UISCE ÉIREANN : IRISH WATER

Greater Dublin **Drainage Project**

Outline Construction Environmental Management Plan

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Contents

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List of Acronyms

ASA	Alternative Sites Assessment
ASP	Conventional Activated Sludge Plant
dBa	Decibel A-weighting
EIAR	Environmental Impact Assessment Report
FCC	Fingal County Council
GDA	Greater Dublin Area
GDD	Greater Dublin Drainage
GDSDS	Greater Dublin Strategic Drainage Study
GRP	Glass Reinforced Plastic
HDD	Horizontal Directional Drilling
IFAS	Integrated Fixed Film Activated Sludge Process
LLLD	Long Length Large Diameter
MBR	Membrane Bioreactors
P.E.	Population Equivalent
PE	Polyethylene
RBSF	Regional Biosolids Storage Facility
SBR	ASP in Sequencing Batch Reactors
SDR	Standard Dimension Ratio
SEA	Strategic Environmental Assessment
SHC	Sludge Hub Centre
SMP	Sludge Management Plan
TBM	Tunnel Boring Machine
TCL	Tunnel the Complete Length
TD	Tunnel and Dredge
WwTP	Wastewater Treatment Plant

1. Introduction

1.1 Introduction

This Outline Construction Environmental Management Plan (from herein referred to as the Outline CEMP) has been prepared; to identify construction methodologies to be implemented for the GDD project, to demonstrate that the project can be constructed in a safe manner, and to outline specific mitigation measures that should be implemented to minimise impact of the project. This document provides a description of the individual project elements and an outline construction methodology for each of the project elements as well as an outline construction delivery programme for the GDD project.

This Outline CEMP will be a key part of the construction contract to ensure that all mitigation measures, which are considered necessary to protect the environment, prior to construction, during construction and/or during operation of the proposed development, are fulfilled. Irish Water shall be responsible for ensuring that the contractor manages the construction activities in accordance with this Outline CEMP. The contractor will prepare a final CEMP which is in accordance with and builds on the Outline CEMP to ensure that construction delivers the mitigation measures set out within the Environmental Impact Assessment Report and the Natura Impact Assessment.

Objectives and measures are also included for the management, design and construction of the project to control the material impact of construction insofar as it may affect the environment, local residents and the public in the vicinity of the construction works. In order to achieve this, the contractor will adopt the objectives and control measures set out in this Outline CEMP with respect to:

- Population
- Water Quality - Marine
- Hydrology and Hydrogeology
- Flora and Fauna
- Landscape and Visual
- Traffic and Transport
- Air Quality and Odour
- Noise and Vibration
- Archaeology and Cultural Heritage
- Soils and Geology
- Agronomy
- Waste
- Material Assets

The final CEMP will include any conditions of planning including any additional mitigation measures which are received as part of third party submissions during the Oral Hearing (if required), which are included in the planning conditions.

This document should not be considered a detailed construction method statement; this will be progressed by the contractors, appointed to undertake the individual works, prior to commencement of the works.

The environmental and waste management components of this Plan are based on documentation which includes:

- Recommendations from environmental specialists following the preparation of the EIAR
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects as published by the Department of the Environment, Communications and Local Government (2006).
- CIRIA (Construction Industry Research and Information Association) Report No. 133 Waste Minimisation in Construction.
- NRA Guidelines for the Management of Waste from National Road Construction Projects.
- CIRIA guidance on 'Control of Water Pollution from Construction Sites' (CIRIA Report No C532, 2001); and
- CIRIA guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).

This document should be read in conjunction with the Environmental Impact Assessment Report and The Natura Impact Assessment Report for the GDD project.

1.2 Description of Proposed Development

The GDD project will meet the need for additional wastewater treatment within the Dublin area as identified in a number of national, regional and local planning policy documents. It will serve the waste water needs of existing and future drainage catchments in the north, west and north-west of the Dublin agglomeration (including Ballymun, Finglas, Blanchardstown, Mulhuddart, Ratoath, Ashbourne, Clonee and Dunboyne) and the Lower Liffey Valley catchment in north-east Kildare.

In addition, the project will have the capacity provide sustainable treatment for municipal wastewater sludge and domestic septage, generated in Fingal, to produce a 'biosolid' end product and will utilise the bio-gas produced during the treatment process as an energy source on site

The GDD project will provide wastewater treatment for an estimated population equivalent (PE) of 500,000 persons.

