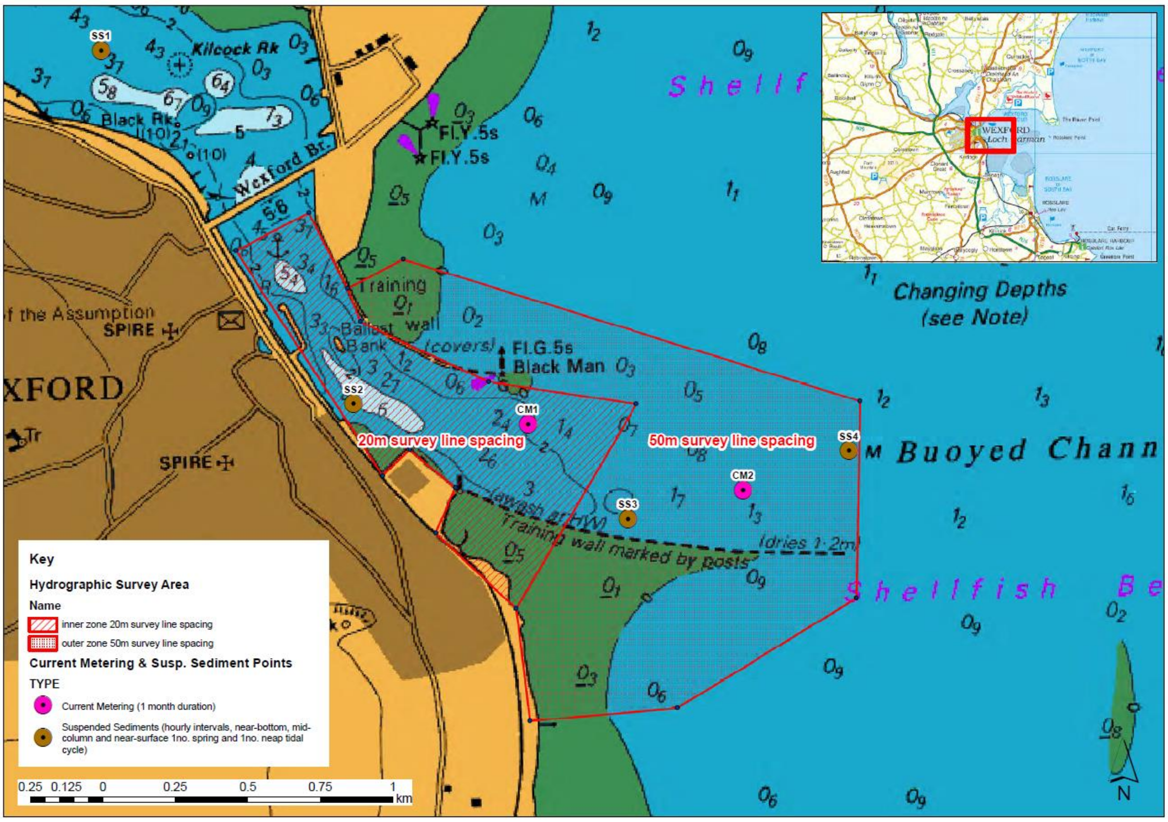


Figure 2.4: Location of ADCP surveys and Suspended Sediment Sampling surveys.

The tidal current speed and direction measurements were required in order to:

- To develop and calibrate the computational models that would be used to simulate potential marina layout options;
- To provide baseline conditions against which the impact of potential marina options could be compared against; and
- To determine the nature of the existing sediment transport regime within Wexford Bay.

The survey results indicated that current velocities within the approach channel to Wexford Harbour did not exceed 0.75m/s during the continuous month deployment period. The recorded measurements also indicated that owing to the significant freshwater contribution from the River Slaney the water column was stratified and there was a prominent tidal wedge that extended throughout the approach channel. It is likely that this stratified environment would have a notable effect on the sediment transport regime within Wexford Bay.

2.6 SEDIMENT SAMPLING AND CHEMICAL ANALYSIS

It is important to test marine sediments prior to any dredging to determine if any contaminants are present and if so, how they can be dealt with in the arising dredged spoil material. To this end physical site investigations were conducted to determine if the marine sediments at Trinity Wharf contained polluting substances or contaminants.

The sediment quality and particle size analysis of the marine sediments at Trinity Wharf was established through a comprehensive sampling and analysis programme. The sampling programme was undertaken in July 2016 by Hydrographic Surveys Ltd whilst the sediment quality analysis was undertaken by the RPS Laboratory Services. This laboratory holds the relevant accreditations required by the Marine Institute for the analysis of the suite of contaminants in accordance with their specified parameters. The location of samples taken at Trinity Wharf is shown in Figure 2.5 below.

Figure 2.5: Location of sediment sampling stations at Trinity Wharf.

2.7 RESULTS OF SEDIMENT ANALYSIS

As can be seen from Figure 2.5, samples were taken from five locations; three stations on the foreshore to the northwest of Trinity Wharf, one station on the north eastern (navigation channel) face of Trinity Wharf and one on the south eastern side of Trinity Wharf.

Surface samples were taken from all stations and a hand corer was used to recover samples from *c.* 1m depth at stations B, D and E. The samples were collected during low water spring tide as these areas are only dry during the lowest tides.

The Marine Institute has published Guidelines for the Assessment of Dredge Material for Disposal in Irish Waters (Cronin, M. et al., 2006). These guidelines give threshold guidance levels for ecotoxins within marine sediments and can be used to inform on the cleanliness of sediment in terms of their acceptability for sea disposal.

Figure 2.6 on page 15 shows a summary of the results from the sampling, referenced to the above Guidelines. The full results are presented in Appendix G.

Generally speaking, all three areas returned results showing mild levels of contamination in the sediments although in a couple of instances there were moderate levels of contamination.

2.7.1 North West of Trinity Wharf (Stations A, B & C)

The samples taken from the north west side of Trinity Wharf (stations A, B and C) showed a number of elevated results.

Station A

In general, Station A, furthest from the Wharf, contained the least contaminated sediments on this side of the development area with stations B & C, closer to the Wharf, showing increasing levels of contaminants. The sample analysed was taken from the surface. Metals levels were generally acceptable, although there were elevations above the lower guidance level for arsenic and nickel. Polycyclic Aromatic Hydrocarbon (PAH) and PolyChlorinated Biphenyl (PCB), Organotin (TBT and DBT) and total petroleum hydrocarbon (TPH) levels were acceptable.

The guidance does not have set limits for the majority of Organochlorine Pesticide (OCP) with the exception of Lindane and HCP. These results were both above the Marine Institute's published upper guidance level, and the other parameters tested were above the Threshold Effects Level (TEL) published in the guidance and thus may also present a potential risk.

Station B

Station B had samples taken at both the surface (B1) and 1m below the surface (B2) and held the greatest amount of contaminants out of the three stations on this side of Trinity Wharf. The sample collected at depth tended to have higher levels of contaminants than the surface sample. Metals levels above the lower guidance levels were found for arsenic, copper, nickel, lead and zinc.

PAH levels were also above the lower guidance level in both the surface and -1m samples, with the deeper sample recording total values approximately twice that of the surface sample.

PCB, Organotin and TPH levels were satisfactory.

OCP levels were all above the threshold effects level and the parameters for which limits have been set, Lindane and HCP were both above the upper guidance level.

Station C

Station C was a surface sample and contained elevations above the lower guidance level for arsenic, cadmium, nickel and zinc in the metals suite. Polycyclic Aromatic Hydrocarbon (PAH) and PolyChlorinated Biphenyl (PCB), Organotin (TBT and DBT) and total petroleum hydrocarbon (TPH) levels were acceptable.

As with the other samples in the OCP suite, the results for Lindane and HCP were both above the upper guidance level for Station C, and the other parameters tested were above the Threshold Effects Level (TEL) published in the guidance and thus may also present a potential risk.

2.7.2 North East of Trinity Wharf (Station D)

Station D had samples taken at both the surface (D1) and 1m below the surface (D2). The samples were collected from the small accumulation of sediment immediately adjacent to the Wharf at the boundary with the navigation channel.

In the metals suite, the two samples (surface and depth) recorded generally quite similar values, with the exception of copper, where the depth sample recorded a substantially higher value and both samples were above the upper guidance level suggesting that there may be an item buried beneath the sediment which is releasing copper. In keeping with many of the other surrounding stations, values for arsenic, nickel lead and zinc were also above the lower guidance level.

PAH levels were acceptable; with the samples taken at depth recording levels almost three times lower than the surface sample.

PCB levels were found to be above the lower guidance limit; however the deeper samples were four times higher than the surface sample. Organotin and TPH levels were satisfactory.

OCP levels were also generally within acceptable thresholds although Lindane and HCP were <1µg/kg which is above the lower guidance level, though the results were influenced by the limit of detection for the analysis which is <1µg/kg.

2.7.3 South East of Trinity Wharf (Station E)

Station E had samples taken at both the surface (E1) and 1m below the surface (E2). The sample collected at depth from station E was substantially more contaminated than the surface sample.

In the metals suite, Station E was the only station which did not record elevated levels of arsenic or nickel. Sample E1 (surface) recorded only slight elevation of copper and all other metals levels were acceptable. Sample E2 (at depth) had slightly raised levels of cadmium and lead with all other metals at acceptable levels.

In respect of PAH, the surface sample was well within the acceptable level however the sample collected at depth was over seven times higher and above the lower guidance limit. Similarly, the surface sample was totally clean of PCBs however the sample collected at depth recorded levels over 25 times higher and was again over the lower guidance level.

Organotin and TPH levels were satisfactory. OCP levels were also generally within acceptable thresholds although as with station D values for Lindane and HCP were <1µg/kg which is above the lower guidance level, though the results were influenced by the limit of detection for the analysis which is <1µg/kg and in practice the sediment may not be above the threshold.

2.7.4 Summary of Results

The samples from the north west side of Trinity Wharf (A, B & C) have values above the upper guidance threshold for OCPs and PAH levels that are substantially in excess of the lower guidance limit (there is no upper limit established at present). It is unlikely that these sediments would be eligible for disposal at sea.

The samples from the north east side of Trinity Wharf (Station D) are generally fairly clean though they also have some exceedances of the lower threshold level. The copper levels are exceptionally high, suggesting a localised pollutant buried within the sediment, this may require some further investigation and may exclude these sediments from disposal at sea.

The samples from the south east side of Trinity Wharf (Station E) have a number of parameters that are above the lower guidance level but none that exceed the upper guidance level.

The sediments on all three sides of Trinity Wharf showed some degree of contamination and all eight samples recorded results above the lower threshold limit for many of the parameters. It is therefore likely that sediment dredged from any of the marina options to the north east and south east of Trinity Wharf would be ineligible for dumping at sea without mitigation measures being applied. It is also likely that the sediments dredged for marina options at the north western shore, nearest the town, would probably not be eligible for dumping at sea at all.

Determinand		Units	RL	A1	B1	B2	C1	D1	D2	E1	E2	Guideline Lower level	Guideline Upper level
			RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505		
			Depth	surface	surface	-1m	surface	surface	-1m	surface	-1m		
			Sample Type	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT		
				NORTHWEST				CENTRE		SOUTHEAST			
dry solids (at 105øC)		%	0	42	44.8	44.8	38.4	68.5	69.8	66.5	67.9		
dry solids (assisted air-drying at <30øC)			0	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed		
visual inspection			0	S/C	S/C	S/C	S/C	S/C	S/C	S/C	S/C		
aluminium	METALS	mg/kg	1	21200	26900	33200	59300	20400	19200	22400	26300		
arsenic		mg/kg	0.5	16	13.8	14.4	17.6	16.5	16.9	7.32	8.63	9	70
cadmium		mg/kg	0.1	0.61	0.61	0.61	0.7	0.55	0.47	0.41	0.83	0.7	4.2
chromium		mg/kg	0.5	76.5	67.5	58.8	82.8	57.4	52.9	31.6	40.6	120	370
copper		mg/kg	0.5	28.6	39.2	42.5	34.2	637	4810	53.7	28.8	40	110
mercury		mg/kg	0.01	0.11	0.18	0.19	0.13	0.1	0.07	0.07	0.13	0.2	0.7
lithium		mg/kg	1	54.2	46.8	41.6	66.9	22.7	20.1	24.6	28.6		
nickel		mg/kg	0.5	30.5	25.6	23.8	33.1	27.8	24	11.3	14.1	21	60
lead		mg/kg	0.5	45.2	61.5	97.7	51.3	149	149	27.5	105	60	218
total organic carbon		%	0.03	2.62	3.34	3.4	2.83	1.51	1.35	0.89	1.78		
zinc		mg/kg	2	158	175	191	176	373	390	87.7	143	160	410
acenaphthene	PAHs	ug/kg DW	0.1	3.57	27	95.6	14.9	10.1	< 2.000	0.15	29.6		
acenaphthylene		ug/kg DW	0.1	4.76	29.3	65.4	13.3	4.09	3.87	1.81	33.4		
anthracene		ug/kg DW	0.1	36.4	96.9	246	31.5	28.9	11.9	9.63	101		
benzo(a)anthracene		ug/kg DW	0.1	127	391	914	87.9	93.1	54.7	98.1	640		
benzo(a)pyrene		ug/kg DW	0.1	108	335	874	205	64.2	31.1	91.6	481		
benzo(b)fluoranthene		ug/kg DW	0.1	177	466	1140	296	94.1	45	121	695		
benzo(g,h,i)perylene		ug/kg DW	0.1	85.6	221	532	150	38.5	20.1	60.6	255		
benzo(k)fluoranthene		ug/kg DW	0.1	65.2	184	494	105	33.1	15.8	49.8	261		
chrysene		ug/kg DW	0.1	106	313	774	121	65.2	30.4	70.4	585		
dibenzo(a,h)anthracene		ug/kg DW	0.01	27.8	78.2	200	52.9	15.6	8.45	19.9	117		
fluoranthene		ug/kg DW	0.1	194	922	1630	300	181	66.9	150	1210		
fluorene		ug/kg DW	0.1	10.9	51.8	143	12	10.2	< 4.000	< 4.000	42.4		
indeno(1,2,3-c,d)pyrene		ug/kg DW	0.1	71.1	189	465	126	33.3	16.9	53.1	247		
phenanthrene		ug/kg DW	0.1	60.4	476	763	73.5	114	13.2	19.7	917		
naphthalene		ug/kg DW	0.1	< 16.649	23	75	< 18.248	< 7.000	< 7.000	< 7.000	< 7.000		
pyrene		ug/kg DW	0.1	167	696	1450	285	140	64.3	133	965		
			Σ 16	**1244.73**	**4499.2**	**9861**	**1874**	**925.39**	**382.62**	**878.79**	**6579.4**	4000	no limit
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	PCBs	ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**1.42**	**5.51**	< 0.10	**3.7**		
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**1.75**	**13**	< 0.10	**4.96**		
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**1.02**	**12.8**	< 0.10	**3.03**		
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**1.14**	**9.01**	< 0.10	**3.59**		
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	0.47	**1.96**	< 0.10	**1.37**		
2,4,4'-trichlorobiphenyl (PCB congener 28)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**2.71**	0.52	< 0.10	**1.21**		
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)		ug/kg DW	0.1	< 0.24	< 0.22	< 0.22	< 0.26	**3.02**	**2.03**	< 0.10	**7.38**	1	180
			Σ 16	<1.68	<1.54	<1.54	<1.82	**11.53**	**44.83**	<.7	**25.24**	7	1260
tributyltin (TBT)	TBTs	ug/kg as cation DW	2	< 4.76	< 4.47	< 4.47	< 5.21	< 2.00	< 2.00	< 2.00	4.18		
dibutyltin (DBT)		ug/kg as cation DW	5	< 5.00	< 5.00	< 5.00	< 5.21	< 5.00	< 5.00	< 5.00	< 5.00		
				0.00976	0.00977	0.00977	0.01042	0.00700	0.00700	0.00770	0.00918	0.1	0.5
total petroleum hydrocarbons by GCFID (C10 - C40)		mg/kg DW	10	68.7	134	114	150	38.5	31.7	22.7	107	1	-
o,p'-DDD (o,p'-TDE)	OCPs	ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	1.22	
o,p'-DDE		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	2.07	
o,p'-DDT		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	1.19	TEL
p,p'-DDD (p,p'-TDE)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	1.22	
p,p'-DDE		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	2.07	
p,p'-DDT		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	1.19	
gamma-hexachlorocyclohexane (lindane)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	0.3	1
hexachlorobenzene (HCB)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00	0.3	1
aldrin		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
cis-chlordane		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
trans-chlordane		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
dieldrin		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
endrin		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
endosulfan A		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
endosulfan B		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
heptachlor epoxide		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
heptachlor		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
monobutyltin (MBT)		ug/kg as cation DW	2	< 4.8	< 4.5	< 4.5	< 5.2	< 2.00	< 2.00	< 2.00	< 2.00		
methoxychlor		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
trifluralin		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
alpha-hexachlorocyclohexane (alpha-HCH)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
beta-hexachlorocyclohexane (beta-HCH, beta-BHC)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
delta-hexachlorocyclohexane (delta-HCH)		ug/kg DW	1	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00		
carbonate % dry matter		%	0.1	58.9	3.74	5.92	2.86	33.9	23.3	4.29	3.44		
density (on dry solid)		g/cm3 DW	0	2.1	2	2	2.1	1.6	1.4	1.7	1.6		

Figure 2.6: Sediment Analysis Results compared with Marine Institute Guidance Levels.

3 CONCEPT DEVELOPMENT

The aims and objectives of this study included developing a range of potential options that would facilitate an attached marina at Trinity Wharf. To this end the coastal team at RPS prepared a series of preliminary conceptual marina options based on knowledge of the site and of the coastal processes within Wexford Bay.

As can be seen from Figure 3.1 Trinity Wharf has three distinct boundaries that protrude into Wexford Harbour. Each of these boundaries is relatively sheltered from waves propagating from the north through to the south east; all three boundaries are also very close to an existing navigational channel that is maintained for Wexford Harbour. Based on these reasons, all three boundaries illustrated in Figure 3.1 were initially considered as feasible locations at which a potential attached marina could be developed.

The following sections of this chapter present the various conceptual marina layouts that were developed for this study; the chapter also includes the preliminary assessment of each of the conceptual layouts.

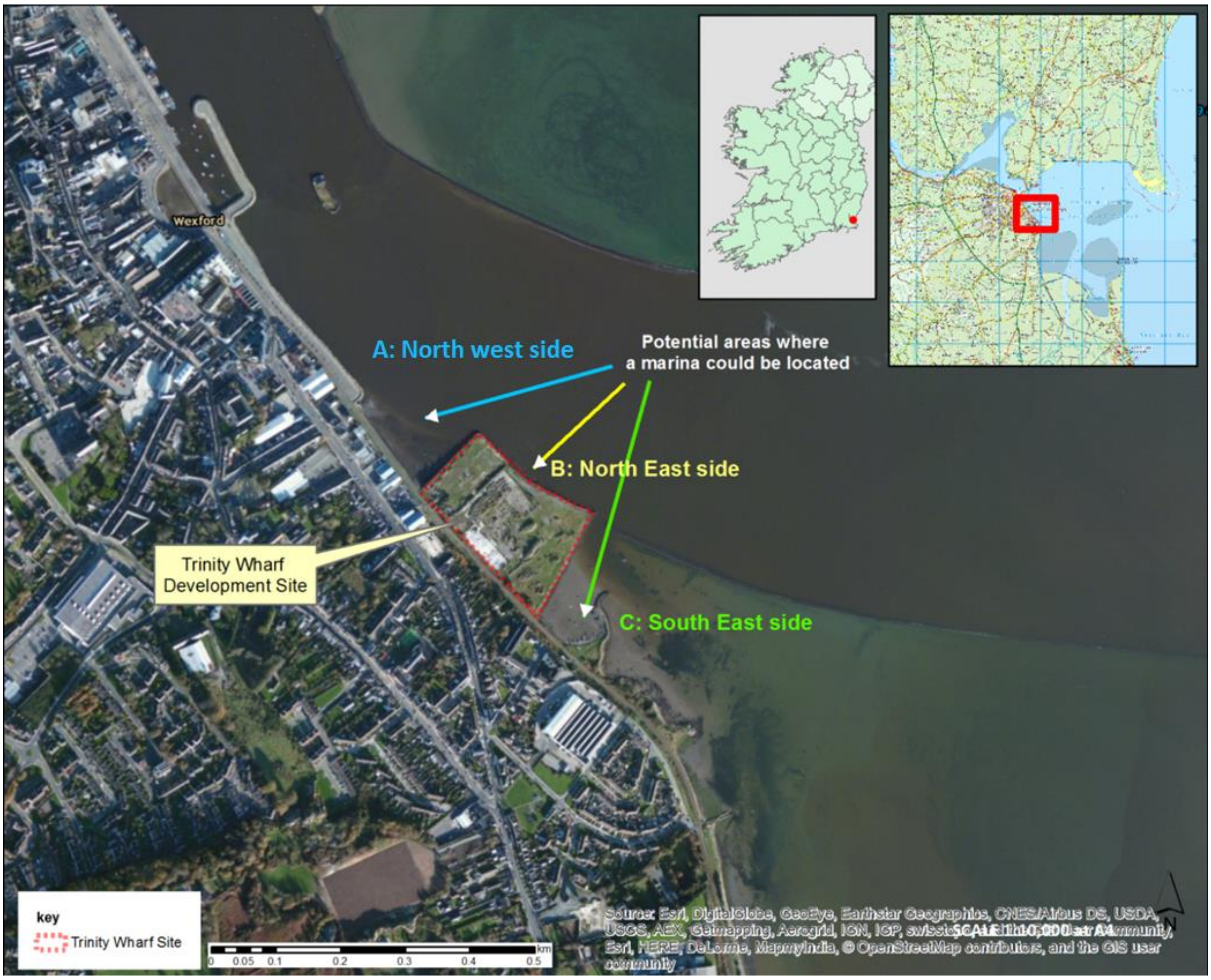


Figure 3.1: Possible locations for an attached marina at Trinity Wharf.

3.1 CONCEPTUAL LAYOUTS

The conceptual configuration and layout of each marina option was developed using previous experience and expertise, knowledge of marina operations and accepted industry guidelines standards for marina design and operation.

It was understood from the outset that the aim of this study was to investigate the feasibility of enhancing the overall potential and desirability of the Trinity Wharf site by developing an attached marina that would act as a focal point for the rest of the development. For this reason RPS aimed to develop a series of conceptual marina options that would avoid undue interference with the existing navigation channel to Wexford Harbour by restricting the overall size of the each marina option based on existing environmental conditions.

3.1.1 Fixed Breakwaters vs Floating Breakwaters

When developing conceptual marina options it is essential to ensure that the proposed marina area is well sheltered from excessive wave energy. Based on location of the study site together with existing knowledge of the wave climate at Wexford it is known that some variation of a breakwater will be required to create suitable wave conditions at Trinity Wharf. Breakwaters can be loosely classified into two main categories: fixed breakwaters or floating breakwater. Both types of breakwaters are described in more detail below:

Fixed breakwaters

Rubble mound breakwaters are the most commonly applied type of fixed breakwater and are in their simplest forms a mound of stones that can be constructed to withstand extremely arduous wave conditions. However, despite providing effective wave protection to an area, these large fixed structures are very expensive to construct as most quarries yield mainly finer material. Furthermore, given the relatively impermeable nature of fixed breakwaters, these structures can modify existing coastal processes and if due consideration is not given to their design and construction, can result in significant negative environmental impacts.

Floating breakwaters

Floating breakwaters are used in relatively sheltered environments that experience mild wave climates with very short wave periods. Floating breakwaters are an attractive alternative to fixed breakwaters as they consist of pre-fabricated units that are designed to float on the surface of the water. As these structures only interact with the surface of the water column, there are virtually no associated environmental impacts.

The following sections summarise a series of conceptual marina options; it will be seen that some of these options utilise both fixed and floating breakwater options.

3.1.2 Conceptual Option 1

This option is based on developing the north western side of Trinity Wharf to create an attached marina.

A suitable wave climate would be provided by constructing a series of floating breakwaters around the perimeter of the proposed marina to create a sheltered area of approximately 16,000m^2. This potential marina area could facilitate approximately 70 marina berths.

To reduce wave reflection within the marina and protect Trinity Wharf from overtopping and flooding it would be necessary to construct an appropriately designed sloping revetment around the perimeter of the existing boundaries of Trinity Wharf.

In order to create a minimum operating depth of -2.5m CD, it would be necessary to dredge and dispose of approximately 40,000m^3 of sediment material from the proposed marina area.

Figure 3.2 below illustrates an indicative layout of conceptual marina Option 1.

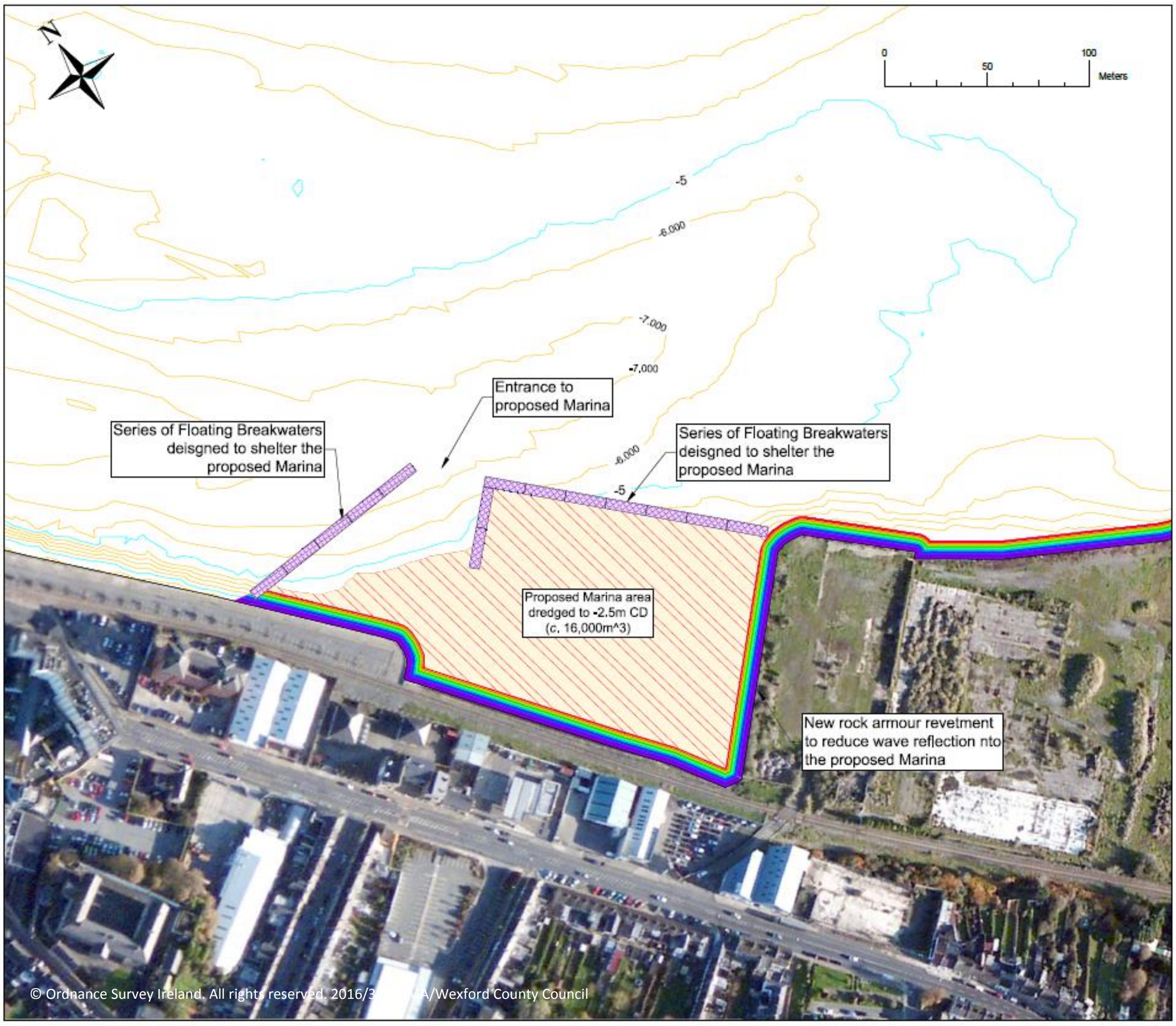


Figure 3.2: Indicative layout of conceptual marina Option 1.

3.1.3 Conceptual Option 2

As can be seen from Figure 3.3 below, Option 2 is based on developing the northern corner of Trinity Wharf to create an attached marina scheme.

A series of floating breakwater would be used to ensure a suitable wave climate within the marina area. The marina area would be *c.* 6,600m^2 and capable of facilitating approximately 60 vessels. Wave reflection would be reduced within the proposed marina area by constructing a suitable sloping revetment around the perimeter of Trinity Wharf.

As this option is located on the northern corner of Trinity and projects into the deeper region of the Slaney estuary, only *c.*650m^3 of material would have to be dredged to achieve a desired operational depth of -2.5m CD. However, it would be possible to strategically position vessels with smaller draughts in this area and completely avoid any initial capital dredging requirements.

Based on existing hydrographic and bathymetric survey data it is likely that the littoral currents are highest in the area of the northern corner. As such, it is likely that this particular option would require less maintenance dredging relative to the other options presented in Section 3.1.

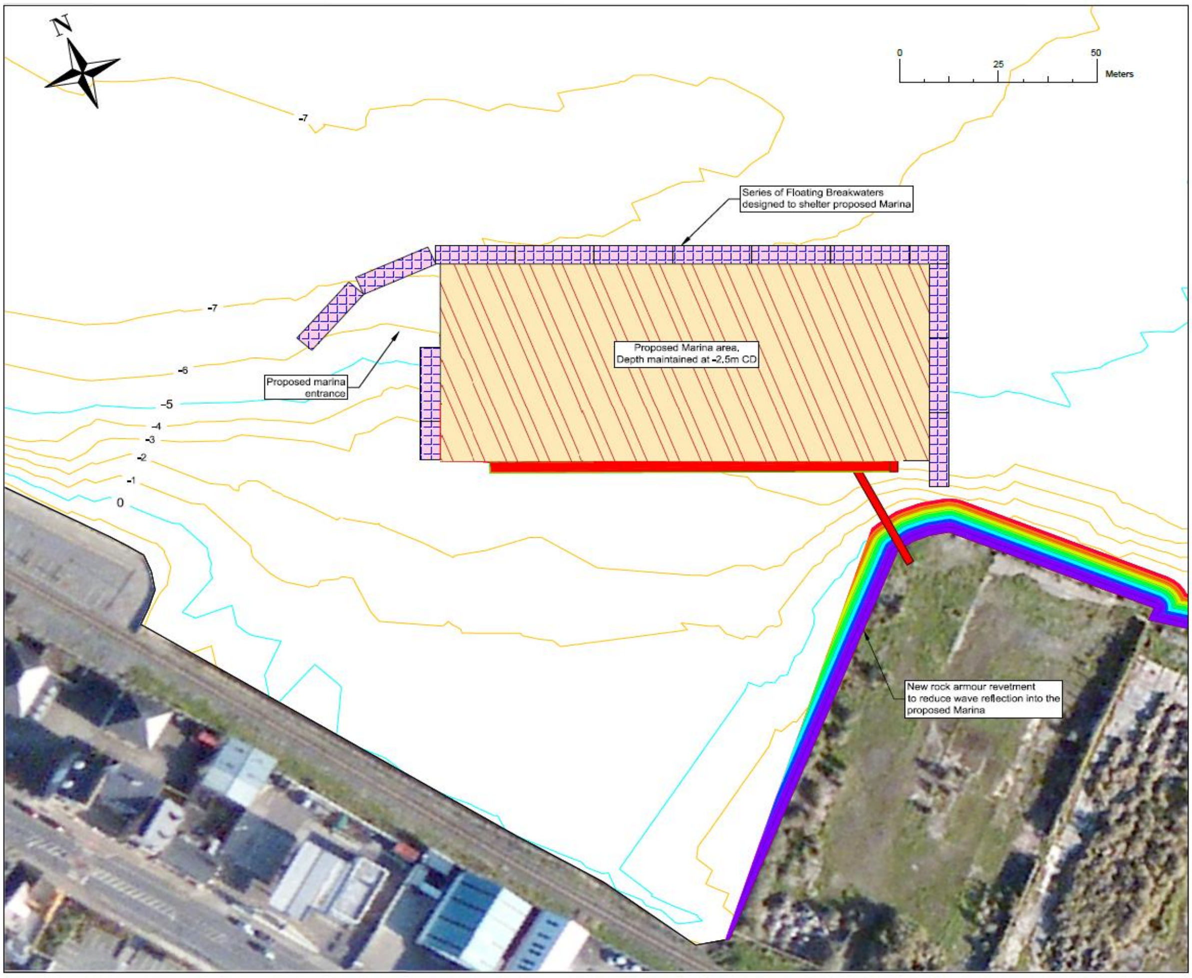


Figure 3.3: Indicative layout of conceptual marina Option 2.

3.1.4 Conceptual Option 3

Option 3 would involve constructing an appropriately designed rubble mound breakwater approximately 320m in length just beyond the north eastern boundary of Trinity Wharf. This would create a sheltered marina of *c.* 18,000m^2 capable of facilitating approximately 100 berths.

To reduce wave reflection within the marina and protect Trinity Wharf from overtopping and flooding it would be necessary to construct an appropriately designed sloping revetment around the perimeter of the existing boundaries of Trinity Wharf.

To create the appropriate minimum operating depth of -2.5m CD it would be necessary to dredge and dispose of *c.* 6,500m^3 of marine sediment.

An indicative layout of conceptual marina Option 3 is illustrated in Figure 3.4 below.

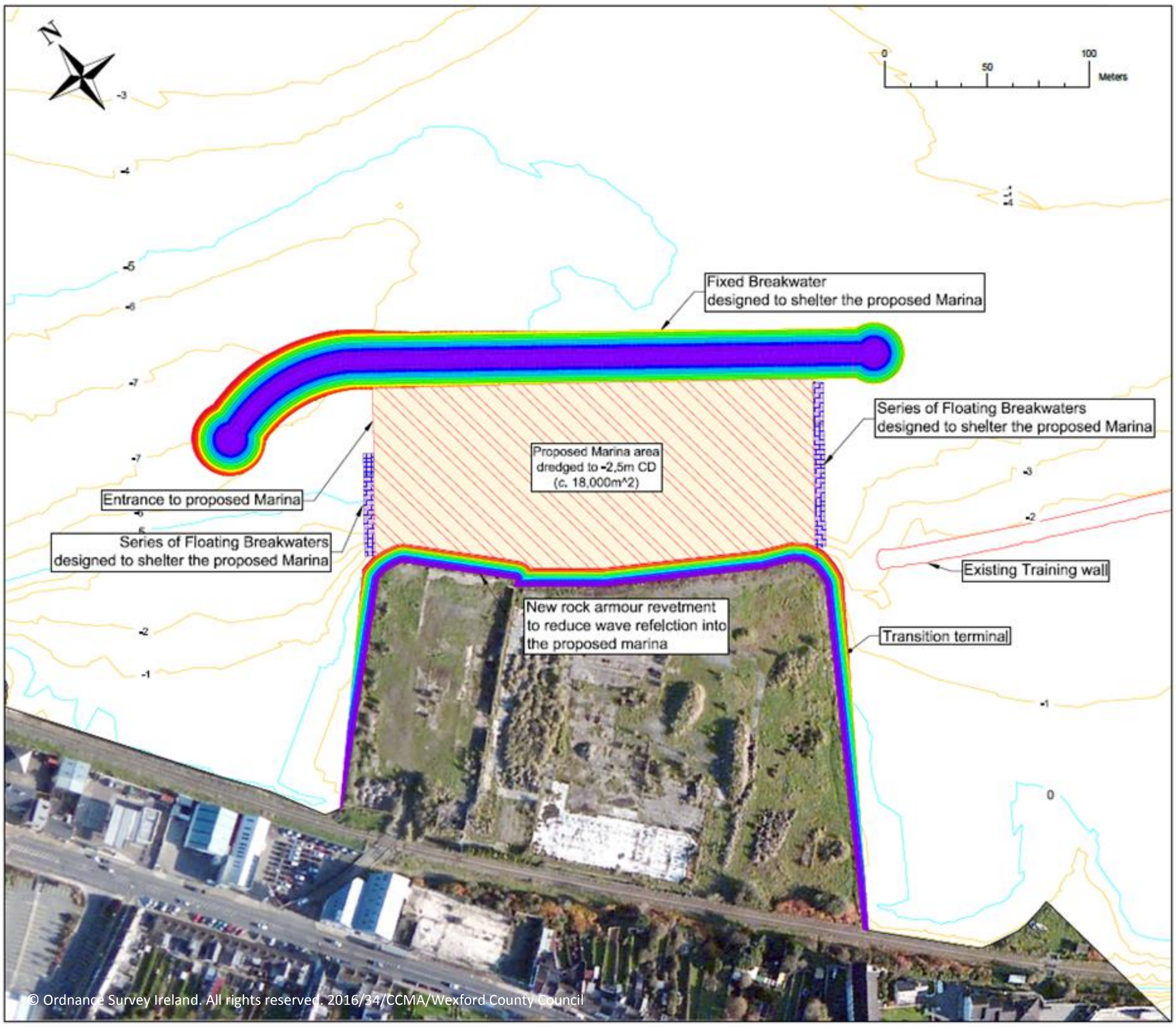


Figure 3.4: Indicative layout of conceptual marina Option 3.

3.1.5 Conceptual Option 3a

This option is almost identical to Option 3 but would involve constructing a series of floating breakwaters as opposed to using a fixed rubble mound break water to create a sheltered marina area of *c.* 18,000m^2.

This option would require the dredging of approximately 6,500m^3 of marine sediment to achieve the desired minimum operating depth of -2.5m CD.

Figure 3.5 illustrates an indicative layout of conceptual marina Option 3a.

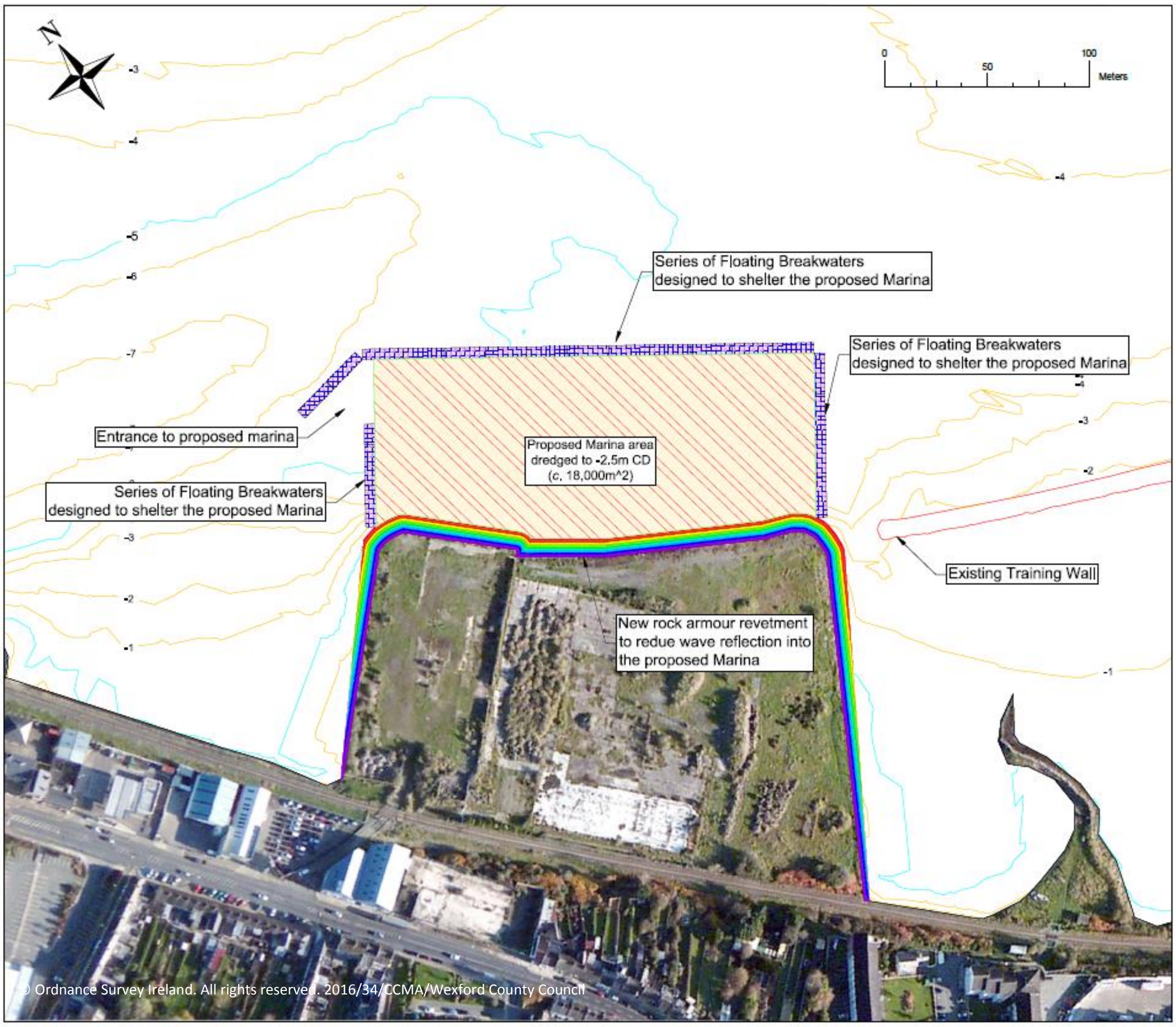


Figure 3.5: Indicative layout of conceptual marina Option 3a.

3.1.6 Conceptual Option 3b

Option 3b is similar to Option 3a but would involve reclaiming approximately 1,750m² of land to the north east of Trinity Wharf. This area of reclaimed land would then be used to store the 6,500m³ of material that would need to be dredged from the proposed marina area to create the minimum operating depths of -2.5m. Implementing this option would therefore alleviate the need to dispose of the dredged material at sea.

Due to the land reclamation, this size of the marina area would be slightly smaller at *c.*14,000m².

An indicative layout of conceptual marina Option 3b is illustrated in Figure 3.6 below.

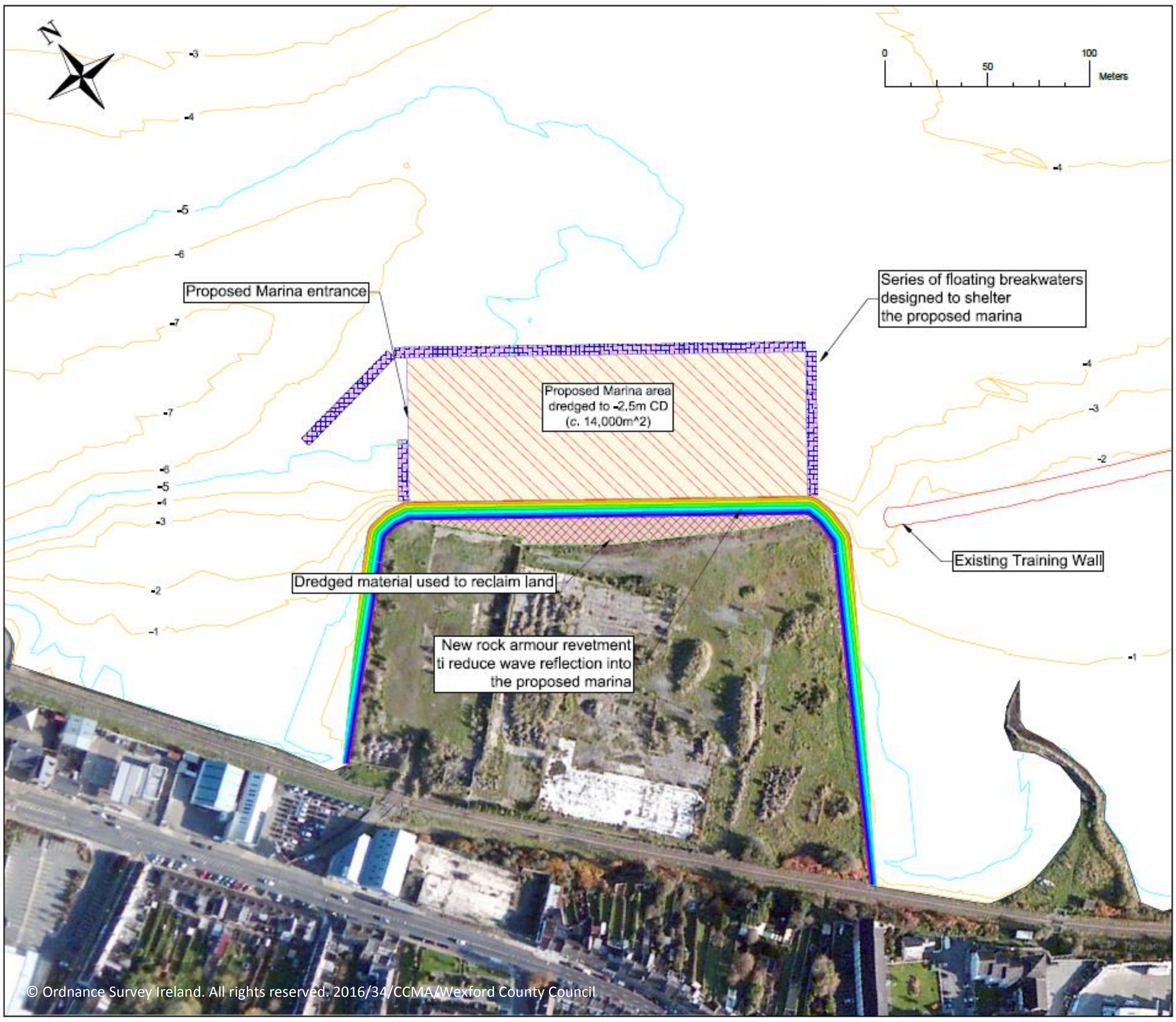


Figure 3.6: Indicative layout of conceptual marina Option 3b.

3.1.7 Conceptual Option 4

The third option is based on developing the south eastern side of Trinity Wharf to create an attached marina behind the existing training wall. This particular option would create a potential marina area of approximately 25,000m^3. However, despite the large marina area created by this option, the actual usable size would be seriously compromised due to the existing small harbour in this area known as 'Goodtide Harbour'. An indicative layout of this conceptual Option is illustrated in Figure 3.7.

To create a suitable wave climate it would be necessary to construct a series of floating breakwaters to the south east of the proposed site. To reduce wave reflection within the marina and protect Trinity Wharf from overtopping and flooding it would be necessary to construct an appropriately designed sloping revetment around the perimeter of the Trinity Wharf site.

To provide an entrance to the proposed marina area *c.* 40m of the existing training wall would have to be demolished. Furthermore, to prevent wind generated waves entering the marina area from the north westerly sectors it would be necessary to extend the existing seawall to tie in with the north eastern corner of Trinity Wharf.

To create the appropriate minimum operating depth of -2.5m CD it would be necessary to dredge and dispose of approximately 87,000m^3 of marine sediment.

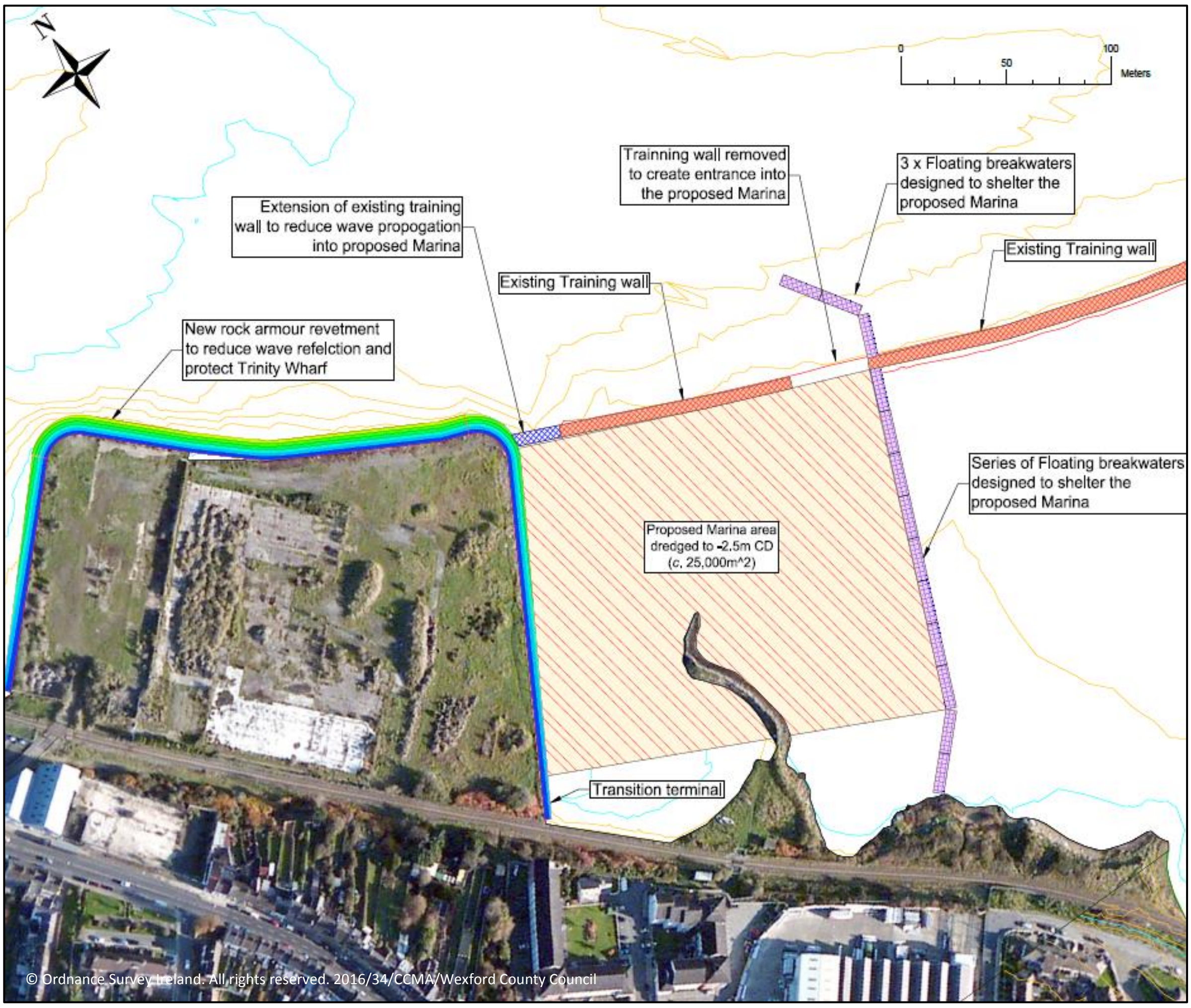


Figure 3.7: Indicative layout of conceptual marina Option 4.

A summary of the characteristics of the conceptual layouts are presented in Table 3.1 below.

Table 3.1: List of conceptual layouts and a summary of the works involved for each option.

Conceptual layout	Summary of works	Proposed Marina area [m^2]
1	▪ Installing a series of floating breakwaters	16,000
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ Dredging & disposing of *c.*40,000m^3 of material	
2	▪ Installing a series of floating breakwaters	6,600
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ No dredging required (based on marina layout plan)	
3	▪ Installing a rubble mound breakwater	18,000
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ Dredging & disposing of *c.*6,500m^3 of material	
3a	▪ Installing a series of floating breakwaters	18,000
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ Dredging & disposing of *c.*6,500m^3 of material	
3b	▪ Installing a series of floating breakwaters	14,000
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ Reclaiming *c.* 10m of land on the north east boundary	
	▪ Using the reclaimed area to store the 6,500m^3 of dredge material	
4	▪ Installing a series of floating breakwaters	25,000
	▪ Constructing a sloping revetment around Trinity Wharf	
	▪ Extending the existing training wall to meet the Trinity Wharf	
	▪ Modifying the existing training wall to create a marina entrance	
	▪ Dredging & disposing of *c.*87,000m^3 of material	

Each of the initial conceptual layouts summarised in Table 3.1 are assessed in more detail in the following sections of this report.

3.2 ASSESSMENT OF CONCEPTUAL LAYOUTS

A high level assessment and scoping exercise was undertaken to identify the related issues associated with each of the conceptual layouts under consideration. An assessment of each layout was conducted based on experience from previous hydrodynamic modelling studies, knowledge of the existing site conditions based and information collected during the site surveys detailed in Section 2.

The results of the assessment and scoping exercise are detailed in the High Level Scoring Matrix included in Appendix A. A summary of the conclusions from this scoping exercise is given below.

3.2.1 Dredging Requirements

- It was determined that given the magnitude of the dredging works required for Options 1 and 4, both options could potentially impact the nearby Wexford Harbour and Slobs SPA and Slaney River Valley SAC. The works could also adversely impact the highly sensitive shell fishing industry in Wexford Bay.

- It is expected that the potential negative impacts associated with the dredging works required to implement Options 3, 3a and 3b could be mitigated by utilising environmentally friendly dredging methods including the use of a silt screen etc.

- Option 2 is the most environmentally acceptable option as it could be implemented without the need for any capital dredging if the marina layout was configured correctly.

3.2.2 Coastal Processes

- As Option 1 is situated on a lee shore it is very likely that this option would require a demanding future maintenance dredging program to maintain the minimum operating depth.

- Option 2 is situated in a naturally deep part of the existing navigation channel. Strong littoral currents are likely to maintain acceptable navigation depths in this area.

- The rubble mound breakwater proposed in Option 3 has the potential to significantly impact existing coastal processes within Wexford Bay; particularly current speeds and directions. This could result in notable adverse impacts to the nearby aquaculture sites.

- It was determined that Options 2, 3a and 3b are unlikely to result in any significant long term impacts to either the existing coastal processes or to the nearby environmentally designated areas.

- Option 4 has the potential to significantly impact the existing sediment transport regime due to the required modification of the existing training wall on the south east boundary of Trinity Wharf. This option would almost certainly result in significant adverse impacts on the licensed aquaculture sites in Wexford Bay.

3.2.3 Construction Considerations

- All options generally employ similar forms of construction in that the attached marinas will be constructed using industry standard modular pontoon and finger units.

- Option 3 involves constructing a significant coastal defence structure approximately 320m in length. It is therefore important to determine a source and the availability of suitably sized rock armour. The fixed breakwater would also be vulnerable to damage if exposed to excessive wave energy during the construction phase when not fully armoured.

- Option 4 involves partially demolishing the existing training wall to the south east of Trinity. Modifying old structures can be particularly challenging if the technical specifications of the structures are unknown.

3.2.4 Initial Capital Cost

- Option 3 would be significantly more expensive than other the options due to the cost of importing appropriately sized rock armour and constructing a suitable rubble mound breakwater.

- Option 2 would have the lowest capital cost due to minimal dredging requirements and the smaller number of floating pontoons required to create the proposed marina area.

- Substantial costs are associated with Options 1 and 4 due to the magnitude of the dredging operations required to create a marina with a minimum operating depth of -2.5m CD.

3.2.5 Impact on Existing Harbour Operations

- Option 2 and 3 could potentially impact existing navigation routes that vessels use to stay within the deeper parts of the Wexford Harbour approach channel.

- Options 3a and 3b also impinge on the existing approach channel to Wexford Harbour. However, given the width of the approach channel at this point this minor impingement is unlikely to result in any significant navigational issues.

- Option 4 is likely to have significant implications for users of the 'Goodtide Harbour' which is located just beyond the south eastern boundary of Trinity Wharf.

3.2.6 Summary of Conclusions

Based on knowledge of existing site conditions it was determined that due to the demanding maintenance dredging programs that would be required to maintain the minimum operating depths in the proposed marina areas detailed in Options 1 and 4, neither of these options were feasible. The initial capital dredging required to implement either of these options also has the potential to create significant environmental impacts. For these reasons Options 1 and 4 were ruled out.

The conceptual marina options that were shortlisted for further consideration are detailed in Section 3.3 overleaf.

3.3 SHORTLISTED CONCEPTUAL LAYOUTS

3.3.1 Option 2 – Floating breakwater on the North Eastern corner

This conceptual option involves constructing a marina on the northern corner of the Trinity Wharf site. This option has been illustrated in Figure 3.8 and would involve the following key elements:

- Installing twelve 5 x 20m and two 5 x 10m floating breakwaters around the perimeter of the proposed marina site to create a sheltered area of approximately 6,600m^2 capable of facilitating *c.*61 berths.
- Two of these eleven floating breakwaters will be situated on the western extent of the marina to reduce wind waves generated over short fetches from the westerly sectors entering the proposed marina.
- A suitably designed sloping revetment would be constructed around the perimeter of the Trinity Wharf site to protect the hinterland and reduce wave reflection.
- The effective width of the navigation channel between the north western extent of the marina and the opposite training wall would be *c.*258m.

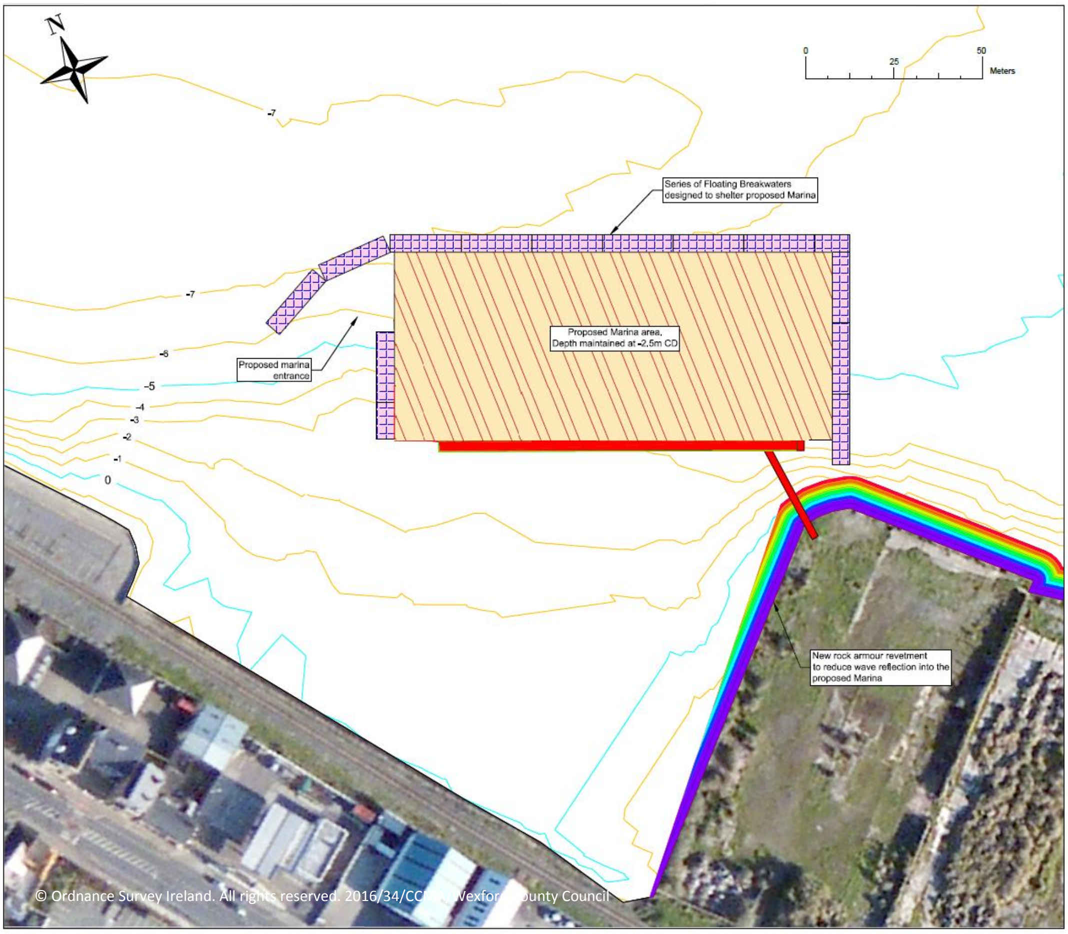


Figure 3.8: Indicative extent and layout of proposed marina Option 2.

3.3.2 Option 3 - Fixed Breakwater and Floating Breakwaters on the North Eastern Boundary

This option would involve constructing an attached marina on the north eastern boundary of Trinity Wharf. This particular option is illustrated in Figure 3.9 and would involve the following key elements:

- Constructing a fixed rubble mound breakwater *c.* 320m in length to create a sheltered marina area of approximately 18,000m^2.
- Constructing a suitably designed sloping revetment around the perimeter of the Trinity Wharf site to protect the hinterland and reduce wave reflection in the proposed marina area.
- Installing two 5 x 20m floating breakwaters on the western extent of the proposed marina to reduce incident wave energy propagating into the marina from the easterly sectors.
- Installing one 5 x 20m floating breakwater on the eastern extent of the proposed marina to reduce wind waves generated over short fetches from entering the proposed marina area.
- Dredging and disposing of approximately 6,500m^3 of sediment material from the proposed site to create a minimum operating depth of -2.5m CD throughout the marina.

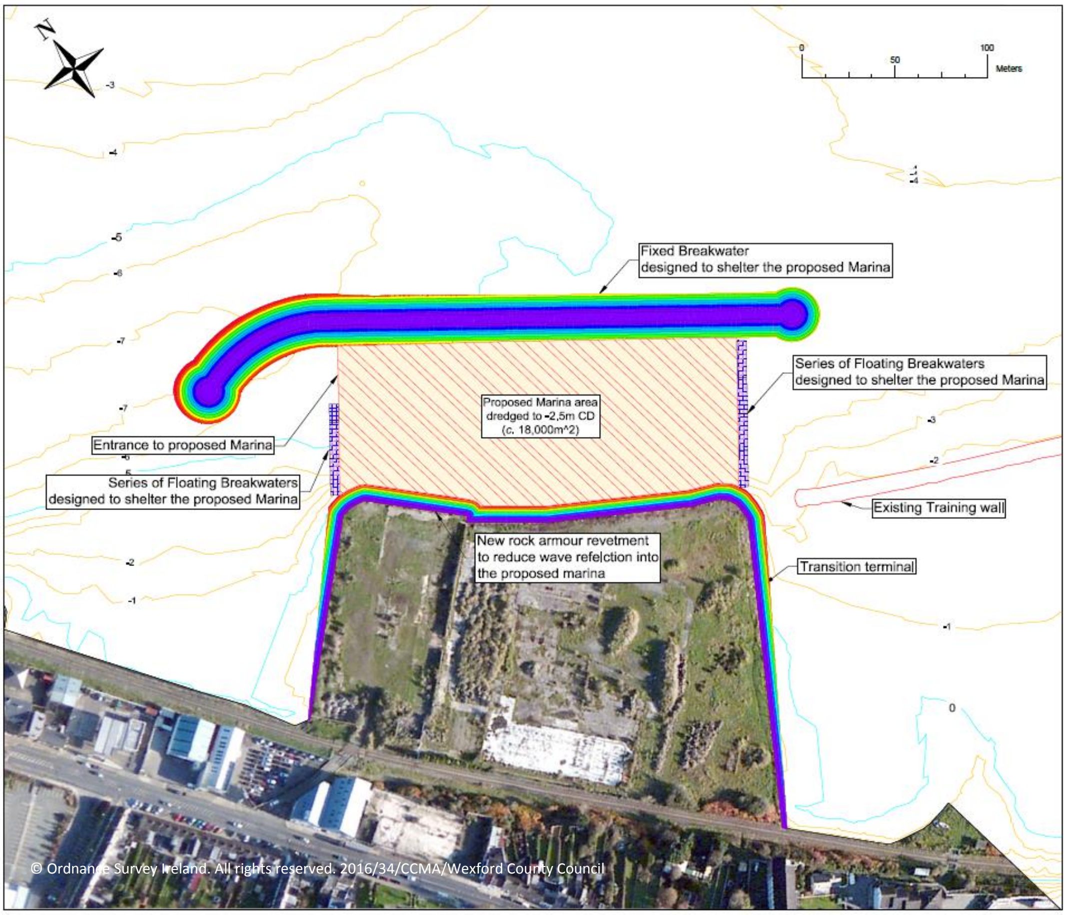


Figure 3.9: Indicative extent and layout of proposed marina Option 3.

3.3.3 Option 3a – Series of Floating Breakwaters on the North Eastern Boundary

Option 3a involves constructing a series of floating breakwaters on the north eastern side of Trinity Wharf. This option has been illustrated in Figure 3.10 and would involve the following key elements:

- Installing fifteen 5 x 20m floating breakwaters around the perimeter of the proposed marina to create a sheltered area of approximately 18,000m^2.
- Constructing a suitably designed sloping revetment around the perimeter of the Trinity Wharf site to protect the hinterland and reduce wave reflection in the proposed marina area.
- Installing two 5 x 20m floating breakwater on the western extent of the proposed marina to reduce wind waves generated over short fetches from the westerly sectors entering the proposed marina area.
- Dredging and disposing of approximately 6,500m^3 of sediment material from the proposed site to create a minimum operating depth of -2.5m CD throughout the marina.

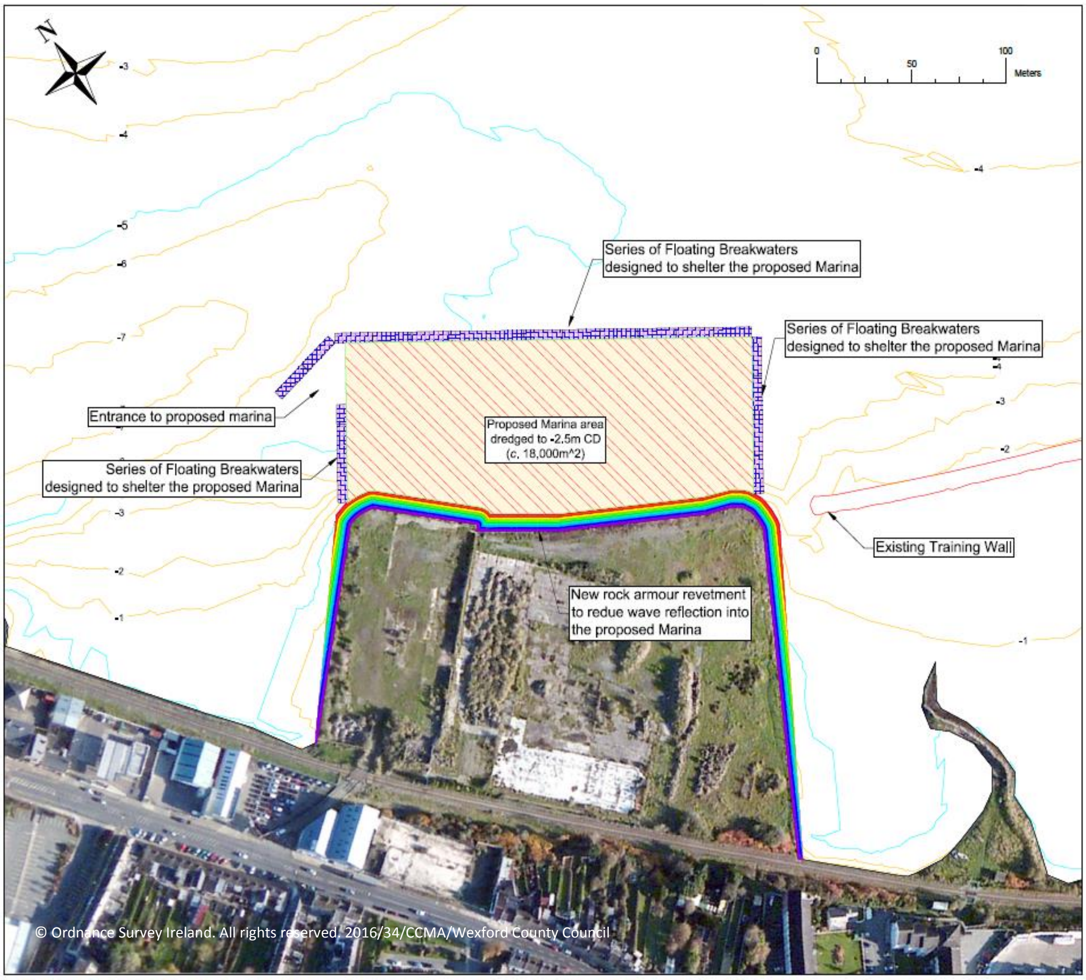


Figure 3.10: Indicative extent and layout of proposed marina Option 3a.

3.3.4 Option 3b – Series of Floating Breakwaters on the North Eastern Boundary and Land Reclamation

Option 3b is similar to Option 3a; however this option involves reclaiming approximately 10m of land to the north east of Trinity Wharf which would then be used to store treated dredge material. This option has been illustrated in Figure 3.10 and would involve the following key elements:

- Reclaiming *c.* 10m of land to the northeast of Trinity Wharf.
- Installing fifteen 5 x 20m floating breakwaters around the perimeter of the proposed marina to create a sheltered area of approximately 14,000m^2.
- Constructing a suitably designed sloping revetment around the perimeter of the Trinity Wharf site to protect the hinterland and reduce wave reflection in the proposed marina area.
- Installing two 5 x 20m floating breakwater on the western extent of the proposed marina to reduce wind waves generated over short fetches from the westerly sectors entering the proposed marina area.
- Dredging approximately 6,500m^3 of sediment material and storing this material in the reclaimed the 10m of land at Trinity Wharf.

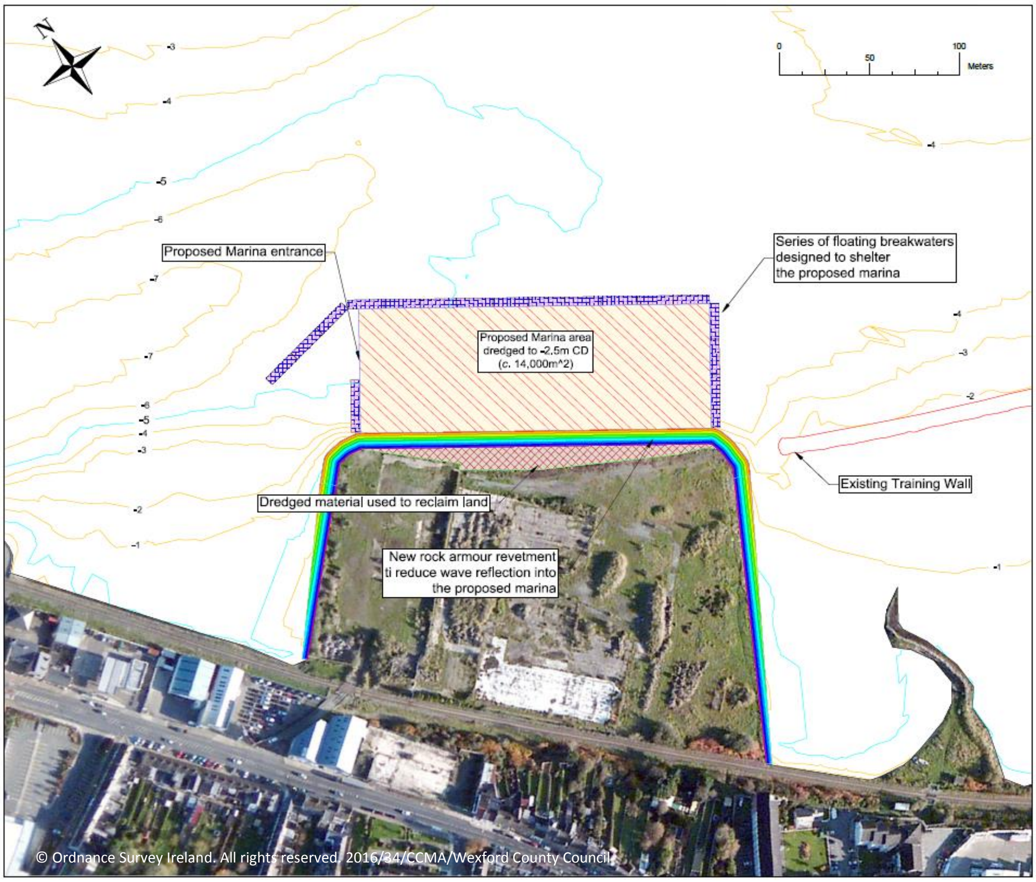


Figure 3.11: Extent and layout of proposed marina Option 3b.

4 COMPUTATIONAL MODELLING OVERVIEW

4.1 INTRODUCTION

RPS has previously undertaken modelling of the coastal process at Rosslare Strand and the wider Wexford area. This expertise and experience was used to inform the initial conceptual layout assessment presented in Section 3.

The detailed modelling undertaken for this study was used to improve the selection of the feasible marina layouts, undertake hydraulic refinement of these layouts, provide hydraulic design data and assess the impact of the proposed marina options on the coastal processes of the area around Trinity Wharf.

At Trinity Wharf the main factors that need to be considered when assessing the shortlisted marina options are:

1. **Waves:** Any marina area should be free of, or readily protected from, the potential for wave damage. It is therefore necessary to determine the wave climate of a potential site as it is the most important engineering factor that governs the location and design of a marina. When suitable protection is not provided by a surrounding land mass or natural feature, then some means of constructed wave protection must be considered.

2. **Tidal Currents:** Currents are generated by the horizontal movement of water and can often cause problems to marine operations if they exceed speeds of several knots. Tidal currents also influence other key effects such as scouring and deposition of sediments which can have significant impacts on maintenance dredging requirements.

