# 3 Alternatives

## 3.1 Introduction

This chapter describes the alternatives considered by Irish Water during the design process for the proposed development and outlines the main reasons for choosing the proposed development.

This chapter of the EIAR has been prepared in accordance with Part 2 of Annex IV of the EIA Directive which identifies that the following is required in the EIAR:

*"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, taking into account including a comparison of the environmental effects."*

This chapter has therefore been structured to describe the following reasonable alternatives that have been considered:

- The do-nothing scenario;
- Alternative locations for the proposed development;
- Alternative processes (technologies) for treating wastewater; and
- Alternative designs (including scale, layouts and specific characteristics) for the proposed development.

It should be noted that this chapter describes the reasonable alternatives considered by Irish Water only and does not consider historic proposals for wastewater treatment put forward by other proponents (i.e. Arklow Town Council and Wicklow County Council). Further information on historic design iterations is provided in **Section 2.5 of Chapter 2**.

## 3.2 Do-nothing

The do-nothing scenario refers to what would happen if the proposed development was not implemented and appropriate wastewater treatment was not provided in Arklow town.

As outlined in **Sections 1.4.2.2 of Chapter 1** and **Chapter 6**, the need for wastewater treatment provision in Arklow town has been well documented in national, regional and local policy as well as legal cases.

The UWWT Directive and the transposing Urban Wastewater Treatment Regulations, 2001, as amended sets standards to be met in the collection and treatment of wastewater as well as the monitoring requirements for wastewater discharges from urban areas. The UWWT Directive and the associated Regulations require that secondary or equivalent treatment is provided for wastewater generated in urban areas such as Arklow.

Furthermore, the Water Framework Directive (WFD) sets objectives to reduce the discharge of pollutants to waters, to prevent deterioration in water quality and achieve ‘Good Status’ in all waters over time.

The European Commission is currently taking a case against Ireland at the Court of Justice of the European Union for its failure to ensure that urban wastewater in 38 agglomerations (of which Arklow is one such named agglomeration) is adequately collected and treated to prevent serious risks to human health and the environment. Indeed, the referral decision also raises additional concerns about the failure to ensure that a correct operating licence has been issued for the treatment plants serving the agglomeration of Arklow.

It is clear therefore, that from a legislative perspective alone, the ‘do-nothing’ scenario is not a reasonable alternative in the context of the proposed development.

Notwithstanding the legislative requirements, the provision of appropriate treatment of wastewater in Arklow is required to improve water quality in the Avoca River and enable further development in Arklow town, which is currently constrained by the absence of treatment.

For those reasons, the ‘do-nothing’ scenario was not considered further.

## 3.3 WwTP Site and Sewer Route Selection

### 3.3.1 Background and Scheme Objectives

The background to the proposed development and the historical context is provided in **Section 2.5 of Chapter 2**.

In 2014, following its formation under the Water Services Act 2013, Irish Water commenced a new site selection process for the proposed WwTP and associated infrastructure. In commencing this site selection process, the objectives for the proposed development were set out to ensure the selection of a suitable solution in accordance with these objectives (Refer to **Section 2.4 of Chapter 2** for further detail on the objectives of the proposed development).

### 3.3.2 WwTP Site Selection

A site selection process was undertaken to evaluate various sites for the WwTP in and around Arklow town. The principal aims of the site selection process was to:

- Review all suitable sites for the proposed WwTP in the environs of Arklow town;
- Review suitable locations for the treated effluent discharge point from the WwTP; and
- review suitable corridors for the proposed connecting pipelines (interceptor sewers) from the existing drainage networks to the proposed WwTP.

The consultation process and timeline for the site selection process is summarised in the schematic below:

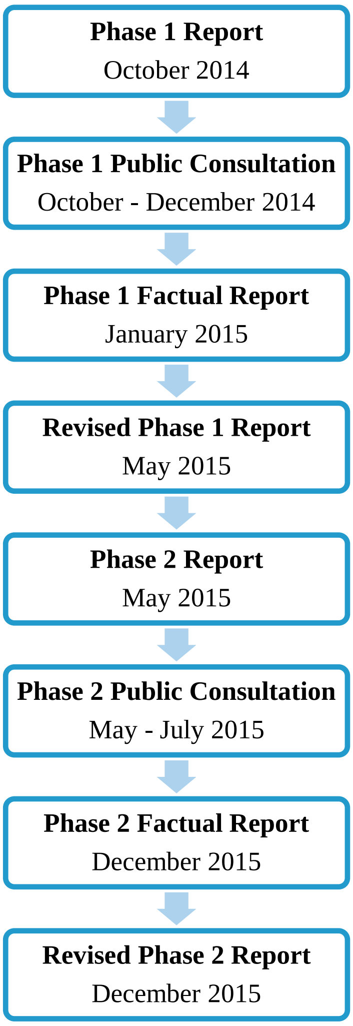


Figure 3.1: Consultation process and timeline for the site selection process

### 3.3.2.1 Phase 1 Site Selection Report

**Overview**

In October 2014, the Phase 1 Site Selection Report was prepared by Byrne Looby PH McCarthy[1]. The extent of the study area for this report was the administrative boundary for Arklow town and environs as set out in the Arklow Town and Environs Development Plan 2011 - 2017.

[1] Byrne Looby PH McCarthy (2014) Site Assessment Report – Phase 1 for the Arklow Wastewater Treatment Works. Available from: https://www.water.ie/projects-plans/arklow-wwtp/SA-Report_Arklow_WwTP.pdf [Accessed 21 August 2018]

Consideration was given to relevant best practice including EPA guidance[2,3] and planning policy[4,5]:

The site selection process was predicated on a WwTP with an ultimate capacity of 36,000PE, which, from previous studies, was considered to provide adequate capacity for Arklow over the design horizon. This scale of plant was considered to require a site of at least 2 hectares (ha) to provide:

- Flexibility in the final selection of the treatment process to be utilised;
- Sufficient space to adequately construct and screen the site; and
- To ensure flexibility regarding purchase of the required land.

**Assessment of environmental constraints**

To identify suitable land parcels within the study area, a desk-based assessment of environmental constraints was undertaken in the first instance to screen out unsuitable sites from further consideration. The following environmental constraints were identified:

- **Biodiversity** – Areas designated for nature conservation interest under European and national legislation in the study area were mapped (such as Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Ramsar sites as well as Special Areas of Conservation (SACs), candidate SACs and Special Protection Areas (SPAs) designated under the Birds Directive or Habitats Directive). Any sites that overlapped with these designated areas were not considered further. Other protected areas of ecological value were also avoided, such as designated shellfish waters, nature reserves, Refuge for Fauna, Tree Preservation Orders, Flora Protection Orders and Parks Biodiversity Buffer Designations/Nature Development Area.
- **Cultural Heritage** – Areas designated for heritage and archaeology, such as National Monuments, archaeological sites as identified in the Record of Monuments and Places (RMP), structures listed in the Record of Protected Structures (RPS) and Architectural Conservation Areas were also mapped. Any sites that overlapped with these designated areas were not considered further.
- **Geology** – Any sites that overlapped with Geological Heritage Sites identified by the Geological Survey of Ireland were mapped. Any sites that overlapped with these designated areas were not considered further.
- **Water** – Sensitive water bodies including Salmonid waters, designated biodiversity sites, recreational waters, designated bathing waters, designated nutrient sensitive waters, designated shellfish waters and aquifers designated as extremely vulnerable were mapped. Any sites that overlapped with these designated areas were not considered further.

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[2] EPA (2006) Landfill Manuals: Manual on Site Selection (Draft for Consultation)
[3] EPA (1999) Wastewater Treatment Manuals: Treatment Systems for Small Communities, Business, Leisure Centres and Hotels
[4] Wicklow County Development Plan 2010 – 2016
[5] Arklow Town and Environs Development Plan 2011 – 2017

Areas at risk from fluvial and tidal flooding (i.e. for the 1 in 100 year storm event that were mapped as part of the Arklow Flood Feasibility Study), as well as storm events north of the M11 bridge (identified from the OPW CFRAM study) were also screened out and not considered further.

- **Landscape** – Areas designated as 'Highly Sensitive Landscapes' as defined within the Wicklow County Development Plan 2010 – 2016 were mapped. Any sites that overlapped with these designated areas were not considered further.
- **Sensitive receptors** – In the absence of recommended buffer zones in the relevant planning policy, a 100m buffer zone around known residential receptors was applied and a 50m buffer zone was applied around known commercial receptors (as agreed with Wicklow County Council during Phase 1 of the site selection process)[6]. Appropriate buffers were also applied to roads and railway lines identified in the Wicklow County Development Plan 2010 – 2016. Any sites that overlapped with these buffers were not considered further.

Once all of these constraints were identified and mapped, an examination of the remaining land areas in the study area was undertaken to identify suitable sites (of at least 2ha in size). On this basis, a total of 11 land parcels were identified by this screening assessment.

**Assessment of extant permissions**

A planning search was subsequently undertaken to identify any planning applications and/or extant permissions that may further constrain any of the 11 identified land parcels. As a result, one of the 11 sites (at Ballynattin) was excluded. Ballynattin was excluded on the basis that when the buffer zones for sensitive receptors were applied, the size of the available land parcel became such that it was now of insufficient size to accommodate the proposed WwTP.

At the end of this screening assessment, ten land parcels (identified by their townland names), were identified for further consideration as outlined below and illustrated in Figure 3.2:

- Lamberton and Ballyraine;
- Kilbride (ED Kilbride);
- Bogland and Kish;
- Killiniskyduff;
- Money Big;
- Ballymoney (ED Kilbride);
- Tinahask Upper;

[6] Note - The Phase 2 Public Consultation identified that a site, proximate to the Old Wallboard site at Ferrybank, had an extant planning permission (since expired) for construction of residential and retail units which had not been identified. The buffer zone applied for the existing business (at the time) on this site, means that this new information did not alter the outcome of the Phase 1 or 2 assessment.

- Seabank;
- Old Wallboard site at Ferrybank; and
- IFI/Shelton Abbey.

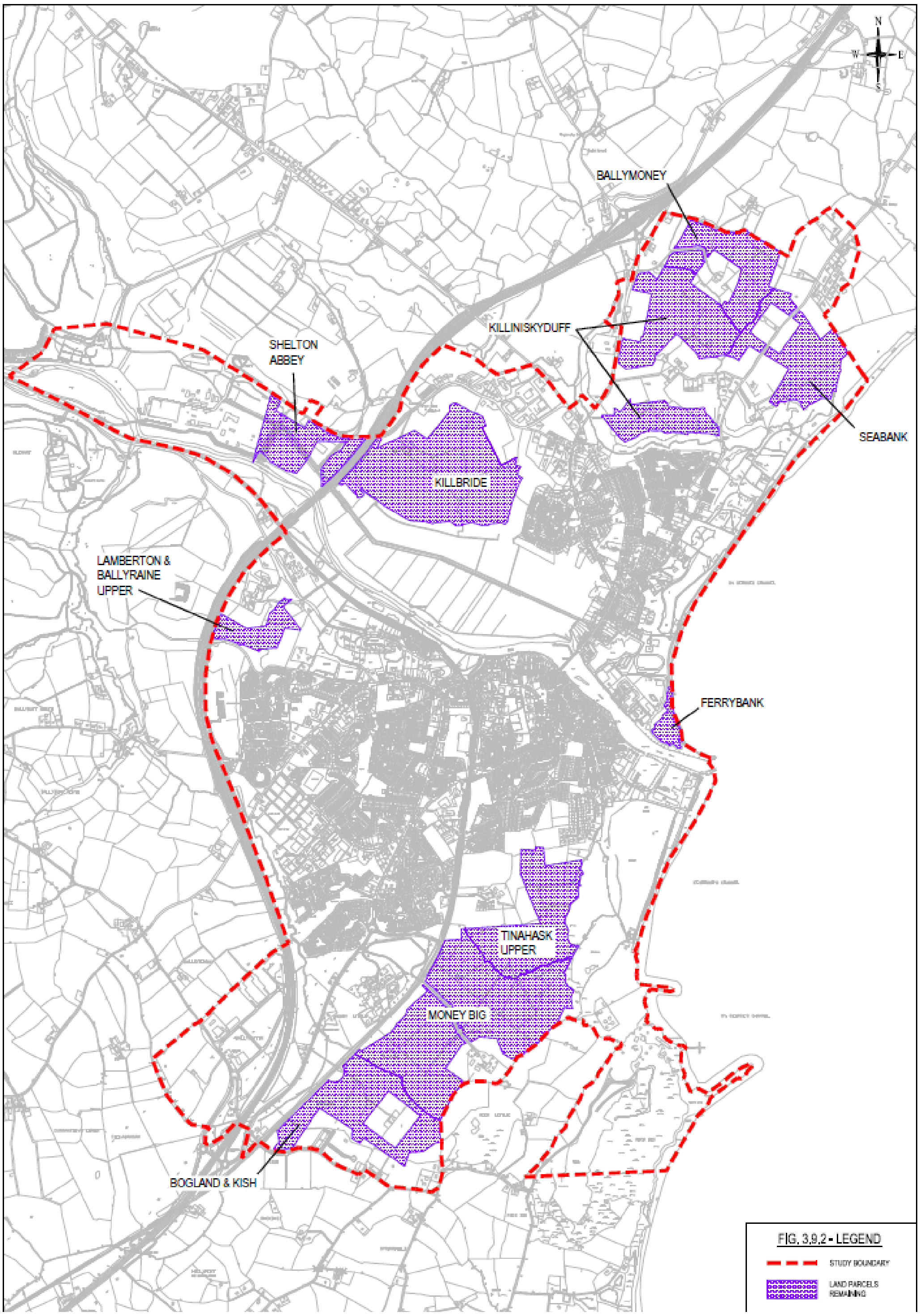


Figure 3.2: Location of ten shortlisted land parcels

**Assessment of site suitability**

Having identified ten land parcels through the initial screening assessment, the next step was to assess these parcels in terms of their proximity and accessibility to the identified load centre in Arklow town as well as an evaluation of the feasible outfall locations.