Figure 1 – Proposed Project Overview indicates the relative locations of each of the Project elements.

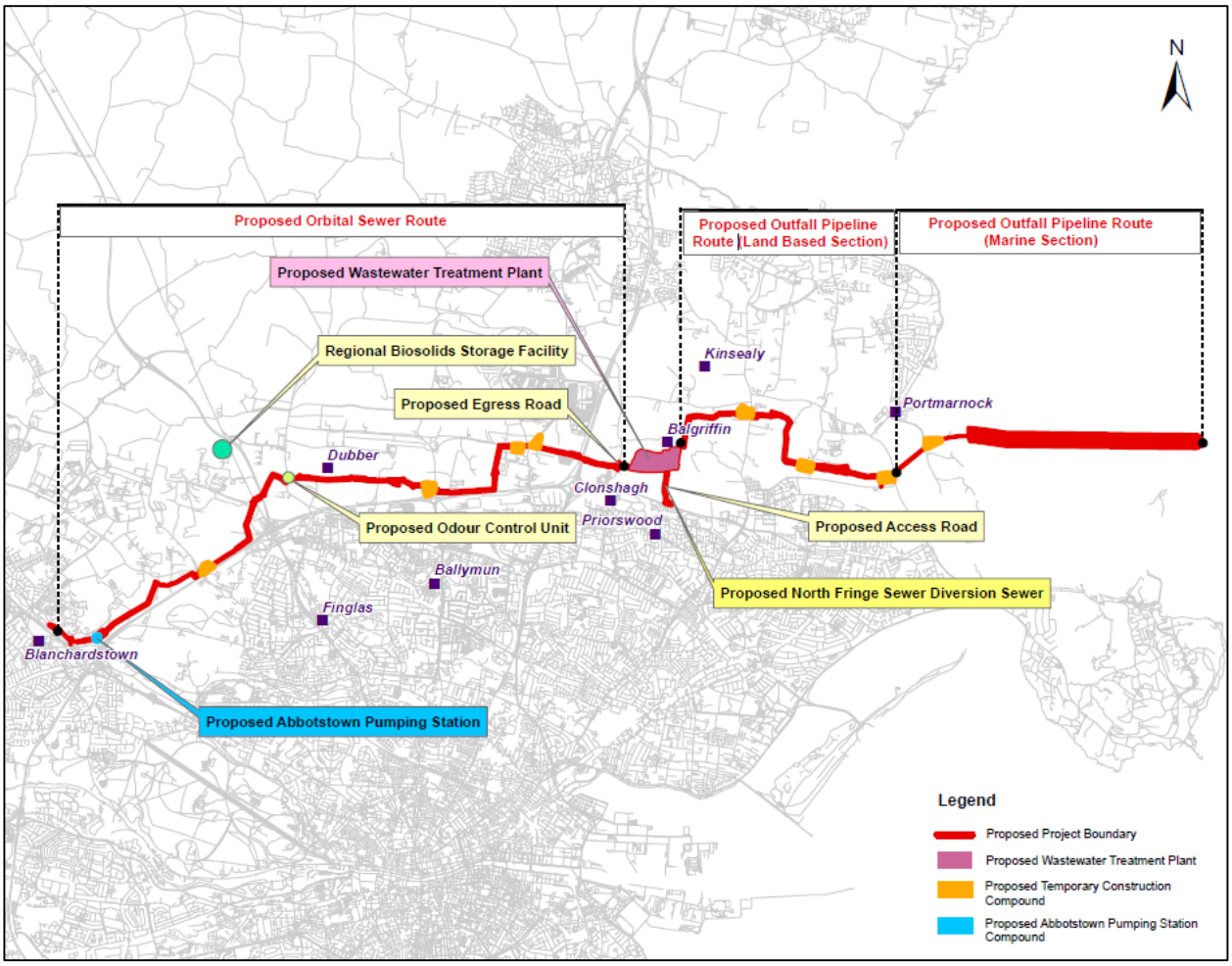


Figure 1: Proposed Project Overview

A brief description of the scheme is provided hereunder, however a detailed description of the proposed development is provided in Chapter 4 of the EIAR.

