21 Summary of Mitigation, Monitoring and Residual Effects

21.1 Introduction

This chapter provides a summary of the proposed mitigation and monitoring measures as well as an overview of the residual likely significant effects associated with the proposed development (as identified in **Chapters 7 – 19**).

21.2 Summary of Mitigation Measures

A number of safeguards and management measures have been identified in order to mitigate negative environmental effects during construction and operation as described in detail in **Chapters 7 – 19**.

It should be noted that this generally excludes any inherent measures and elements that have been incorporated in the design as these design measures have been documented as part of **Chapter 4**. Further, any environmental management measures during construction that have been identified and are associated with construction activity and methodology are documented in the Outline CEMP which is available in **Appendix 5.1.**

The mitigation measures that have been established to minimise any likely significant negative effects arising from the proposed development on the surrounding environment are summarised in **Sections 21.2.1- 21.2.13**.

21.2.1 Traffic and Transportation

The following measures in relation to traffic and transportation will be implemented during construction:

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrances and prevent disruption to neighbouring businesses. Construction vehicles will not be allowed to park on the public road either outside the site or on any of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limits and will be directed to the relevant area by the Site Manager;
- Trucks required to wait on site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. A lance will be provided to clean down the bodies and sides of the truck prior to leaving site;
- Roads outside the site will be visually inspected on a daily basis and power swept and washed as and when required;

- All site staff including truck drivers will be required to abide by the normal rules of the road;
- The contractor shall prepare a Detailed Construction Traffic Management Plan (CTMP) covering all construction stages that takes into account other potential construction works in the area including the proposed Arklow Flood Relief Scheme. The CTMP should demonstrate how pedestrians, cyclists and motorised vehicles can pass through the works areas safely and that measures are in place which ensure traffic operates in as an efficient manner as possible;
- The CTMP should include a detailed consultation plan to deal with third party queries from both residents and retail/ commercial operators. The CTMP will require agreement with both Wicklow County Council and An Garda Síochána. The contractor should appoint a single point of contact to facilitate the communication of the various traffic management plans and the preparation of a project specific website to aid communications would also be beneficial.
- As part of the CTMP a Mobility Management Plan should be prepared to ensure access to the site by sustainable travel modes is encouraged. The following measures will need to be considered within the Mobility Management Plan:
    - The provision of showers/ changing rooms for construction staff;
    - The provision of cycle parking for staff; and
    - The promotion of car sharing among staff, including van pooling to travel between the different work sites.
- For works at North Quay, the following individual traffic management measures should be considered:
    - The works should be carried out during a quiet period of the year, possibly late summer however impacts on tourist traffic will also need to be considered.
    - The works should be carried out utilising a longer working day (16-24 hour basis), however the impact on adjacent residents would need to be considered to reduce the time North Quay needs to remain closed.
    - The junction would need to be manned during busy periods to ensure the junction operates efficiently and safely.
    - Parking in and around the junction of Ferrybank and Seaview Avenue needs to be managed and controlled by appropriately trained personnel.
- For any works to Arklow Bridge that require lane closures the following measures are suggested:
    - No scheduled lane closures should commence before 21:00 and all lane closures should be lifted by 07:00 in the morning.
    - The length of lane closure and the required working area needs to be made as small as possible to reduce the length of the shuttle system.

No mitigation measures have been proposed with respect to traffic and transportation effects from the operation of the proposed development as the projected increase in traffic will have no impact on prevailing traffic conditions.

21.2.2 Air Quality and Climate

The following measures in relation to air quality and climate will be implemented during construction:

- Implementation of standard mitigation, as stated in the TII guidance[1], including the following measures:
  - Spraying of exposed earthwork activities and site haul roads during dry weather;
  - Provision of wheel washes at exit points;
  - Covering of stockpiles;
  - Control of vehicle speeds, speed restrictions and vehicle access; and
  - Sweeping of hard surface roads.
- Erection of c. 2.4m hoarding will be provided around the working areas to minimise the dispersion of dust from the working areas;
- Generators will be located away from sensitive receptors in so far as practicable;
- Stockpiles will be located as far as possible from sensitive receptors and covered and/or dampened during dry weather;
- Employee awareness is also an important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected.
- Where asbestos is uncovered on site during construction, the ACM will be double-bagged and removed from the site by a competent contractor and disposed of in accordance with the relevant procedures and legislation.

As there are no significant effects on air quality during the operation of the proposed development, no mitigation measures are proposed.

In relation to climate, the use of energy efficient design reduces the annual CO_2 emissions of the proposed development. Key energy and resource efficiency measures incorporated in the design include:

- The WwTP has been located as close as possible to the load centre in Arklow town; and adjacent to the Irish Sea (i.e. the target location for final discharge of effluent) and all treated effluent discharges will be conveyed to the long sea outfall via gravity flow to minimise pumping requirements (and thus associated energy use);

[1] Transport Infrastructure Ireland (TII), (formerly the National Roads Authority (NRA)) (2011). Guidelines for the Treatment of Air Quality during the Planning and Construction of National Roads Schemes. TII, Dublin, Ireland

- All flows in the interceptor sewer network and the WwTP will be conveyed by gravity to the WwTP to minimise pumping requirements (and thus associated energy use);
- Soft start pumps/efficient pump selection will be utilised throughout;
- On-site renewable energy in the form of PV panels that use solar energy have been incorporated into the Process building to optimise the generation and use of renewable energy at the WwTP; and
- The buildings on the WwTP site will be naturally ventilated where possible, with heating limited to mitigate the effects of frost and condensation in the Inlet Works and Process Building only. Occupied spaces will have heat recovery ventilation systems. The combination of these HVAC elements wills minimise associated energy use in the WwTP buildings during operation.

21.2.3 Odour

No mitigation measures are required during the construction of the proposed development with regards to odour.

No mitigation measures above those inherent design measures (including the provision of Odour Control Units) described in **Chapter 4** are required during the operation of the proposed development with regard to odour.

21.2.4 Noise and Vibration

The appointed contractor(s) will be required to prepare a Noise and Vibration Management Plan (NVMP) that will outline how they will comply with the noise criteria set out in this EIAR. The NVMP will deal specifically with construction activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the construction of the proposed development. The NVMP will detail the provision and installation of localised acoustic screens, the best practice noise measures that the contractor will be required to adhere to for construction activities and the noise and vibration monitoring programme that the appointed contractor(s) will be required during construction.

In addition, the appointed contractor(s) will prepare detailed method statements addressing the likely groundborne noise and vibration levels that will be generated as a result of the construction activities once the specific details of the proposed plant, equipment and construction methodologies are known.

Where considered necessary, structural surveys will be undertaken at sensitive receptors in close proximity to the works to establish their condition and tolerance for vibration impacts

The following measures in relation to noise and vibration will be implemented during construction:

- The contractor will take specific noise abatement measures and comply with the recommendations of the standard[2] and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 and 2016 so as to acknowledge the EC (Noise Emission by Equipment for Use Outdoors) (Amendment) Regulations 2006;
- A site representative shall be appointed to be responsible for matters relating to noise and vibration;
- Construction of temporary infrastructure (e.g. haul roads and the causeway) will be with materials that minimise noise and vibration and design of haul roads will minimise reversing;
- Internal haul roads shall be well maintained;
- Unnecessary revving of engines should be avoided and equipment should be switched off when not required;
- Rubber linings shall be used in chutes and dumpers etc. to reduce noise;
- Drop heights of materials shall be minimised;
- Generators will be located away from sensitive receivers and will be enclosed;
- Careful selection of plant, equipment, construction methods and programming with the objective of reducing noise and vibration where possible. Only equipment, including road vehicles, conforming to relevant national or international standards, directives and recommendations on noise and vibration emissions, will be used;
- Plant and vehicles shall be started sequentially rather than all together;
- Selecting electrically powered plant that is quieter than diesel or petrol-driven plant, if interchangeable;
- Fitting suitable anti-vibration mountings where practicable, to rotating and/or impacting equipment;
- Avoiding percussive piling, except where there is an overriding justification;
- Using noise-control equipment such as jackets, shrouds, hoods, and doors, and ensuring they are closed;
- Locating plant and equipment, as far as is reasonably practicable, away from receptors or as close as possible to noise barriers or hoardings where these are located between the source and receptor;
- Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery;
- Ensuring that all plant is maintained regularly to comply with relevant national or international standards and operation of plant and equipment that minimises noise emissions;
- Ensuring that plant is shut down when not in use;

[2] British Standards Institution (BSI) (2014) 5228-1 and 2:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites. Noise and Vibration.