Load Centre

The load centre was identified as the point to which all flow gravitates, from the wastewater network in Arklow town. At the time of this assessment, the load centre was identified as the midway point of the planned sewer crossing at the Avoca River (towards the mouth of the Avoca River).

The proximity of this load centre to the ten sites and the associated energy requirements (if pumping was required) was an important consideration to minimise the need for additional infrastructure, associated capital and operational costs, energy demand, carbon emissions and environmental impacts of pumping flows from the load centre to the preferred site.

Outfall Locations

It should be noted that a river outfall was not considered during this stage of the site selection process, on the basis that a single point discharge into the Avoca River would not provide sufficient dilution of the effluent (Note - this principle had been established through previous surveys as discussed in detail in **Section 3.3.4**). Furthermore, the existing high levels of naturally deposited material in the river channel (which has required regular maintenance through dredging) and the pNHA designation of a large section of the Avoca River, meant that only marine outfalls discharging to the Irish Sea were considered at this stage.

Comparable coastal WwTPs along the eastern seaboard were also examined, in terms of the type of outfall structures and associated Emission Limit Values (ELVs). This examination demonstrated that the selection of marine outfalls was the preferred option, with standard 25:35:125 limits (BOD:COD:TSS) typical for comparable WwTPs. The proximity of each of the ten sites to the coastline was equally a factor in minimising the need for additional infrastructure, carbon emissions and associated environmental impacts.

Other

It was also necessary to consider other aspects of the ten sites in relation to high level engineering constraints. In the context of site selection, constraints examined included accessibility, proximity to existing services, site topography and existing land use.

**Outcome**

When these constraints were considered in terms of site suitability, sites with a greater combined distance from both the load centre and from a coastal location (for a possible marine outfall) were excluded from further consideration.

The phase 1 site selection process therefore determined that three sites were to be taken forward for detailed technical and environmental consideration in the Phase 2 site selection report. These sites were:

- Old Wallboard site at Ferrybank;
- Seabank; and
- Tinahask Upper.

**Consultation**

As noted in **Section 1.5.3 of Chapter 1**, non-statutory public consultation on the Phase 1 site selection process was undertaken by Irish Water over a period of 8 weeks (15 October 2014 - 12 December 2014) and a copy of the Phase 1 Consultation Report was published thereafter[7].

This public consultation period generated a large number of submissions from interested parties and the general public. Specifically, two issues arose which required further consideration:

- Additional lands at the IFI/Shelton Abbey land parcel (i.e. the adjacent old IFI plant site closed in 2000) would be available for a WwTP if required, hence no longer classifying these lands as a ‘sensitive receptor’ (Note that the IFI site was originally identified as commercial development and hence had the 50m buffer applied); and
- Irish Water should consider discharging treated wastewater into the Avoca River as well as considering a marine outfall.

These two issues were then considered further by the design team, as detailed below.

In respect of the IFI/Shelton Abbey land parcel, the size and shape of the revised land parcel made it more suitable for the location of a WwTP. Further work was also undertaken in respect of flood risk at the IFI/Shelton Abbey site[8]. This study concluded that an adequate area of land was available within this site for the proposed WwTP and that, while portions of this land are within flood zones A or B, they are well protected by an existing flood defence embankment.

Further modelling was undertaken in April 2015[9] in order to inform the feasibility of a river outfall. This exercise concluded that a river outfall was a feasible option, albeit that a higher standard of effluent discharge would be required than for a marine outfall.

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[7] Byrne Looby PH McCarthy (2015) Arklow Wastewater Treatment Plant – Phase 1 Site Selection Report. Available from: https://www.water.ie/projects-plans/arklow-wwtp/Phase-1-Consultation-Report.pdf [Accessed 21 August 2018]
[8] Byrne Looby PHMcCarthy (2015) Flood Risk Assessment and Management Report
[9] Irish Hydrodata (2015) Preliminary Report: Arklow WWTP Investigation of the Impact of Treated Wastewater Discharges To Avoca River and Irish Sea. Available from: https://www.water.ie/docs/App-A.pdf [Accessed 22 August 2018]

The Phase 1 site selection assessment was therefore revisited due to this additional information. It was determined that the IFI/Shelton Abbey site should be taken forward for further assessment, given its location in proximity to the Avoca River, and the submissions received during the public consultation process in relation to the size of the land parcel.

**Updated Phase 1 Site Selection Report**

An updated Phase 1 Site Selection Report was prepared in May 2015[10], taking account of the public consultation submissions received and further information as described above. This report re-evaluated the ten shortlisted sites again with regard to this updated information. On this basis, it concluded that:

- Should a river discharge be a viable option (based primarily on the combined distance from both the load centre and nearest river or coastal outfall location), the following land parcels would be taken forward for detailed technical and environmental consideration in the Phase 2 site selection report:
    - Old Wallboard site at Ferrybank;
    - Kilbride; and
    - IFI/Shelton Abbey
- Should a marine discharge be required, i.e. river discharge is not a viable option (based primarily on the combined distance from both the load centre and a coastal discharge location only), the following land parcels would be taken forward for detailed technical and environmental consideration in the Phase 2 site selection report:
    - Old Wallboard site at Ferrybank;
    - Seabank; and
    - Tinahask Upper.

On the basis of the additional modelling, which confirmed that a river outfall was a viable option, the updated Phase 1 Site Selection Report recommended that the following land parcels were brought forward for further consideration against a range of environmental, technical and economic criteria under a Phase 2 Site Assessment:

- Old Wallboard site at Ferrybank;
- Kilbride; and
- IFI/Shelton Abbey.

[10] Byrne Looby PH McCarthy (2015) Arklow Wastewater Treatment Plant: Site Assessment Report – Revised Phase 1. Available from: https://www.water.ie/docs/1-Main-Body.pdf [Accessed 21 August 2018]

#### 3.3.2.2 Phase 2 Site Selection Report

**Overview**

The Phase 2 site selection assessment (Refer to **Appendix 3.1**), prepared in May 2015, brought forward these three shortlisted sites for further assessment. Figure 3.3 shows each of the sites as well as the location of associated sewers and outfalls.

The Old Wallboard site at Ferrybank site is located within the townland of Ferrybank to the north of the Avoca River. This site is bounded to the south by the North Quay and the Avoca River, the Irish Sea to the east and the Mill Road to the west. The site is currently comprised of an abandoned factory building, associated outbuildings and structures and the land parcel is partially overgrown. The site area is approximately 2.83ha.

The Kilbride site is located approximately 870m north of Arklow town centre to the north of the Avoca River. The site comprises all or part of approximately five undeveloped green fields surrounding Kilbride House, to the immediate south of the M11.

The IFI/Shelton Abbey site is located approximately 1.4km north-west of Arklow town centre on the northern banks of the Avoca River. The site comprises three undeveloped green fields and two previously developed plots on the northern banks of the Avoca River, to the immediate west of the M11.

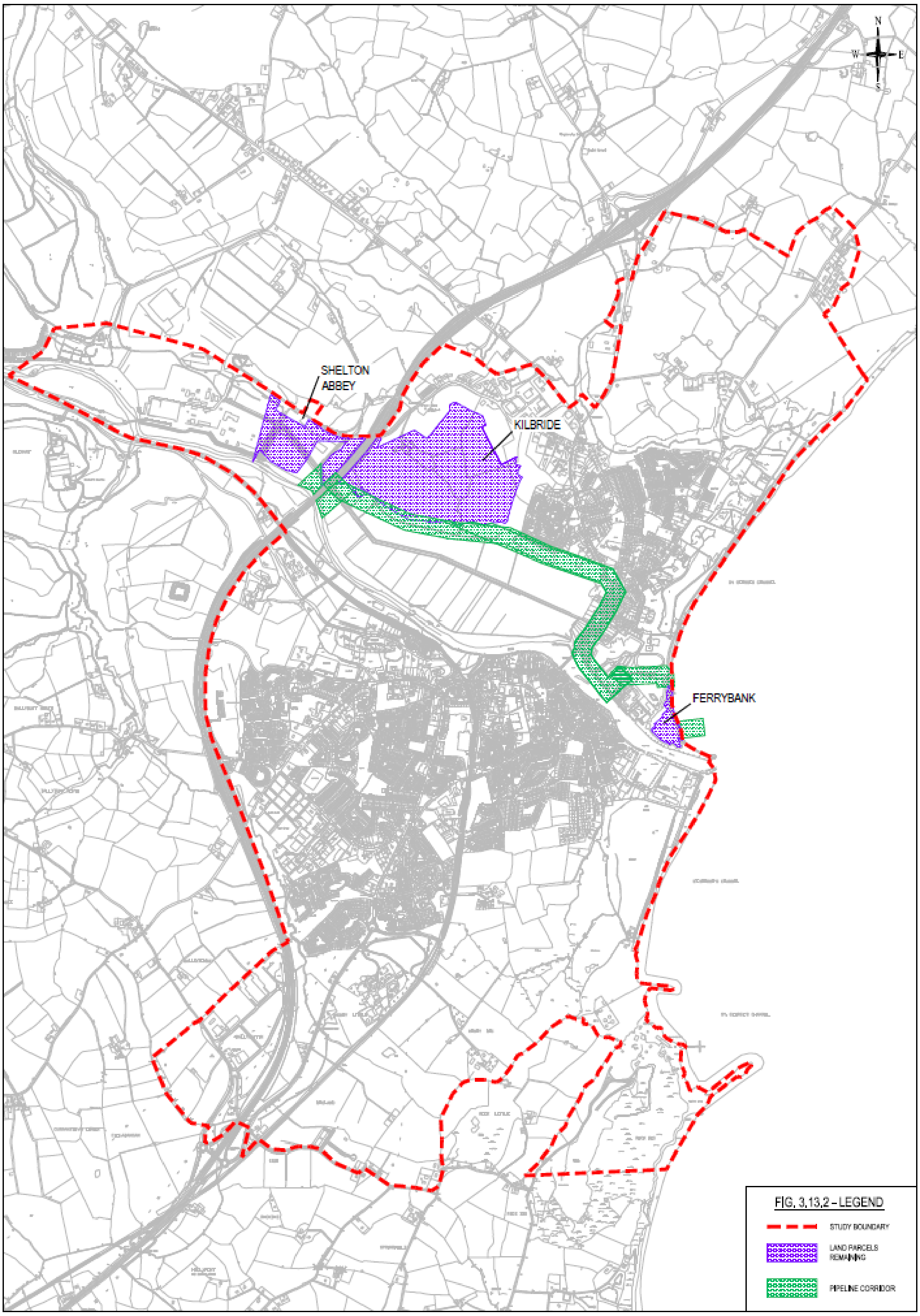


Figure 3.3: Location of three shortlisted sites

### Multi-criteria assessment

The Phase 2 site selection process comprised a multi-criteria assessment of the three shortlisted sites and the associated corridors for the sewers and outfalls. The multi-criteria assessment considered a range of technical, economic and environmental criteria as detailed in Table 3.1.

Specifically, the environmental criteria utilised for the Phase 2 site selection assessment, whilst not exhaustive, broadly reflect the environmental factors that would be typically considered relevant during the EIA scoping process for a WwTP of this nature and scale.

Table 3.1: Technical, economic and environmental criteria considered during the Phase 2 site selection assessment

| Environmental Criteria | Technical/Economic Criteria |
|---|---|
| Ecology | Safety |
| Cultural Heritage | Planning Policy |
| Landscape & Visual | Engineering & Design |
| Hydrology & Hydrogeology | Capital and Operational Costs (including annual energy costs) |
| Soils & Geology (including contamination) | Land Valuation |
| Traffic | |
| Air Quality & Odour | |
| Agriculture & Agronomy | |
| Noise & Vibration | |
| People & Communities | |

To support this assessment, a number of additional specialist surveys were undertaken including:

- Ground investigation works at the shortlisted brownfield land parcels, where possible;
- Ecological surveys;
- Archaeological surveys; and
- Asbestos surveys.

The Phase 2 site selection assessment was based on a qualitative assessment, whereby competent specialists assessed the three sites under each of the relevant criteria in Table 3.1.