1.3 Scheme Elements

The proposed scheme, illustrated on Figure 1 Proposed Project Overview, is comprised of the following interlinked elements:

- Regional Wastewater Treatment Plant (WwTP) to be located on a 29.8ha site in the townland of Clonshagh in Fingal;
- Sludge Hub Centre (SHC) to be co-located on the same site as the Regional WwTP;
- Orbital Sewer from Blanchardstown to the WwTP at Clonshagh;
- Odour Control Unit (OCU) to be located on the Orbital Sewer at the R122 at the interface point between the rising main and gravity sections;
- Diversion sewer from the North Fringe Sewer (NFS) to the WwTP;

- Abbotstown Pumping Station to be located on a 0.4ha site in the grounds of the National Sports Campus at Abbotstown;
- Outfall Pipeline from the WwTP to the discharge point located approximately one kilometre north-east of Ireland's Eye; and
- Regional Biosolids Storage Facility to be located on a 11.0ha site at Newtown Dublin 11.

Abbotstown pumping station and the Orbital sewer (Blanchardstown – Clonshagh) and the connecting sewer from the NFS to the WwTP will facilitate the transfer of wastewater from the catchments to the WwTP site. The wastewater is then treated at the WwTP and treated wastewater is discharged via the outfall pipeline to the discharge location one kilometre north east of Ireland's Eye.

Treated sludge, in the form of biocake, will be transported from the Sludge Hub Centre in covered trucks to the Regional Biosolids Storage Facility for seasonal storage.

1.4 Scheme Layout

The proposed project, which is generally located along the southern fringe of Fingal in North County Dublin covers an area from Blanchardstown, in the west of the county, to Baldoyle/Portmarnock, in the east of the county and in the marine environment off North County Dublin between Baldoyle Bay and Ireland's Eye. The project includes approximately 26km of pipeline routes linking the Abbotstown pumping station to the WwTP at Clonshagh and also linking the WwTP to the marine discharge point.

The pipelines will be constructed below ground as gravity sewers and rising mains, based on the existing topography of the lands to be traversed. The only above ground infrastructure associated with the pipelines will be access chamber covers and vent stacks/odour control units. The pipeline crosses lands which are used for agriculture, recreation, commercial activities and lands within the boundaries of the Connolly Hospital in Blanchardstown.

Abbotstown Pumping Station

The site for the Abbotstown pumping station covers a footprint of approximately 0.4ha and will be constructed such that it consists of a single building partially below ground and partially above ground. All infrastructure associated with the pumping station will be contained within the footprint of the pumping station building or located below ground. The Abbotstown pumping station has a maximum height of 10m above existing ground level. The wet well in Abbotstown is a maximum of 17m below ground level.

The pumping station will consist of a dry/wet well arrangement and both the wet well and dry well are located below ground. Wastewater will discharge into the pumping station wet well by gravity (from the Blanchardstown sewer) and a suction pipeline will connect to the pumps which are located in a dry well. This arrangement allows for easier and safer pump maintenance.

The portion of the pumping station which is above ground level is allocated to infrastructure required to support, control and mitigate any potential impacts in relation to the pumping station. This includes an ESB substation, electrical switch room, backup generator, control room and odour control unit (OCU). The maximum height of the OCU vent stack is 10 m above ground level.

Wastewater Treatment Plant (WwTP)

The proposed WwTP site will cover a footprint of c. 29.8ha. The site has been designed to accommodate a treatment plant that will be capable of processing wastewater from c. 500, 000 PE and to cater for future expansion as wastewater flows and loads develop in the contributing catchments over time.

The main principle of the design is that all wastewater processing and treatment will occur in enclosed buildings or covered tanks. At the planning stage of the scheme a number of options have been considered for the treatment process and the final layout of the site will depend on the treatment process designed by the Design, Build and Operate (DBO) Contractor.

Typical unit treatment processes include:

- Preliminary Treatment, a physical/mechanical process which is designed to remove gross suspended and floating materials from the raw wastewater before they damage/clog the pumps or downstream treatment processes. Preliminary treatment involves screening (coarse and fine screens) to remove papers and plastics as well as fats, oils, grease and grit removal, prior to sedimentation

- Primary Sedimentation which is a settling process where the larger solids in the wastewater are settled out by gravity in large tanks (settlement or sedimentation tanks). The settled solids are removed from the tanks by mechanical scrapers and transferred to the sludge treatment facilities.