- Ensuring that air lines are maintained and checked regularly to prevent leaks;
- Designing all audible warning systems and alarms to minimise noise. Non-audible warning systems can be used in preference, i.e. cab-mounted CCTV or the use of banksmen. If required, ensure that audible warning systems are switched to the minimum setting required by the Health and Safety Authority and where practicable use 'white noise' reversing alarms in place of the usual 'siren' style reversing alert
- A c. 2.4m hoarding shall be provided around working areas, including around the TBM launch site;
- Rotary drills and bursters actuated by hydraulic or electrical power will be used for excavating hard material. In some instances, chemical bursting can be used where nearby sensitive structures are particularly vulnerable to vibration from pneumatic breakers etc.;
- Handling all materials, particularly steelwork, in a manner that minimises noise. For example, storing materials as far as possible away from sensitive receptors and using resilient mats around steel handling areas;
- During construction, regular inspections will be undertaken to ensure that the noise and vibration minimising methods, plant and mitigation identified in the specimen design stage are adopted on site and are working effectively. If applicable, it is proposed that construction method inspections be integrated into any health and safety or quality surveillance regime;
- Typically, site activities shall be limited to 7am – 7pm, Monday to Friday; and 8am – 2pm, Saturday. However, during the interceptor sewer construction works, the TBM equipment (including generator) will operate on a 24-hour basis. No works are anticipated on Sundays and Bank Holidays (with the exception of tunnelling). Aside from the 24-hour use of the TBM equipment, it is anticipated that there will be times due to exceptional circumstances that construction work will be necessary outside of normal construction core working hours. Any such working hours outside the normal construction core working hours will be agreed with Wicklow County Council. The planning of such works will have regard to nearby sensitive receptors;
- A Communications Management Plan shall be prepared to provide for effective community liaison to help ensure the smooth running of construction activities and to address any issues that may arise;
- Noise monitoring should be undertaken at the start of each new activity to determine the compliance with limit values. This may involve monitoring on a daily basis initially (for the first three weeks), but subject to satisfactory results, this could be relaxed to once a week/twice-weekly depending upon the site activities. The frequency will be increased again if particularly noisy activities (such as driven piling) are undertaken;
- Continuous noise and vibration monitoring will take place at three of the nearest sensitive receptors (including Arklow Bridge). Environmental noise and vibration monitoring will be undertaken by suitably-trained and experienced staff;

- BS5228-1[2] provides an example of noise insulation and temporary rehousing policy and defines the threshold value of eligibility, this recommends a minimum number of days before a resident may be eligible. Where minimum durations of "*a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months"*, are predicted, the standard[2] recommends re-housing. The contractor will outline the specific construction methodologies and agree a schedule that minimises effects on receptors. Any requirement for temporary re-housing will be confirmed by the contractor in consultation with Irish Water and the affected stakeholder. The determination for such mitigation will be made after detailed construction methodologies, phasing and detailed equipment are known. This information will be presented in the NVMP.
- During tunnelling, the most effective pre-emptive measure that to reduce impacts is soil probing prior to tunnelling works. Probing prior to tunnelling will allow hard obstacles or rock to be identified. If encountered pre- auguring will be undertaken at these locations where hard obstacles have been identified prior to tunnelling to minimise noise and vibration impacts. Where ground conditions may be unknown, this measure will be carried out prior to tunnelling.

During the construction of the marine outfall, there is the potential for noise impacts on marine mammals. The Department of Arts, Heritage and the Gaeltacht have published guidance[3] on best practice construction mitigation measures that should be followed for construction in Irish waters. The following summarised measures will be implemented during the construction of the outfall in Arklow Bay:

Pre- Drilling

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.

Drilling activity shall not commence if marine mammals are detected within a 500m radial distance of the drilling sound source, i.e., within the Monitored Zone.

Pre- Start Monitoring

Drilling 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.

[3] Department of Arts, Heritage and the Gaeltacht (2014) *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf.

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.

In waters up to 200m deep, 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 immediately by normal drilling operations. The delay between the end of Pre-Start Monitoring and the necessary full drilling output must be minimised.

Drilling

Once normal drilling operations commence, there is no requirement to halt or discontinue the activity 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 drilling 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 must be undertaken in accordance with the above conditions prior to the recommencement of drilling activity.

During operation, all equipment will be housed within buildings/chambers which will limit noise breakout to atmosphere. Therefore, a greater level of compliance than that presented in Table 10.38 in Chapter 10 would be expected.

21.2.5 Biodiversity

The following measures in relation to biodiversity will be implemented during construction:

Terrestrial biodiversity, habitats, and flora

The mitigation measures for habitats and flora aim to implement Objective NH12 of Wicklow County Development Plan 2016-2022 (see **Section 11.3.1.3 of Chapter 11**), in the context of the ecological baseline conditions recorded within the planning boundary of the proposed development.

Chapter 5 provides for top-soiling and seeding of existing areas of Amenity grassland **GA2** within the planning boundary of the proposed development, where these are removed or damaged during the construction phase. Further, **Section 13.5 of Chapter 13** (as summarised in **Section 21.3.7)** makes recommendations in relation to the planting of replacement trees in these locations. The species listed in **Table 11.10 in Chapter 11** are suitable for seeding in these areas, and managed as short meadow.

Wildflower grassland management

Initially, sown areas will need to be monitored for germination and establishment, and any unwanted species removed manually. Subject to monitoring, mowing may not be required during the first year after seeding. After the meadow is established, the following regime is recommended:

Short meadow would generally be mown 5 times per year, with cut material removed:

- First cut after the 15 April
- Second cut at end of May
- Third cut in mid-late July (maximises growth of Clovers and other wildflowers)
- Fourth cut at the end August
- Fifth cut after mid-October.

Long meadow would be mown once a year, in late September or October, with cut material removed.

For both short and long meadow, a high cut setting of >8-10cm is recommended during mowing or strimming.

At the Alps SWO and storm water storage tank site, Honeysuckle will be planted at 2m centres along the western and eastern sides of the perimeter fence. This measure will provide shelter and habitat for insects and feeding habitat for bats at a small site where tree and shrub planting would be inappropriate. The grass and wildflower seed mix listed in **Table 11.10 in Chapter 11** will be seeded within and adjoining the temporary construction site as part of completion works and managed initially as short meadow, to implement measures to control Buddleia are required in this area as identified in **Appendix 11.2.3**.

Landscaping around the four buildings at the WwTP site will follow a basic grid, derived from the primary geometries of the site. This grid will include hard landscaping between the buildings in addition to soft landscaping that will be planted around the site perimeter. This landscaping will be provided as part of the completion works, as illustrated in **Drawing No. 247825-00-L002 in Volume 3**.

Planting of trees, shrubs and climbers, and seeding with the bespoke mix of native grasses and wild flowers listed in **Table 11.10 in Chapter 11**, to be managed as short and long meadow, will be carried out in areas agreed with the project architect Clancy Moore within the WwTP site, and also along the site road frontage where a 5m setback to be provided will allow space for planting of groups of trees and short meadow, with Honeysuckle provided at intervals along the WwTP site boundary fence. Irish native species are proposed throughout, as specified in **Tables 11.10 and 11.11 in Chapter 11**, with the exception of Scot's pine for which a cultivar is likely to be more suitable for this coastal location.

Birds

Tree felling, removal of scrub and other tall vegetation will be carried out between 1 September and 28 February, to avoid any risk to breeding birds and their habitats.

At the WwTP site, depending on the schedule of demolition of existing buildings, the sequence of demolition works may require to be modified to take account of a small number of breeding birds that may be present within structures, in the event of works occurring from 1 March to 31 August.

Nesting boxes for the Red-listed species Grey Wagtail, and for Pied Wagtail will be provided in alternate arches of Arklow Bridge, on ledges above high water level in the existing concrete structure on the upstream side of the bridge, because existing ledges are not secure from predation, in order to provide nesting habitat for these species that feed extensively along the river channel.

Bats

As all bat species recorded within the planning boundary are protected under Annex IV of the Habitats Directive, the works to be carried out to the two southernmost arches of Arklow Bridge and their associated piers require a derogation from the National Parks and Wildlife Service of the Department of Culture, Heritage and the Gaeltacht to allow works that would create a risk to bats and would remove existing roosting options. The measures proposed will meet the requirements for protecting the bats availing of Arklow Bridge. A Derogation Licence No. DER/BAT 2018 – 73 has been issued and is reproduced in **Appendix 11.7**. All measures outlined herein will be complied with.

The measures proposed specifically for the two southernmost arches of Arklow Bridge derogation include:

- Examination of the bridge prior to works by the licensed bat specialist for evidence of bats.
- Exclusion of bats if necessary with one-way valves devised by the bat specialist.
- Capture of any bats that are still present prior to works and retention until the risk of injury or re-entry to the bridge has been removed.
- Provision of 4 x 2FR Schwegler woodcrete bat tubes for each modified arch (i.e. 12 x 2FR bat tubes). These bat boxes must be attached to the bridge in an unlit area above high-water mark.
- The boxes should be attached upright unless there is insufficient clearance above the river and the lower section would be immersed. Two boxes should be attached together to form a large cavity suitable for a large population of bats.

Examination of all mature trees, and bat boxes along River Walk with roost potential prior to removal

All mature trees at the Alps, along River Walk, and along the south and north quays in Arklow shall be examined for bats prior to felling.

This may be achieved through a bat detector assessment if undertaken in the active season (prior to November and after March) or alternatively may require supervision at the time of felling. Any mature trees will require survey prior to felling.

All buildings within the WwTP site shall be examined for bats prior to removal. This may be achieved through a bat detector assessment if undertaken in the active season (prior to November and after March) or alternatively may require supervision at the time of removal.

Lighting at the WwTP site

External lighting will be installed around the WwTP for the safety and security of staff on the site. The lighting will be kept close to the buildings and only operate when there is movement. The lighting will be designed in consultation with the licenced bat expert, using emerging lighting technologies and having regard to best practice.