This included data collection (based on desktop assessment) and, in some cases, site surveys and invasive site investigation works as well as site visits and ‘windshield surveys’.

The sites were then assessed against each criterion (and sub-criterion) to categorise potential impacts across a five point scale between ‘imperceptible’ and ‘profound’ based on the EPA[11] and the NRA[12] guidance.

Technical aspects of the sites were assessed in a manner that allowed the most and least favourable site options to be identified.

[11] EPA (2002) Guidelines for the Information to be contained in Environmental Impact Statements
[12] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide

In respect of technical considerations, the location of the site, with respect to a corridor for the potential sewer and outfall locations were also considered, to ensure that the WwTP site was not selected in isolation.

On this basis, the assessment was conducted in accordance with the following methodology, with each criterion or sub-criterion given equal weight:

- **Step 1** – Mapping of impacts for the three sites by the environmental and technical specialists based on desktop assessment and in some cases visual inspections to produce individual matrices;
- **Step 2** – Identification of the best positioned 2ha site within each of the three sites based on relative technical and environmental constraints;
- **Step 3** – Update individual matrices to reflect the focus from the overall site to the individual 2ha site within those land parcels;
- **Step 4** – Combination of the individual matrices into one overall primary matrix;
- **Step 5** – Identify cells that are most favourable across the sub-criteria (Shade these cells green);
- **Step 6** – Identify the cells which are the least favourable (Shade these cells amber). This process was continued for subsequent iterations;
- **Step 7** – Review the completed matrix to determine whether any sites with 'least favourable' classifications can be omitted (Note – this resulted in the omission of IFI/Shelton Abbey); and
- **Step 8** – Review each sub-criterion to determine whether there are any differentiating levels of impact remaining across the two site options (Note – this resulted in the conclusion that Kilbride was less favourable than the Old Wallboard site at Ferrybank).

As outlined above, detailed matrices were prepared for each site to consider each of the criteria and sub-criteria that were assessed (i.e. across the technical, economic and environmental criteria).

At Step 7, both the Kilbride site and the Old Wallboard site at Ferrybank were assessed as being 'more favourable' across a greater number of criteria, therefore resulting in the omission of the IFI/Shelton Abbey site from further consideration.

At Step 8, the Old Wallboard site at Ferrybank was assessed as being 'more favourable' across a greater number of criteria assessed, therefore resulting in the identification of the Old Wallboard site at Ferrybank site as the preferred site for the WwTP.

In comparison to the Kilbride and IFI/Shelton Abbey sites, the Old Wallboard site at Ferrybank was considered more favourable under the following criteria:

- Cultural heritage;
- Landscape and visual;
- Ecology;

- Hydrology;
- Hydrogeology;
- Agronomy and land use;
- Traffic; and
- Engineering and design (including carbon emissions, power and maintenance requirements).

**Public consultation**

As noted in **Section 1.5.3 of Chapter 1**, the second public consultation phase took place over an eight week period (15 May 2015 - 10 July 2015), with an updated Phase 2 Site Assessment Report[13] following thereafter based on the submissions received.

In general, the feedback on the outcomes of the Phase 2 site selection assessment was positive, with many seeing the Old Wallboard site at Ferrybank as a suitable site for locating the WwTP. Some concern was expressed with regard to the proximity of the Old Wallboard site at Ferrybank to nearby lands which have development potential (i.e. within the 'Waterfront' land use zoning) and its prominent position on the waterfront.

Prior to finalising the site selection report, Irish Water also met with An Bord Pleanála as part of the pre-application consultation process as described in detail in **Section 1.5.2 of Chapter 1**. An Bord Pleanála identified that planning policy was considered too narrowly in the site selection report, as it did not consider the potential for each of the sites to support the realisation of the Core Strategy targets in the Wicklow County Development Plan 2010- 2016 or the potential to realise some of the specific land use zoning objectives contained in the Arklow Town and Environs Development Plan 2011-2017. On foot of that meeting Irish Water undertook further consultation with Wicklow County Council Planning Department and the EPA regarding the proposed development.

The Phase 2 Site Selection Report (Refer to **Appendix 3.1 - Section 4.11** and the assessment matrix in particular) was reviewed on this basis and the analysis was revisited to take into account the specific concerns of An Bord Pleanála. However it is important to note this did not affect the conclusion i.e. the Old Wallboard site at Ferrybank remained as the preferred site as discussed in further detail below.

**Consultation with An Bord Pleanála, Wicklow County Council and Environmental Protection Agency**

Prior to finalising the site selection report, Irish Water met with An Bord Pleanála as part of the pre-application consultation on the Strategic Infrastructure Development process.

[13] Byrne Looby PH McCarthy (2015) Arklow Wastewater Treatment Plant: Site Assessment Report – Phase 2. Available from: https://www.water.ie/projects-plans/arklow-wwtp/Phase-2-Site-Assessment-Report-December-2015.pdf [Accessed 21 August 2018]

On foot of the meeting, Irish Water was asked to further consult with Wicklow County Council Planning Department and the EPA regarding the proposed development.

One of the topics discussed with An Bord Pleanála and Wicklow County Council was the scope of the site selection process with regard to planning policy objectives for Arklow, particularly the Core Strategy targets of the three sites and the potential to realise some of the specific objectives of the Arklow Town and Environs Plan 2011 – 2017. As a result, the site selection was revisited and updated, to take account of changes to planning policy.

Specifically in relation to the Old Wallboard site at Ferrybank, following consultation with Wicklow County Council, it was considered that the development of a WwTP on lands zoned WZ 'Water-front Zone: to promote and provide for mix-use development' would not be inconsistent with the objective to realise housing targets set out in the Wicklow County Development Plan 2010-2016 and the Arklow Town and Environs Plan 2011 – 2017 and would not impede the delivery of the Core Strategy.

The need to meet the specific objectives for the waterfront zoning was recognised by Irish Water and it was acknowledged that the WwTP would need to be:

"*designed to a high architectural standard and quality, such that it becomes an anchor for the area, contributes to the public realm surrounding the site by providing improved access to the shore, adjacent to the plant and potentially links to the adjacent sports ground and ensures that the potential to redevelop adjoining lands is not undermined by the siting of a WwTP at this location*." [14]

**Outcome**

The outcome of the Phase 2 site selection assessment (that was communicated during the associated consultation period – Refer to Appendix 3.1) is that Irish Water indicated its intent to proceed with the emerging preferred site (i.e. Old Wallboard site at Ferrybank). This site was deemed to represent a suitable site in terms of technical and environmental considerations for those reasons outlined above and detailed in the Phase 2 Site Selection Report[13].

### 3.3.2.3 Planning Policy

The site selection reports were prepared with cognisance of the Wicklow County Development Plan 2010 – 2016 and the Arklow Town and Environs Plan 2011 – 2017. Since the publication of these reports, the Wicklow County Development Plan 2016 – 2022 (i.e. the County Development Plan) and the Arklow and Environs Local Area Plan 2018 – 2024 (i.e. the Arklow LAP) have both been adopted by Wicklow County Council (Refer to **Chapter 6** for further information on planning policy).

[14] Byrne Looby PH McCarthy (2015) Arklow Wastewater Treatment Plant - Phase 2 Consultation Report Final. Available from: https://www.water.ie/projects-plans/arklow-wwtp/Phase-2-Consultation-Report.pdf [Accessed 21 August 2018]

The current County Development Plan and the Arklow LAP have been considered with regard to land use planning objectives of relevance to the site selection process, particularly for the three shortlisted sites.

As discussed in detail in **Section 6.4 of Chapter 6**, the land use zoning objectives support the provision of a WwTP at the Old Wallboard site at Ferrybank. This site is within the Waterfront Zone (WZ) in the Arklow LAP, and the following is included in the zoning matrix for this area:

'*to facilitate the provision of a new Waste Water Treatment Plant with an appropriate high quality architectural design/appearance'*.

The land use zoning at the Kilbride and IFI/Shelton Abbey sites does not accommodate the provision of a WwTP, with the IFI/Shelton Abbey site being outside the administrative boundary of Arklow Town and the Kilbride site being zoned as an 'action area' for employment opportunity.

It is clear from the most recent planning policy and land use zoning and associated objectives identified therein that the Old Wallboard site at Ferrybank, is now firmly supported through the land use planning framework. On this basis, the Old Wallboard site at Ferrybank remains the most suitable site for the proposed development.

### 3.3.3 Sewer Route Selection

#### 3.3.3.1 General

The purpose of the proposed interceptor sewers is to collect untreated wastewater flows currently discharging directly to the Avoca River and to transport these flows to the proposed WwTP. Given the topography of Arklow and the termination of all existing outfalls at the river, the areas along the north and south banks of the Avoca River are considered the only viable locations for the proposed interceptor sewers.

A detailed report, Interceptor Sewer Route Options Report was undertaken (Refer to **Appendix 3.2**) and documents the options for the alignment of the sewer within the sections illustrated in Figure 3.4.

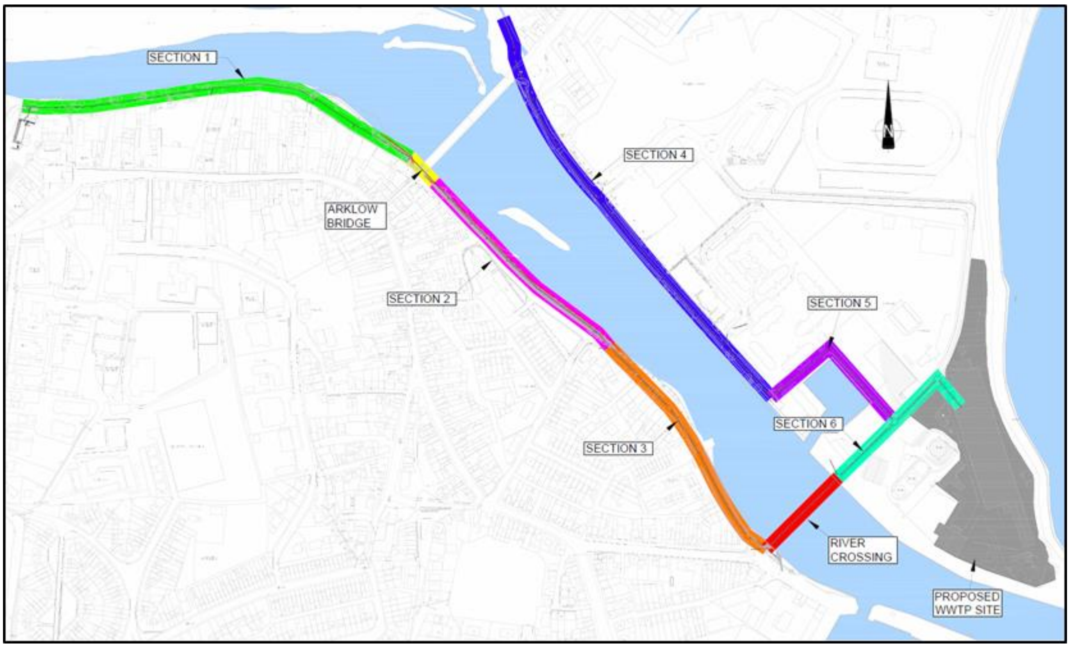


Figure 3.4: Location of sewer alignments considered (Source: Byrne Looby – Refer to Appendix 3.2 for further detail).

#### 3.3.3.2 Avoca River Crossing

Arklow has developed on both sides of the Avoca River and therefore a river crossing to transfer wastewater to a single WwTP would be required as part of the proposed development. Several alternatives were considered for locating this sewer crossing as described below.

A sewer crossing upstream of Arklow Bridge was ruled out early in the design development process because it would require works in the Arklow Town Marsh pNHA. Further, a crossing upstream of Arklow Bridge would also require deeper sewer excavations due to its upstream location and distance from the WwTP site. On the basis of these two constraints, a crossing upstream of Arklow Bridge was ruled out from further consideration.

A sewer crossing downstream of Arklow Bridge was therefore assessed based on two main criteria, namely the shortest length to cross the river and proximity to the preferred WwTP site. These two criteria have a significant bearing on overall impacts including the duration of construction duration and energy use during operation. Two locations were identified for further assessment on this basis (Refer to Figure 3.5):

- Location 1: Shortest river crossing (approximately 80m): this is located at a narrow point approximately halfway between Harbour Rd and South Green on the south side, and runs to a location in front of the Marina Village development on the north side.
- Location 2: a crossing (approximately 120m) between Harbour Road and Mill Road with the sewer continuing up Mill Road to enter the WwTP site.