- Biological Treatment where organic matter in the wastewater is broken down through the action of bacteria which is facilitated by the addition of air (aeration). Sludge produced during this process is removed from the tanks and transferred to the sludge treatment facilities.

- Final Settlement where any organic matter carried over from the biological treatment is settled out in large tanks, removed from the tanks by mechanical scrappers and transferred to the sludge treatment facilities.

The buildings and tanks will be primarily above ground with the exception of the inlet works which will be below ground due to the level of the incoming orbital sewers. The building height on the WwTP site is proposed as a maximum of 18m above ground level.

The WwTP site provides for an ESB Substation, switch room, control rooms, combined heat and power (CHP) units and 6 no. odour control units (OCU). The maximum height of the OCU and CHP vent stacks is 24m above ground level.

Regional Biosolids Storage Facility (RBSF)

The purpose of the development of the RBSF is to provide a facility, serving the Greater Dublin region, for the storage of treated wastewater sludge (biosolids) prior its re-use on agricultural lands. The sources of biosolids to be stored at the RBSF are the proposed GDD WwTP and the Ringsend WwTP.

The location for the proposed RBSF is at a site in Newtown, Dublin 11. It comprises approximately 11 hectares of partially developed land and is situated off the R135 road, on the western side of the N2 national road. It is approximately 1.6km north of Junction 5 (Finglas) on the M50 motorway and 1.5km west of Dublin Airport. The proposed site is to be known as the Regional Biosolids Storage Facility (RBSF). The location of the RBSF is shown in Figure 1.

The total storage required at the RBSF by 2040 is estimated at 35,400m^3. Storage will be provided in two buildings at the RBSF site and will be provided on a phased basis, as described in more detail in the following sections.

Additionally, struvite will be produced at the Ringsend WwTP as a by-product to wastewater treatment process following the commissioning of the phosphorus recovery system at the beginning of 2021. Irish Water may not be in a position to apply for the “end-of-waste” approvals and/or REACH approvals until the P-recovery technique is selected as the standard to be attained and quality of product cannot be assessed unless specific techniques are known. There will be a need for an alternative disposal route pending these approvals, and for an interim period there is a requirement to facilitate its reuse under traditional waste regulated channels of land-spreading.

In the short term, it is likely that struvite will be stored in segregated bays at the RBSF until market arrangements are firmly established. Unlike biocake and biofert, struvite will typically be bagged on the WwTP site to facilitate transfer to the fertiliser industry. However, in the interim situation, the product will be delivered in bulk to the RBSF. The annual quantities of struvite are expected to be in the region of 6,000 tonnes per year based on the design load for the Ringsend WwTP. Sufficient storage can be provided at RBSF for the required storage months in the expected interim period.

The required storage volume of 35,400m^3 will be provided in two storage buildings. Each building will be approximately 105m long and approximately 50m wide.

The two storage buildings will be located centrally, toward the northern end of the site. Their location allows the utilisation of some of the existing infrastructure on the site and is such that, a new internal road can be provided around the perimeter of the buildings. The road will allow vehicular access to the storage buildings and for vehicles to travel past the buildings and around the site in one direction.

At the highest point, the roof level will be approximately 15.2m above ground level and the eaves level of the building will be approximately 12m above ground level.

1.5 Planning Drawings

This Outline CEMP should be read in conjunction with the Planning Drawings listed in Appendix 1.

2. Health and Safety

A PSDP has been appointed for the planning stage of the GDD project and Irish Water will make the required appointments in advance of the commencement of detailed design and construction stages. These will include project supervisor design process (PSDP), contractor and project supervisor construction stage (PSCS).

During the development of the scheme the PSDP will coordinate the designers and ensure that all risks are assessed. The PSDP will prepare the Preliminary Health and Safety Plan in advance of the construction stage and this will inform the contractor of Particular Risks, residual risks and particular sequences of work during the design of the scheme.