Mitigation for bats includes the following additional lighting considerations:

- Floodlighting is required for two of the external yards, and will be located within the building facade, and screened from broader light spillage by the louvered elements of the facade. Floodlights will be LED, as these have glass lenses which can be used to direct the light to the working area and reduce light spillage;
- Floodlights for working areas will make use of multiple lights to produce a more uniform light output and to lower the individual output from a single source – these will however still be quite high output;
- The site lighting incorporates the use of street lights to light the roadway around the building. The street lights will be selected to minimize upward lighting spill, hoods, louvres, shields or cowls would be fitted on the lights to reduce light spillage, and will incorporate the use of presence detection;
- Perimeter fence lighting will also incorporate presence detection, and will be off by default until motion is detected;
- low level (~ 1m high) bollard lighting is being used in selected areas (refer to architect's landscape plans);
- lights should be of low intensity. It is better to use several low intensity lights than one strong light spilling light across the entire area. The source of light should be Light Emitting Diodes (LEDs) as this is a narrow beam highly directional highly energy efficient light source. The lighting should allow for a light level of 3 lux at ground level. This low lighting is thus easier to control both the direction but also the actual light level because it is so close to the target area (if using bollard lighting);
- narrow spectrum lighting should be used with a low UV component. Glass also helps reduce the UV component emitted by lights.

In the event of security lighting being required, it is recommended that infra-red lighting and infra-red cameras are employed to record anti-social activity to assist in crime solving and prevention. This would not raise the visible light levels that would affect mammals and birds to a much greater extent.

Additional habitat creation measures for bats

It is envisaged that the façade of the new buildings at the WwTP will provide roosting opportunities for bats. As part of the proposed development, the appointed bat specialist shall review the buildings and advise on an appropriate location for of a purpose-built bat box such as the Improved Roost-Maternity Bat Box; likely to be located on the southern facade of both Process and Inlet works Buildings at about 4.5m off the ground. These locations will not be directly illuminated.

Planting of trees, shrubs, climbers, and species rich grassland within the planning boundary of the proposed development is detailed in **Chapter 4** and **Section 11.5.1.1**.

Marine mammals

The Standard Management Conditions for the contractor will include a requirement to consider alternative construction methodologies during the development of the detailed design, including confirmation of the sound generation characteristics (in air and in water) of all methodologies and all the equipment intended to be used in coastal and marine environments (i.e. in all areas east of Arklow Harbour at South Quay), and to apply the appropriate risk minimisation measures to manage the risk to marine mammals from man-made sound sources in Irish waters. These risk minimisation measures include the following list of measures (listed on page 18 of the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters[4]):

- A6.1. Minimise the duration over which the sound-producing activity is intended to take place;
- A6.2. Minimise the individual and cumulative sound pressure and exposure levels delivered into the environment by the activity. If necessary the use of alternative, lower impact equipment and methods could be explored (e.g., vibratory hammer, gravity base piles).
- A6.3. Incorporate the use of clear “ramp-up” (i.e., “soft-start”) procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause significant behavioural impact on marine mammals to the full output necessary for completion of the activity.
- A6.4. Incorporate the use of fully enclosing or confined bubble curtains, encircling absorptive barriers (e.g., isolation casings, cofferdams) or other demonstrably effective noise reduction methods at the immediate works site, in order to reduce underwater sound propagation from on-site operations.

[4] Issued by the Minister for Arts, Heritage and the Gaeltacht as official guidelines and codes of practice under Regulation 71 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10-30 dB.

- A6.5. Use trained and experienced marine mammal observers (MMOs) to provide effective means of detecting marine mammals in the vicinity of coastal and marine plans or projects. Associated operational considerations must also be taken into account (see section 4.2 of the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters).

Implementation of these measures during construction will ensure that no risks of injury to, or of a disturbance/behavioural response by marine mammals from man-made sound will arise during construction.

Aquatic ecology

The contractor shall submit a detailed programme of work to the client and to Inland Fisheries Ireland showing the order of procedure and the method by which it is proposed to carry out the authorised works, together with a timetable for completion of such work. These works shall comply with the Inland Fisheries Ireland guidance[5].

The seasonal restriction contained in the guidance[5] has been modified in consultation with Inland Fisheries Ireland, in respect of the proposed development, to take account of the presence and seasonal passage on migration of Habitats Directive Annex II listed fish species Atlantic Salmon, River Lamprey, and potentially also Sea Lamprey in the Avoca River and Estuary. All instream works including the installation and removal of sheet piling or geotextile wrapped gabions required to provide barriers between works areas /temporary haul roads and aquatic habitats will be carried out during the three months of July to September inclusive.

The following mitigation measures will apply:

- Four weeks' notice shall be given in writing to the Employer's Representative and Inland Fisheries Ireland before the authorised works commence;
- A suitably qualified Environmental Clerk of Works shall be appointed to oversee and monitor all measures taken to protect the aquatic environment;
- The Contractor shall pay all statutory fees associated with the works;
- The Contractor shall be responsible for maintaining flows in the river at all times.
- The Contractor will be permitted to construct temporary haul roads in the river beside the proposed pipeline however the flow must be maintained throughout this period to enable free passage of fish. The details of the all temporary works in and immediately adjoining the Avoca River shall be subject to approval by the Employer's Representative and by Inland Fisheries Ireland;
- The Contractor shall take all practicable measures to prevent the deposition of silt or other material in, and the pollution or damage to the Avoca River;

[5] Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters

- Any construction equipment and vehicle which in the opinion of the Employer's Representative presents a risk of affecting the Avoca River shall be removed from Site;
- Instream machine works shall be minimised, and any machines working in the watercourse must be protected against leakage or spillage of fuels, oils, greases and hydraulic fuels;
- Instream earthworks must be executed so as to minimise the suspension of solids. Construction works, especially ones involving the pouring of concrete, must be conducted in the dry;
- De-watering of any in-stream or marine sheet piled areas will be via a screened water intake pipe, to avoid injury or mortality to any fish that may be present;
- Search for and safe removal to safe waters of any fish trapped in enclosed works areas in the aquatic environment will be carried out by suitably qualified and licenced personnel, using methodologies to be agreed with Inland Fisheries Ireland;
- Discharge from the dewatering process would be passed to a suitably sized settlement pond or a propriety silt removal system, before discharge to the Avoca River or the local sewer network. Back-up equipment will be required to be maintained ready for use at all works sites. Any discharge to either sewer or watercourse would be subject to a discharge licence. It is noted that the existing sewer network currently discharges untreated waters to the Avoca River;
- In order to minimise the volumes of water required to be removed from contained works areas in which in-situ cement works and/or excavation are required, works areas will be covered overnight and other periods when works are not in progress, in order to minimise infiltration of rainfall into works areas;
- To minimise the risk of spills and/or leaks, standard good practice will be followed with regard to pollution prevention as part of the appointed Contractor's detailed CEMP(s);
- All in-situ cement works will be monitored by the appointed contractor's Environmental Manager to ensure that spill prevention and remediation measures are in place, to minimise the risk and extent of spills and to rapidly deploy clean up equipment;
- Machinery maintenance work, re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles / equipment will take place in designated bunded areas within the temporary construction compounds. All waste oil, empty oil containers and other hazardous wastes will be disposed of in compliance with the requirements of the Waste Management Acts 1996, as amended. All of the construction machinery operating near any watercourse will be systematically checked in order to avoid leaks of oils, hydraulic fluids and fuels; and

- Spill-kits and hydrocarbon absorbent packs will be stored in the cabin of each vehicle and operators will be fully trained in the use of this equipment.

Coastal processes

Relevant mitigation measures for coastal processes are described in **Section 15.5.1 of Chapter 15,** in **Appendix 15.5** and outlined in **Section 21.3.9**.

21.2.6 Archaeology, Architectural and Cultural Heritage

The following measures in relation to archaeology, architectural and cultural heritage will be implemented during construction:

- All ground excavations associated with the proposed development will be monitored by a suitably qualified archaeologist. This will enable the identification of any previously unrecorded features/ deposits of archaeological significance. Full provision will be made to ensure the preservation by record of any such features, should that be deemed the most appropriate manner in which to proceed, following consultation with the DCHG;
- All archaeological works will be carried out under the supervision of a project archaeologist, appointed on behalf of Irish Water, to ensure all mitigation measures are implemented;
- All excavations associated with the outfalls and revetment upgrade, will be monitored by a suitably qualified underwater archaeologist. Works will be carried out under licence to the DCHG and full provision will be made to ensure the preservation by record of any features that may be identified, should that be deemed the most appropriate manner in which to proceed, following consultation with the DCHG;
- All excavations associated with the interceptor sewer within the river channel (and any associated underpinning works) will be monitored by a suitably qualified underwater archaeologist. Works will be carried out under licence to the DCHG and full provision will be made available to ensure the preservation by record of any features that may be identified, should that be deemed the most appropriate manner in which to proceed, following consultation with the DCHG;
- All archaeological works will be carried out under the supervision of a project archaeologist, appointed on behalf of Irish Water, to ensure all mitigation measures are implemented; and
- All works to Arklow Bridge will be carried out under the supervision of a conservation engineer. A full assessment of potential effects will be undertaken once the preferred methodology has been selected for the underpinning works. This will lead to the production of a construction method statement that will ensure the historic fabric of Arklow Bridge is maintained throughout construction.

No likely significant effects to archaeology, architecture and cultural heritage during the operation of the proposed development have been identified. Therefore, no mitigation measures have been proposed with respect to effects from operation of the proposed development.