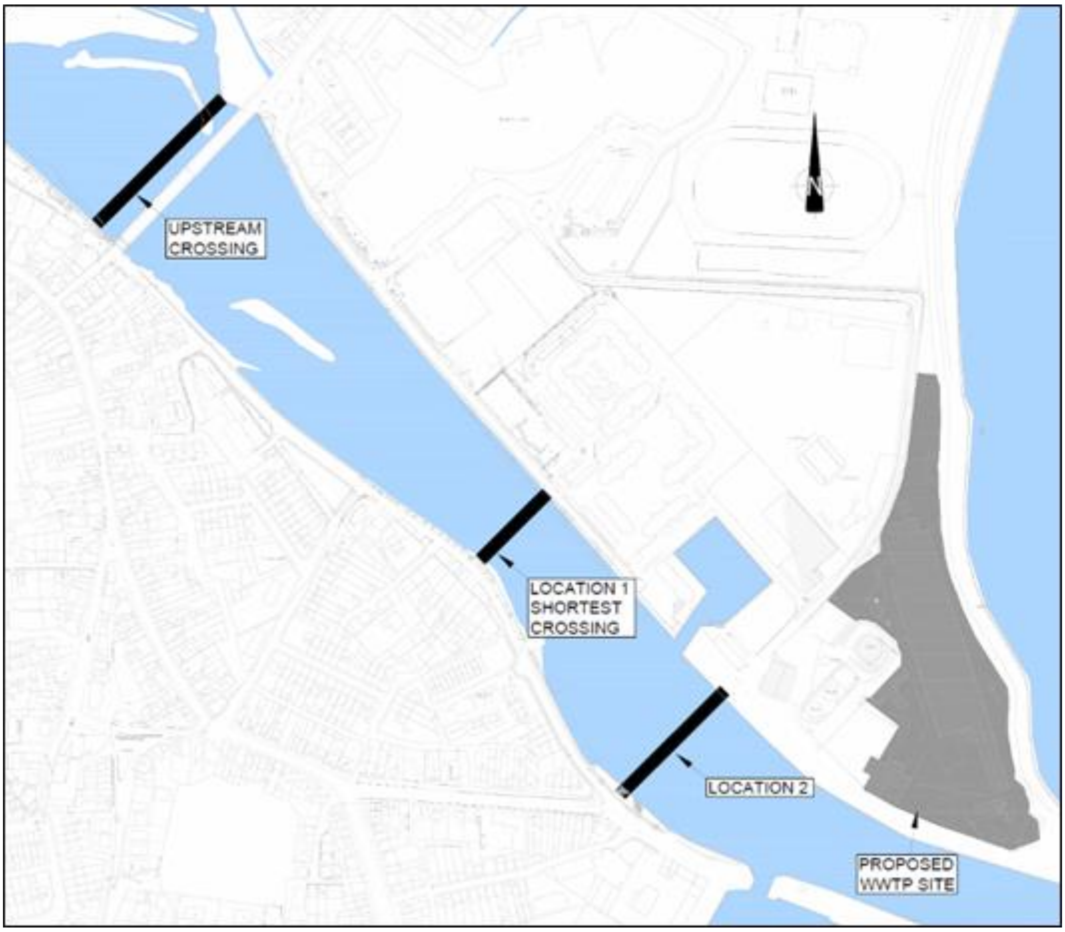


Figure 3.5: Location of the river crossings considered (Source: Byrne Looby – Refer to Appendix 3.2 for further detail)

The final selection of the river crossing point location was based on three main considerations:

- Extent of sheet piled quay walls;
- Impact of the proposed Arklow Flood Relief Scheme; and
- Length of crossing.

Investigation revealed that sheet piles are present at both of the proposed crossing points to a depth of 12m, hence neither location was considered more favourable in this regard.

The proposed Arklow Flood Relief Scheme proposes various measures to prevent future flooding in Arklow, including a proposal to widen the river at its narrowest point. As this is coincident with Location 1, there is potential for design and construction conflicts between the two schemes as there is a physical overlap of development proposals, particularly where the sewer would cross the proposed re-aligned sheetpiled river wall on the widened section.

Location 1 particularly where the sewer would cross the proposed re-aligned sheetpiled river wall on the widened section.

Location 2 held a further advantage because it minimised the length of deep tunnelling required to the WwTP. Hence it was decided that Location 2, despite being the longer river crossing by approximately 40m, was the preferred location for the crossing.

### 3.3.4 Outfalls

#### 3.3.4.1 Overview

An outfall is required to discharge the treated effluent to receiving waters. As outlined in **Section 3.3.2.1**, both marine and river outfall options were considered as part of the site selection process (i.e. a marine outfall for the Old Wallboard site at Ferrybank, river outfall for IFI/Shelton Abbey and both for Kilbride – Refer to Figure 3.3).

Hydrodynamic and water quality models were prepared[9] to simulate the impacts of the proposed discharges from the long sea outfall to allow comparisons to be made and suitable discharge standards to be set.

Three offshore discharge locations (at approximately 400, 650 and 900m from the shoreline), together with a river discharge location (the harbour mouth chosen for assessment purposes) were considered. The modelling demonstrated that the discharge standards required for a river outfall would be much more onerous than that of a marine outfall. For that reason, the river outfall was not considered further.

The main regulatory constraints that apply to the discharges are:
Urban Wastewater Treatment Regulations 2001 (SI 254/2001);

- European Communities (Water Policy) Regulations (SI 722/2003);
- European Communities Environmental Objectives (Surface Waters) Regs 2009 (SI 272/2009);
- European Communities (Birds and Natural Habitats) Regs(SI 477/2011);
- Bathing Water Quality Regulations 2008 (SI 79/2008);
- European Communities (Quality of Salmonid Waters) Regulations 1988 (SI 293/1988).

#### 3.3.4.2 Long Sea Outfall

The location of the long sea outfall has been determined by the layout and position of the treatment units on the WwTP site. Treated effluent from the WwTP will be discharged from the final process units to the initial section of the pipeline which therefore determined the beginning of the pipeline route.

The route, length and position of the discharge point were also informed by hydrodynamic modelling to ensure adequate dispersion of the effluent to ensure compliance with regulatory requirements.

The initial outfall route selection process took account of flow currents in Arklow Bay as well as the proximity to beaches and other sensitive sites (such as European sites and the beaches at Brittas Bay and Clogga which are designated bathing waters.

The modelling (Refer to **Appendix 15.2**) demonstrated that bacterial concentrations were the critical parameter for the marine outfall options and that a 900m outfall could ensure compliance with the bathing water ‘excellent’ category during calm and windy conditions. The modelling also considered tidal and marine currents. A marine outfall, of approximately 900m in length was therefore selected to ensure compliance.

In addition to the hydrodynamic modelling, a marine site investigation was carried out to inform the outfall route selection and design process. This investigation indicated that ground conditions are sand and gravel over clay, over sand and gravel, over bedrock as discussed in detail in **Chapter 14**. The marine site investigation also included an underwater archaeological investigation, to identify any archaeological constraints associated with the outfall route options.

The location of the existing General Electric (GE) sub-sea electricity cable from the Arklow Bank Offshore Wind Park also formed a significant constraint in the location and route of the marine outfall.

The final route of the marine outfall was chosen with consideration of these constraints. The size and hydraulic profile of the outfall have been chosen based on the requirements for gravity discharge and the flow volumes to be discharged. The outfall will discharge at the seabed, through a diffuser (which ensures adequate mixing and dispersion) as described in detail in **Section 4.3.5 of Chapter 4**. The depth and spacing of the diffusers has been selected to provide the dilution considered necessary to eliminate any localised surface sheens, slicks or odours.

### 3.3.4.3 Storm Water Overflow (SWO) at WwTP

A storm water overflow (SWO) is required at the WwTP to discharge excess stormwater flows, when the capacity of the WwTP and the stormwater storage tank is exceeded, in accordance with standard practice for WwTP design. The SWO is also required to provide an emergency relief for excess flows in the sewered catchment during extreme rainfall events and during extended power outages. The excess stormwater will be discharged through the SWO, to the Irish Sea.

This SWO needs to discharge flows at a level of -3.9 m OD, just below the Mean Low Water Springs level, meaning that the SWO will terminate at the toe of the proposed revetment in order to ensure compliance with Irish Water standards[15].

The positioning and route of this SWO took into consideration the proposed location of the long sea outfall (which was chosen following a dispersion modelling exercise), the location of the existing GE power cable from the Arklow Bank Wind Park and the location of the relevant infrastructure within the WwTP (including stormwater storage, inlet works sump and SWO pump sump). This largely dictated the route of the SWO pipeline.

The flow that needs to be discharged under design conditions and the required hydraulic profile of the SWO, determine the size of the pipe required. The outcome of the hydraulic modelling has identified the requirements in this regard.

#### 3.3.4.4 Storm Water Overflows (SWO)

To alleviate flooding in the network system in the event of power failure, pump failure / blockage at the WwTP or the combination of extreme rainfall events and high tide levels, it was considered necessary to provide SWOs within the interceptor sewer network at appropriate locations.

During rainfall events, SWOs act as relief valves within the network, allowing excess storm flows and heavily diluted wastewater to be discharged directly to receiving waters. This helps protect properties from flooding and prevents wastewater backing up into streets and homes during heavy storm events. New SWOs are therefore proposed at the following locations:

- A SWO at the head of the proposed interceptor sewer on the southern side of the river channel adjacent to The Alps. This SWO would intercept wastewater (including significant volumes of combined flows) in this area and provide appropriate storage with excess storm flows (screened) discharging through an existing outfall to the Avoca River;
- A SWO at South Quay-Harbour road on the interceptor sewer (at tunnel shaft TSS1) discharging (screened) stormwater through a new outfall to the Avoca River; and
- A SWO at the inlet pumping station at the WWTP (as described under **Section 3.3.4.3**).

The SWOs act as emergency overflows for excess storm flows and their location and design has been chosen with a view to optimising the hydraulic design of the system and in particular to reduce the need to pump stormwater at the WwTP.

The alternative of omitting these overflows or storage volumes would result in increased pipe size, unacceptable flooding risk in the event of pump outage at the WwTP and also the requirement to pump large volumes of stormwater for exceptional rainfall events that coincide with high tide levels. Accordingly, it is considered that there are no reasonable alternative to providing the proposed SWOs.

## 3.4 Treatment Processes

The proposed development will be procured as a Design and Build project, as detailed in **Chapter 4** and **Chapter 5**, with the appointed contractor responsible for the final detailed design of the proposed development. A number of alternatives were considered in the selection of the specimen design for the WwTP which will be used for the purposes of the assessment in this EIAR.

### 3.4.1 Approach to Process Selection

An exercise was undertaken to identify a preferred specimen design for the treatment processes included in the proposed development. This exercise:

- Identified the design parameters and constraints to be considered in the design;
- Identified acceptable process options for the level of treatment required;
- Provided preliminary sizing of the various structural and MEICA elements of the treatment process;
- Considered layout arrangements for the proposed major process units;
- Provided an overview of capital and operational expenditure for the preferred options; and
- Described the selection of the most appropriate option for the WwTP.

The process selection formed the foundation on which both the engineering and architectural design of the proposed development could progress.

In terms of WwTP design and selection the key design criterion is the anticipated Emission Limit Values (ELVs) likely to be enforced through the Waste Water Discharge Authorisation (WWDA) by the EPA (which is the consenting authority in this regard). It should be noted that the EPA will not issue the WWDA until the statutory consent is in place, therefore it was assumed that the ELVs imposed would be similar to other eastern seaboard plants with marine discharges, with ELVs of 25:35:125 (BOD:COD:TSS) considered.

The assessment also examined the impact on the major process units of requiring nutrient removal, should more stringent limits be stipulated by the EPA. The proposed treatment solution is flexible enough such that it can be adapted within the existing configuration of the SBR tanks in the Process building by provision of variants to the specimen design and degassing options for denitrification. The level of the major process units could be adjusted either above or below ground to accommodate greater treatment capacity should the EPA impose more onerous ELVs that require nutrient removal. In addition, provision has been made in the specimen design to provide phosphorus removal as a simple retrofit solution.

In formulating the various treatment process options, the following considerations were taken into account during the design development of the treatment processes in the WwTP:

- Relevant legislation, best practice and industry design standards for wastewater treatment;
- Information obtained as part of the consultation process;
- ELVs likely to be applied;
- Design of the collector sewer network;
- Raw water characterisation e.g. determine if alkalinity addition required;

- Plant sizing and loading;
- Site size, configuration and any planning considerations;
- Storm water volumes to be managed;
- Oxygen demand required;
- Sludge production, treatment and disposal;
- Environmental emissions i.e. effluent, odour and noise; and
- Regulatory requirements and technical specifications.

The scope of the proposed development is to design a treatment process capable of treating an ultimate population equivalent of 36,000PE (albeit that the process capacity would be installed on a phased basis). The key objectives are to ensure that the site is adequate for the preferred treatment option up to 36,000PE and that the technology provided is capable of meeting the anticipated ELVs.

### 3.4.2 Process Treatment Options

The first part of the process treatment options assessment looked at treatment options that could meet the expected ELVs. Table 3.2 provides a summary of the industry standard appropriate technologies vis a vis the requirements of the proposed development. This high level assessment allowed each technology to be awarded a point score where the required criteria (10 in total) were met or were considered relevant.