Examples of some Particular Risks that have been identified to date are;

- Working in the vicinity of the Connolly Hospital – infection control and aspergillus prevention measures
- Construction of Abbotstown pumping station – deep excavations required
- Transportation/Utilities crossings – Crossing of major transportation routes – e.g. M1, Dublin Belfast rail line, high pressure gas mains
- Marine outfall construction – working in marine environment with deep water, heavy pre-fabricated elements, sheet piling, diving operations.

The contractor and PSCS have responsibility for health and safety during the construction of the scheme, and will develop the project Safety and Health plan.

At completion of construction the Safety File is produced and will be provided to Irish Water, to ensure that the scheme can be operated safely.

3. Construction Programming and Sequencing

Orbital Sewer, Abbotstown Pumping Station, Orbital Sewer, Wastewater Treatment Plant and Outfall Pipeline,

The programme for the construction of the Orbital Sewer, Abbotstown Pumping Station, Orbital Sewer, Wastewater Treatment Plant and Outfall Pipeline elements of the GDD project is driven by the activity of longest duration, this being the wastewater treatment plant which it is estimated will take in the region of 3 years to construct with a further year required to commission the entire project.

The other elements of the GDD project i.e. Abbotstown pumping station; orbital sewer and outfall pipeline will be programmed to be completed within this timescale.

An estimated timeline for the GDD scheme is provided hereunder. This programme identifies the critical path activities (WwTP) construction and commissioning of the project) and the estimated duration of the other activities.

Figure 2: Outline Construction Programme for Orbital Sewer, Abbotstown Pumping Station, WwTP & Outfall Pipeline

RBSF

The initial phase of construction for the RBSF will involve the construction of one storage building in 2020. The construction works are estimated to last 12 months. The second building is likely to be constructed in 2024 to meet requirements at that stage. An indicative programme for the construction works for the initial phase is shown in Figure 3

Task No.	Task Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
1	Mobilisation and Site Set Up												
2	Demolition												
3	Earthworks and Excavation												
4	Roads												
5	Drainage												
6	Storage Building Concrete Foundations												
7	Storage Building Concrete Ground Slab												
8	Storage Building Retaining Walls												
9	Structural Steel and Roof Trusses												
10	Roofing												
11	Cladding												
12	Mechanical and Electrical												
13	Administration and Welfare Building												
14	Landsacping and Planting												
15	Comissioning												

Figure 3: Outline Construction Programme for RBSF - Initial Phase

4. Construction Environmental Management

The following sections provide information in relation to issues that will be encountered during the construction stage of the project. This section identifies controls that will be in place during the construction stage and mitigation measures that have been specified in the Environmental Impact Statement.

The appointed contractor(s) will develop a Construction and Environmental Management Plan (CEMP) in advance of commencement on site and this will be adhered to during the course of the construction phase of the scheme.

4.1 Site Operation

4.1.1 Site Compounds

During the construction phase, there will be compounds at the waste water treatment plant (WwTP) site and at the Abbotstown pumping station. In addition, there are strategic satellite compounds which have been identified and are located along the scheme route. The locations of these compounds are indicated on Drawing 32102902-1110 to 1112.

4.1.2 Working hours

Typically working hours are expected to be;

- Weekdays 7am to 7pm,
- Weekends and Bank Holidays 7am to 2pm

It is noted that certain activities may have to take place outside these hours. Should this be necessary advance notice will be provided.

There will be a requirement for 24hour working during tunnelling works. This would be facilitated by 2 no. 12 hour work shifts.

4.1.3 Site personnel

During the construction period, the maximum staffing levels will be as follows;

Table 1: Estimated Construction Personnel

Scheme Element	Staffing
Regional Wastewater Treatment Plant (WwTP) & Sludge Hub Centre (SHC)	250-300 peak
Orbital Sewers	20-30 peak

Scheme Element	Staffing
Abbotstown Pumping Station	20-30 peak
Outfall Pipeline (Land based)	20-30 peak
Outfall Pipeline (Land based) Tunnel Section	20 peak
Outfall Pipeline (Marine based) Subsea pipeline section *	30 peak

4.1.4 Material – Deliveries, Removal and Storage

Vehicles making deliveries and removing materials from sites will make use of the haul routes and access points identified in the EIAR and shall be planned to be outside peak traffic hours. Site entrances and delivery schedules shall be managed to ensure that there is no queuing on the public road. Loads with the potential for dust generation shall be transported in trucks that have a tarpaulin and this shall be used to cover the material.