21.2.7 Landscape and Visual

The following measures in relation to landscape and visual will be implemented during construction:

- The nature of the construction activities in the townscape environment is such that there will always be disruption. Mitigation during construction relates to phasing of construction activity to different working areas sequentially to minimise the duration of significant effects arising from construction activities at any one location, and/or effective pedestrian and traffic management to minimise inconvenience and ensure access is maintained as appropriate;
- While the establishment of working areas, tunnelling shafts and traffic diversion will require felling of many existing quayside trees, the detailed design has identified opportunities to protect and retain most of the more valuable Willow trees along the riverside walkway upstream of Arklow Bridge that contribute to the setting of the Avoca River and provide a high degree of visual amenity in this locality;
- Where trees are required to be removed along South Quay and North Quay for construction, such trees are of lower value and will be re-planted post construction so as to reinstate the existing visual environment along the quayside;
- All tree protection works will be implemented strictly in accordance with BS5837:2012[6];
- Requirement for detailed construction management plans that set out robust tree protection methodologies in accordance with BS5837: 2012, where trees are to be retained, including in particular the Willow trees upstream of Arklow Bridge, and ensuring that tree protection is implemented and maintained throughout construction;
- Careful dismantling, storage and ultimate reinstatement of the Seafarers Memorial Garden has been identified as important to the locality and contemporary culture of the area, and a detailed method statement will be required from the appointed contractor to ensure the feature is satisfactorily reinstated following construction;
- For the most part, (excluding the land reclamation areas downstream of Arklow Bridge along South Quay), the existing finishes will be reinstated post construction. Where land is reclaimed downstream of Arklow Bridge, the widened quayside will incorporate a simple grass verge between the existing low wall concrete kerb upstand and the new quay wall.

[6] British Standards Institute (2012) BS 5837:2012 Trees in relation to design, demolition and construction. Recommendations.

This will provide a quayside finish that is consistent with the existing quayside, and will facilitate potential further public realm plans anticipated as part of the proposed Arklow Flood Relief Scheme); and

- Reinstated vegetation is undertaken by a suitably qualified landscape contractor, and their contract will include 2-year aftercare.

The following measures in relation to landscape and visual will be implemented during operation:

- The design of the proposed development has been coordinated with the separate design development of the planned Arklow Flood Relief Scheme (which is scheduled for submission at a later date), including coordination of the quay wall design at South Quay – Arklow Bridge and other structural components to avoid duplication and redundancy, and also in anticipation of quayside public realm upgrades on River Walk, South Quay and North Quay likely to occur as part of the planned Arklow Flood Relief Scheme;
- All tree protection works, planting and aftercare will be implemented strictly in accordance with BS5837:2012[6];
- As set out in **Chapters 3 and 4**, the architectural vision and design details anticipate the WwTP as a high quality architectural set-piece that will take the place of the Old Wallboard facility at Ferrybank. It is to contribute to the regeneration of the area and to catalyse future urban waterfront development as anticipated in the Arklow LAP;
- The specimen building design at the proposed WwTP will be further developed by the architect. The architect's services will be maintained, to ensure that all build ups and finishes are completed to the correct specification and standard of build quality;
- The detail and alignment of the interceptor sewer and the land reclamation proposals along South Quay have been developed to protect the setting and integrity of Arklow Bridge. The full extent of the nineteen arches will remain visible from both upstream and downstream, and the southern quay wall detail will be stepped locally to retain the integrity and visibility of the first (i.e. southernmost) arch; and
- The proposed structural interventions and reinforcement to the Arklow Bridge will have negligible visual effect above low water level. Nonetheless, the alignment of the interceptor sewer under the southernmost arch, and the riverbed in the adjoining two arches will be reduced. The trench for the sewer will be backfilled and covered to the level of the existing riverbed and finished using salvaged flag stones from the existing south quay wall further downstream. During operation, this will provide a riverbed finish through the southern arch that is consistent with other bridge arches, and will also purposefully reuse the salvaged fabric of the south quay.

21.2.8 Land and Soils

As outlined in **Section 5.8** of **Chapter 5** and in the Outline CEMP (Refer to **Appendix 5.1**), the adopted construction techniques will comply with the requirements of statutory bodies (Building Control Amendment Regulations, Health Service Executive inspections, Irish Water inspections and compliance with Employers Requirements). The following measures in relation to land and soils will be implemented during construction:

- Precautionary measures will be taken to contain any areas within the planning boundary at risk of contaminated run-off;
- Potential pollutants shall be adequately secured against vandalism and will be provided with proper containment according to the relevant codes of practice. Any spillages will be immediately contained and contaminated soil shall be removed from the proposed development and properly disposed of in an appropriately licensed facility;
- Dust generation shall be kept to a minimum through the wetting down of haul roads as required and other dust suppression measures;
- Any stockpiles of earthworks and site clearance material shall be stored on impermeable surfaces and covered with appropriate materials;
- Silt traps shall be placed in gullies to capture any excess silt in the run-off from working areas;
- Soil and water pollution will be minimised by the implementation of good housekeeping (daily site clean-ups, use of disposal bins, etc.) and the proper use, storage and disposal of these substances and their containers as well as good construction practices as described in Section 5.8 of chapter 5 Construction Strategy, the Outline CEMP as well as the CIRIA guidance[7];
- A contingency plan for pollution emergencies will also be developed by the contractor prior to the commencement of the works and regularly updated during construction. This contingency plan will identify the actions to be taken in the event of a pollution incident in accordance with the CIRIA guidance7 which requires the following to be addressed:
    - Containment measures;
    - Emergency discharge routes;
    - List of appropriate equipment and clean-up materials;
    - Maintenance schedule for equipment;
    - Details of trained staff, location and provision for 24-hour cover;
    - Details of staff responsibilities;
    - Notification procedures to inform the EPA or Environmental Department of the Wicklow County Council;

[7] Masters – Williams et al (2001) Control and management of water pollution from construction sites in their publication Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors

- Audit and review schedule;
- Telephone numbers of statutory water consultees; and
- List of specialist pollution clean-up companies and their telephone numbers.

Alps SWO and Stormwater Tank

- Excavations shall be kept to a minimum, using shoring or trench boxes where appropriate. For more extensive excavations, a temporary works designer shall be appointed to design excavation support measures in accordance with all relevant guidelines and standards;
- All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the proposed development with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the proposed development, shall be used for other projects where possible, subject to appropriate approvals/notifications;
- Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain in situ along the sites will be avoided;
- Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion;
- Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations;
- Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions; and
- To reduce the amount of dewatering required at any given time, it is likely that the contractor would construct the sewer in sections. Discharge from the dewatering process would be passed to a suitably sized settlement pond or a proprietary silt removal system located within the working area where possible, before discharge to the Avoca River or the local sewer network. Any discharge to either sewer or watercourse would be subject to a WWDA.

South Interceptor Sewer, North Interceptor Sewer and Central Interceptor sewer including river crossing

- All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the proposed development with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing. These excavated soil materials will be stockpiled located within the working area where possible, using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the proposed development shall be used for other projects where possible, subject to appropriate approvals/notifications;
- Earthworks haulage will be along agreed predetermined routes along existing national, regional and local routes. Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain in situ along the sites will be avoided;
- Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion;
- Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations. Monitoring will be more rigorous at Arklow bridge as it is a protected structure. This will include more frequent monitoring and more monitoring points. Monitoring points will be located on the face of the bridge piers and centred every 1m or at least one monitoring point for each phase in the underpinning procedure. Horizontal, vertical and rotational displacement in all directions will be monitored;
- Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions;
- To reduce the amount of dewatering required at any given time, it is likely that the contractor would construct the sewer in sections. Discharge from the dewatering process would be passed to a suitably sized settlement pond or a proprietary silt removal system located within the working area, before discharge to the Avoca River or the local sewer network. Any discharge to either sewer or watercourse would be subject to a WWDA Infilling of river channel and installing sheet piles; and
- The temporary causeway will be contained on the river side to mitigate against siltation migration into the Avoca River.

The two most likely methods to achieve this containment would either be an additional row of sheet piles on the river side of the causeway or alternatively a row of stone gabions wrapped in a geotextile membrane. Either method would require that the containing material (i.e. the sheet piles or the gabion walls) are extended (i.e. to a height above the surface of the causeway) to be effective. The infilling will produce a favourable lateral force on the existing quay wall but an unfavourable lateral force on the sheet piles. Horizontal movement monitoring of the sheet piles will be implemented during construction activities to ensure that the movement does not exceed the design limitations.