Table 3.2: Industry standard appropriate technologies and their relevance in this application for Arklow WwTP

| Appropriate Technology System Assessment | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Arklow WWTP** | Primary & Secondary Settlement | | | | | Biofilm (Attached Growth) Systems | | | | | Suspended Growth Systems | | | Advanced |
| No. | Technology Description | Conventional Primary Settlers | Septic Tanks | Imhoff Tanks | Upward flow secondary settlement tanks | Horizontal flow secondary settlement tanks | Constructed Wetlands | Intermittent Aerobic Filters | Percolating Filters | Rotating Biological Contactors (RBC) | Submerged Filters | Extended Aeration Activated Sludge | Oxidation Ditch | Sequencing Batch Reactor (SBR) | Membrane Bioreactors |
| 1 | Ability of the process to achieve the secondary level of treatment in the WWDA ELVs compared to the 25 / 35 standard in the UWWTD | x | x | x | x | x | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 2 | Flexibility of process to allow for an upgrade from UWWTD standard to WWDA ELVs | Processes cannot achieved the required discharge standards and are not evaluated further | | | | | | | | | √ | √ | √ | √ | √ |
| 3 | Suitability of process to meet the initial design load of 24,000 PE and future increase to the ultimate design load of 36,000 PE. | | | | | | | | | | √ | √ | √ | √ | √ |
| 4 | Land acquisition considerations | | | | | | | √ | √ | √ | √ | √ | √ | √ | √ |
| 5 | Planning / Environmental considerations | | | | | | | | | | √ | √ | √ | √ | √ |
| 6 | Cost of construction | | | | | | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 7 | Cost of O&M | | | | | | √ | √ | √ | √ | √ | √ | √ | √ | |
| 8 | Anticipated Design Life and Capital Replacement | | | | | | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 9 | Impact and ability of the process to cope with flooding / high surface water volumes. | | | | | | | | | | √ | √ | √ | √ | √ |
| 10 | Respnse to shock loading from the network (organic) | | | | | | | | | | | √ | | √ | √ |
| | **Points Score** | | | | | | **4** | **5** | **5** | **5** | **9** | **10** | **9** | **10** | **9** |

Using this approach, many of the available technologies were discounted on the basis of ability to achieve the required discharge standards, or the ability to be modified to achieve any potential ELVs that may be required for the WWDA.

The outcome from this preliminary assessment illustrated that the most suitable treatment technology was the suspended growth type system, which combines both attached and suspended growth processes.

Each of the suspended growth type systems was then considered in more detail. Two technologies were discounted early on in the evaluation as follows:

- Rotating Biological Contactors (RBCs) – RBCs are an attached growth process and while reliable they can cause operational problems when required to handle increasing and fluctuating loads. The treatment capacity is limited to the media area provided which is fixed and long term high organic loading can cause anaerobic conditions, resulting in odour and poor treatment performance, which considering the site location in this instance, is considered a risk. For RBCs, wastewater concentration and flow rate influence the systems efficiency, with removal rates of organics ranging from 40% - 85%. For plants of 36,000PE to ensure adequate performance is achieved, multiple stage units may be required. In addition to offline contingency requirements, this process is not the most efficient use of available space – activated sludge process are more flexible in treating ranges of flows and loads, have removal efficiencies up to 95% and occupy significantly less area to achieve comparable effluent standards.
- Membrane Bioreactors (MBRs) – on the basis that while this treatment technology can achieve very stringent emissions standards and have a small footprint in comparison to other technologies, MBRs are a more advanced treatment technology that typically have relatively high capital and operating costs (including membrane cleaning and replacement), high energy costs (can be up to 30% higher than non-membrane technologies) and may require chemical additives (depending on the consistency of the influent to the works). MBRs require significant upstream preliminary processes which from experience can cause higher than normal cleaning and maintenance requirements. The technology was therefore considered overly complex and operationally risky with regards to the proposed development.

On the basis of the above, two technologies were carried forward for more detailed evaluation:

- Conventional activated sludge process;
  - Conventional aeration process including primary treatment; and
  - Extended aeration process.
- Sequencing batch reactor process.

A summary of these processes and the relevant considerations in the final process selection is provided in Sections 3.4.2.1 - 3.4.2.4.

### 3.4.2.1 Continuous Flow Processes

**Overview**

Two continuous flow processes were examined as potential treatment options namely, ‘Conventional treatment’ with a primary treatment stage and ‘Extended aeration’.

Continuous flow refers to a system in which each process has a dedicated function and each function is carried out on a continuous, sequential basis. Figure 3.6 illustrates the basic configuration of a conventional wastewater treatment process.

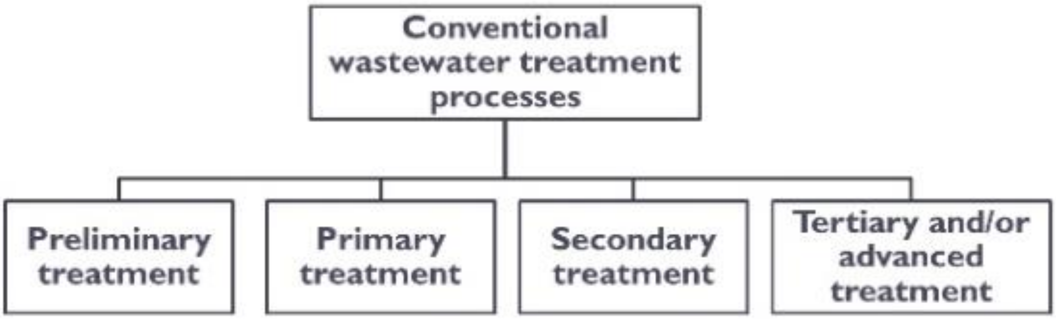


Figure 3.6: Basic configuration of a conventional wastewater treatment process

The preliminary treatment stage is to remove large residuals from the process (as described in **Section 3.4.3**). This stage typically includes screening and grit removal.

The primary settlement stage is used to reduce the organic and solids loads passed forward for biological treatment. This process produces a primary sludge, which has high microbial activity, is malodorous and requires thickening and stabilisation prior to disposal.

**Conventional treatment with a primary treatment**

The conventional activated sludge process is in effect a plug flow system where the primary effluent from the previous stage enters the aeration tank and travels through the tank at a constant rate to the point of discharge. The wastewater is aerated in the tank, in which micro-organisms metabolise the suspended and soluble organic matter. In the aeration stage, primary effluent mixes with return sludge from the secondary settlement stage providing a medium to reduce the organic load by up to 95%.

The treated wastewater then goes forward to final settlement. The final effluent is separated from the secondary sludge during final settlement with the secondary sludge being thickened and dewatered prior to being disposed off-site and the treated effluent going to tertiary treatment (if required) or discharged to the receiving waters.

The primary sludge (conventional) configuration was considered for the proposed development as this treatment is required in the event that anaerobic digestion (AD) be used as the sludge treatment process. AD uses primary and secondary sludges as feed for an anaerobic reactor, in turn generating a methane based biogas which can provide an energy source for the plant.

Given the proximal location of the WwTP to potential commercial and residential areas, the risk of odour generation from both treatment and transport of primary based sludges was considered high for this particular site and for this reason and from a cost perspective, this treatment option was not considered further.

**Extended aeration**

The extended aeration process similarly, is a continuous flow process with units dedicated to perform a specific function. One sludge type is produced by the extended aeration process, namely waste activated or secondary sludge. There is no primary settlement or primary sludge producing stage in the extended process.

Due to the specific functionality of each process unit additional structures and footprint are required when compared to the batching process which is reviewed in **Section 3.4.2.2**.

### 3.4.2.2 Sequencing Batch Reactor

A sequencing batch reactor (SBR) provides a comparable activated sludge process to the continuous flow options with an alternative configuration. SBRs gained popularity as a result of the lower footprint requirements when compared to continuous flow and conventional systems, therefore improving the effective capacity of a given area. SBRs perform all of the same functions as a continuous flow system with the following distinct differences:

- Tanks are used for multiple functions including filling, aeration and settlement avoiding the need to construct and operate multiple stages;
- There is generally no primary treatment stage; and
- There is no return pumping stage which reduces power demand for pumping.

The SBR is a fill and draw type reactor system that involves a single complete mix reactor in which all steps of the activated sludge process occur. For municipal wastewater treatment with a batch flow process, a minimum of 2 basins are required to allow one unit to be available for fill mode while the other goes through the react, settling and decanting sequences.

The SBR process provides a basic structure which can be developed into a number of innovative variants depending on specific site and treatment requirements. A number of innovative variations to the SBR process which are currently in use and may be further evaluated by the contractor during the detailed design stage include the Granular Sludge SBR (Nereda®), the Mixed Liquor Vacuum Degassing (MLVD) and the MBBR HYBAS™.

### 3.4.2.3 Process Selection

Of the two processes reviewed, SBR was selected as the preferred option for the proposed development. One of the main criteria used to determine the preferred solution is the treatment and handling of the sludges produced by both processes. In this regard, the SBR process is the preferred option producing only waste activated sludge which can be thickened and dewatered to 20% TDS as a minimum prior to transport.

In contrast, the conventional continuous flow process requires the removal of BOD and TSS in a primary settlement stage. Primary sludge requires a separate thickening process and cannot be dewatered without blending or digestion. In addition, the odours associated with the production of primary sludge constitute a risk in relation to compliance with contract performance specifications for environmental emissions. Given the location of the proposed site and proximity to receptors, it is preferable to provide a solution that does not generate primary sludge on site.

Furthermore, selection of the SBR process presents the following benefits:

- Smaller footprint in comparison to conventional activated sludge process;
- High degree of operational flexibility with respect to effluent quality and dissolved oxygen control;
- Greater offline flexibility with respect to effluent quality and dissolved oxygen control;
- Effluent quality meets anticipated nitrogen requirements for marine discharge;
- No primary treatment stage required;
- No separate final clarification or return aerated sludge stage required;
- Proven treatment process capacity upgrades do not require significant modification or interruption to the existing process;
- High degree of automation which reduces operational staff requirements;
- Lower initial capital cost; and
- Lower power consumption per capita than conventional process.

The main disadvantage of selecting an SBR process is the level of complexity of the process control automation. Specific training will be required for operators to ensure that the functionality and limitations of the process is understood. However, the procurement strategy will ensure that only suitably experienced and trained personnel will operate the plant.

Following selection of the secondary treatment process, the other key treatment processes were considered as outlined in Sections 3.4.2.4.

#### 3.4.2.4 Inlet Works (Preliminary Treatment)

Irish Water stipulates the accepted inlet works arrangement for treatment works in excess of 25,000PE (Refer to Figure 3.7).

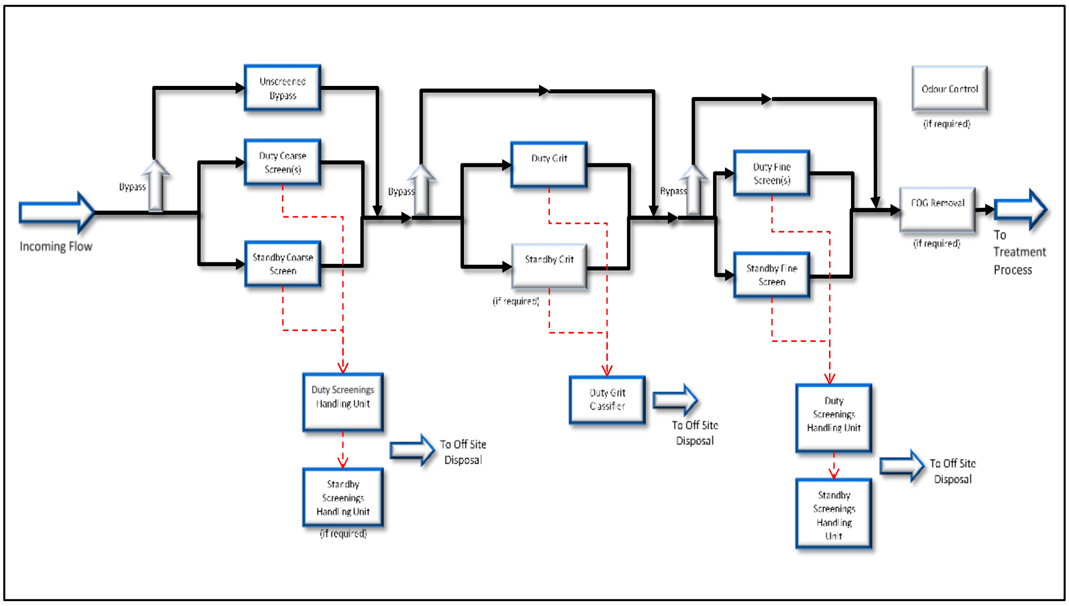


Figure 3.7: 25,000+ PE Inlet Works Arrangement (Source: Irish Water[15])

At a minimum, all process units identified in Figure 3.7 are required for the proposed development. The inlet works therefore, must include:

- Screenings channels – coarse (25mm) and fine (6mm) screens; and
- Aerated grit chamber.

The contractor will have some flexibility to consider the most appropriate configuration and equipment choices to meet the required Irish Water specifications.

### 3.4.3 Storm Water Management

Irish Water design standards[15] require that, for plants >25000PE the design basis for the management of storm flows shall be for two hours retention for low significance discharges to coastal/transitional waters. The design of the stormwater management system was on this basis and therefore there are no reasonable alternatives in this regard.