All materials to be stored in compounds shall be stored in a manner that is safe and that is in line with best industry practice, instances of such are fuels and chemicals, which should be stored in an appropriately bunded area/within double skinned tanks. All potential harmful substances will be stored in accordance with the manufacturers' guidelines. The contractor will ensure that adequate means to absorb or contain any spillages of these chemicals are available at all times.

4.1.5 Security & Signage

All site working areas, including; sites, pipeline corridors and temporary compounds, will be considered to be live construction sites and the contractor will fence off and secure these areas appropriately, to ensure the works can be carried out safely, with the minimum of impact on the public and landowners.

Depending on the location and the proximity to commercial and residential properties, the fencing may comprise stockproof fencing, chainlink fencing or solid hoarding.

Appropriate temporary signage will be put in place during construction to facilitate local residents, commercial activities and visitors to the area. Signage for roadworks and construction entrances shall be in accordance with the relevant regulations and guidance documents (such as Chapter 8 of the Traffic Signs Manual).

4.1.6 Site Services

The contractor will require water, wastewater, power and communications facilities during the course of the construction period, to facilitate the construction, to enable welfare facilities to be provided for the workforce and to allow the safe and efficient management of the project.

- Water supply

  A water supply will be required for the contractor's welfare facilities as well as other activities on site such as equipment and material wash down, dust suppression etc. Direct connections will be provided to each of the site compounds from the public water supply.

  Where possible dust suppression and wash down will use recycled water however it may be necessary to supplement this water during dry periods.

- Waste water

  Site compounds will require welfare facilities and which will necessitate a method of collecting waste water generated. It will be possible to provide a direct connection to local sewers at the WwTP site. Other compounds will be serviced by means of a waste water storage tank, which will be emptied by means of a suction tanker and the waste water shall be disposed of to a licensed WwTP.

- Power

  Power will be required at each compound to facilitate welfare facilities, office compounds, store rooms etc. It is proposed that satellite compounds will be powered by means of generators, which will be suitably acoustically enclosed. Due to the power requirement and the duration of the construction of the WwTP it is proposed that the contractor will obtain a metered power supply from the ESB for the duration of the works.

  Permanent power supplies will be required at Abbotstown pumping station, at the WwTP for the operational phase of the project and at the odour control unit at Dubber.

  A permanent power supply will also be required at the RBSF.

- Telecoms

  For the duration of the construction period, the contractor will provide communications facilities (telephone, broadband) at the WwTP, pumping station and the satellite compounds. This will be provided via a fixed line, gsm network or satellite networks.

4.1.7 Condition Surveys

Prior to commencement of construction condition surveys, including photographic records, will be carried out of all properties adjacent to the works. This includes lands the pipelines traverse and structures which may be in close proximity to the pipeline, pumping station or WwTP.

A condition survey of haul routes shall also be agreed and carried in conjunction with the Local Authority/Road Authority.

4.1.8 Construction Traffic Management

The proposed scheme is spread over a circa 20km corridor from Blanchardstown to Baldoyle and as a result construction access routes are widespread. Construction access will be required for the delivery and removal of material, plant and personnel to the works locations. Works on public roads are limited to a number of crossing points, and the majority of these will be crossed by trenchless crossing.

The access routes which have been identified are the N3, M50, N2, M1, R139, R132, R108, R122, R123, R843, R121, R135, R106, R809, Cappagh Road, Clonshaugh and the Golf Links Road in Portmarnock. These routes and access points are identified on Planning Drawings 32102902-2001 to 32102902-2014.

The importation and disposal of construction related materials will entail the transportation of materials from quarries and to licensed waste disposal facilities. The active quarries and waste management facilities in the region have been identified, as have the routes required to access these sites. The routes identified are national primary and secondary roads primarily (M50, M1, N/M2, N4, N7, N11, and N81) with short sections of regional road. These sites and routes are identified in Section 13 of the EIAR.

Section 13 of the EIAR – Traffic and Transportation, identifies the peak potential traffic generation for the proposed scheme. This peak figure varies over the course of the project.