WwTP and Revetment

- Excavations and therefore the transport of soils across the site shall be kept to a minimum, using shoring or trench boxes where appropriate. For more extensive excavations, a temporary works designer shall be appointed to design excavation support measures in accordance with all relevant guidelines and standards;
- It should be noted that both the excavation and import of materials will be required for construction of the revetment;
- Excavations in made ground for the WwTP and the revetment will be monitored by an appropriately qualified person to ensure that any spots of contamination (such as nitrocellulose or asbestos) encountered are identified, segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure no cross-contamination with clean soils elsewhere throughout the site;
- Excavated contaminated soils will be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure no cross-contamination with clean soils elsewhere throughout the site;
- Dewatering will be required for the construction of the WwTP. Discharge volumes could be up to 250m^3/day and would be passed to a suitably sized settlement pond or a propriety silt removal system, along with any other treatment as required by WCC before discharge to the Avoca River or the local sewer network. This will most likely include treatment to remove elevated heavy metals which were noted during the ground investigation. Any discharge to either sewer or watercourse would be subject to a WWDA;
- Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations;
- Ground settlements will be controlled through the selection of a foundation type and construction methods which are suitable for the particular ground conditions. See **Chapter 5** for further details;

- All excavated material will, where possible, be reused as construction fill. The appointed contractor will ensure acceptability of the material for reuse for the proposed development with appropriate handling, processing and segregation of the material. This material would have to be shown to be suitable for such use and subject to appropriate control and testing according to the Earthworks Specification(s). These excavated soil materials will be stockpiled using an appropriate method to minimise the impacts of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff. Any surplus suitable material excavated that is not required elsewhere for the proposed development shall be used for other projects where possible, subject to appropriate approvals/notifications;
- Where compaction occurs due to truck movements and other construction activities on unfinished surfaces, remediation works will be undertaken to reinstate the ground to its original condition. Where practicable, compaction of any soil or subsoil which is to remain in situ along the sites will be avoided; and
- Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding. Runoff will be controlled through erosion and sediment control structures appropriate to minimise the water impacts in outfall areas. Care will be taken to ensure that the bank surfaces are stable to minimise erosion.

Outfalls (Long Sea Outfall and SWO)

- Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations;
- Ground settlements will be controlled through the selection of methods of construction as outlined in **Chapter 5** which are suitable for the particular ground conditions;
- Based on ground conditions and construction methods, there should be limited mobilisation of those sediments; and
- Best practice guidelines[8] will be adhered to as a minimum for any dredging exercises to be carried out. Measures to minimise disruption to the seabed and mobilisation of sediments will be applied and seabed conditions will be taken into account when selecting construction methods.

No mitigation has been proposed with respect to effects from operation of the proposed development in relation to land and soils.

21.2.9 Water

The following measures in relation to water will be implemented during construction:

[8] British Standards (2016) BS6349-5 - Maritime works – Part 5: Code of practice for dredging and land reclamation

Hydrology and Water Quality

The standard best practice measures in the Outline CEMP (Refer to **Appendix 5.1**) for the proposed development will mitigate significant negative effects on surface water quality during construction. The Outline CEMP has regard to the guidance contained in the handbook published by CIRIA[9].

Further, temporary works will be designed to minimise effects on the hydrology and flow regime in the study area during construction. The outline CEMP includes a range of site specific measures which will include the following:

- During construction, surface water runoff would be collected by the temporary drainage system installed by the contractor and then treated or desilted on-site before discharge into the Avoca River;
- Earthworks operations shall be carried out such that the surfaces are designed with adequate slope to promote safe runoff and prevent flooding;
- Good housekeeping such as site clean ups, use of disposal bins, etc. will be adopted in construction areas;
- In order to prevent accidental release of hazardous materials such as fuels, cleaning agents etc. into surface water during construction, all hazardous materials will be stored within appropriately bunded containment areas designed to retain spillages;
- Temporary bunds will be used for storage of oil/diesel; and
- The temporary causeway and the surface water runoff from this area would be entirely contained to prevent any pollution entering the Avoca River. This would be contained through the implementation of best practice measures outlined in the Outline CEMP (Refer to **Appendix 5.1**).
- As outlined in **Chapter 5**, it is necessary to construct launch and reception chambers to facilitate tunnelling works. As these shafts will extend beneath the ground water level, it will be necessary to "plug" these shafts to prevent water ingress.

Mitigation during construction will include implementing best practice during excavation and tunnelling works to avoid the release of bentonite and prevent sediment running into the drainage network and/or hydrological environment during construction of the proposed development.

Coastal processes

The following mitigation measure has been proposed with respect to effects on coastal processes from construction of the proposed development:

- Construction of the long sea outfall will generally be restricted to the period May – September, with the period between November-February generally avoided. In this manner, the months with likely worst wave and wind conditions, which lead to higher levels of sediment suspension and transport, are avoided.

[9] CIRIA(2015) Environmental Good Practice on Site Guide, 4th Edition.

Flood risk

WwTP site

During construction, there is a risk of coastal erosion and a risk of wave overtopping. Similarly to the construction of the long sea outfall, works between November and February should be avoided. It is also recommended that the contractor considers tidal and wind forecasts and monitors these closely to minimise the risk of coastal erosion and wave overtopping.

Given the absence of a significant risk of flooding at the site of the proposed WwTP, no further mitigation measures to address flood risk during construction are required.

Interceptor sewers

In order to mitigate and minimise the potential flood risk caused by the construction of the temporary causeway and the interceptor sewers in the Avoca river channel, the following sequence of works is proposed prior to construction of the temporary causeway:

- Proposed underpinning of the 2 southernmost arches and lowering of the second Arch by c. 1m at the bridge is completed.
- Proposed in-stream works at and upstream of the bridge is fully completed (i.e. the upstream interceptor sewer manhole and the laying of the interceptor sewer beneath the bed of Bridge Arch 1).
- The temporary works should proceed from downstream to upstream (i.e. from east to west direction).
- Following completion of construction of the interceptor sewer in the Avoca River (i.e. when the causeway is no longer required), the causeway would be removed in a similar sequential manner.
- Timely removal of sections of the causeway should be a priority once works have been completed.

The following measures in relation to water will be implemented during operation of the proposed development:

Hydrology and Water Quality

The proposed development will improve water quality in the Avoca River by eliminating, for the most part, the discharge of untreated wastewater into the river channel. Excess storm flows will continue to be discharged as emergency overflows in the event of WwTP pumping station failure, however this is likely to occur significantly less than the permitted 7 spills per bathing season.

All storm flows to the Avoca River (discharged as emergency overflows) would be screened via static screens in the CSOs to ensure the maximum particle size in the water column does not exceed 6mm in diameter to ensure compliance with Irish Water standards.

Coastal processes

No mitigation measures have been proposed with respect to effects on coastal processes from operation of the proposed development.

Flood risk

Given the absence of a significant risk of flooding of the site of the proposed WwTP, no mitigation measures to address flood risk during operation are required.

As the proposed development directs almost all wastewater flows to the WwTP shows that the proposed development will result in an overall slight beneficial impact upstream of the bridge in terms of flooding, no mitigation measures are required to address flood risk during operation.

21.2.10 Resource and Waste Management

The following measures in relation to resource and waste management will be implemented during construction:

- The contractor is required to prepare, implement and maintain a Construction and Demolition Waste Management Plan throughout construction that addresses the following as a minimum:
  - Description of the proposed development;
  - Wastes arising including procedures for minimisation/reuse/recycling;
  - Estimated cost of waste management;
  - Roles including training and responsibilities for construction and demolition waste;
  - Procedures for education of workforce and plan dissemination programme;
  - Record keeping procedures;
  - Waste collectors, recycling and disposal sites including copies of relevant permits or licences; and
  - Waste auditing protocols.
- The Contractor will minimise waste disposal so far as is reasonably practicable;
- Waste from the proposed development will be transported by authorised waste collectors in accordance with the Waste Management (Collection Permit) Regulations 2007 to 2016 to take into account the Waste Management (Collection Permit) (Amendment) Regulations 2016;
- Waste from the proposed development will be delivered to authorised waste facilities in accordance with the Waste Management Acts 1996-2011 and the Waste Management (Collection Permit) (Amendment) Regulations 2016;

- Source segregation: Where possible metal, timber, glass and other recyclable material will be segregated during construction works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding, and photographs of wastes to be placed in each container as required, will be used to facilitate segregation. Where waste generation cannot be avoided this will maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental impact;
- Material management: 'Just-in-time' delivery will be used so far as is reasonably practicable to minimise material wastage;
- Supply chain partners: The contractor will engage with the supply chain to supply products and materials that use minimal packaging, and segregate packaging for reuse;
- Waste Auditing: The contractor will record the quantity in tonnes and types of waste and materials leaving site during the construction phase;
- Waste fuels/oils may be generated from equipment used on-site during construction and may be classified as hazardous waste. Such wastes will be stored in a secure, bunded area on-site prior to collection by a contractor who holds the appropriate waste collection permit;
- Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material may not be re-used within the proposed works the contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable;
- The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and which is disposed of; and
- The contractor(s) will ensure that any off site interim storage or waste management facilities for excavated material have the appropriate waste licences or waste facility permits in place.

No mitigation measures have been proposed with respect to effects on resource and waste management from operation of the proposed development.

21.2.11 Population and Human Health

The following measures in relation to population and human health will be implemented during construction:

- Provide for safe pedestrian access at points of entry and exit of construction vehicles accessing River Walk and Châteaudune Promenade from Main Street;

- Ensure provision of a safe surface for the existing eastern footpath (currently gravel) from Vale Road for use of the walk by more vulnerable older age groups as an alternative to the temporary closure of surfaced section from River Walk;
- Provide continued access to boat moorings on North Quay during open cut works;
- Where practicable, use short sections of transparent hoarding or include viewing windows in the hoarding at locations popular for amenity such as in front of the cafes on River Walk and at the Bridgewater Shopping Centre;
- Stagger works wherever possible and remove hoarding as soon as it is no longer needed to mitigate against severance;
- Avoid works that could involve high noise or visual intrusion during major social events around the Avoca River, notably any sites used by the annual Arklow Maritime Festival or other public events.
- Provide temporary signalling or manning of junction between Ferrybank and Seaview Avenue while diversion to Bridgewater Shopping Centre is in effect;
- Maintain regular proactive consultation with local residents and businesses, particularly along River Walk, South Green, Harbour Road, Bridgewater Shopping Centre, Aldi and Marine Village, but also with all living or working along South Quay, North Quay and Ferrybank.
- Other than the mitigation outlined in the respective **Chapters 7 - 10**, no further mitigation has been proposed with respect to human health effects during construction of the proposed development. This is because, in accordance with the best scientific evidence no significant health effects are predicted with the mitigation already proposed.