3. **Sediment Transport:** Structures that interfere with the existing sediment transport regime typically cause deposition and erosion of sediment around the structure. The potential impacts of a structure should therefore be fully evaluated. Protected basins in particular usually experience high levels sedimentation which should be assessed in order to estimate future maintenance dredging requirements and avoid navigation issues.

Details of the computational modelling engines used to assess each potential marina option are presented overleaf.

4.2 MODELS USED IN THE STUDY

The hydraulic model studies were undertaken using the RPS in house MIKE21/3 suite of coastal process modelling software. The MIKE21/3 modelling system was developed by the Danish Hydraulics institute and is regarded one of the world's foremost computational modelling systems for the marine environment.

4.2.1 MIKE 21/3 Flow Model FM

MIKE 21/3 Flow Model FM is a modelling system based on a flexible mesh approach. The modelling has been developed for applications within oceanographic, coastal and estuarine environments.

MIKE 21/3 Flow Model FM is composed of the following modules:

- Hydrodynamic Module
- Transport Module
- ECO Lab/Oil Spill Module
- Mud Transport Module
- Sand Transport Module
- Particle Tracking Module

The Hydrodynamic Module and the Spectral Wave Module are the basic computational components of the MIKE 21/3 modelling systems. Using the MIKE 21/3 Coupled Model FM it is possible to simulate the mutual interaction between waves and currents using a dynamic coupling between the Hydrodynamic Module and the Spectral Wave Module. The MIKE 21/3 Coupled Model FM also includes a dynamic coupling between the Sand Transport Modules, Hydrodynamic Module and Spectral Wave modules. Hence, a full feedback of the bed level changes on the waves and flow calculations can be included.

4.2.2 Hydrodynamic Module

The Hydrodynamic Module simulates water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The effects and facilities include:

- Flooding and drying
- Momentum dispersion
- Bottom shear stress
- Coriolis force
- Wind shear stress
- Barometric pressure gradients
- Tidal potential
- Precipitation/evaporation
- Wave radiation stresses
- Sources and sinks

The Hydrodynamic Module can be used to solve both three-dimensional (3D) and two-dimensional (2D) problems. In 2D the model is based on the shallow water equations - the depth-integrated incompressible Reynolds averaged Navier-Stokes equations.

4.2.3 Spectral Wave Module

The Spectral Wave Module simulates the growth, decay and transformation of wind-generated waves and swell in offshore and coastal areas. The following physical phenomena can be taken into account:

- Wave growth by action of wind
- Non-linear wave-wave interaction
- Dissipation due to white-capping
- Dissipation due to bottom friction
- Dissipation due to depth-induced wave breaking
- Refraction and shoaling due to depth variations
- Wave-current interaction
- Effect of time-varying water depth and flooding and drying

The Spectral Wave Module includes two different formulations:

- Directional decoupled parametric formulation
- Fully spectral formulation

The directional decoupled parametric formulation is based on a parameterization of the wave action conservation equation. The parameterization is made in the frequency domain by introducing the zeroth and first moment of the wave action spectrum as dependent variables.

4.2.4 Mud Transport Module

The Mud Transport (MT) module includes a state-of-the-art mud transport model that simulates the erosion, transport, settling and deposition of cohesive sediment in marine, brackish and freshwater areas. The module also takes into account fine-grained non-cohesive material.

The MT module is an add-on module to the MIKE 21/3 Flow model described in Section 4.2.1 and is based on a coupling between the hydrodynamic solver and the transport solver for passive components. The influence of waves on the erosion/deposition patterns can be included by applying the Spectral Wave module.

The MT Module has many application areas and some of the most frequently used are listed below:

- Dispersion of dredged material
- Optimization of dredging operations
- Siltation of harbours
- Siltation in access channels
- Cohesive sediment dynamics and morphology.
- Dispersion of river plumes
- Erosion of fine-grained material under combined waves and currents

The main computational features of the MIKE21/3 Flow Model FM Mud Transport module are listed below and have been summarised in Figure 4.1.

- Multiple sediment fractions
- Multiple bed layers
- Flocculation
- Hindered settling
- Inclusion of non-cohesive sediments
- Bed shear stress from combined currents and waves
- Waves included as wave database or 2D series
- Consolidation
- Morphological update of bed

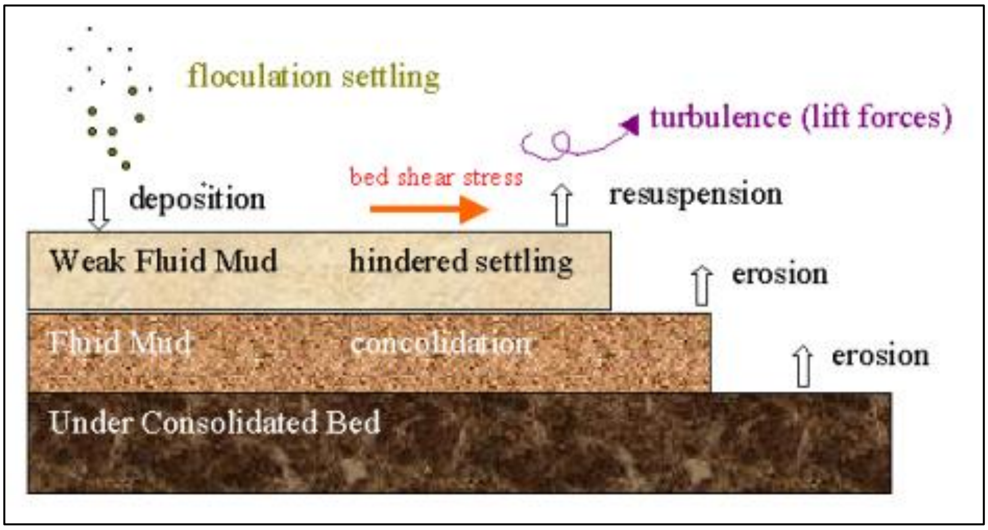


Figure 4.1: Example of the physical processes modelled by the MIKE 21/3 Mud Transport module.

4.3 BATHYMETRY DATA

The high resolution bathymetry data recorded by Hydrographic Surveys Ltd and detailed in Section 2.4 was used to develop the range of numerical models used throughout this study. This data was complemented by bathymetric data from the Irish National Seabed Survey (INSS), INFOMAR and other local bathymetric surveys collated by RPS as part of the Irish Coastal Protection Strategy Study (ICPSS) and the South Eastern Catchment Flood Risk Assessment and Management (CFRAM) study.

5 CLIMATE DATA AND ANALYSIS

5.1 STANDARD AND EXTREME TIDAL LEVELS AT WEXFORD HARBOUR

The tidal levels for Wexford Harbour have been derived using Volume 1 of the 2016 Admiralty Tide Tables for United Kingdom and Ireland. These standard levels are also applicable to Trinity Wharf as Wexford Harbour is located approximately 0.50km to the west of Trinity Wharf. The still water levels for Wexford Harbour are presented in Table 5.1 below.

Table 5.1: Standard and inferred tidal elevations at Wexford Harbour to Mean Sea Level (MSL) and Chart Datum (CD).

Wexford Harbour	Mean Sea Level (MSL)[m]	Chart Datum (CD)[m]
Highest Astronomical Tide	1.12	2.3
Mean High Water Spring	0.82	2.0
Mean High Water Neap	0.22	1.4
Mean Low Water Neap	-0.28	0.90
Mean Low Water Spring	-0.68	0.50

5.1.1 Extreme Water Levels

Water levels are a crucial aspect to be considered during the design process of any coastal infrastructure, particularly marinas as increased water levels can facilitate the propagation of larger waves into a given site. In order to determine the extreme water levels at Wexford Harbour, RPS made reference to the Irish Coastal Protection Study.

As part of this study an Extreme Value Analysis (EVA) of the water levels around coast of Ireland was undertaken, including in Wexford Bay. The extreme high water levels that were derived as part of the ICPSS project for various return periods in Wexford Bay are presented in Table 5.2 below.

Table 5.2: Extreme water levels at Wexford Bay for various return period conditions.

Return Period (N) [years]	High Water Level (MSL) [m]	High Water Level (CD) [m]
2	1.14	2.31
5	1.29	2.47
10	1.40	2.58
20	1.51	2.69
50	1.64	2.82
100	1.74	2.92
200	1.84	3.02
1000	2.06	3.24

5.2 WAVE AND WIND DATA

Wave and wind data from the European Centre for Medium Range Weather Forecasts (ECMWF) European Waters Wave model for the years 1996-2014 were used as a source to generate 3 hourly annual wave records for an offshore point east of Wexford Bay (52.5°N 6.0°W). The 3 hourly data included wind waves and swell wave components defined in terms of the significant wave height H_{mo}, mean wave period, T_m, and mean wave direction. Wind velocities and directions were also included in the dataset.

The wave rose for the 3 hourly significant wave heights for the offshore point is presented in Figure 5.1 below. It will be seen from this figure that the largest offshore waves originate in the south westerly sectors. Given the close proximity of the offshore point to the Celtic Sea swell waves from the south westerly sector dominate the offshore wave rose. It should be noted that given the relatively sheltered nature of Trinity Wharf, virtually no swell waves penetrate Wexford Bay to reach the study site. The inshore wave climate is comprised predominantly of wind waves generated over very short fetches within Wexford Bay itself.

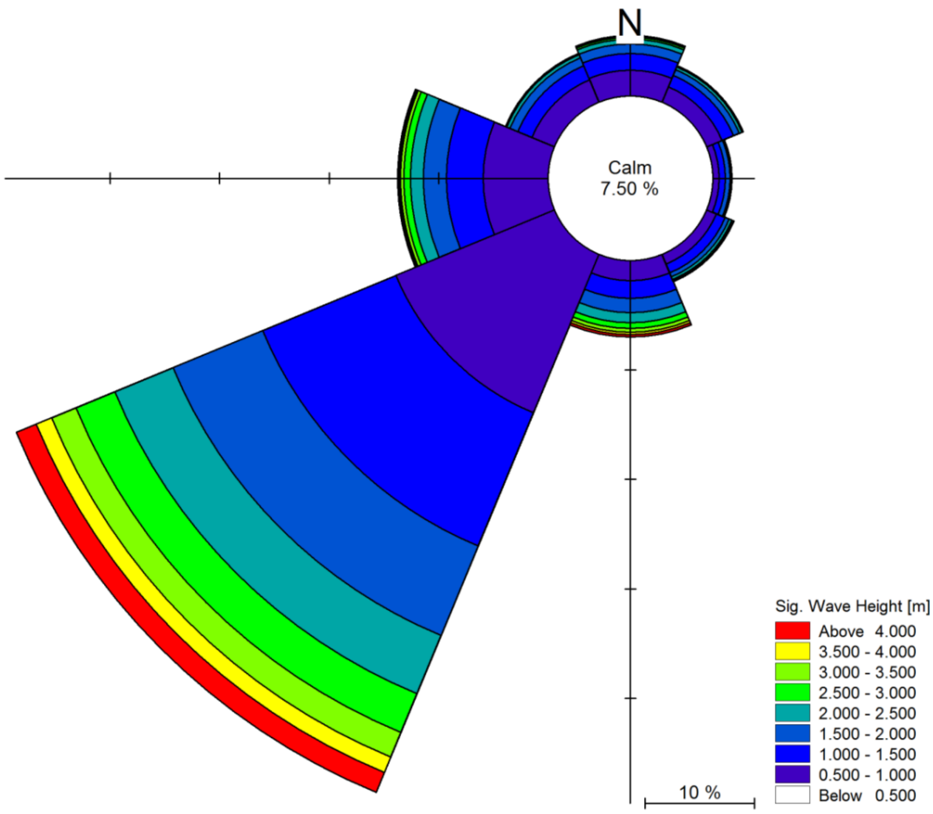


Figure 5.1: Wave rose of the offshore wave climate at the point 52.5°N 6.0°W for the 18 year period 1996-2014.

As can be seen from Figure 5.2 which illustrates the wind rose for the 3 hourly wind velocities for the offshore point just beyond Wexford Bay, the highest recorded wind speeds were also found to originate in the south west sectors. However at Trinity Wharf only wind waves generated over short fetches within Wexford Bay from the north through to east and south easterly sectors are likely to reach the study site. It will be seen from Figure 5.2 that the maximum wind speeds from these particular sectors almost never exceed 14m/s.

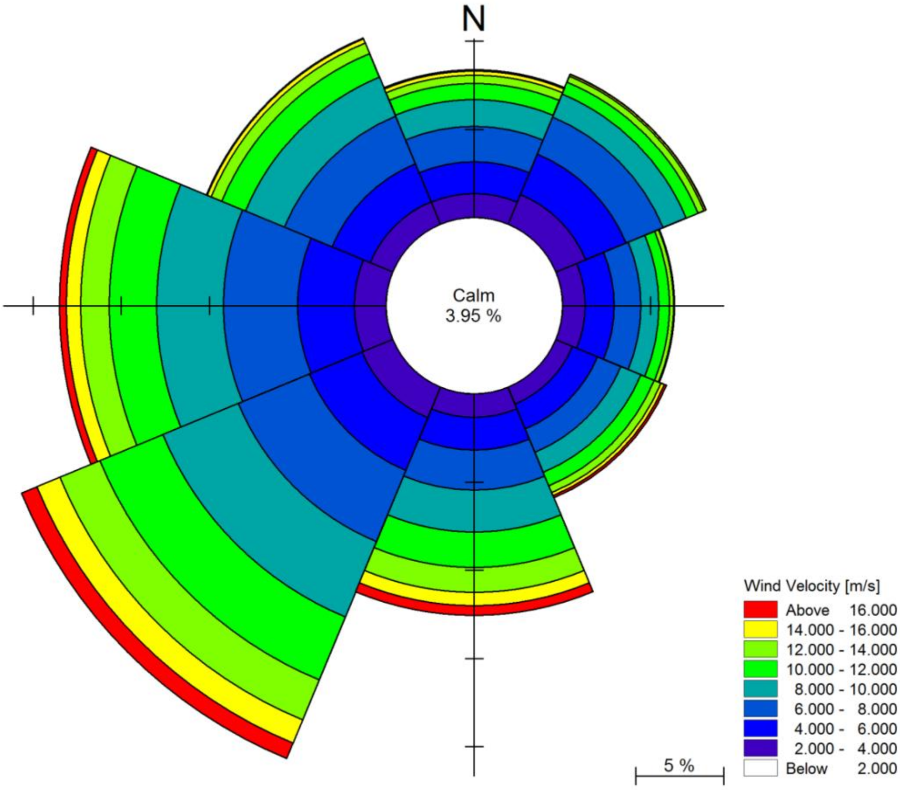


Figure 5.2: Wind rose of the offshore wave climate at the point 52.5°N 6.0°W for the 18 year period 1996-2014.

5.2.1 Extreme Waves and Wind Conditions

An extreme value analysis of the ECMWF offshore 3 hourly wave and wind data set for the 18 year period from 1996 - 2014 was undertaken using the MIKE EVA toolbox. Given the location of the study site and that the largest wind waves that the study site is exposed to originate in the south west through east to the north sectors, the offshore wave and wind climate was divided into six 45^{o} sectors. This enabled an individual analysis to be conducted for each of these sectors.

The extreme value analysis was performed by fitting a theoretical probability distribution to the 3-hourly ECMWF data set. A partial duration series, also known as a peak over threshold model was used to select the largest events that occurred within the data set for each relevant directional sector. A truncated Gumbel probability distribution was then fitted to the datasets using a Jackknife re-sampling technique. This approach was used to derive a series of return period waves heights for each sector. The significant wave heights of various return periods for the five sectors are presented in Table 5.3 overleaf.

An example of an EV plot for the offshore wave height from the easterly sector is shown in Figure 5.3. It will be seen that offshore wave events with a return period of 100 years from this sector have significant wave heights in excess of 4.5m.

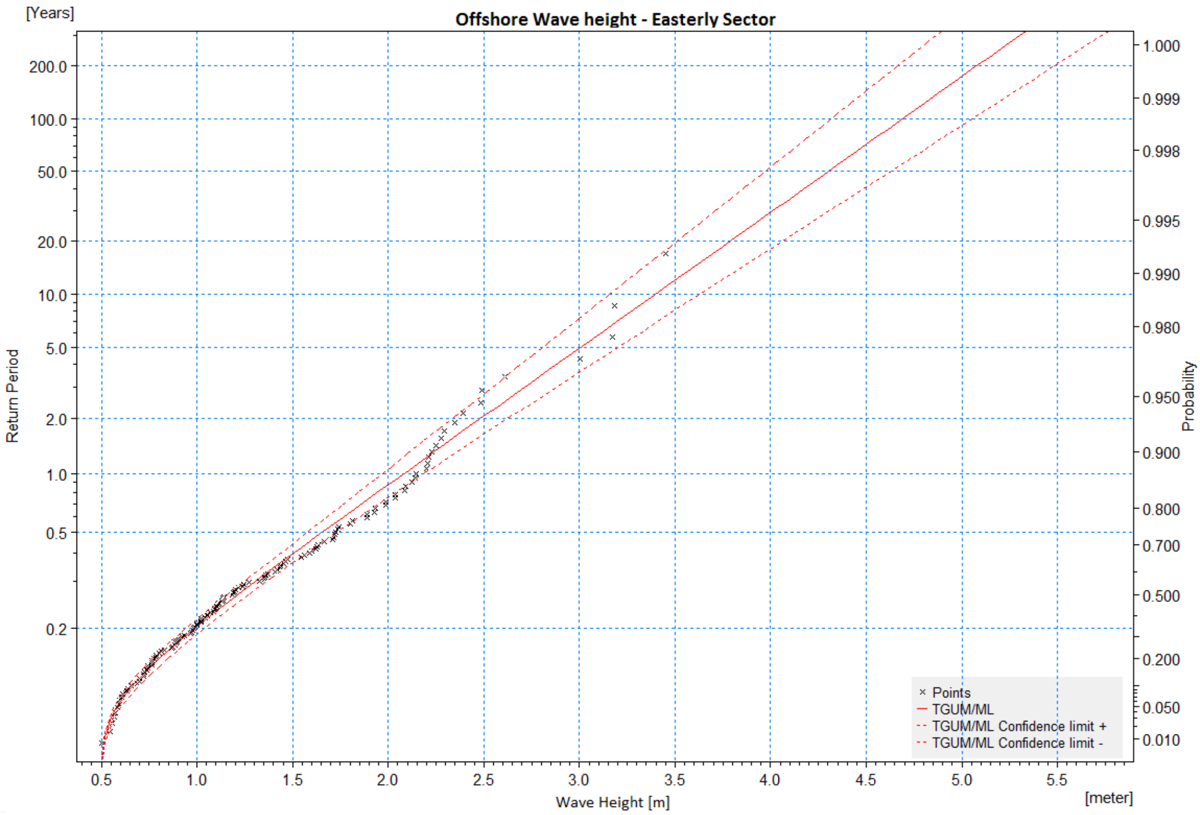


Figure 5.3: Extreme Value Analysis of offshore wave heights - Easterly Sector.

Table 5.3: Results of Extreme Wave and Wind Analysis.

Direction 22.5 - 67.5°			
Return Period [years]	**Significant Wave Height [m]**	**Mean Energy Wave Period [s]**	**Wind Speed [m/s]**
2	2.98	7.32	17.7
5	3.45	7.88	19.42
10	3.84	8.31	20.71
20	4.2	8.69	22.05
50	4.7	9.19	23.71
100	5.05	9.53	25.1
200	5.4	9.85	26.4

Direction 67.5 - 112.5°			
Return Period [years]	**Significant Wave Height [m]**	**Mean Energy Wave Period [s]**	**Wind Speed [m/s]**
2	2.5	6.71	16.8
5	3	7.35	18.65
10	3.4	7.82	20.2
20	3.8	8.27	21.35
50	4.37	8.86	23.2
100	4.66	9.15	24.52
200	5.08	9.56	25.9

Direction 112.5 - 157.5°			
Return Period [years]	**Significant Wave Height [m]**	**Mean Energy Wave Period [s]**	**Wind Speed [m/s]**
2	3.28	7.68	21
5	3.9	8.37	22.6
10	4.35	8.84	23.8
20	4.87	9.36	25
50	5.45	9.90	26.55
100	5.9	10.30	27.7
200	6.36	10.69	28.85

Direction 157.5 - 202.5°			
Return Period [years]	**Significant Wave Height [m]**	**Mean Energy Wave Period [s]**	**Wind Speed [m/s]**
2	5.3	9.76	24
5	6.12	10.49	25.3
10	6.71	10.98	26.3
20	7.32	11.47	27.2
50	8.11	12.08	28.5
100	8.72	12.52	29.44
200	9.32	12.95	30.4

6 WAVE CLIMATE AT TRINITY WHARF

The transformation of waves from the offshore region to Trinity Wharf was undertaken using the MIKE 21 SW model. The extent, bathymetry and mesh structure of the main tidal and spectral wave model is illustrated in Figure 6.1. The size of the mesh varied from about 1km at the boundary of the model down to a fine grid size of *c.*10m in the immediate vicinity of Trinity Wharf. The detailed mesh structure in the vicinity of Trinity Wharf is illustrated in Figure 6.2.

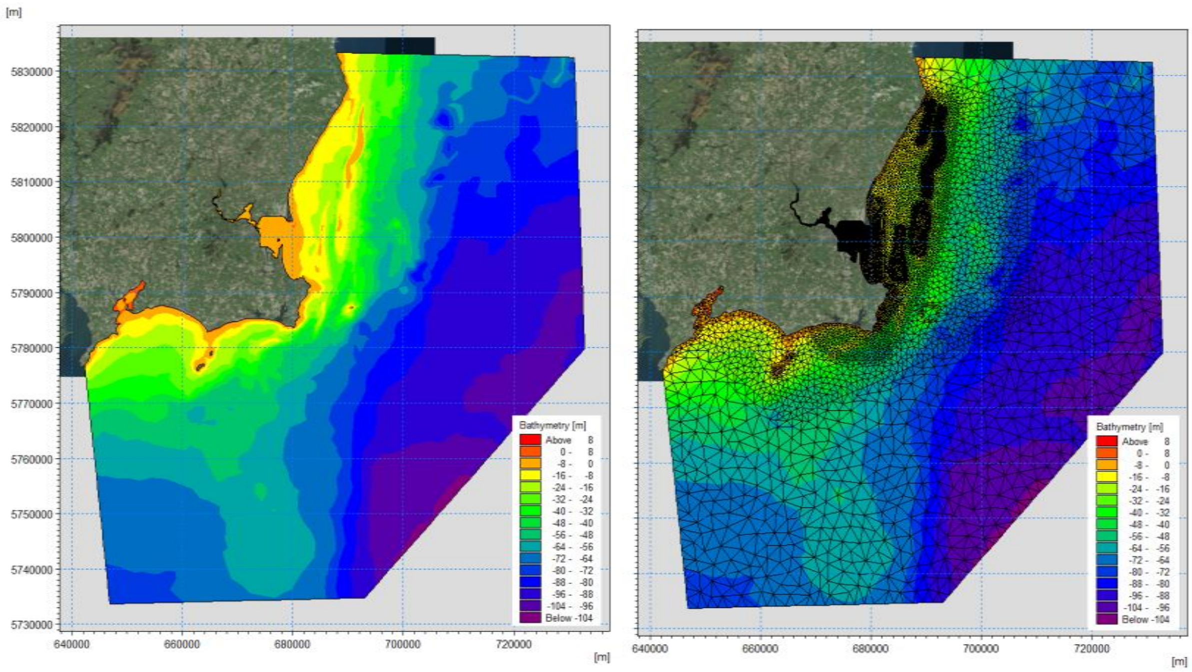


Figure 6.1: Extent & bathymetry of the MIKE 21 model (left) and the mesh structure of the model (right).

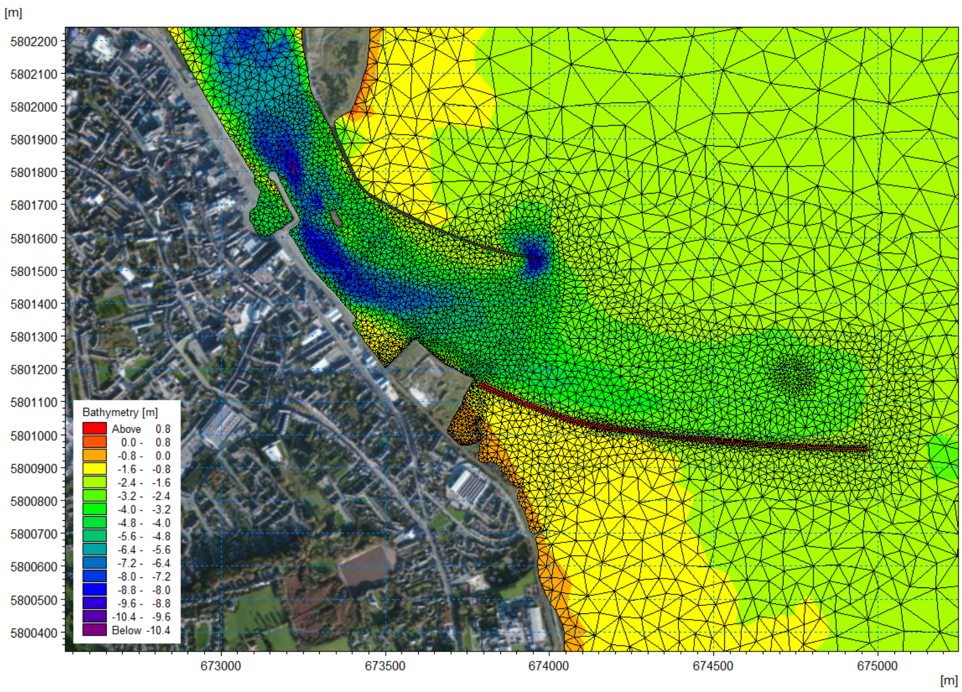


Figure 6.2: Mesh detail of the MIKE 21 model in the Trinity Wharf and River Slaney area.

6.1 EXISTING WAVE CLIMATE AT TRINITY WHARF

To identify which storm directions yielded the most arduous conditions in terms of wave energy at Trinity Wharf, initial wave transformations were undertaken at a high spring tide for a range of 1 in 50 year and 1 in 1 year return period storm conditions from the north, north east, east and south. Results of these modelling efforts demonstrated that the most arduous wave conditions were experienced at Trinity Wharf during storm events originating in the north easterly sector.

It can be seen from Figure 6.3 overleaf that under 1 in 50 year return period storm conditions the significant height of incident waves at Trinity Wharf does not exceed 1.00m; the corresponding mean wave period for these waves is between 2.0 – 3.0 seconds. Based on the proposed marina area highlighted in Figure 6.4, also overleaf, the mean significant wave height within the proposed marina was found to be 0.84m whilst the mean wave period within the marina area was found to be 2.70 seconds.

The numerical simulations also illustrated the notable effect that both training walls have on the existing wave climate. The training wall to the north of Trinity Wharf prevents larger wind waves developing over the north easterly fetches, but despite this, waves can be seen to refract around the end of the training wall and impact the north western extent of Trinity Wharf. The shallowing bathymetry on the lee side of second training wall to the south east of Trinity Wharf acts to refract and funnel the waves towards the south eastern boundary of the study site, however most waves in this region are small (0.40 -0.50m) relative to the more exposed boundaries of the study area.

Figure 6.3 also illustrates the significant wave heights and the corresponding mean wave periods at Trinity Wharf during 1 in 1 year return period storm conditions originating in the north easterly sector. It will be seen that significant wave heights at the north eastern boundary of Trinity Wharf generally range between 0.50 – 0.60m with corresponding wave periods of *c.*1.5 -2.0 seconds. The mean significant wave height and mean wave period within the proposed marina area were found to be 0.51m and 2.29 seconds respectively.

Based on the results of the numerical simulations, it can be concluded that:

- The wave climate at Trinity Wharf is dominated primarily by wind waves generated over short fetches within Wexford Bay;
- Trinity Wharf is partially protected from incident waves by the training wall to the north of the study site;
- The second training wall to south east of Trinity Wharf refracts incident waves in such a manner that they are funnelled to the south eastern boundary of the study site; and
- The maximum and average wave conditions within the proposed marina area are presented in Table 6.1 below.

Table 6.1: Maximum and Average Wave Conditions within the proposed marina under existing conditions.

Environmental Condition	Maximum		Average	
	Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year storm	0.54	2.31	0.51	2.29
1 in 50 year storm	0.90	2.75	0.84	2.70

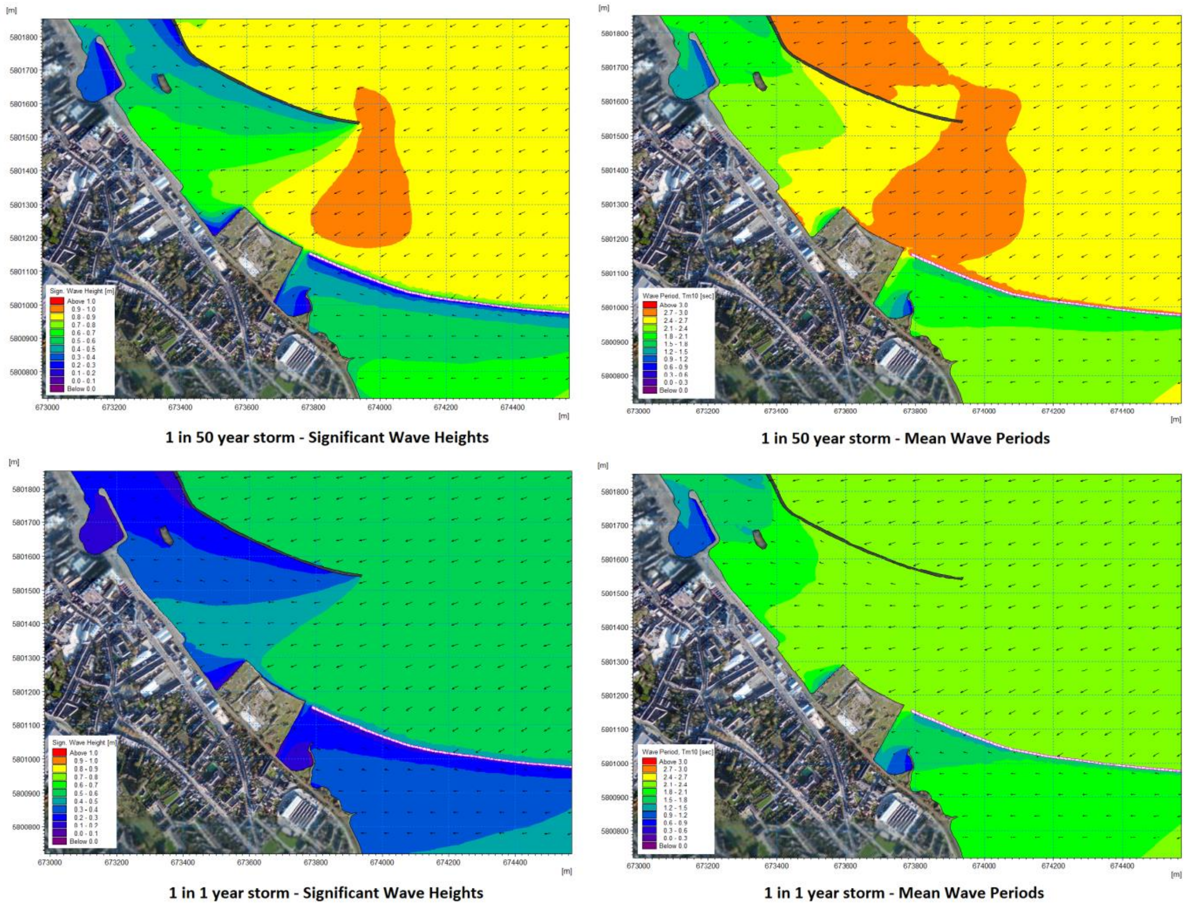


Figure 6.3: Wave climate at Trinity Wharf during 1 in 50 and 1 in 1 year storm events from the North East - Existing Conditions.

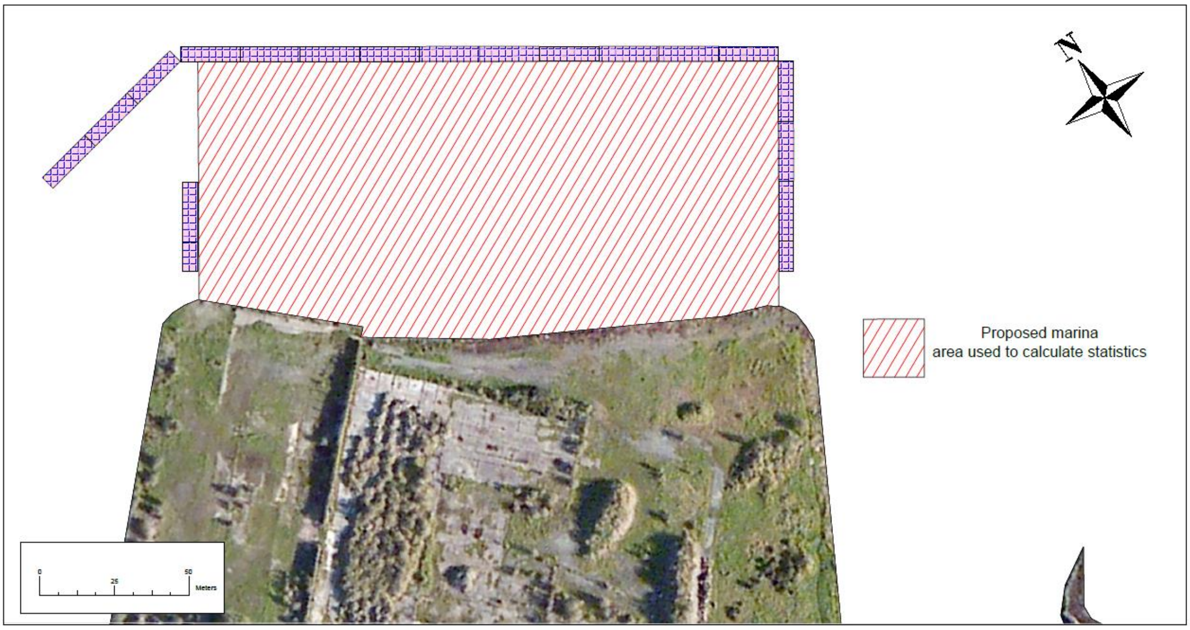


Figure 6.4: Proposed marina area used to calculate wave climate statistics.

6.2 WAVE HEIGHT ACCEPTANCE THRESHOLDS

The previous section has demonstrated that the proposed site at Trinity Wharf is affected by medium to low energy wind waves that are generated predominantly over short fetches within Wexford Bay. In order to critically assess the wave climate under each of the shortlisted options, numerical modelling results were compared with established wave height acceptance thresholds. The two wave height acceptance thresholds used for this study have been based on guidelines published by the Yacht Harbour Association and the Australian Standard (AS3962) '*Guidelines for design of Marinas*' and are presented in Table 6.2 below.

Table 6.2: Wave height acceptance threshold values.

Environmental Conditions	Description	Wind/Wave conditions	Threshold wave conditions
Normal Operating Condition (NOC)	The conservative worst case wind and wave climate that can be expected to be experienced in the marina during normal operations year round	1 in 1 year return period conditions	Hs < 0.3 metres Tp < 2.0 seconds
Design Condition	The worst case storm conditions which may be experienced in the marina during its design lifetime	1 in 50 year return period conditions	Hs < 0.4 metres Tp < 2.5 seconds

Comparing the wave height threshold values presented in Table 6.2 with the baseline wave climate presented in Section 6.1 indicates that:

- The existing wave heights for both Normal Operating Conditions and Design Conditions are considerably higher than the recommended threshold values; and

- The existing wave periods for both Normal Operating Conditions and Design Conditions are higher than the recommended threshold values.

This high level assessment demonstrates that in order for any marina facility to be viable and safe in all weather conditions, a considerable reduction in existing wave heights and periods is required. A suitably designed wave defence structure is therefore essential in order to shelter the proposed marina area.

6.3 WAVE CLIMATE WITH CONCEPTUAL OPTION 2 IMPLEMENTED

Figure 6.5 illustrates the significant wave heights and corresponding mean wave periods during a 1 in 50 year return period storm event from the north east with Option 2 implemented. It will be seen that the floating breakwater on the northern corner of Trinity Wharf effectively reduces wave heights and wave periods in the lee of the structure. In some areas the wave heights are decreased by more than 0.50m compared to baseline conditions. At the entrance to the proposed marina area the wave heights are reduced by between 0.05 – 0.40 metres. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.28m and 2.08 seconds respectively.

It will be seen from Figure 6.5 that during 1 in 1 year storm conditions the rubble mound breakwater reduces the significant wave heights to less than 0.20m with corresponding mean wave periods of less than 1.90 seconds. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.15m and 1.92 seconds respectively.

As can be seen in Figure 6.5, the combined effect of the floating breakwaters and the natural shelter created on the lee side of Trinity Wharf is to significantly reduce the local wave climate and create favourable navigation conditions at the entrance to the proposed marina.

The difference between the wave climate under existing conditions and marina Option 2 for 1 in 50 and 1 in 1 year return period storm conditions is illustrated in Figure 6.6.

Based on the results of the numerical simulations it can be concluded that implementing marina Option 2 will:

- Significantly reduce the height and period of incident waves under all conditions to within the wave height accepted threshold conditions detailed in Section 6.2.
- Reduce significant wave heights within the proposed marina by more than 0.50m under 1 in 50 year conditions.
- Reduce significant wave heights within the proposed marina by more than 0.40m under 1 in 1 year conditions.
- The maximum and average wave conditions within the proposed marina with Option 2 implemented area are presented in Table 6.3 below.

Table 6.3: Maximum and Average Wave Conditions within the Proposed Marina Area with Conceptual Marina Option 3 implemented.

Environmental Condition	Maximum		Average	
	Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year storm	0.19	2.28	0.15	1.92
1 in 50 year storm	0.37	2.70	0.28	2.08

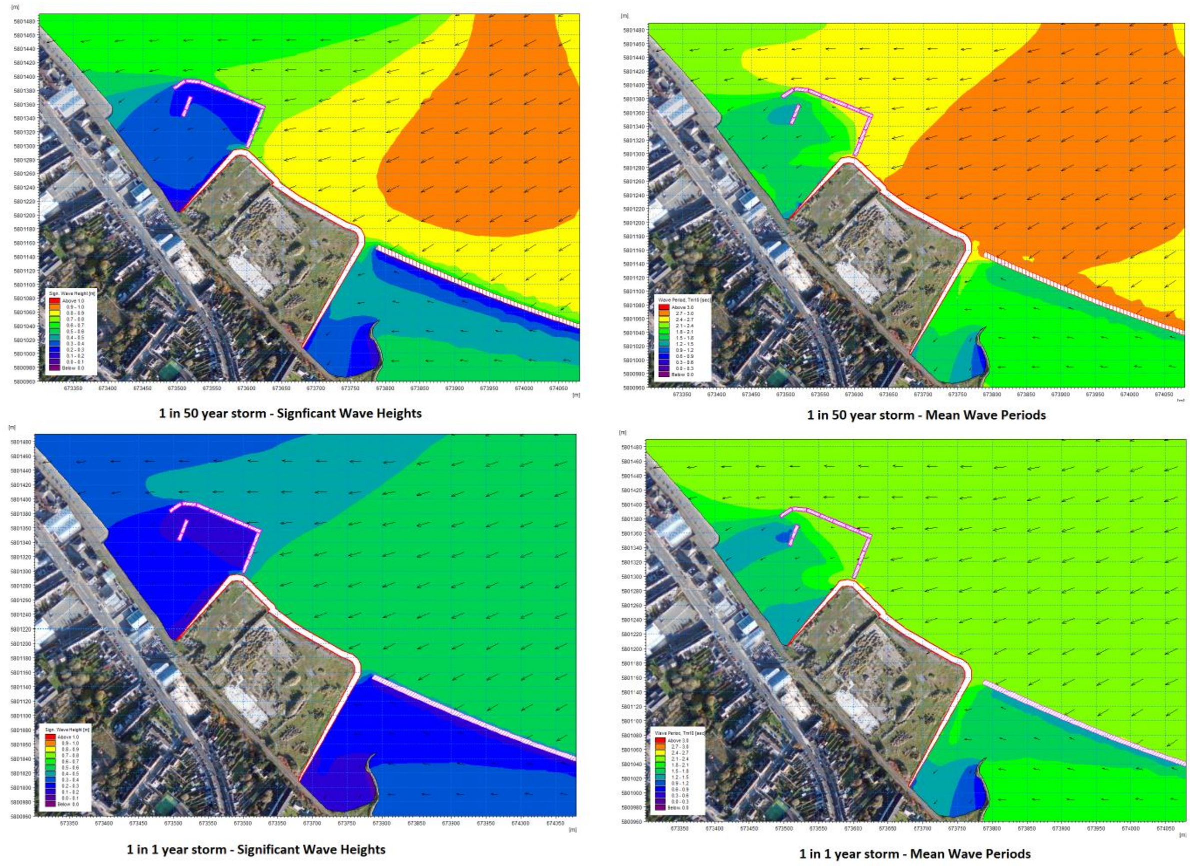


Figure 6.5: Wave climate at Trinity Wharf during 1 in 50 and 1 in 1 year storm events from the North East – Option 2: Floating Breakwater.

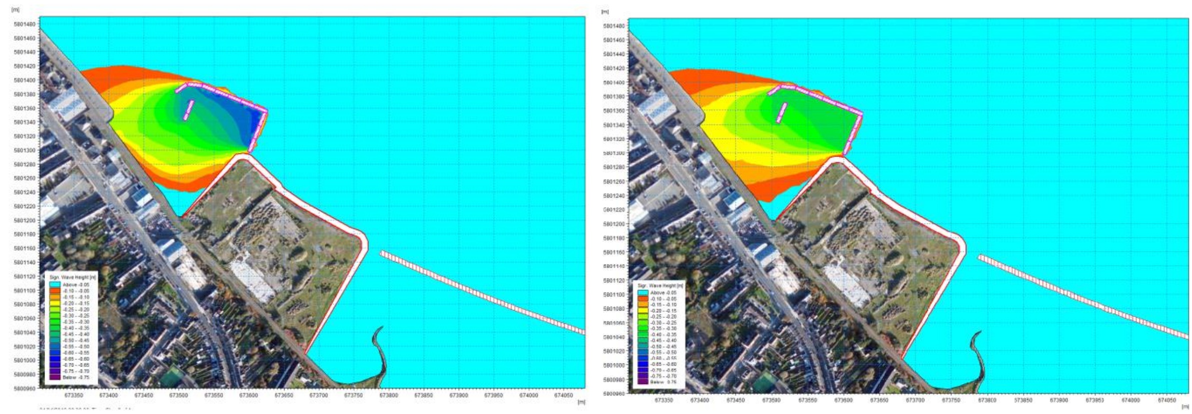


Figure 6.6: Difference in 1 in 50 and 1 in 1 year storm wave climates at Trinity Wharf with Option 2 Implemented.

6.4 WAVE CLIMATE WITH CONCEPTUAL OPTION 3 IMPLEMENTED

Figure 6.7 illustrates the significant wave heights and corresponding mean wave periods during a 1 in 50 year return period storm event from the north east with Option 3 implemented. It will be seen that the fixed breakwater effectively reduces wave heights and wave periods in the lee of the structure. In some areas the wave heights are decreased by over 0.40m compared to baseline conditions. At the entrance to the proposed marina area the wave heights are reduced by between 0.05 – 0.35m. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.27m and 1.97 seconds respectively.

It will be seen from Figure 6.7 that during 1 in 1 year return period storm conditions the rubble mound breakwater reduces the significant wave heights to less than 0.30m with corresponding mean wave periods of less than 2.1 seconds. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.14m and 1.79 seconds respectively.

Assessing the direction of the incident waves with the fixed breakwater in place indicates that the waves refract around the structure. As a result incident waves continue to propagate almost completely normal to the shoreline at Trinity Wharf. At the south eastern extent of the structure, the direction of incident waves can be seen to suddenly change as they are refracted. However, these waves are then almost completely attenuated by the floating breakwater at the north eastern boundary of Trinity Wharf.

The difference between the wave climate under existing conditions and marina Option 3 for 1 in 50 and 1 in 1 year return period storm conditions is illustrated in Figure 6.8.

Based on the results of the numerical simulations it can be concluded that implementing marina Option 3 will:

- Significantly modify the existing wave climate in the lee of the rubble mound breakwater.
- Significantly reduce the height and period of incident waves under all conditions to within the accepted thresholds conditions detailed in Section 6.2.
- Reduce significant wave heights within the proposed marina by more than 0.50m under 1 in 50 year storm conditions.
- Reduce significant wave heights within the proposed marina by more than 0.35m under 1 in 1 year storm conditions.
- The maximum and average wave conditions within the proposed marina with Option 3 implemented area are presented in Table 6.4 below.

Table 6.4: Maximum and Average Wave Conditions within the Proposed Marina Area with Conceptual Marina Option 3 implemented.

Environmental Condition	Maximum		Average	
	Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year storm	0.18	1.01	0.14	1.79
1 in 50 year storm	0.33	1.24	0.27	1.97

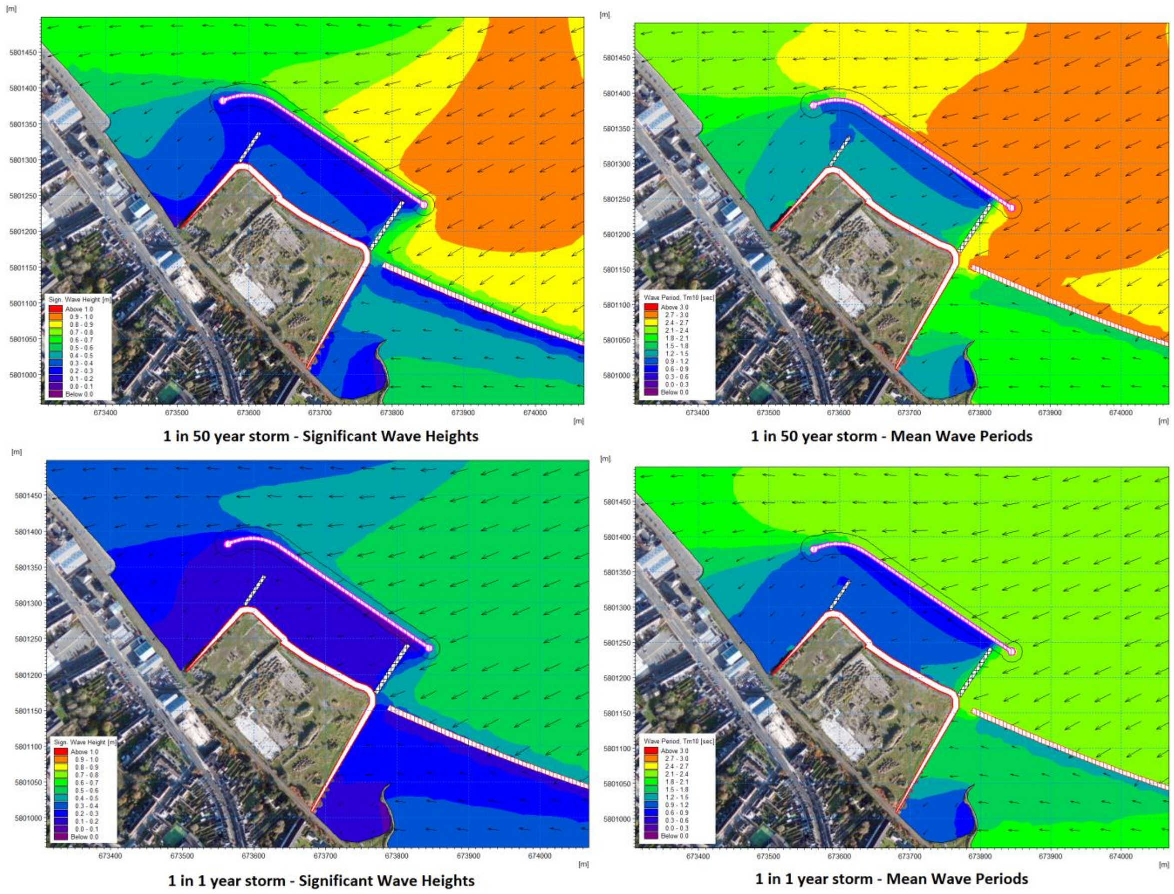


Figure 6.7: Wave climate at Trinity Wharf during 1 in 50 and 1 in 1 year storm events from the North East – Option 3: Fixed Breakwater.

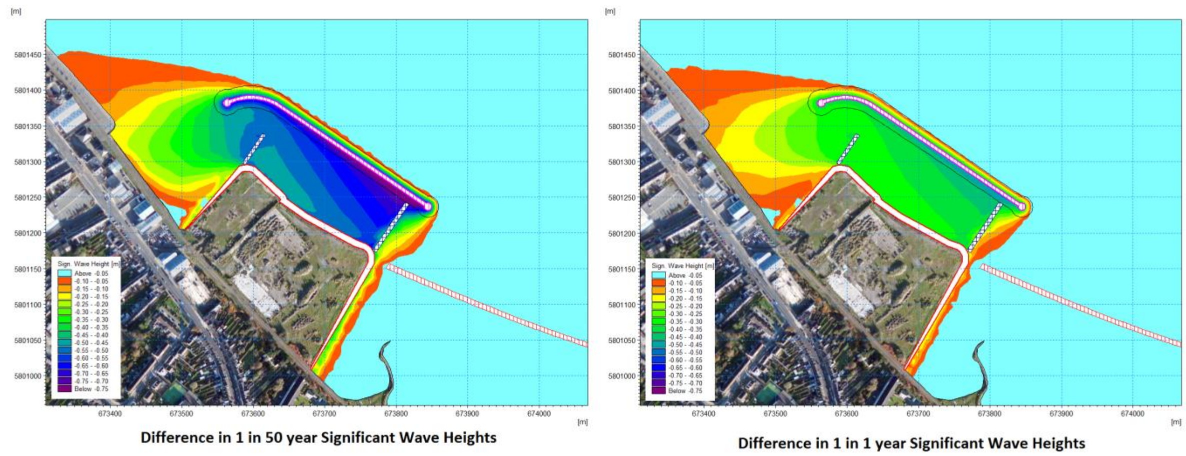


Figure 6.8: Difference in 1 in 50 and 1 in 1 year storm wave climates at Trinity Wharf with Option 3 Implemented.

6.5 WAVE CLIMATE WITH CONCEPTUAL OPTION 3A IMPLEMENTED

Figure 6.9 illustrates the significant wave heights and corresponding mean wave periods during a 1 in 50 year return period storm event from the north east with a series of fixed breakwaters in place as described in Section 3.3.3. Within the proposed marina area, immediately behind the breakwaters, waves are reduced by up to 0.50m. Towards the boundary of Trinity Wharf it can be seen that the continuous wind field begins to develop wind waves again, however even in this area the height of the significant waves do not exceed 0.40m. The average significant wave height and mean wave period within the proposed marina area was found to be 0.30m and 2.14 seconds respectively.

It will be seen from Figure 6.9 that during 1 in 1 year return period storm conditions the floating breakwaters create a sheltered wave climate with a maximum significant wave height of 0.20m and a corresponding mean wave periods of less than 2.3seconds. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.16m and 1.95 seconds respectively.

The difference between the wave climate under existing conditions and marina Option 3a for 1 in 50 and 1 in 1 year return period storm conditions is illustrated in Figure 6.10. As the floating breakwaters only interact with the top layer of the water column, they do not modify the direction of the wave climate by refracting incident waves. Given this, the floating breakwaters have virtually no impact on wave direction.

Based on the results of the numerical simulations it can be concluded that implementing marina Option 3a will:

- Significantly reduce the height and period of incident waves under all conditions to within the accepted threshold conditions detailed in 6.2.
- Reduce significant wave heights within the proposed marina by more than 0.50m under 1 in 50 year storm conditions.
- Reduce significant wave heights within the proposed marina by more than 0.30m under 1 in 1 year storm conditions.
- The maximum and average wave conditions within the proposed marina with Option 3 implemented area are presented in Table 6.5 below.

Table 6.5: Maximum and average wave conditions within the proposed marina with conceptual marina Option 3a implemented.

Environmental Condition	Maximum		Average	
	Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year storm	0.20	2.30	0.16	1.95
1 in 50 year storm	0.38	2.74	0.30	2.14

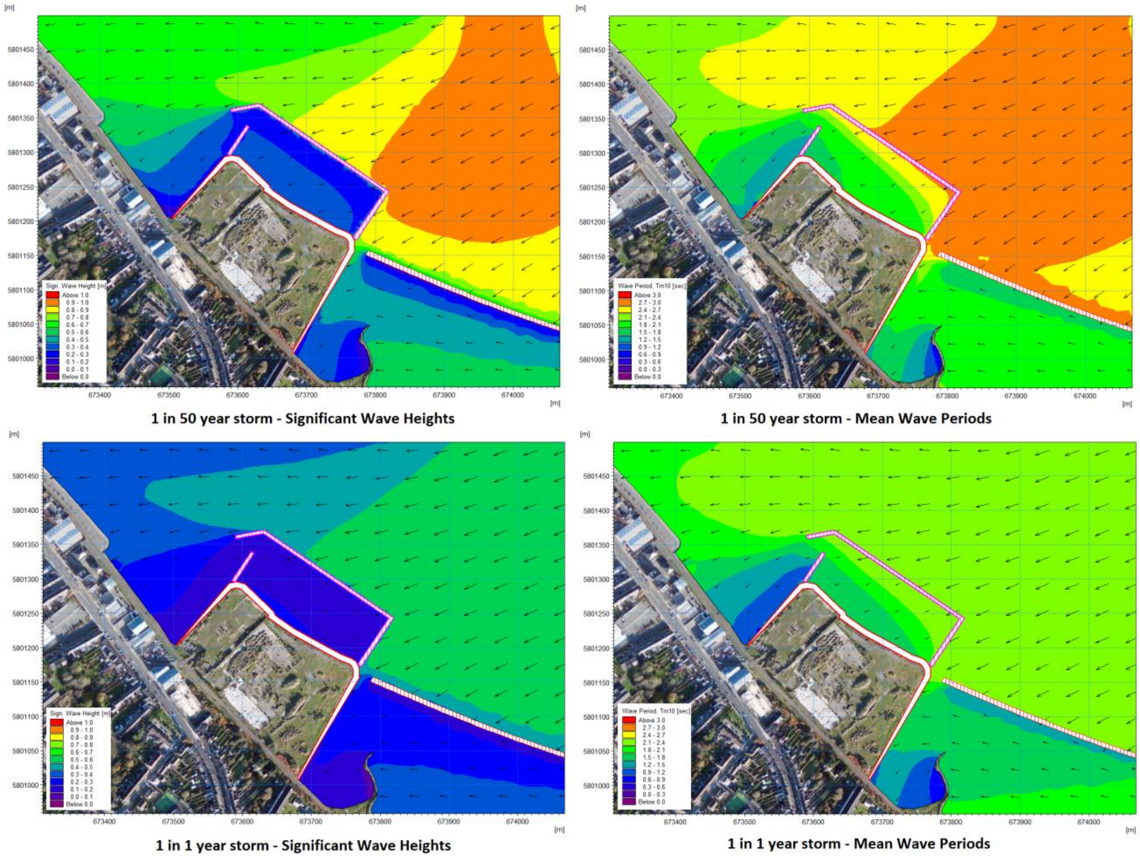


Figure 6.9: Wave climate at Trinity Wharf during 1 in 50 and 1 in 1 year Storm Events from the North East – Option 3a: Floating Breakwater.

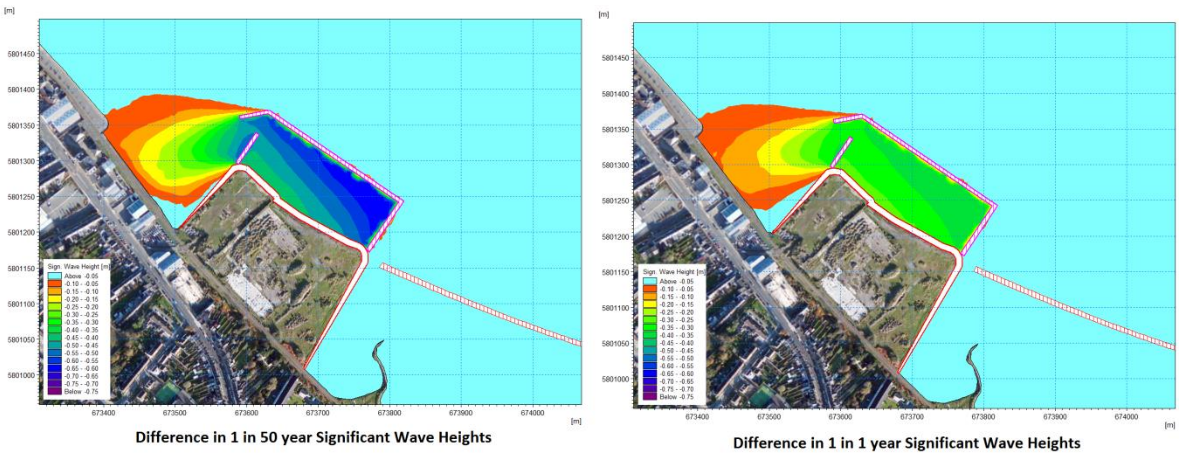


Figure 6.10: Difference in 1 in 50 and 1 in 1 year storm wave climates at Trinity Wharf with Option 3a Implemented.

6.6 WAVE CLIMATE WITH CONCEPTUAL OPTION 3B IMPLEMENTED

As would be expected, implementing marina Option 3b results in a wave climate that is almost identical to the wave climate experienced under marina Option 3a. During 1 in 50 year storm conditions the series of floating breakwaters reduce incident wave heights by up to 0.30m as illustrated in Figure 6.11. The average significant wave height and mean wave period within the proposed marina area was found to be 0.30m and 2.14 seconds respectively.

Based on 1 in 1 year storm conditions it will be seen from Figure 6.11 that the floating breakwaters create a sheltered wave climate with a maximum significant wave height of 0.20m and a corresponding mean wave period of less than 2.3 seconds. The mean significant wave height and mean wave period within the proposed marina area was found to be 0.16m and 1.95 seconds respectively.

Similar to Option 3a, Option 3b only modifies the height of the existing wave climate and not the direction of wave propagation .This can be attributed to the fact that floating breakwaters only interact with the top layer of the water column and therefore do not refract waves to the same degree as structures that modify the bathymetry of an area.

The difference between the wave climate under existing conditions and marina Option 3b for 1 in 50 and 1 in 1 year return period storm conditions is illustrated in Figure 6.12.

Based on the results of the numerical simulations it can be concluded that implementing marina Option 3b will result in an almost identical wave climate to that experienced under marina option 3a. It can also be concluded that implementing Option 3b will:

- Significantly reduce the height and period of incident waves under all conditions to within the accepted thresholds conditions detailed in 6.2.
- Reduce significant wave heights within the proposed marina by more than 0.50m under 1 in 50 year storm conditions.
- Reduce significant wave heights within the proposed marina by more than 0.30m under 1 in 1 year storm conditions.
- The maximum and average wave conditions within the proposed marina with Option 3 implemented area are presented in Table 6.6 below.

Table 6.6: Maximum and Average Wave Conditions Within the Proposed Marina with Conceptual Marina Option 3b Implemented.

Environmental Condition	Maximum		Average	
	Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year storm	0.20	2.30	0.16	1.95
1 in 50 year storm	0.38	2.74	0.30	2.14

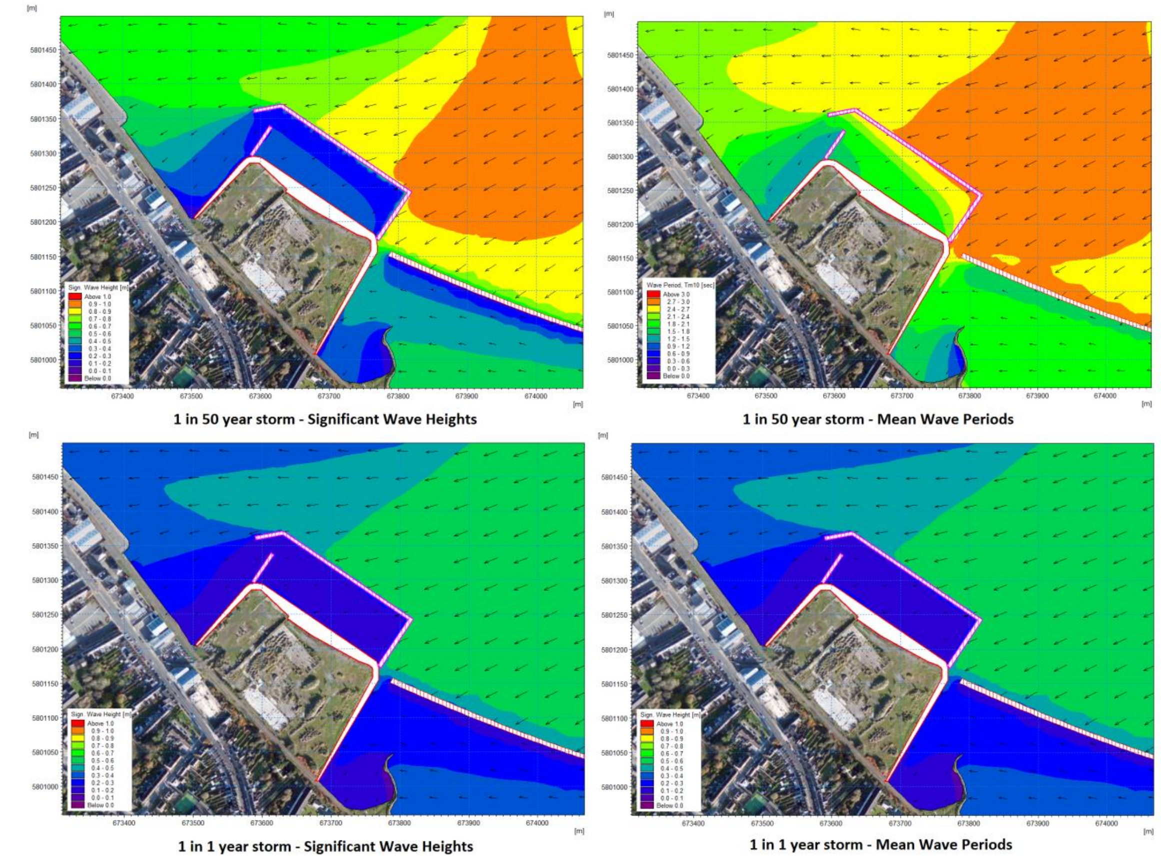


Figure 6.11: Wave Climate at Trinity Wharf during 1 in 50 and 1 in 1 year storm events from the North East – Option 3b: Floating Breakwater & Land Reclamation.

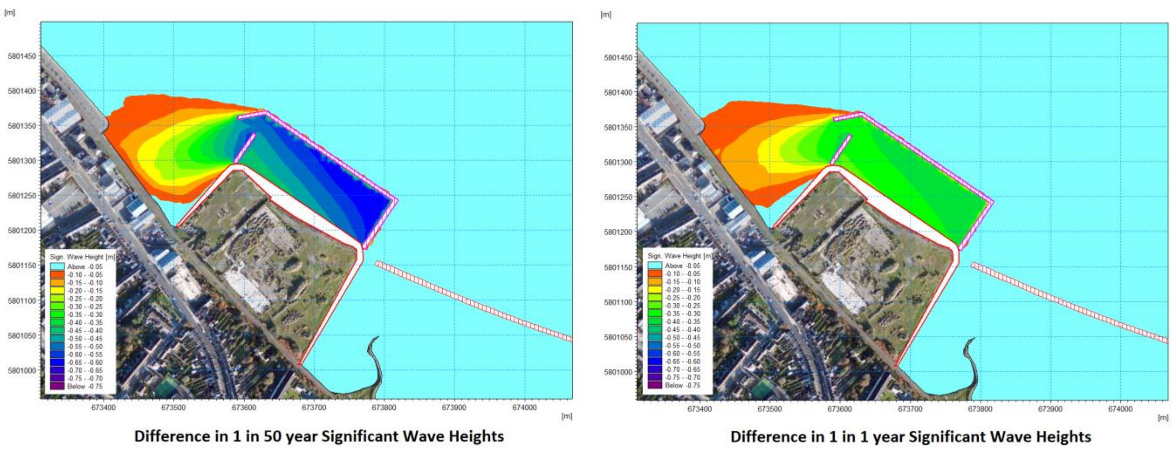


Figure 6.12: Difference in 1 in 50 and 1 in 1 year storm wave climates at Trinity Wharf with Option 3b Implemented.

6.7 SUMMARY OF WAVE CLIMATE ASSESSMENT

A detailed assessment of the existing wave climate at Trinity Wharf was undertaken using the MIKE 21 SW software package. This assessment indicated that based on a 18 year record, the maximum wave activity that reaches Trinity Wharf originates in the north easterly sectors. The assessment also demonstrated that the wave climate at Trinity Wharf is comprised almost exclusively of wind waves which are generated over short fetches within Wexford Bay.

To investigate the feasibility of developing a marina area at Trinity Wharf the wave climate at the study site under existing conditions was compared with established and accepted wave parameter thresholds. Modelling efforts were then repeated to determine if the wave climate with the various conceptual marina layouts implemented fell within the accepted threshold conditions. The threshold conditions used for this study have been based on guidelines published by the Yacht Harbour Association and the Australian Standard (AS3962) '*Guidelines for design of Marinas*' and are summarised below:

- Under normal operating conditions (1 in 1 year event), significant wave heights should not exceed 0.3m and mean wave periods should not exceed 2.0s.
- Under design conditions (1 in 50 year event), significant wave heights should not exceed 0.4m and mean wave periods should not exceed 2.5s.

Numerical modelling of the most arduous wave conditions from the north easterly sector with various marina options implemented demonstrated that:

- The significant wave heights and mean wave periods under existing conditions within the proposed marina area are considerably higher than the threshold values for both Normal Operating Conditions and Design Conditions.
- All options successfully reduce the wave climate within the proposed marina area to accepted threshold values;
- Option 3 resulted in the greatest reduction in significant wave heights.

A summary of the wave height statistics for each layout is presented in Table 6.7.

Table 6.7: Summary of wave statistics in the proposed marina area for various layouts.

	Marina Option	Maximum Value		Mean Value	
		Significant wave height [m]	Mean wave period [s]	Significant wave height [m]	Mean wave period [s]
1 in 1 year RP conditions	***Existing (baseline)***	*0.54*	*2.31*	*0.51*	*2.29*
	Option 2	0.19	2.28	0.15	1.92
	Option 3	0.18	1.01	0.14	1.79
	Option 3a	0.20	2.30	0.16	1.95
	Option 3b	0.20	2.30	0.16	1.95
1 in 50 year RP conditions	***Existing (baseline)***	*0.90*	*2.75*	*0.84*	*2.70*
	Option 2	0.37	2.70	0.28	2.08
	Option 3	0.33	1.24	0.27	1.97
	Option 3a	0.38	2.74	0.30	2.14
	Option 3b	0.38	2.74	0.30	2.15

7 TIDAL REGIME AT TRINITY WHARF

A three-dimensional variation of the numerical model presented in Section 6 was used to simulate tidal conditions across the model domain during typical spring tidal conditions. The 3D model used a similar mesh structure as the 2D model but was repeated 5 times in the vertical direction to create a 3D domain. To increase computational efficiency, the overall extent of the model was reduced as illustrated in Figure 7.1 below.

Boundary conditions for the tidal flow model were derived from RPS' Irish Sea Surge model. Overall, this model covers the Northern Atlantic Ocean and UK continental shelf up to a distance of 600km from the Irish Coast as illustrated in Figure 7.1. The Irish Sea Surge model has been calibrated against a large number of tidal stations around the UK and Ireland, the model is also used to provide online storm surge forecasting for the Office of Public Works (OPW).

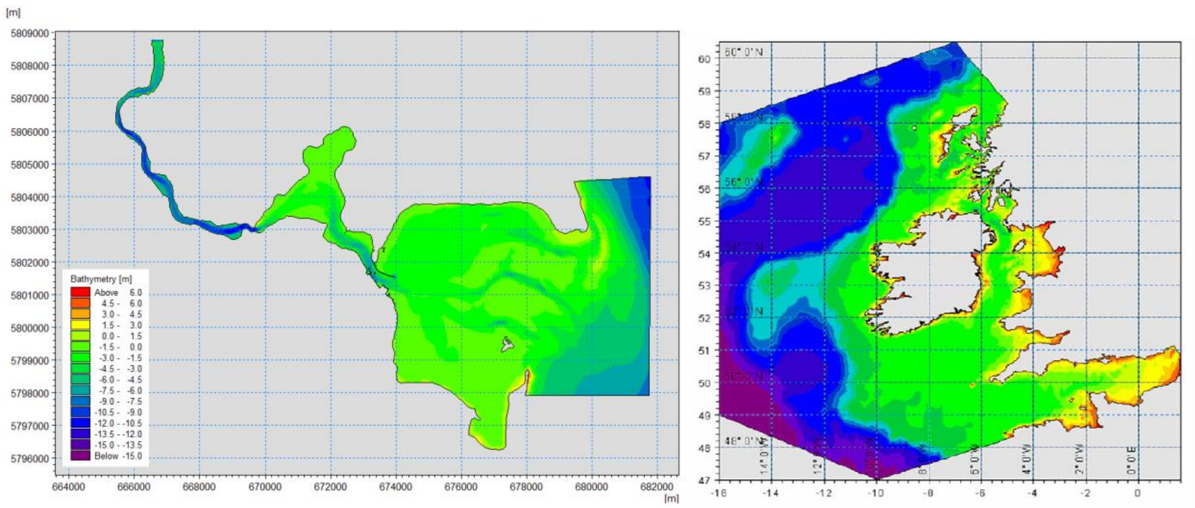


Figure 7.1: Extent of the 3D Wexford Harbour model (left) and the RPS Irish Sea Surge model (right) used to provide boundary condition data.

An extensive calibration process that compared modelled data with recorded data collected during the hydrographic survey detailed in Section 2.4 demonstrated that the model was fit for purpose, details of this calibration procedure is detailed in Appendix B.

Simulations were undertaken for existing site conditions and then repeated for the various marina concept options detailed in 3.3. It should be noted that for the purposes of brevity RPS has taken a conservative approach and only presented the tidal regime for each model variation during spring tidal conditions in the <u>bottom layer</u> of the 3-dimensional tidal model. This is considered the most suitable approach for the following reasons:

1. Data pertaining to the tidal regime characteristics in the bottom layer of the tidal model is the most relevant as the aquaculture sites and many of the environmentally designated habitats including the mudflats and sandflats interests are found on the seabed.
2. It is well established that any modifications within the marine environment results in the greatest impact to coastal process during spring tidal conditions as it is during spring tides that tidal ranges and current velocities reach their maxima.

7.1 EXISTING TIDAL REGIME AT TRINITY WHARF

Results of the numerical simulations indicated that at Trinity Wharf there is a distinct phase difference between the peak current velocities and the surface as illustrated in Figure 7.2. As a consequence of this phase difference, peak current velocities do not coincide with the mid-ebb and mid-flood points of the tidal regime but are instead observed approximately 1.5hours after mid-ebb and mid-flood.

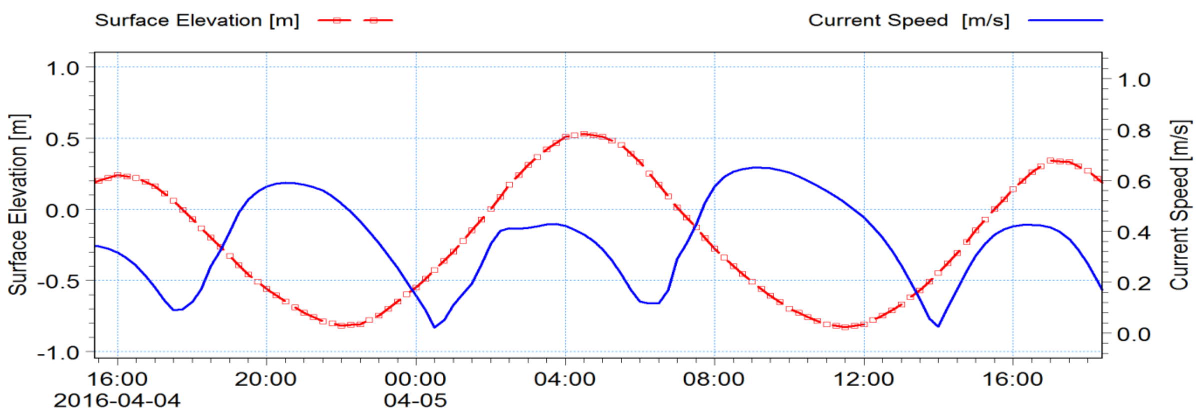


Figure 7.2: Phase difference between the surface elevation and current speeds at Trinity Wharf.

The flow entering Wexford Harbour from the River Slaney not only contributes to the asymmetric tide illustrated in Figure 7.2 but it also increases current speeds during mid-ebb to low water conditions by up to 50% relative to current speeds observed during mid-flood to high water conditions.

Figure 7.3 overleaf illustrates the current speeds and directions at Trinity Wharf during various phases of a spring tidal cycle on the bottom layer. It will be seen from this figure that there is a distinct difference between peak velocities and surface elevations and that current speeds during high water are notably greater than those observed during mid-flood or mid-ebb.