A storm tank will be provided with two operational cells. The storm tank cells will receive screened wastewater from the inlet works. The first operational cell will act as a first flush cell, capturing heavy solids. The function of the second operational cell is to capture flows from a sustained rainfall event. Following the rainfall event, the contents of the stormwater tanks will be returned for full treatment through the WwTP. If the capacity of the stormwater tanks is exceeded, excess flows will discharge by gravity through the SWO to the Irish Sea.

[15] Irish Water (2016) Technical Standard: Inlet Works & Stormwater Treatment (Wastewater). Document No: IW-TEC-700-99-02. Revision 1.0 (March 2016)

### 3.4.4 Odour Control and Vent Stack

The existing stack on the WwTP site was considered at an early stage for re-use in the proposed development. However, its current location did not facilitate its use. It was therefore decided to proceed with the design of new stacks for the odour control/ventilation of the buildings.

The location of the vent stack at the Inlet Works building was chosen based on the location of the OCU to keep duct lengths to a minimum and to reduce the visibility of the vent stack structure from the surrounding area. The location of the vent stack at the Process building was chosen to conceal the stack from view from the surrounding lands.

The height of the vent stacks at the WwTP were chosen to be 1m above the building height to allow for effective dispersion of emissions and to minimise the effect of building downwash.

## 3.5 Options considered during Design Development

### 3.5.1 Architectural Design Alternatives

#### 3.5.1.1 WwTP Site Layout

An iterative process was undertaken to evaluate and establish the proposed layout on the Old Wallboard site at Ferrybank. The site and its physical characteristics as well as the local planning policy context were considered during the evaluation of various strategies for the site layout and how this would inform the architecture.

The site, between the rock revetment adjoining the Irish Sea and the Avoca River, has long been associated with industry in Arklow. Further, the existing structures (i.e. the remains of the Old Wallboard factory – a tall and long structure) are highly visible in the broader landscape of Arklow town. This context of maritime industry has reduced in recent years but remains a strong presence in the materiality and forms of surrounding buildings.

The legislative context is set out in both the current Arklow LAP and the preceding Arklow Town and Environs Development Plan 2011 – 2017 (which was in place at the commencement of the design development process). Both of these documents define the land use zoning of the WwTP site as ‘WZ – Waterfront’. This zoning establishes a clear aspiration for the area to diversify to mixed use development including residential, commercial and amenity uses and states a desire for a denser configuration of built structures – with a minimum of 3-4 stories indicated for developments in this area. The current plan (2018-2024) also specifically states the objective:

*“To facilitate the provision of a new Waste Water Treatment Plant with an appropriate high quality architectural design/appearance.”*

During the design development four approaches were considered in terms of the potential layout of the WwTP and these are described in the following sections.

## Distributed Design

The distributed design involves laying out the plant in a conventional approach that is regularly adopted for WwTP's of this nature. As illustrated in **Figure 3.1 in Volume 3**, all operational aspects of the plant would be located in discrete single storey structures, with yards and roads between the structures. A summary of the advantages and disadvantages of the distributed design option is provided in Table 3.3.

Table 3.3: Advantages and disadvantages of the distributed design option

| **Advantages** | **Disadvantages** |
|---|---|
| Low Capital Cost | The low lying and distributed pattern of discrete structures would reinforce the existing pattern of ad hoc industrial structures which forms the immediate context. This strategy would not comply with Wicklow County Council's aspirations to transition to a more urban location, incorporating mixed use developments of some scale on adjacent sites, and their specific requirement for a 'high quality architectural approach'.<br><br>These issues were highlighted and emphasised during pre-planning meetings with Wicklow County Council. |
| Low lying buildings would not be visible from the wider context | The distributed approach would present a landscape of tanks, pipe runs and yards which would not positively contribute to the visual environment and landscape character |
| Easy to access for maintenance and adjustment, replacement and/or upgrades | This approach maximises the footprint of the building structures, therefore the entirety of the site would be required with minimal opportunity for landscaping or for any areas being handed over to the public as amenity use. This would limit opportunities for community gain. |
| | The distributed approach would result in a greater need for pumping leading to higher operational costs as each stage of the treatment process would be on the same level. |
| | This approach is not considered to comply with the zoning objective of the Waste Water Treatment Plant having 'an appropriate high quality architectural design/appearance.' |

| Advantages | Disadvantages |
|---|---|
| | The distributed approach would result in a landscape of tanks, pipe runs and yards around the buildings that would not positively contribute to the visual environment and landscape character. In particular this would be visible from adjoining sites were they to be developed, curtailing residential development. |

The distributed design option for site layout was therefore considered as being inappropriate to the site due to its inability to respond to the legal context as set out in the Arklow LAPs. In particular this approach would present a maximum footprint with minimal opportunity for landscaping, amenity uses or a high quality design approach. It would also present a risk of not complying with the desired land use planning objectives (including on surrounding lands), and thereby restricting the development of this part of the town in the medium to long term.

### Stacked Design

The stacked design is the opposite of the distributed approach. As illustrated in **Figure 3.2 in Volume 3**, all the relevant functions would be consolidated into a single structure, in effect placing all the operational parts of the WwTP into a building, the façade of which would then be modelled to present a strong architectural presence to the surrounding area. A summary of the advantages and disadvantages of the stacked design option is provided in Table 3.4.

Table 3.4: Advantages and disadvantages of the stacked design option

| Advantages | Disadvantages |
|---|---|
| Consolidating the plant into a single building would present the WwTP as an urban structure rather than a distributed industrial process and would free up areas of the site that could be used for public amenity. | Once all aspects of the plant were accurately sized the WwTP structure would be up to 26m tall, i.e. the equivalent of 7 stories. |
| A more compact structure would present greater potential for the extent of landscaping on site | There were high capital costs associated with this option |
| Reduced pumping requirement between each stage of treatment processes due to use of gravity. | Operational difficulties associated with access for maintenance and adjustment, replacement and/or upgrades |
| | The building mass would mean that a hard landscaping (for operational traffic etc.) would need to surround the structure on all four sides, thus making this area difficult to screen |

| Advantages | Disadvantages |
| --- | --- |
| | Height and bulk of the form and massing of the building structures would be inappropriate in scale to the context of Arklow’s townscape |

The stacked design option was therefore considered as being inappropriate to the site due to the excessive height and increased visibility of the structure. However, the idea of treating the plant as a building, not as an industrial process alone was considered worthy of incorporating into any future approach if possible.

### Linear Design

The linear design approach would see the various operational aspects of the WwTP being placed in a single long structure (refer to **Figure 3.3 in Volume 3**). This option is similar to the distributed design option but it would provide a more compact form and similar to the stacked design as the linear form is thought of as a discrete structure, with a façade that would screen all relevant aspects of the WwTP.

A summary of the advantages and disadvantages of the linear design option is provided in Table 3.5.

Table 3.5: Advantages and disadvantages of the linear design option

| Advantages | Disadvantages |
| --- | --- |
| Low Capital Cost (for architectural aspects) | The low lying and distributed pattern of discrete structures would reinforce the existing pattern of ad hoc industrial structures which forms the immediate context. This strategy would not comply with Wicklow County Council’s aspirations to transition to a more urban location, incorporating mixed use developments of some scale on adjacent sites, and their specific requirement for a ‘high quality architectural approach’. |
| Low lying buildings would not be visible from the wider context | The linear form would not allow yard areas to be concealed by the building mass |
| Easy to access for maintenance and adjustment, replacement and/or upgrades | During the design development, it was established that the linear form would not fit on the WwTP site |

The linear design option was therefore considered as being inappropriate to the site as it produced a treatment process design that could not be contained on the WwTP site.

### Stacked and Linear

The stacked and linear approach seeks to combine the best aspects of the other reasonable alternatives that were considered, (refer to **Figure 3.4 in Volume 3**). In this approach the inlet works would be stacked over the stormwater storage tanks. SBR functions, electrical areas, workshops and a PV solar farm would be located on a separate discrete structure, as would the sludge tanks and odour units. The three building structures would be placed so that they mask the primary operational yard from view in the surrounding area. Ancillary structures including the administration building would also be placed as a gate lodge and control point on Mill Road. A summary of the advantages and disadvantages of the stacked and linear design option is provided in Table 3.6.

Table 3.6: Advantages and disadvantages of the stacked and linear design option

| **Advantages** | **Disadvantages** |
|---|---|
| The Inlet Works and Process building structures present the WwTP as an urban structure rather than a distributed industrial process. These will be less visible on the site than the existing wallboard plant, but will still present the plant as a piece of civic infrastructure. | This option carries a higher capital cost than other options |
| Easy to access for maintenance and adjustment, replacement and/or upgrades | |
| A more compact footprint would accommodate provision for a landscaped area that could be handed over to Wicklow County Council and for much of the edges of the site itself to be landscaped. | |
| Building forms can mask operational yards from view. | |
| Stacked approach to the inlet works structure would reduce pumping requirements between prelminary and secondary treatment processes (located in the Inlet Works and Process buildings). | |

On consideration, the stacked and linear design option was identified as the most advantageous option for the site layout. It presents a strong response to the land use zoning objectives of the Arklow LAPs, while also facilitating a more sustainable design for operation of the plant once constructed. This design option has been adopted during the design development and is described in further detail in **Chapter 4.**

#### 3.5.1.2 Landscape

The landscape strategy was developed as part of the design development. The approach to landscaping that has been taken was governed by the ambient conditions at the WwTP site, including the level of contamination in the soil (refer to **Section 14.3** for further detail) and the associated requirement to seal the underlying contamination and provide planting with minimal root depth.

The design for landscaping was therefore selected on the basis of current information on contamination at the WwTP as described in **Chapters 7 - 19**. This context limits the range of possible options as regards landscaping. During the design development two options were explored:

- Not providing any landscaping; and
- Providing landscaping.

**No Landscaping**

In this approach, the areas surrounding the building would not be landscaped and no planting would be undertaken at the WwTP site. Hard standing would surround the structures and the site would be secured with palisade fencing. A summary of the advantages and disadvantages of not landscaping is provided in Table 3.7.

Table 3.7: Advantages and disadvantages of not landscaping

| Advantages | Disadvantages |
|---|---|
| Lower capital cost | No softening of the interface between the built structures and the surrounding public realm. |
| Low maintenance | No contribution to the public realm. |
| | The need for landscaping, integrated with the design was emphasised in pre-planning meetings with Wicklow County Council |

On consideration, this option would not comply with the land use zoning objectives as outlined in the Arklow LAPs. It was therefore decided that an integrated landscape design would be developed as part of the proposed development.

**Integrated landscaping (including planting)**

This approach extends to planting, hard landscaping details and the making of boundaries. This more holistic approach was developed iteratively throughout the design development process.

Specifically, this approach included consultation with the lead ecologist to determine an appropriate selection of planting for the WwTP site.

The selection of planting is based on what native species are already doing well on the Old Wallboard site at Ferrybank (in spite of the ambient conditions) and developing an approach to landscaping on this basis. Where appropriate, species selection was undertaken to protect, and where practicable enhance, biodiversity in accordance with objective NH12 of the Wicklow County Development Plan.

Given the proposed stacked and linear arrangement, landscaping around the four buildings would follow a basic grid, derived from the primary geometries of the site. This grid would include hard landscaping between the buildings in addition to soft landscaping that would be planted around the site perimeter. A summary of the advantages and disadvantages of integrated landscaping is provided in Table 3.8.

Table 3.8: Advantages and disadvantages of integrated landscaping (including native planting)

| Advantages | Disadvantages |
|---|---|
| Uses planting species which are already growing well on the site. | Higher capital costs |
| Low maintenance | |
| Makes a strong contribution to the public realm in line with LAP and desires expressed by Wicklow CoCo in preplanning meetings. | |
| Extends habitats | |

This approach was adopted as the preferred strategy for the site as it complies with the land use zoning objectives in the Arklow LAP and the biodiversity objectives of the Wicklow County Development Plan. This design option has been adopted during the design development and is described in further detail in **Chapter 4**.

#### 3.5.1.3 WwTP Façade

Once the site layout was established, a further iterative process was undertaken to identify, and determine the appropriate façades for the WwTP buildings.

Early in the process, particularly with regard to the Inlet Works building it became evident that significant numbers of loading bays, hoist locations and areas for pipework transfer would be required. In thinking about how to make a high quality architectural response, it was evident that there was little scope for design treatments beyond that determined by process and off the shelf responses.

In thinking about this through the iterative design process, it was determined that the façade would be kept away from the operational skin of the building structure, so that there was a gap between the façade and the actual operational skin behind.

This meant that loading bays, craneage points, fire escapes and localised pipe runs would be masked and not visible from the surrounding area. The outer façade would also be off the ground so that it forms a canopy to trucks making deliveries and/or removing skips from the WwTP.

Further, consideration was given to the assumption that the WwTP may evolve to become a civic structure and positive part of the local landscape, therefore cognisance has been given to approaches rooted in the constructional logics of the plant, the site and its history.

During the design development four façade typologies were considered and these are described in the following sections.