Other than the mitigation outlined in the respective **Chapters 7 - 10**, no further mitigation measures have been proposed with respect to population and human health effects from operation of the proposed development.

21.2.12 Material Assets

The following measures in relation to material assets will be implemented during construction:

- Wherever possible, mitigation by avoidance of negative effects on property was a priority during the design development of the proposed development. Landowners will be compensated as appropriate for permanent and temporary land acquisition, in accordance with the relevant legislation. The details of any individual agreements will be private and confidential and therefore mitigation measures in the form of compensation are not specific or detailed herein;
- A Property Protection Scheme will be put in place by Irish Water prior to works commencing on site. This will involve advance condition surveys prior to construction for all properties within the zone of influence of the proposed development.

If it is determined that any reported minor cosmetic damage has been caused by construction of the proposed development, suitable remedial works will be undertaken to repair the damage to the properties with the use of the appropriate conservation technique;

- Mitigation measures for all areas of temporary land acquisition will involve reinstatement to their original condition so far as is reasonably practicable;

  Access to all existing properties will be maintained at all times during the construction of the proposed development. This may require temporary alternate access arrangements at some locations. All access will be reinstated upon completion of construction;

- The contractor will be obliged to put measures in place to ensure that there are no interruptions to existing utilities and services unless this has been agreed in advance with the relevant service provider. As outlined in **Chapter 5**, all utilities and services diversions will be agreed and undertaken as part of the enabling works and in advance of the commencement of construction activities. All construction activities in the vicinity of existing services and utilities will be carried out in ongoing consultation with the relevant service provide and undertaken in compliance with any requirements or guidelines they may have;

- Sewer diversions will be undertaken as part of the enabling works prior to the commencement of construction activities. Upon commissioning, the older pipelines being abandoned will be sealed off and/or removed as described in **Chapter 5;**

- Surface water management measures will be adopted along the entire site, as outlined in **Chapter 15** and **Section 21.2.9**;

- As described in **Chapter 5** and outlined in **Appendix 5.1**, the contractor will be required to prepare and maintain a detailed CEMP during the construction phase of the proposed development. The appointed contractor will be required to comply with the Outline CEMP. Effective implementation of the CEMP would ensure that disruption and nuisance are kept to a minimum throughout the construction of the proposed development. The detailed CEMP will be required to have regard to the guidance[9] and industry best practice. The CEMPs will be effective throughout construction and the contractor will be required to review and update the CEMP as construction progresses.

- In addition to the CEMP, it is anticipated that the contractor will prepare relevant management plans and Works Method Statements in advance of any works commencing on site. Every effort will be made to ensure that any significant effects on material assets will be avoided, prevented or reduced during the construction of the proposed development.

The following measures in relation to material assets will be implemented during operation:

- Landowners will be compensated as appropriate for permanent land acquisition, in accordance with legislation. The details of any individual agreements will be private and confidential and herein.

21.2.13 Major Accidents and Natural Disasters

The following measures in relation to major accidents and natural disasters will be implemented during construction:

- The construction methodology for the revetment employed by the contractor, that would involve replacement of the revetment in sections, will work to mitigate the risk of flooding in that it would enable the section under construction to be quickly protected during storm events; and
- A detailed CEMP would be prepared prior to the commencement of any works and implemented during the works. The CEMP will be a live document maintained by the contractor that would work to ensure that potential risks of major accident and/or disaster are identified, avoided and mitigated, as necessary.

The following measures in relation to major accidents and disasters will be implemented during operation:

- As outlined in **Chapter 4 and Section 19.2.1**, the proposed development will be designed and built in line with best international current practice and, as such, mitigation against the risk of major accidents and/or disasters would be embedded through the design.
- In accordance with the provision of the European Commission Guidance a Risk Management Plan will be prepared and implemented on site to ensure an effective response to disasters or the risk of accidents. The plan should include sufficient preparedness and emergency planning measures.
- Further, a maintenance programme would be implemented at the site, in compliance with the conditions of the Waste Water Discharge Authorisation required under the Waste Water Discharge (Authorisation) Regulations 2007 - 2016. The purpose of the maintenance programme is to ensure that all critical equipment at the WwTP and elsewhere throughout the proposed development is operating correctly, therefore reducing the risk of major accidents and/or disasters on site.

  As outlined in Section 19.4, the scenarios with the highest risk score in terms of a major accident and/or disaster during operation were identified as ‘discharge, spillage or longer-term seepage of untreated wastewater, fuel, chemicals solvents etc. into the watercourse or groundwater table,’ and ‘fire/explosion.’

The storage of diesel in a contained and bunded area on-site would mitigate '*by prevention'* the risk of surface and/or ground pollution, as well as the risk of fire/explosion resulting from the potential spillage of fuel.As a further means of mitigation '*by remedy,*' fire extinguishers would be provided in the Administration building, and an industrial purpose fire hose reel would be installed to service both the Inlet Works Building and the Process Building, in accordance with the relevant NSAI Standards[10]; and

- The proposed development would also be subject to a fire safety risk assessment in accordance with Chapter 19 of the Safety, Health and Welfare at Work Acts 2005 to 2014, which would assist in the identification of any major risks of fire on site, and mitigation of the same during operation.

21.3 Summary of Monitoring Measures

A range of monitoring measures has been identified to demonstrate that the proposed development conforms to the predictions made as part of this EIAR. This monitoring will take place after consent is granted and provide assurance that aspects of the proposed development are functioning as intended and thus not generating significant effects.

Monitoring has been identified to occur after consent is granted in order to provide assurance that aspects of the proposed development are functioning as intended (and thus not generating significant effects) as described in detail in **Chapters 7 – 19**. Where appropriate, remedial actions have also been identified.

The monitoring measures outlined for the proposed development are summarised in **Sections 21.3.1 - 21.3.13**.

21.3.1 Traffic and Transportation

For each construction stage, the individual traffic management plans will need to be continually monitored to ensure the impact on traffic flows on the surrounding street network are minimised and additional mitigation measures are introduced as required to assist the flow of traffic. The monitoring regime needs to consider all modes of traffic including pedestrians, cyclists and car parking provision.

No monitoring has been proposed with respect to traffic and transportation effects from the operation of the proposed development as the projected increase in traffic will have no impact on prevailing traffic conditions.

21.3.2 Air Quality and Climate

Dust monitoring will be undertaken at a range of nearest sensitive receptors during the construction phase. The TA Luft dust deposition limit values of 350 mg/m^2/day (averaged over one year) will be applied as a 30-day average.

[10] NSAI (2015) *IS291:2015 Selection, commissioning, installation, inspection and maintenance of portable fire extinguishers. NSAI (2012) IS EN 671-1:2012: Fixed firefighting systems. Hose systems. Hose reels with semi-rigid hose.*

As no likely significant effects are predicted to occur during the operation of the proposed development, no monitoring measures are required.

21.3.3 Odour

No monitoring measures are required during the construction of the proposed development with regard to odour.

The following measures in relation to odour will be implemented during operation:

- Environmental emissions, including odour, will be regulated by Wicklow County Council. Although the WwTP will not be formally regulated by the EPA, Irish Water will be operating the plant in accordance with EPA licensing standards. Monitoring of the odour units will be undertaken during commissioning and at predetermined frequencies over the life time of the proposed development.
- Emissions from the WwTP and interceptor sewer vent stacks will be measured with continuous monitors to indicate the performance levels of the abatement measures. Furthermore, independent performance checks will be carried out by an ISO17025 accredited testing laboratory at quarterly intervals during the first two years of operation to verify the effectiveness of control measures and ongoing compliance with the odour limits.

21.3.4 Noise and Vibration

The following measures in relation to noise and vibration will be implemented during construction:

- The contractor(s) shall be required to carry out continuous noise and vibration monitoring at the three closest sensitive receptors to the proposed WwTP and interceptor sewer works during the construction phase.
- Vibration monitoring will be undertaken on the piers of the bridge and measured against the limits in **Table 10.11 in Chapter 10**. In the event of vibration limits being exceeded, works will cease and alternative construction methods will be used.
- Noise and vibration levels will be compared to the limit values outlined in **Table 10.6 and Table 10.11 in Chapter 10**, respectively. If exceedances are recorded, the possibility of alternative construction methodologies will be examined to reduce impact at sensitive receptors.

During operation, environmental emissions, including noise, will be regulated by Wicklow County Council. Although the WwTP will not be formally regulated by the EPA, Irish Water will be operating the plant in accordance with EPA licensing standards. Monitoring at the site boundary will be undertaken during commissioning and at predetermined frequencies over the life time of the proposed development.