The model results also demonstrate the notable impact that that both training walls have on the tidal regime at Trinity Wharf as they act to accelerate the tidal flows within the approach channel, including in the vicinity of Trinity Wharf. It was found that despite a localised increase in current velocities at Ballast Island due to a restriction in the flow, tidal current velocities did not generally exceed 0.60m/s in the vicinity of Trinity Wharf. Model results indicate that it would be feasible to construct either floating breakwater or fixed breakwaters in the Trinity Wharf site.

Based on the results of the numerical simulations, it can be concluded that:

- The existing tidal regime at Trinity Wharf is dominated by a strong north-westerly & south-easterly bi-directional, asymmetric flow with peak current speeds occurring approximately 1.5 hours after mid-ebb and mid-flood.
- The River Slaney contributes to the asymmetry observed in tidal current speeds.
- Current speeds observed during mid-ebb to low water conditions were up to 50% greater than those observed during mid-flood to high water conditions.
- Despite localised flow restrictions, current velocities do not generally exceed 0.60m/s.
- Tidal conditions at Trinity Wharf are suitable for constructing floating breakwaters.

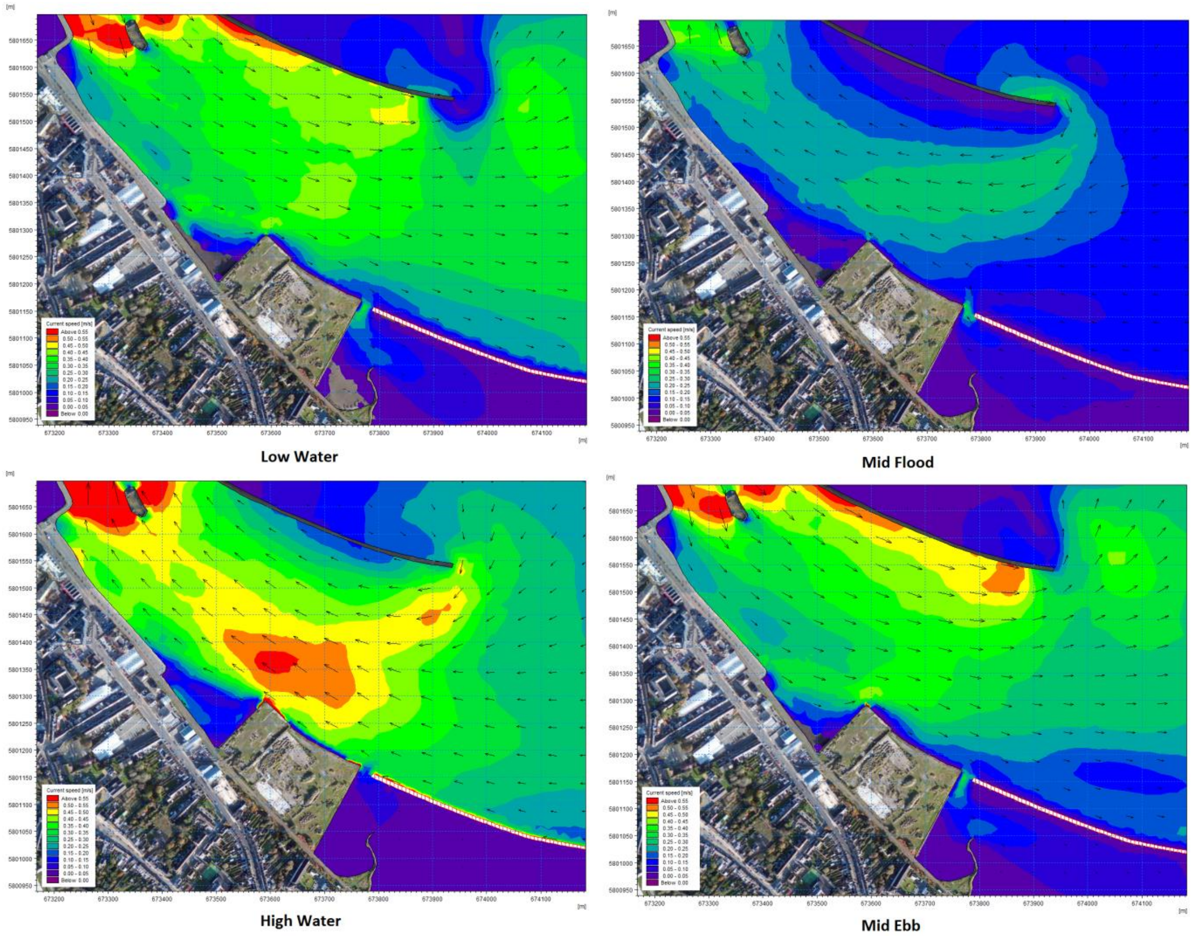


Figure 7.3: Spring tidal flows at Trinity Wharf under existing conditions.

7.2 TIDAL REGIME WITH CONCEPTUAL OPTION 2 IMPLEMENTED

The difference in spring tidal current velocities on the bottom layer of the model domain as a result of implementing marina Option 2 is illustrated in Figure 7.4 below. The results of the numerical simulations demonstrate that the Option 2 has virtually no impact on the existing tidal regime beyond the immediate vicinity of Trinity Wharf.

Based on the results of the numerical simulations it can be concluded that:

- Option 2 has only a very limited impact on the existing tidal regime.
- The proposed sloping revetment designed to protect the perimeter of Trinity Wharf results in a localised increase in current speeds of c. 0.42m/s however this increase occurs in an area of almost slack water.
- There is a slight decrease in current speeds on the north western and south eastern sides of Trinity Wharf as a result of the proposed sloping revetment, however these impacts are not considered significant.
- Based on differences to the tidal regime it is highly unlikely that Option 2 would have a significant impact on the environmentally sensitive areas within Wexford Bay.

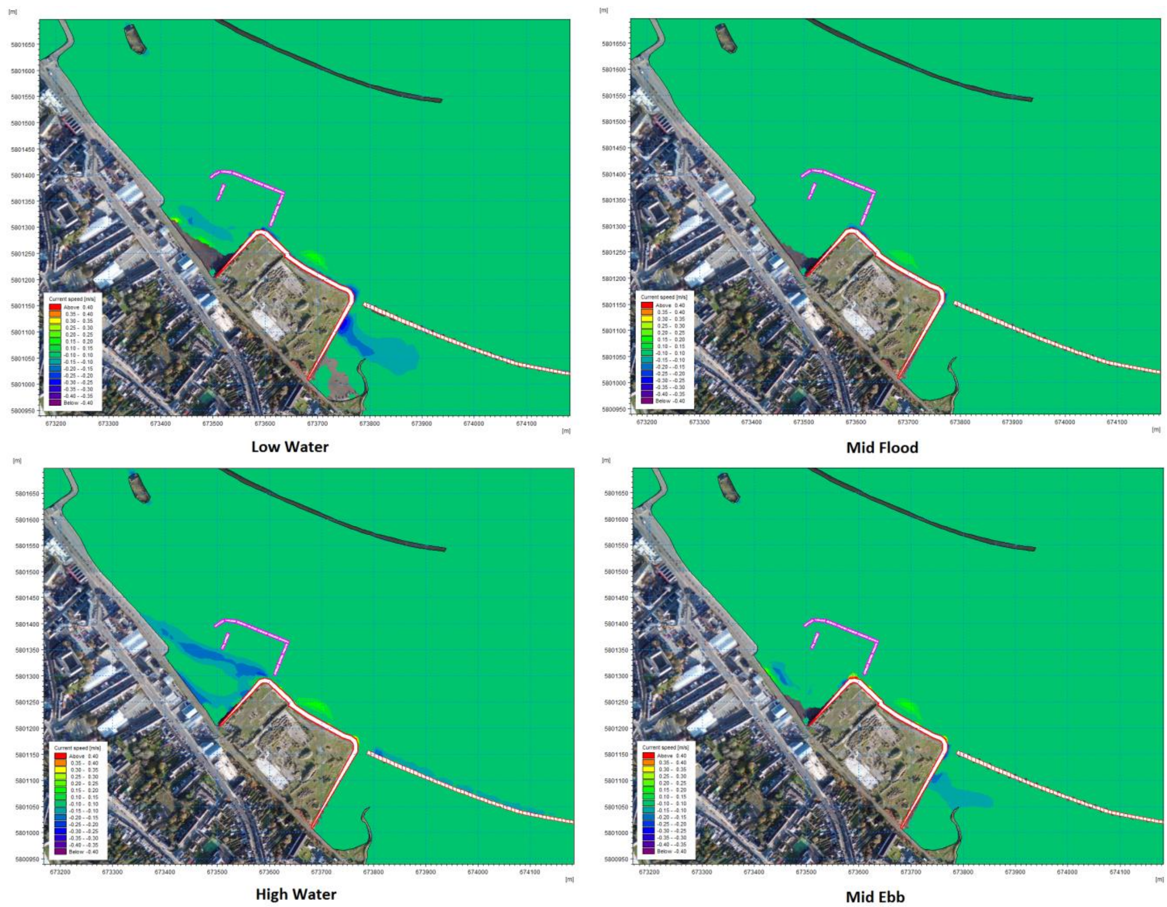


Figure 7.4: Difference in spring tidal flows at Trinity Wharf with Marina Option 2 Implemented.

7.3 TIDAL REGIME WITH CONCEPTUAL OPTION 3 IMPLEMENTED

Figure 7.5 below illustrates the difference in spring tidal current velocities on the bottom layer of the model domain as a result of implementing marina Option 3. It can be seen from this figure that the fixed rubble mound breakwater does have a limited but significant effect on the existing tidal regime within the immediate vicinity of the breakwater.

It can be concluded from these results that:

- The most significant impact of the fixed rubble mound breakwater is at the base of the structure where current flows can be accelerated or decelerated by up to 75% depending on the phase of the tidal cycle.
- Option 3 has a limited impact on tidal current speeds beyond the immediate vicinity of the fixed breakwater.
- The fixed breakwater *generally* reduced current speeds on the lee side of the structure, i.e. within the proposed marina area.
- The proposed sloping revetment designed to protect the perimeter of Trinity Wharf results in a localised increase in current speeds; however this increase does not exceed 0.35m/s and occurs in an area of almost slack water.
- Based on differences to the tidal regime it is considered that Option 3 could result in a significant impact on the existing sediment transport regime and therefore potentially affect the environmentally sensitive areas within Wexford Bay.

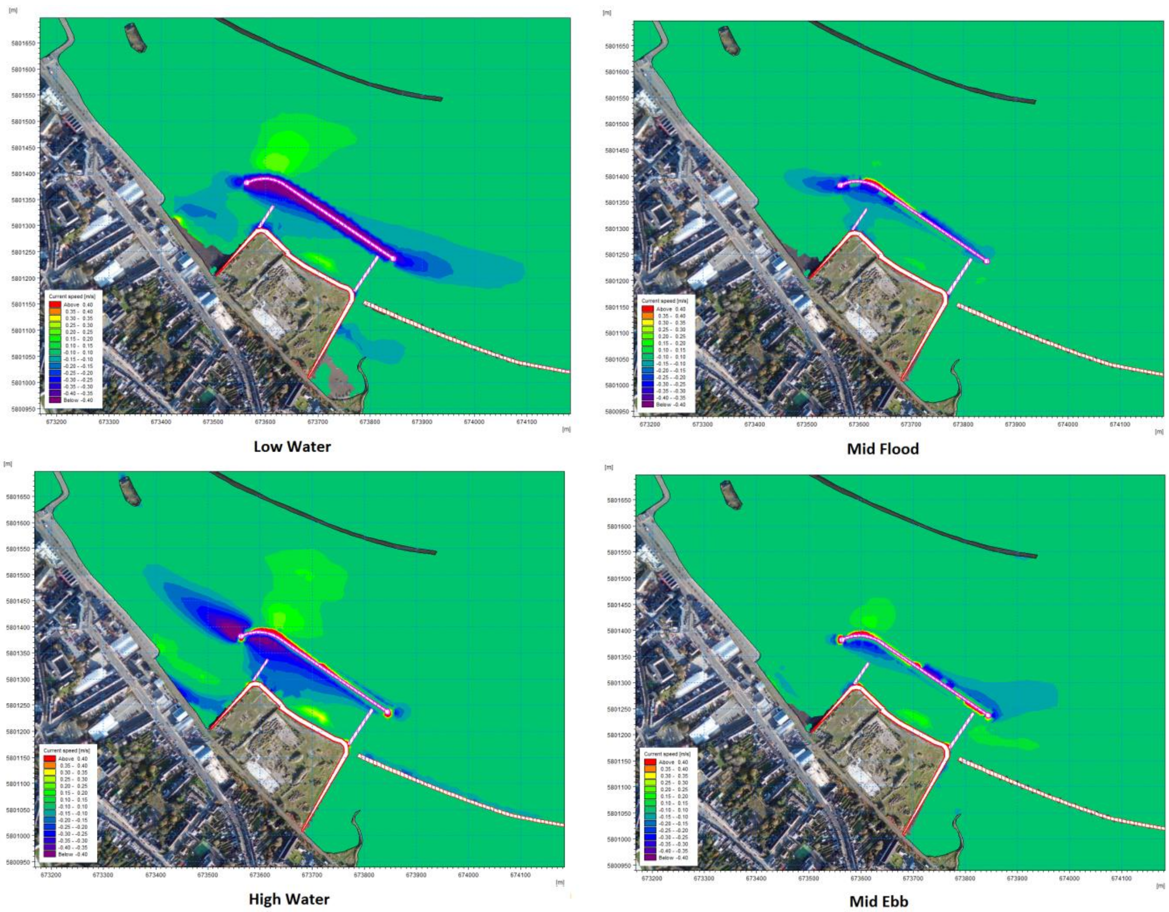


Figure 7.5: Difference in spring tidal flows at Trinity Wharf with Marina Option 3 Implemented.

7.4 TIDAL REGIME WITH CONCEPTUAL OPTION 3A IMPLEMENTED

The difference in spring tidal current velocities on the bottom layer of the model domain as a result of implementing marina Option 3a is illustrated in Figure 7.6 below. The results of the numerical simulations demonstrate that the Option 3a has virtually no significant impact on the existing tidal regime beyond the immediate vicinity of Trinity Wharf.

Based on the results of the numerical simulations it can be concluded that:

- Option 3a has only a very limited impact on the existing tidal regime.
- The proposed sloping revetment designed to protect the perimeter of Trinity Wharf results in a very localised increase in current speeds of c. 0.42m/s, however this increase occurs in an area of almost slack water.
- There is a slight decrease in current speeds on the north western and south eastern sides of Trinity Wharf as a result of the sloping armour, however these impacts are not considered significant.
- Based on differences to the tidal regime it is highly unlikely that Option 3a would have a significant impact on the environmentally sensitive areas within Wexford Bay.

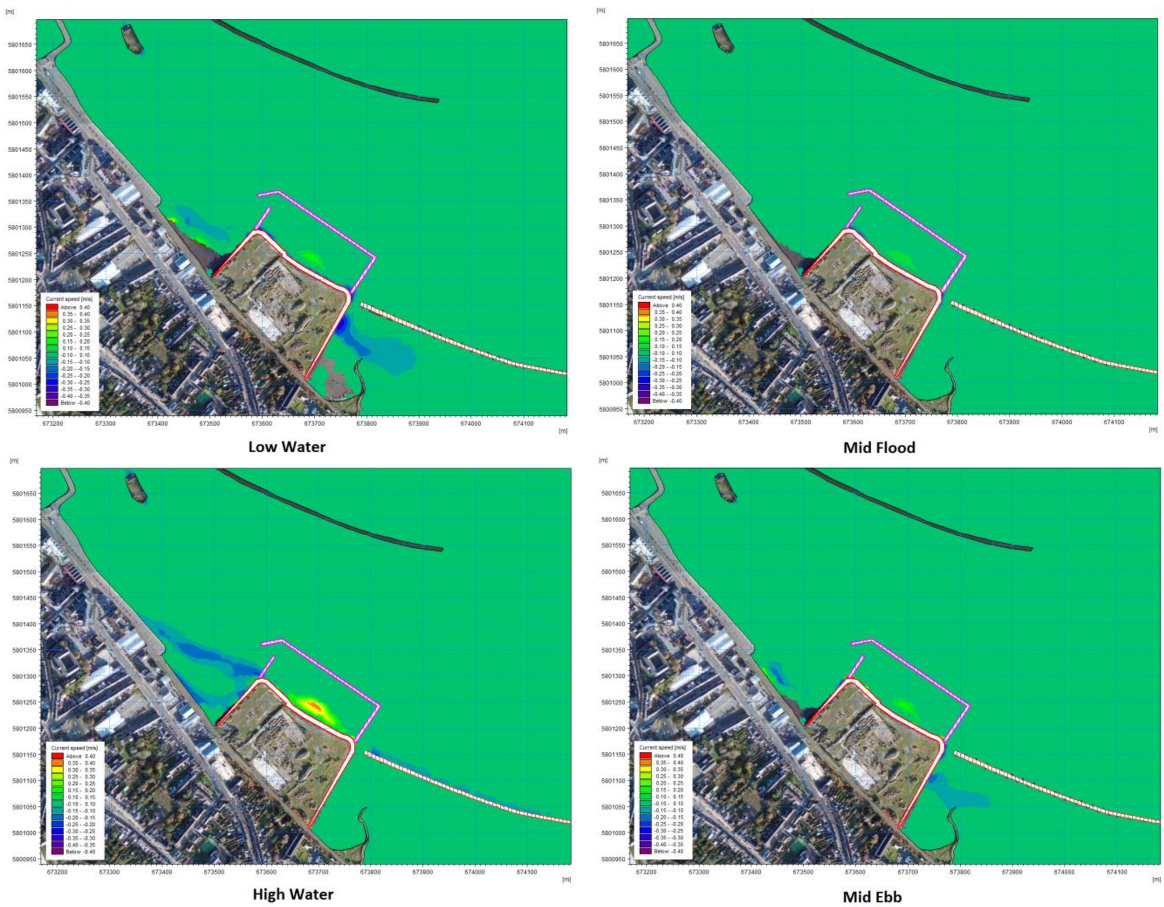


Figure 7.6: Difference in spring tidal flows at Trinity Wharf with Marina Option 3a Implemented.

7.5 TIDAL REGIME WITH CONCEPTUAL OPTION 3B IMPLEMENTED

Figure 7.7 below illustrates the difference in spring tidal current velocities on the bottom layer of the model domain as a result of marina Option 3b being implemented. It can be seen from this figure that marina Option 3b does have a notable impact on the existing tidal regime within the immediate vicinity of the reclaimed land and proposed sloping revetment.

It can be concluded from the results of the numerical simulations that:

- Option 3b has more of an impact on the existing tidal regime relative to Option 3a.
- The impact of Option 3b is localised at all phases of the tidal regime. The reclaimed land and proposed sloping revetment results in a localised increase in current speeds of *c.*0.46m/s, however this localised increase occurs in an area of almost slack water.
- There is a slight decrease in current speeds on the north western and south eastern sides of Trinity Wharf as a result of the proposed sloping revetment; however these impacts are not considered significant.
- Based on differences to the tidal regime it is highly unlikely that Option 3b would have a significant impact on the environmentally sensitive areas within Wexford Bay.

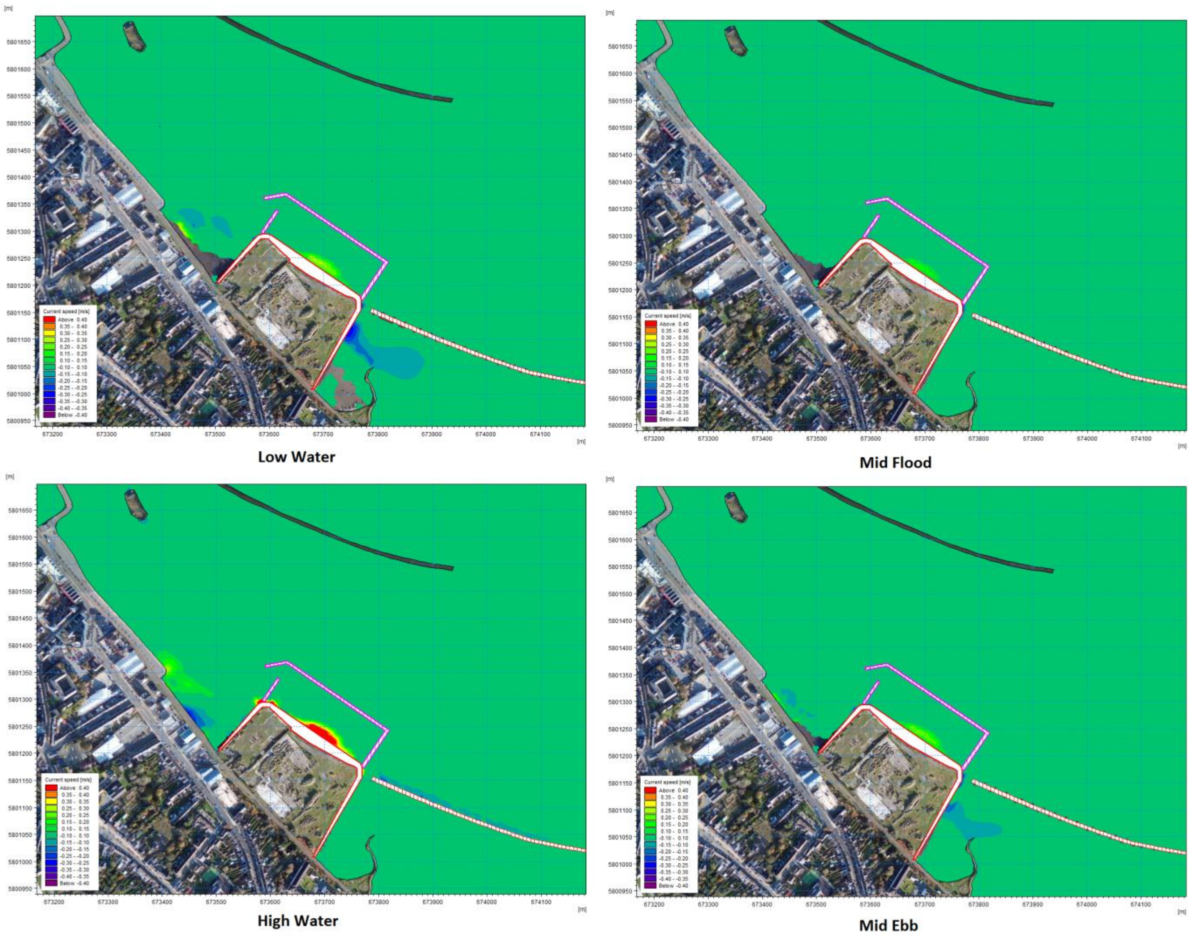


Figure 7.7: Difference in spring tidal flows at Trinity Wharf with Marina Option 3b Implemented.

7.6 SUMMARY OF TIDAL REGIME ASSESSMENT

A detailed assessment of the existing tidal regime at Trinity Wharf was undertaken using the MIKE 3 HD software package detailed in Section 4.2.2. This assessment demonstrated that the dominant bi-directional flow at Trinity Wharf was highly asymmetric with peak current speeds occurring more than 1 hour after mid ebb/flood tides. Results also indicated that current speeds at Trinity Wharf did not generally exceed 0.70 m/s apart from in localised regions where the flow becomes restricted, such as at Ballast Island.

To quantify the impact of the shortlisted conceptual marina layouts on the existing tidal regime, results of numerical simulations were used to create plots that illustrated the difference between the existing tidal regime and tidal regime under each of the shortlisted options along the bottom layer of the water column.

Numerical modelling of a typical spring tidal cycle with various marina options implemented demonstrated that:

- Option 2 had virtually no impact on the existing tidal regime. Small, insignificant differences were noted at all phases of the tidal cycle, but these changes were caused by the proposed sloping revetment and not the floating breakwaters.
- Option 3 resulted in the most notable impact to the existing tidal regime whereby tidal current speeds were modified by ±75% at the base of the rubble mound breakwater depending of the phase of the tidal cycle.
- Option 3 was found to have a significant impact on the existing tidal regime and is therefore likely to impact the environmentally sensitive areas within Wexford Bay.
- Similar to Option 2, both Options 3a and 3b were found to have only a very limited impact on the existing tidal regime by increasing current speeds in an area of almost slack water in the immediate vicinity of the proposed sloping revetment.
- It is highly unlikely that Options 2, 3a or 3b would result in a significant impact on the environmentally sensitive areas within Wexford Bay.

Based on this information it can be concluded that marina Option 3 would significantly impact the existing current speeds and therefore has the potential to adversely impact the nearby environmental sensitive areas. It can also be concluded that it is highly unlikely that Options 2, 3a or 3b would adversely impact on the environmentally sensitive areas within Wexford Bay as none of these options significantly impact the existing tidal regime.

8 SEDIMENT TRANSPORT REGIME AT TRINITY WHARF

As detailed in Sections 6 and 0 of this report, conceptual Option 3 which included the provision of a fixed breakwater and a series of floating breakwaters to create an appropriately sheltered wave climate resulted in significant impacts to the existing tidal regime. Results from numerical simulations found that Option 3 modified current flows by up to ±75% depending on the phase of the tidal cycle. Given these impacts RPS considered Option 3 to be unviable. As such, RPS decided against undertaking computational sediment transport modelling for this option.

Conversely, based on the results of the numerical modelling programme up to this point, conceptual Option 2 was considered to be the most viable option due to the lack of dredging requirements and the imperceptible impact on the existing tidal regime.

As Option 2 is considered to be the most viable of all of the option described in Section 3 and because it is very similar to Options 3a and 3b, RPS have undertaken sediment transport modelling for Option 2 only. The sediment transport modelling undertaken as part of this study has been described in more detail in the following Section.

8.1 SEDIMENT TRANSPORT MODELLING

With a catchment area of over 1,700km^2 and a high sediment load, the Slaney River and its adjoining tributaries are amongst the most significant features at the study site. During periods of high river flows such as those experienced during winter or flooding events it is known that a proportion of the sediment load that is received from the Slaney River settles and accretes at the entrance to Wexford harbour. Therefore, this material could potentially accrete at the Trinity Wharf site too.

As sedimentation processes could have significant implications for any proposed marina at Trinity Wharf with regards to future maintenance dredging requirements, RPS have undertaken sediment transport simulations to quantify and assess the sediment transport regime based on a scenario with high sediment loads entering in from the Slaney estuary

Input values for the sediment transport models were taken from the following sources:

- The baseline hydrodynamic inputs were taken from the calibrated and validated tidal model presented in Section 0 of this report.
- The extreme river flows were based on various Hydrologic Estimation Points (HEP) along the lower and upper Slaney estuary that were derived as part of the South Eastern CFRAMS project. The location of the various HEPs is illustrated in Figure 8.1 overleaf.
- The suspended sediment loads and sediment characteristics were based on the flow and suspended sediment monitoring that was undertaken by Hydrographic Surveys in 2016 as detailed in Section 2.5.

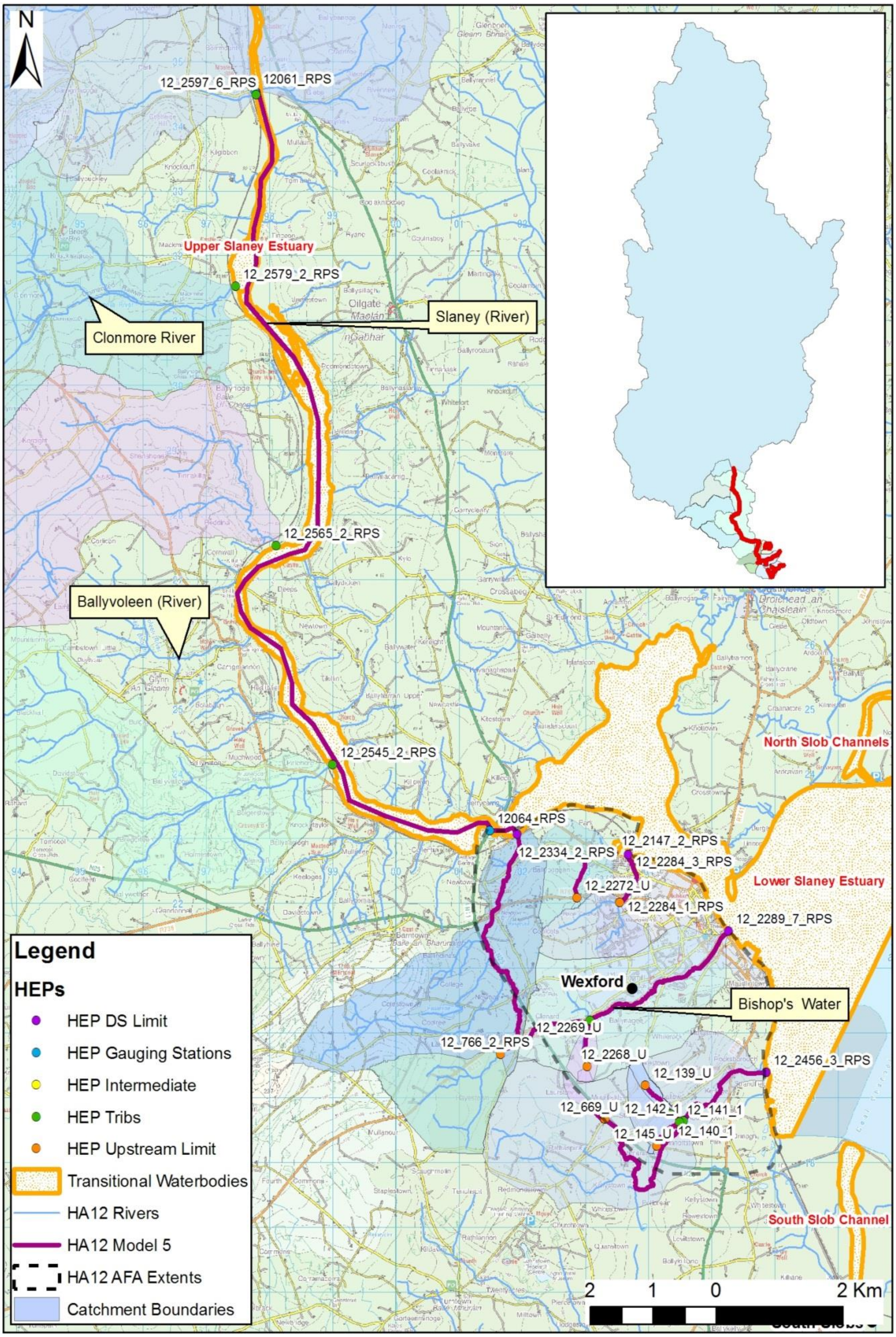


Figure 8.1: Hydraulic Estimation points along the Slaney River. (South Eastern CFRAMS, 2017).

8.2 SEDIMENT TRANSPORT UNDER A HIGH SEDIMENT LOAD SCENARIO

8.2.1 Background

To investigate potential future maintenance dredging requirements at the Trinity Wharf development under high flow and high sediment load conditions RPS used the coupled MIKE21 HD FM Mud Transport module described in Section 4.2. This model was used to simulate and assess the dispersion of the sediment plume entering from the Slaney River and any subsequent siltation in the navigation channel or around Trinity Wharf.

The flow and suspended sediment monitoring undertaken by Hydrographic Surveys Ltd. in 2016 during relatively good summer water found that based on 12 Suspended Particulate Matter (SPM) samples taken from the Wexford Bridge, the river flow entering from Slaney estuary had an average suspended sediment concentration of 20.35mg/L (n=12, ±10.65). This survey campaign also found the classification of the suspended sediment to range between fine silt and very fine sand (D_{n50}= 0.0078 – 0.25mm) with the most dominant fraction comprising of a medium silt.

For the high sediment load scenario, RPS used a boundary condition at the Slaney River with the suspended sediment concentration equivalent to x18 greater than average i.e. 360mg/L. Critical shear stresses and settling velocities corresponding with a fine silt material were used to represent the sediment in the coupled MIKE21 HD MT model which was run for a 7 day spring tide simulation.

8.2.2 Sediment Transport Results

As can be seen from Figure 8.2 which illustrates the average suspended sediment concentration over one single spring tidal cycle, there is a plume of suspended sediment that propagates down the Slaney estuary and disperses into the wider Slobs area. The concentration of this plume is highest in the Slaney estuary and gradually reduces as the sediment disperses in the navigation channel and settles in the Slobs area.

When assessing the corresponding levels of siltation, i.e. bed level change, it will be seen from Figure 8.3 that following the 7 day “high sediment load scenario” the extent of siltation is very similar to the extent of the suspended sediment plume envelope that is illustrated in Figure 8.2. It will be noted that the levels of siltation in the Slaney estuary and wider Slobs estuary is generally between 0.0025 – 0.0050m.

A zoomed illustration of the total bed level changes in the navigation channel at Trinity Wharf demonstrates that there is actually very little siltation along the centre of the main navigation channel (i.e. < 0.0025m). Furthermore, in confined regions such as at Ballast Island, the bed level is actually reduced; this can be attributed to the accelerated flows in this region which actually erodes the bed layer. It will also be seen that there is a notable accretion of material at the entrance to Wexford Harbour; this is in line with anecdotal evidence which indicates this area is frequently dredged in order to maintain acceptable navigational depths.

Importantly, after a 7 day high sediment loading scenario, siltation levels within the proposed Trinity Wharf marina do not exceed 0.0025m thus indicating that this option will be require virtually no maintenance dredging. However, it should be noted that higher levels of siltation rates were detected on the lee side of the proposed marina area. Over a long period of time (i.e. years) this material could gradually move towards the proposed marina area and eventually necessitate a very minor maintenance dredging campaign.

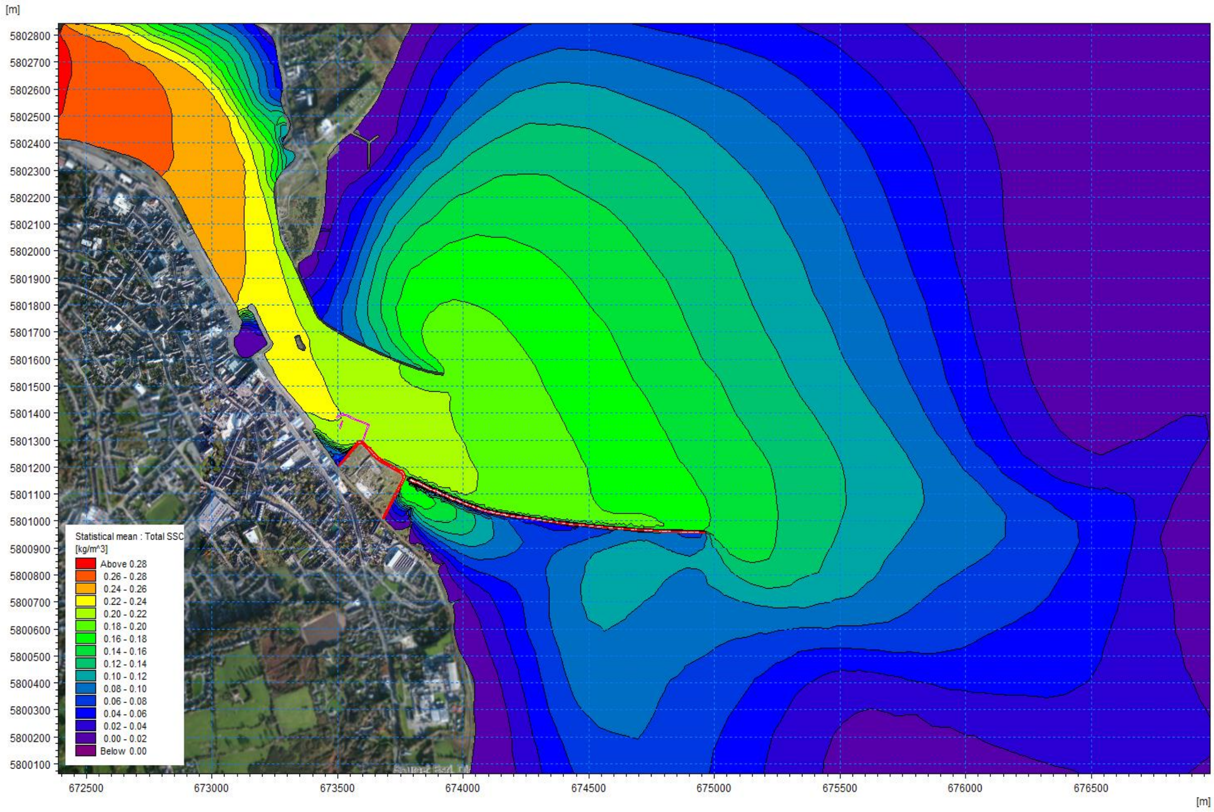


Figure 8.2: Average Suspended sediment concentration over 1 spring tidal cycle with high sediment loading from the Slaney River.

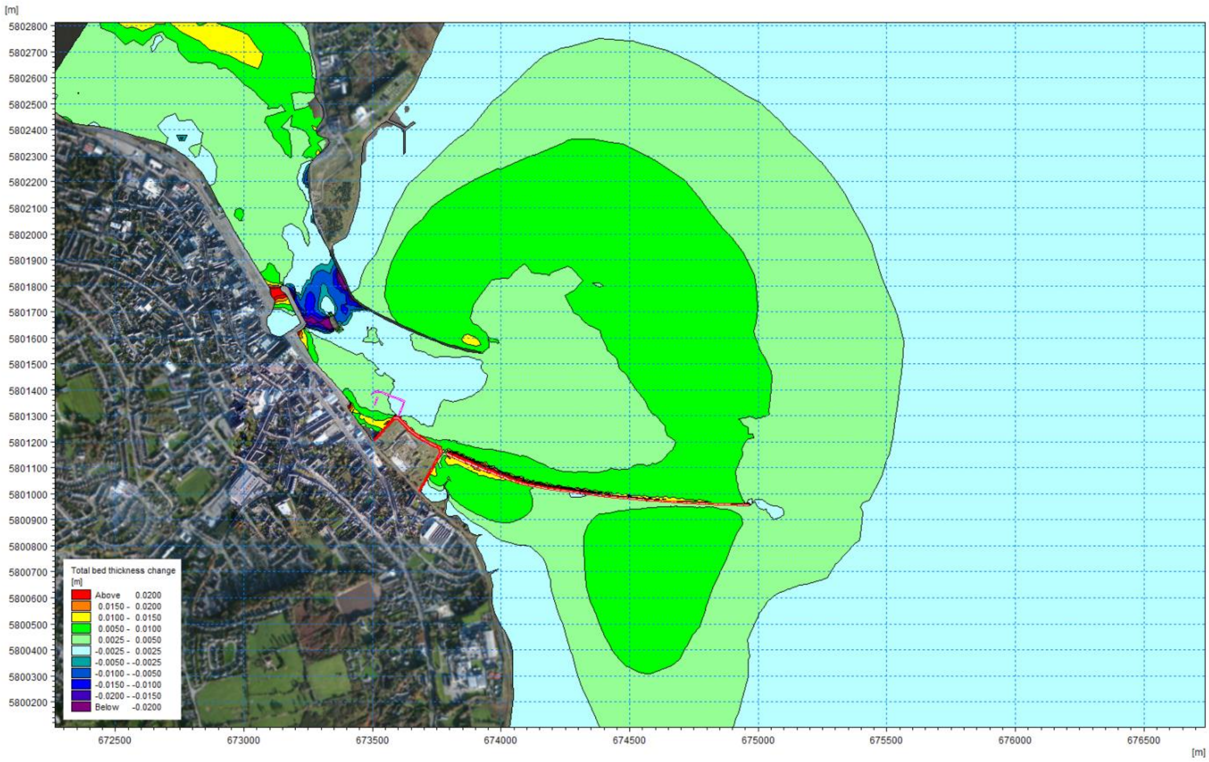


Figure 8.3: Total bed level change in the Slobs after 1 week of high sediment loading from the Slaney River.

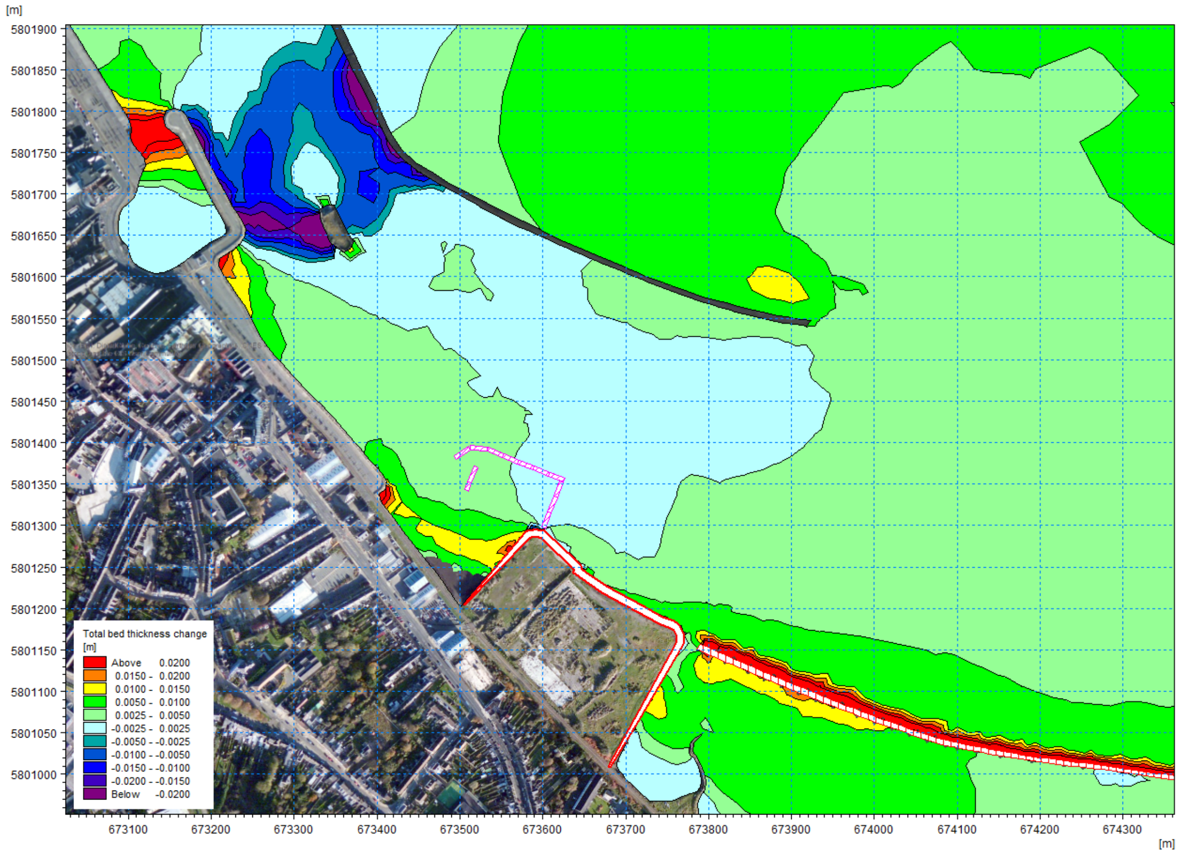


Figure 8.4: Total bed level change in the navigation channel and Trinity Wharf after 1 week of high sediment loading from the Slaney River.

8.3 SUMMARY OF SEDIMENT TRANSPORT ASSESSMENT

Based on the results of the numerical modelling programme up to this point, conceptual Option 2 was considered to be the most viable option due to the lack of dredging requirements and the imperceptible impact on the existing tidal regime. RPS therefore only undertook sediment transport modelling for conceptual Option 2.

This detailed assessment of the sediment transport regime, based on a high sediment load scenario, was undertaken the coupled MIKE21 Hydrodynamic (HD) Mud Transport (MT) model and used results from a sediment survey to derive boundary conditions for a “high sediment load scenario”. To be conservative, RPS increased the average suspended levels of sediment entering from the Slaney estuary by a factor of 18 and ran this simulation for a 7 day period over spring tide conditions.

Based on this assessment of a 7 day high sediment load scenario, it was found that:

- Fine silt material is well dispersed in the wider Slaney estuary/Slobs area.
- Levels of siltation are greatest at the entrance to the existing Wexford harbour & wider Slobs area and smallest along the centre of the confined navigation channel.
- Siltation levels within the proposed Trinity Wharf marina do not exceed 0.005m thus indicating little need for a future maintenance dredging campaign.
- There are increased levels of siltation on the lee side of the proposed marina option which could eventually move towards the navigation channel and necessitate very minor and periodic dredging works.

9 ENVIRONMENTAL SCOPING

County Wexford includes a number of areas of high ecological value, with a variety of habitats and species of conservation concern that are protected under European and national designations. A desktop study was carried out to identify those areas which have been designated for the protection of habitats and species. These designated areas are summarised in Sections 9.1 and 9.2 below.

9.1 EUROPEAN/INTERNATIONAL DESIGNATIONS

9.1.1 Special Areas of Conservation

Special Areas of Conservation (SAC) are prime wildlife conservation areas, considered to be important on a European as well as National level. In Ireland, the majority of SACs are in rural areas, although a few sites reach into town or city landscapes, such as Dublin Bay, Cork Harbour and indeed Wexford Harbour.

SACs are selected under the Habitats Directive for the conservation of a number of habitat types, which in Ireland includes raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries and sea inlets. The Directive also affords protection to 25 species of flora and fauna including Salmon, Otter, Freshwater Pearl Mussel, Bottlenose Dolphin and Killarney Fern. Collectively, these are known as Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds).

The areas chosen as SAC in Ireland cover an area of approximately 13,500km^2. Roughly 53% is land, with the remainder being marine or large lakes. Across the EU, over 12,600 sites have been identified and proposed, covering 420,000km^2 of land and sea, an area the size of Germany. There are eight SACs within 15km of the proposed development site at Trinity Wharf, shown in Figure 9.1. These areas are discussed in further detail in Section 9.4.3.

9.1.2 Special Protection Areas

Special Protection Areas, (SPA) are conservation areas which are important sites for rare and vulnerable birds (as listed on Annex I of the Birds Directive), and/or for regularly occurring migratory species. SPAs are designated under the 'Birds Directive' (Council Directive 2009/147/EC - codified version of Directive 79/409/EEC on the Conservation of Wild Birds, as amended).

Ireland's SPA network encompasses over 5,700km^2 of marine and terrestrial habitats. The marine areas include some of the productive intertidal zones of bays and estuaries that provide vital food resources for several wintering wader species. Marine waters adjacent to breeding seabird colonies and other important areas for seaducks, divers and grebes are also included in the network. The remaining areas of the SPA network include inland wetland sites important for wintering waterbirds and extensive areas of blanket bog and upland habitats that provide breeding and foraging resources for species including Merlin and Golden Plover. Agricultural land also represents a share of the SPA network, ranging from the extensive farmland of upland areas where its hedgerows, wet grassland and scrub offer feeding and/or breeding opportunities for Hen Harrier to the intensively farmed coastal polderland where internationally important numbers of swans and geese occur. Coastal habitats including Machair are also represented in the network, which are of high importance for Chough and breeding Dunlin. There are four SPA within 15km of the proposed development site at Trinity Wharf, as shown below in Figure 9.1. These areas are discussed in further detail in Section 9.4.3.

Figure 9.1: International/European Designations surrounding Trinity Wharf/Wexford Harbour.

9.1.3 Ramsar Wetlands

Ramsar Sites are designated for the protection of wetland areas (which are important feeding habitats for birds) under the 'Convention on Wetlands of International Importance' which took place in Ramsar, Iran in 1971. There are three Ramsar sites in County Wexford, two of which, 'Wexford Wildfowl Reserve' and 'The Raven', are close to the proposed development area at Trinity Wharf (2.8km and 4.5km respectively).

In Ireland, all Ramsar sites have also been recognised as SPA and/or SAC areas and so are afforded protection by the European Communities (Birds and Natural Habitats) Regulations 2011. Wexford Wildfowl Reserve is included within the Wexford Harbour and Slobs SPA whilst the Raven Ramsar site is included within the Raven SAC.

9.1.4 EU Shellfish Waters

The European Union Shellfish Waters Directive is designed to protect the aquatic habitat of bivalve and gastropod molluscs, including oysters, mussels, cockles, scallops and clams. The Directive requires Member States to designate waters that need protection in order to support shellfish life and growth. It also sets physical, chemical and microbiological requirements that designated shellfish waters must either comply with or endeavour to improve.

There are 64 sites in Ireland that are designated shellfish areas. The Directive is implemented in Ireland by the European Communities (Quality of Shellfish Waters) Regulations 2006 (SI No 268 of 2006). There are two designated shellfish areas close to the proposed development site at Trinity Wharf; Wexford Harbour Inner (1.96km) and Wexford Harbour Outer (0km).

9.1.5 OSPAR Marine Protected Areas

OSPAR Marine Protected Areas (MPA) are sites identified under the OSPAR Convention to protect the marine environment of the North East Atlantic. Ireland has identified a number of its SACs as OSPAR MPAs for marine habitats. None of the MPAs occur in County Wexford, the nearest being Tramore Dunes and Backstrand SAC in County Waterford.

9.2 NATIONAL ENVIRONMENTAL DESIGNATIONS

9.2.1 Natural Heritage Areas

Natural Heritage Areas (NHAs) are designated under the Wildlife Acts (1976 - 2000) as they are considered important habitats which support animals or vegetation of importance. There is one NHA in County Wexford; the County Wexford – Keeragh Islands NHA which is offshore from the south Wexford coast (outside the area shown in Figure 9.2).

There are a further 38 proposed Natural Heritage Areas (pNHAs) in County Wexford which were published on a non-statutory basis in 1995, but have not since been statutorily proposed or designated. pNHAs are subject to limited statutory protection but are recognised for their ecological value by planning and licensing authorities. The pNHAs in County Wexford near to the proposed development area at Trinity Wharf are shown in Figure 9.2.

9.2.2 Wildfowl Sanctuaries

Wildfowl Sanctuaries are established under the Wildlife Act, 1976 and are excluded from the 'Open Season Order' in which shooting of game birds is permitted. There are five wildfowl sanctuaries in County Wexford of which two (Rosslare Point and Slaney Estuary (part of) are close to the proposed development site at Trinity Wharf.

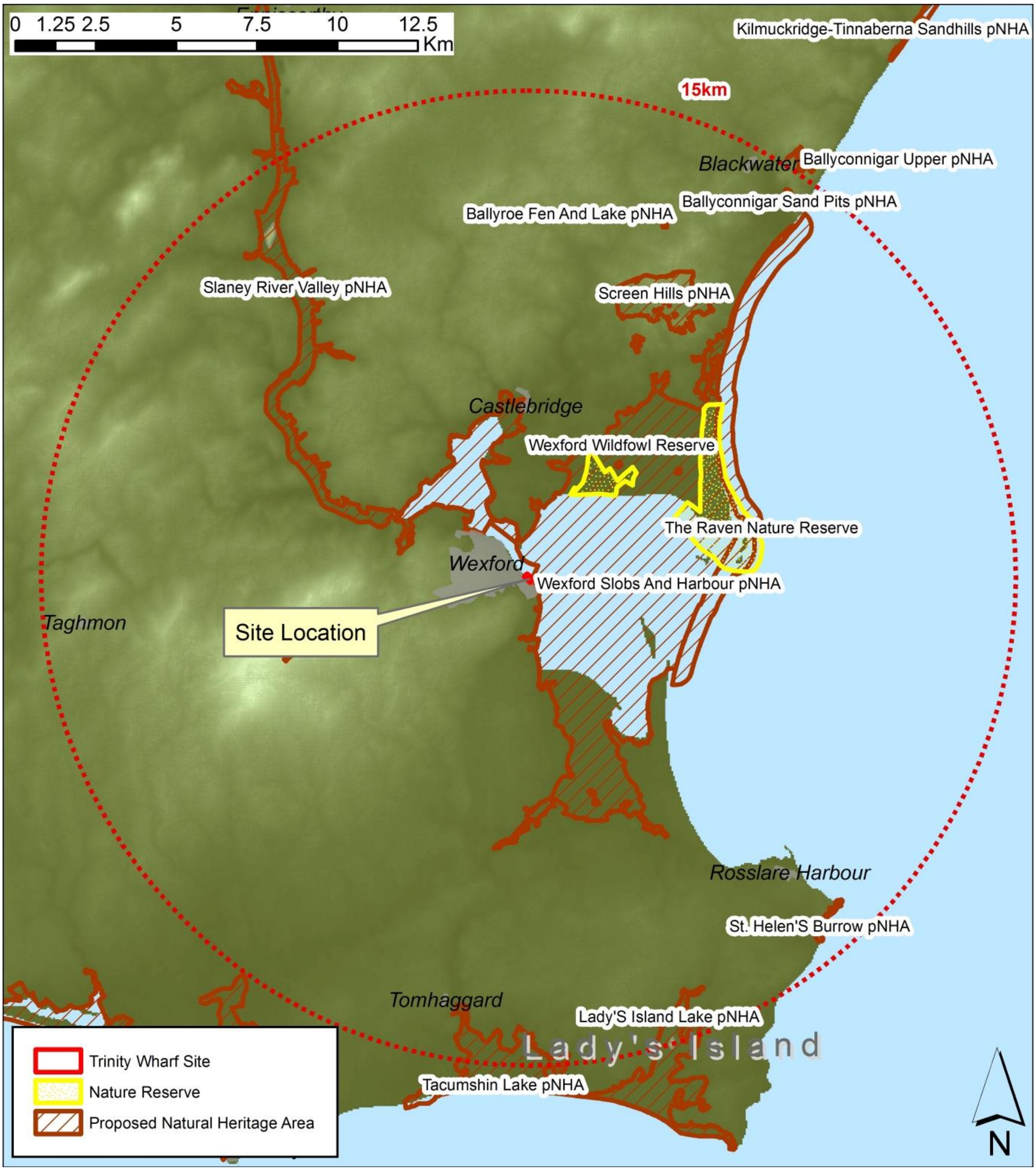


Figure 9.2: National Designations surrounding Trinity Wharf/Wexford Harbour.

9.2.3 National Parks

National Parks are established under the International Union for the Conservation of Nature and are areas identified as not materially altered by human exploitation and occupation and where steps have been taken to prevent exploitation or occupation in respect of ecological, geomorphological or aesthetic features. There no national parks in County Wexford.

9.2.4 Nature Reserves

Nature Reserves are identified as being important habitats to support wildlife and are protected under Ministerial Order. There are three statutory nature reserves in County Wexford, of which two (The Raven and Wexford Wildfowl Reserve) are close to the proposed development site at Trinity Wharf (4.6km and 2.7km respectively). These are shown on Figure 9.2.

9.2.5 Freshwater Pearl Mussel Catchments and Sensitive Areas

The Freshwater Pearl Mussel (FPM) is an endangered bivalve which lives in fast-flowing, clean rivers. As filter feeders, freshwater pearl mussels are extremely vulnerable to water pollution and engineering work in rivers such as the construction of weirs or deepening of pools. The species *Margaritifera margaritifera* and *Margaritifera durrovensis* are protected under the Habitats Directive (92/43/EEC) and the Wildlife Acts (1976, amended 2000). There is one FPM catchment (Slaney-Derreen) on the River Slaney and a further four areas identified as being 'sensitive'. 'Sensitive' sites are those which either have previous records of *Margaritifera*, but their current status is unknown, or are catchments of other extant populations.

The catchment of the SAC population listed in S.I. 296 of 2009 is approximately 60km upstream from Trinity Wharf and the nearest sensitive catchment is approximately 18km upstream of Trinity Wharf. Due to the upstream distances, there is no potential for adverse effects on these catchments from any proposed development at Trinity Wharf.

9.3 THE WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC) ('WFD'), (as amended by Decision 2455/2001/EC and Directives 2008/32/EC, 2008/1) aims to improve water quality and quantity within rivers, estuaries, coasts and aquifers.

Its purpose is to protect and improve all river, transitional, coastal and groundwater water resources and to prevent the deterioration of aquatic ecosystems and associated wetland by setting out a timetable until 2027 to achieve good ecological status or good potential status. Member States are required to manage the effects on the ecological quality of water which result from changes to the physical characteristics of water bodies. Action is required in those cases where these 'hydro-morphological' pressures are having an ecological impact which will interfere with the ability to achieve WFD objectives.

The following Directives have been subsumed into the Water Framework Directive:

- The Drinking Water Abstraction Directive,
- Sampling Drinking Water Directive,
- Exchange of Information on Quality of Surface Freshwater Directive,
- Shellfish Directive ,
- Freshwater Fish Directive,
- Groundwater (Dangerous Substances) Directive, and
- Dangerous Substances Directive.

The key outcomes of the WFD in Ireland have been:

- Identification and establishment of individual River Basin Districts (RBD).
- Preparation of individual river basin management plans for each of the catchments. These contain the main issues for the water environment and the actions needed to deal with them.
- Establishment of a programme of monitoring water quality in each RBD.
- Establishment of a Register of Protected Areas (includes areas previously designated under the Freshwater Fish and Shellfish Directives which have become sites designated for the protection of economically significant aquatic species under WFD and placed on the Protected Areas register).
- Promotion of sustainable management of the water environment by carefully considering current land use and future climate scenarios, minimising the effects of flooding and drought events and facilitating long term improvements in water quality, including the protection of groundwater near landfill sites, as well as minimising agricultural runoff.

The relevant legislation in Ireland for the implementation of the WFD are the European Communities (Water Policy) Regulations, 2003 (S.I. No. 722/ 2003) and the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272/2009). The WFD uses river basin districts as its study areas and is based on a 6 year cycle of planning.

The progression of marine engineering works and a marina development at Trinity Wharf will need to consider the requirements of the WFD and ensure that it does not compromise its objectives, and that it contributes to achieving its aims. Water quality is linked to the proposed enhancements at Trinity Wharf as the construction and operation of the development has the potential to lead to water pollution and changes in morphology. Any plans for developing Trinity Wharf should therefore promote sustainable management of the water environment by carefully considering current land use and future climate scenarios, minimise the effects on sensitive habitats and species and aid in facilitating long term improvements in water quality, including the protection of groundwater.

9.3.1 Shellfish

The WFD is also responsible for the safeguarding of shellfish areas through its Shellfish Pollution Reduction Programmes. These aim to improve water quality and ensure the protection or improvement of designated shellfish waters in order to support shellfish life and growth and contribute to the high quality of shellfish products directly edible by man.

The Shellfish Pollution Programme Identifies key and secondary pressures on water quality in designated shellfish areas and outlines specific measures to address identified key and secondary pressures on water quality. It also addresses the specific pressures acting on water quality in each area.

Legislation covering shellfish waters in Ireland includes the European Communities (Quality of Shellfish Waters) Regulations 2006 (SI 268/2006) (as amended 2009).

There are two designated shellfish waters in close proximity to the development area at Trinity Wharf, which are on the Register of Protected Areas and thus are subject to these Regulations. These include the Wexford Harbour Inner E.U. Shellfish Water, which is approximately 2km upstream of the site in the upper part of the Slaney Estuary and the Wexford Harbour Outer E.U. Shellfish Water, which is immediately adjacent to the development area.

Figure 9.3 shows the aquaculture sites within Wexford Bay, sourced from Ireland's Marine Atlas (www.atlas.marine.ie). It is understood that Wexford County Council were previously subject to litigation following the construction of a marine outfall (shown as a green line in Figure 9.3) due to its impacts on aquaculture sites. Therefore the potential impacts on aquaculture represents one of the key issues in the development of the Preferred Option for the development of a marina at Trinity Wharf and the engineering works required to secure the perimeter of the site.

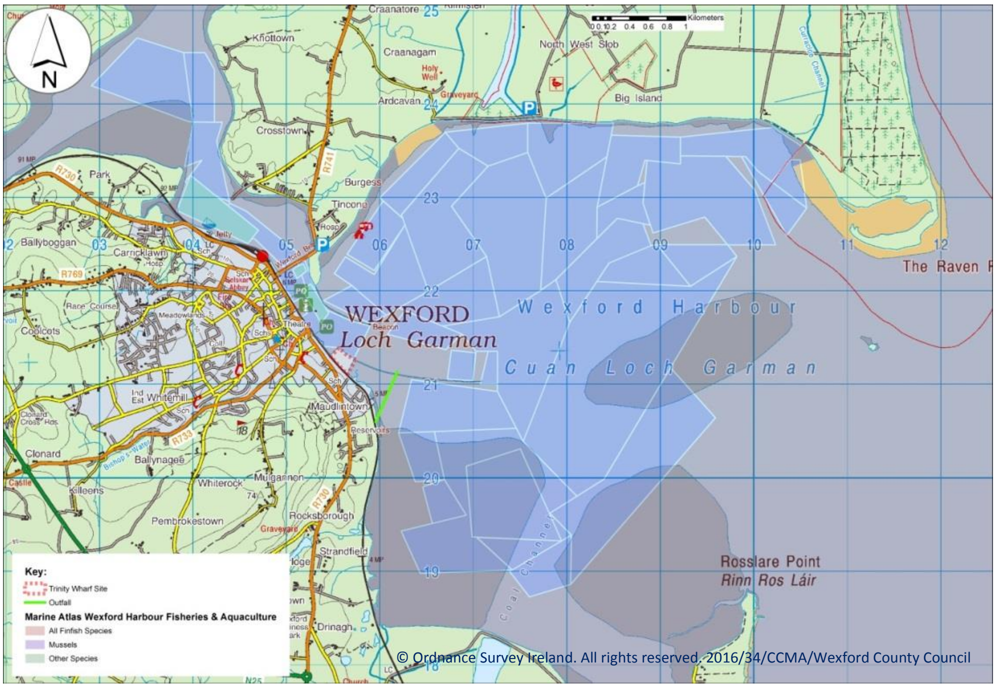


Figure 9.3: Fisheries and Aquaculture in Wexford Harbour (from Marine Atlas).

A consultation request was made to the Aquaculture & Foreshore Management Division of the Department of Agriculture, Food and the Marine (DAFM) in February 2016 (see Chapter 10). When no response was received, this consultation request was followed up in July 2016. A data request was subsequently made on 18th July to the DAFM to obtain details of the current aquaculture licences.

The boundaries of the currently-licensed aquaculture sites in Wexford Harbour were sent to RPS in ESRI shapefile format by the DAFM on 19 August 2016 and these are shown below in Figure 9.4.

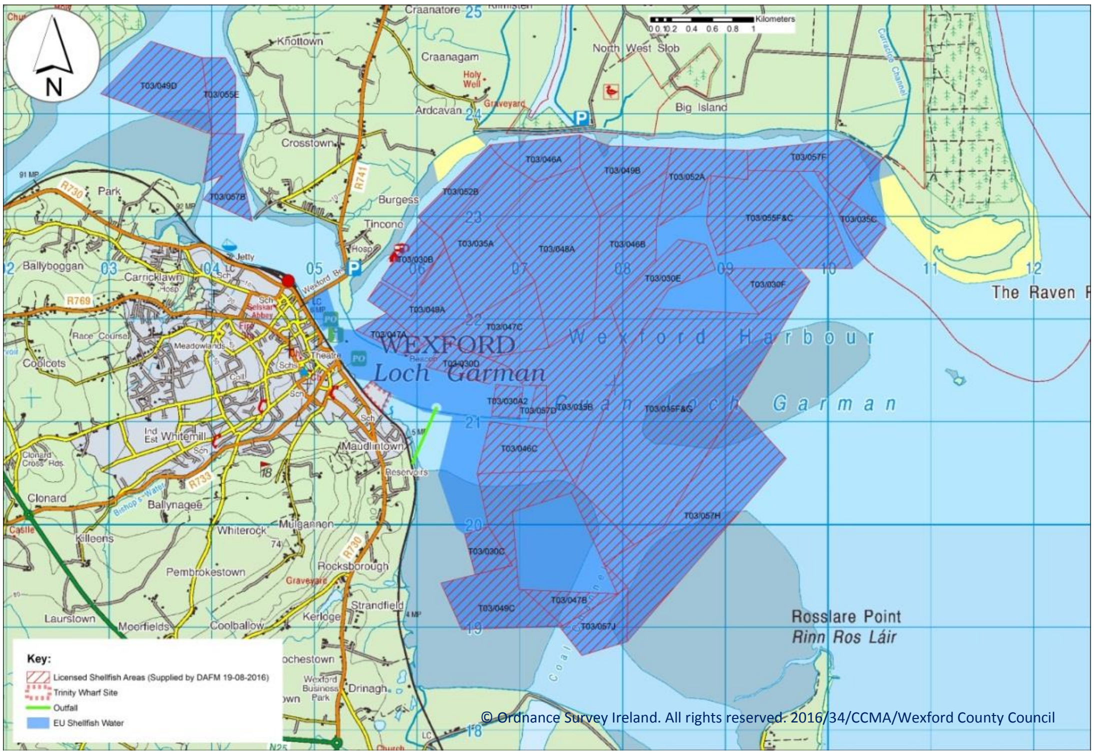


Figure 9.4: Licensed Shellfish Areas in Wexford Harbour 2016.

RPS also received some information from Wexford County Council which was gathered in respect of 2015 remedial works to the waste water outfall a short distance south east of Trinity Wharf. This data, merged with RPS' GIS information is shown below in Figure 9.5 and Figure 9.6.

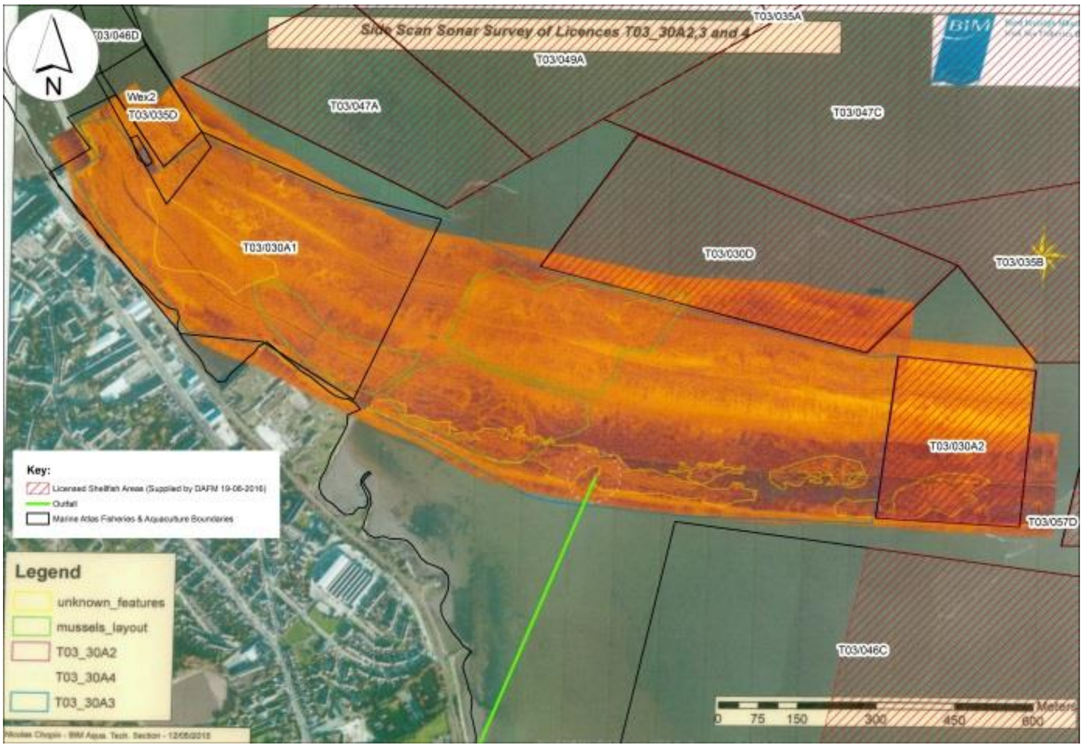


Figure 9.5: Council- Supplied Shellfish Data – Side Scan Sonar.

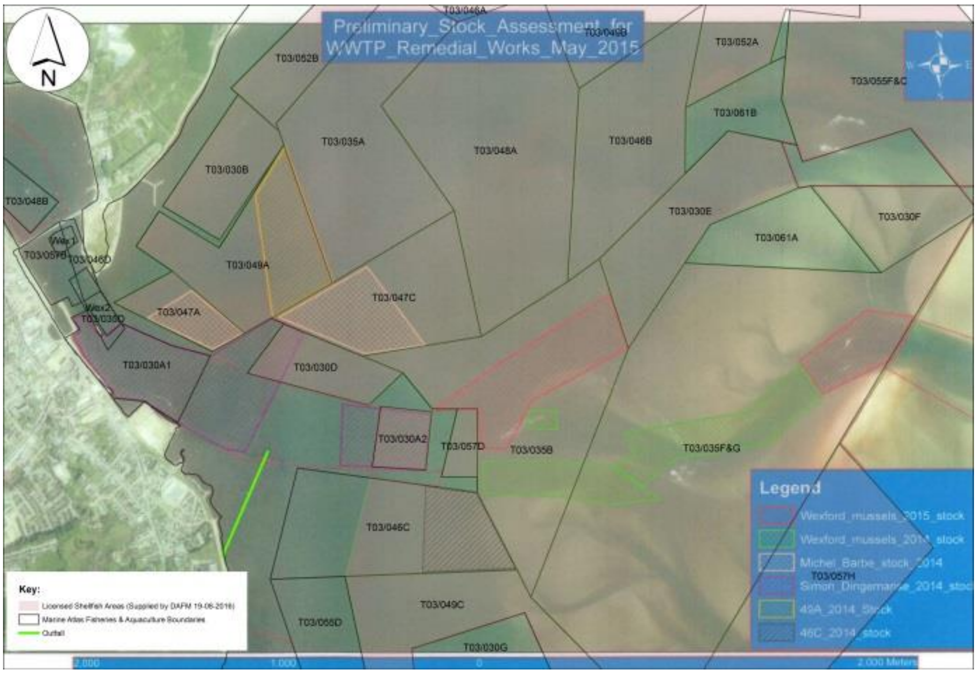


Figure 9.6: Council- Supplied Shellfish Data –Stocking Areas.

The data sent to RPS by Wexford County Council appears to show that the area immediately adjacent to Trinity Wharf is actively cultivated for shellfish. BIM side scan sonar data (shown on Figure 9.5) shows that in 2015 there was a mussel bed adjacent to the north eastern boundary of Trinity Wharf and that the boundary of the cultivated area is broadly coincident with an area labelled in the Irish Marine Atlas dataset with an apparent license number – T03/030A1.

Further data from the Council on stocks (Figure 9.6) shows stock areas within this demarcated area T03/030A1 but also extending beyond the boundaries of the parcels the Marine Atlas dataset into an area labelled T03/030A3, outlined in blue on Figure 9.5. Anecdotal evidence from the harbour master also indicated that the foreshore immediately surrounding Trinity Wharf was under license to an individual who had purchased the licence from Lett's in 2015 and that the area is actively fished.

Consequently the status of the area T03/030A1 was queried with DAFM to establish whether the site is used for aquaculture or not, as the construction of a marina within a licensed aquaculture site would potentially require compensatory measures to be undertaken.

The DAFM responded informally that an application had been made for T03/030A1, which was apparently not successful, and a subsequent application was made for the same location under licence T03/030A3 but this was also turned down by judicial decision in September 2008. Site T03/030A3 is still on the DAFM system as a current application but has not been approved. The DAFM confirmed by email on 04/10/2016 to RPS that this area is not currently licensed for shellfish cultivation.

9.3.2 Freshwater Fish

The former Freshwater Fish Directive (2006/44/EC) has been subsumed into the Water Framework Directive. The responsibility of monitoring fish for the purpose of assigning waterbody status in accordance with the Water Framework Directive has been assigned to Inland Fisheries Ireland (IFI).

In Ireland the WFD Freshwater Morphology Programme of Measures and Standards has identified barriers to fish migration as one of the principal issues placing channels at risk in terms of failing to achieve good hydro-morphology status. Such barriers can adversely impact on fish community composition and population structure.

The River Slaney is included on the WFD Register of Protected areas as an E.U. Salmonid River. The Slaney River Valley SAC, which immediately borders the development area includes designations for *Lampetra fluviatilis* (River Lamprey), *Lampetra planeri* (Brook Lamprey), *Petromyzon marinus* (Sea Lamprey) *Alosa fallax* (Twaite Shad) and *Salmo salar* (Salmon) all of which migrate through the Slaney Estuary, past Trinity Wharf.

During the last WFD cycle in the transitional waters of the South Eastern River Basin District, a total of 21 fish species were recorded in the three transitional water bodies surveyed during 2014 (IFI, 2014). The greatest species richness was recorded on the Lower Slaney Estuary, with a total of 17 species being captured. This was followed by the Upper Slaney Estuary (10 species) and North Slob Channels (five species). As expected with decreasing salinity levels, higher numbers of freshwater fish were recorded in the Upper Slaney Estuary, while in contrast a higher number of species (mostly marine) were recorded in the Lower Slaney Estuary. A number of economically important species were encountered in the Lower Slaney water body, including European Seabass, Mackerel, Pollack and Whiting. Atlantic Salmon and European Eel which are both vulnerable fish species were also recorded throughout this estuarine system.

The development of facilities at Trinity Wharf will need to consider the impact upon fish habitat. Construction-related threats include siltation due to changes in flow affecting erosion and deposition patterns, pollution from construction/operation activities and displacement of fish. Construction of coastal protection structures and breakwaters has the potential to cause disturbance and habitat damage and cause a temporary or permanent impediment to fish and eel passage. Any options selected for securing the site perimeter or developing a marina should take consideration of potential impacts on restricting fish passage.