An outline Traffic Management Plan has been prepared to accompany this document and is provided in Appendix 2. The purpose of this document is to;

- Outline minimum road safety measures to be undertaken at site access / egress locations, during the works and including approaches to such access / egress locations;
- Demonstrate the need to adhere to the relevant guidance documentation for such works; and
- Provide the basis for the preparation of a final TMP by the contractor appointed to carry out the works.

The appointed contractor(s) will prepare a Construction Traffic Management Plan which will address the following issues.

- Site Access & Egress;
- Traffic Management Signage;
- Routing of Construction Traffic / Road Closures;
- Timings of Material Deliveries to Site;
- Traffic Management Speed Limits;
- Road Cleaning;
- Road Condition;

- Road Closures;
- Implementation of Traffic Management Plan
- Details of Working Hours and Days;
- Details of Emergency Plan;
- Communication;
- Construction Methodologies; and
- Particular Construction Impacts.

Particular mitigation measures are identified in various sections of the EIAR and summarised below, these requirements shall be included in the Construction Traffic Management Plan.

- At particular locations along the scheme, further traffic considerations are required and are dealt with at a high level in the Outline Traffic Management Plan attached.
- To minimise any hindrance, advance notice will be given to the owners of all residential/ commercial/ community properties before construction starts and in advance of any major planned disruptions to traffic management arrangements.
- If required, alternative access arrangements will be put in place to ensure continued access to homes and businesses during road crossing works.
- The scheduling of deliveries of materials to site outside of times where peak traffic flows will be using the network.
- A wheelwash will be installed at the entrance/egress to/from the WwTP site and other locations deemed appropriate.
- Roads used by construction traffic will be monitored visually and a road sweeper will be used to remove debris from construction activities when required.
- Loads of materials leaving site shall be assessed and covered where necessary to reduce dust impacts.
- The local communities and relevant stakeholders (such as An Garda Síochána) will be kept abreast of construction activities and the scheduling of construction works in their area. Cognisance will be taken of any feedback with regard to conflicts with local events and construction activities scheduled to minimise such conflicts.
- Construction site entrances will be signposted appropriately in accordance with Chapter 8 of the Traffic Signs Manual. All entrances will be designed/managed such that HGVs are not forced to queue on the public road network.

4.2 Environmental Management Plan

The contractor will implement controls to minimise potential negative impacts from the proposed scheme with respect to air quality, surface water, groundwater and ecology. The contractor shall ensure that all hazardous materials are stored and disposed of in accordance with best practice and statutory requirements.

The mitigation measures as set out in Chapter 24 of the EIAR shall be included in the Contractors CEMP. These measures are considered necessary to protect the environment prior to the commencement of and during the Construction Phase and/or during the Project. During the construction phase of the proposed scheme, the likely environmental impacts and proposed mitigations are detailed hereunder;

Air Quality

- **Dust**

  The mitigation measures as set out in Chapter 24 of the EIAR shall be included in the Contractors CEMP.

  The Construction Stage of the project will be carefully managed and an Air Quality and Dust Management Plan will be formulated by the contractor to ensure that construction activities are managed to minimise dust emissions

  The principal objective of the Plan is to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the proposed Project, and the Plan will include measures such as enclosure of material stockpiles, hard surfacing of heavily used areas, and covering of vehicles carrying spoil, the use of fixed and mobile water sprays as dust suppressants, implementation of a daily inspection programme to monitor dust control measures and training programmes for staff to ensure that the objectives of the CEMP and the Air Quality and Dust Management Plan are fully understood.

  The Plan will include specific measures for the maintenance of infection control and aspergillus prevention measures and compliance during works in the Connolly Hospital Campus. All construction works on the Connolly Hospital Campus shall be undertaken in strict compliance with the “National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis during Construction/Renovation Activities”.

  Construction traffic should be managed to ensure effective vehicle cleaning, that vehicles comply with emission standards, haul route inspections are undertaken and speed reduction on unsurfaced routes is enforced.

- **Noise and Vibration**

  The mitigation measures as set out in the EIAR shall be included in the Contractors CEMP.

  The contractor will prepare a Noise and Vibration Management Plan (NVMP) which will deal specifically with onsite activities in a strategic manner to remove or reduce significant noise

and vibration impacts associated with the construction works. The NVMP will specify the noise and vibration monitoring and reporting that will be carried out ensuring that all potential noise sensitive receptors are covered in the monitoring programme.