21.3.5 Biodiversity

The following measures in relation to biodiversity will be implemented during construction:

- Monitoring of new seeding and planting provided as habitat and flora mitigation will be carried out during implementation of these measures;
- Monitoring of the effectiveness of implementation of bat mitigation measures, including occupancy of bat roost boxes and bat responses to WwTP site lighting, will be carried out during the construction phase; and
- Monitoring and reporting of marine mammals will be provided by Marine Mammal Observers referred to in **Section 11.5.1.1**.

The following measures in relation to biodiversity will be implemented during operation:

- Monitoring of new seeding and planting provided as habitat and flora mitigation will be carried out during the first two years of operation; and
- Monitoring of the effectiveness of implementation of bat mitigation measures, including occupancy of bat roost boxes, and bat responses to WwTP site lighting, will be carried out during the first two years of operation.

21.3.6 Archaeology, Architectural and Cultural Heritage

The mitigation measures recommended in **Chapter 12** and **Section 21.2.6**, including the monitoring of works by qualified archaeologists and a conservation engineer, would support effective monitoring during construction to allow the further assessment of the scale of the predicted impacts and the effectiveness of the recommended mitigation measures.

No monitoring has been proposed with respect to archaeology, architectural and cultural heritage effects from operation of the proposed development.

21.3.7 Landscape and Visual

It is likely that the appointed contractor will need to have an individual appointed to liaise with residents and other stakeholders in advance of establishing working areas so as to ensure such working areas have the minim potential impact of residents and their properties. Additionally, reinstatement of the Seafarers Memorial Gardens will require the provision of a proposed reinstatement layout for agreement with the local community and Wicklow County Council prior to carrying out the works.

Monitoring during operation relates principally to the aftercare of reinstated landscape areas to ensure the proper establishment of soft landscape as proposed. Any plants or trees that fail will be required to be replaced in the next available planting season.

21.3.8 Land and Soils

The following measures in relation to land and soils will be implemented during construction:

- Excavations in made ground will be monitored by an appropriately qualified person to ensure that any contaminated material is identified, segregated and disposed of appropriately. Any identified hotspots shall be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross-contaminate clean soils elsewhere;
- Any excavation shall be monitored during earthworks to ensure the stability of side slopes and to ensure that the soils excavated for disposal are consistent with the descriptions and classifications according to the waste acceptance criteria testing carried out as part of the site investigations;
- Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations. Monitoring will be more rigorous at Arklow bridge as it is a protected structure. This will include more frequent monitoring and more monitoring points. Monitoring points will be located on the face of the bridge piers and centred every 1m or at least one monitoring point for each phase in the underpinning procedure. Horizontal, vertical and rotational displacement in all directions will be monitored;
- The construction of the offshore elements shall follow international best practice in regard to the management of the trenching / excavations, the stability of the excavation/trenched area and the disposal of any spoil generated from either the excavation or the tunnelling / horizontal directional drilling works;
- Movement monitoring shall be carried out during any activities which may result in ground movements or movements of any nearby structures; and
- Water quality monitoring will be carried out at all discharge points as per the requirements of the issued WWDA.

Ongoing monitoring of the infrastructure for leaks shall be carried out during operation. If leaks are detected, the system should include measures for the management of any resulting contamination of the surrounding soils.

21.3.9 Water

The following measures in relation to water will be implemented during construction:

Hydrology and water quality

- Visual monitoring would be undertaken as part of the regular site audits during the construction of the proposed development to ensure existing surface water drainage discharge into the Avoca River/coastal waters is not impacted by the proposed development; and

- This is necessary to ensure that surface water flooding is not caused by any damages to existing surface water sewers/outfalls discharging into the Avoca River during construction of the interceptor sewers.

Flood risk

- The contractor is required to monitor tide and wind forecasts to minimise the risk of coastal erosion and wave overtopping; and
- The contractor is required to monitor weather forecasts to inform operation of the temporary causeway.

The following measures in relation to water will be implemented during operation of the proposed development:

Hydrology and water quality

- Monitoring of all SWOs by storm water level indicator instruments will be undertaken by the operator to provide records of any overflows, ensuring that bathing season spill events are recorded.

Coastal processes

- The scour protection at the outfall shall be monitored to ensure its performance and avoid any potential risk derived from the potential future exposure of the pipeline and/or diffuser. Scour protection will be monitored by Irish Water as part of the overall long outfall maintenance. Outfall monitoring would include visual inspection either by divers or robotics and would be performed every 5 years and after significant storm events as part of the overall operational management regime. The inspection crew would check the pipeline for scour protection damage, slide, anchor, or other damage. Scour protection shall be reinstated and/ or repaired if any damage is observed.

Flood risk

No monitoring during operation is required for flood risk during the operation of the proposed development.

21.3.10 Resource and Waste Management

Monitoring required as part of the CDWMP and the Outline CEMP, as set out in **Sections 16.5.2.1 and 21.2.10** and **Appendix 5.1**, in relation to waste will be undertaken and recorded by the contractor(s).

Monitoring of sludge generation and management will be undertaken in accordance with the provisions of operational procedures for the WwTP and the NWSMP. No monitoring has been proposed with respect to effects from other operational wastes from the proposed development.

21.3.11 Population and Human Health

The following measures in relation to population and human health will be implemented during construction:

- Traffic flows should be monitored to ensure that significant delays or congestion are not occurring in Arklow town due to diversions or construction traffic; and
- Regular proactive consultation should be undertaken with local businesses and a log of complaints/issues raised by stakeholders should be maintained and monitored throughout construction. Where practicable, residents and local businesses should be advised in advance on the timing of works to understand the effect on business turnover or population amenity.

The following measures in relation to population and human health will be implemented during operation:

- Monitoring of the volume of HGV movements to and from the WwTP are proposed. In other respects, the positive effect of the proposed development mitigates the need for further monitoring with regard to population and human health effects during operation of the proposed development.

21.3.12 Material Assets

No monitoring measures have been proposed with respect to effects on material assets during construction and operation of the proposed development.

21.3.13 Major Accidents and Natural Disasters

As outlined in **Chapter 5**, a detailed CEMP would be prepared prior to the commencement of any works and implemented and monitored during the works. The CEMP will be a live document maintained by the Contractor, and will work to ensure that potential risks of major accident and/or disaster are monitored, as necessary. Refer to Appendix 5.1 for an outline CEMP that sets out the minimum standards to be employed by the contractor.

The following measures in relation to major accidents and natural disasters will be implemented during operation:

- Irish Water and the operator of the proposed development would continue to assess the risk of major accidents and/or disasters on site on an on-going basis during operation; and
- The maintenance programme, record of reported incidents, as well as general site activities will be monitored on an on-going basis to ensure risk of major accidents does not increase over time.

21.4 Residual Significant Effects

This EIAR has been prepared by competent experts in accordance with Article 1(2)(g) of the EIA Directive to identify the likely significant effects associated with the proposed development in accordance with the relevant legislation and guidance.

A range of likely significant effects have been avoided or reduced through the implementation of mitigation measures and monitoring, therefore leading to the residual effects as outlined in **Sections 21.4.1 - 21.4.13**.

21.4.1 Traffic and Transportation

21.4.1.1 Construction

The construction of the proposed development will result in additional traffic congestion particularly where construction works are taking place on Arklow Bridge and the section of North Quay between the Ferrybank Road and the Bridgewater Shopping Centre. These effects will be temporary in nature and following the completion of the construction works will have no residual, long term effects.

During all construction stages the individual working areas will result in some restrictions and inconvenience to the movement of people and traffic. These restrictions will be temporary in nature and particularly localised to the working areas.

21.4.1.2 Operation

No residual effects on traffic and transportation are anticipated during the operation of the proposed development.

21.4.2 Air Quality and Climate

No residual effects are predicted on air quality and climate during the construction and operation of the proposed development.

21.4.3 Odour

21.4.3.1 Construction

No residual effects on odour are anticipated during the construction of the proposed development.

21.4.3.2 Operation

As outlined in **Section 9.5.2 of Chapter 9**, the odour levels are predicted to be in compliance with the limits presented in **Section 9.2.2 of Chapter 9**, therefore no significant residual effects are expected to occur at any of the receptor locations during the operation of the proposed development.

21.4.4 Noise and Vibration

21.4.4.1 Construction

Compliance with noise limit values in can be achieved at the nearest sensitive receptors to the proposed WwTP site. However, noise limit values will be exceeded at the nearest sensitive receptor to the proposed interceptor sewer for some types of works. The implementation of the mitigation measures outlined in **Section 10.6 of Chapter 10** will assist in reducing the impact on nearby sensitive receptors.

Residual short-term, slight to significant negative effects are predicted during the construction of the proposed development as outlined in Table 21.1

Table 21.1: Summary of residual noise and vibration effects during construction

Construction Phase	Summary of Residual Effect
WwTP construction.	Range from short term imperceptible negative impact to short term moderate negative impact
Revetment construction.	Range from short term slight negative impact to short term significant negative impacts
Sea Outfall construction. Impact of WwTP, Sea Outfall and Revetment construction.	Range from short term moderate negative impact to short term significant negative impacts
Impact assessment for residential receptors – trench works, shaft construction, tunnelling, ground borne noise and airborne noise	Short term significant negative impacts
Interceptor Sewer (Vibration) and Construction Traffic	Short term slight negative impacts
Sheet Piling (Vibration)	Short term moderate negative impacts
Arklow Bridge Works	Potential for short term significant effects

21.4.4.2 Operation

It is predicted that the EPA limits will be complied with during the operation of the proposed development and that there will be no significant residual effects during operation of the proposed development.