IFI were contacted in February 2016 as part of the initial consultation on the proposals. Senior Fisheries Officer Donnachadh Byrne returned a detailed response (attached in Appendix F) outlining a number of fishery sensitivities in the area and making several recommendations. These have been taken into consideration in selecting the preferred option and it is proposed that IFI will be re-consulted during the next phase of the study.

9.4 REQUIREMENT FOR APPROPRIATE ASSESSMENT

9.4.1 Legislative Context

The preparation of a masterplan or development of a new project at Trinity Wharf is subject to the provisions of Article 6(3) of the EU Habitats Directive via the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) ('the 2011 Regulations'). The 2011 Regulations transpose the provisions of the Habitats Directive 92/43/EEC into Irish law and consolidate the European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010, as well as addressing transposition failures identified in judgements of the Court of Justice of the European Union (CJEU).

The 'Habitats Directive' (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora) provides legal protection for habitats and species of European importance. The main aim of the Habitats Directive is "*to contribute towards ensuring biodiversity through the conservation of natural habitats of wild fauna and flora in the European territory of the Member States to which the treaty applies*". Actions taken in order to fulfil the Directive must be designed to: "*maintain or restore, at a favourable conservation status, natural habitats and species of wild fauna and flora of Community interest*".

A key outcome of the Habitats Directive is the establishment of Natura 2000, an ecological infrastructure developed throughout Europe for the protection of sites that are of particular importance for rare, endangered or vulnerable habitats and species. In Ireland, SACs together with SPAs designated under the 'Birds Directive' (Council Directive 2009/147/EC - codified version of Directive 79/409/EEC on the Conservation of Wild Birds, as amended) are included in the Natura 2000 network, and are hereafter referred to as 'European sites'.

A central protection mechanism of the Habitats Directive is the requirement of competent authorities to undertake Appropriate Assessment (AA) to consider the possible nature conservation implications of any plan or project on European sites before any decision is made to allow the plan or project to proceed.

The 2011 Regulations provide the following definition of a project:

> *"project", subject to the exclusion, except where the contrary intention appears, of any project that is a development requiring development consent within the meaning of the Planning and Development Acts 2000 to 2011, includes—*
>
> *a) land use or infrastructural developments, including any development of land or on land,*
> *b) the extraction or exploitation of mineral resources, prospecting for mineral resources, turf cutting, or the exploitation of renewable energy resources, and*
> *c) any other land use activities,*
>
> *that are to be considered for adoption, execution, authorisation or approval, including the revision, review, renewal or extension of the expiry date of previous approvals, by a public authority and, notwithstanding the generality of the preceding, includes any project referred to at subparagraphs (a), (b) or (c) to which the exercise of statutory power in favour of that project or any approval sought for that project under any of the enactments set out in the Second Schedule of these Regulations applies*".

Article 6(3) of the Habitats Directive states: "*Any plan or project not directly connected with or necessary to the management of the [European] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and if appropriate, after having obtained the opinion of the general public*."

Article 6(4) is the procedure for allowing derogation from this strict protection, in certain restricted circumstances:

Article 6(4) of the Habitats Directive states: "*If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*"

9.4.2 Approach to Appropriate Assessment

The European Commission (EC) has produced non-mandatory methodological guidance (EC, 2000, 2002, 2007) in relation to the process of AA which suggests a four-stage process, although not all steps may necessarily be required. The process recommends an initial "test of likely significance", or "screening" followed, if necessary, by appropriate assessment. The Department of Environment, Heritage & Local Government[1] (DEHLG) has transposed the principles of the European Commission guidance into a document specific to Ireland entitled '*Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities*' (DEHLG, 2010).

A summary of the stages is given below and additional detail on the iterative process by which each of the stages is reached and concluded is given overleaf in **Error! Reference source not found.**.

Stage One: Screening or 'Test of Likely Significance'- The process which identifies the likely impacts upon a European site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;

Stage Two: Appropriate Assessment - The consideration of the impact on the integrity of the European site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;

Stage Three: Assessment of Alternative Solutions - Where adverse effects remain after the inclusion of mitigation, this Stage examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of European Sites;

Stage Four: Assessment Where Adverse Impacts Remain - An assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

[1] From 2011-2016 known as the Department of Community, Environment and Local Government (DECLG) and since 2016 known as the Department of Housing, Planning and Local Government (DHPLG)

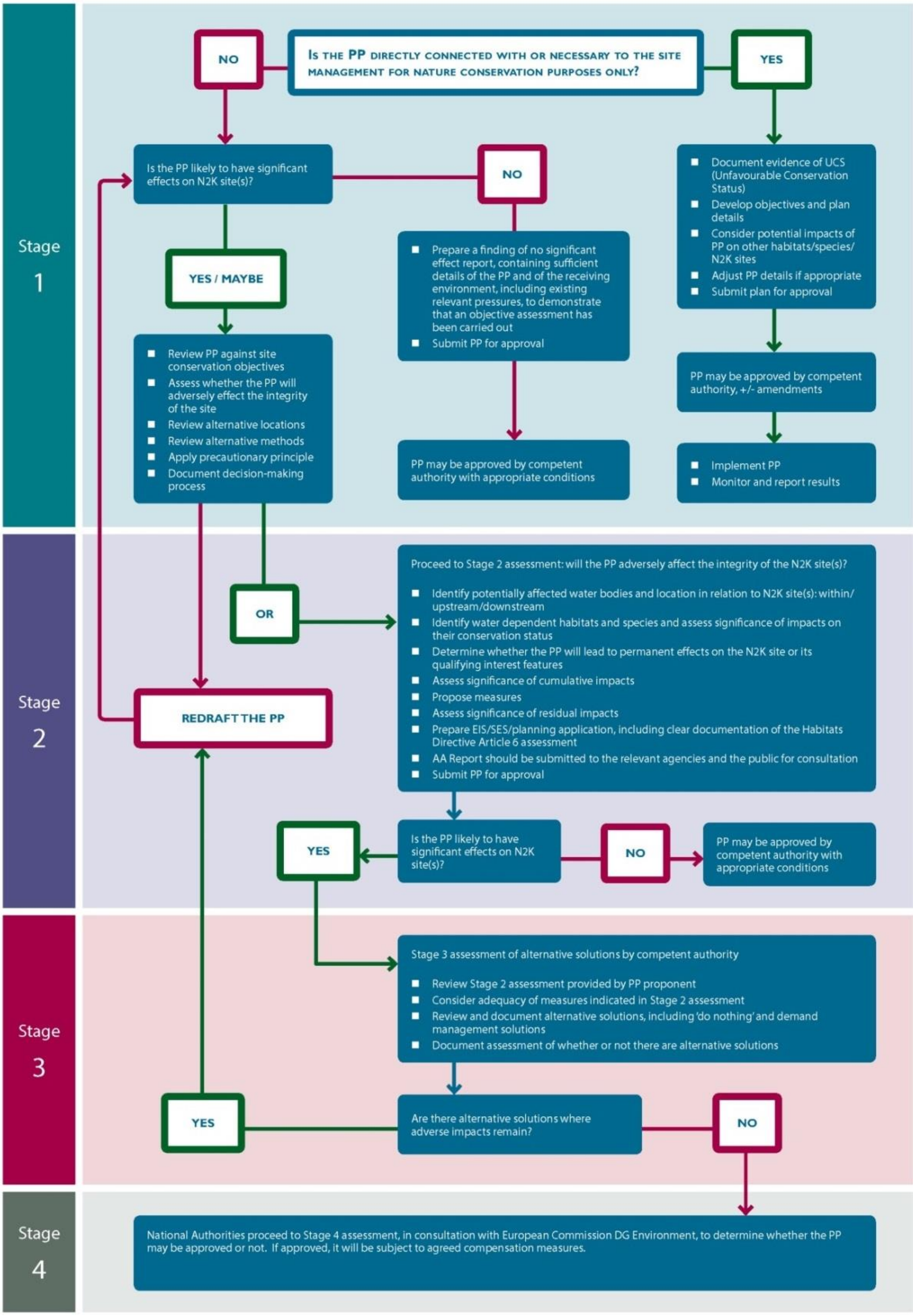


Figure 9.7: Schematic of the stages of Appropriate Assessment.

'Screening' is the process of deciding whether or not an Appropriate Assessment is required for a plan or project. It addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3) of the Habitats Directive, i.e.

- Whether a plan or project is directly connected to or necessary for the management of the site; and
- Whether a plan or project, alone or in-combination with other plans and projects, is likely to have significant effects on a European site in view of its Qualifying Interest Features and their corresponding Conservation Objectives.

The Screening Stage includes:

- Site location and description of the plan or project;
- Identification and initial screening of European sites for potential negative effects;
- Screening conclusion.

The assessment of likely significant effects is based on the likelihood and significance of any effects of the proposed plan or project on each European site's qualifying features, particularly with reference to the relevant conservation objectives. In this context, the likelihood depends on whether there is the opportunity and pathway for the effect to occur, and the significance is regarded as the effect on the susceptible qualifying features of the site(s). If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2 Appropriate Assessment.

9.4.3 Methodology

The Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities' (DEHLG, 2010), recommends that all European sites within a 15 kilometre precautionary buffer area are screened. It should be acknowledged that 15 kilometres is not a set limit and for some projects the screening distance may need to be extended beyond 15km, particularly where projects may affect water quality and/or quantity. Due to the enclosed nature of Wexford Harbour and the small footprint of the various options being considered in the Feasibility Study, which is solely for the marina and not for the overall development of Trinity Wharf, it has been assumed that at this stage there is no requirement to extend the search area beyond 15km.

As discussed above, there are 12 European sites within 15km of the development area that require screening for adverse effects under the 2011 Regulations.

The risk of adverse impact on the European sites was evaluated by examining their location in relation to development site and considering whether any potential impact pathway between the development site and the European Site could be identified, via surface water, groundwater, land or air. Consideration was given to connectivity by virtue of an ecological stepping stone or biodiversity corridor.

The preliminary screening exercise reviewed the potential for:

- Direct Impacts, examples of which include (but are not limited to):
    - A construction footprint within the boundary of a European site,
    - A construction footprint outside a European site but which may obstruct the passage of a qualifying feature in accessing a European site,
    - A construction footprint which alters the coastal processes of the surrounding foreshore, or
    - Operational impacts of the development such as disturbance from noise and light pollution, and water quality impacts from visiting craft
- Indirect Impacts, example of which include (but are not limited to):
    - Water quality impacts associated with construction works, for example, suspended sediment and sedimentation impacts, or
    - Changes to existing hydrological and morphological regimes.

The potential for significant effects on European sites from the development of a marina and associated marine engineering works at Trinity Wharf was assessed, taking into account the source-pathway-receptor model.

The source is the project, namely the marine engineering works to secure the perimeter of Trinity Wharf and the construction of the marina and its subsequent operation. The pathway is defined as the means or route by which a source can migrate to the receptor. The receptor is defined as the European site and its qualifying features. Each element can exist independently, however a potential impact is created where there is a linkage between the source, pathway and receptor.

NPWS guidance recommends that appropriate assessment screening is informed by the conservation condition of the qualifying interest/s of a European site, however as this is a preliminary screening for the feasibility study and is not yet associated with a formal plan or project, the condition of the qualifying interest was not considered to be relevant, as the purpose of the screening is to identify which European sites may be at risk of experiencing impacts and not, at this stage, assessing the potential significance of any potential impacts.

Each European site was individually reviewed to identify whether there were potential impact pathways, via surface water, groundwater, land or air, evident from the construction and operation of a marina and/or coastal protection works at Trinity Wharf. This included reviewing the environmental and geographical information for the area to ascertain the presence or absence of linkages between the development area at Trinity Wharf and European sites and also examining the potential for impacts on other areas of biodiversity value, such as NHAs (or pNHAs), wildfowl reserves or nature reserves, which may provide a stepping stone between European sites, or wider areas where mobile qualifying interests (e.g. migratory fish or birds) may be affected by changes, outside the boundary of the designated area.

A total of 8 SACs and 4 SPAs were identified as being within, or within 15km of, Trinity Wharf and these were consequently included in the screening process.

Where no apparent linkages or relationships were found between the European site and the development area at Trinity Wharf, a conclusion of "no identifiable impact pathway" was drawn and the site was eliminated from the screening process. Where a connectivity or linkage was possible, the precautionary principle was applied and the site was retained in the screening and has been recommended for further assessment (which may include appropriate assessment) at the masterplanning or development stage.

The full summary of the screening exercise for each European site is presented in Appendix C, however the results have been summarised below in Table 9.1.

Table 9.1: Summary of Preliminary Screening for Potential Impact Pathways to European Sites.

SITE CODE	SITE NAME	Approx. Distance from Trinity Wharf (km)	Area (ha)	Potential Impact Pathway: Requirement for AA Screening
002953	Blackwater Bank SAC	12.8	12,407	No
002269	Carnsore Point SAC	12.6	8,736	No
000704	Lady's Island Lake SAC	13.5	540	No
004009	Lady's Island Lake SPA	13.5	468	No
002161	Long Bank SAC	10.5	3,372	No
000710	Raven Point Nature Reserve SAC	4.6	595	Yes
000708	Screen Hills SAC	7.7	141	No
000781	Slaney River Valley SAC	0	4,873	Yes
000709	Tacumshin Lake SAC	13.3	559	No
004092	Tacumshin Lake SPA	13.5	476	No
004019	The Raven SPA	4.7	4,207	Yes
004076	Wexford Harbour and Slobs SPA	0	5,982	Yes

The screening for potential impact pathways found that no potential impact pathway to the qualifying interests is thought to exist for eight out of the 12 European sites. A potential impact pathway exists between the establishment of marine engineering works and a marina at the development and the qualifying interests of four European sites. These are:

- Raven Point Nature Reserve SAC (site code 000710),
- Slaney River Valley SAC (site code 000781),
- The Raven SPA (site code 004019), and
- Wexford Harbour and Slobs SPA (site code 004076)

The extents of the designated areas are shown on Figure 8.5 whilst a summary of the qualifying interests of each of the sites is presented in Table 9.2 overleaf. The conservation objectives for each of the sites' qualifying interests are included in Appendix D.

Table 9.2: Qualifying interests for Sites identified as having a potential Impact Pathway during Preliminary Screening.

Name: Raven Point Nature Reserve SAC	**Site Code: (IE000710)**
Qualifying Interest(s)	**Annex I Habitats:** Embryonic shifting dunes [2110], Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120], Dunes with Salix repens ssp.argentea (*Salix arenariae*) [2170], Annual vegetation of drift lines [1210], Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130], Humid dune slacks [2190], Mudflats and sandflats not covered by seawater at low tide [1140] and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330].
Name: Slaney River Valley SAC	**Site Code: (IE000781)**
Qualifying Interest(s)	**Annex I Habitats:** Estuaries [1130], Mudflats and sandflats not covered by seawater at low tide [1140], Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260], Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae*, *Salicion albae*) [91E0], Old sessile oak woods with *Ilex* and *Blechnum* in British Isles [91A0]. **Annex II Species:** *Lampetra fluviatilis* (River Lamprey) [1099], *Lampetra planeri* (Brook Lamprey) [1096], *Petromyzon marinus* (Sea Lamprey) [1095], *Salmo salar* (Salmon) [1106], *Margaritifera margaritifera* (Freshwater Pearl Muscle) [1029], *Lutra lutra* (Otter) [1355], *Phoca vitulina* (Common Seal) [1365], *Alosa fallax* (Twaite Shad) [1103].
Name: The Raven SPA	**Site Code: (IE004019)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Red-throated Diver (*Gavia stellata*) [A001], Cormorant (*Phalacrocorax carbo*) [A017], Common Scoter (*Melanitta nigra*) [A065], Grey Plover (*Pluvialis squatarola*) [A141], Sanderling (*Calidris alba*) [A144], Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395], Wetland and Waterbirds [A999].
Name: Wexford Harbour and Slobs SPA	**Site Code: (IE004076)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Little Grebe (*Tachybaptus ruficollis*) [A004], Great Crested Grebe (*Podiceps cristatus*) [A005], Cormorant (*Phalacrocorax carbo*) [A017], Grey Heron (*Ardea cinerea*) [A028], Bewick's Swan (*Cygnus columbianus bewickii*) [A037], Whooper Swan (*Cygnus cygnus*) [A038], Light-bellied Brent Goose (*Branta bernicla hrota*) [A046], Shelduck (*Tadorna tadorna*) [A048], Wigeon (*Anas penelope*) [A050], Teal (*Anas crecca*) [A052], Mallard (*Anas platyrhynchos*) [A053], Pintail (*Anas acuta*) [A054], Scaup (*Aythya marila*) [A062], Goldeneye (*Bucephala clangula*) [A067], Red-breasted Merganser (*Mergus serrator*) [A069], Hen Harrier (*Circus cyaneus*) [A082], Coot (*Fulica atra*) [A125], Oystercatcher (*Haematopus ostralegus*) [A130], Golden Plover (*Pluvialis apricaria*) [A140], Grey Plover (*Pluvialis squatarola*) [A141], Lapwing (*Vanellus vanellus*) [A142], Knot (*Calidris canutus*) [A143], Sanderling (*Calidris alba*) [A144], Dunlin (*Calidris alpina*) [A149], Black-tailed Godwit (*Limosa limosa*) [A156], Bar-tailed Godwit (*Limosa lapponica*) [A157], Curlew (*Numenius arquata*) [A160], Redshank (*Tringa totanus*) [A162], Black-headed Gull (*Chroicocephalus ridibundus*) [A179], Lesser Black-backed Gull (*Larus fuscus*) [A183], Little Tern (*Sterna albifrons*) [A195], Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395], Wetland and Waterbirds [A999].

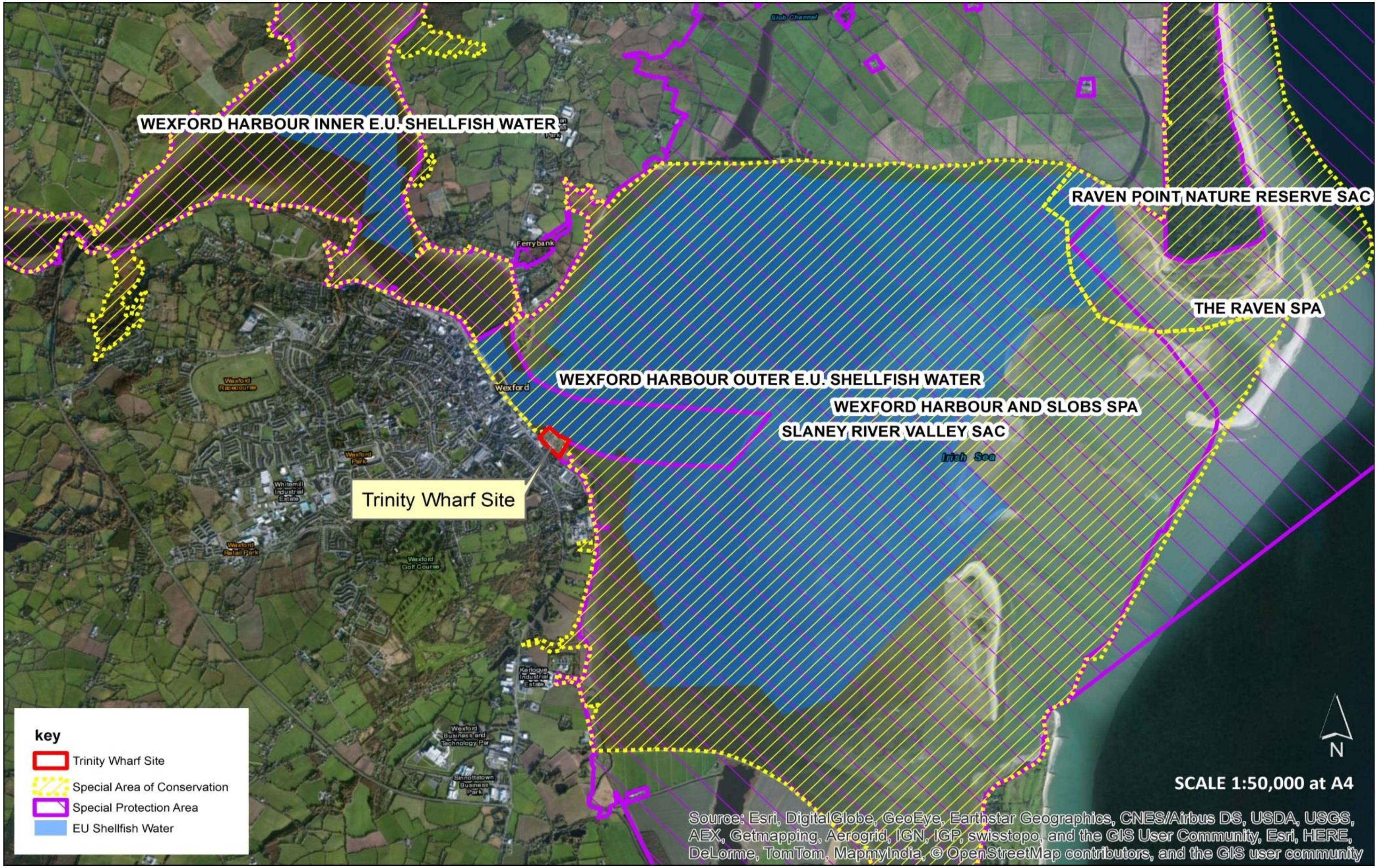


Figure 9.8: Designated areas in proximity of Trinity Wharf requiring AA Screening /Stage 2 AA.

9.5 WINTERING BIRD SURVEYS

Natura Environmental Consultants was commissioned by Wexford County Council to carry out a survey of waterbirds in the vicinity of Trinity Wharf, Wexford Town during the winter 2015/16. The area adjacent to Trinity Wharf below High Water Mark is included within the Wexford Harbour and Slobs Special Protection Area (SPA).

The purpose of the survey was to inform the Feasibility Study by identifying whether Trinity Wharf or any of its surrounding foreshore is of importance to the bird species that are qualifying interests of the adjacent SPAs and thus whether any parts of Trinity Wharf were preferred over other areas for the potential development of the marina.

A full copy of the draft survey report is included in Appendix E.

A total of 23 species of waterbirds were recorded in this survey. Of these, 15 species are qualifying interests of Wexford Harbour and Slobs SPA (NPWS 2012).

The surveys found that Trinity Wharf itself does not hold any waterbirds. The northern and eastern edges are steep concrete walls and have no suitable foraging or roosting habitat. The southern side of the wharf is bordered by intertidal mudflat at Batt Street Harbour (Goodtide Harbour). This generally holds very small numbers of waders including Oystercatcher, Bar-tailed Godwit, Curlew, and Redshank at low tide. Single Grey Heron and Little Egret also occur in Batt Street Harbour at low tide.

The most important features for waterbirds in this area are the North and South training walls on either side of the mouth of the River Slaney. These areas are used at both low and high tide especially by roosting Lapwing (peak 552), Oystercatcher, Cormorant, Black-headed Gull and Herring Gull. The walls also provide foraging habitat at low tide for Oystercatcher and Turnstone.

The other main high tide roost site approximately 500m to the north-west of Trinity Wharf is the ballast structure in the centre of the river. This artificial structure is used at high tide by significant numbers of roosting Oystercatcher (peak 120) as well as Lapwing, Black-tailed Godwit, Turnstone and Black-headed Gull.

The shallow waters lying to the south of the South Training Wall and north of the North Training Wall are used for foraging by several species of waterbirds including Great Crested Grebe (peak 27), Red-breasted Merganser (peak 78), Goldeneye (peak 4) and Cormorant.

The survey concluded that the bird numbers present in this area represent a small proportion of the total numbers in the Wexford Harbour and Slobs SPA. Very few individuals occurred within the immediate vicinity (200m) of the Wharf because there is limited suitable habitat here.

The Preferred Option avoids disturbance of the training walls and is located within an area where low bird activity was recorded. The Preferred Option will be circulated for consultation with the relevant authorities to inform the final Feasibility Report.

10 CONSULTATIONS

Following appointment, consultation letters were issued in February 2016 to the following stakeholders:

- DAHG Development Applications Unit (written response received 4th March 2016)
- Wexford County Council Access Officer (written response received 4th March 2016)
- DAFM and DECLG Foreshore Unit (no response received, follow up sent 18th July 2016)
- DAFM Aquaculture Unit (no response received, follow up sent 18th July 2016, response received same day and subsequent data request submitted also that day. Requested data has not yet been provided at the time of writing due to staff holidays.
- IFI (written response received 30th March 2016)
- EIR (no response received – follow up considered unnecessary)
- ESB (no response received – follow up considered unnecessary)

An example copy of the outgoing letter and copies of the written responses received are included in Appendix F.

Telephone and email correspondence took place with Captain Phil Murphy, the harbour master at Wexford Harbour, during February and April 2016.

Through Natura Environmental Consultants, contact was established with Birdwatch Ireland and local NPWS rangers Tony Murray and Dominic Berridge in February 2016, seeking general observations on the proposal. It was agreed to arrange a meeting onsite once the preferred option(s) had been identified.

RPS also corresponded with the Marine Institute in March 2016 to establish whether there was any known history of contaminated sediments near the site and to establish an appropriate protocol for analysis for the presence of potential contaminants in the marine sediments surrounding the development site.

Following the completion of this report and the identification of a preferred option, these agencies will be re-contacted with the results of the model studies and the details of the preferred option and their opinions sought.

11 PROPOSED MARINA OPTION

11.1 REFINEMENT OF CONCEPTUAL OPTIONS

The potential impact of the four shortlisted marina options on the existing wave climate, tidal regime and sediment transport regime was assessed using a combination of high level analysis and a series of computational models as detailed in Sections 6 - 0. The results of this assessment are summarised in Table 11.1 below.

Table 11.1: Summary of the computational assessment of the shortlisted Marina Options.

Marina Option	Summary description	Impact on wave climate	Impact on tidal regime	Impact on sediment transport
Option 2	A series of floating breakwaters on the northern corner of Trinity Wharf to create a sheltered marina area – No dredging required	Positive impact	No significant impact	No Dredging required – No Impact
Option 3	Fixed rubble mound break water on the north east boundary of Trinity Wharf to create a sheltered marina area	Positive impact	Significant negative impact	Major Capital Works – High Impact
Option 3a	A series of floating breakwaters on the north east boundary of Trinity Wharf to create a sheltered marina area	Positive impact	No significant impact	Minor Dredging required – Minor Impact
Option 3b	Reclaiming approximately 10m of land and constructing a series of floating breakwaters on the north east boundary of Trinity Wharf to create a sheltered marina area	Positive impact	No significant impact	Minor Dredging required – Minor Impact

As can be seen from this table, Option 3 was considered unfeasible as the fixed rubble mound breakwater was found to have a significant adverse impact on the existing tidal regime. Furthermore it is expected that the notable capital works required to construct the fixed rubble mound breakwater, including dredging works, would result in unacceptable levels of impact to the nearby environmentally sensitive areas. For these reasons, Option 3 has not been considered further.

Option 3a and 3b were found to be generally similar in all respects in that neither Option resulted in any significant negative impacts to the existing coastal processes at Trinity Wharf and that both are technical viable options. However, it should be noted that both Options require a small amount dredging to achieve the desired navigational depth and could therefore have potential impacts on the nearby environmentally sensitive areas unless mitigation measures were implemented during construction.

Based on the experience of RPS' Coastal team and the results of the extensive modelling programme that have been presented in this report, Option 2 is considered to be the most environmentally friendly and technically feasible option for the following reasons:

- Option 2 has virtually no impact on the existing tidal regime as the sheltered marina area is created using a series of floating breakwaters that only interact with the very top layer of the water column.
- The wave climate at the study site is such that a series of appropriately specified floating breakwaters will effectively attenuate incident waves to provide a sheltered wave climate that is within the Normal Operating Conditions and Design Conditions recommended by the Yacht Harbour Association and the Australian Standard (AS3962) '*Guidelines for design of Marinas*'.
- As marina Option 2 is situated on the northern corner of Trinity Wharf and extends into the relatively deep navigation channel, no capital dredging works are required to achieve the desired minimum operating depth of -2.5m CD.
- The lack of capital dredging works ensures that the proposed marina will not negatively impact the nearby environmentally sensitive areas.
- Sediment transport simulations have demonstrated that even during high sediment load scenarios, the existing navigation channel is almost completely "self-cleaning" which means the bathymetry of the channel has reached an equilibrium with the tidal currents in this area. As such there is very little change bed level within the main navigation channel.
- As there is very little siltation within the proposed marina area, Option 2 is unlikely to require a continuous maintenance dredging campaign.

Furthermore, following consultation and feedback with various stakeholder groups including Wexford County Council it was found that Option 2 was the preferred option as it was nearest to Wexford town.

11.2 DEVELOPMENT OF CONCEPTUAL MARINA OPTION 2

Throughout this feasibility study and consultation process a number of technical, environmental and operational issues have been identified and addressed. Based on consideration of these issues, a final conceptual marina layout (Option 2) has been developed to best meet the needs of the project objectives as set out in Section 1.

The developed marina option includes creating a sheltered marina area with 61 berths by constructing a series of high-end pre-fabricated 5 metre wide floating breakwaters with skirts that will be tethered to the seabed. One of the major advantages of this Option is that no capital dredging is required to achieve the desired minimum operating depth of -2.5m CD, thus avoiding potential environmental impacts. It is envisaged that the north western perimeter of Trinity Wharf will be protected by an appropriately designed sloping revetment structure. The finished deck level of the Trinity Wharf area will be *c.* 3.4m OD (Malin) which compares with a previous highest recorded tide level of 2.0m in 2004.

It is proposed that the floating pontoons of the marina will be constructed using industry standard modular pontoon and finger units. Pontoon berths and walkways will be restrained using tubular piles driven into the seabed. A single gangway that will be pivoted on the reclaimed deck and rested on the main walkway will provide access to the proposed marina area.

The location of the proposed marina option has been selected to minimise navigational restrictions within the existing approach channel to Wexford Harbour.

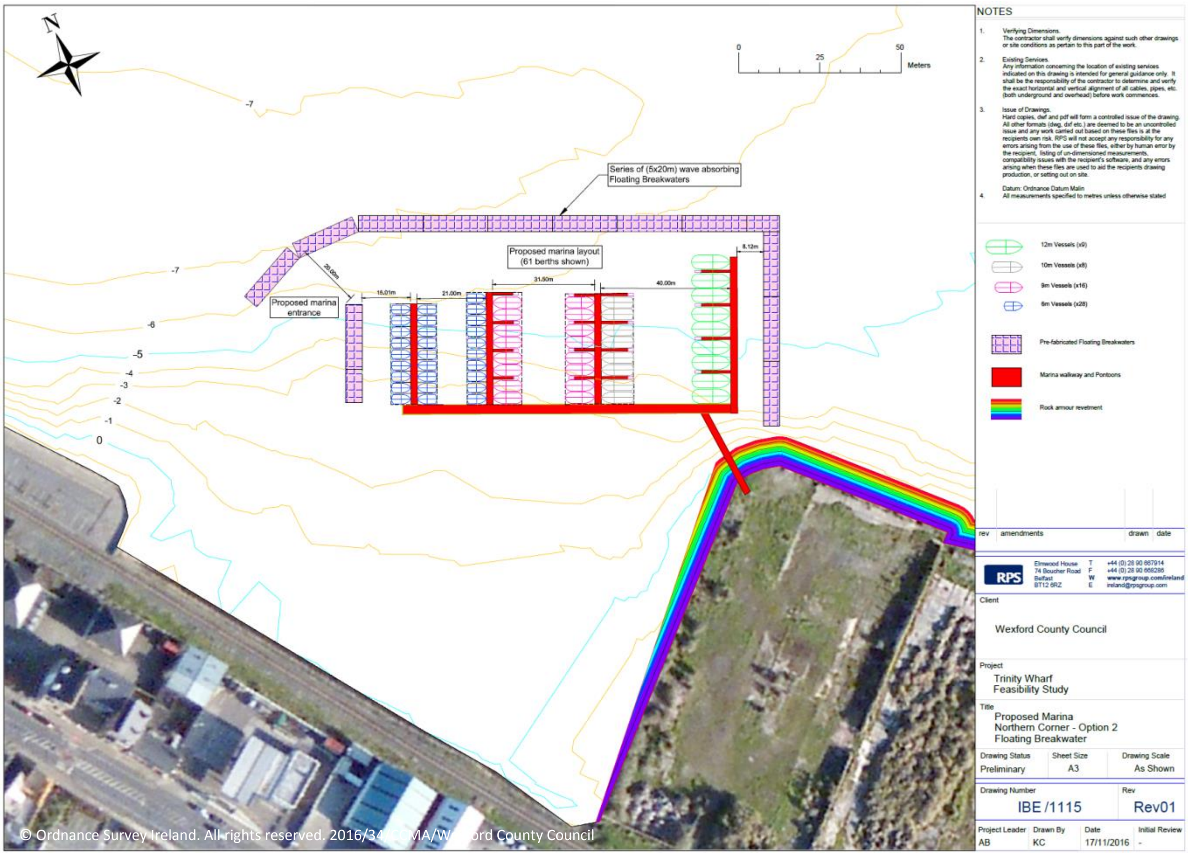


Figure 11.1: Developed Marina Layout Option 2.

11.2.1 Revetment Detail

To reduce wave reflection into the proposed marina and mitigate the threat of both flooding and overtopping, the northern perimeter of the Trinity Wharf site should be protected by a suitably designed sloping revetment structure.

To this end RPS have undertaken a preliminary analysis of the 1 in 200 year wave climate at the Trinity Wharf site based on climate change recommendations made by the OPW for the Medium Range Future Scenario (MRFS) whereby sea level rise is expected to rise by 0.50m by 2100. RPS used results from this analysis to calculate overtopping rates at Trinity Wharf using the EurOtop Wave Overtopping tools developed by HR Wallingford.

Based on this analysis, RPS found that in order to provide adequate protection to pedestrians and the wider hinterland, a sloping revetment structure should be constructed around the northern perimeter of Trinity Wharf with a crest level of *c.*2.40m ODm and backed by a +1m parapet to create a final deck level of *c.*+3.40m. The technical specification of this sloping revetment will be subject to future detailed design based on the masterplan of the proposed Trinity Wharf development.

11.3 CONSTRUCTION COST ESTIMATES

This section sets out preliminary budget estimates of construction cost required to implement the works detailed in Options 2 (Table 11.2).

Table 11.2: Preliminary budget estimates for Marina Option 2 (61 berths).

No.	Item	Budget Cost (€ M)
1	Floating Breakwaters and Bridge Access	1.17m
2	Marina Pontoons & Berthing Booms	0.48m
3	Piling and Support	0.12m
	Total (excl. VAT)	**€1.77M ±5%**

The costs presented in Table 11.2 are based on current estimated rates provided to RPS by Marinetek Group who are considered leaders in the manufacturing and installation of marinas and floating breakwater solutions. This cost estimate included the provision of the fundamental marina elements, but does not include the cost of parking, lighting, landside facilities or professional services. RPS have assumed that the cost of these various elements have been accounted for by Wexford County Council in the terrestrial aspect of the Trinity Wharf development scheme.

It should be noted that the above costs are subject to detailed design and thus represent a budget estimate only.

12 CONCLUSION

RPS was commissioned by Wexford County Council to determine the feasibility of enhancing an area of reclaimed land at Trinity Wharf by developing a marina attached to the site which would act as a focal point for the rest of the development. To this end RPS undertook an extensive work programme that included:

- Fieldwork comprising hydrographic surveys, geophysical surveys, sediment sampling and analysis and tidal current survey;
- The development and initial assessment of a range of conceptual marina options;
- A range of numerical modelling simulations that investigated the potential impact of the shortlisted conceptual marina options on the existing coastal processes;
- Identification and refinement of the preferred conceptual marina option based on the results of the hydraulic modelling and consultation process to determine initial capital and maintenance costs for the proposed facility; and
- The production of detailed drawings for the preferred marina option and high level design information for the marine construction works along the boundary of the Trinity Wharf site.

Trinity Wharf has three distinct boundaries that protrude into the Wexford Harbour; these boundaries and corners were therefore considered the most logical locations to develop an attached marina facility. Based on data recorded during the various site surveys and monitoring programmes together with the Coastal team's knowledge of marina design and operations, it was determined that any proposed marina facility would require either floating or fixed breakwaters to create a sheltered wave climate.

A series of conceptual layouts were developed for the Trinity Wharf site. An initial assessment ruled out potential sites on either the north western side or south eastern side of Trinity Wharf due the significant capital dredging that would be required. Several options that involved developing the north eastern boundary or northern corner of Trinity Wharf were brought forward, these options included:

- **Option 2:** Constructing a series of floating breakwaters to create a sheltered marina area of 6,600m^2 on the northern corner. No dredging required;
- **Option 3:** Constructing a 320m fixed rubble mound breakwater to create a sheltered marina of approximately 16,000m^2 on the north eastern side with *c.* 6,500m^3 to be dredged.
- **Option 3a:** Constructing a series of floating breakwaters to create a sheltered marina area of 16,000m^2 on the north eastern side with *c.* 6,500m^3 to be dredged; or
- **Option 3b:** Reclaiming approximately 1,750m^2 of land (*c.*10m) to store dredge material and then constructing a series of floating breakwaters to create a slightly smaller marina area of 14,500m^2 on the north eastern side with *c.*6,500m^3 to be dredged.

Computational modelling techniques were used to assess and quantify the performance and potential impact of each of the shortlisted marina options on the existing wave climate, tidal regime and sediment transport regime. The results of computational modelling indicated that:

- The wave climate under existing conditions is considerably higher than the studies' acceptance threshold conditions which were based on guidelines published by the Yacht and Harbour Association and the Australian Standard (AS3962) '*Guidelines for the design of marinas'*.
- All Options successfully reduced the wave climate to within acceptable thresholds without resulting in any significant adverse impacts to the existing wave climate.
- The fixed breakwater proposed in Option 3 was found to modify current speeds within the immediate vicinity of the structure by ±75% depending of the phase of the tidal cycle.
- Options 2, 3a and 3b did not result in any significant adverse impacts to the existing tidal regime.
- There was only minor level of siltation in the proposed marina area under Option 2 following a high sediment load 7 day scenario indicating minimal future dredging requirements.

Based on this information Option 3 was ruled out of study. All of the remaining options were considered to technically feasible solutions if the potential environmental impacts associated with the dredging works for Options 3a and 3b were appropriately mitigated. However, following consultation and feedback with various stakeholder groups and Wexford County Council, Option 2 was identified as the preferred Option as it was nearest the Wexford town and fitted in with the Council's overall vision of the project and the redevelopment of the Trinity Wharf area.

Therefore, based on the experience of the coastal team, the findings of the numerical modelling programme and feedback from the consultation process, RPS propose the development of Option 2.

12.1 RECOMMENDATIONS

A proposed marina layout (Option 2) has been derived which achieves the objectives of the study, satisfies the explicit needs of Wexford Council and best meets the needs address the feedback from the consultation process. In brief the refined marina Option 2 includes the development of:

- An attached marina facility on the northern corner of Trinity Wharf constructed using industry standard modular pontoon and finger units to create *c.*61 berths.
- A series of high-end pre-fabricated 5 metre wide floating breakwaters with skirts tethered to the seabed to create a sheltered wave climate
- A suitably designed sloping revetment with a crest level of *c.*2.40m ODm and backed by a +1m parapet to create a final deck level of *c.*+3.40m to protect the boundary of the Trinity Wharf Development.

This option is particularly advantageous as no dredging will be required to achieve the minimum operating depth of -2.5m CD. Budget estimates of construction cost (excl. VAT) for the proposed Option 2 is *c*. €1.77M euros ±5%. This estimate does not include professional fees or the cost of developing landside facilities.

13 REFERENCES

Council Directive 2001/42/EC *on the Assessment of the Effects of Certain Plans and Programmes on the Environment*

Council Directive 92/43/EEC *on the Conservation of Natural Habitats and of Wild Fauna and Flora*

Council Directive 2009/147/EC *on the Conservation of Wild Birds*

Cronin, Margot, McGovern, Evin, McMahon, Terry and Boelens, Rick (2006) *Guidelines for the Assessment of Dredge Material for Disposal in Irish Waters.*

DEHLG (2009 –rev. 2010) *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*

EC (2000) *Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*

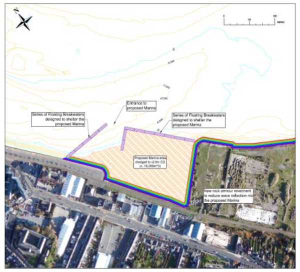
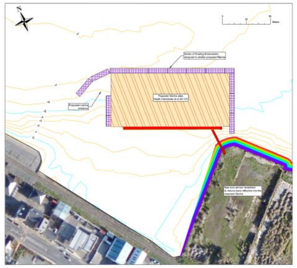
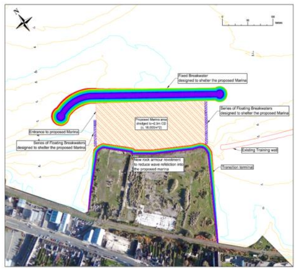
Inland Fisheries Ireland (2014) *Water Framework Directive Fish Stock Survey of Transitional Waters in the South Eastern River Basin District – Slaney Estuary and North Slob Channels 2014*

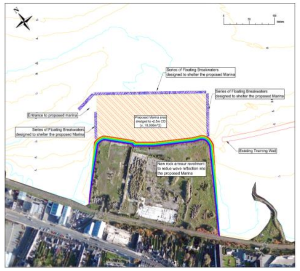
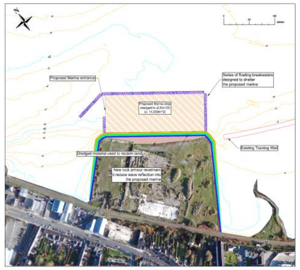
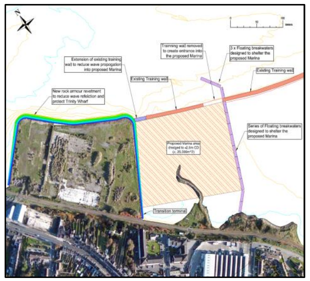
SERBD (2016). *The River Basin Management Plan for the South Eastern River Basin District (2009 – 2015)..*

RPS (2017). *South Eastern CFRAM Study*: *IBE0601 HA 11, 12 & 13 Hydraulics Report.*

APPENDIX A

HIGH LEVEL SCORING MATRIX

Option	Layout	Marina Area and Approximate Capacity	Dredging Requirements / Initial Capital Works	Option Brought Forward after High Level Assessment?	Numerical Modelling Assessment (i.e. Coastal Processes)	Pros	Cons	Indicative cost
Option 1	 Floating Breakwater, NW Boundary	Area = 16,000m^2 Capacity = *c.* 70 berths	Dredge and disposal of *c.* 40,000m3 of potentially contaminated material	No	NA (Ruled out during High Level Assessment and therefore not modelled)	Close to Wexford Town Does not impinge on existing navigation channel	Significant Dredging requirements of potentially contaminated material Area prone to accretion of sediment from Slaney River Likely to require future maintenance dredging programme	NA (Ruled out during High Level Assessment and therefore not costed)
Option 2	 Floating Breakwater, N Corner	Area = 6,600m^2 Capacity = *c.* 60 berths	No dredging required based on existing bathymetric and final marina configuration	Yes	<u>Wave Climate</u> Normal Operating Conditions and 1 in 50 year Design Conditions meet with floating breakwaters *in situ* <u>Tidal Regime</u> Virtually no detectable impact <u>Sediment Transport</u> Siltation levels in proposed marina does not exceed 0.005m following a 7 day "high sediment load" scenario. No future maintenance dredging expected	Close to Wexford Town No Dredging Requirements Minimal impingement on existing navigation channel	Slightly reduced marina capacity compared to Options 3, 3a and 3b	€1.77M ±5%
Option 3	 Fixed Breakwater, NE Boundary	Area = 18,000m^2 Capacity = *c.* 100 berths	Dredge and disposal of *c.* 6,500m3 of material Significant capital works required to construct rubble mound breakwater	Yes	<u>Wave Climate</u> Normal Operating Conditions and 1 in 50 year Design Conditions meet with fixed breakwater *in situ* <u>Tidal Regime</u> Current flows changed by up to ±75% depending on phase. <u>Sediment Transport</u> Option ruled out before ST modelling	Large and substantial marina area with high berthing capacity	Significant capital works required to construct rubble mound break water Adverse impact on existing coastal processes thus potential to impact nearby environmentally designated sites	NA (Ruled out after numerical modelling and therefore not costed)

Option 3a	 Floating Breakwater, NE Boundary	Area = 18,000m^2 Capacity = *c.* 100 berths	Dredge and disposal of *c.* 6,500m3 of material	Yes	<u>Wave Climate</u> Normal Operating Conditions and 1 in 50 year Design Conditions meet with floating breakwaters *in situ* <u>Tidal Regime</u> Very localised but insignificant impact at edge of sloping revetment. <u>Sediment Transport</u> Based on modelling of Option 2, insignificant levels of deposition (<0.005m) after 7 days. Channel "self cleansing".	Large and substantial marina area with high berthing capacity	Minor dredging works required. Disposal of dredged sediment	€2.5M ±5%
Option 3b	 Floating Breakwater, Land Rec. NE Boundary	Area = 14,000m^2 Capacity = *c.* 100 berths	Reclamation of c. 1,750m2 of land Dredging of *c.* 6,500m3 of sediment material. Potential to store treated dredge material in reclaimed area	Yes	<u>Wave Climate</u> Normal Operating Conditions and 1 in 50 year Design Conditions meet with floating breakwaters *in situ* <u>Tidal Regime</u> Very localised but insignificant impact at edge of sloping revetment. <u>Sediment Transport</u> Based on modelling of Option 2, insignificant levels of deposition (<0.005m) after 7 days. Channel "self cleansing".	Large and substantial marina area with high berthing capacity Area of Trinity Wharf development increased with land reclamation Disposal of dredge material in land reclaim area	Capital Works associated with the reclamation of land Minor dredging works required.	€2.62M ±5%
Option 4	 Floating Breakwater, Land Rec. SE Boundary	Area = 25,000m^2 Capacity = *c.* 40 berths	Significant amount of capital work required including the partial demolition of existing training wall Dredge and disposal of 25,000m3 of sediment material.	No	NA (Ruled out during High Level Assessment and therefore not modelled)	Virtually no impact on existing navigation channel to Wexford Harbour	Significant Dredging requirements Impact existing operations at Good-tide harbour	NA (Ruled out during High Level Assessment and therefore not modelled)

APPENDIX B

MODEL CALIBRATION

B1 MODEL CALIBRATION

The hydrodynamic model detailed in Section 6 was verified using two different datasets which are described below:

1. **Moored Acoustic Doppler Current Profilers (ADCPs)** - Two ADCPs (CM1 andCM2) were moored on the downstream side of the approach channel to Wexford Harbour in March 2016 as part of a hydrographic survey that was undertaken by Hydrographic Surveys Limited.

2. **Tidal Stream data issued by the United Kingdom Hydrographic Office (UKHO)** - The Admiralty Chart for Wexford Harbour (chart no. 1772) details one tidal stream in close proximity to the entrance of Rosslare Harbour. Tidal stream data detailed by the UKHO provides a reasonably estimation of the current direction and velocities six hours before and after High Water (HW). By validating the Trinity Wharf model against this tidal stream it is possible to ensure that the model is perform well through the entire domain and therefore also in Wexford Bay at Trinity Wharf[2].

The location of the two ADCP current meters and the position of the tidal stream in relation to Wexford Bay and Trinity Wharf is illustrated in Figure B1.1 overleaf.

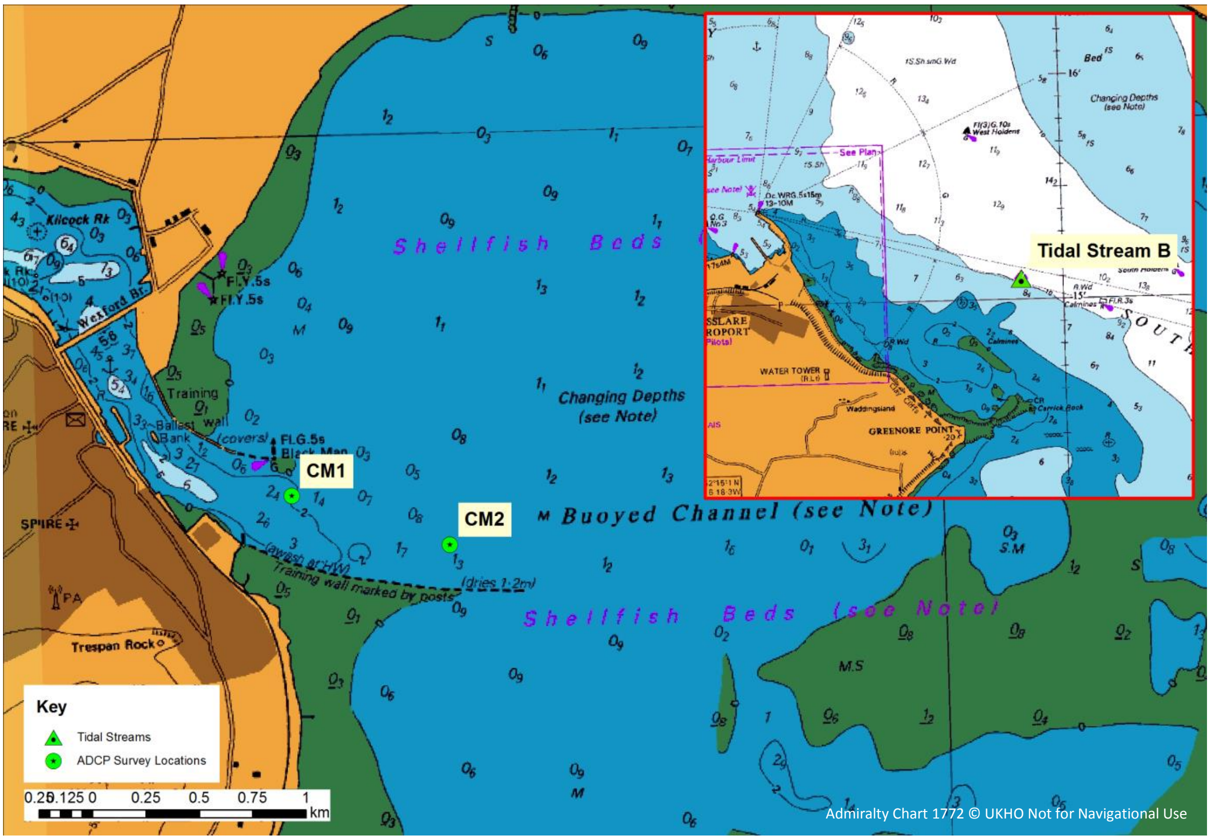


Figure B1.1: Location of the two ADCP meters and one tidal stream (inlay) in relation to Wexford Bay and Rosslare Harbour (inlay)

[2] It should be noted that the data reported by the Admiralty charts is historical data and therefore may not entirely reflect current conditions which are affected by the morphology of the sea bed in the area

B1.1 Model calibration using recorded ADCP data

The model calibration process focused on ensuring that the tidal currents and directions that were recorded by the ADCP devices detailed in Chapter 2 were adequately simulated within the model. The ADCP profilers were set up to record in 0.5 metre bins. Current velocities at various depths corresponding to bottom, mid or sub surface currents were extracted from the data recorded by the instruments and compared against model simulation results at equivalent depths. These actual depths from the sea bed are shown in Table B1.1.

As part of the calibration process, various refinements and adjustments were made to the mesh and boundary conditions of the model until RPS were satisfied that the model predictions were sufficiently accurate to be considered representative of the observed tidal conditions.

Table B1.1: Distance from sea bed in metres at CM1 and CM2 for sub surface, mid depth and bottom measurements.

Layer	CM1	CM2
Sub Surface	2.75 m	2.25 m
Mid Depth	1.50 m	1.25m
Bottom	0.25 m	0.25 m
Total Water Depth (MSL)	*c.* 2.95 m	*c.* 2.60 m

Figure B1.2 and Figure B1.3 below illustrate the comparison between the measured data and the modelled data at the inner and outer survey stations, i.e. at CM1 and CM2 respectively. It will be seen from these figures that local prevailing weather conditions contributed to "noisy" data being observed in the sub surface layer of the water column. Despite these minor fluctuations, it was found that the model accurately simulated the current directions and velocities during the specified period.

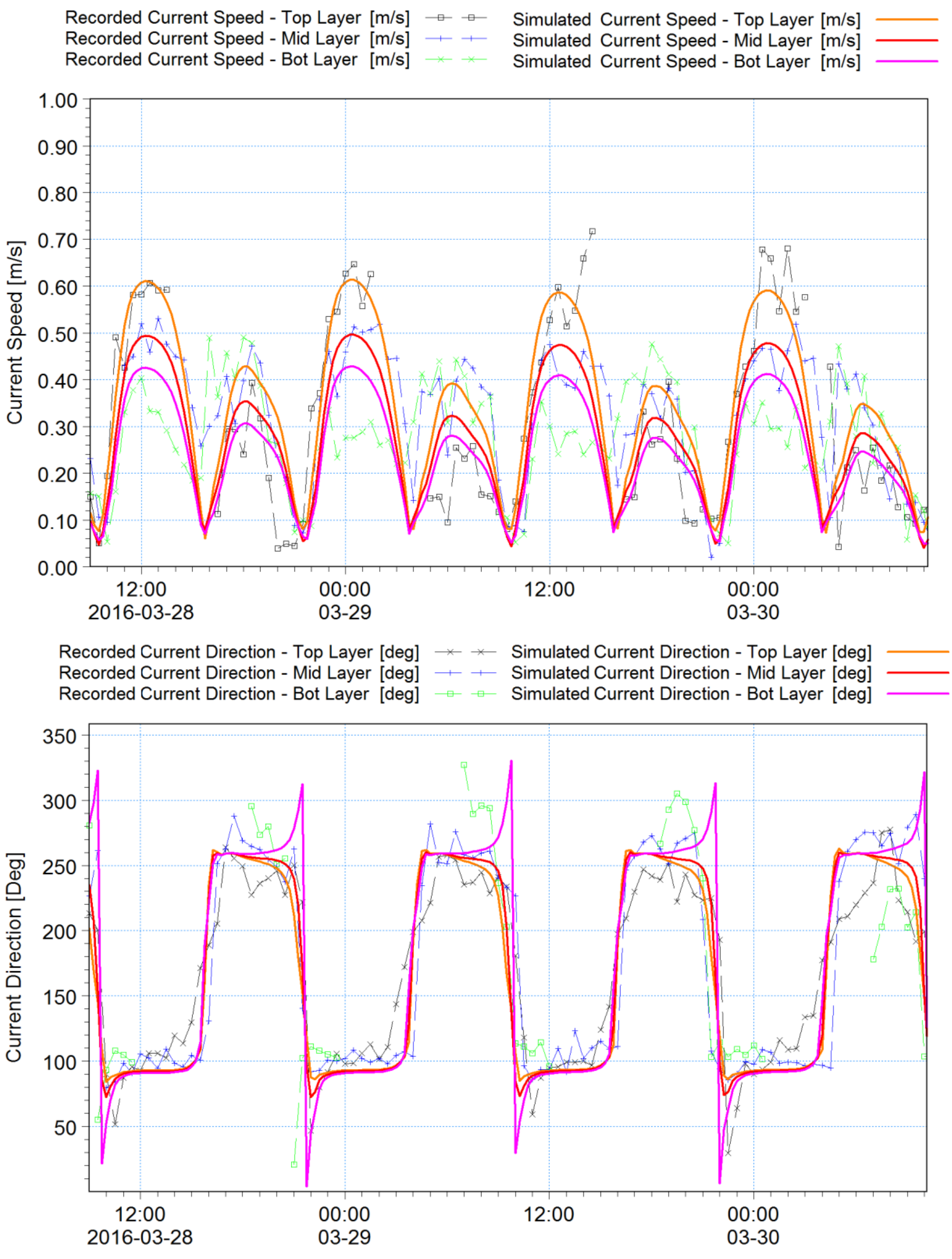


Figure B1.2: Comparison of modelled and observed spring current speed (above) and current direction (below) at survey station CM1.

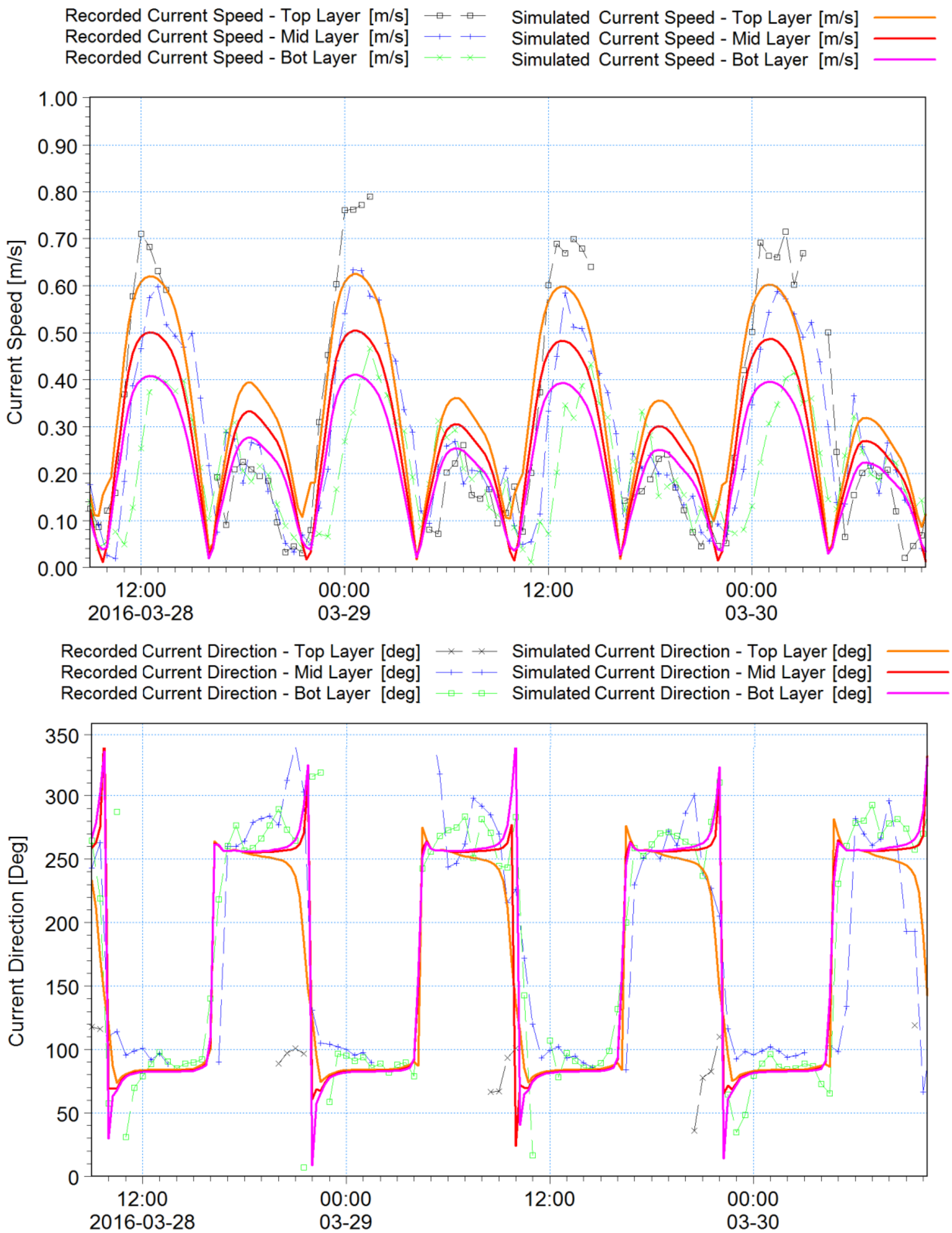


Figure B1.3: Comparison of modelled and observed spring current speed (above) and current direction (below) at survey station CM2.

B1.2 Model calibration using Tidal Stream data

Figure B1.4 below illustrates the modelled current speeds and directions compared with the recorded data at the tidal diamond B during typical spring tidal conditions. It will be seen from this figure that the model accurately represents the tidal asymmetry and that the current speeds are of the right order of magnitude. It may be noted that the depth averaged modelled current speed and velocities are not completely identical, this can attributed to the following main reasons:

1. The numerical model was not refined to provide detailed information in the Rosslare area.
2. Tidal stream information is based on historical data and may not entirely reflect current conditions which are affected by the morphology of the sea bed in the area.

Despite these factors, this calibration procedure demonstrated that the Trinity Wharf model provides a good representation of tidal flow patterns over the entire model area.

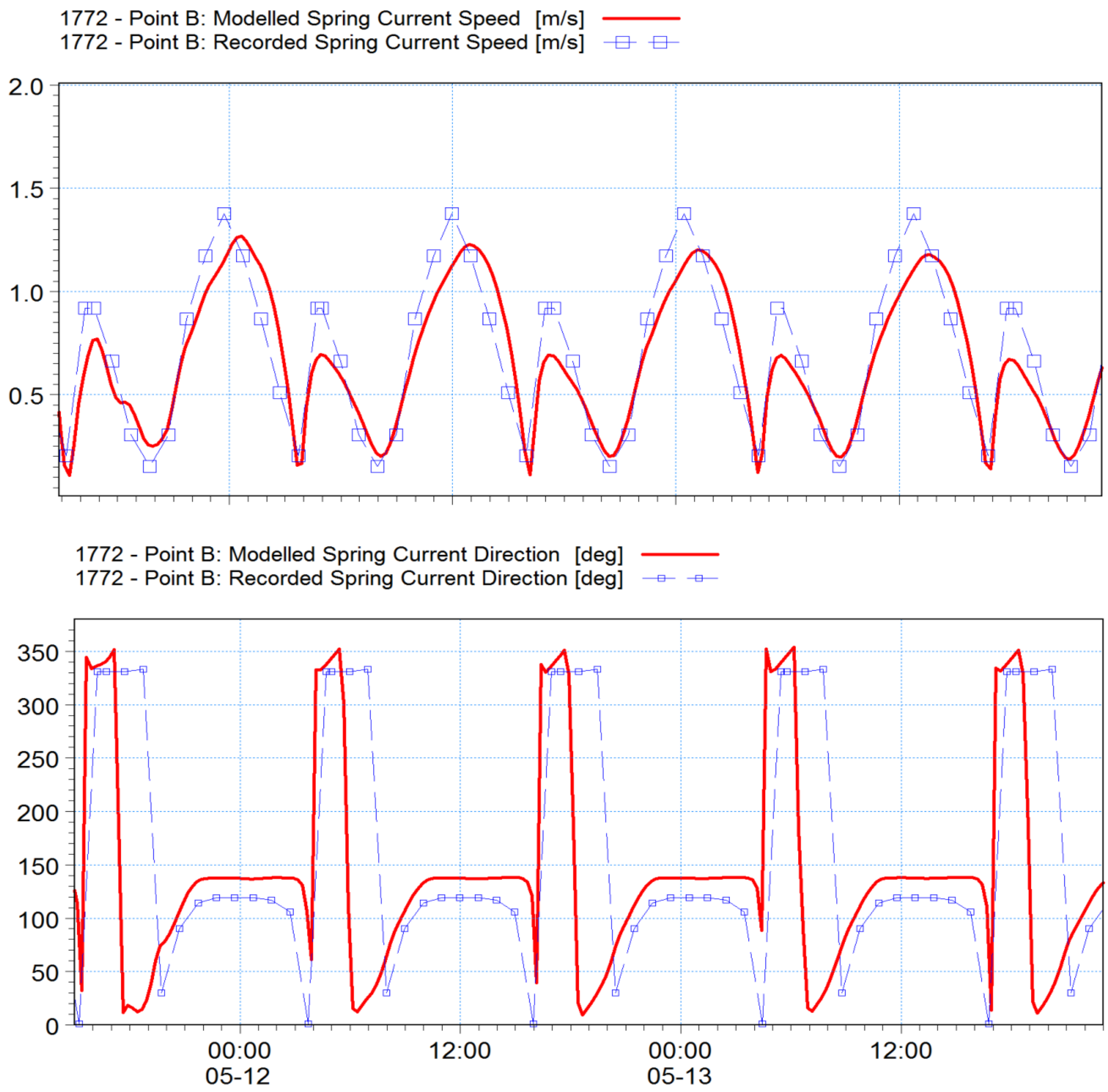


Figure B1.4: Modelled and recorded current speeds (upper figure) and directions (lower figure) at Tidal Stream 1772 B during typical spring tide conditions.

APPENDIX C

PRELIMINARY SCREENING OF NEARBY EUROPEAN SITES

Preliminary Screening summary for European Sites

Name: Blackwater Bank SAC	**Site Code: (IE002953)**
Qualifying Interest(s)	**Annex I Habitats:** Sandbanks which are slightly covered by sea water all the time [1110].
Proximity to AFA(s) and Linkage	The Blackwater Bank SAC consists of a series of offshore sandbanks running roughly parallel to the coastline of Co. Wexford. The total area of this site is approximately 12,407 ha. This designation includes the Lucifer Bank, Blackwater Bank and Moneyweights Bank. These features are at the southern end of a series of offshore sandbanks that run along the eastern seaboard of Ireland as far north as Co. Dublin. The site is of conservation importance for its submerged sandbanks, a habitat that is listed on Annex I of the E.U. Habitats Directive. Blackwater Bank SAC is 12.8 linear kilometres from the development site at Trinity Wharf. It is outside Wexford Harbour, in the open waters of St George's Channel. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interests of Lady's Island Lake SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina, or coastal engineering works at Trinity Wharf and the qualifying interests of Blackwater Bank SAC. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Carnsore Point SAC	**Site Code: (IE002269)**
Qualifying Interest(s)	**Annex I Habitats:** Mudflats and sandflats not covered by seawater at low tide [1140] and Reefs [1170].
Proximity to AFA(s) and Linkage	Carnsore Point SAC comprises the area of sea and underlying bedrock and sediments off Carnsore Point. It includes rocky reefs that are strewn with boulders, cobbles and patches of sand, both on the shore and underwater. The site is of considerable conservation significance for the presence of intertidal mud and sandflats, as well as reefs, all habitats that are listed on Annex I of the E.U. Habitats Directive Carnsore Point SAC is 12.6 linear kilometres from the development site at Trinity Wharf, however the distance by sea is around 14km. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interest of Carnsore Point SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina, or coastal engineering works at Trinity Wharf and the qualifying interest of Carnsore Point SAC. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Lady's Island Lake SAC	**Site Code: (IE000704)**
Qualifying Interest(s)	**Annex I Habitats:** Coastal lagoons [1150], Perennial vegetation of stony banks [1220] and Reefs [1170].
Proximity to AFA(s) and Linkage	Lady's Island Lake SAC is comprised of a shallow, brackish coastal lagoon separated from the sea by a sand and shingle barrier. The site includes the intertidal reef of Carnsore Point, and the area of reef to the west of the point. Lady's Island Lake SAC is 13.5 linear kilometres from the development site at Trinity Wharf; however the distance by sea is over 25km. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any

	engineering works required to secure the boundary of the site, and the qualifying interests of Lady's Island Lake SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina or coastal engineering works at Trinity Wharf and the qualifying interests of Lady's Island Lake SAC. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Lady's Island Lake SPA	**Site Code: (IE004009)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Gadwall (*Anas strepera*) [A051], Black-headed Gull (*Chroicocephalus ridibundus*) [A179], Sandwich Tern (*Sterna sandvicensis*) [A191], Roseate Tern (*Sterna dougallii*) [A192], Common Tern (*Sterna hirundo*) [A193], Arctic Tern (*Sterna paradisaea*) [A194] and Wetland and Waterbirds [A999] habitat.
Proximity to AFA(s) and Linkage	Lady's Island Lake SPA, comprises a lagoon habitat which is regarded as an excellent example of a sedimentary lagoon with a sand/shingle barrier. It is by far the largest and best example of this type of lagoon in the country. Lady's Island Lake SPA is 13.5 linear kilometres from the development site at Trinity Wharf; however the distance by sea is over 25km. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interests of Lady's Island Lake SPA.
Potential Impacts	**There is no potential impact pathway between the development of a marina or coastal engineering works at Trinity Wharf and the qualifying interests of Lady's Island Lake SPA. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Long Bank SAC	**Site Code: (IE002161)**
Qualifying Interest(s)	**Annex I Habitats:** Sandbanks which are slightly covered by sea water all the time [1110].
Proximity to AFA(s) and Linkage	The Long Bank SAC incorporates Long Bank and Holdens Bed which are offshore sandbanks located several kilometres to the east of Rosslare and Wexford Harbour. Offshore sandbanks are generally constructed of sediment that ranges from cobbles to coarse sand, and the sand is duned in large waves at least a meter in height and several meters in width. Where the current is strong the surface fauna is typically very sparsely scattered, with, for example,occasional starfish, crabs or hermit crabs. These banks, however, frequently have a distinctive meiofauna living within them and can be important feeding grounds for birds.This site is of conservation importance for its submerged sandbanks, a habitat that islisted on Annex I of the E.U. Habitats Directive. Long Bank SAC is 10.5 linear kilometres from the development site at Trinity Wharf and is in open water outside Wexford Bay. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interest of Long Bank SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina or coastal engineering works at Trinity Wharf and the qualifying interest of Long Bank SAC. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Raven Point Nature Reserve SAC	Site Code: (IE000710)
Qualifying Interest(s)	**Annex I Habitats:** Embryonic shifting dunes [2110], Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120], Dunes with Salix repens ssp.argentea (*Salix arenariae*) [2170], Annual vegetation of drift lines [1210], Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130], Humid dune slacks [2190], Mudflats and sandflats not covered by seawater at low tide [1140] and Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330].
Proximity to AFA(s) and Linkage	The Raven is situated on the north side of Wexford Harbour, incorporating the dynamic sand system of Raven Point and the coast running north to Curracloe House. The site is designated as a National Nature Reserve. The site incorporates a large sand dune system comprising a suite of coastal habitats which are listed on Annex I of the E.U. Habitats Directive. The dynamic nature of the system is best seen at the southern end of the site where sandflats, lagoons, drift lines and small dune slacks develop and are being continuously transformed by the activity of the sea and the wind. There has been heavy erosion along the eastern side of the site in recent years, but the sand dune system on the south-western end of the Raven is accreting, building towards the west along the wall which is the southern boundary of the Wexford Slobs, at about 3 m per year. The Raven Point Nature Reserve is an excellent example of a dynamic dune system that contains a suite of coastal habitats listed on Annex I of the E.U. Habitats Directive. It also provides a roosting site for an internationally important flock of Greenland White-fronted Goose, a species listed on Annex I of the E.U. Birds Directive. Further, it supports many uncommon species of plant and animal. Overall, this is a site of considerable conservation significance. The boundary of Raven Point Nature Reserve SAC is approximately 4.6km from Trinity Wharf. Due to the proximity of the European site to the site of the proposed development, there exists the potential for impact pathways via surface water. Further study is required to assess whether the pathway has the potential for significant impacts to the qualifying interests.
Potential Impacts	**A potential surface water pathway exists between the proposed development site at Trinity Wharf and the qualifying interests of Raven Point Nature Reserve SAC. A Stage 1 Screening for Appropriate Assessment is required to determine whether there exists the potential for significant impacts on the qualifying interests of this site.**

Name: Screen Hills SAC	Site Code: (IE000708)
Qualifying Interest(s)	**Annex I Habitats:** European dry heaths [4030], Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110].
Proximity to AFA(s) and Linkage	The Screen Hills SAC is characterised by a type of glacial landscape known as “kettle and kame”, a term which refers to kettlehole lakes found in hollows between small hills. The lakes, which are mostly small, mark the positions of former ice blocks in an acidic, sandy moraine. The Screen Hills contain important examples of two habitats listed on Annex I of the E.U. Habitats Directive, with the heath area being particularly unusual. The area is very important as a good example of a “kettle and kame” glacial landscape. The presence of several Red Data Book plant species adds further importance to this site. The boundary of Screen Hills SAC is 7.7km from the development site at Trinity Wharf. However the SAC is a terrestrial site with no connectivity to the marine environment. There is therefore not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interest of Screen Hills SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina or coastal engineering works at Trinity Wharf and the qualifying interest of Screen Hills SAC. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: Slaney River Valley SAC	Site Code: (IE000781)

Qualifying Interest(s)	**Annex I Habitats:** Estuaries [1130], Mudflats and sandflats not covered by seawater at low tide [1140], Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260], Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae*, *Salicion albae*) [91E0], Old sessile oak woods with *Ilex* and *Blechnum* in British Isles [91A0]. **Annex II Species:** *Lampetra fluviatilis* (River Lamprey) [1099], *Lampetra planeri* (Brook Lamprey) [1096], *Petromyzon marinus* (Sea Lamprey) [1095], *Salmo salar* (Salmon) [1106], *Margaritifera margaritifera* (Freshwater Pearl Muscle) [1029], *Lutra lutra* (Otter) [1355], *Phoca vitulina* (Common Seal) [1365], *Alosa fallax* (Twaite Shad) [1103].
Proximity to AFA(s) and Linkage	This SAC comprises the freshwater stretches of the River Slaney as far as the Wicklow Mountains and a number of tributaries, in addition to the estuary at Ferrycarrig and Wexford Harbour. The site supports populations of several species listed on Annex II of the E.U. Habitats Directive, and habitats listed on Annex I of this Directive, as well as important numbers of wintering wildfowl including some species listed on Annex I of the E.U. Birds Directive. The presence of wet and broadleaved woodlands increases the overall habitat diversity and the occurrence of a number of Red Data Book plant and animal species adds further importance to the site. Overall it is of considerable conservation significance. The Slaney River Valley SAC is immediately adjacent to the proposed development area at Trinity Wharf and surrounds it on all sides. The footprint of any of the proposed marina options would be within the SAC, as would any marine engineering works to secure the perimeter of the site. There are potential impact pathways to the SAC qualifying interests via surface water, land and air and groundwater pathways.
Potential Impacts	**Potential surface water, land and air and groundwater pathways exist between the proposed development site at Trinity Wharf and the qualifying interests of Slaney River Valley SAC. A Stage 1 Screening for Appropriate Assessment is required to determine whether there exists the potential for significant impacts on the qualifying interests of this site. It is likely that a Stage 2 Appropriate Assessment will be required for this site to determine the significance of any potential impacts.**

Name: Tacumshin Lake SAC	**Site Code: (IE00000709)**
Qualifying Interest(s)	**Annex I Habitats:** Coastal lagoons [1150], Annual vegetation of drift lines [1210], Perennial vegetation of stony banks [1220], Embryonic shifting dunes [2110] and Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120].
Proximity to AFA(s) and Linkage	Tacumshin Lake is a shallow coastal lagoon (formerly a shallow sea bay) which over time has been separated from the sea by a gravel/sand spit that has extended across the mouth of the bay from east to west, due to long-shore drift. The site is of particular conservation significance for its lagoon, which is an excellent example of a sedimentary lagoon with a gravel/sand barrier. It is also one of the largest in the country. The lagoon supports a wide variety of plants and animals, including many lagoonal specialist species. This habitat, which is both threatened and declining throughout Europe, is listed on Annex I of the E.U. Habitats Directive with priority status. Good examples of four other habitats that are listed on Annex I of this Directive occur within the site, i.e. drift lines, perennial vegetation of stony banks, embryonic shifting dunes and Marram dunes. Tacumshin Lake is also an important ornithological site and has been designated a Special Protection Area under the E.U. Birds Directive. It is nationally important for nine bird species, especially Gadwall and Pintail. The presence of a number of rare or scarce plant species adds additional interest to the site. Tacumshin Lake SAC is located on the south coast. It is 13.3 linear kilometres from the development site at Trinity Wharf; however the distance by sea is around 30km, around Rosslare Point and Carnsore Point. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interests of Tacumshin Lake SAC.
Potential Impacts	**There is no potential impact pathway between the development of a marina, or coastal engineering works at Trinity Wharf and the qualifying interests of Tacumshin Lake SAC.**

	Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.