### In-situ concrete

An in-situ concrete façade would provide a large, cantilevering structure of concrete cast in situ. A summary of the advantages and disadvantages of the in-situ concrete façade is provided in Table 3.9.

Table 3.9: Advantages and disadvantages of the in-situ concrete facade

| **Advantages** | **Disadvantages** |
|---|---|
| Concrete is a common material in maritime industrial settings, and weathers well with minimal maintenance. | High Capital Cost |
| Robust, resilient material that is difficult to damage. | Difficult to guarantee quality of concrete in a design build and operate context |
| In-situ concrete is an expected part of the construction methodology elsewhere. | Concrete surface is scaleless and abstract when viewed in the distance and up close |
| | Difficult to construct |
| | Relatively high embodied energy / carbon |

The in-situ concrete option was therefore considered as being inappropriate due to the complexities involved in its construction, its inability to respond to human scale and its higher carbon content. However, the aspiration for a robust, low maintenance material was carried forward through the design development.

### Pre-cast concrete

The pre-cast concrete façade would provide a frame in steel or concrete, with a screen made of precast concrete slats. This façade would be porous to light and air. A summary of the advantages and disadvantages of the pre-cast concrete façade is provided in Table 3.10.

Table 3.10: Advantages and disadvantages of the pre-cast concrete facade

| Advantages | Disadvantages |
|---|---|
| Concrete is a common material in maritime industrial settings, and weathers well with minimal maintenance | Simple orthogonal form does not work well when viewed at a distance |
| Robust, resilient material that is difficult to damage | High weight façade |
| Pre-cast concrete is an expected part of the construction methodology elsewhere | |
| Porous nature of the façade means that the façade would glow at night time with a diffused light from within | |
| Modular approach means that the façade would present a rhythm and scale which would respond to proximity | |
| Modular approach is easier to construct than in situ concrete | |

Given the high weight of this façade and the fact that it does not work well when viewed at a distance, the pre-cast concrete façade was considered as being inappropriate. However, the quality of the finish whereby the façade would have a different quality at night was considered as an aspiration that should be carried forward throughout the design development.

### Timber

The timber façade would provide a frame of timber and steel surrounded by a façade of solid oak that would be allowed to weather naturally. This would be detailed such that it is made in vertical lifts which step out to protect the layer below. A summary of the advantages and disadvantages of the timber façade is provided in Table 3.11.

Table 3.11: Advantages and disadvantages of the timber façade

| Advantages | Disadvantages |
|---|---|
| Modular approach is easier to construct. | Large quantity of timber required – difficult to ensure quality and consistency in a DBO context. |
| Modular approach means that the façade would present a rhythm and scale which would respond to proximity. | Leaving the oak to weather naturally will present a degree of risk in the perception of the building to locals – this can be read as being a finish which has not been maintained. It was decided that this was not appropriate to such a potentially significant element of the civic realm. |
| Low maintenance as oak performs well in saline environments. | Specialist tradespeople not ordinarily involved in the construction process would be required |

For the reasons stated above, the timber façade was considered as being inappropriate as the building needed to form a role as a piece of civic infrastructure, and therefore the land use objective of the Arklow LAP around high quality architectural design would not be achieved. However, the quality of this approach whereby the façade would have a different quality in rain than when dry was considered as an aspiration that should be carried forward throughout the design development.

### Fibre Cement

The fibre cement façade would provide a frame in steel and aluminium with a series of oversized fibre cement louvres that would project out from the building. The gaps in between would be permeable to light and air whilst the louvres would be scaled to present a strong silhouette to the building when viewed from a distance, and the scale of each lift means that it responds to human scale when viewed close to. A summary of the advantages of the fibre cement façade is provided in Table 3.12.

Table 3.12: Advantages and disadvantages of the fibre cement façade

| Advantages | Disadvantages |
|---|---|
| Modular approach is easier to construct. | The approach uses a relatively standard material and achieves its aesthetic qualities through a very precise level of detail and specification. This would therefore require precise detailing and construction. |
| Modular approach means that the façade would present a rhythm and scale which would respond to proximity. | |
| Layering of each panel would mean that the façade would present a different appearance in rain than when dry – the wet area would not collect on the upper level of each panel, but would on the lower giving a rich quality to the building responding to the weather. | |
| Porous nature of the façade means that the façade would glow at night time with a diffused light from within. | |
| Robust, and difficult to damage. | |
| Lightweight and constructed with easily sourced and specified materials offering a large degree of control for maintenance purposes. | |
| Fibre cement is appropriate to an industrial context, and references the previous structures on the site. At the same time the pronounced horizontal lines generated by the louvres work well with the series of horizontal lines presented by the maritime context (river, quay side, revetment, horizon) | |
| Presents a subtle but clear silhouette when viewed at a distance allowing the structure become a clear civic structure in the broader landscape. | |

On balance, this approach was considered the most appropriate as it complied with the land use objectives of the Arklow LAP and the aspiration to make the plant a piece of civic infrastructure. In order to counteract the disadvantage regarding the precise detailing, the following steps have been taken:

- The design details have been developed in detail with structural engineers and other consultant inputs to prove its detailing and buildability;
- The design drawings indicate detailed façade sections at 1:33 and a detailed model at 1:50 has been developed giving a precise description of the façade and thus certainty as to the eventual appearance of this element; and
- This element will not be subject to the design / build element of the eventual tender documentation and will be retained under the control of the client and their design representatives to ensure that the precise details are carried through.

The fibre cement façade was considered the most advantageous façade and this design option has been adopted during the design development and is described in further detail in **Chapter 4**.

**Design development of preferred option and resolution.**

The approach to the architectural design went through detailed design development including multiple iterations and adjustments to arrive at the proposed development as described in **Chapter 4**. These iterations were explored in physical model, drawing and renderings, and where appropriate inputs were sought from Wicklow County Council, An Bord Pleanála, and the local community during the consultation exercises as described in **Section 1.5 of Chapter 1.**

Consultation throughout the design development resulted in further updates including:

- Making the panels more pronounced such that the special nature of the building can be more clearly articulated;
- Adjustments to how the façade terminates against the sky to make a cornice which gives a clear shadow at this point; and
- Adjustments to the scale, rhythm and modulation of the façade.

The finished design therefore presents a robust approach that is grounded in the logics of the WwTP, the historical context of the Old Wallboard site at Ferrybank and future growth as described in planning policy. The architectural design represents a new civic structure that could set the tone for the future evolution of this part of Arklow town and will facilitate future developments on adjoining lands.

### 3.5.2 Infrastructure Design Alternatives

#### 3.5.2.1 Sewers

**General**

The overall design for the proposed network is a gravity sewer discharging directly to the WwTP at the Old Wallboard site at Ferrybank. This solution avoids the need for any intermediate pumping at a separate ‘main-lift’ pumping station with associated transfer pipelines and additional capital and operational costs (including in particular associated energy costs).

The pipe sizing for the sewers is based on hydraulic modelling of the sewer network using Infoworks CS. The hydraulic model has been run for the preferred solution and models both the current state of the network and the expected network for a 50 year design horizon including all anticipated upgrades and extensions.

The sizing is based on restricting the number of overflow events at the SWOs whilst providing appropriate stormwater storage at the Alps and WwTP in conjunction with online storage in the network pipes.

**Interceptor Sewer under Arklow Bridge**

The proposed interceptor sewer is required to cross Arklow Bridge on the south side in an area with limited working space and with a large number of services present, most significantly a 355mm diameter gas main.

Three design options were considered:

- Option 1 - lay the pipe on land between the bridge abutment and the existing buildings.
- Option 2 - lay the pipe within the river through the existing arch with the channel edge moved out to accommodate the pipe.
- Option 3 - tunnel at sufficient depth to pass under all obstacles.

<u>Option 1</u>

Option 1 involves laying the pipe by open cut methods from a manhole upstream of the bridge to a manhole in South Quay downstream of the bridge. The pipe would be c. 750mm diameter and depths would vary from approximately 2m to approximately 4m. Diversion of the existing gas main is not expected to be feasible, hence the sewer would need to be laid with adequate clearance from this gas main.

Additionally, given that Arklow Bridge provides the only river crossing in Arklow town, a full road closure of Bridge Street is not expected to be feasible because of the absence of alternative access routes. Even partial road closures are likely only to be permitted at night given the potential negative impacts on local residents that night working would bring. A summary of the advantages and disadvantages for Option 1 is available in Table 3.13.

Table 3.13: Advantages and disadvantages of Option 1 for the sewers

| Advantages | Disadvantages |
|---|---|
| No impact on river flows | Maximum traffic impact |
| No impact on upstream and downstream works | Maximum impact on residents as night working likely |
| | Maximum risk of structural damage to buildings |
| | H&S risk associated with gas main |
| | Risk to other services |
| | Requires access to private property |
| | Difficult to build |

Option 2

Option 2 involves creating a new river wall to outside the existing wall through the bridge arch and laying the pipe in the section thus created.

The design will also necessitate working within the river channel with associated temporary works required. Depending on the exact details of the abutment foundation, some underpinning or other protection may be required.

Due to the restricted clearances under the bridge, the use of normal sheet piling techniques to create the new channel wall, as proposed in other sections, would not be possible and a specific design solution is required. There is a moderate risk of damage to the bridge itself but this should be avoidable with suitable design and construction techniques. A summary of the advantages and disadvantages for Option 2 is available in Table 3.14.

Table 3.14: Advantages and disadvantages of Option 2 for the sewers

| Advantages | Disadvantages |
|---|---|
| Minimum traffic impact | Possible impact on river flow and flood defence scheme |
| Minimum impact on residents as night working unlikely | Agreement required with OPW |
| Minimum risk of structural damage to buildings | Foreshore consent likely required |

| | |
|---|---|
| Minimum H&S risk associated with gas main | |
| Minimum risk to other services | |
| No access to private property required | |
| No impact on upstream and downstream works | |

Option 3

Option 3 is the laying of the pipe in a tunnel from a shaft upstream of the bridge to a shaft downstream. This would require the construction of a c. 5m diameter shaft either outside the existing quay walls or breaching the quay wall. To avoid the existing gas main, the downstream shaft would have to be located outside the existing quay wall.

The main disadvantage of this option is the impact on channel flow capacity, both during construction and thereafter. Permanent intrusion into the river channel would be required or the pipe would have to be positioned low enough to allow a side access below channel level.

To allow tunnelling, the pipe would also need to be lower than the expected channel depth for the proposed Arklow Flood Relief Scheme with a consequent knock on effect on downstream levels. It should be noted that there are also five existing sewers at high level to be intercepted between the Arklow Bridge and South Green, over a distance of approximately 250m.

Tunnelling under the bridge abutment is not expected to be permissible due to the need to avoid damage to it and the lack of information about the abutment and its foundations. Tunnelling generally can pose a small risk to surrounding buildings due to subsidence above the tunnel but this is expected to be minimal for all structures other than Arklow Bridge, with a moderate risk for the bridge abutment with suitable design and construction techniques.

A summary of the advantages and disadvantages for Option 3 is available in Table 3.15.

Table 3.15: Advantages and disadvantages of Option 3 for the sewers

| **Advantages** | **Disadvantages** |
|---|---|
| Minimum traffic impact | Significant impact on downstream levels |
| Minimum impact on residents as night working unlikely | Some impact on river channel |
| Minimum risk of structural damage to buildings | |

| Advantages | Disadvantages |
|---|---|
| Minimum H&S risk associated with gas main | |
| Minimum risk to other services | |
| No access to private property required | |

Conclusion

Option 3 was considered to offer limited advantages over Option 2 and significant disadvantages in terms of requiring the levels downstream to be lowered. On this basis Option 3 was disregarded.

Option 1 was considered to pose a number of issues around buildability and would have the most significant impact on traffic, local residents and the highest risk of damage to existing buildings and services. Option 2 minimises these risks, hence is preferred to Option 1.

Option 2 (i.e. laying the pipe through the bridge) was therefore selected as the preferred option for this section of the sewer.

**River Crossing**

Three design options for the river crossing were considered:

- Gravity;
- Inverted siphon; and
- Pumped.

Pumped crossing

The pumped crossing was ruled out as it offered no benefits and would be more expensive to construct and operate in comparison to the other two options.

Inverted siphon

The inverted siphon offered an advantage over the gravity crossing in that its outlet would be at a higher level than the siphon's lowest point, thus reducing excavation depths on sections of the sewer from the outlet to the WwTP.

However, inverted siphons require ongoing maintenance and are often associated with odour problems. The latter was considered particularly problematic, given that the area is zoned as a Waterfront Development zone and can be expected to contain residential and commercial development in the future. In addition, the siphon would act as a potential restriction on sewer flow, necessitating protective measures upstream to prevent surcharging.

Gravity

It was concluded that the advantages offered by the crossing operating under gravity outweighed the disadvantages, hence the gravity design was chosen as the preferred option.

The sizing of the river crossing was determined on the basis of modelling that has shown that for a gravity sewer, a c. 1500mm diameter pipeline will be required for a single pipe. A twin pipe solution was rejected as it would result in higher construction costs for a relatively small reduction in excavation depth.