21.4.5 Biodiversity

21.4.5.1 Construction

The residual indirect effects on the European site Buckroney – Brittas Dunes and Fen SAC (site code: 000729), in respect of the Qualifying Interests are assessed as neutral. No residual direct or indirect effects arise on European sites.

The residual effects on the listed fish species listed in Annex II of the Habitats Directive (Atlantic Salmon, River Lamprey and Sea Lamprey) during construction are assessed as neutral.

The residual effects on bat species listed on Annex IV of the Habitats Directive (Common pipistrelle, Soprano pipistrelle, Leisler's bat and Daubenton's bat) are assessed as neutral.

The residual effects on cetacean species listed on Annex IV of the Habitats Directive, and on Harbour Seal and Grey Seal listed on Annex II of the Habitats Directive, are assessed as neutral.

The residual effects on breeding birds and their nests, eggs and nestlings, are assessed as neutral.

Residual local effects on terrestrial flora and habitats within the planning boundary, providing locally important biodiversity and ecological connectivity through the urban environment of Arklow, are assessed as short term, slight, and reversible, in the context of the urban area of Arklow.

21.4.5.2 Operation

The residual indirect effects on the European site Buckroney – Brittas Dunes and Fen SAC (site code: 000729), in respect of the Qualifying Interests are assessed as neutral. No residual direct or indirect effects arise on European sites.

The residual effects on fish species listed on Annex II of the Habitats Directive (Atlantic Salmon, River Lamprey and Sea Lamprey) are positive during operation.

The residual effects on cetacean species listed on Annex IV of the Habitats Directive, and on Harbour Seal and Grey Seal listed on Annex II of the Habitats Directive, are assessed as neutral.

The residual effects on breeding birds and their nests, eggs and nestlings, are assessed as neutral. The provision of nesting boxes for Grey Wagtail and Pied Wagtail at Arklow Bridge is assessed as slight positive during operation.

Residual local effects on terrestrial flora and habitats within the planning boundary, providing locally important biodiversity and ecological connectivity through the urban environment of Arklow are assessed as not significant.

The residual effects on bat species listed on Annex IV of the Habitats Directive (Common pipistrelle, Soprano pipistrelle, Leisler's bat and Daubenton's bat) are assessed as neutral.

21.4.6 Archaeology, Architectural and Cultural Heritage

No residual effects are predicted upon archaeological, architectural and cultural heritage resources during construction and operation of the proposed development.

21.4.7 Landscape and Visual

Residual landscape/townscape effects will generally relate to the new WwTP element and revetment, the widened South Quay area immediately south of Arklow Bridge, and the Alps SWO and stormwater storage compound as it interfaces with the riverside walkway.

Residual landscape/townscape effects within the townscape of Arklow and its wider environs will vary considerably throughout the townscape of Arklow town and its wider environs, and these are described with reference to the series of photomontages (Refer to **Appendix 13.1** and **Volume 3**) for a range representative locations throughout the project development area and it context.

The overall residual landscape/townscape and visual effect is considered to be moderate and neutral, or less.

21.4.8 Land and Soils

No residual effects are predicted in relation to land and soils during construction and operation of the proposed development.

21.4.9 Water

21.4.9.1 Construction

Hydrology and Water Quality

Hydrology and Drainage

No residual effects on hydrology and drainage are anticipated during the construction of the proposed development.

Water Quality

The residual effect on water quality will be short term, slight negative effects during construction of the proposed development.

Coastal Processes

The residual effects on coastal processes are assessed as neutral during construction.

Flood Risk

No residual effects on flood risk are anticipated during the construction of the proposed development.

21.4.9.2 Operation

Hydrology and Water Quality

Hydrology and Drainage

During operation, all flows from the Arklow catchment will be conveyed to the proposed WwTP at Ferrybank, save during extreme rainfall events where overflows through the SWO's may occur (albeit modelling has confirmed that these spills will be very limited). There will therefore be no residual effect on drainage during operation of the proposed development.

There will be an overall reduction in the frequency of sewer surcharge associated with the proposed development which is considered a significant positive residual effect on hydrology during operation of the proposed development.

Water Quality

During operation as the majority of the storm flows will be conveyed to the WwTP, the spills via the SWO's will be on average less than 1 spill/bathing season which is well below the permitted 7 spills/bathing season. There will be a significant positive residual effect in relation to surface water quality, due to the removal of existing outfalls discharging untreated wastewater into the Avoca River and appropriate treatment of all wastewater.

The proposed 900m outfall and SWOs will replace the 19 existing outfalls and overflows. All treated effluent will discharge into the harbour, therefore there will thus be a significant positive effect on water quality both in the harbour and on the bathing areas, as a result of the proposed development.

Coastal Processes

No significant residual effect is expected on coastal processes during operation of the proposed development.

Flood Risk

There will be an overall reduction in the existing flood extent following construction of the proposed development (associated with the bridge underpinning works) which will be a slight positive effect during operation of the proposed development.

It should be noted that the sheet pile wall constructed as part of the proposed development would also serve as advance works for the flood walls to be built as part of the proposed Arklow Flood Relief Scheme. It is recognised that once constructed, the proposed Arklow Flood Relief Scheme would further reduce any residual flood risk during the operation of the proposed development and thus bring about further positive, cumulative effects on flood risk.

21.4.10 Resource and Waste Management

The following residual effects in respect to resource and waste management are as follows:

- The residual effect of excavation waste is expected to be slight, negative and short-term.
- The residual effect of demolition waste is expected to be slight, negative and short-term.
- The residual effect of general construction waste is expected to be imperceptible and short term.
- The residual effect of operational waste is expected to be imperceptible and long term.
- The residual effect of decommissioning waste is expected to be slight negative and short term.

21.4.11 Population and Human Health

21.4.11.1 Construction

There will be a significant residual effect on local businesses such as cafes and restaurants that have a partial dependence on views of the river and amenity use. In addition, residual effects on the amenity of people living beside the river and the proposed interceptor sewer is inevitable. These effects will be temporary in nature and will have been moderated by the proposed mitigation.

No residual effects on human health have been identified during construction of the proposed development.

21.4.11.2 Operation

The provision of wastewater treatment in Arklow town will reactivate the potential for the economic and residential development providing a significant positive residual effect for the community and local economy during operation of the proposed development.

The elimination, in so far as possible, of the discharge of untreated wastewater into the Avoca River will have a significant positive residual effect on water quality and recreational activities associated with the Avoca River, including general tourism and water sports. However, use of the Avoca River for direct contact recreation such as swimming may still be compromised by legacy contamination from historical mining that was undertaken in the upper catchment.

Significant positive effects in terms of public health and socio-economic benefits with resultant benefits for human health are predicted on the basis of having an efficient and adequate wastewater treatment facility operating that is capable of accommodating population growth.

21.4.12 Material Assets

21.4.12.1 Construction

A slight negative long-term effect on existing land-owner's is predicted where land will be permanently acquired to facilitate the proposed development. For areas of temporary land acquisition where compensation will be agreed and which will be reinstated to their original condition as a minimum, it is concluded that there will be no residual significant effects. A slight negative long-term effect on land-use is predicted where land will subject to permanent wayleaves and permanent rights of way in order to facilitate the proposed development.

The residual effects of the proposed development on electricity, telecommunications, gas, water supply, sewer network and drainage infrastructure during construction is not significant.

21.4.12.2 Operation

A slight negative long-term effect on existing land-owner's is predicted where land will be permanently acquired to facilitate the proposed development.

The proposed development is considered to be an improvement over the 'do-nothing' scenario as the redevelopment of a brownfield site at Ferrybank and the removal of dilapidated buildings by the provision of vital infrastructure for Arklow town is considered to be a significant positive long-term residual effect.

A slight negative long-term effect on land-use is predicted where land will be subject to permanent wayleaves and permanent rights of way in order to facilitate the proposed development.

It is anticipated that the residual effects of the proposed development on electricity, telecommunications, gas, water supply, sewer network and drainage infrastructure during operation are not considered to be significant. The proposed development will result in a permanent, positive residual effect on the wastewater network by providing a robust, reliable collection network and treatment capacity that is capable of accommodating anticipated population growth in Arklow town.

21.4.13 Major Accidents and Natural Disasters

The risk of a major accident and/or disaster during the construction and operation of the proposed development is considered 'low' in accordance with the risk evaluation methodology. It is considered that there would no significant residual effects during the construction and operation of the proposed development.

21.5 References

British Standards (2016) *BS6349-5 - Maritime works – Part 5: Code of practice for dredging and land reclamation*

British Standards Institution (BSI) (2014) *5228-1 and 2:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites. Noise and Vibration.*

CIRIA (2015) *Environmental Good Practice on Site Guide, 4th Edition*

Department of Arts, Heritage and the Gaeltacht (2014) *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf.

IFI (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters.*

Masters – Williams et al (2001) *Control and management of water pollution from construction sites in their publication Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors*

NSAI (2015) *IS291:2015 Selection, commissioning, installation, inspection and maintenance of portable fire extinguishers. NSAI (2012) IS EN 671-1:2012: Fixed firefighting systems. Hose systems. Hose reels with semi-rigid hose.*

Transport Infrastructure Ireland (TII), (formerly the National Roads Authority (NRA)) (2011). *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Roads Schemes. TII, Dublin, Ireland*