Name: Tacumshin Lake SPA	**Site Code: (IE00004092)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Little Grebe (*Tachybaptus ruficollis*) [A004], Bewick's Swan (*Cygnus columbianus bewickii*) [A037], Whooper Swan (*Cygnus cygnus*) [A038], Wigeon (*Anas penelope*) [A050], Gadwall (*Anas strepera*) [A051], Teal (*Anas crecca*) [A052], Pintail (*Anas acuta*) [A054], Shoveler (*Anas clypeata*) [A056], Tufted Duck (*Aythya fuligula*) [A061], Coot (*Fulica atra*) [A125], Golden Plover (*Pluvialis apricaria*) [A140], Grey Plover (*Pluvialis squatarola*) [A141], Lapwing (*Vanellus vanellus*) [A142], Black-tailed Godwit (*Limosa limosa*) [A156] and Wetland and Waterbirds [A999].
Proximity to AFA(s) and Linkage	Tacumshin Lake is a shallow coastal lagoon situated on the south Co. Wexford coast. The waterfowl population of the lagoon is exceptionally diverse and the area supports large numbers of birds through the whole year, which is unusual among Irish wetlands. Tacumshin Lake SPA is one of the most important ornithological sites in the country. The occurrence of internationally important populations of Whooper Swan and Bewick's Swan is of especial note, as is the presence of nationally important populations of an additional 13 wintering waterfowl species. It is one of the top sites in the country for species such as Pintail and Gadwall. It is also of importance for its summer visitors, including such rare and localised species as Marsh Harrier, Garganey and Reed Warbler. The site is also notable for a range of passage waders. Also of note is that a number of the species that occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Bewick's Swan, Golden Plover, Ruff, Wood Sandpiper and Marsh Harrier. Greenland White-fronted Goose which uses the site on occasions is also listed on Annex I of this directive. Tacumshin Lake SPA is located on the south coast. It is 13.5 linear kilometres from the development site at Trinity Wharf; however the distance by sea is around 30km, around Rosslare Point and Carnsore Point. Due to the distances involved, across open coastal waters, there is not considered to be any potential impact pathway via surface water, land and air, or groundwater pathways between the proposed marina at Trinity Wharf or any engineering works required to secure the boundary of the site, and the qualifying interests of Tacumshin Lake SPA.
Potential Impacts	**There is no potential impact pathway between the development of a marina, or coastal engineering works at Trinity Wharf and the qualifying interests of Tacumshin Lake SPA. Consequently this site may be eligible to be screened out from requiring Appropriate Assessment.**

Name: The Raven SPA	**Site Code: (IE004019)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Red-throated Diver (*Gavia stellata*) [A001], Cormorant (*Phalacrocorax carbo*) [A017], Common Scoter (*Melanitta nigra*) [A065], Grey Plover (*Pluvialis squatarola*) [A141], Sanderling (*Calidris alba*) [A144], Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395], Wetland and Waterbirds [A999].
Proximity to AFA(s) and Linkage	The Raven SPA is dynamic sand dune system where sand flats, lagoons, driftlines and small dune slacks develop and are being continuously transformed by the activity of the sea and the wind. This site is of international ornithological importance as it provides crucial roosting habitat for the Wexford Harbour flock of Greenland White-fronted Geese. The site also provides habitat for a range of other species, including six which have populations of National Importance; the Raven is probably the most regular site in the country for Slavonian Grebe. Of particular significance is that six of the wintering species are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Great Northern Diver, Slavonian Grebe, Golden Plover, Bar-tailed Godwit and Greenland White-fronted Goose. Little Tern, a species breeding in the site, is also listed on Annex I of this directive. Owing to the recognised importance of the area, Raven Point is a statutory Nature Reserve and a Ramsar site. The boundary of the Raven SPA is approximately 4.7km from Trinity Wharf. Due to the proximity of the European site to the site of the proposed development, there exists the

	potential for impact pathways on the qualifying interests via surface water and air. Further study is required to assess whether the pathway has the potential for significant impacts to the qualifying interests.
Potential Impacts	**A potential surface water pathway exists between the proposed development site at Trinity Wharf and the qualifying interests of the Raven SPA. A Stage 1 Screening for Appropriate Assessment is required to determine whether there exists the potential for significant impacts on the qualifying interests of this site.**

Name: Wexford Harbour and Slobs SPA	**Site Code: (IE004076)**
Qualifying Interest(s)	**Species of Special Conservation Interest:** Little Grebe (*Tachybaptus ruficollis*) [A004], Great Crested Grebe (*Podiceps cristatus*) [A005], Cormorant (*Phalacrocorax carbo*) [A017], Grey Heron (*Ardea cinerea*) [A028], Bewick's Swan (*Cygnus columbianus bewickii*) [A037], Whooper Swan (*Cygnus cygnus*) [A038], Light-bellied Brent Goose (*Branta bernicla hrota*) [A046], Shelduck (*Tadorna tadorna*) [A048], Wigeon (*Anas penelope*) [A050], Teal (*Anas crecca*) [A052], Mallard (*Anas platyrhynchos*) [A053], Pintail (*Anas acuta*) [A054], Scaup (*Aythya marila*) [A062], Goldeneye (*Bucephala clangula*) [A067], Red-breasted Merganser (*Mergus serrator*) [A069], Hen Harrier (*Circus cyaneus*) [A082], Coot (*Fulica atra*) [A125], Oystercatcher (*Haematopus ostralegus*) [A130], Golden Plover (*Pluvialis apricaria*) [A140], Grey Plover (*Pluvialis squatarola*) [A141], Lapwing (*Vanellus vanellus*) [A142], Knot (*Calidris canutus*) [A143], Sanderling (*Calidris alba*) [A144], Dunlin (*Calidris alpina*) [A149], Black-tailed Godwit (*Limosa limosa*) [A156], Bar-tailed Godwit (*Limosa lapponica*) [A157], Curlew (*Numenius arquata*) [A160], Redshank (*Tringa totanus*) [A162], Black-headed Gull (*Chroicocephalus ridibundus*) [A179], Lesser Black-backed Gull (*Larus fuscus*) [A183], Little Tern (*Sterna albifrons*) [A195], Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395], Wetland and Waterbirds [A999].
Proximity to AFA(s) and Linkage	Wexford Harbour is the lowermost part of the estuary of the River Slaney. The site is divided between the natural estuarine habitats of Wexford Harbour, the reclaimed polders known as the North and South 'Slobs', and the tidal section of the River Slaney. Wexford Harbour and Slobs SPA is one of the most important ornithological sites in the country. It is of world importance for Greenland White-fronted Goose, and supports internationally important populations of a further four species (Mute Swan, Light-bellied Brent Goose, Black-tailed Godwit and Bar-tailed Godwit). In addition, it has 25 species of wintering waterbirds with populations of national importance. Also of significance is that several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Little Egret, Whooper Swan, Bewick's Swan, Greenland White-fronted Goose, Hen Harrier, Golden Plover, Bar-tailed Godwit, Ruff, Wood Sandpiper, Little Tern and Short-eared Owl. The site is an important centre for research, education and tourism. Wexford Harbour and Slobs SPA is immediately adjacent to the south eastern boundary of the proposed development area at Trinity Wharf. Therefore marina options and marine engineering works on this side of Trinity Wharf would occur inside the boundary of the designated area. The designation boundary avoids the navigation channel and so is not immediately adjacent to the north western or north eastern sides of Trinity Wharf. The footprint of the marina options and marine engineering works on either of these sides would therefore not be within the designated area. Due to the proximity of the European site to the development area, there are potential impact pathways to the SAC qualifying interests via surface water, land and air and groundwater pathways.
Potential Impacts	**Potential surface water, land and air and groundwater pathways exist between the proposed development site at Trinity Wharf and the qualifying interests of Wexford Harbour and Slobs SPA. A Stage 1 Screening for Appropriate Assessment is required to determine whether there exists the potential for significant impacts on the qualifying interests of this site. It is likely that a Stage 2 Appropriate Assessment will be required for this site to determine the significance of any potential impacts.**

APPENDIX D

SCREENED-IN EUROPEAN SITES - SUMMARY OF QUALIFYING INTERESTS AND CONSERVATION OBJECTIVES

Site Name and Code	Qualifying interests	Key environmental conditions supporting site integrity	Conservation Objectives	Water-dependent
Slaney River Valley SAC (000781)	Freshwater Pearl Mussel *Margaritifera margaritifera* [1029]	Riverine habitat. Water quality (Q5). Riverbed breeding gravels. Unhindered migratory routes for salmon.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Population** – maintaining itself on a long-term basis as a viable component of its natural habitat. **Range** – neither being reduced nor likely to be reduced for the foreseeable future. **Habitat** – there is, and will probably continue to be, a sufficiently large habitat to maintain populations on a long-term basis.	Yes
	Sea Lamprey *Petromyzon marinus* [1095]	Riverine habitat. Water quality. Riverbed breeding gravels and silt nursery substrate. Unhindered migratory channels.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Distribution: extent of anadromy –** Greater than 75% of main stem length of rivers accessible from estuary. **Population structure of juveniles –** At least three age/size groups present. **Juvenile density in fine sediment –** Juvenile density at least 1/m². **Extent and distribution of spawning habitat** - No decline in extent and distribution of spawning beds. Improved dispersal of spawning beds into areas upstream of barriers. **Availability of juvenile habitat** - More than 50% of sample sites positive.	

	Brook Lamprey *Lampetra planeri* [1096]	Riverine habitat. Water quality. Riverbed breeding gravels and silt nursery substrate. Unhindered migratory channels.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Distribution** - Access to all water courses down to first order streams. **Population structure of juveniles** - At least three age/size groups of brook/river lamprey present. **Juvenile density in fine sediment** - Mean catchment juvenile density of brook/river lamprey at least $2/m^2$. **Extent and distribution of spawning habitat** - No decline in extent and distribution of spawning beds. **Availability of juvenile habitat** - More than 50% of sample sites positive.	
	River Lamprey *Lampetra fluviatilis* [1099]	Riverine habitat. Water quality. Riverbed breeding gravels and silt nursery substrate. Unhindered migratory channels.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Distribution: extent of anadromy** - Greater than 75% of main stem and major tributaries down to second order accessible from estuary. **Population structure of juveniles** - At least three age/size groups of river/brook lamprey present. **Juvenile density in fine sediment** - Mean catchment juvenile density of brook/river lamprey at least $2/m^2$. **Extent and distribution of spawning habitat** - No decline in extent and distribution of spawning beds. **Availability of juvenile habitat** - More than 50% of sample sites positive.	
	Twaite Shad *Alosa fallax* [1103]	Riverine habitat. Water quality. Riverbed breeding gravels. Unhindered migratory routes	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Distribution: extent of anadromy** - Greater than 75% of main stem length of rivers accessible from estuary. **Population structure- age classes** - More than one age class present.	

			<u>Extent and distribution of spawning habitat</u> - No decline in extent and distribution of spawning habitats. **<u>Water quality - oxygen levels</u>** - No lower than 5mg/l. **<u>Spawning habitat quality: Filamentous algae; macrophytes; sediment</u>** - Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth.	
	Atlantic Salmon *Salmo salar* [1106]	Riverine habitat. Water quality (Q4-5). Riverbed breeding gravels. Quality riparian vegetation. Unhindered migratory routes	***Restore*** favourable conservation condition, defined by the following attributes and targets: **<u>Distribution: extent of anadromy</u>** - 100% of river channels down to second order accessible from estuary. **<u>Adult spawning fish</u>** - Conservation Limit (CL) for each system consistently exceeded. **<u>Salmon fry abundance</u>** - Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling. **<u>Out-migrating smolt abundance</u>** - No significant decline. **<u>Number and distribution of redds</u>** - No decline in number and distribution of spawning redds due to anthropogenic causes. **<u>Water quality -</u>** At least Q4 at all sites sampled by EPA.	
	Otter *Lutra lutra* [1355]	Prey availability. Water Quality. Riparian vegetation for breeding sites. Unhindered passage along waterways.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **<u>Distribution</u>** – No significant decline. **<u>Extent of terrestrial habitat</u>** - No significant decline. Area mapped and calculated as 64.7ha above high water mark (HWM); 453.4ha along river banks/ around ponds.	

			<u>**Extent of marine habitat**</u> - No significant decline. Area mapped and calculated as 534.7ha. <u>**Extent of freshwater (river) habitat**</u> - No significant decline. Length mapped and calculated as 264.1km. <u>**Extent of freshwater (lake/lagoon) habitat**</u> - No significant decline. Area mapped and calculated as 0.4ha. <u>**Couching sites and holts**</u> – No significant decline. <u>**Fish biomass available**</u> - No significant decline. <u>**Barriers to connectivity**</u> - No significant increase.	
	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation [3260]	Natural (relatively unmodified) flow regime. Water quality.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: <u>**Habitat distribution**</u> - No decline, subject to natural processes. <u>**Habitat area**</u> - Area stable at 12.6km or increasing, subject to natural processes. <u>**Hydrological regime: river flow**</u> - Maintain appropriate hydrological regimes. <u>**Hydrological regime: tidal influence**</u> - Maintain natural tidal regime. <u>**Substratum composition: particle size range**</u> - For the tidal sub-type, the substratum of the channel must be dominated by particles of sand to gravel, with silt at the river margins. <u>**Water quality: nutrients**</u> - The concentration of nutrients in the water column must be sufficiently low to prevent changes in species composition or habitat condition. <u>**Vegetation composition: typical species**</u> - Typical species of the relevant habitat sub-type reach favourable status. <u>**Floodplain connectivity: area**</u> - The area of active floodplain at and upstream of the habitat must be	

			maintained.	
	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]	Periodical fluvial inundation.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** - Area stable or increasing, subject to natural processes, at least 18.7ha for sites surveyed. **Habitat distribution** - No decline. **Woodland size** - Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and “small” woods at least 3ha in size. **Woodland structure: cover and height** - Diverse structure with a relatively closed canopy containing mature trees; sub-canopy layer with semi-mature trees and shrubs; and well-developed herb layer. **Woodland structure: community diversity and extent** - Maintain diversity and extent of community types. **Woodland structure: natural regeneration** - Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy. **Hydrological regime: Flooding depth/height of water table** - Appropriate hydrological regime necessary for maintenance of alluvial vegetation. **Woodland structure: dead wood** - At least $30m^3$/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder). **Woodland structure: veteran trees** - No decline. **Woodland structure: indicators of local disctinctiveness** - No decline. **Vegetation composition: native tree cover** - No decline. Native tree cover not less than 95%.	

			Vegetation composition: typical species - A variety of typical native species present, depending on woodland type, including alder (*Alnus glutinosa*), willows (*Salix* spp) and, locally, oak (*Quercus robur*) and ash (*Fraxinus excelsior*). **Vegetation composition: negative indicator species** - Negative indicator species, particularly non-native invasive species, absent or under control.	
Raven Point Nature Reserve SAC (000710)	Mudflats and sandflats not covered by seawater at low tide [1140]	Silt deposits in sheltered estuaries.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes. **Community distribution** – the following community types should be maintained in a natural condition: sand dominated by polychaetes community complex; estuarine muds dominated by polychaetes and crustaceans community complex.	Yes
	Annual vegetation of drift lines [1210]	Sandy substrate. Physical impact and nutrient supply from tidal flow.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Vegetation structure: zonation** – maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession. **Vegetation composition: typical species and sub-communities** – maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*),sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Orache (*Atriplex spp*.). **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover.	

	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Frequency of tidal submergence.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **<u>Habitat area</u>** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. **<u>Habitat distribution</u>** - no decline, subject to natural processes. **<u>Physical structure: sediment supply</u>** – maintain/restore natural circulation of sediments and organic matter, without any physical obstructions. **<u>Physical structure: creeks and pans</u>** – allow creek and pan structure to develop, subject to natural processes, including erosion and succession. **<u>Physical structure: flooding regime</u>** – maintain natural tidal regime. **<u>Vegetation structure: zonation</u>** - maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession. **<u>Vegetation structure: vegetation height</u>** – maintain structural variation within sward. **<u>Vegetation structure: vegetation cover</u>** – maintain >90% of the saltmarsh area vegetated. **<u>Vegetation composition: typical species and sub-communities</u>** – Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009). **<u>Vegetation composition: negative indicator species *Spartina anglica*</u>** – No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%.	

	Embryonic shifting dunes [2110]	Dune-building grasses *Elytrigia juncea* and *Leymus arenarius*. Supply of windblown sand.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Vegetation structure: zonation** – maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession. **Vegetation composition: plant health of fore-dune grasses** - >95% of sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present). **Vegetation composition: typical species and sub-communities** – Maintain the presence of species-poor communities with typical species: sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*). **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover.	
	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]	Supply of wind-blown sand.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Vegetation structure: zonation** – maintain the range of coastal habitats, including transitional zones,	

			subject to natural processes, including erosion and succession. **Vegetation composition: plant health of dune grasses** - >95% of marram grass (Ammophila *arenaria*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present). **Vegetation composition: typical species and sub-communities** – Maintain the presence of species-poor communities with typical species: marram grass (Ammophila *arenaria*) and/or lyme-grass (*Leymus arenarius*). **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover.	
	Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	Low wind, weakly saline conditions in shelter of *Ammophila arenaria* dunes. Grazing.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. Total areas mapped 22.65ha. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Vegetation structure: bare ground** – bare ground should not exceed 10% of fixed dune habitat, subject to natural processes. **Vegetation structure: vegetation height** – maintain structural variation within sward. **Vegetation composition: typical species and sub-communities** – Maintain range of sub-communities with typical species listed in Ryle et al. 2009). **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover.	

			Vegetation composition: scrub/trees – no more than 5% cover or under control.	
	Dunes with *Salix repens ssp. argentea (Salicion arenariae)* [2170]	Humid dune slacks.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. Total areas mapped 0.14ha. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Vegetation structure: zonation** – maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession. **Vegetation structure: bare ground** – bare ground should not exceed 10% of cover, subject to natural processes. **Vegetation structure: vegetation height** – maintain structural variation within sward. **Vegetation composition: typical species and sub-communities** – Maintain range of sub-communities with typical species listed in Ryle et al. 2009). **Vegetation composition: cover and height of *S. repens*** – Maintain >10% cover of creeping willow (*Salix repens*); vegetation height should be in the average range of 5-20cm. **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover. **Vegetation composition: scrub/trees** – no more than 5% cover or under control.	

	Humid dune slacks [2190]	High water maintained by groundwater and impermeable soils. Grazing. Salinity.	***Restore*** favourable conservation condition, defined by the following attributes and targets: **Habitat area** – The permanent habitat area is stable or increasing, subject to natural processes, including erosion and succession. Total areas mapped 0.75ha. **Habitat distribution** - no decline, subject to natural processes. **Physical structure: functionality and sediment supply** – maintain the natural circulation of sediment and organic matter, without any physical obstructions. **Physical structure: hydrological and flooding regime** – maintain natural hydrological regime. **Vegetation structure: zonation** – maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession. **Vegetation structure: bare ground** – Bare ground should not exceed 5% of dune slack habitat, with the exception of pioneer slacks, which can have up to 20% bare ground. **Vegetation structure: vegetation height** – maintain structural variation within sward. **Vegetation composition: typical species and sub-communities** – Maintain range of sub-communities with typical species listed in Ryle et al. 2009). **Vegetation composition: cover of *S. repens*** – Maintain >40% cover of creeping willow (*Salix repens*). **Vegetation composition: negative indicator species** – negative indicator species (including non-natives) to represent less than 5% cover. **Vegetation composition: scrub/trees** – no more than 5% cover or under control.	

The Raven SPA (004019)	Red-throated Diver (*Gavia stellata*) [A001]	Fish availability in shallow inshore/freshwaters. Undisturbed, ice-free marine/freshwater feeding grounds.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Population trend –** Long-term population trend stable or increasing. **Distribution –** There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation.	-
	Cormorant (*Phalacrocorax carbo*) [A017]	Fish availability in shallow inshore/freshwaters. Undisturbed, ice-free marine/freshwater feeding grounds. Nesting sites on rocky cliffs.		
	Grey Plover (*Pluvialis squatarola*) [A141] Sanderling (*Calidris alba*) [A144]	Food availability (intertidal fauna/pasture). Flooding regime of coastal grasslands. Undisturbed coastal roosting sites close to feeding areas.		
	Wetland and Waterbirds [A999]	Supply of riverine freshwater; Unimpeded tidal flow; Shelter from open coasts; Diverse invertebrate Communities.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Wetland habitat area –** The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 4,207ha, other than that due to natural patterns of variation.	
Wexford Harbour and Slobs SPA (004076)	Little Grebe (*Tachybaptus ruficollis*) [A004] Great Crested Grebe (*Podiceps cristatus*) [A005] Grey Heron (*Ardea cinerea*) [A028] Bewick's Swan (*Cygnus columbianus*	Fish/crustacean/vegetation availability in shallow inshore/freshwaters. Undisturbed, ice-free marine/freshwater feeding grounds.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Population trend –** Long-term population trend stable or increasing. **Distribution –** There should be no significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation.	-

	bewickii) [A037] Whooper Swan (*Cygnus cygnus*) [A038] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Mallard (*Anas platyrhynchos*) [A053] Pintail (*Anas acuta*) [A054] Scaup (*Aythya marila*) [A062] Goldeneye (*Bucephala clangula*) [A067] Coot (*Fulica atra*) [A125] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]			
	Cormorant (*Phalacrocorax carbo*) [A017]	Fish availability in shallow inshore/freshwaters. Undisturbed, ice-free marine/freshwater feeding grounds. Nesting sites on rocky cliffs.		
	Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Greenland White-fronted Goose	Food availability (intertidal aquatic vegetation/ pasture/ crops). Undisturbed coastal roosting sites close to feeding sites. Grazing.		

	(*Anser albifrons flavirostris*) [A395]			
	Shelduck (*Tadorna tadorna*) [A048]	Food availability (intertidal flora and fauna/pasture/cereal). Undisturbed coastal roosting sites close to feeding sites.		
	Red-breasted Merganser (*Mergus serrator*) [A069]	Fish/crustacean prey availability in shallow inshore waters. Undisturbed, ice-free marine/freshwater feeding grounds.		
	Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus*) [A142] Knot (*Calidris canutus*) [A143] Sanderling (*Calidris alba*) [A144] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit	Food availability (intertidal fauna/pasture). Flooding regime of coastal grasslands. Undisturbed coastal roosting sites close to feeding areas.		

	(*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Lesser Black-backed Gull (*Larus fuscus*) [A183]			
	Common Scoter (*Melanitta nigra*) [A065]	Invertebrate prey availability in shallow inshore waters. Undisturbed, ice-free marine/freshwater feeding grounds.		
	Hen Harrier (*Circus cyaneus*) [A082]	Suitable roosting habitat. Suitable foraging habitat (wetlands, scrub, tillage, hedgerows). Prey availability (birds and mammals).	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Roost attendance: individual hen harriers** – No significant decline. **Suitable foraging habitat** – no significant decline. **Roost Site Condition** – The roost site should be maintained in a suitable condition. **Disturbance at the roost site** – Human activities should occur at levels that do not adversely affect the Hen Harrier winter roost population.	
	Little Tern (*Sterna albifrons*) [A195]	Sheltered coastal environment or sandy beach. Fish/invertebrate prey availability in shallow inshore waters. Undisturbed, ice-free marine/freshwater feeding grounds.	***Maintain*** favourable conservation condition, defined by the following attributes and targets: **Breeding population abundance: apparently occupied nests (AONs)** – No significant decline. **Productivity rate: fledged young per breeding pair** - No significant decline.	

			<u>Distribution: breeding colonies</u> - No significant decline. **<u>Prey biomass available</u>** – No significant decline. **<u>Barriers to connectivity</u>** – No significant increase. **<u>Disturbance at the breeding site</u>** – Human activities should occur at levels that do not adversely affect the breeding little tern population.	
	Wetland and Waterbirds [A999]	Supply of riverine freshwater; Unimpeded tidal flow; Shelter from open coasts; Diverse invertebrate Communities.	***Maintain*** favourable conservation condition, defined by the following attribute and target: **<u>Wetland Habitat area</u>** - the permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 4,241ha, other than that due to natural patterns of variation.	

APPENDIX E

COPY OF DRAFT WINTERING BIRD SURVEY REPORT

TRINITY WHARF WEXFORD HARBOUR

WINTER BIRD SURVEYS 2015/16

DRAFT REPORT

March 2016

NATURA
ENVIRONMENTAL CONSULTANTS

Natura Consultants, Glanmore,
Ashford, Co. Wicklow, Ireland.
T: +353 (0) 404 34300
M: (0) 86 825 0414
E: info@naturaconsultants.com
W: www.naturaconsultants.com

1. INTRODUCTION

Natura Environmental Consultants was commissioned by Wexford County Council to carry out a survey of waterbirds in the vicinity of Trinity Wharf, Wexford Town during the winter 2015/16. The area below High Water Mark is included within the Wexford Harbour and Slobs Special Protection Area (SPA) is legislated for under the Birds Directive (Council Directive 79/409/EEC on the Conservation of Wild Birds).

2. METHODOLOGY

Study area

The study area for these surveys was the tidal area within a 1km radius of Trinity Wharf (Figure 1). The shoreline is largely artificial sea wall to the north of Trinity Wharf. To the south of the Wharf there is a small area of intertidal mudflat at Batt Street Harbour. The remainder of the coast to the south of the Wharf is rocky shore with dense seaweed cover.

Figure 1: Study area for waterbird counts

Count methods

Surveys of the entire study area were carried out within 2 hours of low tide and 2 hours of high tide on five separate dates between November 2015 and March 2016 (Table 1). All waterbirds in this area were mapped and counted using 10x binoculars and 35x telescope.

Table 1. Survey dates and tide times

Date	High Water time	HW Survey times	Low Water time	LW Survey times
19/11/2015	11:06	11:30-13:00	17:25	15:00-16:20
10/12/2015	17:33	15:30-16:40	11:15	10:30-12:00
07/01/2016	16:34	14:25-15:55	10:50	10:00-11:30
15/02/2016	11:10	11:15-12:30	17:26	16:00-17:00
08/03/2016	18:30	17:00-18:15	12:40	13:00-14:30

3. RESULTS

A summary of results of the winter bird surveys is given in Table 2. A total of 23 species of waterbirds were recorded in this survey. Of these, 15 species are qualifying interests of Wexford Harbour and Slobs SPA (NPWS 2012).

Trinity Wharf itself does not hold any waterbirds. The northern and eastern edges are steep concrete walls and have no suitable foraging or roosting habitat. The southern side of the wharf is bordered by intertidal mudflat at Batt Street Harbour. This generally holds very small numbers of waders including Oystercatcher, Bar-tailed Godwit, Curlew, and Redshank at low tide. Single Grey Heron and Little Egret also occur in Batt Street Harbour at low tide.

The most important features for waterbirds in this area are the North and South training walls one either side of the mouth of the River Slaney. These areas are used at both low tide and high tide especially by roosting Lapwing (peak 552), Oystercatcher, Cormorant, Black-headed Gull and Herring Gull. The walls also provide foraging habitat at low tide for Oystercatcher and Turnstone.

The other main high tide roost site approximately 500m to the north-west of Trinity Wharf is the ballast structure in the centre of the river. This artificial structure is used at high tide by significant numbers of roosting Oystercatcher (peak 120) as well as Lapwing, Black-tailed Godwit, Turnstone and Black-headed Gull.

The shallow waters lying to the south of the South Training Wall and north of the North Training Wall are used for foraging by several species of waterbirds including Great Crested Grebe (peak 27), Red-breasted Merganser (peak 78), Goldeneye (peak 4) and Cormorant.

Table 2. Peak numbers of waterbirds within 1km of Trinity Wharf at high tide and low tide 2015/16 and average peak numbers for the entire Wexford Harbour and Slobs SPA.

Species	Scientific name	Peak Population High Tide	Peak Population Low Tide	Mean Peak Population Wexford Harbour & Slobs SPA[1]
Mute Swan	*Cygnus olor*	2	2	129
Light-bellied Brent Goose*	*Branta bernicla hrota*	10	10	2445
Goldeneye*	*Bucephala clangula*	1	4	43
Red-breasted Merganser*	*Mergus serrator*	78	25	90
Cormorant*	*Phalacrocorax carbo*	31	47	17
Shag	*Phalacrocorax aristotelis*	3	0	91
Little Egret	*Egretta garzetta*	1	5	320
Grey Heron*	*Ardea cinerea*	6	9	2
Little Grebe*	*Tachybaptus ruficollis*	1	2	17
Great Crested Grebe*	*Podiceps cristatus*	27	27	11
Oystercatcher*	*Haematopus ostralegus*	155	81	474
Lapwing*	*Vanellus vanellus*	355	552	3602
Black-tailed Godwit*	*Limosa limosa*	13	1	1944
Bar-tailed Godwit*	*Limosa lapponica*	0	3	838
Curlew*	*Numenius arquata*	3	12	498
Redshank*	*Tringa totanus*	12	10	13
Greenshank	*Tringa nebularia*	0	2	335
Turnstone	*Arenaria interpres*	29	15	33
Black-headed Gull*	*Chroicocephalus ridibundus*	351	331	1414
Common Gull	*Larus canus*	3	3	299
Lesser Black-backed Gull*	*Larus fuscus*	4	5	11
Herring Gull	*Larus argentatus*	60	35	194
Great Black-backed Gull	*Larus marinus*	16	4	97

1. Mean of peak counts over three winters 2011/12 to 2013/14. Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a joint scheme of BirdWatch Ireland and the National Parks and Wildlife Service of the Department of Arts, Heritage & the Gaeltacht.

*Qualifying interest of Wexford Harbour and Slobs SPA.

4. CONCLUSIONS

A total of 23 species of waterbirds were present within 1km of Trinity Wharf in winter 2015/16. The most abundant species here were Black-headed Gull, Oystercatcher and Lapwing. The most important habitats are the training walls on either side of the river mouth. The bird numbers present in this area represent a small proportion of the total numbers in the Wexford Harbour and Slobs SPA. Very few individuals occurred within the immediate vicinity (200m) of the Wharf because there is limited suitable habitat here.

5. REFERENCE

NPWS (2012) Conservation Objectives: Wexford Harbour and Slobs SPA 004076. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

APPENDIX F

COPY OF WRITTEN CONSULTATION CORRESPONDENCE

RPS®
Elmwood House, 74 Boucher Road, Belfast, BT12 6RZ, Northern Ireland
T +44 (0)28 9066 7914 F +44 (0)28 9066 8286 E ireland@rpsgroup.com W rpsgroup.com/ireland

Our Ref: SM/IBE1115/160210L02

10 February 2016

Caroline Horan
Access Officer
Wexford County Council
Carricklawn
Wexford

Dear Ms Horan

Trinity Wharf, Wexford: Feasibility Study

RPS have been commissioned by Wexford County Council to undertake a Feasibility Study for a proposed marina development at Trinity Wharf, Wexford (please refer to the attached **Map A**, which shows the location of the development site).

The purpose of the Feasibility Study is to contribute to an overall Masterplan for the redevelopment of the Trinity Wharf site which, as I'm sure you are aware, has recently been purchased by the Council.

Trinity Wharf has three coastal boundaries (marked A, B and C on Map A) where a marina development attached to the site could potentially be located. However, the surrounding foreshore and the River Slaney has a number of environmental designations, including SPA, SAC, Ramsar, pNHA and EU Shellfish water (see attached **Map B**). Several additional EU designated sites are located in the outer parts of Wexford Harbour and in the coastal waters beyond the estuary.

The aim of the Feasibility Study is to investigate the potential options for a marina layout, which will include investigating which (if any) of the development's three coastal boundaries would be most suitable to locate the marina and whether fixed or floating structures are the most appropriate. The Feasibility Study's aim is also to identify and examine the potential constraints to developing a marina, focusing particularly on the potential impacts on the surrounding designated habitats and species, as well as the nearby commercial shellfisheries.

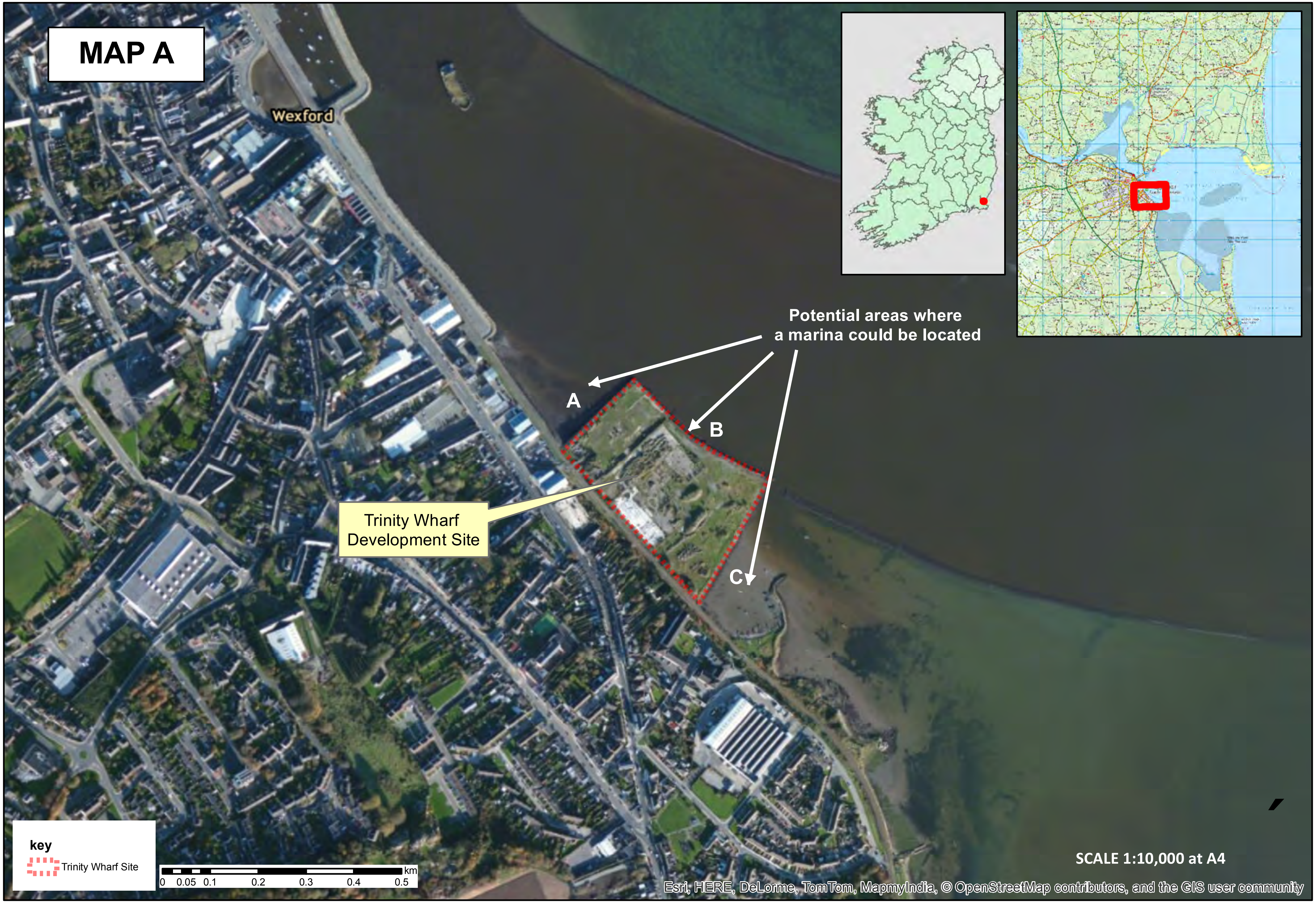
A key aspiration of the Council's plan for the site is to include provisions for disabled access, including at the marina. To this end, I wish to seek any input you might have on the scope of such provisions and whether there are any policies, guidance documents, minimum standards or any other relevant information that may be helpful for conducting the Feasibility Study (which includes the provision of an outline design).

I look forward to hearing from you, should you have any queries, or require any further information, please do not hesitate to contact me.

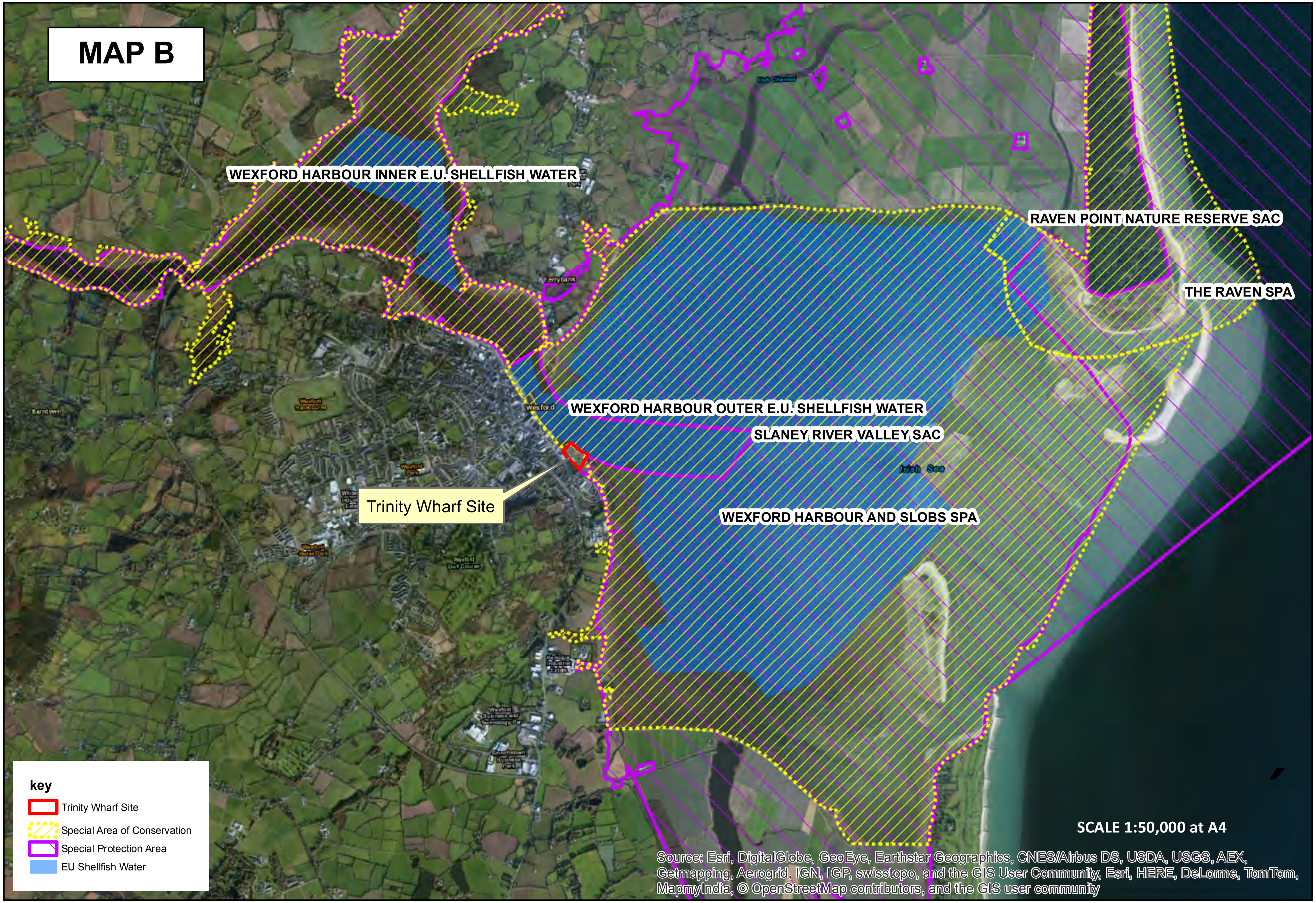
Yours sincerely

S. Mathews

Sophie Mathews, Associate
(Encs)



MAP A
Wexford
Potential areas where
a marina could be located
A
B
C
Trinity Wharf
Development Site
key
Trinity Wharf Site
0 0.05 0.1 0.2 0.3 0.4 0.5 km
SCALE 1:10,000 at A4
Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community


MAP B
WEXFORD HARBOUR INNER E.U. SHELLFISH WATER
RAVEN POINT NATURE RESERVE SAC
THE RAVEN SPA
WEXFORD HARBOUR OUTER E.U. SHELLFISH WATER
SLANEY RIVER VALLEY SAC
WEXFORD HARBOUR AND SLOBS SPA
Trinity Wharf Site
key
Trinity Wharf Site
Special Area of Conservation
Special Protection Area
EU Shellfish Water
SCALE 1:50,000 at A4
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Iascach Intíre Éireann
Inland Fisheries Ireland

Sophie Matthews
RPS Consultants
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

RECEIVED
10 MAR 2016

08 March 2016

Feasibility study for proposed marina at Trinity Wharf, Wexford.

Dear Ms. Matthews,

Inland Fisheries note that the site of this proposed development is located within and borders transitional waters which form part of the Slaney River Estuary.

Estuaries and inshore waters provide significant nursery habitat for the larval and juvenile forms of (transitional and marine) fish species, in addition to providing shelter and food for many young and adult fish and shellfish. These in turn provide food resources for other levels of the trophic chain including shore birds, waterfowl, larger fish and marine mammals. Intertidal areas host high densities of benthic fauna in particular worms and molluscs. This in turn can make them important habitats for juvenile fish such as flounder, and juvenile crustaceans such as crabs which may inhabit such habitats in high numbers. The majority of fish in estuaries, feed primarily on the benthos and thus live a demersal existence. Estuarine fish can generally be divided into a number of groups:

- Estuarine dependant (opportunists) species typically enter estuaries from the sea for a period each year but do not stay permanently. The majority of these species drift into estuaries as larvae and when as young fish they become demersal, they take advantage of the rich benthic food sources available in sublittoral and intertidal estuarine habitats. Estuaries contain large numbers of '0 group' fish that use them as nursery grounds before migrating to the sea as recruits to adult populations.
- Marine stragglers enter estuaries irregularly and are often restricted to the seaward end (usually low in numbers of individuals)
- Riverine species come from the freshwater end of the system and are mainly found in low salinity waters.
- Truly estuarine species (residents) comprise only a small number of species although they may form a high overall biomass. The gobies are most typical of this group as they are found in estuaries around the year.
- Migratory species use the estuary and inshore waters as a route from rivers to the open sea or vice versa. Most of these species are anadromous (breed in freshwater) e.g. the lampreys, the shads and the salmon (*Salmo salar*) / sea trout (Salmo trutta). Eels (*Anguilla anguilla*) are catadromous and breed in the sea.

With regard to this proposed development, the following observations and comments relate to construction on lands bordering the estuary and are of necessity of a general nature, as construction proposals and method statements are not as yet available. While they apply to the proposed development in general, the waters in fisheries terms likely to be impacted represent important spawning and/or nursery habitat for numerous species referred to above. They also, in the context of the proposed works, have the potential to convey deleterious matter from those works such as concrete, silt, fuel, lubricating and hydraulic oils from construction plant and equipment to areas throughout the Slaney Estuary unless proper safeguards are in place. IFI request you have particular regard to the following in the planning stage of the proposed development.

Uncured concrete can kill fish and macro-invertebrates by altering the pH of the water. Concrete delivery vehicles should be precluded from washing out at or in the environs of the site, or at such location as would result in a discharge to surface waters. If bagged cement is stored on site during construction work, it should be held in a dry secure area when not in use.

One of the potential impacts of the proposed development is the discharge of silt-laden waters to waters, where earth moving and excavation works are on-going. Silt is likely to settle out on fish habitat and interfere with the ability of certain fish species to feed. Similarly, plant and macro-invertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods and strategies to minimise discharges of silt/suspended solids to waters.

The potential for soil erosion/suspended solids generation is higher, during/after periods of prolonged rainfall. Systems should be put in place to ensure that there shall be no discharge of suspended solids or any other deleterious matter to waters during the construction/operational phase and during any landscaping works. A comprehensive plan should be drawn up with specific measures to address the high potential for silt pollution of the waters on-site, during demolition/construction and landscaping works.

All oils and fuels should be stored in secure bunded areas, and particular care and attention should be taken during refuelling and maintenance operations on plant and equipment. Bunding should be to a volume not less than the greater of the following; 110% of the capacity of the largest tank or drum within the bunded area, or 25% of the total volume of substance that could be stored within the bunded area. All plant and equipment should carry oil/fuel spill kits. Where temporary diesel or petrol driven pumps are required, they should be sited within portable temporary bunded units. Where site works involve the discharges of drainage water to surface waters receiving rivers, temporary oil interceptor facilities should be installed and maintained. Waste oils, empty oil containers and other hazardous wastes should be disposed of in accordance with the requirements of the Waste Management Act, 1996.

With reference to the marina construction within the SAC, IFI request that the following issues are fully addressed:

- Will this proposed construction result in further infill/reclamation within the Slaney estuary.
- Will this proposed construction require dredging within the SAC.

- Will the construction of shore line/coastal defenses or other works linked to this development increase the likelihood of scour/erosion of SAC habitat?
- Conversely will the construction of shore line/coastal defenses or other works linked to this development increase the likelihood of deposition within SAC habitat?
- It is important that the potential for damage to the SAC is fully addressed in advance of any works.
- As construction proposals and method statements are not as yet available, it is important that the extent and scale of disturbance to the SAC likely to be associated with the construction of a fixed marina compared to the construction of a floating marina are detailed.
- The importance of the habitat affected by this development as a spawning nursery area for fish and shellfish should be fully investigated.

In addition to the above it is important that:

- Access by local Eel and Mussel Fishermen to tidal slip-ways and fishing grounds must be ensured by this development.
- Rod angling for a number of species is practised at & adjacent to this site, it is important that the effects of this development upon such angling activities are addressed.

Yours sincerely,

Donnachadh Byrne
Senior Fisheries Environmental Officer.

Please note that any further correspondence regarding this matter should be addressed to Mr. Donnachadh Byrne, Senior Fisheries Environmental Officer, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24

Sophie Mathews

From: Caroline Horan <Caroline.Horan@wexfordcoco.ie>
Sent: 04 March 2016 13:27
To: Sophie Mathews
Cc: Gerry Forde; John Lambe
Subject: RE: Trinity Wharf Marina Consultation

Afternoon Sophie

Firstly I very much appreciate the invitation to inform the feasibility study, with regard specific access issues and universal design my remit would normally be to assess draft plans or drawings, however in this instance the following list may be of assistance in considering items to be addressed:

- The possible access routes, both vehicle and pedestrian, levels and gradients of same and the site layout taking account of the existing routes which will be expected to support access to the site. Carriage widths and refugee points, controlled crossing points, footpath widths at each side of a vehicle route, cycle lanes public transport stops etc.
- Pavement and pedestrian layouts and designs, widths, locations, and travel distances of pedestrian routes to specific areas supported by parking, seating and crossing points and if planting to be considered and provided so as not to impede on circulation routes. The type of planting so as not to present as a slip hazard on pavements throughout the year.
- Changes in level on access routes note slopes of 1:21 not requiring handrails (gentle slope as opposed to a ramp) aesthetics. Tapered threads on steps not acceptable even if as a design feature steps will require corduroy warning surfaces top and bottom of flights
- Location of car parking to support convenience and the inclusion of sufficient disabled parking provisions, also the provision of set-down areas supporting buildings and possible public transport stops, taxi ranks
- Is a central transport hub/station to be considered given the possibility of providing an rail stop at the development ???
- A wayfinding signage strategy which is clear and effective for all users and consistent throughout the development
- A street furniture strategy which takes account of the circulations spaces between fixtures, the building line and the vehicle/carriage line consistent throughout the development
- The choice of ground surface material for footpaths, anti-slip, glare, colour contrast with street furniture fixtures (bollards) signage etc.
- Lighting

I hope the above assists, and I look forward to working on disability proofing any drawings or draft designs of the development.

Regards,

Caroline Horan
Access Officer
Wexford County Council
Carricklawn
Wexford
Y35 WY93

Your Ref: SM/IBE1115/160210L01
Our Ref: **G Pre00036/2016**
(Please quote in all related correspondence)

04 March 2016

Sophie Mathews CEnv C.WEM MCIWEM
RPS Consulting Engineers
Elmwood House
74 Boucher Road
Belfast BT12 6RZ
Northern Ireland

Via email to Sophie.Mathews@rpsgroup.com

Re: Trinity Wharf Consultation & NPWS Meeting request - feasibility study to feed into Masterplan for redevelopment of Trinity Wharf, Wexford Town

Dear Sophie,

On behalf of the Department of Arts, Heritage and the Gaeltacht, I refer to correspondence received in connection with the above.

Outlined below are heritage-related observations/recommendations of the Department under the stated heading(s).

Nature Conservation

This Department notes this is a consultation request for developing the scope for a future EIA for a proposed marina at Trinity Wharf, Wexford, and that it is felt this might best be achieved by a meeting with staff of this Department, ideally by mid-March. It is not clear to this Department whether this proposed development will involve both a planning application and a foreshore application. This Department notes that the applicant is aware of previous applications in this area which the National Parks and Wildlife Service (NPWS) of this Department previously commented on. The applicant should be aware that while previous comments will give an indication of the views of this Department, CJEU case law has to some extent clarified certain issues and should be consulted as outlined below.

The area of the foreshore for the proposed marina development falls within the Slaney River Valley candidate Special Area of Conservation (cSAC) (Site Code 781). Depending on location it is also within or adjacent to the Wexford Harbour and Slobs

Special Protection Area (SPA) (Site Code 4076) and the Wexford Slobs and Harbour proposed Natural Heritage Area (pNHA) (Site Code 712). Issues to be considered include any disturbance to feeding and roosting birds, alien invasive species and whether there will be any permanent loss of habitats which are qualifying interests for the SAC and or SPA.

Should the applicant still feel there is a need for a meeting please contact Ciara O Mahony at (0761) 002668 or ciara.o'mahony@ahg.gov.ie in the first instance; the meeting request will be facilitated if possible subject to local staff workload and availability.

Please find below some general scoping comments for EIS and appropriate assessment screening/appropriate assessment and for licencing requirements.

EIS

Ecological Survey

With regard to scoping for an EIS for a proposed development, in order to assess impacts on biodiversity, fauna, flora and habitats, an ecological survey should be carried out of the site of the proposed development site including the route of any access roads, pipelines or cables etc. to survey the habitats and species present. Where ex-situ impacts are possible survey work may be required outside of the development sites. Such surveys should be carried out by suitably qualified persons at an appropriate time of the year depending on the species being surveyed for. The EIS should include the results of the surveys, and detail the survey methodology and timing of such surveys. It is expected by this Department that in any survey methodology used that best practice will be adhered to. The EIS should cover the whole project, including construction, operation and, if applicable, restoration or decommissioning phases. Alternatives examined should also be included in the EIS. Inland Fisheries Ireland should be consulted with regard to fish species if applicable. For information on Geological and Geomorphological sites the Geological Survey of Ireland should be consulted.

Baseline data

With regard to the scope of baseline data, details of designated sites can be found at www.npws.ie . For flora and fauna the data of the National Parks and Wildlife Service (NPWS) should be consulted at www.npws.ie . Where further detail is required on any information on the website www.npws.ie , a data request form should be submitted. This can be found at http://www.npws.ie/maps-and-data/request-data . Other sources of information relating to habitats and species include that of the National Biodiversity Data Centre (www.biodiversityireland.ie), Inland Fisheries Ireland (www.fisheriesireland.ie), BirdWatch Ireland (www.birdwatchireland.ie) and Bat Conservation Ireland (www.batconservationireland.org). Data may also exist at a County level within the Planning Authority.

Impact assessment

The impact of the development on the flora, fauna and habitats present should be assessed. In particular the impact of the proposed development should be assessed, where applicable, with regard to:

- Natura 2000 sites, i.e. Special Areas of Conservation (SAC) designated under the EC Habitats Directive (Council Directive 92/43/EEC) and Special Protection Areas designated under the EC Birds Directive (Directive 2009/147 EC),
- Other designated sites, or sites proposed for designation, such as Natural Heritage Areas and proposed Natural Heritage Areas, Nature Reserves and Refuges for Fauna or Flora, designated under the Wildlife Acts 1976 to 2012,
- Species protected under the Wildlife Acts including protected flora,
- '*Protected species and natural habitats*', as defined in the Environmental Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008, including Birds Directive – Annex I species and other regularly occurring migratory species, and their habitats (wherever they occur) and Habitats Directive – Annex I habitats, Annex II species and their habitats, and Annex IV species and their breeding sites and resting places (wherever they occur),
- Important bird areas such as those identified by Birdlife International,
- Features of the landscape which are of major importance for wild flora and fauna, such as those with a "stepping stone" and ecological corridors function, as referenced in Article 10 of the Habitats Directive.
- Other habitats of ecological value in a national to local context (such as those identified as locally important biodiversity areas within Local Biodiversity Action Plans and County Development Plans).
- Red data book species,
- and biodiversity in general.

Reference should be made to the National Biodiversity Plan and any relevant County Biodiversity Plan. Any losses of biodiverse habitat associated with this proposed development should be mitigated for.

In order to assess the above impacts it may be necessary to obtain hydrological and/or geological data. In particular any impact on water table levels or groundwater flows may impact on wetland sites some distance away. The EIS should assess cumulative impacts with other plans or projects if applicable. Where negative impacts are identified suitable mitigation measures should be detailed if appropriate. As EU Member States have to report every 6 years on the National resource of habitats and species listed under the Habitats Directive it is important that any impact on such habitats and species both inside and outside of Natura 2000 sites is recorded.

Alien invasive species

The EIS should also address the issue of invasive alien plant and animal species, such as Japanese Knotweed, and detail the methods required to ensure they are not accidentally introduced or spread during construction. Information on alien invasive species in Ireland can be found at http://invasives.biodiversityireland.ie/ and at http://invasivespeciesireland.com/ .

Hedgerows, and protected species

Hedgerows form important wildlife corridors and provide areas for birds to nest in. In addition badger setts may be present. If suitable trees are present bats may roost there and they use hedgerows as flight routes. Hedgerows also provide a habitat for woodland flora. Where a hedgerow forms a townland or other historical boundary it is usually an old hedgerow. Such hedgerows will contain more biodiversity than a younger hedgerow. Hedgerows should be maintained where possible. The EIS should provide an estimate of the length of hedgerow that will be lost, if any. Where trees or hedgerows have to be removed there should be suitable planting of native species in mitigation. Where possible hedgerows and trees should not be removed during the nesting season (i.e. March 1st to August 31st). Birds nests can only be intentionally destroyed under licence issued under the Wildlife Acts of 1976 to 2012.

Bats

Bat roosts may be present in trees, buildings and bridges*.* Bat roosts can only be destroyed under licence under the Wildlife Acts and a derogation under the Birds and Natural Habitats Regulations and such a licence would only be given if suitable mitigation measures were implemented. Where so called bat friendly lighting is proposed as mitigation then it should be proven to work as mitigation.

Rivers and Wetlands

Wetlands are important areas for biodiversity. Any watercourse or wetland impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. These species could include otters (*Lutra lutra*), which are protected under the Wildlife Acts and listed on Annexes II and IV of the Habitats Directive, Salmon (*Salmo salar*) and Lamprey species listed on Annex II of the Habitats Directive and White-clawed Crayfish (*Austropotamobius pallipes*) which are protected under the Wildlife Acts and listed on Annex II of the Habitats Directive, Frogs (*Rana temporaria*) and Newts (*Trituris vulgaris*) protected under the Wildlife Acts and Kingfishers (*Alcedo atthis*) protected under the Wildlife Acts and listed on Annex I of the Birds Directive (Council Directive 79/409 EEC*)*.

A suitable riparian habitat should be left along each watercourse. Construction work should not be allowed impact on water quality and measures should be detailed in the EIS to prevent sediment and/or fuel runoff from getting into watercourses which could adversely impact on aquatic species. Flood plains, if present, should be identified in the EIS and left undeveloped to allow for the protection of these valuable habitats and provide areas for flood water retention. If applicable the EIS should take account of the guidelines for Planning Authorities entitled “The Planning System and Flood Risk Management” and published by the Department of the Environment, Heritage and Local Government in November 2009.

Water quality

Ground and surface waters quality should be protected during construction and operation of the proposed development and if applicable the applicant should ensure that adequate sewage treatment facilities are or will be in place prior to any development. The applicant should also ensure that adequate water supplies are present prior to development.

Marine

Marine information is available at http://www.npws.ie/marine/

CMPs

Complete project details including construction management plans (CMPs) need to be provided in order to allow an adequate assessment to be undertaken. Applicants need to be able to demonstrate that CMPs and other such plans are adequate and effective mitigation, supported by scientific information and analysis, and that they are feasible within the physical constraints of the site. The positions, locations and sizes of construction infrastructure and mitigation, such as settlement ponds, disposal sites and construction compounds, may significantly affect European sites, other designated sites, habitats, and species in their own right and could have an effect for example on drainage, water quality, habitat loss, and disturbance. If these are undetermined at time of the assessment, all potential effects of the development on the site are not being considered. If applicants are not in a position to decide the exact location and details of these at time of application, then they need to consider the range of options that may be used in their assessment so that all issues are covered.

Appropriate Assessment

Guidance

With regard to appropriate assessment (AA) and screening for AA, some Guidance documents are referred to below which may help. However CJEU case law has to some extent clarified certain issues and should be consulted. In particular case C-258/2011-N6 Galway City Outer Bypass is relevant as is the recent opinion on the Briels case, C-521/12.

Guidance on AA is available in the Departmental guidance document on Appropriate Assessment, which is available on the NPWS web site at http://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf and in the EU Commission guidance entitled "*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*" which can be downloaded from http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

Conservation objectives

In order to carry out the appropriate assessment screening, and/or prepare the Natura Impact Statement (NIS), information about the relevant Natura 2000 sites including their conservation objectives will need to be collected. Details of designated sites and species and conservation objectives can be found on www.npws.ie . Site-specific, as opposed to generic, conservation objectives are now available for some sites. Each conservation objective for a qualifying interest is defined by a list of attributes and targets and are often supported by further documentation. Where these are not available for a site, an examination of the attributes that are used to define site-specific conservation objectives for the same QIs in other sites can be usefully used to ensure the full ecological implications of a proposal for a site's conservation objective and its integrity are analysed and assessed. It is advised, as per the notes and guidelines in the site-specific conservation objectives, that any reports quoting conservation objectives should give the version number and date, so that it can be ensured and established that the most up-to-date versions are used in the preparation of Natura Impact Statements and in undertaking appropriate assessments.

Where further detail is required on any information on the website www.npws.ie , a data request form should be submitted. This can be found at http://www.npws.ie/maps-and-data/request-data .

Cumulative and ex situ impacts

A rule of thumb often used is to include all Natura 2000 sites within a distance of 15km. It should be noted however that this will not always be appropriate. In some instances where there are hydrological connections a whole river catchment or a groundwater aquifer may need to be included. Similarly where bird flight paths are involved the impact may be on an SPA more than 15 km away.

Other relevant Local Authorities should be consulted to determine if there are any projects or plans which, in combination with this proposed development, could impact on any Natura 2000 sites

Water and wastewater

If this development is not on mains sewerage then impacts from wastewater, including cumulative impacts, on groundwater and any nearby surface waters or wetland habitats should be assessed. In addition if it is not on mains water supply then impacts, including cumulative impacts, relating to water abstraction should be assessed. This may require hydrogeological information. Where connection will be to existing infrastructure the impact of the demand for additional potable water, waste water treatment, and additional surface runoff should be assessed.

Alien invasive species

If the proposed development is adjacent to a Natura 2000 site and involves landscaping or a garden, care should be taken to ensure that no terrestrial or aquatic invasive species are used which could impact negatively on these sites. Information on alien invasive species in Ireland can be found at http://invasives.biodiversityireland.ie/ and at http://invasivespeciesireland.com/ .

CMPs

Complete project details including construction management plans (CMPs) need to be provided in order to allow an adequate appropriate assessment to be undertaken. Applicants need to be able to demonstrate that CMPs and other such plans are adequate and effective mitigation, supported by scientific information and analysis, and that they are feasible within the physical constraints of the site. The positions, locations and sizes of construction infrastructure and mitigation, such as settlement ponds, disposal sites and construction compounds, may significantly affect European sites, designated sites, habitats, and species in their own right and could have an effect for example on drainage, water quality, habitat loss, and disturbance. If these are undetermined at time of the assessment, all potential effects of the development on the site are not being considered. If applicants are not in a position to decide the exact location and details of these at time of application, then they need to consider the range of options that may be used in their assessment so that all issues are covered. The CMP should also include methods to ensure invasive alien species are not introduced or spread.

Licences

Where there are impacts on protected species and their habitats, resting or breeding places, licences may be required under the Wildlife Acts or derogations under the Habitats Regulations. In particular bats and otters and cetaceans are strictly protected under annex IV of the Habitats Directive and a copy of Circular Letter NPWS 2/07 entitled "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences*" can be found on the Departmental web site at http://www.npws.ie/sites/default/files/general/circular-npws-02-07.pdf. It should be noted however that this Regulation has been replaced by SI 477 of 2011 and that section 53 is the relevant section.

In addition licenses will be required if there are any impacts on other protected species or their resting or breeding places, such as on protected plants, badger setts or birds nests. Where possible hedges and trees should not be removed during the nesting season (i.e. March 1st to August 31st). Birds nests can only be intentionally destroyed under licence issued under the Wildlife Acts of 1976 to 2012.

In order to apply for any such licenses or derogations as mentioned above the results of a survey should be submitted to the National Parks and Wildlife Service of this Department. Such surveys are to be carried out by appropriately qualified person/s at an appropriate time of the year. Details of survey methodology should also be provided. Such licences should be applied for in advance of planning to avoid delays and in case project modifications are necessary.

Should this survey work take place well before construction commences, it is recommended that an ecological survey of the development site should take place immediately prior to construction to ensure no significant change in the baseline ecological survey has occurred. If there has been any significant change mitigation may require amendment and where a licence has expired, there will be a need for new licence applications for protected species.

The above observations and recommendations are based on the papers submitted to this Department on a pre-planning basis and are made without prejudice to any observations the Minister may make in the context of any consultation arising on foot of any development application referred to the Minister, by a planning authority, in her role as statutory consultee under the Planning and Development Act 2000, as amended.

You are requested to send further communications to this Department's Development Applications Unit (DAU) at **manager.dau@ahg.gov.ie** (team monitored); if this is not possible, correspondence may alternatively be sent to:

The Manager
Development Applications Unit (DAU)
Department of Arts, Heritage and the Gaeltacht
Newtown Road
Wexford
Y35 AP90

Yours sincerely,

Yvonne Nolan

Yvonne Nolan,
Development Applications Unit

APPENDIX G

MARINE SEDIMENT ANALYSIS REPORT

RPS

2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Certificate of Analysis

Report No.: 16-54748

Issue No.: **1**
Date of Issue **23/8/2016**

Customer Details:	John Lambe Wexford County Council Carricklawn Wexford Wexford Y35 WY93
Order No.:	Not given
Customer Reference:	Not given
Quotation Reference:	160729/03
Description:	8 sediment samples in metal containers
Date Received:	29/7/2016
Test Methods:	Details available on request (refer to SOP code against relevant result/s)
Notes:	None
Approved By:	**Marco Lattughi, Operational Director**

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service.
Observations and interpretations are outside of the scope of UKAS accreditation.
Results reported herein relate only to the items supplied to the laboratory for testing.