To provide a minimum 3m clearance which is required below the dredge level at the crossing point, shaft depths of approximately 12m each side of the river will be required to facilitate construction.

The length of the river crossing is approximately 120m. The flows from the southern interceptor sewer will flow through the river crossing by gravity, joining the northern inceptor sewer and being discharged to the proposed WwTP at the Old Wallboard site at Ferrybank.

#### 3.5.2.2 Long Sea Outfall and SWO at WwTP

The design requirements of the long sea outfall and SWO has been dictated by the hydraulic profile of the proposed development through the collection network and the WwTP, as well as the design specifications required by Irish Water in terms of treatment throughput, stormwater storage and network design requirements in addition to required discharge design standards.

The size and vertical profile of the long sea outfall and SWO has therefore been dictated by the process levels on the WwTP site, ground levels, the revetment and sea levels.

#### 3.5.2.3 Revetment

The existing revetment in the vicinity of the Old Wallboard site at Ferrybank was examined in the context of the proposed development. It was deemed that the height of the revetment was not adequate to provide the required protection to the WwTP and it was also clear that the revetment was not in good condition, having been damaged by previous storm events. It was therefore considered necessary to rebuild and raise the height of the revetment, in the vicinity of the WwTP site.

Initially, the provision of a walkway along the crest of the revetment was considered as an opportunity to provide community gain as part of the proposed development. During the design development however, the provision of this walkway was omitted for health and safety considerations. This decision was based on the recommendations in industry guidance[16,17] with regard to tolerable overtopping with respect to pedestrians using the walkway.

[16] EurOtop (2016) Manual on wave overtopping of sea defences and related structures Second Edition, Pre-release.
[17] USACE (2011) Coastal Engineering Manual, Chapter 5, Part VI, September 2011.

Specifically, EurOtop[16] outlines safe overtopping volume limits for pedestrians behind a sea defence structure and states that:

*"A few general conclusions can be made on tolerable overtopping with respect to people. If the wave height exceeds about 3m it may be dangerous to allow people on any structure during wave overtopping."*

The predicted wave height from the modelling undertaken in May 2018 was 3m for the 1 in 500-year event. Whilst the wave height aligns with the allowable overtopping limit (i.e. wave height of 3m), the walkway was still deemed a health and safety risk for the following reasons:

- This estimated overtopping volume is for the area behind the revetment rather than at the crest of the revetment, therefore it is not a true indication of the safety of a walkway on top of the revetment. Due to the space restrictions between the revetment and the WwTP buildings, the placement of a walkway behind the revetment was not deemed a viable option.
- The tie-in sections of the revetment are not up to design standards[16,18]. Given that there is no existing walkway at these locations, a new walkway would be required at these locations. However, the revetment outside of the planning boundary does not meet design standards[16,18] and therefore, there is a risk that overtopping above the recommended limit may occur and pedestrian safety could not be guaranteed at these locations.
- During the design development damage to the existing walkway occurred along Arklow North Beach during Storm Ophelia in October 2017 (Refer to Figure 3.8). An entire stretch of pavement was dislodged by the force of wave action which highlights the risk associated with such walkways.

[18] ICE (2007) The Rock Manual - The use of rock in hydraulic engineering (2nd edition).

Figure 3.8: Dislodgement of pavement observed near the site after Storm Ophelia in 2017

#### 3.5.2.4 Civil Structures and Site Remediation

The following considerations were taken into account during the design development of the civil structures for the buildings at the WwTP site.

**Foundation type**

The foundation type adopted for each of the buildings has been determined by considering the geotechnical load carrying capacity of the soil on site and minimising the extent of contaminated land to be excavated.

Two viable foundation schemes were identified for the proposed development:

- A shallow foundation scheme whereby isolated pads would be located below columns with ground bearing slab for the Inlet works and raft foundation provided for the Process building and Sludge tank enclosure; and
- A system of piles, pile caps and ground beams was investigated for the structures to minimise the extent of contaminated land to be excavated.

The piled system would reduce the extent of contaminated material to be excavated. However, from a preliminary assessment it appears that the potential saving in excavation would not outweigh the additional cost and complexity required for a piled foundation solution.

A piled foundation system is something that may be explored by the contractor during the detailed design. The EIAR has considered and detailed both options in **Chapter 4**, to ensure the reasonable worst case is assessed herein.

**Choice of structural material**

Steel and concrete have been considered as alternative materials for the structural frame for the Inlet Works and Process buildings. The structural grid system is dependent on the process layout which required relatively long spans between support locations.

Steel generally provides greater efficiency achieving larger spans with reduced structural depth in comparison to concrete. Further, an equivalent concrete framed building would likely be heavier, resulting in bigger foundations and potentially deeper excavations. Hence, a steel frame was selected for the structural frame for the proposed buildings.

Nonetheless, a concrete framed structure may provide other financial, programme related or operational (maintenance) benefits that the Contractor might wish to explore during their development of the detailed design and both have been considered in this EIAR.

#### 3.5.2.5 MEP

A number of options for mechanical, electrical and plumbing design in the WwTP have been considered with cognisance of energy demand and efficiency.

**PV Installation**

The following alternatives were considered in relation to the installation of PV panels:

- ‘Do-nothing’, i.e. do not install PV panels.
- PV installation on roof of Inlet Works Building; and
- PV installation on the roof of the Process building.

The WwTP would have significant continuous usage of electrical energy, therefore omission of the PV panels was not considered to be a feasible option from an energy efficiency perspective. The inclusion of the PV installation would reduce annual energy usage from the national electricity grid, reduce operational energy costs and improve energy efficiency of the proposed development.

The roof of the Inlet Works building was initially selected to install PV panels, however this was rejected as the PV panels would increase the height of the Inlet Works building which would then exceed the maximum desired building height defined by Wicklow County Council during consultation.

The roof of the Process building was therefore chosen as the location of the PV installation because the roof of the building would remain within the allowable height limits with the inclusion of the PV installation thereon. This is discussed in further detail in **Chapter 4.**

**Standby Power**

The following alternatives were considered:

- ‘Do-nothing’, i.e. no backup power.
- Uninterruptable Power System (UPS) power supply; and
- Diesel generator.

The continued operation of the WwTP is of high importance and the exclusion of an alternative power supply would render the WwTP non-operational in the event of a power outage. The loss of power would prevent and disrupt pumping activities and thus overall operability. This was deemed not feasible on this basis.

UPS provide power supply for a pre-defined period before being required to be recharged. The UPS power supply would therefore not be suitable for providing long term backup power at this scale, hence an alternative technology is required.

For this reason, a diesel generator has been proposed as an alternative power supply to be used in the event of a loss in utility supply. Diesel generators have been proven to be a reliable backup power source for various types of facilities and for various lengths of time, from hours to days and are therefore provided as part of the proposed development as described in **Chapter 4**.

**HVAC Installations**

<u>Overview</u>

The requirement to either naturally ventilate or mechanically ventilate the buildings on the WwTP site was reviewed against their functional and operational use on a building by building basis and on a space by space basis. Consideration was specifically given to the expected activities and occupation within each building to determine their classification as buildings or otherwise with respect to their compliance with the Building Regulations (TGD Part L Amendment) Regulations 2011. Given the regulatory requirements, there were no reasonable alternatives and on this basis, the finalised HVAC strategy for the proposed development has been determined as described in the following sections.

<u>Inlet Works building</u>

The Inlet Works building (which also houses the sludge thickening and dewatering equipment, polymer makeup units, sludge and solids residuals skips and stormwater storage tanks) has been determined to be a building that is not designed to be heated to temperatures for human occupancy. The Inlet Works building would be used solely to enable the inspection, repair and maintenance of the equipment installed therein. Thus, any heating provision would only be for maintaining a temperature within relevant spaces such that the formation of condensation and frost inside the building is prevented.

Any foul air generated by the initial stages of the treatment process itself or within some of the spaces associated with these initial stages of the treatment process would be extracted by an Odour Control (OC) system and discharged to atmosphere via the vent stack.

On this basis general ventilation only, as required, would be provided via an Air Handling Unit and / or external louvres to provide makeup air as necessary to these spaces.

Process building

The Process building has been determined to be a building that is not designed to be heated to temperatures for human occupancy. Similarly, the Process building would be used solely to enable the inspection, repair and maintenance of the equipment installed therein. Thus, any heating provision would only be for maintaining a temperature within relevant spaces such that the formation of condensation and frost inside the building is prevented.

Mechanical ventilation would be provided to expel the stale air above the Process tanks. This air would be discharged to atmosphere via an extract fan installation and the associated vent stack. External louvres would be provided for the provision of the required make-up air should the extent of air infiltration into the building be deemed insufficient.

Administration building

The Administration building has been determined to be a building that requires mechanically ventilation and thus would be provided by a dedicated Air Handling Unit for this purpose along with a sanitary accommodation extract fan system.

The administration building would therefore be a fully air-conditioned environment in order to provide a secure and comfortable working environment for operational staff.

Sludge Tank Enclosure

The Sludge Tank Enclosure will have no roof and thus will be a naturally ventilated structure rather than an enclosed building with a roof structure, with the sludge tanks therein sealed and connected to the odour control system. Thus, there is no need for any HVAC installations.

## 3.6 Integrated Scheme

The Office of Public Works is responsible for flood relief schemes and, together with Wicklow County Council is proposing a flood relief scheme for Arklow town (as described in **Section 2.6.7 in Chapter 2**). As outlined in **Section 1.5.3 in Chapter 1**, Irish Water has liaised with the Office of Public Works and Wicklow County Council to finalise how the design and construction of both projects along the Avoca River can work together and how the two schemes can be integrated as much as possible, in an effort to ensure that disruption to Arklow town is minimised.

Based on the current best available information, it would appear that the programme for the proposed Arklow Flood Relief Scheme is running behind that of the proposed development and consequently the detailed design of the proposed Arklow Flood Relief Scheme has not progressed to a stage that would allow reasonable alternatives to the level of integration currently proposed and described in **Chapter 4**.

On the basis of the currently available information on the design of the proposed Arklow Flood Relief Scheme, it is anticipated that integration works will be confined to providing new sheet piled river walls for an area on the River Walk / South Quay commencing at Arklow Bridge and extending some 375m downstream (as described in **Chapter 4**).

There is no reasonable alternative given the confined area (as undertaking of works separately would require further construction activities at the same physical locations). In this way through the integration of works, the two schemes are ensuring that the impacts in this area are minimised and the need to come back to the same location at a later date and install the walls for the flood relief scheme (below existing ground level) is avoided.

## 3.7 Construction Methods

### 3.7.1.1 Sewers

A detailed report, Interceptor Sewer Route Options Report has been prepared and is included at **Appendix 3.2**. This report documents the preferred construction methods for the proposed interceptor sewer within the sections illustrated in Figure 3.4 and **Section 3.3.3.1**.

Generally, the construction techniques available for below ground sewer construction falls into two main categories:

- ‘Open Cut Excavation’; or
- ‘Trenchless’, also commonly described simply as ‘Tunnelling’ techniques.

In urban areas, tunnelling (where feasible) minimises excavation, spoil removal, disruption at ground level, above ground utility diversion and road reinstatement requirements. This is particularly the case for large diameter deep sewers such as those required as part of the proposed development. A summary of the preferred construction methods is indicated in Table 3.16 and further detail is provided in **Appendix 3.2**.

Table 3.16: Summary of construction options for proposed interceptor sewers

| Sewer Location | Preferred methodology | Main reasons for preferred option |
|---|---|---|
| Avoca River | Tunnelling | Open cut considered impractical for Avoca River and would likely have significant environmental impact |
| River Walk | Open cut excavation | Tunnelling is not considered practical (insufficient cover depth) for the smaller diameters and shallow depths at this location |
| Avoca River at southernmost bridge arch | Open cut excavation | Open cut preferred through bridge arch as tunnelling would require increased sewer depths and likely increase risk to Arklow Bridge |
| Avoca River adjacent to South Quay | Open cut | Open cut is preferred at this location given the need for the new sheetpiled quay wall (to support the proposed Arklow Flood Relief Scheme) to minimise cumulative effects |
| South Quay | Tunnelling | Open Cut considered impractical given sewer depths required. This would likely have greater environmental impacts |
| Private land/ North Quay | Tunnelling | Open Cut considered impractical given sewer depths required. This would likely have greater environmental impacts |
| North Quay | Tunnelling | Open Cut considered impractical given sewer depths required. This would likely have greater environmental impacts |
| Mill Road | Tunnelling | Open Cut considered impractical given sewer depths required. This would likely have greater environmental impacts |

#### 3.7.1.2 Long Sea Outfall

There are several methods by which the outfall can be constructed. The options considered, based on current best practice and site restraints/characteristics, include:

- Horizontal directional drilling (HDD);
- Float and flood method; and
- Bottom pull method.

It is proposed to allow flexibility for the contractor to select the most appropriate construction method, which will be influenced by their available plant and equipment as well as their previous experience in laying marine outfalls. The contractor will therefore be responsible for determining which method is most appropriate The EIAR has considered and detailed these options in **Chapter 5** to ensure the reasonable worst case is assessed herein.

## 3.8 References

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