UKAS TESTING
1663

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A member of the RPS Group plc. RPS Laboratories and RPS Mountainheath terms and conditions apply - copy on request

RPS

2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - Dry Weights, Carbonate, Total Organic Carbon, TPH, Organotins & Density

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No / Customer Sample ID / RPS Sample No	Certified Reference Material		AQC spike	
				Sample Type	SEDIMENT		SEDIMENT	
				Sample Location / Sample Depth (m) / Sampling Date / Sampling Time	CRM-646		Spike on clean sediment (20µg/kg)	
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**Result**	**Recovery %**	**Result**	**Recovery %**
dry solids (at 105°C)			In house	%	n/a	n/a	n/a	n/a
carbonate % dry matter			In house	%	n/a	n/a	n/a	n/a
total organic carbon*		S		%	n/a	n/a	n/a	n/a
total petroleum hydrocarbons by GCFID (C10 - C40)			In house	mg/kg	n/a	n/a	n/a	n/a
dibutyltin (DBT)	1002-53-5	U	In house	ug/kg DW	52.96	69^{cert}	21.4	107
tributyltin (TBT)	56573-85-4	U	In house	ug/kg DW	47.12	98^{cert}	20.9	105
density (on dry solid)			In house	g/cm3	n/a	n/a	n/a	n/a

Dibutyltin and tributyltin results have been dry weight corrected
cert = % recovery vs certified value

RPS

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Results Summary - Dry Weights, Carbonate, Total Orga Density

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**	**E1**	**E2**
				Customer Sample ID								
				RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								
				Sample Depth (m)								
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time								
Determinand	**CAS No**	**Codes**	**SOP**	**Units**								
dry solids (at 105°C)			In house	%	42.0	44.8	44.8	38.4	68.5	69.8	66.5	67.9
carbonate % dry matter			In house	%	58.9	3.74	5.92	2.86	33.9	23.3	4.29	3.44
total organic carbon*		S		%	2.62	3.34	3.40	2.83	1.51	1.35	0.89	1.78
total petroleum hydrocarbons by GCFID (C10 - C40)			In house	mg/kg	68.7	134	114	150	38.5	31.7	22.7	107
dibutyltin (DBT)	1002-53-5	U	In house	ug/kg DW	< 5.00	< 5.00	< 5.00	< 5.21	< 5.00	< 5.00	< 5.00	< 5.00
tributyltin (TBT)	56573-85-4	U	In house	ug/kg DW	< 4.76	< 4.47	< 4.47	< 5.21	< 2.00	< 2.00	< 2.00	4.18
density (on dry solid)			In house	g/cm3	2.1	2.0	2.0	2.1	1.6	1.4	1.7	1.6

Dibutyltin and tributyltin results have been dry weight corrected

cert = % recovery vs certified value

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T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - Metals

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

						Customer Sample No	Standard Reference Material		A1	B1	B2
						Customer Sample ID					
						RPS Sample No			303498	303499	303500
						Sample Type	SEDIMENT		SEDIMENT	SEDIMENT	SEDIMENT
						Sample Location	SRM-2702				
						Sample Depth (m)					
						Sampling Date			/ /	/ /	/ /
						Sampling Time					
Determinand	**CAS No**	**Codes**	**SOP**	**Mass**	**Units**		**Result**	**Recovery %**			
aluminium*	7429-90-5	USI	ICP-MS	27	mg/kg DW		59000	70 cert	21200	26900	33200
arsenic*	7440-38-2	USI	ICP-MS	75	mg/kg DW		47.5	104.9 cert	16.0	13.8	14.4
cadmium*	7440-43-9	USI	ICP-MS	111	mg/kg DW		0.98	119.9 cert	0.61	0.61	0.61
chromium*	7440-47-3	USI	ICP-MS	52	mg/kg DW		327.1	92.9 cert	76.5	67.5	58.8
copper*	7440-50-8	USI	ICP-MS	65	mg/kg DW		107.4	91.2 ref	28.6	39.2	42.5
lead*	7439-92-1	USI	ICP-MS	208	mg/kg DW		140.3	105.6 cert	45.2	61.5	97.7
lithium*	7439-93-2	USI	ICP-MS	7	mg/kg DW		75.4	96.4 inf	54.2	46.8	41.6
mercury*	7439-97-6	USI	AFS	202	mg/kg DW		0.45	100.6 cert	0.11	0.18	0.19
nickel*	7440-02-0	USI	ICP-MS	60	mg/kg DW		68.4	90.7 cert	30.5	25.6	23.8
zinc*	7440-66-6	USI	ICP-MS	65	mg/kg DW		499.2	102.9 cert	158	175	191

ref = % recovery vs reference value
cert = % recovery vs certified value
inf = % recovery vs information value

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Results Summary - Metals

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Mass	Units	C1	D1	D2	E1	E2
					Customer Sample No	C1	D1	D2	E1	E2
					Customer Sample ID					
					RPS Sample No	303501	303502	303503	303504	303505
					Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
					Sample Location					
					Sample Depth (m)					
					Sampling Date	/ /	/ /	/ /	/ /	/ /
					Sampling Time					
aluminium*	7429-90-5	USI	ICP-MS	27	mg/kg DW	59300	20400	19200	22400	26300
arsenic*	7440-38-2	USI	ICP-MS	75	mg/kg DW	17.6	16.5	16.9	7.32	8.63
cadmium*	7440-43-9	USI	ICP-MS	111	mg/kg DW	0.70	0.55	0.47	0.41	0.83
chromium*	7440-47-3	USI	ICP-MS	52	mg/kg DW	82.8	57.4	52.9	31.6	40.6
copper*	7440-50-8	USI	ICP-MS	65	mg/kg DW	34.2	637	4810	53.7	28.8
lead*	7439-92-1	USI	ICP-MS	208	mg/kg DW	51.3	149	149	27.5	105
lithium*	7439-93-2	USI	ICP-MS	7	mg/kg DW	66.9	22.7	20.1	24.6	28.6
mercury*	7439-97-6	USI	AFS	202	mg/kg DW	0.13	0.10	0.07	0.07	0.13
nickel*	7440-02-0	USI	ICP-MS	60	mg/kg DW	33.1	27.8	24.0	11.3	14.1
zinc*	7440-66-6	USI	ICP-MS	65	mg/kg DW	176	373	390	87.7	143

ref = % recovery vs reference value
cert = % recovery vs certified value
inf = % recovery vs information value

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Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs)

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

					Customer Sample No	**Certified Reference Material**		**AQC spike**		**A1**	**B1**
					Customer Sample ID						
					RPS Sample No					303498	303499
					Sample Type	**SEDIMENT**		**SEDIMENT**		**SEDIMENT**	**SEDIMENT**
					Sample Location	**NIST-1944**		**Spike on clean sediment (1000ug/kg)**			
					Sample Depth (m)						
					Sampling Date					/ /	/ /
					Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Mass**	**Units**	**Result**	**Recovery %**	**Result**	**Recovery %**		
naphthalene	91-20-3		304	128	ug/kg DW	Not certified	n/a	954	95.4	< 16.649	23.0
acenaphthylene	208-96-8		304	152	ug/kg DW	Not certified	n/a	967	96.7	4.76	29.3
acenaphthene	83-32-9		304	154	ug/kg DW	Not certified	n/a	1000	100	3.57	27.0
fluorene	86-73-7		304	166	ug/kg DW	Not certified	n/a	998	99.8	10.9	51.8
phenanthrene	85-01-8		304	178	ug/kg DW	4077	77.4 cert	882	88.2	60.4	476
anthracene	120-12-7		304	178	ug/kg DW	Not certified	n/a	967	96.7	36.4	96.9
fluoranthene	206-44-0		304	202	ug/kg DW	7840	87.9 cert	889	88.9	194	922
pyrene	129-00-0		304	202	ug/kg DW	7860	81 cert	874	87.4	167	696
benzo(a)anthracene	56-55-3		304	228	ug/kg DW	4390	93 cert	967	96.7	127	391
chrysene	218-01-9		304	228	ug/kg DW	4079	83.9 cert	848	84.8	106	313
benzo(b)fluoranthene	205-99-2		304	252	ug/kg DW	4429	74.07 cert	834	83.4	177	466
benzo(k)fluoranthene	207-08-9		304	252	ug/kg DW	1697	73.8 cert	832	83.2	65.2	184
benzo(a)pyrene	50-32-8		304	252	ug/kg DW	3800	88.4 cert	846	84.6	108	335
indeno(1,2,3-c,d)pyrene	193-39-5		304	276	ug/kg DW	2071	74.5 cert	857	85.7	71.1	189
dibenzo(a,h)anthracene	53-70-3		304	278	ug/kg DW	873.6	115.1 cert	854	85.4	27.8	78.2
benzo(g,h,i)perylene	191-24-2		304	276	ug/kg DW	2635	92.8 cert	878	87.8	85.6	221

cert = % recovery vs certified value

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T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - Polycyclic Aromatic Hydrocarbons (EPA 16

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

					Customer Sample No	B2	C1	D1	D2	E1	E2
					Customer Sample ID						
					RPS Sample No	303500	303501	303502	303503	303504	303505
					Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
					Sample Location						
					Sample Depth (m)						
					Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
					Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Mass**	**Units**						
naphthalene	91-20-3		304	128	ug/kg DW	75.0	< 18.248	< 7.000	< 7.000	< 7.000	< 7.000
acenaphthylene	208-96-8		304	152	ug/kg DW	65.4	13.3	4.09	3.87	1.81	33.4
acenaphthene	83-32-9		304	154	ug/kg DW	95.6	14.9	10.1	< 2.000	0.150	29.6
fluorene	86-73-7		304	166	ug/kg DW	143	12.0	10.2	< 4.000	< 4.000	42.4
phenanthrene	85-01-8		304	178	ug/kg DW	763	73.5	114	13.2	19.7	917
anthracene	120-12-7		304	178	ug/kg DW	246	31.5	28.9	11.9	9.63	101
fluoranthene	206-44-0		304	202	ug/kg DW	1630	300	181	66.9	150	1210
pyrene	129-00-0		304	202	ug/kg DW	1450	285	140	64.3	133	965
benzo(a)anthracene	56-55-3		304	228	ug/kg DW	914	87.9	93.1	54.7	98.1	640
chrysene	218-01-9		304	228	ug/kg DW	774	121	65.2	30.4	70.4	585
benzo(b)fluoranthene	205-99-2		304	252	ug/kg DW	1140	296	94.1	45.0	121	695
benzo(k)fluoranthene	207-08-9		304	252	ug/kg DW	494	105	33.1	15.8	49.8	261
benzo(a)pyrene	50-32-8		304	252	ug/kg DW	874	205	64.2	31.1	91.6	481
indeno(1,2,3-c,d)pyrene	193-39-5		304	276	ug/kg DW	465	126	33.3	16.9	53.1	247
dibenzo(a,h)anthracene	53-70-3		304	278	ug/kg DW	200	52.9	15.6	8.45	19.9	117
benzo(g,h,i)perylene	191-24-2		304	276	ug/kg DW	532	150	38.5	20.1	60.6	255

cert = % recovery vs certified value

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Results Summary - Organochlorine Pesticides & Polychlorinated Biphenyls (ICES 7)

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No / Customer Sample ID / RPS Sample No	Certified Reference Material		AQC spike	
				Sample Type	SEDIMENT		SEDIMENT	
				Sample Location / Sample Depth (m) / Sampling Date / Sampling Time	NIST-1944		Spike on clean sediment (25µg/kg)	
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**Result**	**Recovery %**	**Result**	**Recovery %**
aldrin	309-00-2		In house	ug/kg DW	n/a	n/a	n/a	n/a
alpha-hexachlorocyclohexane (alpha-HCH)	319-84-6		In house	ug/kg DW	n/a	n/a	n/a	n/a
beta-hexachlorocyclohexane (beta-HCH, beta-BHC)	319-85-7		In house	ug/kg DW	n/a	n/a	n/a	n/a
delta-hexachlorocyclohexane (delta-HCH)	319-86-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
gamma-hexachlorocyclohexane (lindane)	58-89-9		In house	ug/kg DW	n/a	n/a	n/a	n/a
hexachlorobenzene (HCB)	118-74-1		In house	ug/kg DW	6.03	95.3[cert]	n/a	n/a
cis-chlordane	5103-71-9		In house	ug/kg DW	16.5	85.5[cert]	n/a	n/a
trans-chlordane	5103-74-2		In house	ug/kg DW	8.2	84.5[cert]	n/a	n/a
dieldrin	60-57-1		In house	ug/kg DW	n/a	n/a	n/a	n/a
endrin	72-20-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
endosulfan A	959-98-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
endosulfan B	33213-65-9		In house	ug/kg DW	n/a	n/a	n/a	n/a
heptachlor	76-44-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
heptachlor epoxide	1024-57-3		In house	ug/kg DW	n/a	n/a	n/a	n/a
methoxychlor	72-43-5		In house	ug/kg DW	n/a	n/a	n/a	n/a
o,p'-DDD	53-19-0		In house	ug/kg DW	n/a	n/a	n/a	n/a
p,p'-DDD	3424-82-6		In house	ug/kg DW	n/a	n/a	n/a	n/a
o,p'-DDT	789-02-6		In house	ug/kg DW	n/a	n/a	n/a	n/a
p,p'-DDT	72-54-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
o,p'-DDE	72-55-9		In house	ug/kg DW	n/a	n/a	n/a	n/a
p,p'-DDE	50-29-3		In house	ug/kg DW	n/a	n/a	n/a	n/a
trifluralin	1582-09-8		In house	ug/kg DW	n/a	n/a	n/a	n/a
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5		319	ug/kg DW	80.72	99.9[cert]	27.75	111
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3		319	ug/kg DW	71.91	90.6[cert]	25.25	101
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2		319	ug/kg DW	52.14	71[cert]	24.5	98
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6		319	ug/kg DW	60.26	103.9[cert]	29	116
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2		319	ug/kg DW	74.71	120.3[cert]	25.75	103
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1		319	ug/kg DW	56.16	75.9[cert]	22.5	90
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3		319	ug/kg DW	44.6	100.7[cert]	26.75	107

OCL and PCB results have been dry weight corrected

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Results Summary - Organochlorine Pesticides & Polychl

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2	E1	E2
				Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**	**E1**	**E2**
				Customer Sample ID								
				RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location								
				Sample Depth (m)								
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time								
aldrin	309-00-2		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
alpha-hexachlorocyclohexane (alpha-HCH)	319-84-6		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
beta-hexachlorocyclohexane (beta-HCH, beta-BHC)	319-85-7		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
delta-hexachlorocyclohexane (delta-HCH)	319-86-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
gamma-hexachlorocyclohexane (lindane)	58-89-9		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
hexachlorobenzene (HCB)	118-74-1		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
cis-chlordane	5103-71-9		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
trans-chlordane	5103-74-2		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
dieldrin	60-57-1		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
endrin	72-20-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
endosulfan A	959-98-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
endosulfan B	33213-65-9		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
heptachlor	76-44-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
heptachlor epoxide	1024-57-3		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
methoxychlor	72-43-5		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
o,p'-DDD	53-19-0		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
p,p'-DDD	3424-82-6		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
o,p'-DDT	789-02-6		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
p,p'-DDT	72-54-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
o,p'-DDE	72-55-9		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
p,p'-DDE	50-29-3		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
trifluralin	1582-09-8		In house	ug/kg DW	< 2.38	< 2.23	< 2.23	< 2.61	< 1.00	< 1.00	< 1.00	< 1.00
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	2.71	0.52	< 0.10	1.21
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	3.02	2.03	< 0.10	7.38
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	1.42	5.51	< 0.10	3.70
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	1.75	13.0	< 0.10	4.96
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	1.02	12.8	< 0.10	3.03
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	1.14	9.01	< 0.10	3.59
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3		319	ug/kg DW	< 0.24	< 0.22	< 0.22	< 0.26	0.47	1.96	< 0.10	1.37

OCL and PCB results have been dry weight corrected

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2
Customer Sample ID										
RPS Sample No					303498	303499	303500	303501	303502	303503
Sample Type					**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location										
Sample Depth (m)										
Sampling Date					/ /	/ /	/ /	/ /	/ /	/ /
Sampling Time										
sample type*		S			Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Extremely Poorly Sorted	Trimodal, Very Poorly Sorted	Trimodal, Extremely Poorly Sorted	Trimodal, Very Poorly Sorted
textural group (GRADISTAT)*		S			Gravelly Mud	Slightly Gravelly Sandy Mud	Muddy Gravel	Gravelly Mud	Muddy Sandy Gravel	Muddy Sandy Gravel
sediment name*		S			Very Fine Gravelly Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy	Coarse Silty Very Coarse Gravel	Very Fine Gravelly Medium Silt	Medium Silty Sandy Coarse Gravel	Medium Silty Sandy Very Fine Gravel
arithmetic mean (method of moments)*		S		um	255	296	29600	605	10000	2920
arithmetic sorting (method of moments)*		S		um	1050	1160	26800	1290	11300	4020
arithmetic skewness (method of moments)*		S		um	8.36	6.96	-0.156	2.10	0.711	2.21
arithmetic kurtosis (method of moments)*		S		um	96.6	64.0	1.04	6.02	1.71	7.85
geometic mean (method of moments)*		S		um	25.6	27.6	2050	44.3	1790	505
geometic sorting (method of moments)*		S		um	5.53	6.52	44.3	9.28	16.9	15.3

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**
				Customer Sample ID						
				RPS Sample No	303498	303499	303500	303501	303502	303503
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location						
				Sample Depth (m)						
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time						
Determinand	**CAS No**	**Codes**	**SOP**	**Units**						
geometic skewness (method of moments)*		S		um	1.11	0.788	-0.458	0.969	-1.01	-0.752
geometic kurtosis (method of moments)*		S		um	4.91	3.93	1.43	2.70	2.90	2.14
logarithmic mean (method of moments)*		S		phi	5.29	5.18	-1.03	4.50	-0.842	0.985
logarithmic sorting (method of moments)*		S		phi	2.47	2.70	5.47	3.21	4.08	3.93
logarithmic skewness (method of moments)*		S		phi	-1.11	-0.788	0.458	-0.969	1.01	0.752
logarithmic kurtosis (method of moments)*		S		phi	4.91	3.93	1.43	2.70	2.90	2.14
mean (Folk and Ward method - um)*		S		um	21.7	24.8	3460	59.9	1520	458
sorting (Folk and Ward method - um)*		S		um	5.29	6.11	32.5	11.4	18.7	15.5
skewness (Folk and Ward method - um)*		S		um	0.226	0.229	-0.941	0.514	-0.437	-0.570
kurtosis (Folk and Ward method - um)*		S		um	1.50	1.29	0.530	1.22	0.954	0.715
mean (Folk and Ward method - phi)*		S		phi	5.53	5.33	-1.79	4.06	-0.605	1.13
sorting (Folk and Ward method - phi)*		S		phi	2.40	2.61	5.02	3.51	4.23	3.96
skewness (Folk and Ward method - phi)*		S		phi	-0.226	-0.229	0.941	-0.514	0.437	0.570
kurtosis (Folk and Ward method - phi)*		S		phi	1.50	1.29	0.530	1.22	0.954	0.715

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2
				Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**
				Customer Sample ID						
				RPS Sample No	303498	303499	303500	303501	303502	303503
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location						
				Sample Depth (m)						
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time						
mean description (Folk and Ward method)*		S			Coarse Silt	Coarse Silt	Very Fine Gravel	Very Coarse Silt	Very Coarse Sand	Medium Sand
sorting description (Folk and Ward method)*		S			Very Poorly Sorted	Very Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)*		S			Coarse Skewed	Coarse Skewed	Very Fine Skewed	Very Coarse Skewed	Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)*		S			Leptokurtic	Leptokurtic	Very Platykurtic	Leptokurtic	Mesokurtic	Platykurtic
MODE 1 - um*		S		um	18.9	18.9	54500	13.3	27300	2400
MODE 2 - um*		S		um	3400	1700		3400	2400	13600
MODE 3 - um*		S		um				1200	9600	9.41
MODE 1 - phi*		S		phi	5.75	5.75	-5.75	6.25	-4.75	-1.24
MODE 2 - phi*		S		phi	-1.74	-0.743		-1.74	-1.24	-3.74

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2
				Customer Sample No	A1	B1	B2	C1	D1	D2
				Customer Sample ID						
				RPS Sample No	303498	303499	303500	303501	303502	303503
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location						
				Sample Depth (m)						
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time						
MODE 3 - phi*		S		phi				-0.243	-3.24	6.75
D10 - um*		S		um	4.2	3.7	8.8	4.8	11.7	6.6
D50 - um*		S		um	20.8	21.6	46100	21.9	3430	1670
D90 - um*		S		um	143	317	59900	2990	28100	8430
(D90/D10) - um*		S		um	33.9	85.4	6830	621	2410	1280
(D90 - D10) - um*		S		um	139	313	59900	2980	28100	8420
(D75/D25) - um*		S		um	6.11	8.21	1450	10.4	40.6	103
(D75 - D25) - um*		S		um	43.7	58.2	54300	83.8	22600	3370
D10 - phi*		S		phi	2.80	1.66	-5.91	-1.58	-4.81	-3.08
D50 - phi*		S		phi	5.59	5.53	-5.53	5.52	-1.78	-0.741
D90 - phi*		S		phi	7.89	8.08	6.83	7.70	6.42	7.25
(D90/D10) - phi*		S		phi	2.81	4.87	-1.16	-4.87	-1.33	-2.36
(D90 - D10) - phi*		S		phi	5.08	6.42	12.7	9.28	11.2	10.3
(D75/D25) - phi*		S		phi	1.61	1.78	-0.822	1.98	-0.179	-2.79
(D75 - D25) - phi*		S		phi	2.61	3.04	10.5	3.37	5.34	6.69
% gravel*		S		%	5.40	4.33	57.9	14.9	61.2	43.2

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2
				Customer Sample ID						
				RPS Sample No	303498	303499	303500	303501	303502	303503
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location						
				Sample Depth (m)						
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time						
% sand*		S		%	15.6	21.5	13.0	14.5	21.5	28.4
% mud*		S		%	79.0	74.1	29.2	70.5	17.3	28.3
% very coarse gravel (>32<64mm or <-5>-6phi)*		S		%	0.00	0.00	53.6	0.00	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)*		S		%	0.00	0.00	0.00	0.00	30.2	1.89
% medium gravel (>8<16mm or <-3>-4phi)*		S		%	0.35	0.30	1.74	0.00	8.89	8.75
% fine gravel (>4<8mm or <-2>-3phi)*		S		%	0.00	1.64	1.45	3.69	8.45	9.90
% very fine gravel (>2<4mm or <-1>-2phi)*		S		%	5.05	2.39	1.09	11.3	13.7	22.7
% very coarse sand (>1<2mm or <0>-1phi)*		S		%	1.63	2.74	1.01	3.97	13.7	22.8
% coarse sand (>0.5<1mm or <1>0phi)*		S		%	0.00	0.80	0.00	0.00	0.12	0.04
% medium sand (>0.25<0.5mm or <2>1phi)*		S		%	0.20	3.40	1.39	0.28	2.42	0.96
% fine sand (>0.125<0.25mm or <3>2phi)*		S		%	3.77	5.32	5.25	3.22	3.31	2.10
% very fine sand (>0.0625<0.125mm or <4>3phi)*		S		%	10.0	9.28	5.30	7.07	1.91	2.57
% very coarse silt (>0.03125<0.0625mm or <5>4phi*		S		%	17.0	14.5	5.85	12.1	2.12	3.65
% coarse silt (>0.015625<0.03125mm or <6>5phi)*		S		%	20.3	18.1	7.29	17.4	3.39	5.64
% medium silt (>0.007813<0.015625mm or <7>6phi)*		S		%	19.1	17.3	7.23	19.9	4.44	7.24
% fine silt (>0.003906<0.007813mm or <8>7phi)*		S		%	14.0	13.6	5.73	14.9	4.16	6.73

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	A1	B1	B2	C1	D1	D2
				Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**
				Customer Sample ID						
				RPS Sample No	303498	303499	303500	303501	303502	303503
				Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
				Sample Location						
				Sample Depth (m)						
				Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /
				Sampling Time						
% very fine silt (>0.001953<0.003906mm or <9>8phi*		S		%	6.43	7.01	2.80	5.85	2.22	3.61
% clay (<0.001953mm or >9phi)*		S		%	2.18	3.65	0.28	0.33	0.98	1.45

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	E1	E2
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
sample type*		S			Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted
textural group (GRADISTAT)*		S			Muddy Sand	Slightly Gravelly Sandy Mud
sediment name*		S			Medium Silty Fine Sand	Slightly Coarse Gravelly Fine Sandy Very
arithmetic mean (method of moments)*		S		um	94.3	287
arithmetic sorting (method of moments)*		S		um	76.6	1860
arithmetic skewness (method of moments)*		S		um	0.545	9.88
arithmetic kurtosis (method of moments)*		S		um	2.46	100
geometic mean (method of moments)*		S		um	51.5	40.6
geometic sorting (method of moments)*		S		um	3.73	5.45

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No	**E1**	**E2**
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
Determinand	**CAS No**	**Codes**	**SOP**	**Units**		
geometic skewness (method of moments)*		S		um	-0.723	-0.096
geometic kurtosis (method of moments)*		S		um	2.25	3.99
logarithmic mean (method of moments)*		S		phi	4.28	4.62
logarithmic sorting (method of moments)*		S		phi	1.90	2.45
logarithmic skewness (method of moments)*		S		phi	0.723	0.096
logarithmic kurtosis (method of moments)*		S		phi	2.25	3.99
mean (Folk and Ward method - um)*		S		um	53.5	40.4
sorting (Folk and Ward method - um)*		S		um	3.75	4.62
skewness (Folk and Ward method - um)*		S		um	-0.537	-0.334
kurtosis (Folk and Ward method - um)*		S		um	0.761	0.805
mean (Folk and Ward method - phi)*		S		phi	4.23	4.63
sorting (Folk and Ward method - phi)*		S		phi	1.91	2.21
skewness (Folk and Ward method - phi)*		S		phi	0.537	0.334
kurtosis (Folk and Ward method - phi)*		S		phi	0.761	0.805

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No	**E1**	**E2**
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
Determinand	**CAS No**	**Codes**	**SOP**	**Units**		
mean description (Folk and Ward method)*		S			Very Coarse Silt	Very Coarse Silt
sorting description (Folk and Ward method)*		S			Poorly Sorted	Very Poorly Sorted
skewness description (Folk and Ward method)*		S			Very Fine Skewed	Very Fine Skewed
kurtosis description (Folk and Ward method)*		S			Platykurtic	Platykurtic
MODE 1 - um*		S		um	151	151
MODE 2 - um*		S		um	13.3	26.7
MODE 3 - um*		S		um		
MODE 1 - phi*		S		phi	2.75	2.75
MODE 2 - phi*		S		phi	6.25	5.25

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	E1	E2
				Customer Sample No	**E1**	**E2**
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
MODE 3 - phi*		S		phi		
D10 - um*		S		um	6.5	4.2
D50 - um*		S		um	90.2	57.1
D90 - um*		S		um	201	213
(D90/D10) - um*		S		um	30.9	51.1
(D90 - D10) - um*		S		um	195	209
(D75/D25) - um*		S		um	8.56	11.1
(D75 - D25) - um*		S		um	130	125
D10 - phi*		S		phi	2.31	2.23
D50 - phi*		S		phi	3.47	4.13
D90 - phi*		S		phi	7.26	7.91
(D90/D10) - phi*		S		phi	3.14	3.55
(D90 - D10) - phi*		S		phi	4.95	5.68
(D75/D25) - phi*		S		phi	2.12	2.21
(D75 - D25) - phi*		S		phi	3.10	3.47
% gravel*		S		%	0.00	1.38

RPS

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				Customer Sample No	**E1**	**E2**
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
Determinand	**CAS No**	**Codes**	**SOP**	**Units**		
% sand*		S		%	59.3	47.1
% mud*		S		%	40.7	51.5
% very coarse gravel (>32<64mm or <-5>-6phi)*		S		%	0.00	0.00
% coarse gravel (>16<32mm or <-4>-5phi)*		S		%	0.00	0.93
% medium gravel (>8<16mm or <-3>-4phi)*		S		%	0.00	0.00
% fine gravel (>4<8mm or <-2>-3phi)*		S		%	0.00	0.16
% very fine gravel (>2<4mm or <-1>-2phi)*		S		%	0.00	0.30
% very coarse sand (>1<2mm or <0>-1phi)*		S		%	0.00	0.84
% coarse sand (>0.5<1mm or <1>0phi)*		S		%	0.00	0.00
% medium sand (>0.25<0.5mm or <2>1phi)*		S		%	2.21	3.40
% fine sand (>0.125<0.25mm or <3>2phi)*		S		%	32.2	22.9
% very fine sand (>0.0625<0.125mm or <4>3phi)*		S		%	24.9	19.9
% very coarse silt (>0.03125<0.0625mm or <5>4phi*		S		%	6.89	11.6
% coarse silt (>0.015625<0.03125mm or <6>5phi)*		S		%	10.4	11.5
% medium silt (>0.007813<0.015625mm or <7>6phi)*		S		%	11.0	10.3
% fine silt (>0.003906<0.007813mm or <8>7phi)*		S		%	8.48	9.03

RPS

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Results Summary - PSA Results

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Determinand	CAS No	Codes	SOP	Units	E1	E2
				Customer Sample No	**E1**	**E2**
				Customer Sample ID		
				RPS Sample No	303504	303505
				Sample Type	**SEDIMENT**	**SEDIMENT**
				Sample Location		
				Sample Depth (m)		
				Sampling Date	/ /	/ /
				Sampling Time		
% very fine silt (>0.001953<0.003906mm or <9>8phi*		S		%	3.77	5.34
% clay (<0.001953mm or >9phi)*		S		%	0.23	3.87

RPS

2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - PSA Size Class & Statistics

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

			Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**	**E1**	**E2**
			Customer Sample ID								
			RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location								
			Sample Depth (m)								
			Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
			Sampling Time								
Sediment	**mm**	**phi ϕ**	**Units**								
Very coarse gravel	>32<64	<-5>-6	%	0.00	0.00	53.60	0.00	0.00	0.00	0.00	0.00
Coarse gravel	>16<32	<-4>-5	%	0.00	0.00	0.00	0.00	30.20	1.89	0.00	0.93
Medium gravel	>8<16	<-3>-4	%	0.35	0.30	1.74	0.00	8.89	8.75	0.00	0.00
Fine gravel	>4<8	<-2>-3	%	0.00	1.64	1.45	3.69	8.45	9.90	0.00	0.16
Very fine gravel	>2<4	<-1>-2	%	5.05	2.39	1.09	11.30	13.70	22.70	0.00	0.30
Very coarse sand	>1<2	<0>-1	%	1.63	2.74	1.01	3.97	13.70	22.80	0.00	0.84
Coarse sand	>0.5<1	<1>0	%	0.00	0.80	0.00	0.00	0.12	0.04	0.00	0.00
Medium sand	>0.25<0.5	<2>1	%	0.20	3.40	1.39	0.28	2.42	0.96	2.21	3.40
Fine sand	>0.125<0.25	<3>2	%	3.77	5.32	5.25	3.22	3.31	2.10	32.20	22.90
Very fine sand	>0.0625<0.125	<4>3	%	10.00	9.28	5.30	7.07	1.91	2.57	24.90	19.90
Very coarse silt	>0.03125<0.0625	<5>4	%	17.00	14.50	5.85	12.10	2.12	3.65	6.89	11.60
Coarse silt	>0.015625<0.03125	<6>5	%	20.30	18.10	7.29	17.40	3.39	5.64	10.40	11.50
Medium silt	>0.007813<0.015625	<7>6	%	19.10	17.30	7.23	19.90	4.44	7.24	11.00	10.30
Fine silt	>0.003906<0.007813	<8>7	%	14.00	13.60	5.73	14.90	4.16	6.73	8.48	9.03
Very fine silt	>0.001953<0.003906	<9>8	%	6.43	7.01	2.80	5.85	2.22	3.61	3.77	5.34
Clay	<0.001953	>9	%	2.18	3.65	0.28	0.33	0.98	1.45	0.23	3.87

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2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - PSA Size Class & Statistics

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

				A1	B1	B2	C1	D1	D2	E1	E2
			Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**	**E1**	**E2**
			Customer Sample ID								
			RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505
			Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
			Sample Location								
			Sample Depth (m)								
			Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
			Sampling Time								
Sediment	**mm**	**phi ϕ**	**Units**								
Statistics*	Mean (phi)			5.53	5.33	-1.79	4.06	-0.605	1.13	4.23	4.63
	Sorting			2.40	2.61	5.02	3.51	4.23	3.96	1.91	2.21
	Skewness			-0.226	-0.229	0.941	-0.514	0.437	0.570	0.537	0.334
	Kurtosis			1.50	1.29	0.530	1.22	0.954	0.715	0.761	0.805
	% Silt/Clay		%	79.01	74.16	29.18	70.48	17.31	28.32	40.77	51.64
	Textural Group**			Gravelly Mud	Slightly Gravelly Sandy Mud	Muddy Gravel	Gravelly Mud	Muddy Sandy Gravel	Muddy Sandy Gravel	Muddy Sand	Slightly Gravelly Sandy Mud

* Folk & Ward

** GRADISTAT classification system (Blott, S. J. & Pye, K., 2001)

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2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Results Summary - PSA Wentworth Scale

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

	Customer Sample No	**A1**	**B1**	**B2**	**C1**	**D1**	**D2**	**E1**	**E2**
	Customer Sample ID								
	RPS Sample No	303498	303499	303500	303501	303502	303503	303504	303505
	Sample Type	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
	Sample Location								
	Sample Depth (m)								
	Sampling Date	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
	Sampling Time								
Parameter	**Units**								
Pebble	%	0.35	1.94	56.79	3.69	47.54	20.54	0.00	1.09
Granule	%	5.05	2.39	1.09	11.30	13.70	22.70	0.00	0.30
Very coarse sand	%	1.63	2.74	1.01	3.97	13.70	22.80	0.00	0.84
Coarse sand	%	0.00	0.80	0.00	0.00	0.12	0.04	0.00	0.00
Medium sand	%	0.20	3.40	1.39	0.28	2.42	0.96	2.21	3.40
Fine sand	%	3.77	5.32	5.25	3.22	3.31	2.10	32.20	22.90
Very fine sand	%	10.00	9.28	5.30	7.07	1.91	2.57	24.90	19.90
Silt Clay	%	79.01	74.16	29.18	70.48	17.31	28.32	40.77	51.64
Total	%	100.0	100.0	100.0	100.0	100.0	100.0	100.1	100.1

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2 Shaftesbury Industrial Centre, Icknield Way, Letchworth Garden City, Hertfordshire, SG6 1HE
T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Report No.: **16-54748**
Customer Reference: Not given
Order No: Not given

Comments

Job	Description	Job Comments
16-54748	8 sediment samples in metal containers	n/a

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T +44 (0)1462 480 400, **F** +44 (0)1462 480 403, **E** rpsmh@rpsgroup.com, **W** rpsgroup.com

Report Information

Key to Report Codes

U	UKAS Accredited
M	MCERTS Accredited
S	Subcontracted to approved laboratory
US	Subcontracted to approved laboratory UKAS Accredited for the test
MS	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SI	Subcontracted to internal RPS Group Laboratory
USI	Subcontracted to internal RPS Group Laboratory UKAS Accredited for the test
MSI	Subcontracted to internal RPS Group Laboratory MCERTS/UKAS Accredited for the test
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable sample
S/C (in results)	See Comments
ND (in results)	Not Detected
DW (in units)	Results are expressed on a dry weight basis

Sample Retention and Disposal

Samples will generally* be retained for the following times prior to disposal:

Perishables, e.g. foodstuffs	1 month (if frozen) from the issue date of this report
Waters	2 weeks from the issue date of this report
Other Liquids	1 months from the issue date of this report
Solids (including Soils)	1 months from the issue date of this report

*Sample retention may be subject to agreement with the customer for particular projects

Analytical Methods

PAH's and PCB's	GCMS analysis following extraction of the wet sediment with hexane:acetone by ultrasonic and equlibrium extraction. Extract cleaned-up with alumina and activated copper.
Metals	ICP-MS analysis following microwave assisted digestion in hydrofluoric acid of the dried (<30°C) and ground sediment.
TOC	Combustion and infrared analysis following carbonate removal with hydrochloric acid.
PSA	Wet and dry sieving followed by laser diffraction analysis.
Density	Determination of density from the dry sediment by gravimetric analysis of a known volume of sediment.
Dry solids at 105°C	A portion of the wet sediment is dried at 105°C to constant weight.
TBT and DBT	GCMS analysis following the extraction of the wet sediment and subsequent derivatisation.
Please note:	**All testing carried out using the <2mm fraction**

Laboratories

RPS Letchworth	UKAS Test House 1663
RPS Manchester (Metals only)	UKAS Test House 0605
ESG Scientifics (TOC only)	UKAS Test House 0001
Thompson PSA only	

Profiency Testing (PT)

RPS Letchworth and Manchester Laboratories participate in the QUASIMEME Proficiency Testing Scheme

Appendix 4.4 Trinity Wharf Marina Additional Modelling Services

ROUGHAN & O'DONOVAN

Trinity Wharf Marina

Additional Modelling Services

Document Control Sheet

Client:	Wexford County Council
Project Title:	Trinity Wharf Marina
Document Title:	Additional Modelling Services
Document No:	IBE1115_AMS0001

Text Pages:	25	Appendices:	0

Rev.	Status	Date	Author(s)	Reviewed By	Approved By
D01	Draft	15/11/2018	KC	AKB	AKB
D02	Final	29/11/2018	KC	AKB	AKB

QUALITY ISO 9001:2008 NSAI Certified
ENVIRONMENT ISO 14001:2004 NSAI Certified
HEALTH & SAFETY OHSAS 18001:2007 NSAI Certified
CERTIFIED IQNet MANAGEMENT SYSTEM
ENGINEERS IRELAND cpd ACCREDITED EMPLOYER

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1 INTRODUCTION

In January 2018 RPS completed a study on behalf of Wexford County Council to investigate the feasibility of developing a marina facility at Trinity Wharf in County Wexford. This study identified a preferred option that included the provision of a 61 berth marina to be constructed on the north western corner of the Trinity Wharf site using industry standard modular breakwater units, pontoons and finger berths. This preferred option was considered advantageous due to the lack of capital dredging works required to achieve the desired minimum operating depth of -2.5m (Chart Datum) and thus avoiding potential environmental issues.

Since completion of this study Roughan & O'Donovan (ROD) and Scott Tallon Walker Architects (STW) have finalised the landside development at Trinity Wharf and are now progressing the Environmental Impact Assessment Report (EIAR) on behalf of Wexford County Council. However, due to various factors, it is at present unclear whether planning for the proposed landside Trinity Wharf development will be progressed with or without the preferred marina included. The outline for the proposed developments can be seen in Figure 1.

As such, RPS have been requested by ROD to provide a summary assessment of the potential impacts of the proposed Trinity Wharf development on the coastal processes, with and without the preferred marina *in situ*.

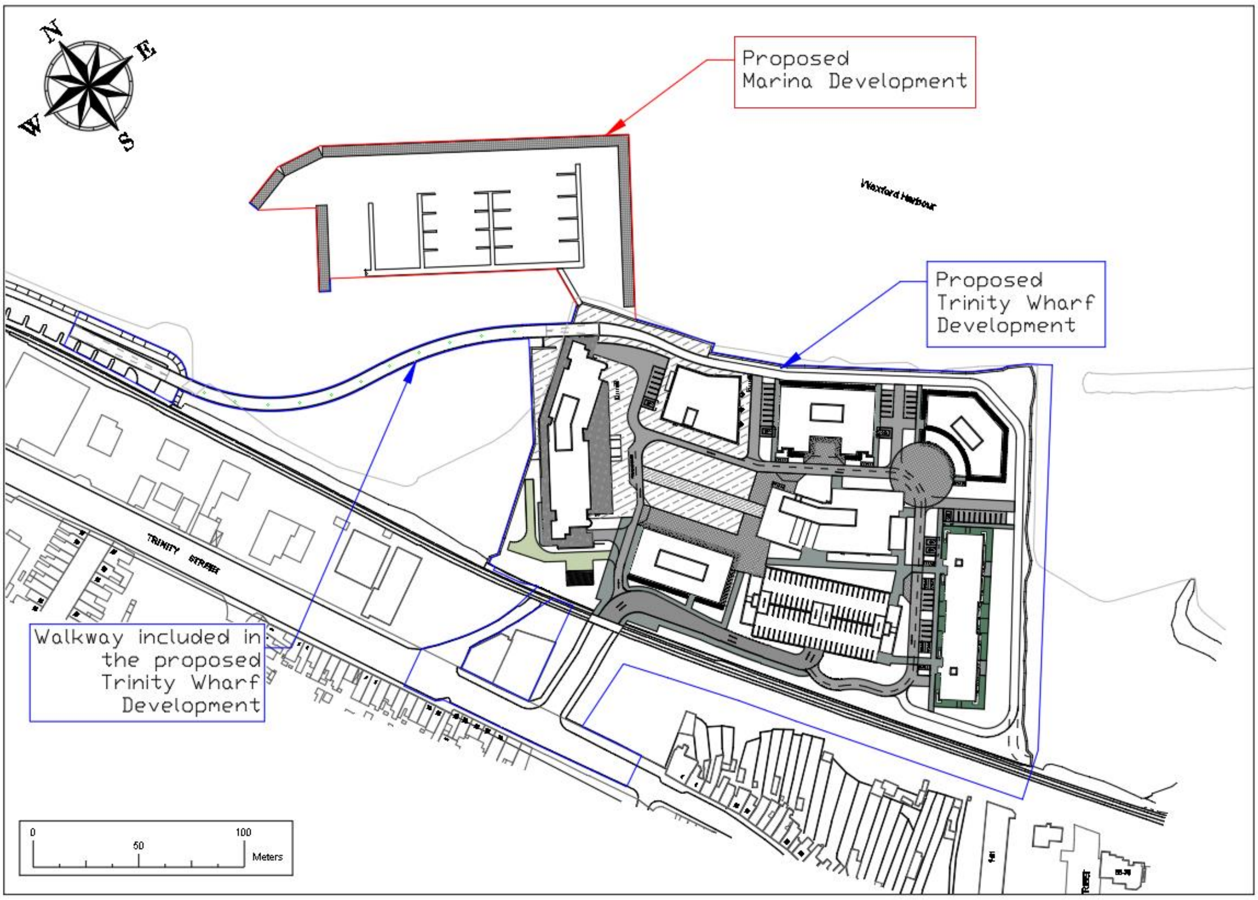


Figure 1: Schematic outline of the proposed landside Trinity Wharf Development and preferred marina option.

In particular, ROD requested the following items of further information:

1. Confirmation of the significant wave heights and mean wave periods throughout the study area for a series of extreme return period events; information was requested for just the landside development and also the combined effect of the landside development with the preferred marina.

2. Confirmation of the current speeds and directions throughout the study area; information was requested for just the landside development and also the combined effect of the landside development with the preferred marina.

3. Confirmation of the extreme tidal levels to OS Malin for the Trinity Wharf area for extreme scenarios with return periods of up to 1 in 1000 years.

4. Description of the potential impact of the proposed landside development and preferred marina on the sediment transport regime within the study area.

5. Recommendation of suitable coastal protection works for along the south eastern perimeter of the proposed Trinity Wharf development to reduce wave reflection into Goodtide harbour.

To assist ROD, STW and Wexford County Council in progressing the Environmental Impact Assessment Report, RPS have responded to these queries in the following Sections of this document.

2 NUMMERICAL MODELLING SYSTEMS

In order to assess the potential impact of the two scenarios on the existing coastal processes it was necessary to update the numerical models that were developed for the original Trinity Wharf Marina feasibility study (RPS, 2018). These models were updated to reflect the following scenarios:

1. **The existing Trinity Wharf site** – This model reflected existing conditions including a training at the north east corner of the site which is partially submerged during

2. **The landside Trinity Wharf Development** -Under this scenario a small area of land (c.400m_2) would be reclaimed on at the north west corner of the Trinity Wharf site. A boardwalk would be constructed to connect Paul Quay to the reclaimed corner of Trinity Wharf. This boardwalk would be supported by a series of circular steel piles. The north west and north east perimeter of the Trinity Wharf site would be protected by a vertical sheet piled sea wall. To reduce wave reflection into Goodtide harbour, the south eastern perimeter of the Trinity Wharf would be protected by a sloped revetment structure in combination with a vertical sheet piled wall.

3. **The landside Wharf Development with the marina** – This scenario was identical to the previous scenario except that it included a series of breakwater units designed to provide a suitable wave climate within the proposed marina area. As piled structures are the preferred restraint system for the marina, a series of circular piles were included in this numerical model.

The three dimensional numerical models used to represent the existing and proposed scenarios with the marina in situ are illustrated in Figure 2 overleaf. It should be noted that only difference between scenarios 2 & 3 is presence of the breakwater units, thus the numerical model representing the scenario 2 has not been presented.

To assess the hydrodynamic regime and spectral wave climate under existing and proposed conditions RPS used the same suite of coastal process modelling software that was used in the original Marina Feasibility Study. This MIKE21/3 modelling system developed by the Danish Hydraulic Institute (DHI) included various numerical modules including the MIKE 21/3 Flexible Mesh Flow Model, the MIKE Hydrodynamic module and the Spectral wave module. A full description of this modelling software and specific modules can be found in the Trinity Wharf Marina Feasibility Study (RPS, 2018).

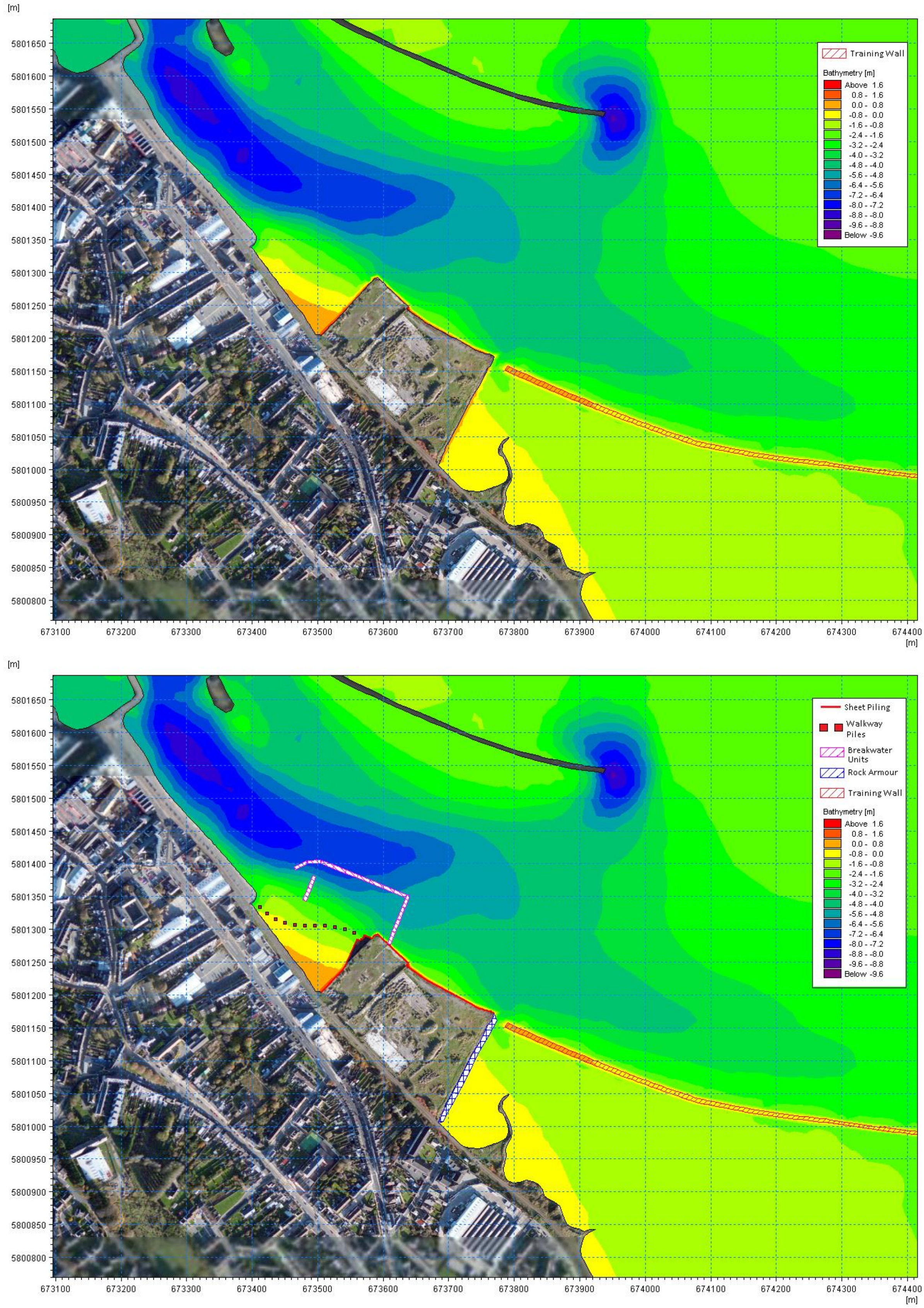


Figure 2: Existing Trinity Wharf bathymetry (top) and proposed layout with marina (bottom)

3 TIDAL REGIME

3.1 EXTREME WATER LEVELS

The extreme combined tide and surge levels for the Trinity Wharf area, as reported in the Irish Coastal Protection Strategy Study (RPS,2010) are presented in Table 3.1 below and should be considered during the design of any landside development.

Table 3.1: Combined tide and surge levels (i.e. extreme water level) at Trinity Wharf (ICPSS, 2010)

Return Period (N) [years]	Water Level to Mean Sea Level [m]	Water Level to Ordnance Datum Malin [m]	Water Level to Chart Datum [m]
2	1.14	1.04	2.31
5	1.29	1.19	2.47
10	1.40	1.31	2.58
50	1.64	1.45	2.82
100	1.74	1.64	2.92
200	1.84	1.74	3.02
1000	2.06	1.97	3.24

3.2 CURRENT FLOWS

The 3D numerical models described in Section 2 were used to simulate and assess the current speeds and directions across the study area during a typical spring tidal regime under existing and proposed conditions. RPS have only presented the tidal regime in the bottom layer of the 3D model as the nearby sensitive environmental receptors are located on the seabed. A full description of the modelling approach used for these simulations can be found in Section 6 of the Trinity Wharf Marina Feasibility Study (2018).

Figure 3 and Figure 4 overleaf illustrate the current speeds and directions at various phases of a typical spring tidal regime throughout the bottom layer of the model.

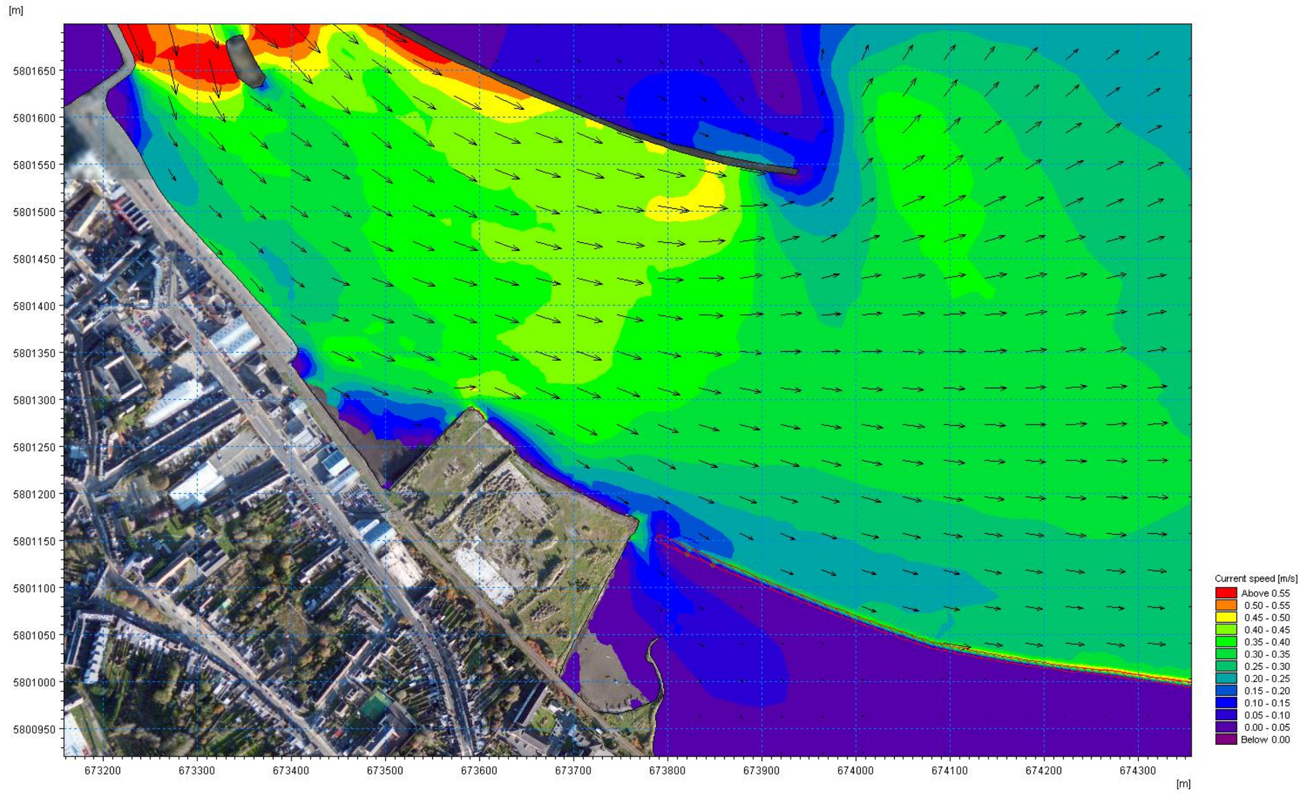
Figure 5 and Figure 6 illustrate the same model output but with the proposed landside development and preferred marina *in situ*.

Figure 7 and Figure 8 illustrates the differences in current speeds as a result of the proposed landside development and marina complex. It will be seen from these figures that the impact of the proposed scheme is virtually imperceptible and that any changes are confined within the immediate vicinity of the proposed development. The most notable changes in the tidal were observed during mid-ebb conditions were changes of *c.* ±0.15m/s can be observed on the lee shore of Trinity Wharf. It was found that the piled structures for the marina and boardwalk did not result in any significant impact to the tidal regime due to the streamlined and narrow shape of the structures.

As the breakwater units are floating structures and only influence a small portion of the surface layer, it was found that the changes to the tidal regime as a result of the landside development in isolation were virtually identically to those caused by the landside development with the marina.

It can therefore be concluded that neither the landside development with the marina nor the landside development in isolation will result in any significant impact to the existing tidal regime.

3.3 TIDAL REGIME WITH THE EXISTING TRINITY WHARF LAYOUT



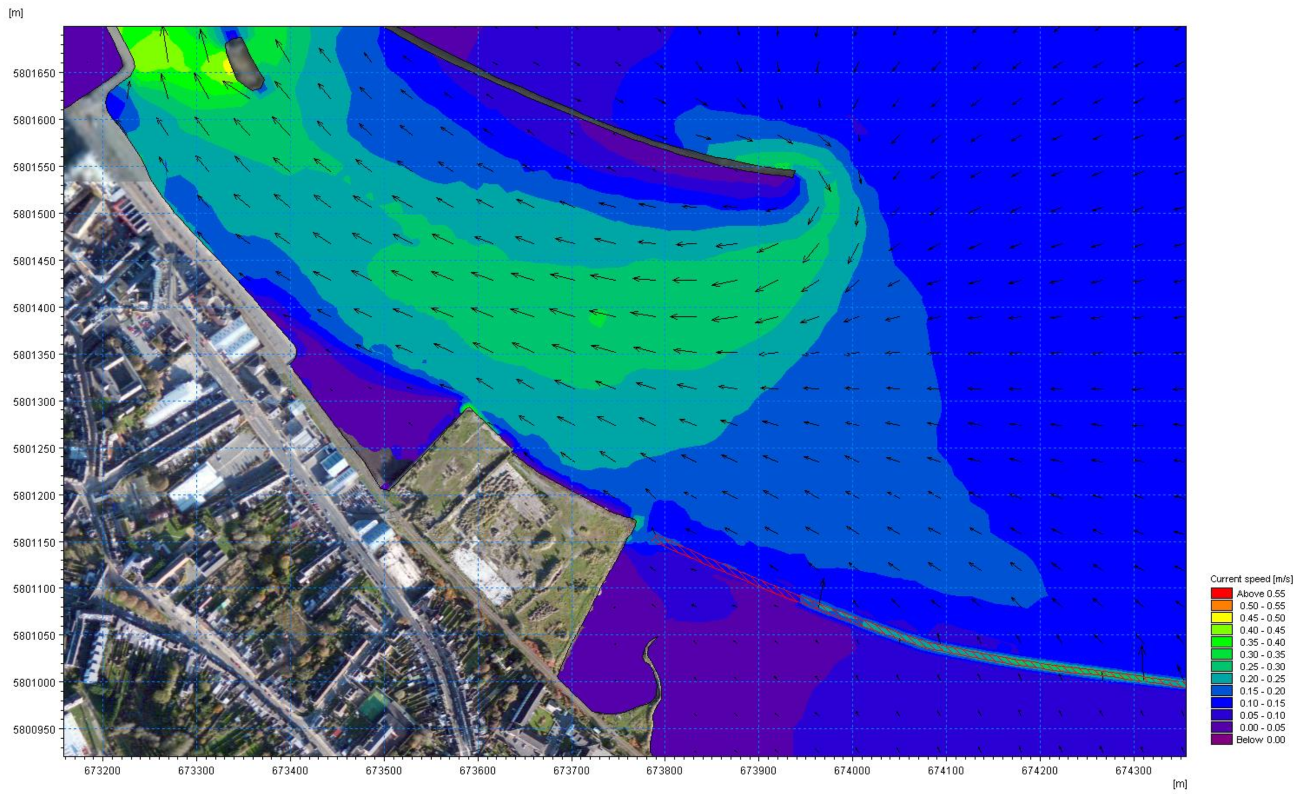


Figure 3: Tidal flows at spring low water (top) and mid-flood (bottom) conditions – Existing Trinity Wharf layout.

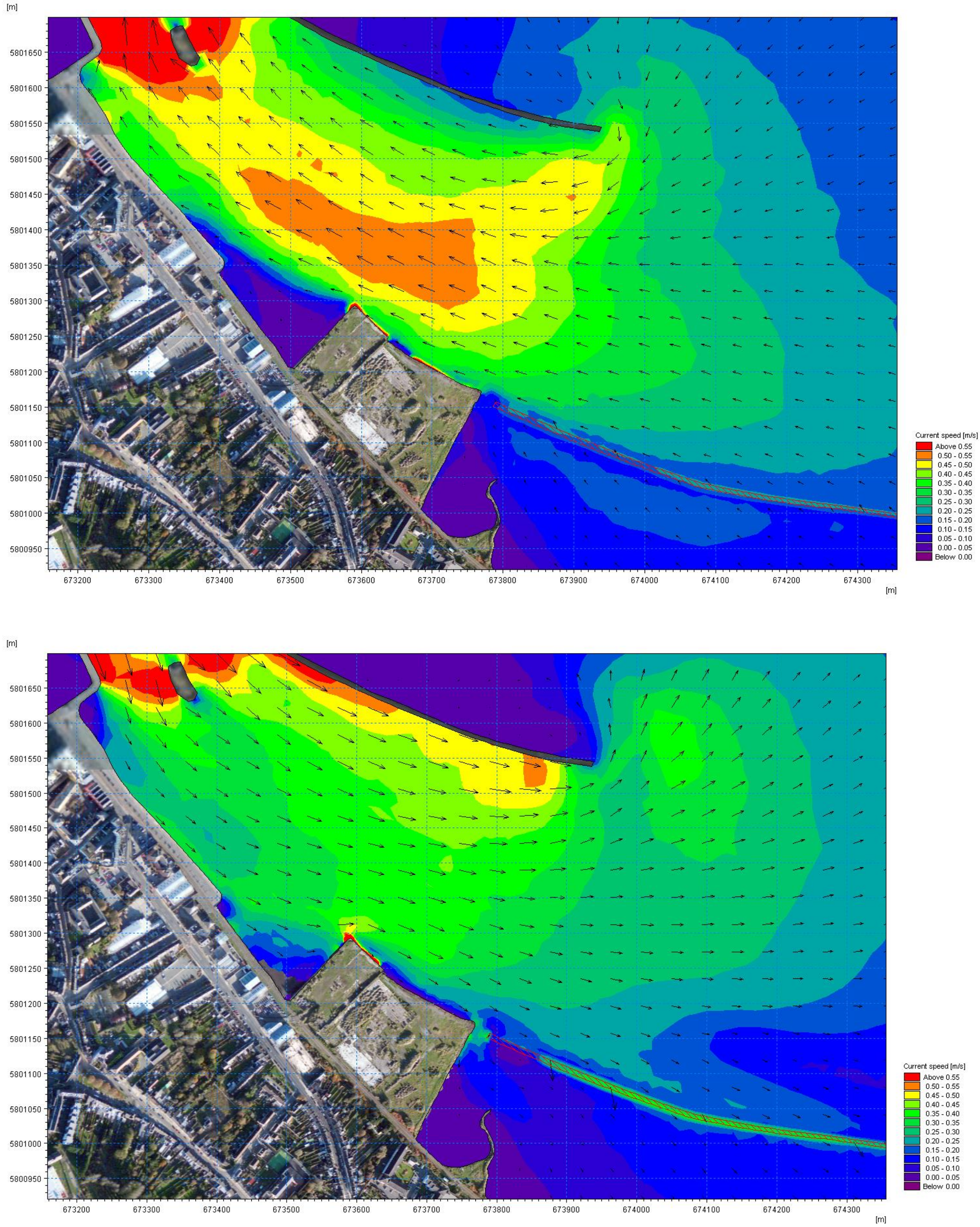


Figure 4: Tidal flows at spring high water (top) and mid-ebb (bottom) conditions – Existing Trinity Wharf layout.

3.4 TIDAL REGIME WITH THE LANDSIDE DEVELOPMENT AND MARINA

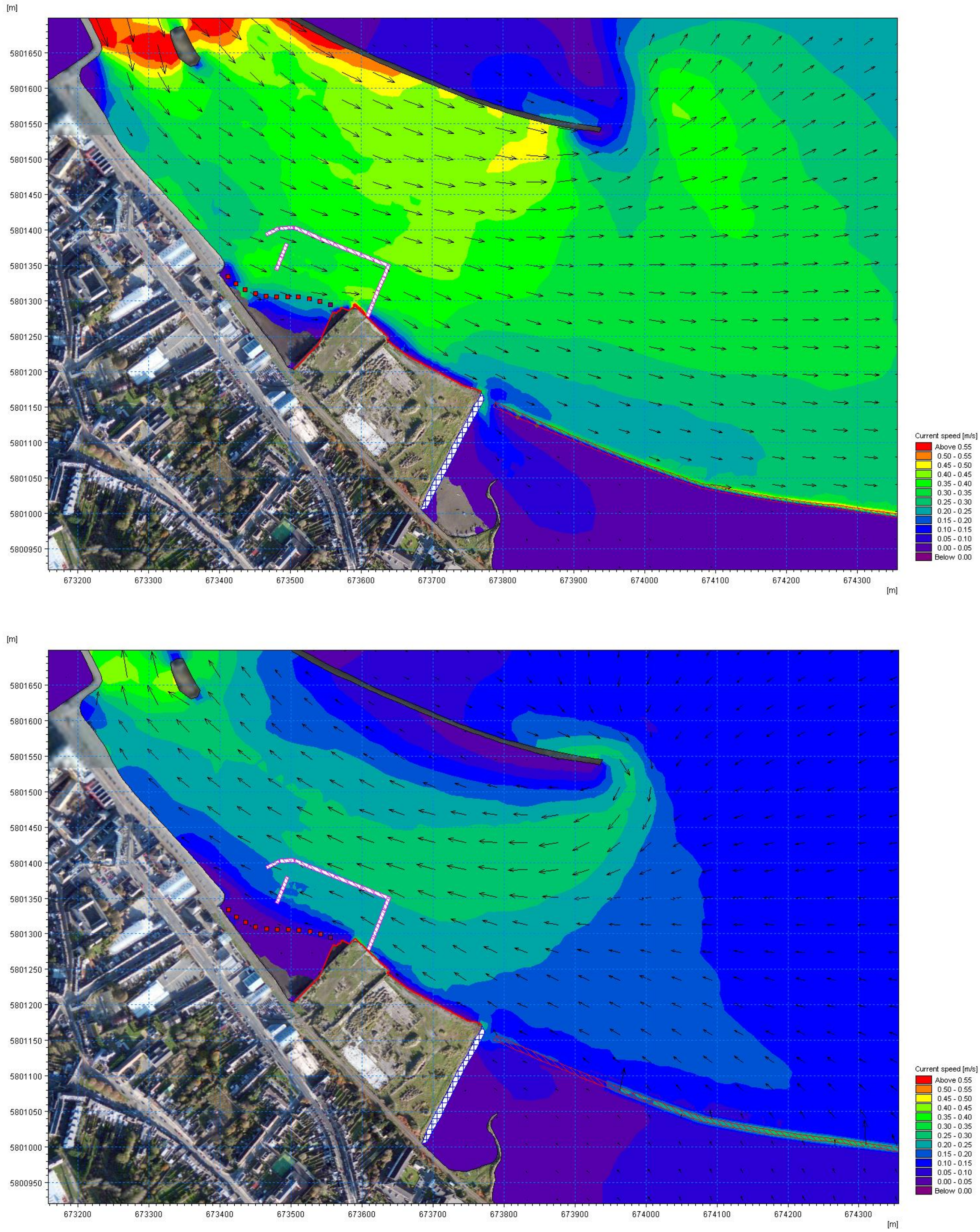
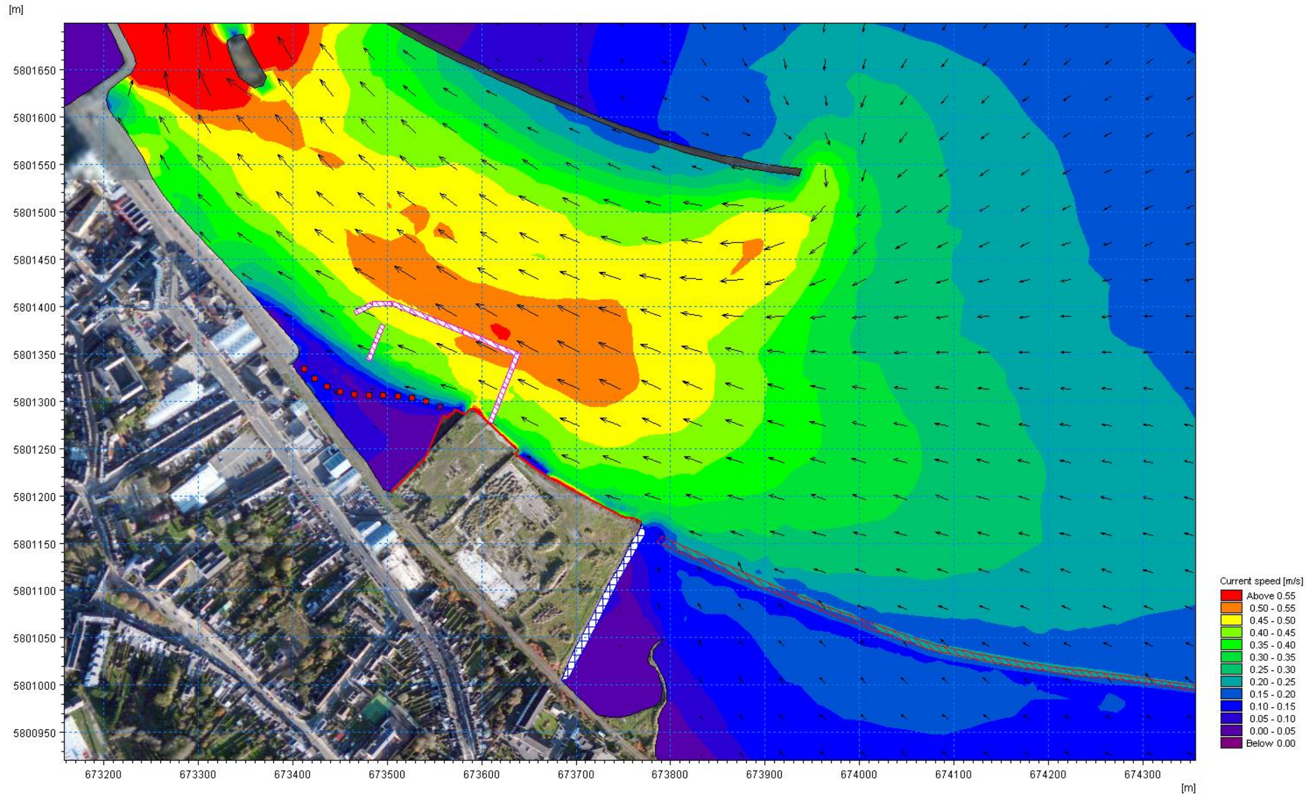


Figure 5: Tidal flows at spring low water (top) and mid-flood (bottom) conditions – Proposed Trinity Wharf Development with marina.



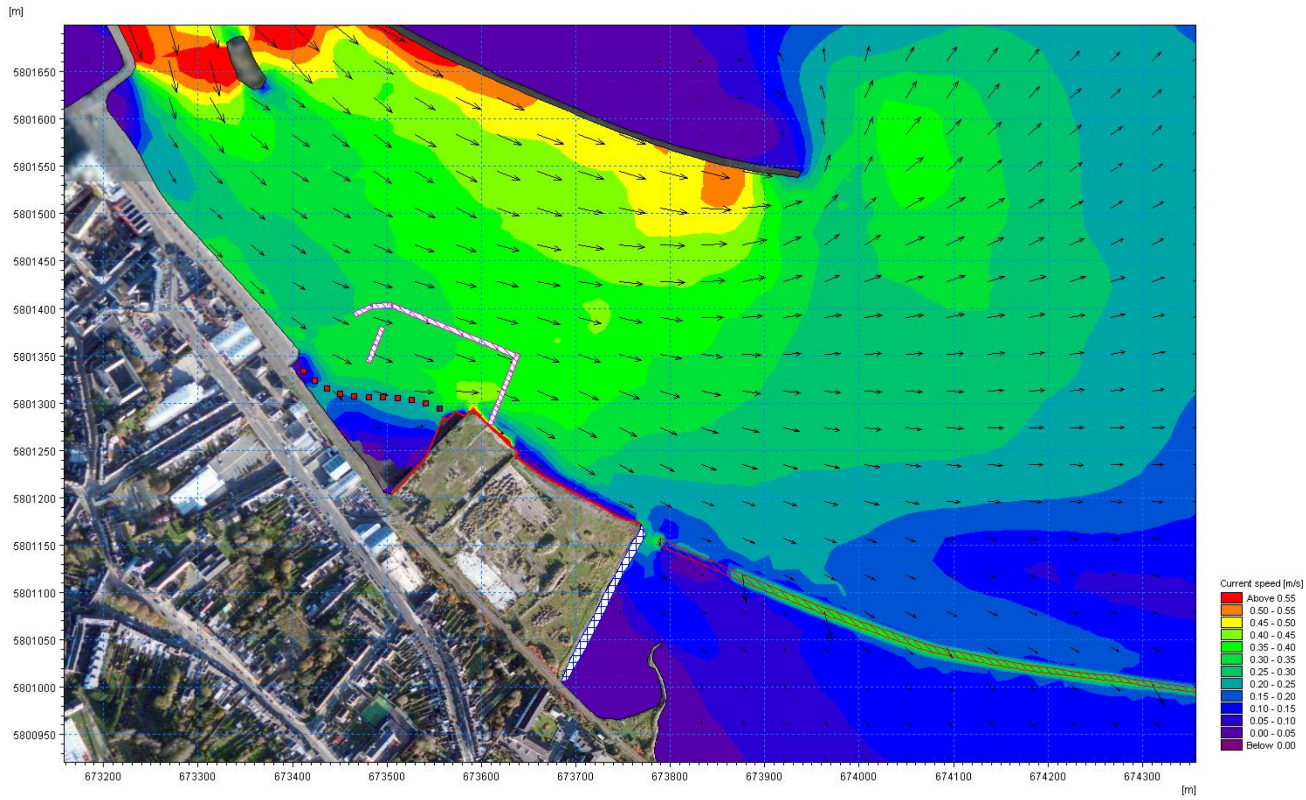


Figure 6: Tidal flows at spring high water (top) and mid-ebb (bottom) conditions – Proposed Trinity Wharf Development with marina

3.5 DIFFERENCES IN THE TIDAL REGIMES (PROPOSED MINUS EXISTING)

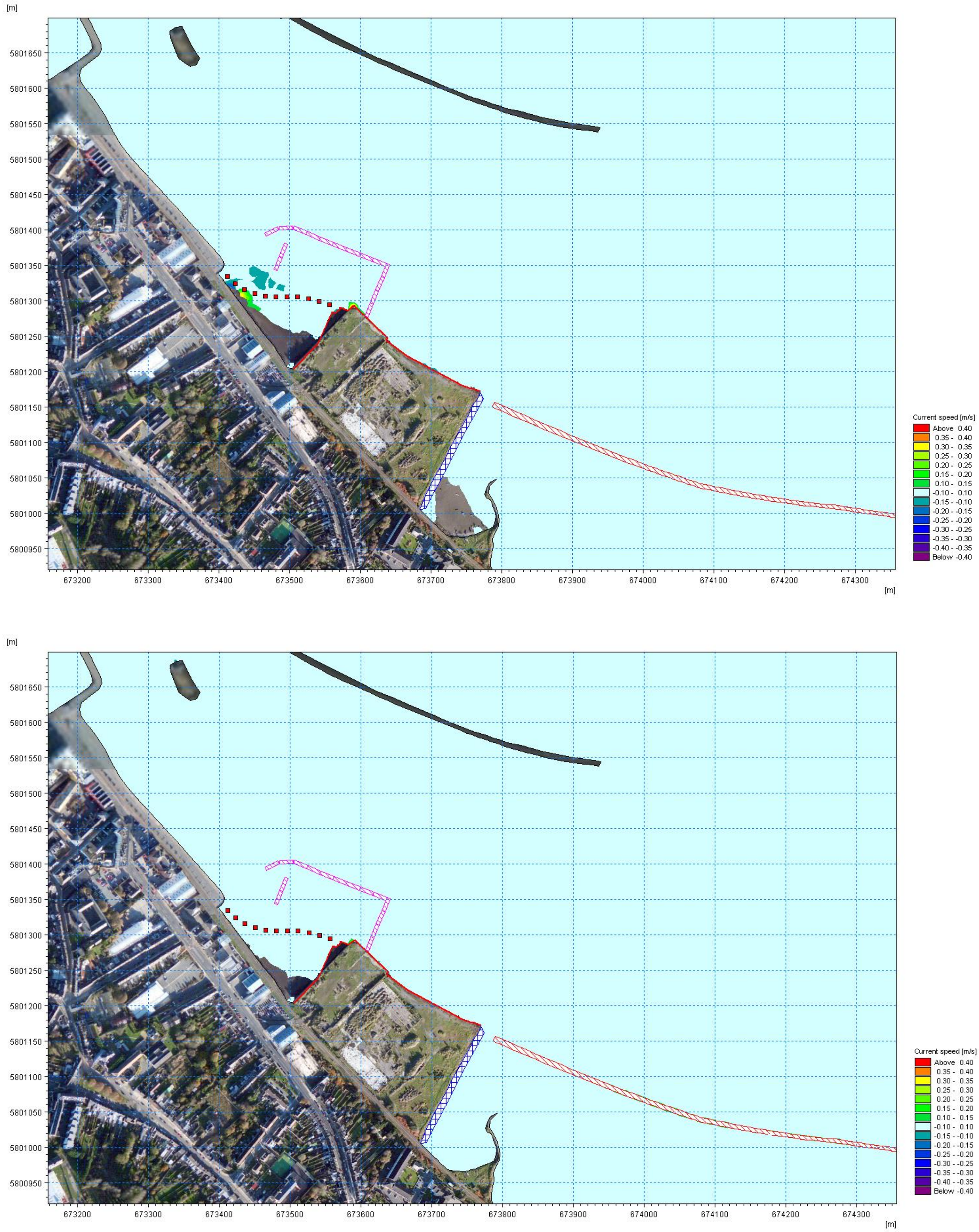


Figure 7: Difference in tidal flows at spring low water (top) and mid-flood (bottom) conditions – proposed minus existing.

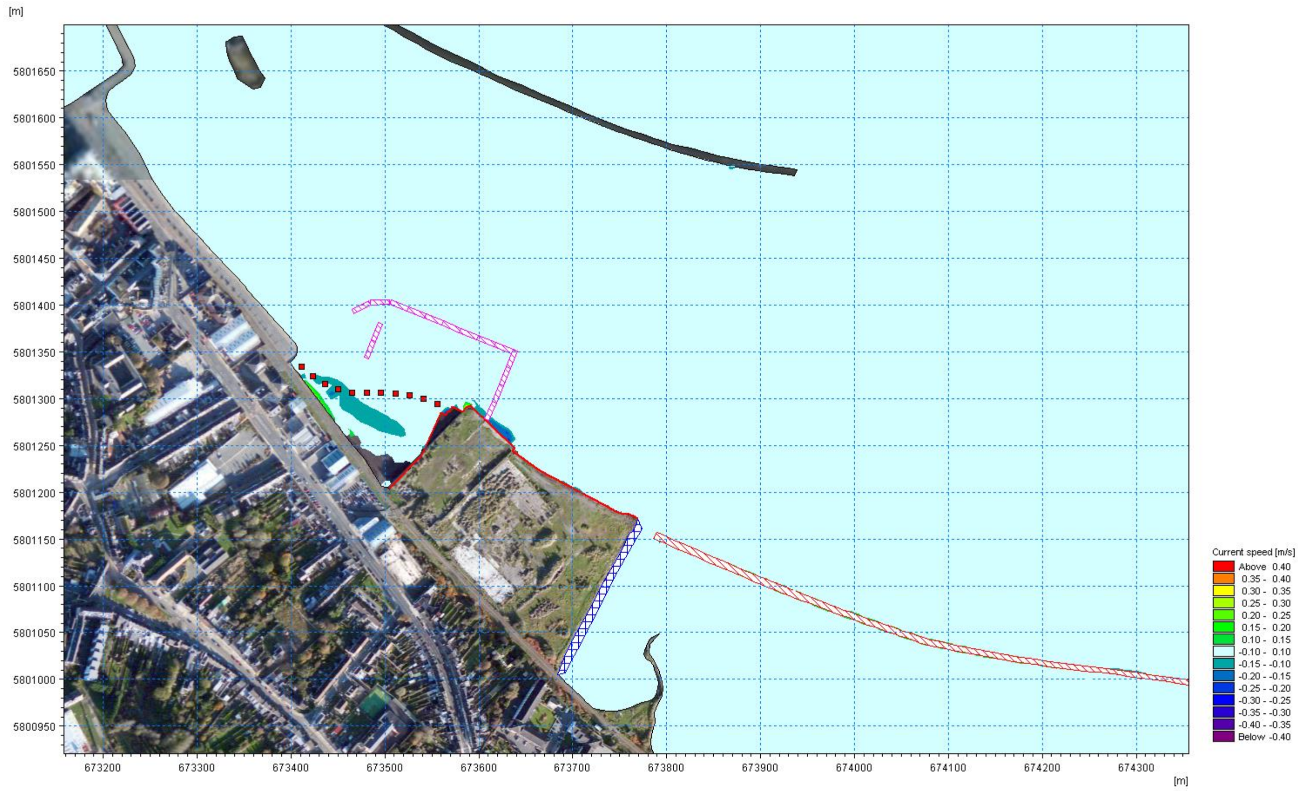


Figure 8: Difference in tidal flows at spring high water (top) and mid-ebb (bottom) conditions – proposed minus existing.

4 WAVE CLIMATE

RPS used the approach described in Section 5 of the Trinity Wharf Marina Feasibility study (RPS, 2018) to assess the inshore wave climate during various extreme wave conditions. These simulations which included 1 in 1 year, 1 in 50 year and 1 in 200 year storm events from the north east and south east were undertaken for the three model scenarios described in Section 2.

The findings from these simulations are presented in Sections 4.1 and 4.2 respectively.

4.1 WAVE CLIMATE WITH THE LANDSIDE DEVELOPMENT ONLY

Figure 9 and Figure 10 illustrate the significant wave heights at the study area during 1 in 1 year, 1 in 50 year and 1 in 200 year return periods storm events from the north east respectively. The difference in the inshore wave climate during the 1 in 200 year wave event from the north east is illustrated in Figure 11.

Figure 12 and Figure 13 illustrates the similar information for events with the same return periods but from the south east. Figure 14 illustrates the difference in the inshore wave climate during the 1 in 200 year wave event from the south east

Based the output from these simulations it should be noted that:

- The maximum significant wave heights across the study area occur during a 1 in 200 year event from the north east. During this event:
  - waves with significant wave heights of *c.*0.90m and corresponding mean wave periods of 2.40s can interact with the pile structures intended to support the boardwalk.
  - waves with significant wave heights of *c.*1.10m and corresponding mean wave periods of 3.00s can interact with the perimeter of the proposed Trinity Wharf site.
- The proposed landside development does not result in any significant impact to the existing wave climate. The only notable change to the wave climate was observed during a 1 in 200 year return period event whereby the wave heights in the lee of the proposed development were decreased by *c.*0.15m. These changes were considered insignificant.

It can therefore be concluded that the proposed landside development at Trinity Wharf will not result in a significant impact to the existing inshore wave climate.

Wave climate with the landside development only

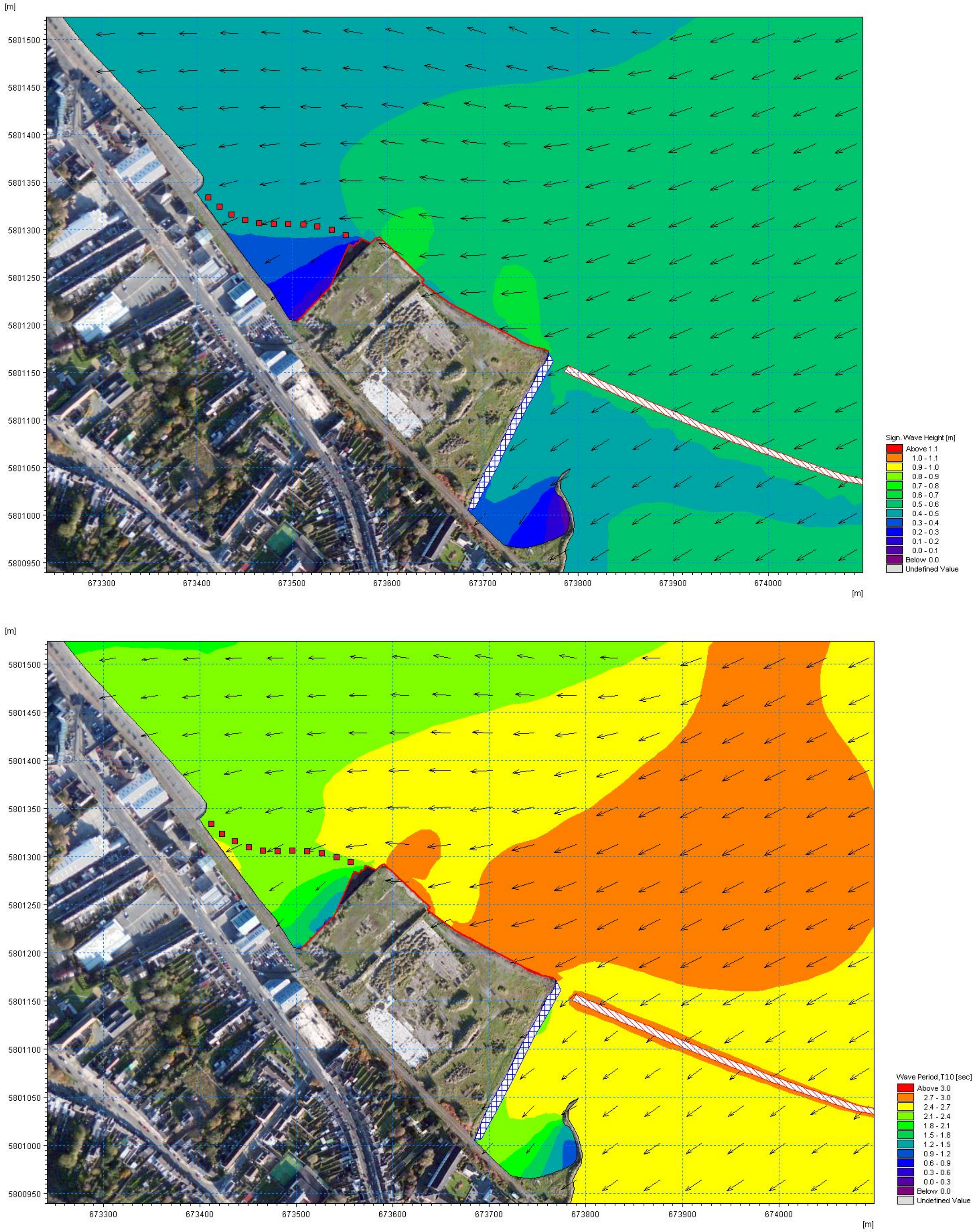


Figure 9: Significant wave heights during a 1 in 1 year (top) and 1 in 50 year (bottom) north easterly storm event – Proposed Trinity Wharf Development without marina

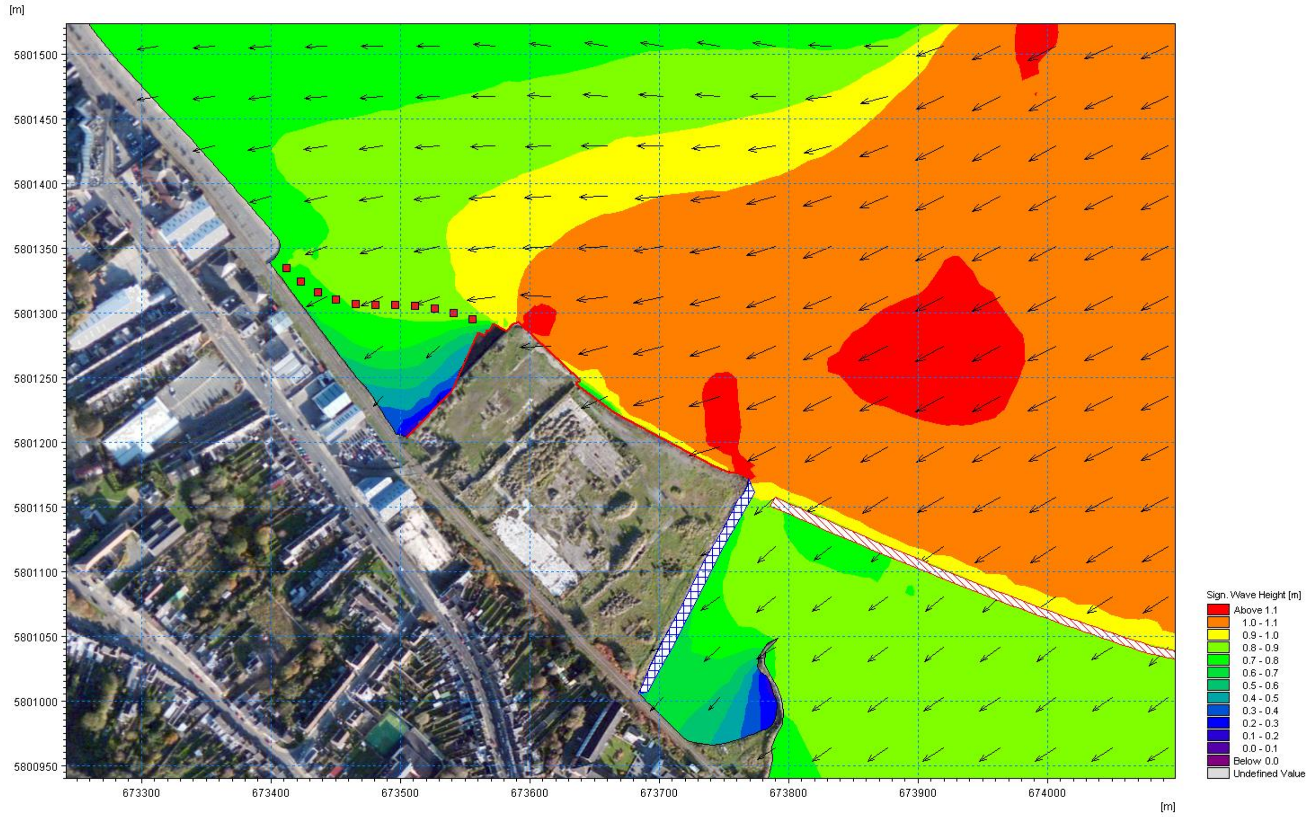
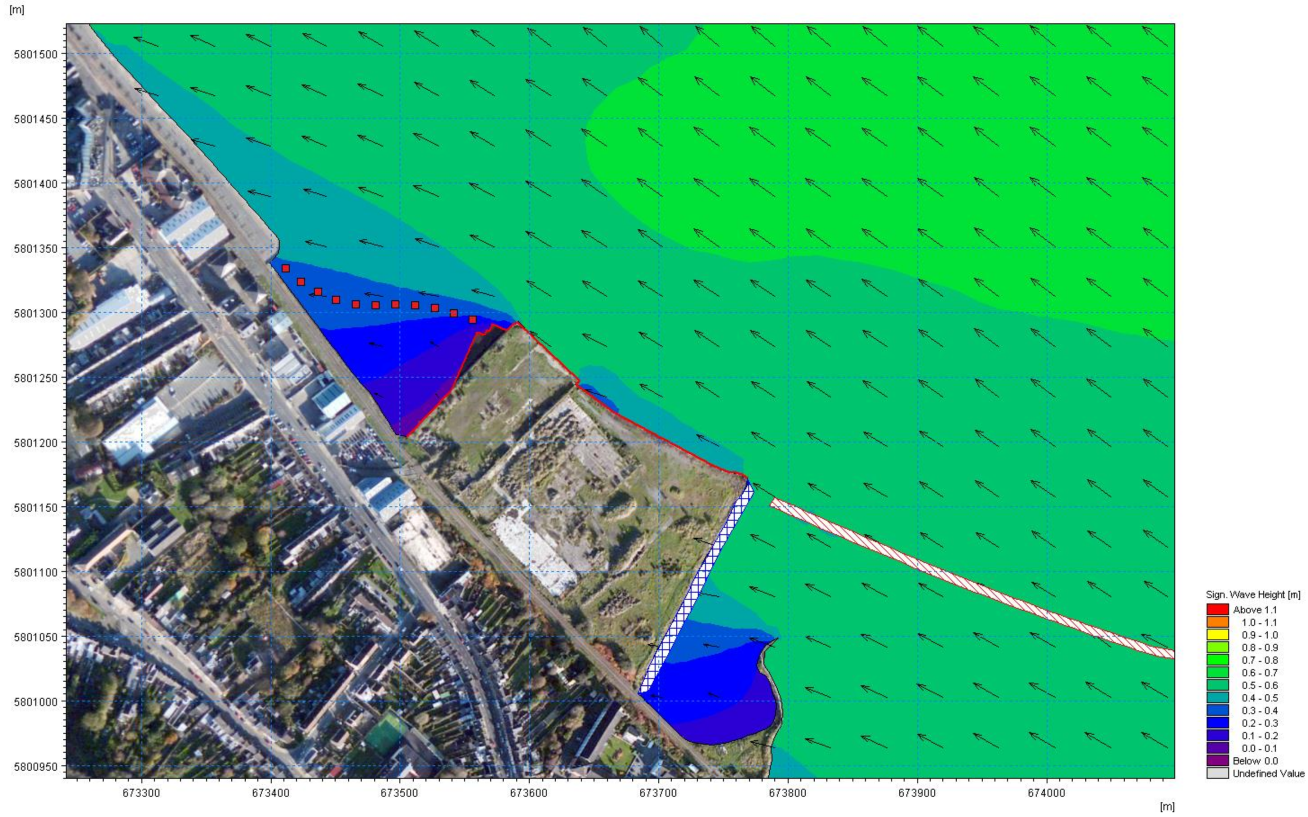


Figure 10: Significant wave heights during a 1 in 200 year north easterly storm event – Proposed Trinity Wharf Development without marina

Figure 11: Difference in 1 in 200 year north easterly storm wave climates – Proposed Trinity Wharf Development without marina *in situ* (proposed minus existing).



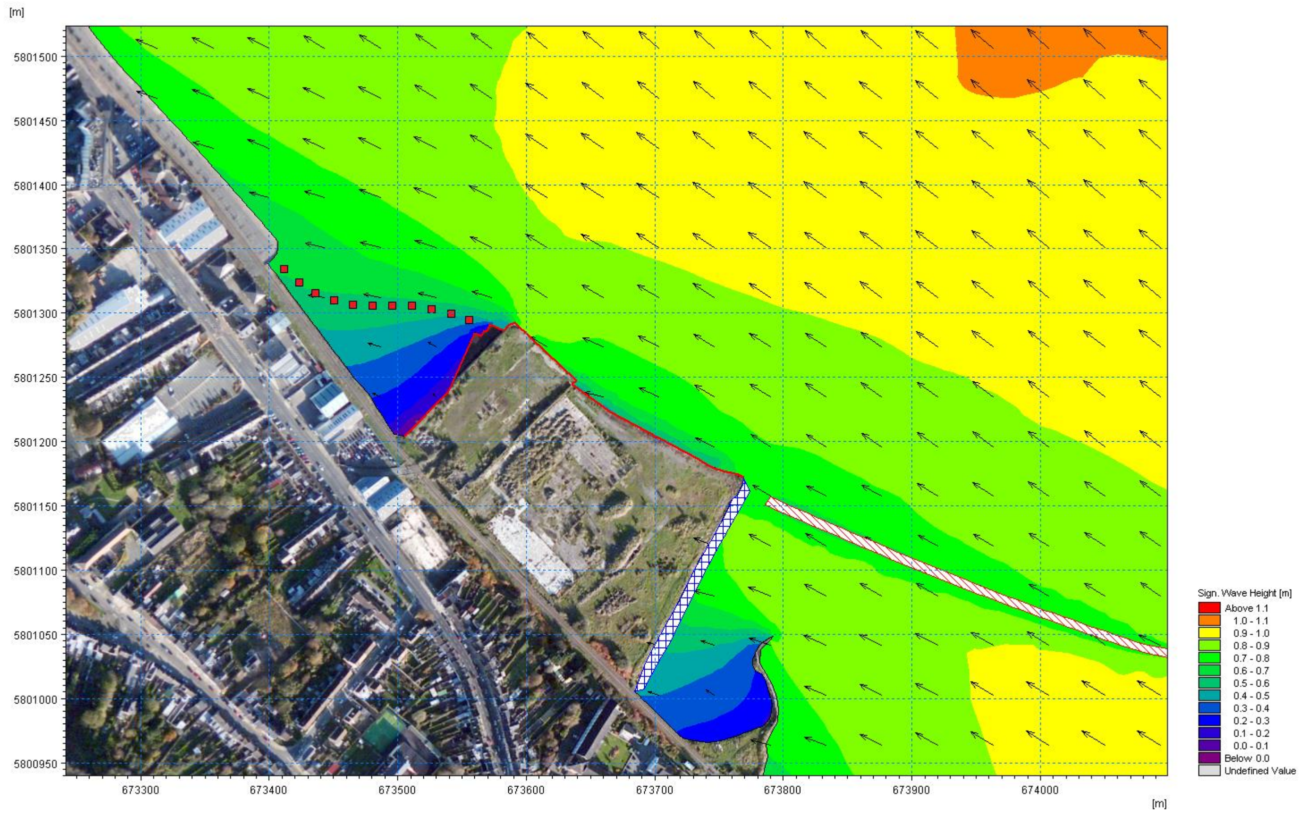


Figure 12: Significant wave heights during a 1 in 1 year (top) and 1 in 50 year (bottom) South Easterly storm event – Proposed Trinity Wharf Development without marina

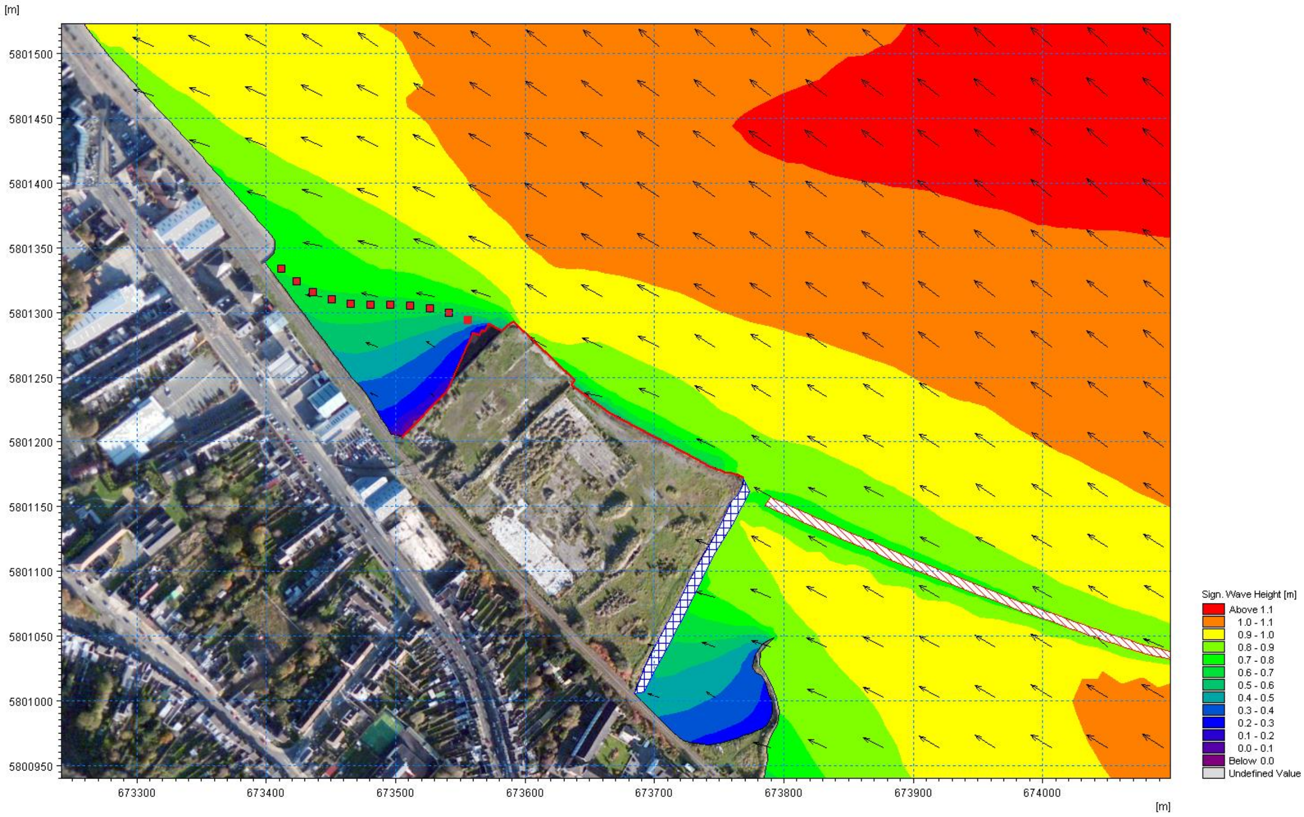


Figure 13: Significant wave heights during a 1 in 200 year south easterly storm event – Proposed Trinity Wharf Development without marina

Figure 14: Difference in 1 in 200 year south easterly storm wave climates – Proposed Trinity Wharf Development without marina *in situ* (proposed minus existing).

4.2 WAVE CLIMATE WITH THE LANDSIDE DEVELOPMENT AND MARINA

Figure 15 and Figure 16 illustrate the significant wave heights at the study area during 1 in 1 year, 1 in 50 year and 1 in 200 year return periods storm events from the north east respectively with both developments *in situ*. The difference in the inshore wave climate during various return period events are illustrated in Figure 17 and Figure 18.

Figure 19 and Figure 20 illustrates the similar information for events with the same return periods but from the south east. Figure 21 and Figure 22 illustrates the difference in the inshore wave climate during the various return period events from the south east.

Based the output from these simulations it should be noted that:

- The proposed marina option successfully reduces the wave climate within the marina area to within accepted threshold values.
- The only differences in the inshore wave climate were found to occur on the lee side of the proposed marina.
- Waves that interacted with the pile structures intended to support the boardwalk during a 1 in 200 year event from the north east had a maximum significant wave height of *c*.0.40m and a corresponding mean wave period of *c.* 3.0s.

It can therefore be concluded that the preferred marina option will not result in any significant changes to the existing inshore wave climate beyond the immediate vicinity of the preferred marina.

Wave climate with the landside development and marina

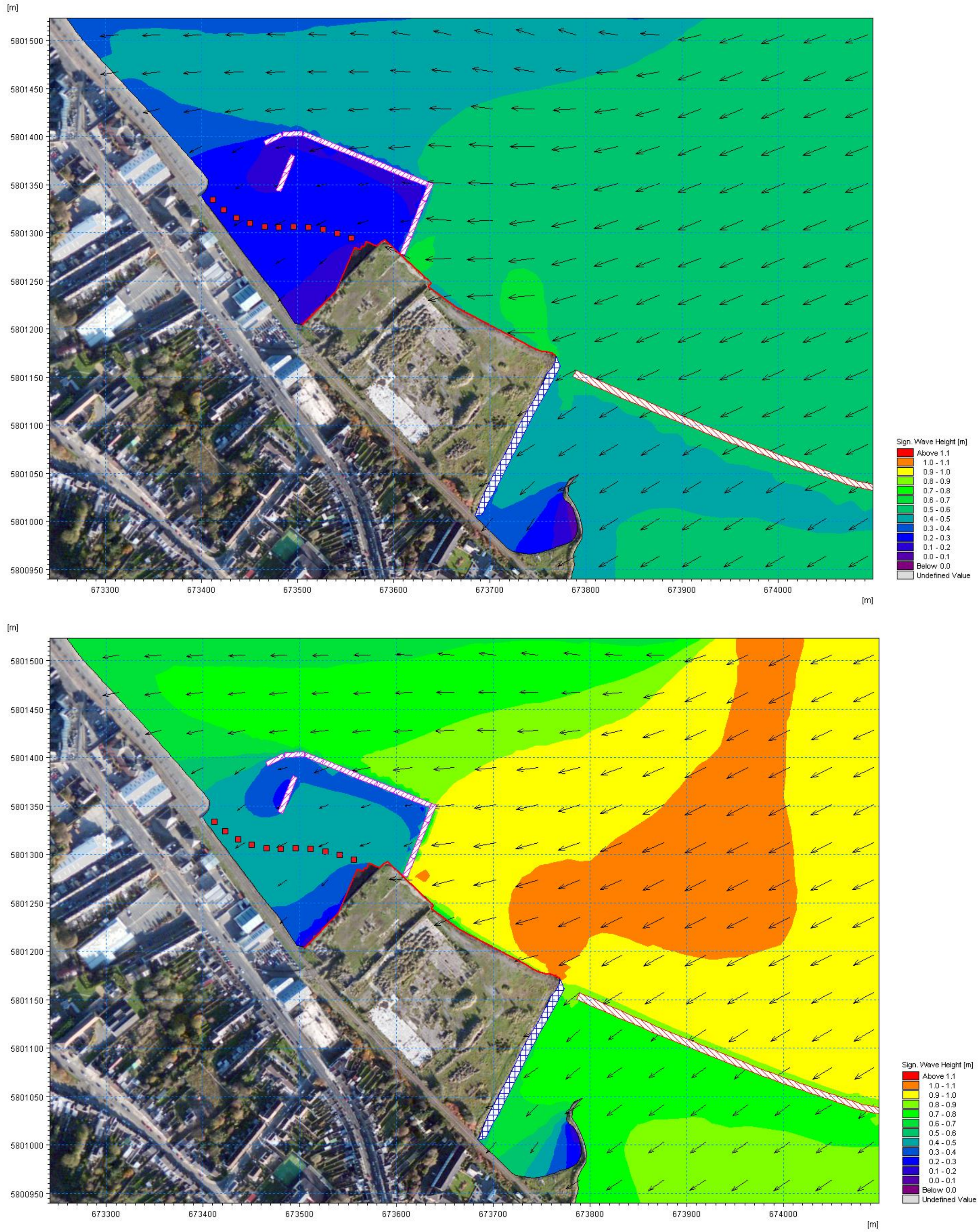


Figure 15: Significant wave heights during a 1 in 1 year (top) and 1 in 50 year (bottom) north easterly Storm event – Proposed Trinity Wharf Development with marina *in situ.*

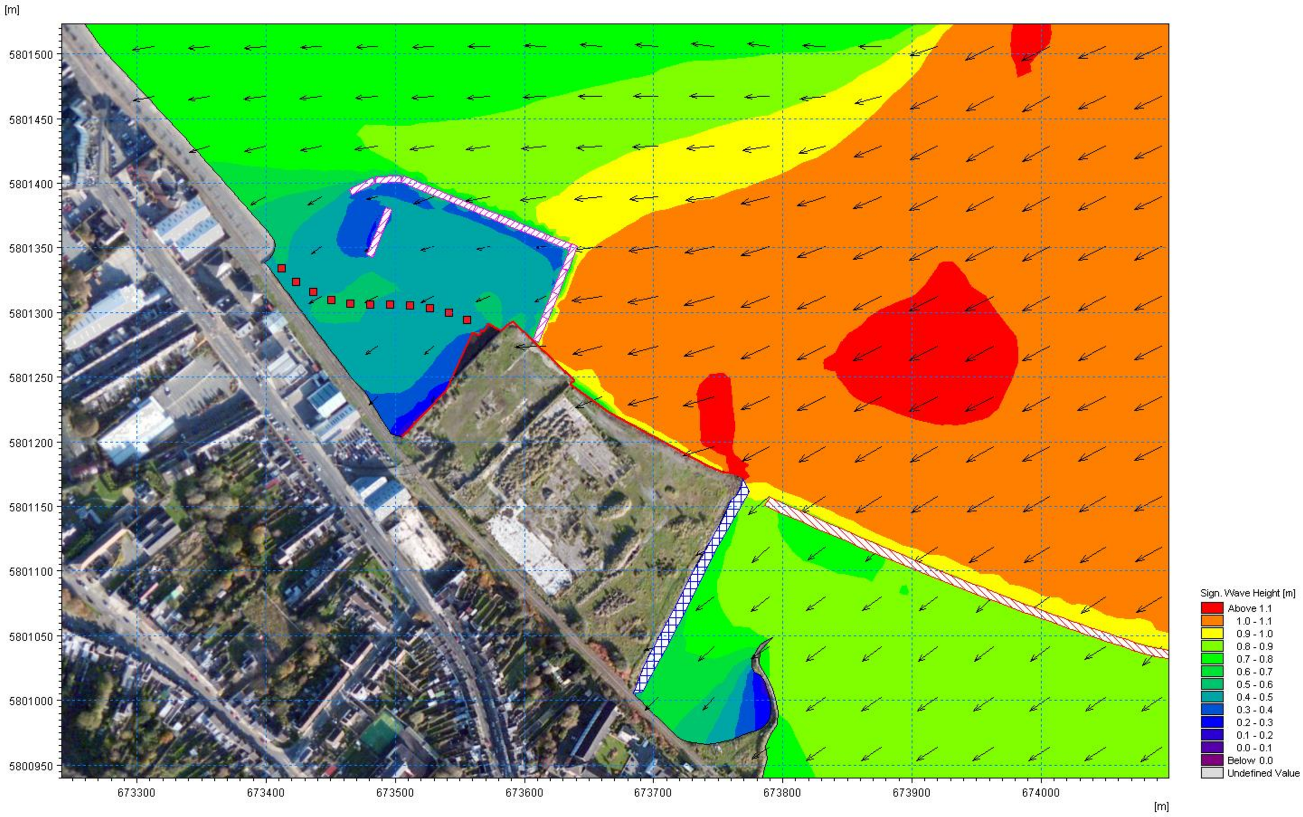


Figure 16: Significant wave heights during a 1 in 200 year north easterly Storm event – Proposed Trinity Wharf Development with marina *in situ.*

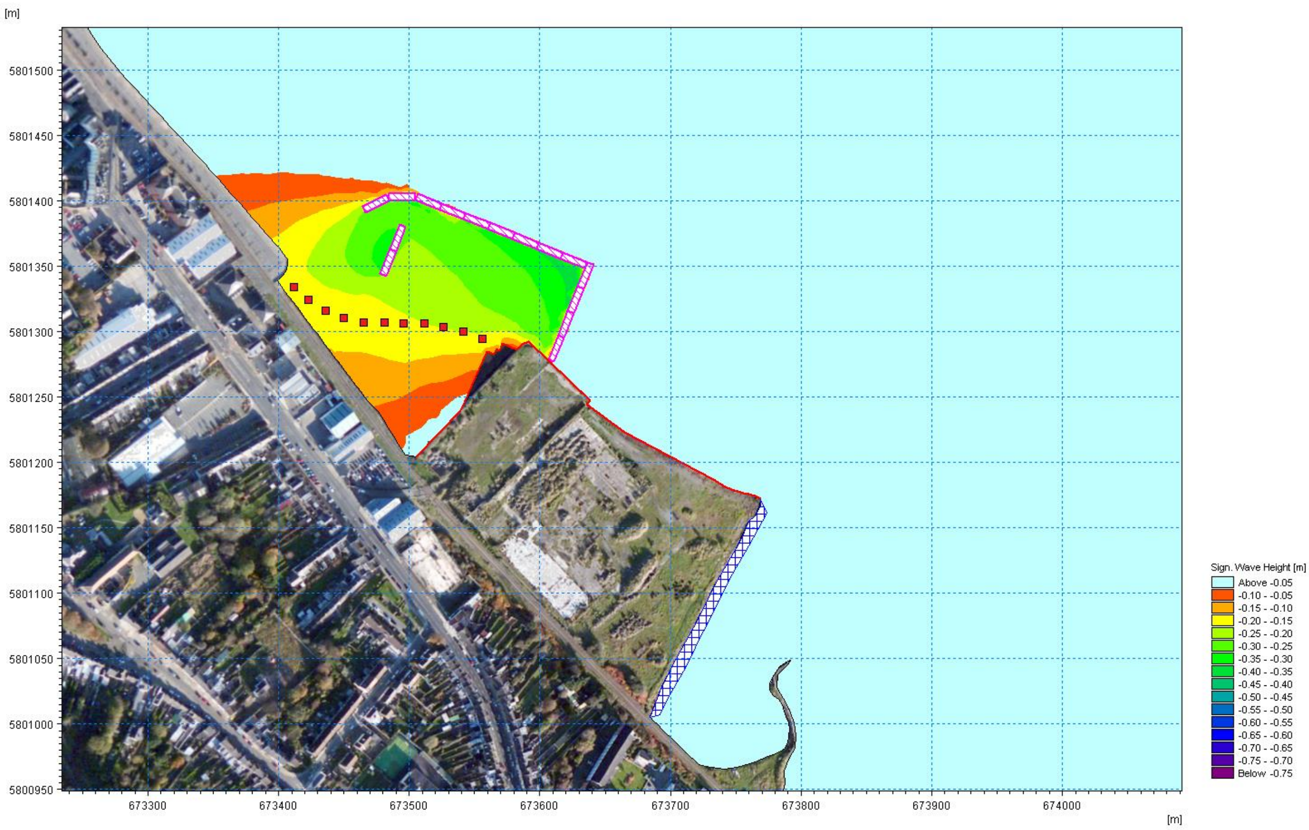
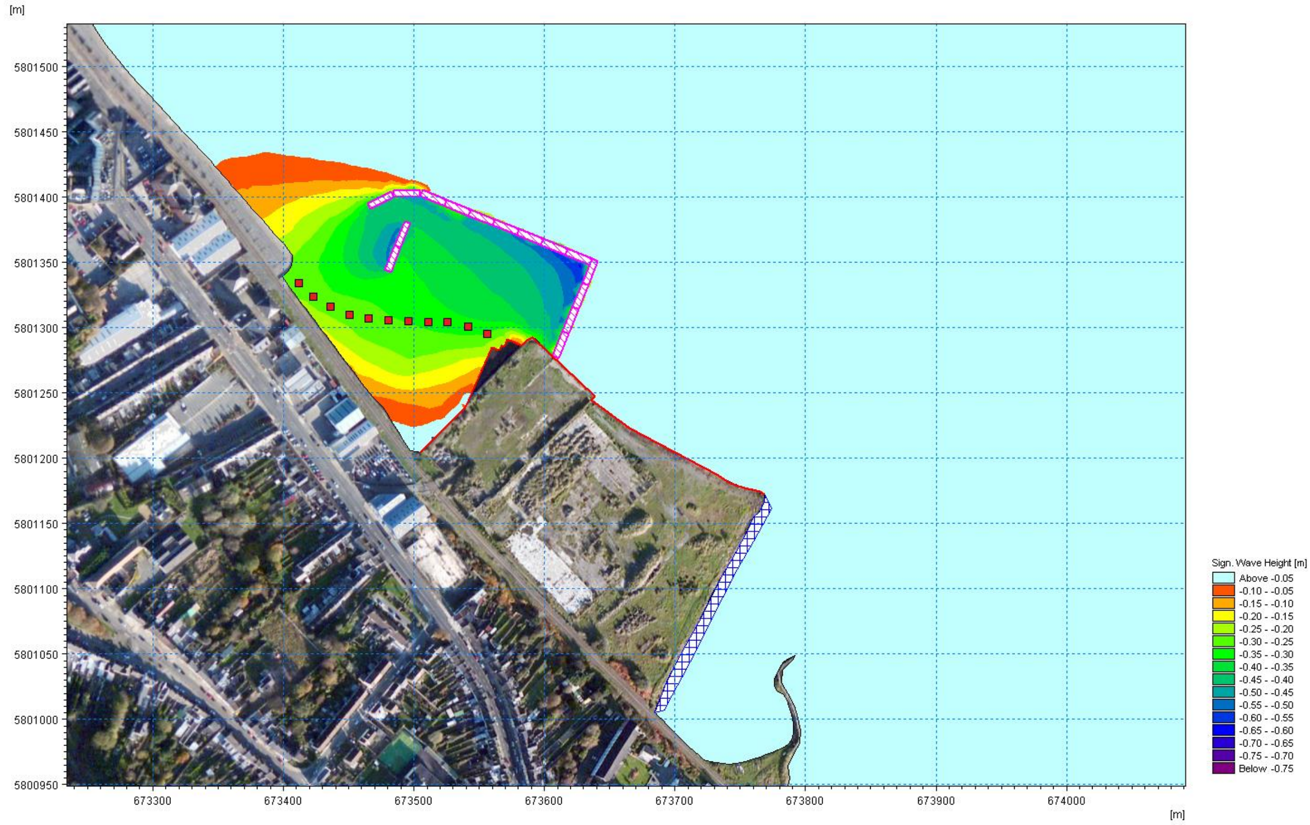


Figure 17: Difference in 1 in 1 year north easterly storm wave climates – Proposed Trinity Wharf Development with marina *in situ* (proposed minus existing).



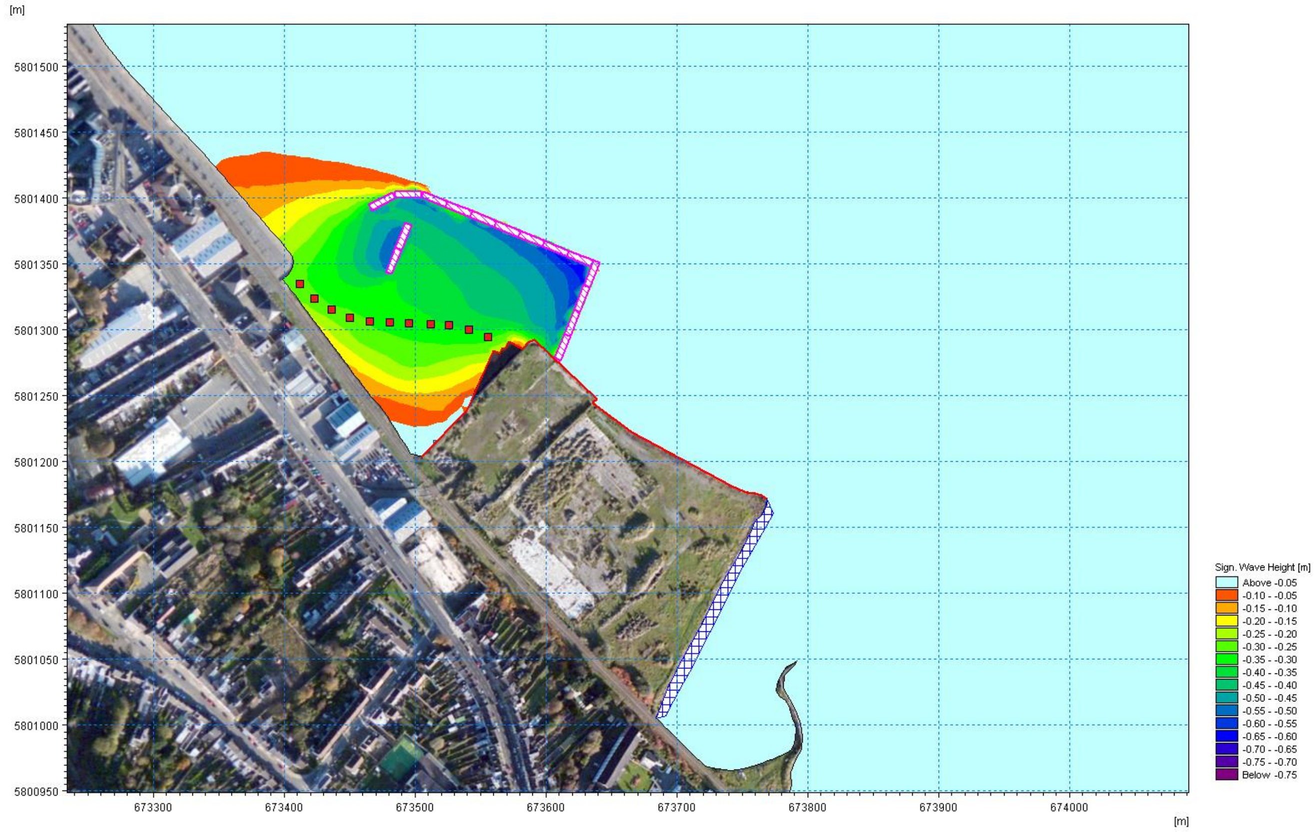
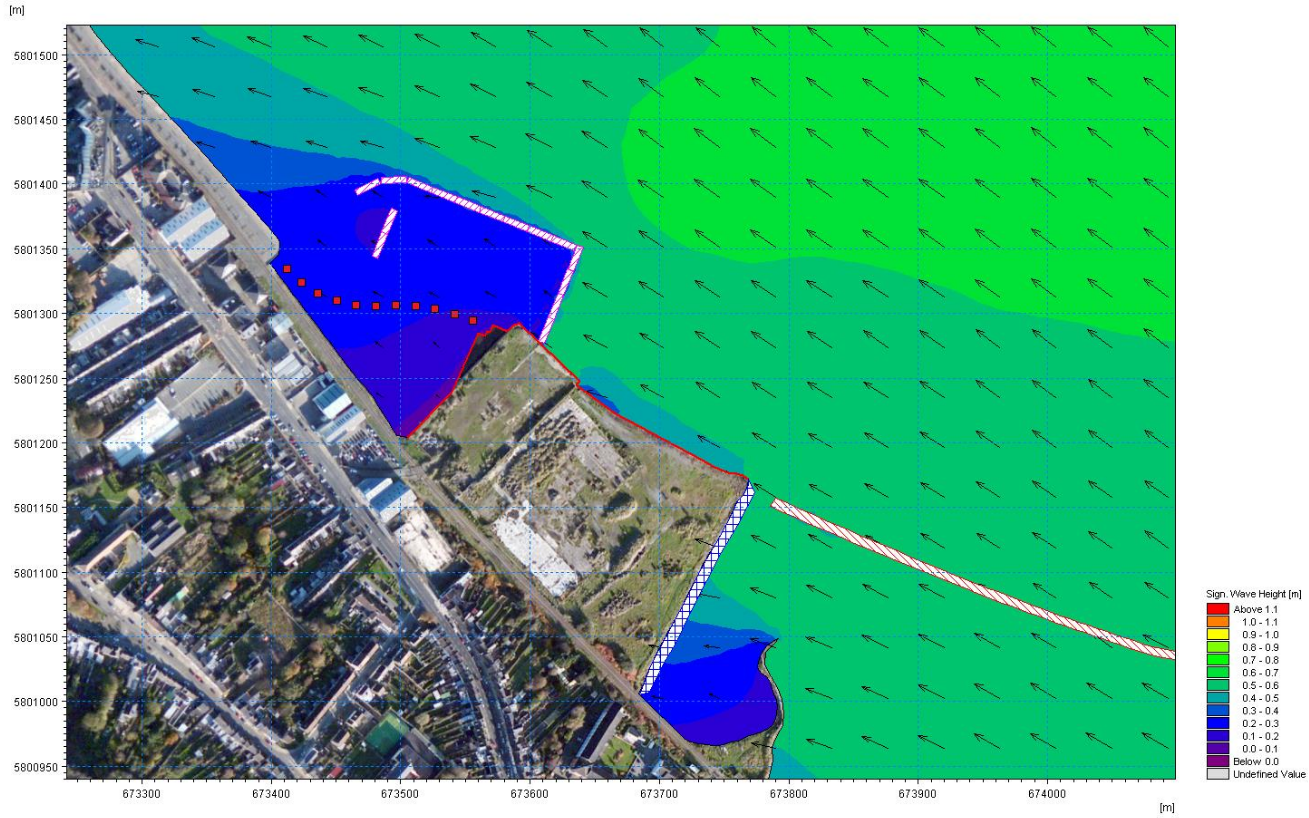


Figure 18: Difference in 1 in 50 year (top) and 1 in 200 year (bottom) north easterly storm wave climates – Proposed Trinity Wharf Development with marina *in situ* (proposed minus existing).



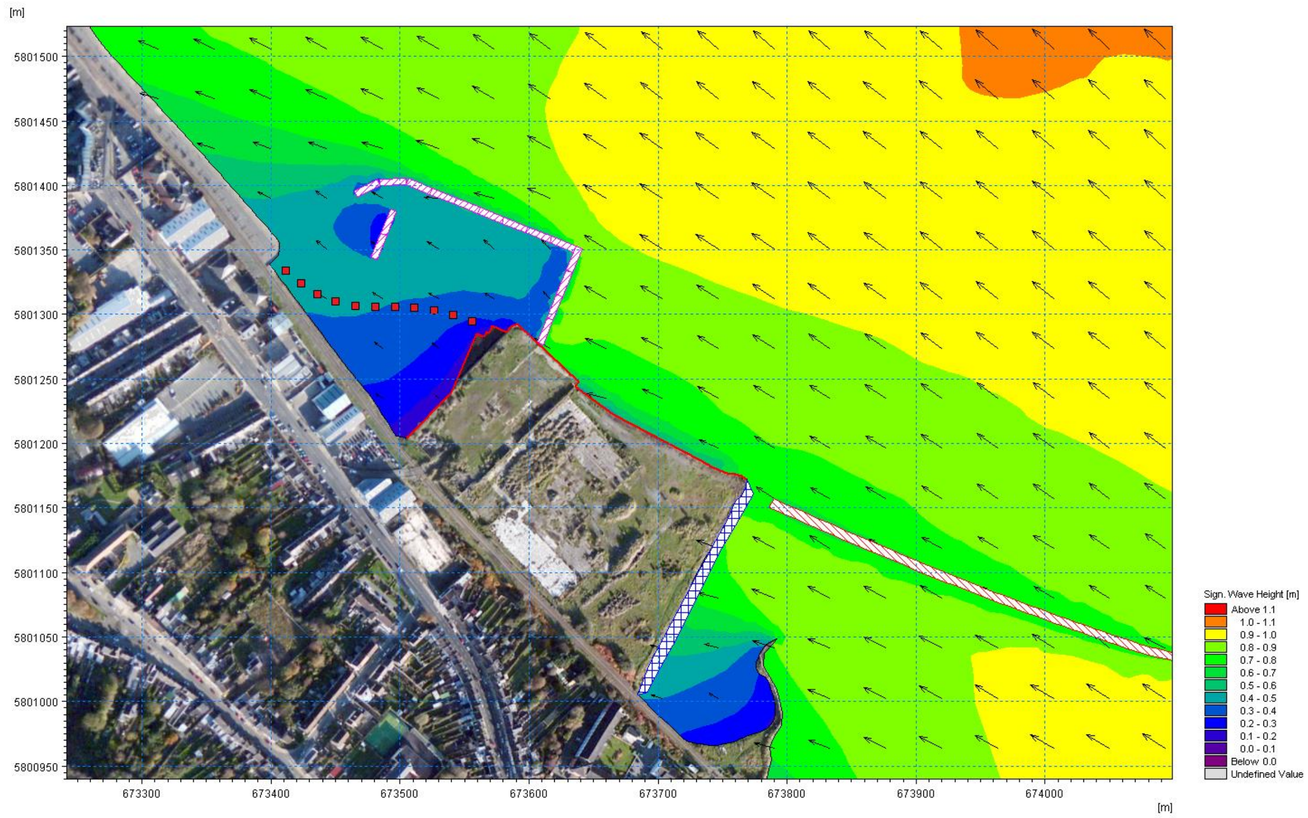


Figure 19: Significant wave heights during a 1 in 1 year (top) and 1 in 50 year (bottom) south easterly Storm event – Proposed Trinity Wharf Development with marina *in situ.*

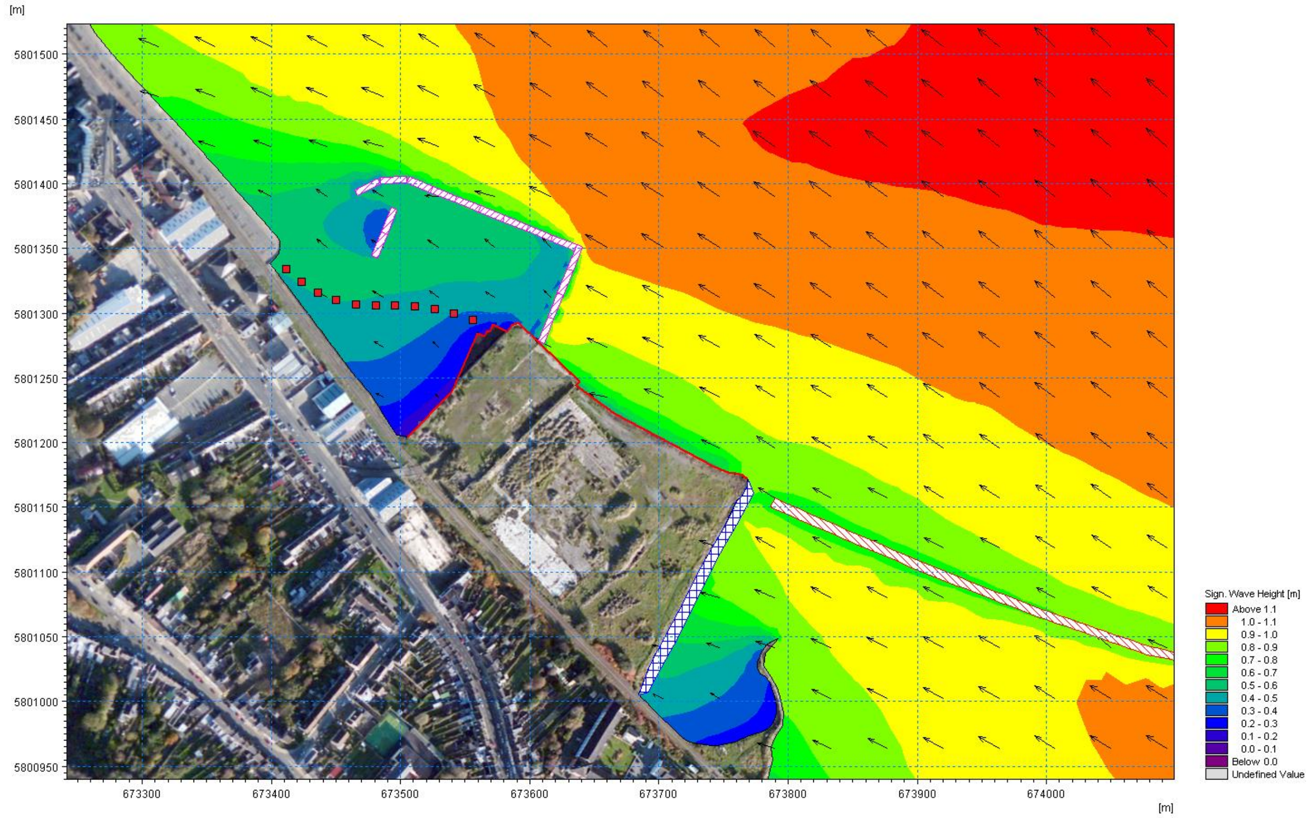


Figure 20: Significant wave heights during a 1 in 200 year south easterly Storm event – Proposed Trinity Wharf Development with marina *in situ.*

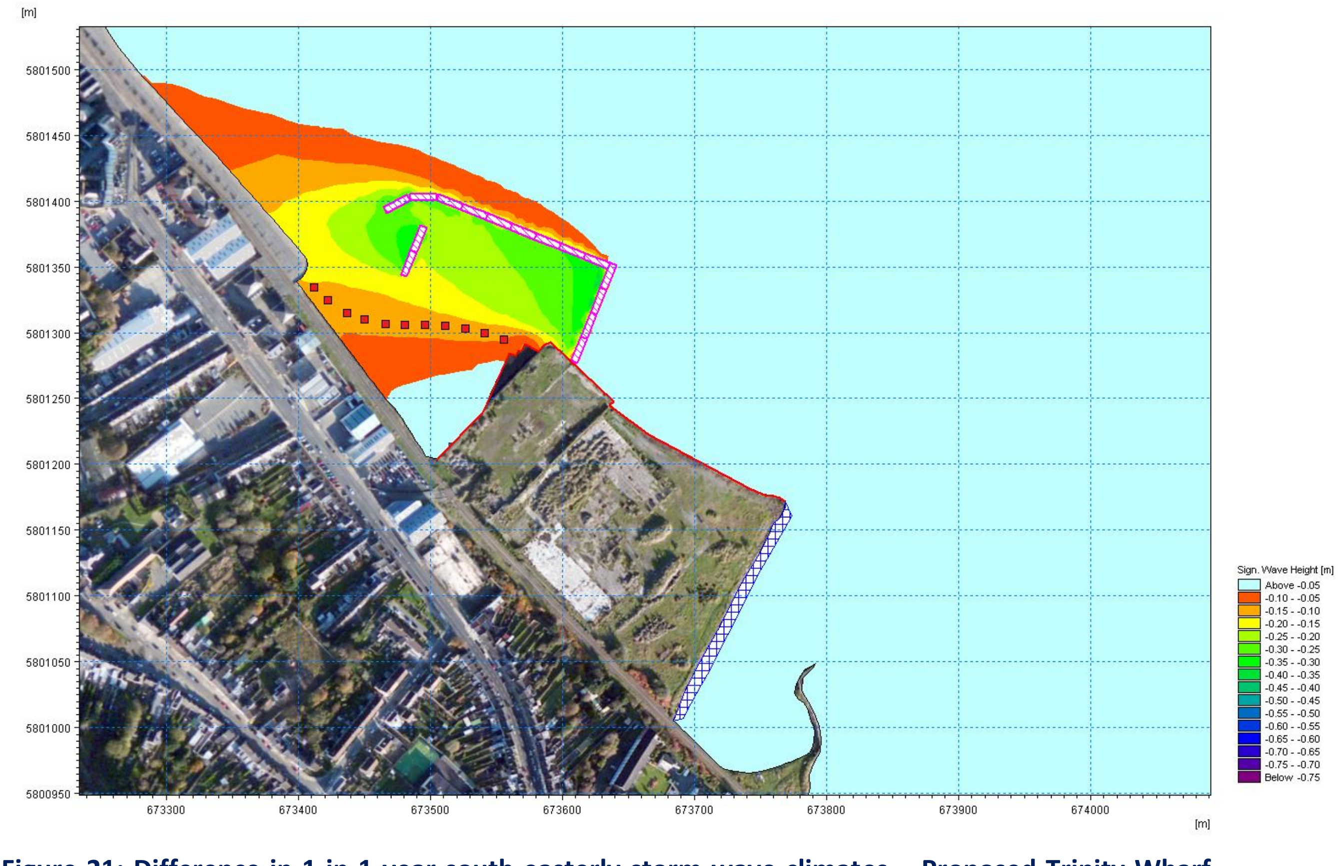
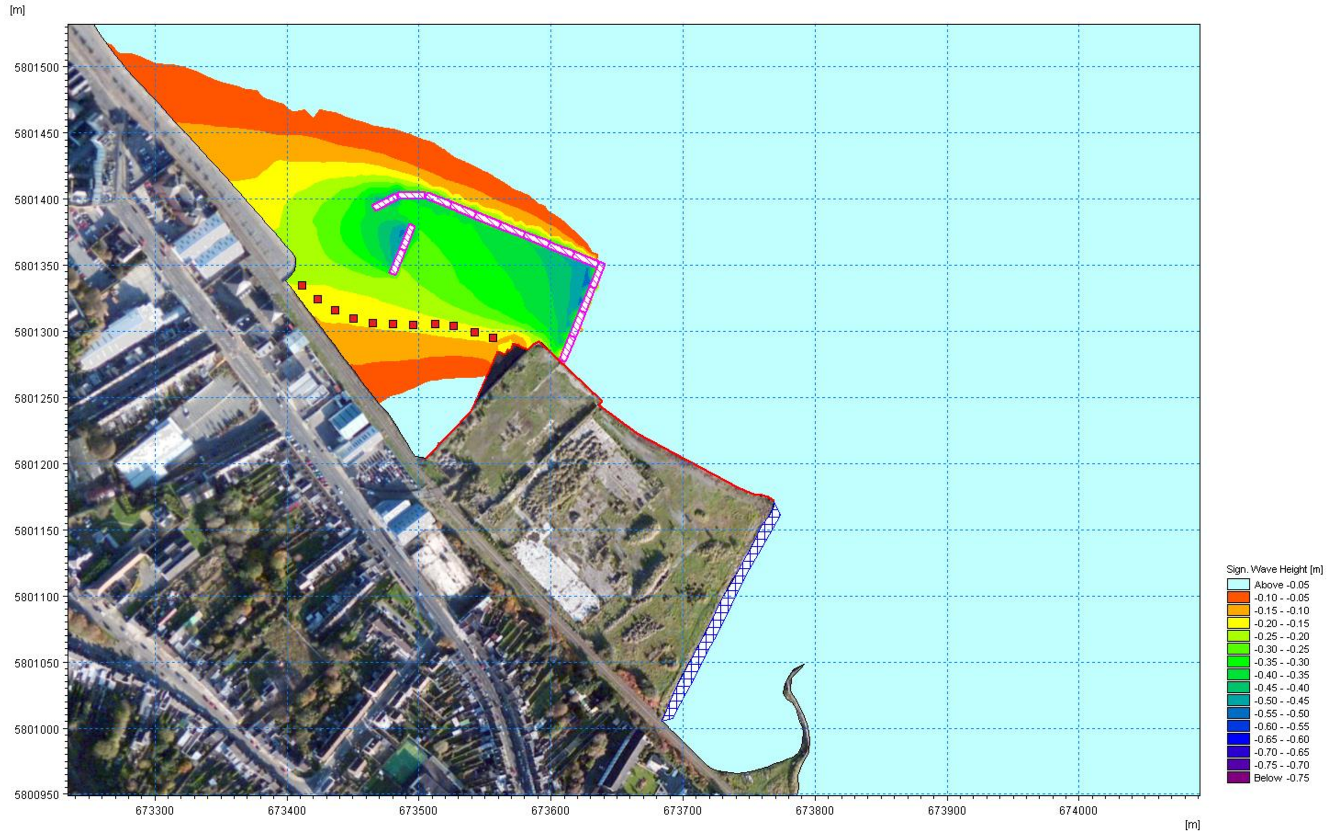


Figure 21: Difference in 1 in 1 year south easterly storm wave climates – Proposed Trinity Wharf Development with marina *in situ* (proposed minus existing).



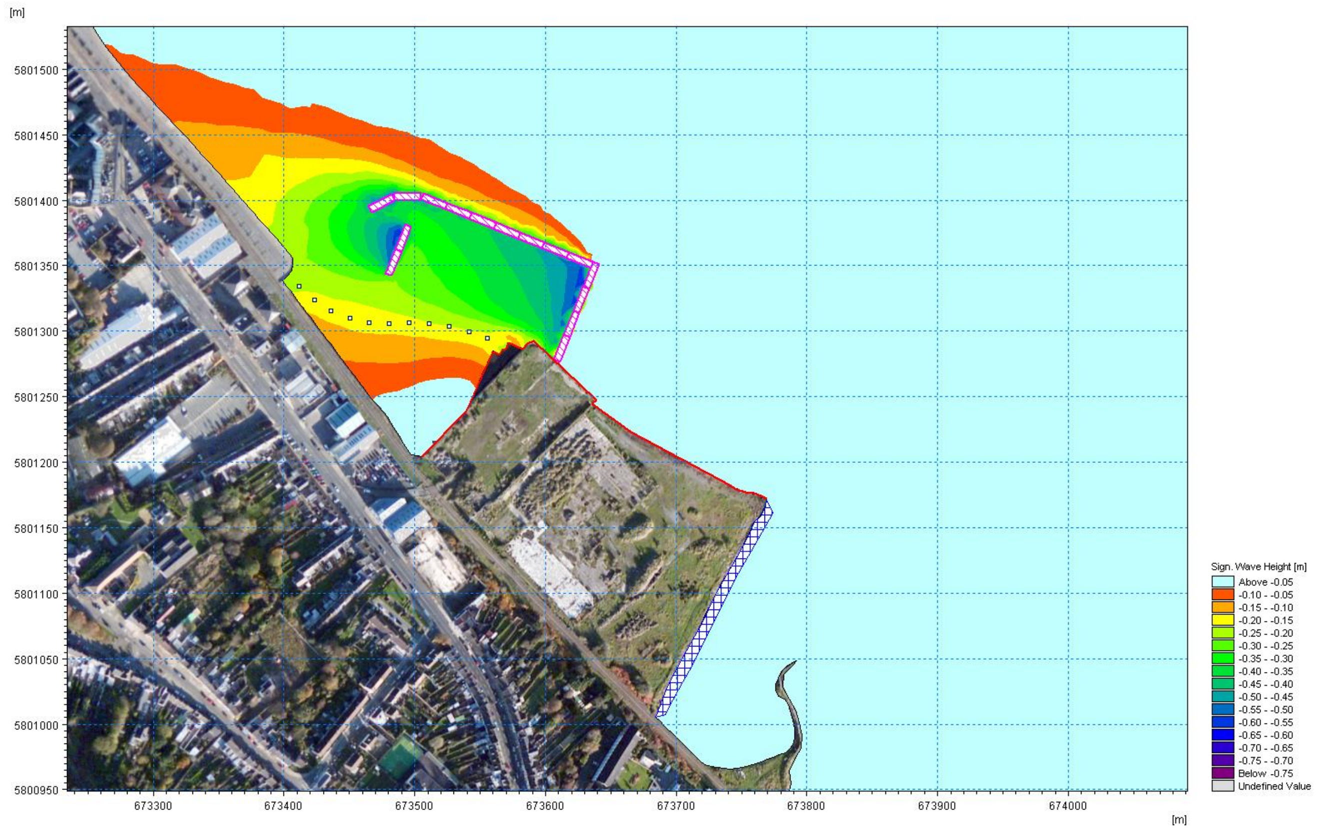


Figure 22: Difference in 1 in 50 year (top) and 1 in 200 year (bottom) south easterly storm wave climates – Proposed Trinity Wharf Development with marina *in situ* (proposed minus existing).

5 SEDIMENT TRANSPORT

It is well established that the sediment transport in any coastal area is governed principally by the combination of prevailing tidal currents and wave climate, i.e. littoral currents. In complex areas such as the Trinity Wharf and the Slobs, other factors such as the long term average and peak river flows from the River Slaney can also influence sediment transport regime.

Given that the previous Sections of this report have robustly demonstrated that neither the proposed landside development, nor the landside development in combination with a marina will result in any significant differences to either the tidal regime or the prevailing wave climate it can be concluded that neither development would result in any significant changes to the sediment transport regime.

As such, it can be concluded that the nearby environmentally sensitive areas will be not be adversely impacted by any changes in the sediment transport as a result of either the landside development in isolation or the landside development in combination with the marina.

6 COASTAL PROTECTION WORKS

To reduce wave reflection into the small area to the south east of Trinity Wharf known locally as Goodtide harbour, RPS recommend installing a rock bank along the south east perimeter of the site. The rock bank should be comprised of 0.5T stone increasing to 0.8T stone at the outer seaward corner. Furthermore, the rock bank should be constructed to a slope of *c.*1:1.5 and rest on top of a suitable membrane layer.

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Appendix 4.5 Trinity Wharf Marina Construction Methodology

ROD
ROUGHAN & O'DONOVAN

Trinity Wharf Marina

Construction Methodology

Document Control Sheet

Client:	Wexford County Council
Project Title:	Trinity Wharf Marina
Document Title:	Construction Methodology
Document No:	IBE1115_CM0001

Text Pages:	4	Appendices:	0

Rev.	Status	Date	Author(s)	Reviewed By	Approved By
D01	Draft	12/11/2018	KC	AKB	AKB
D02	Final	28/11/2018	KC	AKB	AKB
D03	Revised Final	11/01/2019	KC	AKB	AKB

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TABLE OF CONTENTS

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1 CONSTRUCTION METHODOLOGY

1.1 BACKGROUND

This method statement describes the overall approach to the project and will serve to outline a detailed methodology for carrying out the various elements of the proposed marina works at Trinity Wharf. Prior to any works commencing on site a more comprehensive, task specific method statement should be prepared during the detailed design phase for each element of the work.

1.2 SETTING OUT

A suitably qualified site engineer will be responsible for the setting out of all SOP's needed for the correct installation of all individual components of the proposed marina.

Surveyors will establish control stations where temporary bench marks and coordinates will be taken for construction activities at the start of the project and if required will add to this when the terrestrial works at Trinity Wharf are complete. The finished works at Trinity wharf will be used as a baseline for setting out the breakwater units. The proposed marina layout is illustrated in Figure 1 below.

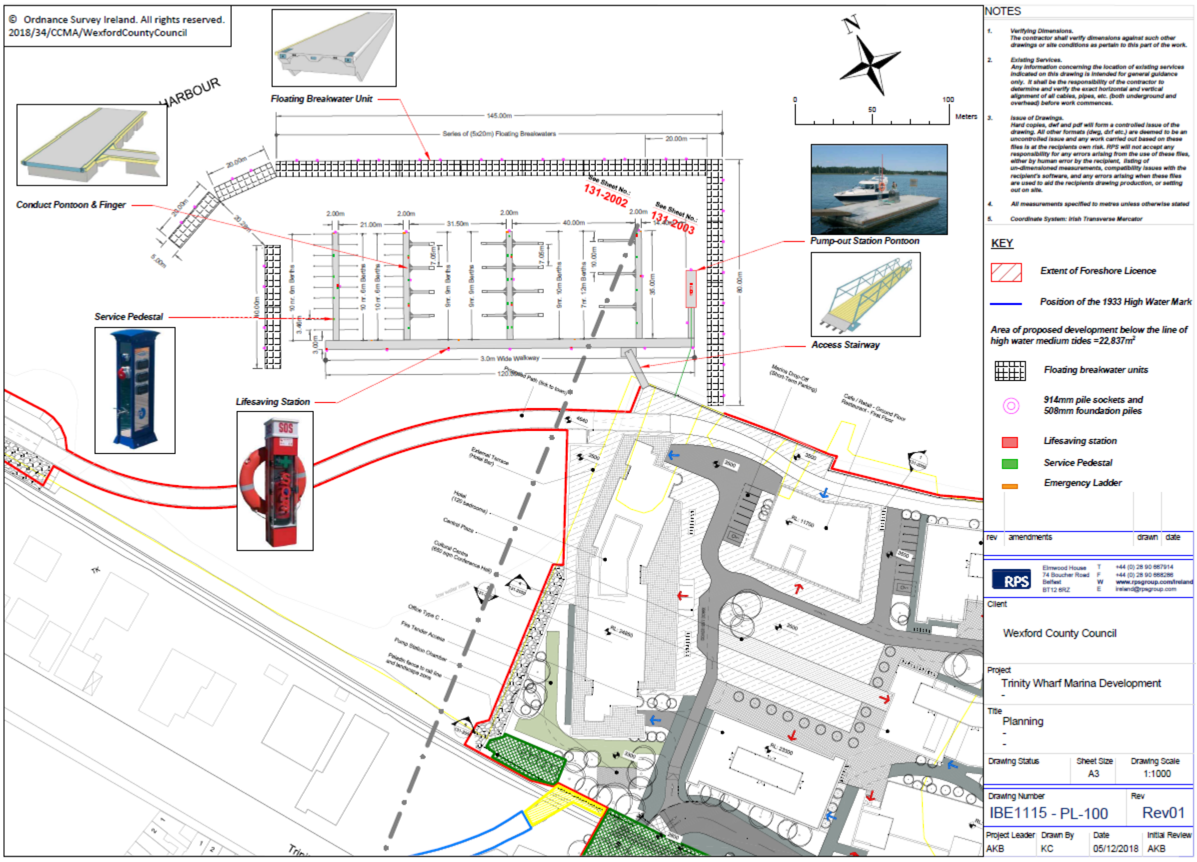

Figure 1: Site layout map illustrating the proposed marina works at Trinity Wharf.

1.3 FABRICATION OF MARINA ELEMENTS

Fabrication of all the marina elements including breakwater units, floating pontoon, finger berths and the access gangway will be fabricated offsite by specialist marina manufacturers. The design performance including the design loads and other specified criteria of these elements will be specified during the detailed design phase of the proposed marina.

1.4 PILING/ANCHORING SYSTEM

Whilst the pile driving barge is on site for the installation of the walkway piles it will be used to drive pile sockets for the breakwater units and the pontoon walkways. Vertical steel piles will then be grouted into the pile sockets to give good line and plumbness.

Alternatively, helical anchors can be drilled into the seabed via a barge at the location for the lower terminal of anchor chains that will connect and secure the breakwater units and pontoon walkways and finger berths. Depending on substrate conditions, restraint chains could also be anchored by appropriately sized anchor blocks buried into the seabed.

The actual method of securing the marina elements (i.e. piled restraints or chained restraints) will be subject to ground investigations during the detailed design phase.

1.5 TRANSPORTATION AND INSTALLATION OF MARINA ELEMENTS

Individual breakwater units and pontoon walkways will be transported to Wexford Harbour by road and then lifted from the quay into the water by a suitably sized mobile crane equipped with slings and chains. A workboat will be used to float the individual breakwater units and pontoon walkways into position. Individual breakwater and pontoon elements will then be connected and secured to pile/chains and bolted together using joints specified by specialist marina manufacturers.

Finger berths will be transported by and placed into position by multicat barge. Individual finger berths will be secured to pontoon walkways using joints specified by specialist marina manufacturers (joints to include rubber washers).

The access gangway will be transported to site by lorry (and assembled on site if necessary). The gangway will then be installed using a suitable mobile crane.

This will be achieved by using a crane equipped with chains to lift the gangway at sling points identified in the manufacturer’s drawings. The gangway itself will then slowly lifted into position and guided by tag lines in order to align it correctly. Once it is connected and resting on the pontoon the crane will be unhooked and released.

Alternatively, the access gangway can be transported to site via flat top barge and jacked into position before being connected and secured to the pontoon walkway and Trinity Wharf.

1.6 MARINA SERVICES & SECURITY

Marina services (water and electricity etc.) will be installed under the access gangway and throughout the service ducts within the pontoon walkways.

Safety stations and access ladders etc. will be placed in strategic places around the marina. Lighting and service pedestals will also be installed on the pontoon walkway and finger berths.

1.7 SITE SAFETY

Safety will be of prime importance during the construction works. The works will be subject to the Safety, Health and Welfare at Work 2005 and the Safety, Health and Welfare at Work (Construction) Regulations, 2013. All aspects of design construction will be reviewed with regard to health and safety and a risk assessment will be carried out. A planning Supervisor (Design Stage) will be appointed to produce a pre tender health and Safety Plan for the project. The Principal Contractor will be responsible for the control and co-ordination of Health and Safety during the works and will be appointed as the Planning Supervisor (Construction Phase).

1.8 CONSTRUCTION TIME

It is estimated that piling and installation of the foundation system will take approximately 1 month to complete. The installation of the marina elements including breakwater units, pontoons, walkways, access bridge and marina services is expected to take an additional 3 months to complete.

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Appendix 4.6 Landscape Design Statement

ROUGHAN & O'DONOVAN

Trinity Wharf Wexford

Landscape Design Statement

Document Ref: X 01

11-12-18

Rev: A

thepaulhogarthcompany

INTRODUCTION

The below outlines the landscape design approach taken to the Trinity Wharf Masterplan in Wexford. These relate directly to the soft landscape (planting) approach but reference the overall spatial proposals for context).
Landscape proposals have been developed following site analysis, document review client and design team briefings.

SITE ANALYSIS

The site was visited to review the landscape Character, opportunities and constraints.

The following key issues were noted:

- Views and points of interest within and outside the site.
- Materials within and to the edges of the site with Concrete, roughhewn stone and timber being prominent.
- Decaying industrial/manufacturing character.
- The variety of ‘emergent’ vegetation was noted with significant meadow grass and wildflower species.
- The exposed nature of the entire site and sea water overtopping of land.
- Site Features in the water (outside the site boundary) including stone beacons and former timber boardwalks.
- Existence of invasive species to the rail line side of site. Including Japanese Knotweed and Three Cornered Leak.

LANDSCAPE AIMS

Following the site analysis, landscape aims were developed. The aims intend to:

1. Utilise the sites unique location on the water.
2. Develop strong physical connectivity to town centre.
3. Create a robust landscape which can survive the harsh maritime environment.
4. Develop landscape areas which will be a destination and where people will want to visit and spend time.
5. Develop a waterside route which can in future become part of a strategic green/blue way.
6. Provide an additional outdoor events space for the town.

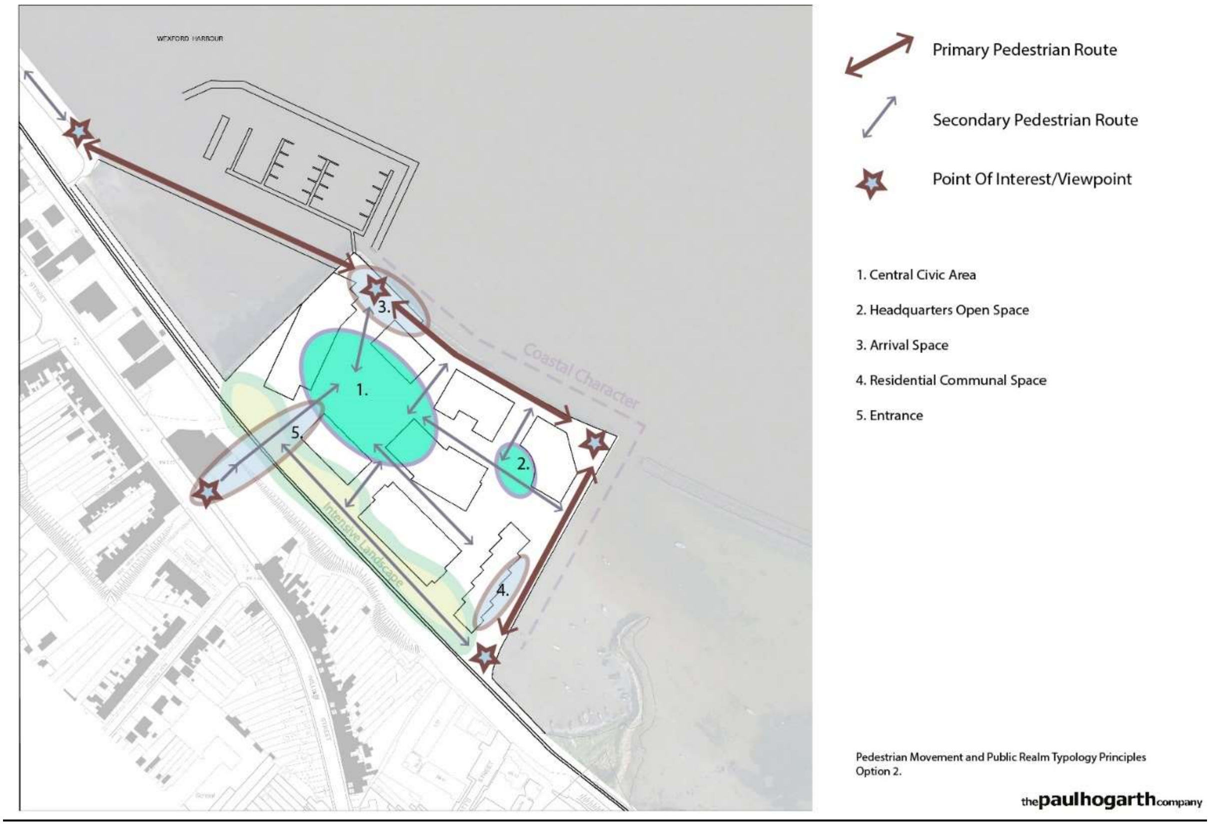
OVERALL LANDSCAPE CHARACTER

A wild and emergent landscape character is proposed to complement and celebrate the locations natural assets. This will include sparse planting to the water sides with glades of single species tree planting developing into mixed species buffer planting along the rail line. This approach will suit the exposed nature of the site by using trees with visual character, repetitive aesthetics but informality of layout.

Shrub planting will be sparsely populated within Rock and gravel 'causeways' at the water side of the site becoming more formal and dense around buildings and towards the railway line. This approach will minimise the impact of salt laden air and potential for saline water inundation from below.

A variety of tree and plant species have been considered favouring natives but reflecting the existing vibrant biodiversity emerging on the site.

Therefore an appropriate and robust planting palette which considers the specifics of the site and can be established and maintained.



Landscape Typologies Diagram

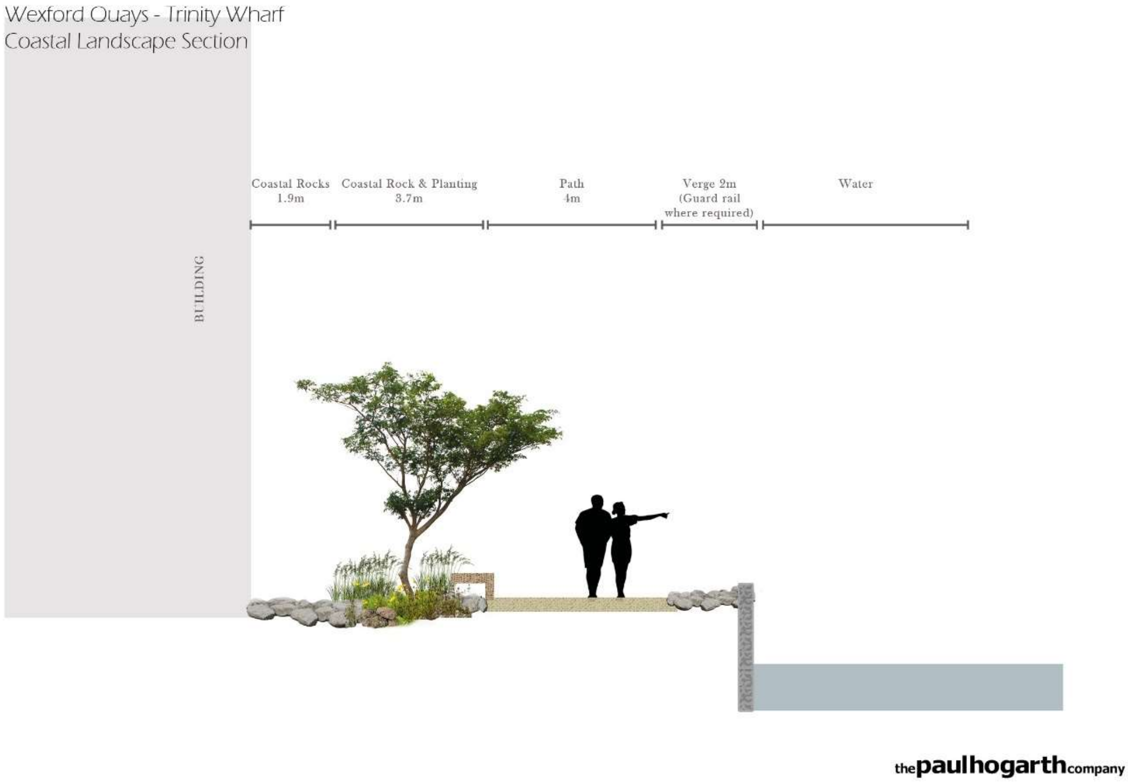
<u>LANDSCAPE TYPOLOGIES</u>

To achieve the above aims and guide the spatial design of the landscape a number of public space Principles/Typologies have been developed for the site.

These include:

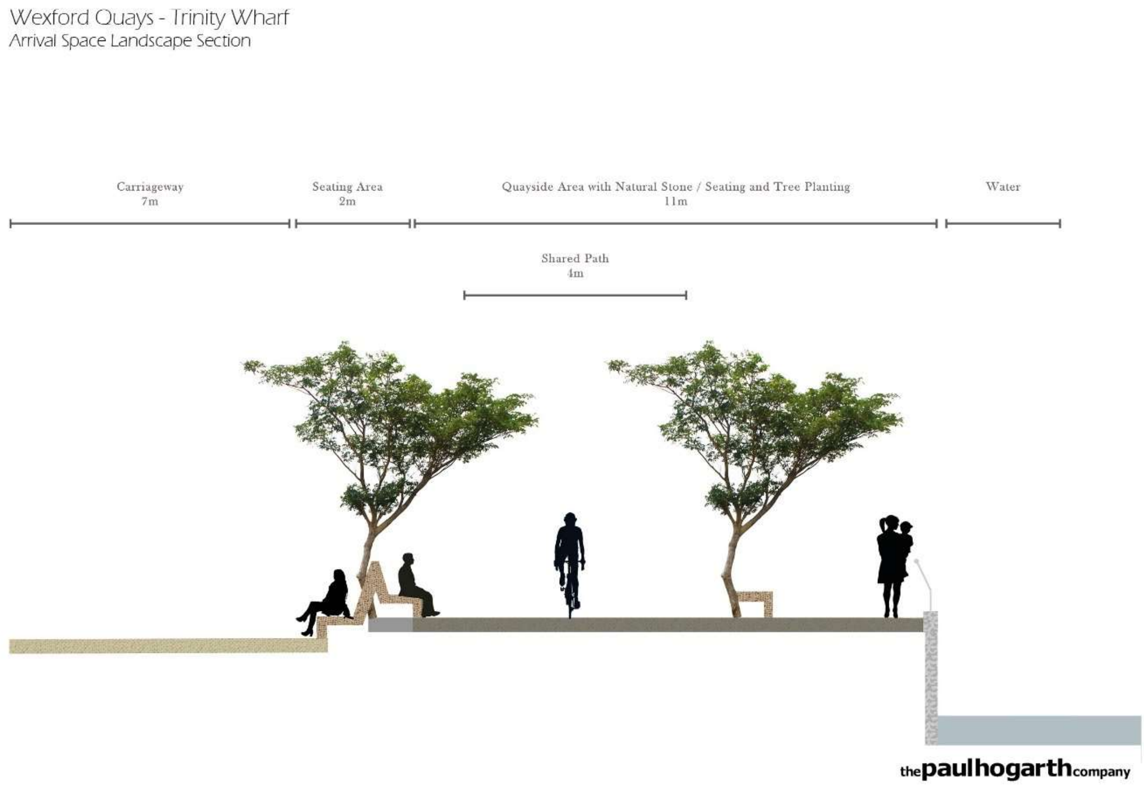
COASTAL PATH -Pedestrian and cycle movement through the site should be encouraged to the waterside to take advantage of the sites unique setting. Exposed Aggregate concrete paths are proposed with Rip Rap hewn stone and levels used to mitigate the visual impact of flood walls on the experience. Pedestrian guardrails incorporated on the walls where required.

Emergent and wild coastal planting is incorporated sparsely among the rocks on the building side of the path to add verticality, colour and visual interest. This includes salt tolerant tree species planted irregularly, specimen shrubs, smaller grasses and flowers.



Drawing Ref: SE_700

ARRIVAL SPACE – The area where the new pedestrian bridge enters the site and the Marina is accessed from. It will be a predominantly hard landscape area providing access to the water for pedestrians as well as seating opportunities for people to gravitate towards and gather. Reclaimed timber benches will echo the former pier structures and trees will provide a more hospitable environments for people.



Drawing Ref: SE_701

CENTRAL CIVIC AREA – The civic space is a flexible public event space which addresses the Cultural and Performance Centre and hotel front doors. It will be an open paved surface capable of heavy vehicular loading and provide fully integrated 'pop up' utilities for a range of events and activities.

Large civic trees will accentuate the orientation of the Cultural and Performance Centre and provide a setting for seats and outdoor eating at the proposed cafe.

INTERNAL ACCESS ROAD– The internal road will be a shared surface with shade tolerant shrub planting providing a setting to the buildings using colour and texture. Specimen trees will soften the building facades providing vertical interest and giving the planting beds a 3 dimensional impact. Trees with seasonal colour and floral displays have been selected to achieve this.

RESIDENTIAL COMMUNAL SPACE – The residential units will be integrated into the public realm but also have communal open space which will be provide residents with seating and play facilities. (*Refer to SK_13)* These will be partially screened from the coastal path using a native hedge, defensive shrub planting and trees. At the railway side of the residential building the density and height of trees will increase to provide some screening.

CENTRAL PATHS & CARPARK - The central paths will be flanked by ground cover planting and glades of tree planting. Small and shade tolerant species are proposed between Cultural and Performance Centre and Carpark to create a human scale to the space while between the carpark and rail line larger tree and shrub species are proposed for screening. Nurse species of planting such as birch will be used to create fast and effective screening and opportunities for a wider variety of planting to establish under.

RAIL LINE PLANTING – Along the rail line side of the site Iarnród Éireanns requirements for planting and its control have been incorporated with a grass, wildflower and then shrub buffer being provided before a maintained hedge and small trees are planted for screening. Nurse species of planting such as birch will be used to create fast and effective screening and opportunities for a wider variety of planting to establish under.

Drawing Ref: SE_702

<u>LANDSCAPE MAINTENANCE & MANAGEMENT</u>

The Client will maintain and manage the proposed landscape with the overall objective of:

- Ensuring the implementation, establishment and long-term health of the proposed landscaping scheme.
- Ensuring best horticultural practices are implemented at all times.
- Ensuring best Safety and Health practices at all times.
- Maintaining high standards of environmental protection practice thorough considered management procedures.
- Utilising methods and timings to respect and encourage wildlife, wherever possible.
- Inspecting for potential defects in the landscape early and addressing them promptly.

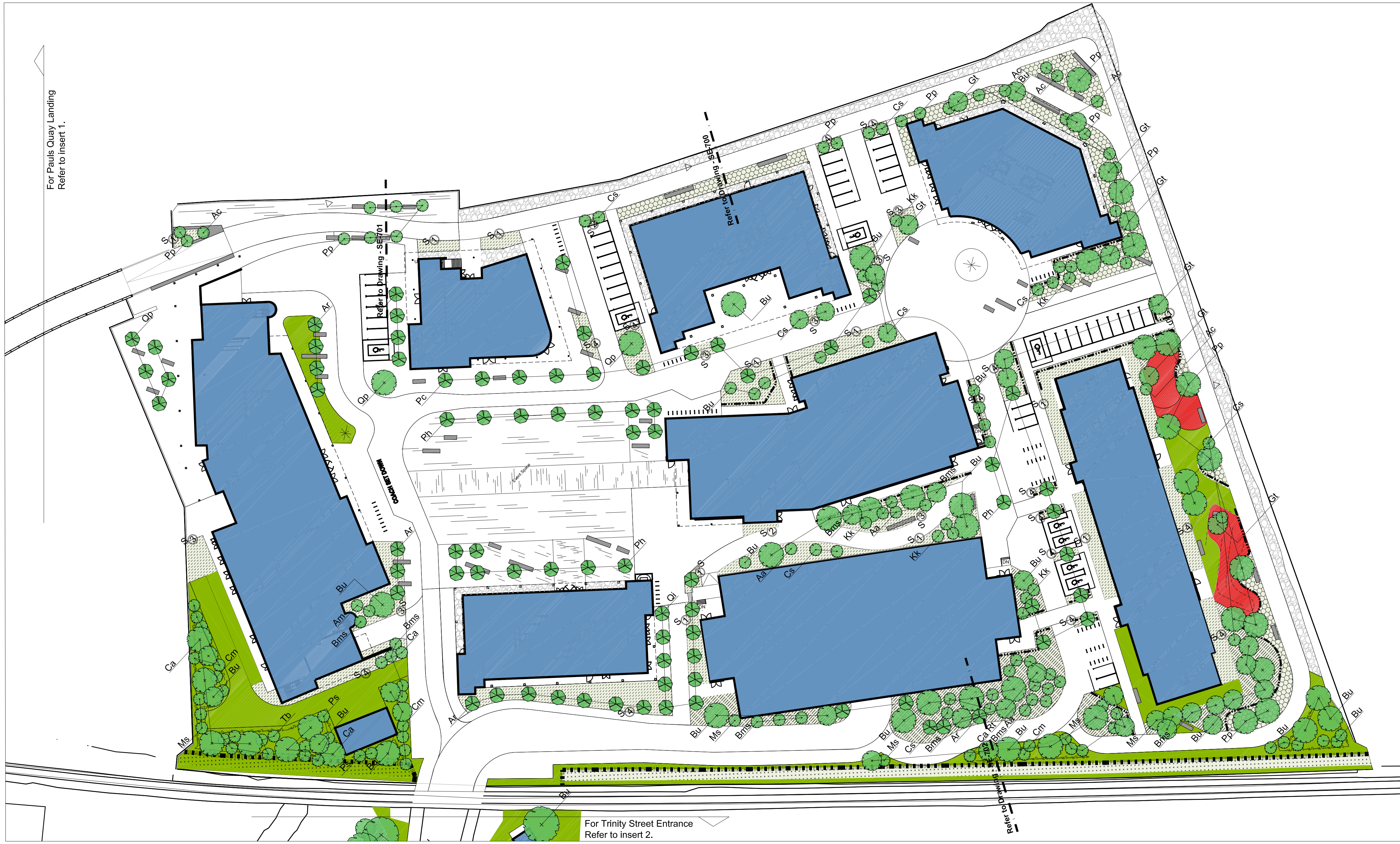
To achieve the above a landscape management plan specific to this site will be prepared by suitably qualified professionals.

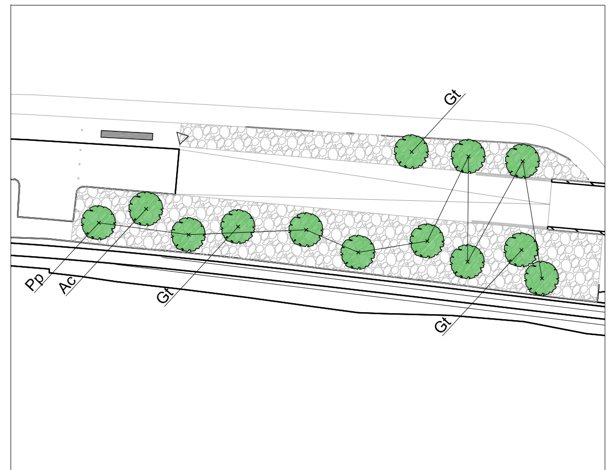
The soft landscaping scheme shall be carried out as early in the development process as possible. Any planting forming part of the approved landscaping that die, are removed, become diseased or unfit for purpose within five years of the implementation of the landscaping scheme will be replaced during the next available planting season.

Landscape contractors will be assessed, and their works monitored to ensure that all work is to the highest standards and carried out by experienced and qualified operatives and to good horticultural practice, using materials, plant and machinery appropriate to the task, undertaken in such a manner that avoids damage and/or nuisance to the site and its surroundings.

Any chemical use (including weed control) will be carried out by suitable trained staff in accordance with the manufacturer's recommendations and legislation. Chemical use will be avoided in coastal areas of the site where the potential for run off and overspray exists.

All arisings will be removed from site and deposited at an approved tip or registered green compost facility. Watering operations will be avoided but carried out immediately (in line with legislation) should plant failure become likely.





Insert 1. Pauls Quay Landing
scale @ A1 1:200

Insert 2. Trinity Street Entrance Area
scale @ A1 1:200

Notes

Drawing should be read in conjunction with all other drawing information.
All plant material (shrubs, hedges and grasses) should be from a proven, sustainable source and be of local provenance.

Trees

Code	Species	Girth Cm	Height	Spec
	Proposed Street Trees			
Ar	Acer rubrum	25-30	3-4.5m	4x Rb / 2m clear stem
Ph	Platanus hispanica	40-45	min5m	5x Rb / 2.2m clear stem
Pc	Pyrus calleryana	40-45	min5m	5x Rb / 2.2m clear stem
Qp	Quercus palustris	30-35	min5m	4x Rb / 2m clear stem
Qi	Quercus ilex	30-35	4-5m	4x Rb / 2.2m clear stem
	Proposed Tree Planting			
Aa	Amelanchier arborea	25-30	4-5m	4x Rb / 2m clear stem
Bu	Betula utilis	30-35	4-5m	5x Rb / 2m clear stem
Bms	Betula utilis (ms)	N/a	3-4m	4x Rb / Multistem (5 breaks)
Cs	Cercis siliquastrum	25-30	4-5m	4x Rb / 2m clear stem
Ck	Cornus kousa (ms)	N/a	3-4m	4x Rb / Multistem (5 breaks)
Rt	Rhys typhinus (ms)	N/a	3-4m	4x Rb / Multistem (5 breaks)
Cm	Crataegus monogyna	14-16	4-5m	3x Rb / 2m clear stem
Ca	Corylus avellana	14-16	4-5m	3x Rb / 2m clear stem
Ms	Malus sylvestris	14-16	6-6.5m	3x Rb / 2m clear stem
Tb	Taxus baccata	N/a	1.5-2m	6x Rb / Feathered
Ps	Prunus spinosa	14-16	min5m	3x Rb / 2m clear stem
Ac	Amelanchier canadensis (ms)	N/a	3-4m	5x Rb / Multi stem (5 breaks)
Gt	Gleditisia tricanthos 'Sunburst'	25-30	6-6.5m	4x Rb / 2m clear stem
Pp	Pinus pinea	N/a	3-4m	4x Rb / 2m clear stem

Shrubs - Railway Edge Mix

%	Species	Height (cm)	Spec	Density (m2)
15	Corylus avellana	60-80	1+1 / Br	3
15	Cornus sanguinea	60-80	1+2 / Br	3
25	Euonymus europaeus	60-80	1+2 / Br	3
35	Symphoricarpos albus	60-80	1+1 / Br	4
10	Viburnum opulus	60-80	1+2 / Br	3

Shrubs - Coastal Mix

%	Species	Height (cm)	Spec	Density (m2)
40	Armeria maritima		3L	9
10	Aubrieta x cultorum		2L	7
10	Cerastium tomentosum		2L	9
5	Erigeron glaucus		3L	7
15	Molinia caerulea		5L	6
5	Saxifraga x urbium		3L	9
5	Sedum album		3L	7
5	Amelanchier canadensis	3.5-4m	Rb	0.05
5	Cercis siliquastrum	3.5-4m	Rb	0.05

Shrubs - Ground Cover Mixes

%	Species	Height (cm)	Spec	Density (m2)
Code:	**S1**			
50	Saxifraga x urbium		3L	9
30	Viburnum davidii	60-80	15L	5
10	Phlox subulata 'Mcdaniels Cushion'		3L	9
10	Tiarella cordifolia		3L	9
Code:	**S2**			
80	Hedera hibernica	60-80	3L	7
20	Pachysandra terminalis 'Variegata'		2L	9
Code:	**S3**			
40	Persicaria bistorta superbum		3L	9
15	Bergenia cordifolia	10-15	2L	7
20	Epimedum grandiflorum		3L	7
25	Molinia caraeluea		5L	6
Code:	**S4**			
100	Euonymus fortunei 'Kewensis'	20-30	3L	9

Shrubs - Defensive Shrub Mix

%	Species	H (cm)	Spec	Density (m2)
40	Rubus cockburnianus	60-80	10L (min 5 breaks)	5
30	Cornus alba siberica	60-80	10L (min 5 breaks)	5
30	Pinus mugo	40-60	15L	3

Hedge Planting - Formal

%	Species	Height (cm)	Spec	Density (linear m)
100	Carpinus betula	80-120	5L container / bushy	7

Hedge Planting - Native

%	Species	Height (cm)	Spec	Density (linear m)
60	Crataegus monogyna	60-80	1+1 Br	7
15	Ilex aquifolium	60-80	1+1 Br	7
25	Prunus spinosa	60-80	1+1 Br	7

Grass Seed Mix

All grass seed mixes to be supplied by EcoSeed or equal approved
(seeds to be sown at 3-5g per metre square). Seed mixes to be developed for all areas.

Proposed Wildflower Grassland

Slender creeping red fescue (Festuca rubra ssp litoralis)
Crested Dogstail (Cynosurus cristatus)
Common Bent (Agrostis capillaris)
Meadow Fescue (Festuca pratensis)
Sweet Vernal Grass (Anthoxanthum odoratum)
Devils bit scabious (Succisa pratensis)
Ribwort plantain (Plantago lanceolata)
Yarrow (Achillea millefolium)
Common Knapweed (Centaurea nigra)
Meadow Sweet (Filipendula ulmaria)
Oxeye daisy (Leucanthemum vulgaris)
Selfheal (Prunella vulgaris)
Meadow buttercup (Ranunculus acris)
Field Scabious (Knautia arvensis)
Yellow rattle (Rhinanthus minor)
Birdsfoot trefoil (Lotus corniculatus)
Tufted vetch (Vicia cracca)

Green Roof

Pre-grown instant vegetation layer supplied in a soil free coconut fibre mat.
Proposed Sedum Roof Species:
Sedum Acre aureurm
Sedum Album Coral Carpet
Sedum Album Athoum
Sedum Album Mini
Sedum Hispanicum
Sedum Summer Glory
Sedum Relexum
Sedum Weihenstephaner Gold
Sedum Voodoo

Pre-grown instant vegetation layer supplied in a soil free coconut fibre mat.
Intensive Areas Species:
Armeria maritima
Achillea millefolium
Silene uniflora
Lotus corniculatus
Leucanthemum vulgare
Thymus vulgaris

Proposed Tree Planting (refer to planting schedule and detail 901)
Proposed Street Trees (refer to planting schedule and detail 901)
Proposed Shrubs Coastal Mix (refer to planting schedule and detail 902)
Proposed Shrubs Defensive Mix (refer to planting schedule and detail 902)
Proposed Shrubs Ground Cover (refer to planting schedule and detail 902)
Proposed Wildflower Grassland (refer to planting schedule for mix)
Proposed Shrubs Railway Edge (refer to planting schedule and detail 902)
Proposed Reinforced Amenity Grass
Proposed Formal Hedge (refer to planting schedule and detail 903)
Proposed Native Hedge (refer to planting schedule and detail 903)
Proposed Play Area (refer to SK13)
Proposed Buildings (For sedum roof locations refer to architects drawings)

Revision	Description	Date	Initial
P00	DRAFT Planning Issue	18.11.30	DM
P01	Amendment to entrance	18.12.03	DM
P02	Issued for planning	18.12.11	DM

the paulhogarth company
landscape architecture — urban design
potters quay, 5 ravenhill road, belfast BT6 8DN
telephone: 028 9073 6690 fax: 028 9073 2705
email:belfast@paulhogarth.com www.paulhogarth.com

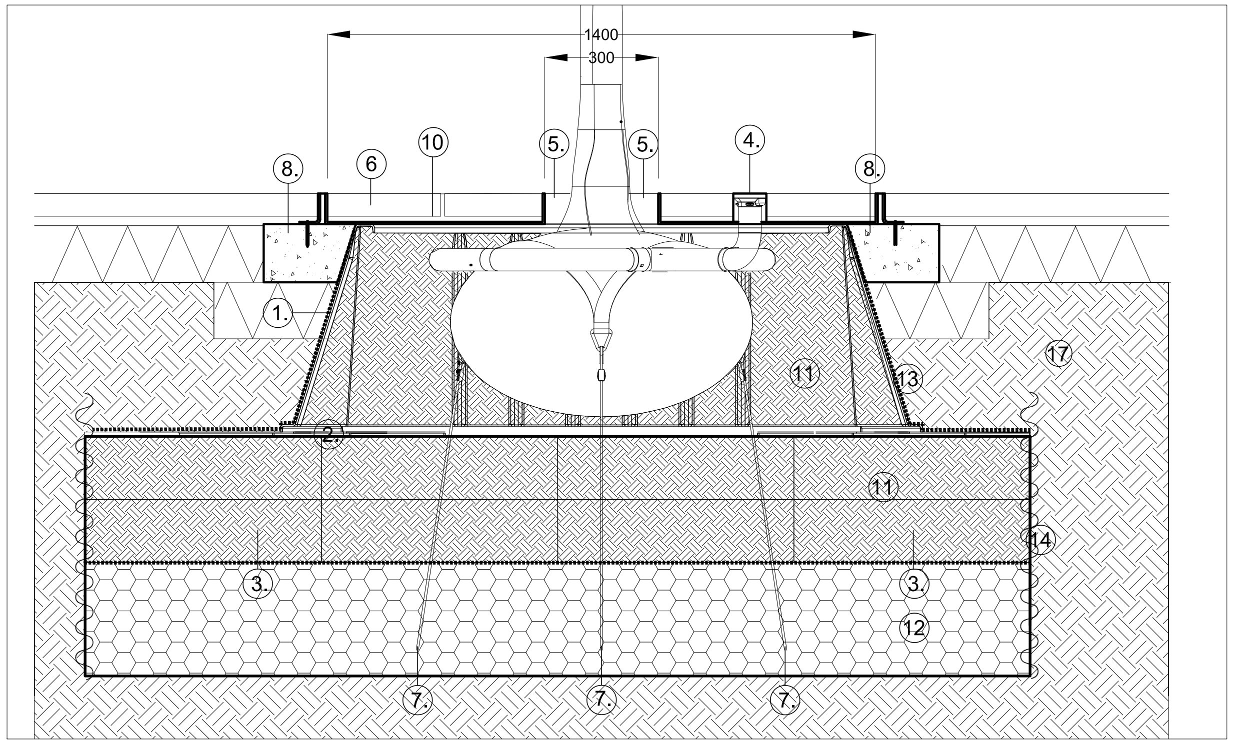
client
WEXFORD COUNTY COUNCIL

project title
TRINITY WHARF - MASTERPLAN

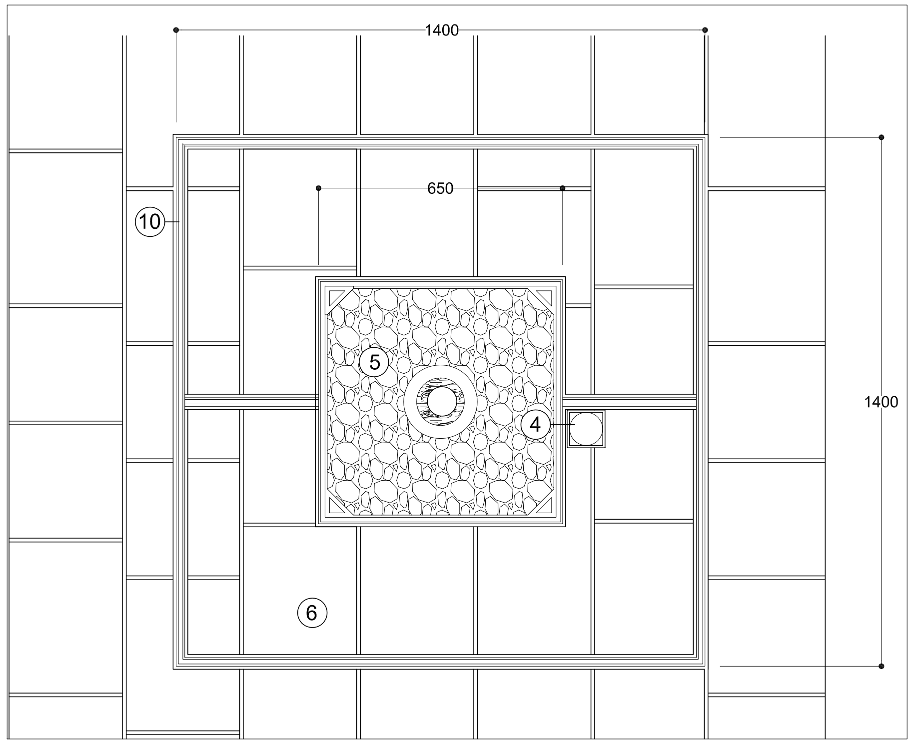
drawing title
PLANTING PLAN

drawn by	checked by	scale @ A1	revision
DM	AM	1:500	P02
project no.	date	drawing no.	
1125	Nov 2018	L-PP-001	

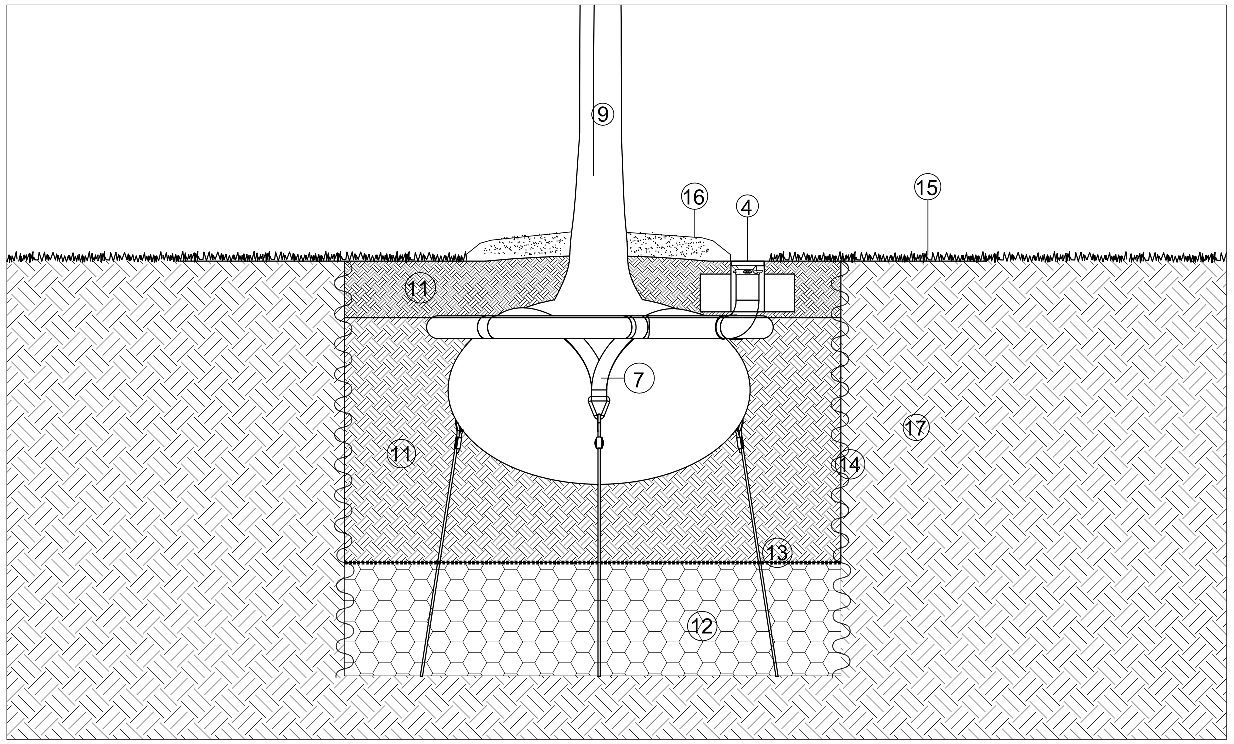
status. Planning



Section - Proposed Tree in Hard Surface
scale@a3 1:20



Plan - Proposed Tree in Hard Surface
scale@a3 1:20



Section - Proposed Tree in Soft Landscape
scale@a3 1:20

Key

1. Root Director ,modular root barrier system
2. Twinwall geonet
3. RootCell structure
4. aeration / irrigation system specially incorporated into the tree grille with lockable lid.
5. 20MM deep porous bound stone surfacing laid on loose stone
6. Proposed paving surface.
7. Large anchor system with drive in heavy-duty composite anchors.
8. Concrete foundation to engineers detail
9. Proposed Mature Tree. Refer to planting plan
10. Recessed tree grill
11. Tree soil / Top soil
12. 300mm Clean stone drainage layer
13. Permeable membrane
14. Re-direct root barrier
15. Proposed Planting. For type refer to layout drawings
16. Bark Mulch
17. Existing soil

Revision	Description	Date	Initial	Revision	Description	Date	Initial
P00	Issued for Planning	11.12.18	DM				

Client
Wexford County Council

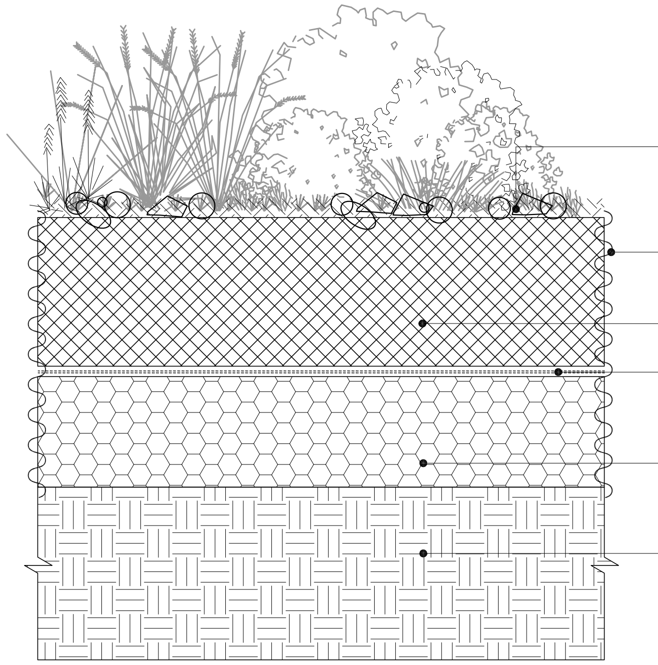
Project Title
Trinity Wharf

Drawing Title
Typical Tree Pits

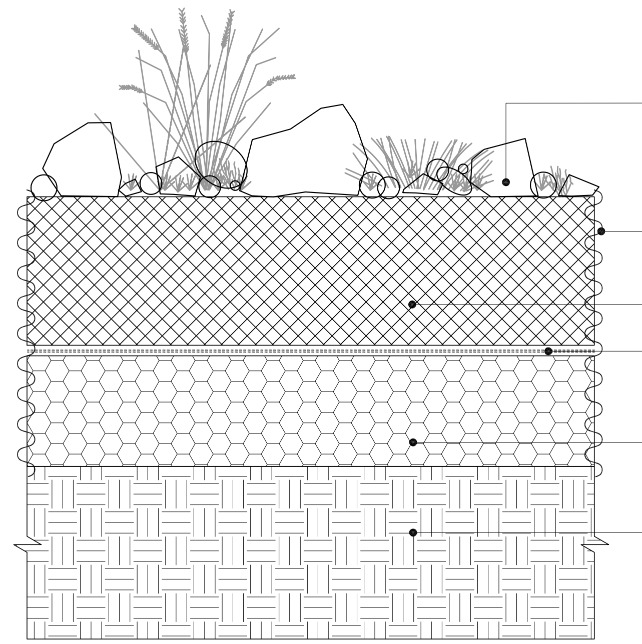
thepaulhogarthcompany
landscape architecture **urban design**
potters quay, 5 ravenhill road, belfast BT6 8DN
telephone: 028 9073 6690 fax: 028 9073 2705
email:belfast@paulhogarth.com www.paulhogarth.com

drawn by	checked by	scale @ A3	drawing no.	revision
DM	AM	1:20	L-DE-901	P00

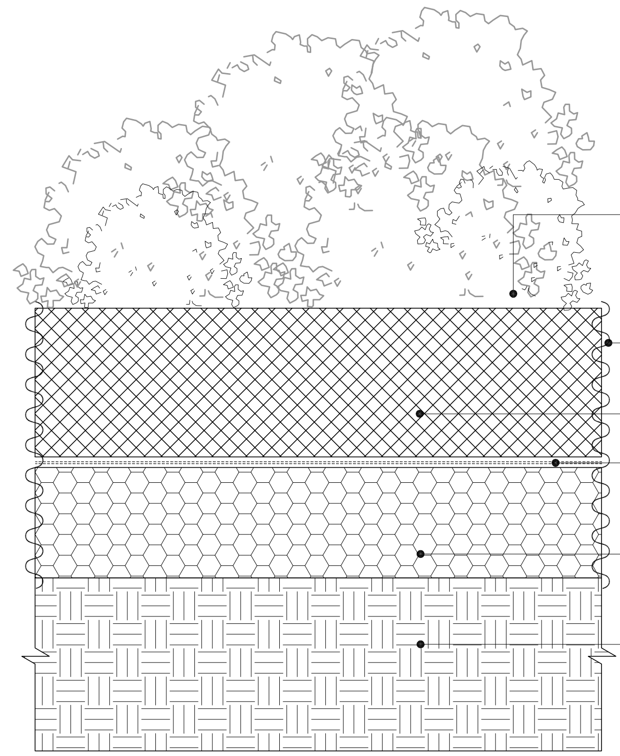
project no.	date	status
1125	10.12.18	Planning



Proposed Defensive Shrub & Groundcover Mix
scale@a3 1:20



Proposed Coastal Shrub Mix
scale@a3 1:20



Proposed Railway Edge Mix
scale@a3 1:20

Notes:
For Tree Pits refer to detail De-901
Plants to be planted upright at original soil height and backfilled with previously prepared thourough mixture of topsoil and peat free planting compost.

Revision	Description	Date	Initial	Revision	Description	Date	Initial
P00	Issued for Planning	11.12.18	DM				

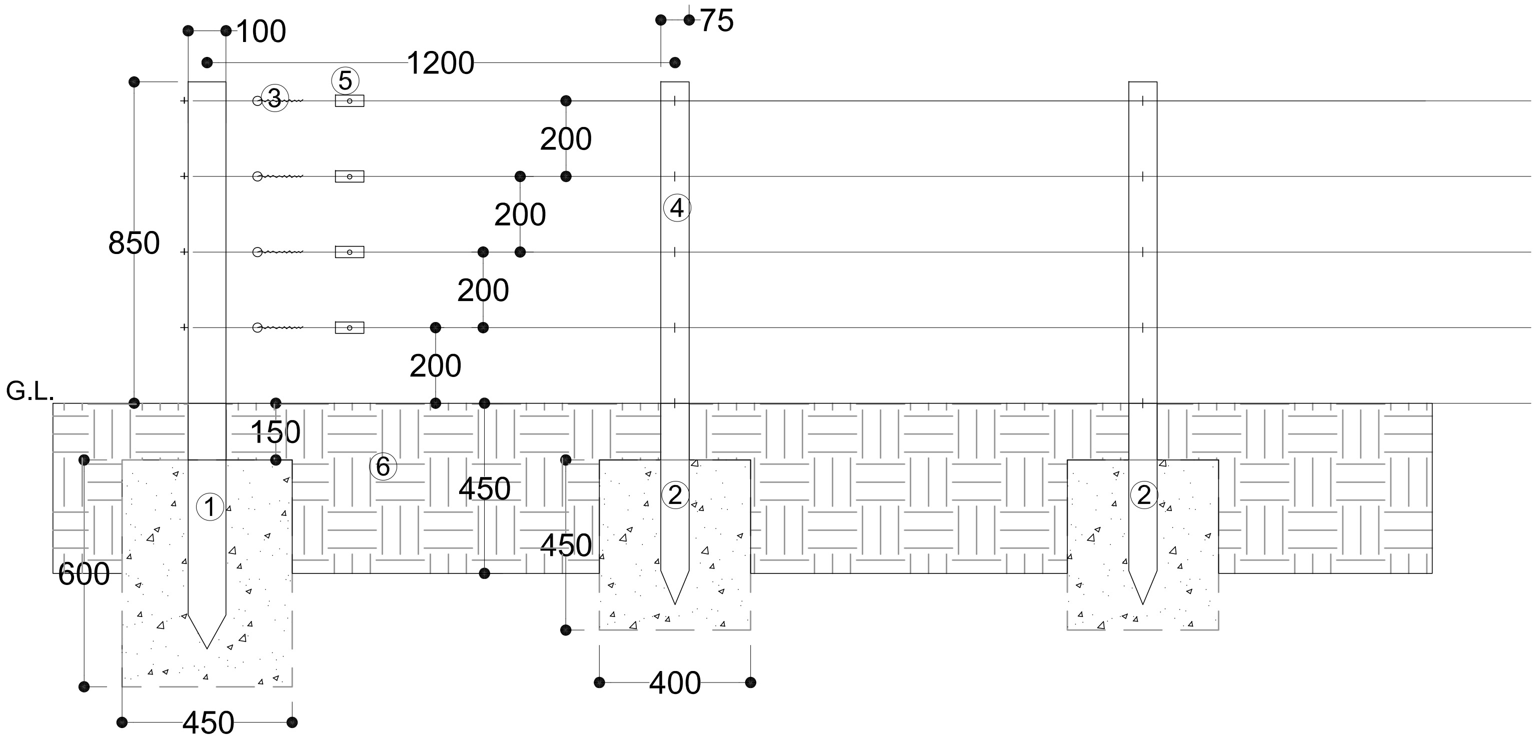
Client
Wexford County Council

Project Title
Trinity Wharf - Masterplan

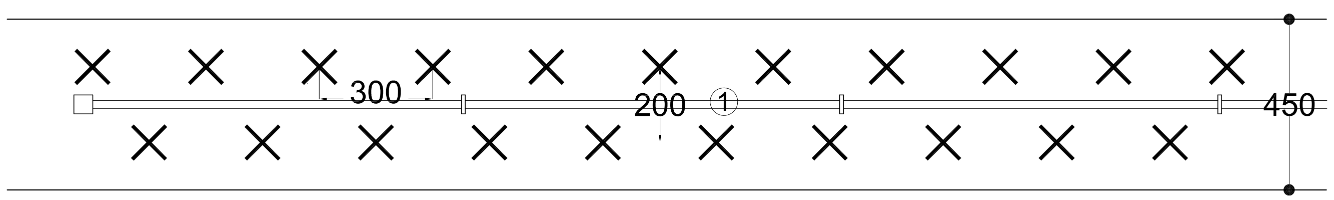
Drawing Title
Shrub Planting Types

the paulhogarth company
landscape architects — urban design
Potters Quay, 5 Ravenhill Road, Belfast BT6 8DN
telephone: 028 9073 6690 fax: 028 9073 2705
email:belfast@paulhogarth.com www.paulhogarth.com

drawn by	checked by	scale @ A3	drawing no.	revision
DM	AM	1:20	L-DE-902	P00
project no. 1125	date 11.12.18	status	Planning	



Typical Elevation
scale@a3 1:20



Typical Plan
scale@a3 1:20

NOTES

1. 1500mm min x 100mm diameter pressure treated timber end post and straining post @ 25m centres and at all changes in direction. To be set In600 x 450 x 450 C20 concrete foundation at all end and corner posts where ground conditions require.
2. 1800 x 75mm diameter pointed timber post to be driven securely into ground (foundation to be cast subject to ground conditions).
3. Wires fixed to posts at either end of run with galvanised Straining Eye Belts, 12.5 mm
4. Wired fixed with galvanised staples
5. Wire tensioners. To be positioned at start of runs and mid-way between straining posts
6. Top soil min depth 450mm with further layer of subsoil 300mm minimum depth. Break up subgrade prior to infill.

NOTES:

75mm perforated drainage pipe to be included within 300mm layer of clean stone, along extents of each hedge. To be tied into main drains. Contractor to submit proposals.

To be planted as double staggered rows @ 300mm centres in trench approx 450mm wide with rows 200mm apart, 7 plants per/lm. Hedging mix to be planted in random groups of no less than 3 or more than 7 of the same species, ensuring that no three plants are aligned in any one direction

Revision	Description	Date	Initial	Revision	Description	Date	Initial
P00	Issued for Planning	11.12.18	DM				

Client
Wexford County Council

Project Title
Trinity Wharf - Masterplan

Drawing Title
Typical Hedge Planting Detail

the paulhogarth company
landscape architects — urban design
Avalon House, 278/280 Newtownards Road, Belfast BT4 1HE
telephone: 028 9073 6690 fax: 028 9073 2705
email:belfast@paulhogarth.com www.paulhogarth.com

drawn by	checked by	scale @ A3	drawing no.	revision
DM	AM	1:20	L-DE-903	P00
project no. 1125	date 10.12.18	status Planning		

Wexford Quays - Trinity Wharf
Coastal Landscape Section

Note: Sections are intended for illustrative purposes only and should be read in conjunction with all other application information

SE-700 revP00

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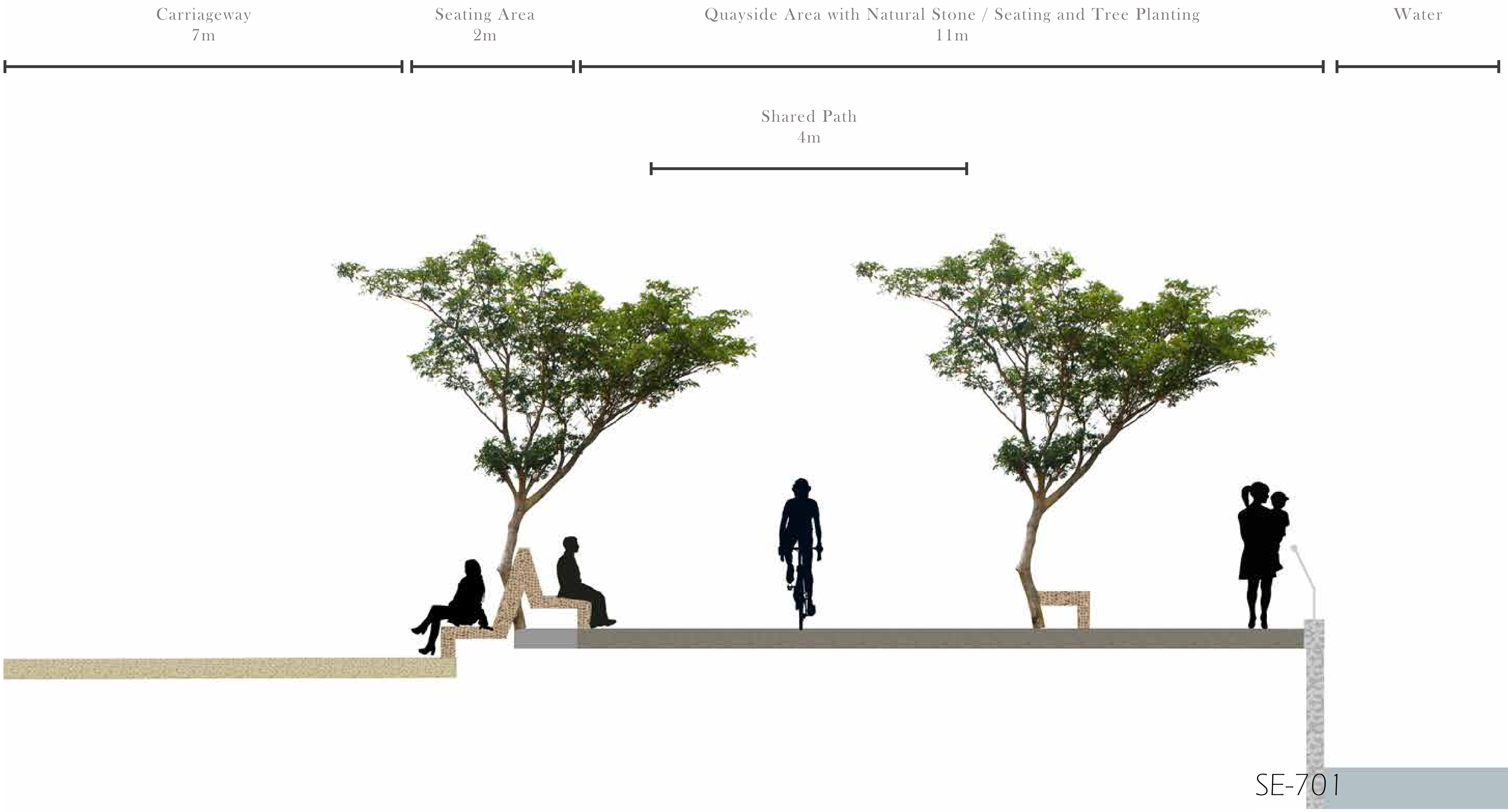
Wexford Quays - Trinity Wharf

Arrival Space Landscape Section

Note: Sections are intended for illustrative purposes only and should be read in conjunction with all other application information



SE-701 revP00

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Wexford Quays - Trinity Wharf
Railway Landscape Section

Note: Sections are intended for illustrative purposes only and should be read in conjunction with all other application information

SE-702 revP00

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TRINITY WHARF - STREET FURNITURE
SK09 PROPOSED SEATING

RECLAIMED TIMBER SEATING

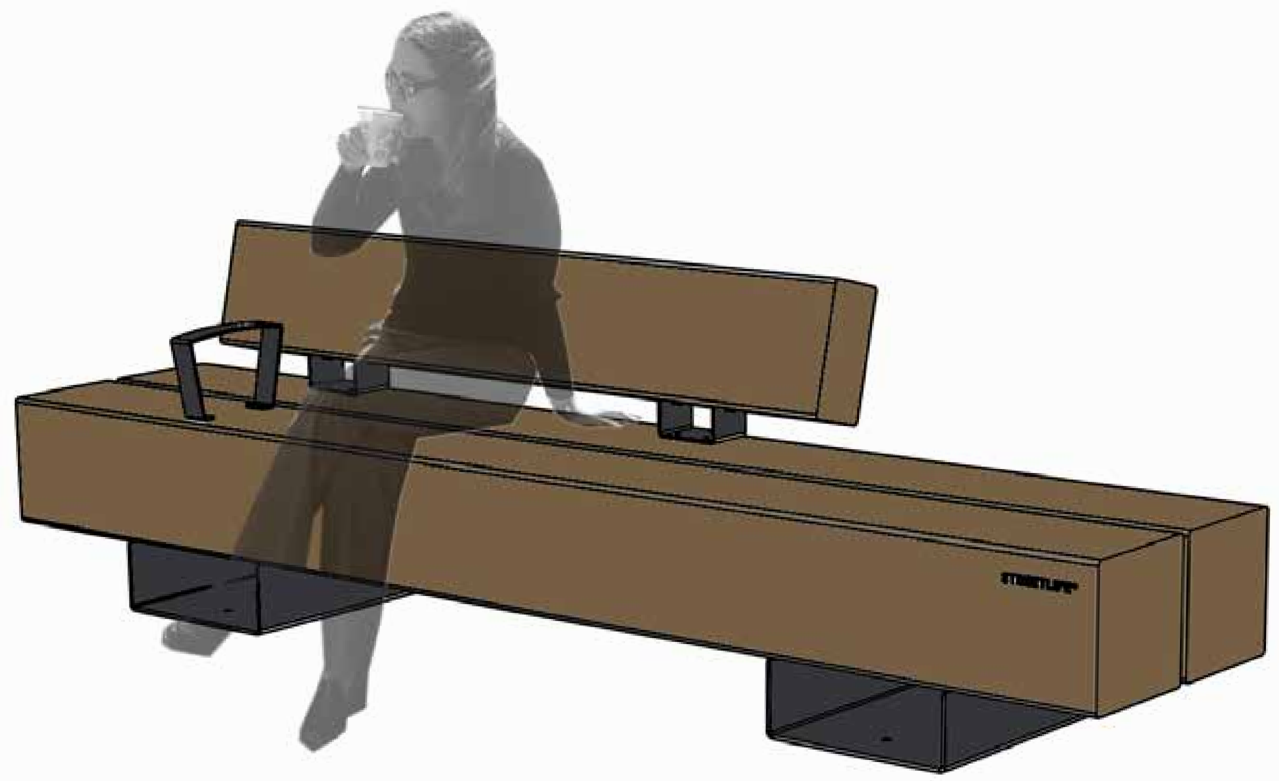
-Manufacturer: Streetlife
-Product: Drifter Bench
-Reclaimed Timber
-Galvanised Steel Base / Painted (RAL Colour / Finish to be confirmed)
-Fixed with Baseplate or Root Mounted in foundation

Options
Single or Double Bench (As image)
-with or without Backrest (Backrest location can be changed)
-with or without Armrests (Armrest location can be changed)
-In various Lengths 1.2 / 2.4 / 4 & 5m
-Picnic Table arrangement

Single Bench (with Backrest)

Double Bench (with Backrest)

Long Single Bench with Table



Double Bench with Backrest & Armrest

Single Bench with Backrest

Double Bench with Backrest

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TRINITY WHARF - STREET FURNITURE
SK10 PROPOSED BIN

Proposed Bin

Ash Hopper

Stubber Plate

Self Levelling Plate

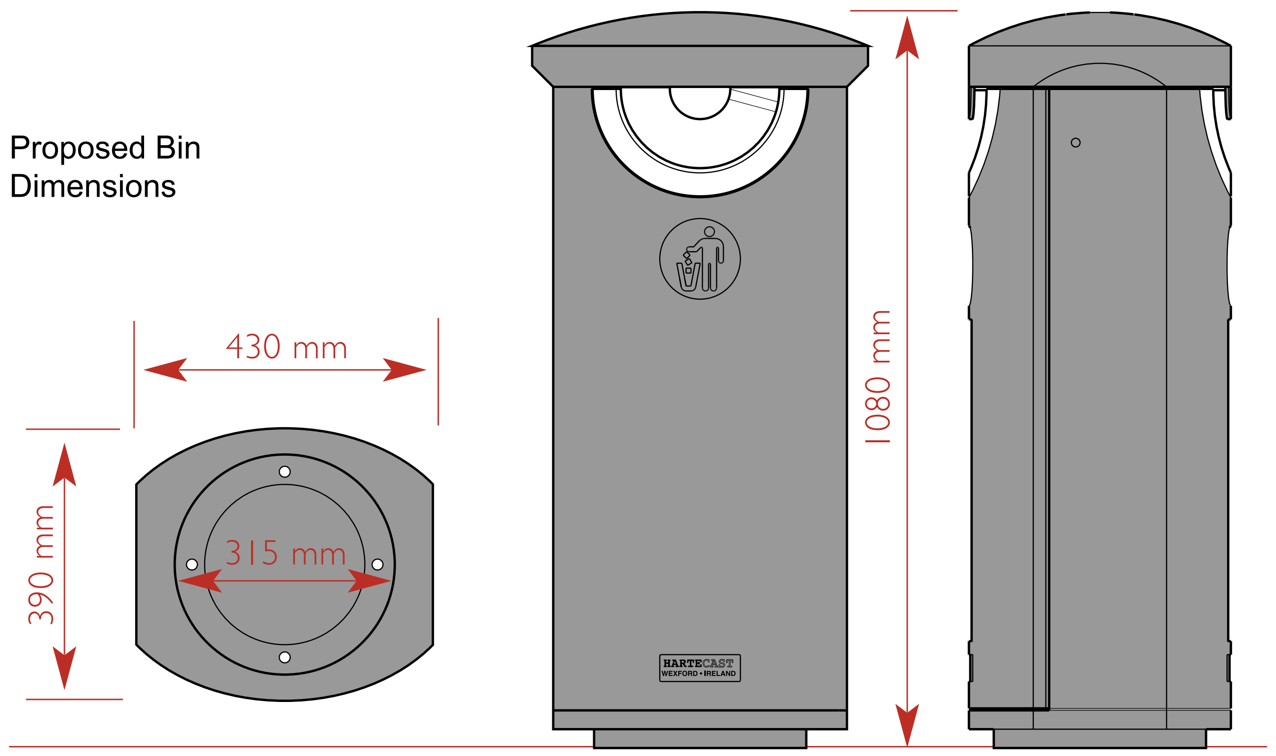
Proposed Bin
Highlighting advertising panel

DUCTILE CAST IRON BIN

-Manufacturer: Hartcast
-Product: HC2055 Bin
-100L capacity
-Manufactured from 12mm cast ductile iron with 316 grade stainless steel
-Stainless steel aperture to protect paint work and prevent chipping
-Fully galvanised with powder coat finsh (RAL colour / finish to be confirmed)
-Stainless Steel stubber plate with key operated ash hopper.
-Robust anti vandal hinging mechanism using 16mm stainless steel shaft door
-Heavy duty sealed glavanised steel liner
-Suppled with detachable base plate both for ease of installation and removal without disturbing ground fixings

Options
-Levelling plates to help cater for differnet gradients
-Available with or without advertising panel
-A restrictor can be added to restrict access by birds and will also combat the problem with domestic waste dumping.

Proposed Bin
Dimensions



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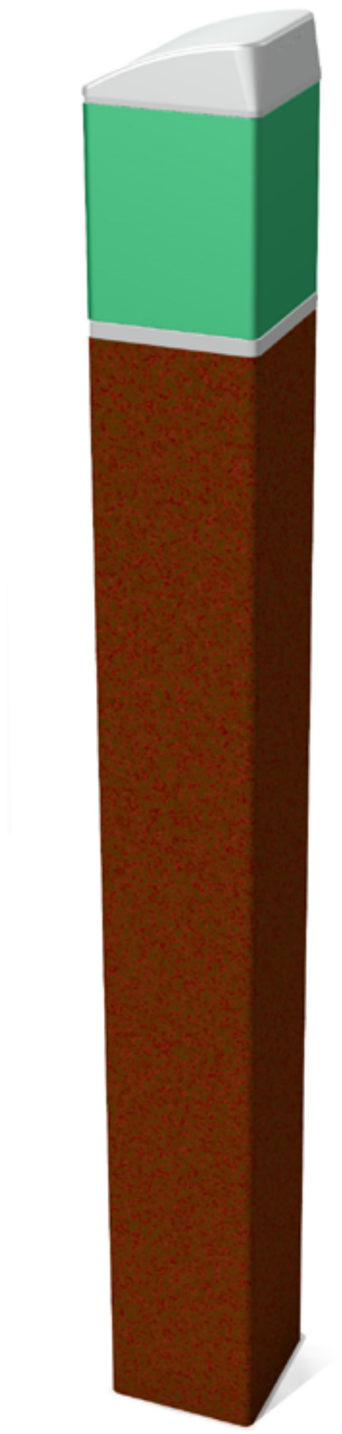
TRINITY WHARF - STREET FURNITURE
SK11 PROPOSED BOLLARD

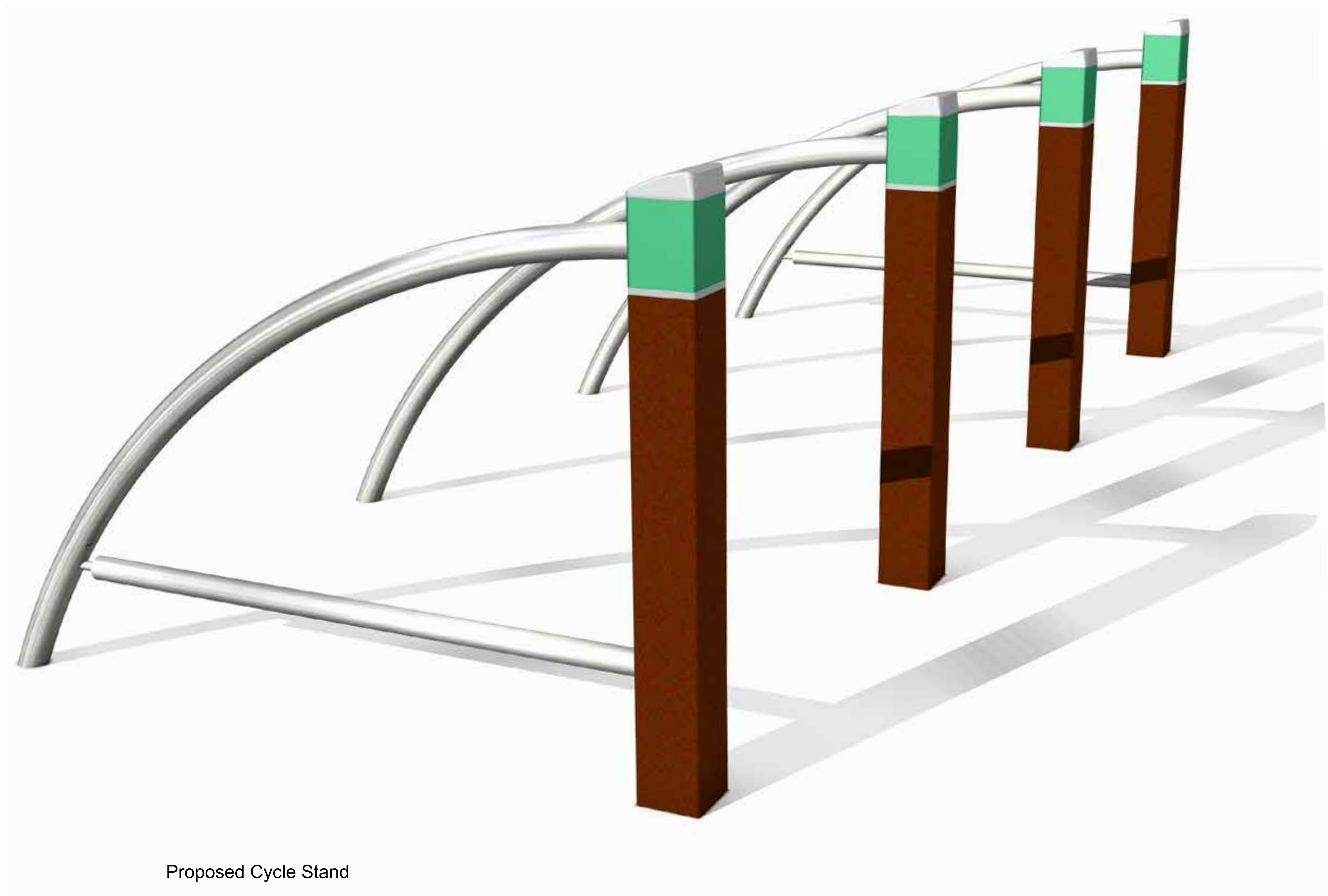
BOLLARDS AND CYCLE STANDS

Bollards
-Manufacturer: Hartcast
-Product: HC2014 Square Bollard
-Stainless steel bollard with cast stainless steel angled cap.
-100x100mm dia 900mm length (300mm underground)
-Powder coat finish (RAL colour to be confirmed)
-Fixed and removable versions with retention socket available.
-Length also also variable

Cycle Stands
-Manufacturer: Hartcast
-Product: HC2095 Cycle Stand
-Stainless Steel Curved Cycle Stand with cast stainless steel collar and cap
-100x100mm dia 900mm length (300mm underground)
-curved pipe is 50mm with a 2mm thickness
-Vertical pipe is polyester powder coat finish (RAL colour to be confirmed)



Proposed Bollard



Proposed Cycle Stand

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TRINITY WHARF - STREET FURNITURE
SK12 PROPOSED SIGNAGE

SIGNAGE _ ORIENTATION AND INTERPRETATION

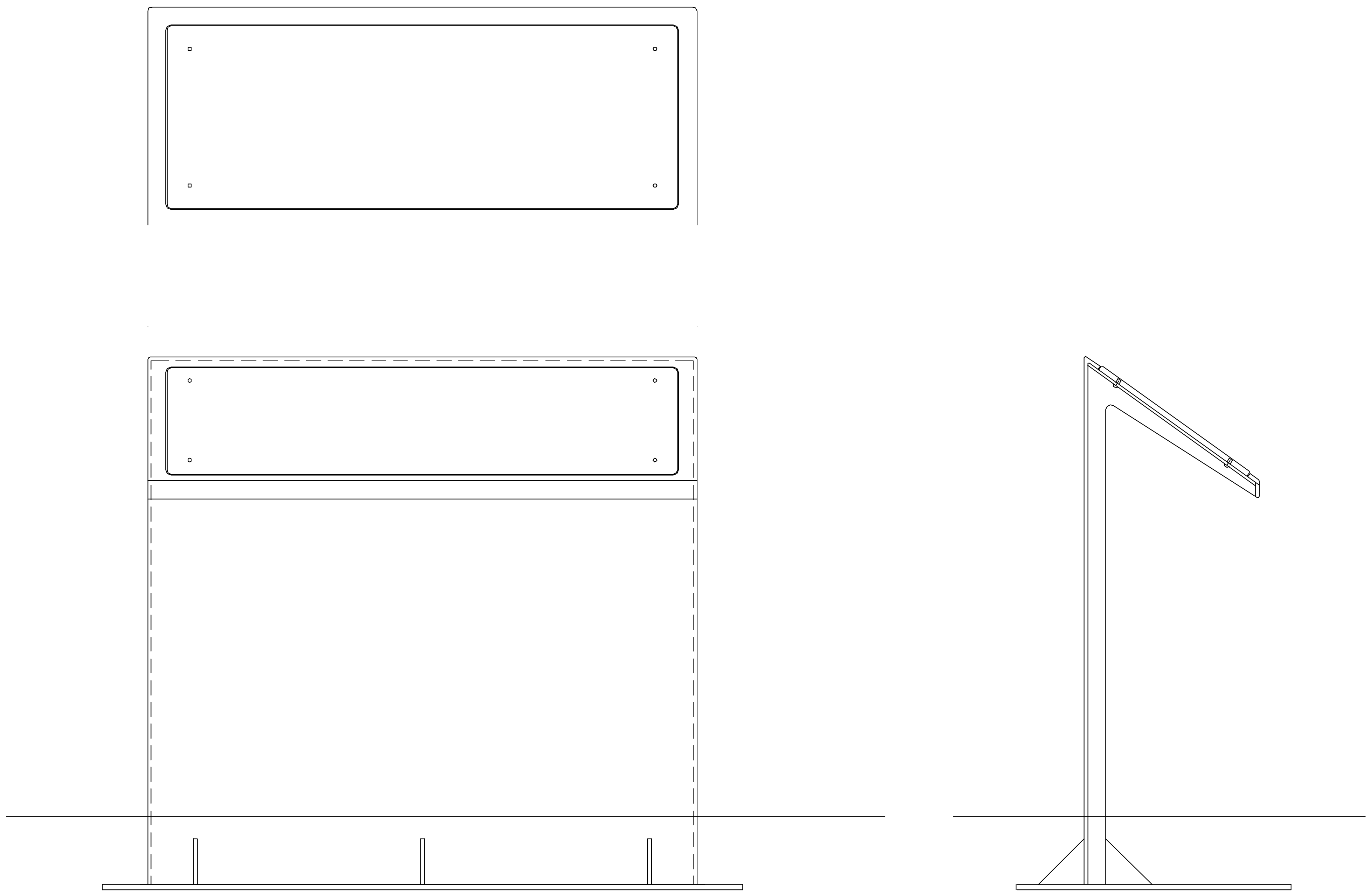
Interpretation Signage
-Galvanised Steel Base Painted (RAL Colour / Finish to be confirmed)
-Interpretation Content (displayed on printed board)
-Fixed with Baseplate or Root Mounted in foundation

Orientation Signage
-Galvanised Main Steel Base Painted (RAL Colour / Finish to be confirmed)
-Orientation Fins and Graphics (displayed on printed board)
-Fixed with Baseplate or Root Mounted in foundation

Exemplar Entrance Signage


Exemplar Interpretative Signage


Exemplar Display Board


Exemplar Interpration Signage

Exemplar Orientation Signage

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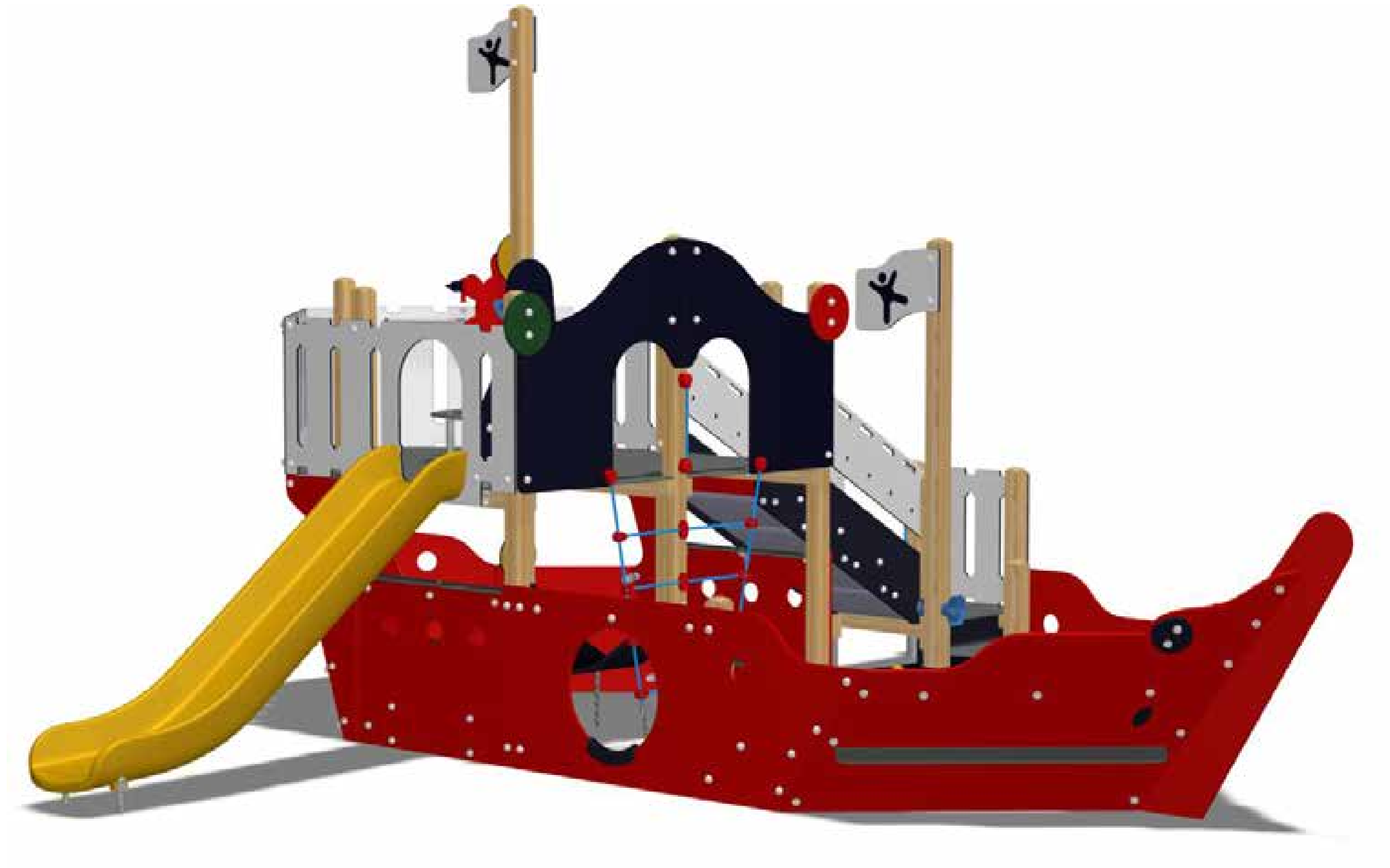
TRINITY WHARF - STREET FURNITURE
SK14 PROPOSED PLAY EQUIPMENT

PROPOSED PLAY EQUIPMENT

- Spring Rocker
- Kompan Pirate Ship
- Double Swing and Basket Swing
- Embankment Slide
- Exemplar image of Wet Pout Safety Surfacing

Single Spring Rocker



Multi Play - Kompan Pirate Ship

Embankment Slide

Exemplar - Wet Pour

Exemplar Double Swing & Basket Swing


Coastal Rocks
As Engineers spec


Natural Stone Paving
Silver Granite


Proposed Concrete
Paving Blocks


Proposed Exposed
Aggregate Paving

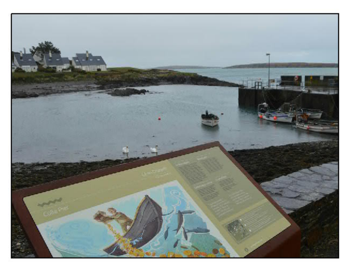

Proposed Block Paving
SUDS


Proposed Asphalt


Proposed Safety Surface


Proposed Granite Kerbs


Proposed Seating


Proposed Signage

All layout drawings to be read in conjunction with details and specification.
Any discrepancies to be brought to the attention of the Landscape Architect.

Softworks Key

- Proposed Semi-mature Tree Planting
- Proposed Semi-mature Street Tree Planting
- Proposed Intensive Shrubs
- Proposed Ground Cover Shrubs
- Proposed Coastal Rock & Planting
- Proposed Woodland
- Proposed Reinforced Grass
- Proposed Coastal Rocks
- Proposed Natural Stone Paving
- Proposed Concrete Paving
- Proposed Exposed Aggregate Concrete
- Proposed Block Paving SUDS
- Proposed Asphalt
- Proposed Safety Surface (to include play equipment)
- Stone Kerbs & Edges
- Proposed Buildings
- Proposed Feature Lighting
- Proposed Seating
- Proposed Interpretative Signage
- Proposed Public Art

NOTE:
REFER TO DRAWING No.: **L-PP-001 - PLANTING PLAN** FOR DETAILS OF THE SOFT LANDSCAPING. PLANTING SHOWN ON THIS DRAWING AS REFERENCE ONLY.

Revision	Description	Date	Initial
P01	Issued for Review	18.10.29	DM
P02	Colour amended and Issued for Review	18.11.05	DM
P03	Amended to suit architects changes	18.11.14	DM

thepaulhogarthcompany
landscape architecture — urban design
potters quay, 5 ravenhill road, belfast BT6 8DN
telephone: 028 9073 6690 fax: 028 9073 2705
email:belfast@paulhogarth.com www.paulhogarth.com

client
WEXFORD COUNTY COUNCIL

project title
TRINITY WHARF - MASTERPLAN

drawing title
HARDWORKS PLAN

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DM	AM	1:500	P03
project no.	date	drawing no.	
1125	Oct 2018	1125-L-HW-200	

status.
Planning