The guidance on the control of noise and vibration from demolition and construction activities presented in BS5228 and the Transport Infrastructure Ireland (TII) (formerly the National Roads Authority (NRA)) published construction noise limits 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA 2004)' will be followed.

Chapter 15 of the EIAR outlines a number of mitigation measures to be adopted at various points along the pipeline corridor. Specific measures to be adhered to include the following:

- Limit noisy construction works to 07.00 to 19.00 weekdays and from 08.00 to 16.30 on Saturdays, unless otherwise agreed.

- Acoustic screens will be carefully positioned to be as effective as possible. In general, the barriers will be brought as close as possible to either the noise source or the receiving position with no gaps or openings in the joins of the barrier material. The barrier material will have a minimum mass per unit area of 7 kg/m2. The minimum height of the barrier will be such that no part of the noise source will be visible from the receiving point. This will not always be possible and therefore the minimum prescribed height is 2.4m.

- Open Trench Works,
  - Standard construction site hoarding of 2.4m height will be used for open trench works at the Premier Business Park, the former bank building at Emsworth House and the Educate Together School on the Malahide Road

  - The Saturday noise criteria of 65dB LAeq,1hr will be adhered to for the open trench tunnelling works by ensuring that the noisier elements of the open trench work (excavation with rock-breaking and backfilling) are not carried out on Saturdays when works are within 60m of any noise sensitive receptor (NSR). Works otherwise to be carried out on Mondays to Fridays between 07.00 and 19.00

- Micro tunnelling works,
  - Site hoarding of 2.4m height will be erected around the boundary of all construction compounds before the main noise generating works commence.

  - Localised acoustic screens of 2.4m height shall be used within TBM compounds for works adjacent to NSR's. The stationary noise generating plant shall be positioned in the construction compounds as far away as possible from the nearest receptor. The screens will be placed adjacent to the stationary noise generating plant on the receptor side of the works. The occupiers of all affected properties shall also receive prior warning, written and verbal, of the micro tunnelling activities proposed by the appointed contractor.

- Maintain ongoing contact with local residents to ensure any complaints relating to construction phase noise for the project from local residents can be addressed. Also, prior to any particularly noisy activities, local residents will be contacted in order to minimise the perceived noise impact.

- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations for comparison with limits and background levels.

Connolly Hospital

The 1km tunnelling works in the vicinity of Connolly Hospital will take approximately six months to complete. The construction of the launch shafts is considered the noisiest element of the construction compound works. Generally, once micro tunnelling works have commenced, it is planned to operate continuously throughout the day and night.

All tunnelling compounds shall have a 2.4m high site hoarding around their perimeter. In addition, the proposed compound in the vicinity of the West Wing of Connolly Hospital will locate all stationary noise generating plant along the most north-westerly section of the compound as far away from the hospital buildings as possible. There will be local acoustic screens of 4m height positioned adjacent to all stationary noise generating plant on the hospital side of the plant items. This will result in reducing noise levels to within the proposed noise criteria at the hospital location. This information shall be included in the Noise and Vibration Management Plan.

Schools on Malahide Road

At the Educate Together National School and St. Nicholas of Myra National School on the Malahide Road, the TBM construction works will meet the daytime noise assessment criteria with the incorporation of the 2.4m hoarding. In terms of vibration, the schools shall receive prior warning, written and verbal, of the micro tunnelling activities proposed and the potential impacts that the occupiers of the building may experience. The Contractor shall investigate if the micro tunnelling works can be completed during holiday term, but at the very minimum, noise abatement measures shall be adopted during drop off and collection times and possibly at break times.

Dardistown Cemetery,

Continuous consultation with the Glasnevin Trust shall be undertaken during the construction phase to ensure that that the day to day operation of the cemetery is not impacted by the works.

Kinsealy Riding Centre

The contractor shall carry out the works in a sympathetic manner restricting the use of flashing beacons, reversing alarms on machines, large machines in close proximity to the enterprise, etc., and at times which are sympathetic to the landowner's business (i.e. avoid times when there may be a high number of children at the property – school holidays, after 3pm, Saturdays etc.)

Appropriately sized close boarded fencing shall be erected along the temporary working area adjacent to the enterprise to provide visual screening and to reduce noise levels. To help in the reduction of noise levels both topsoil and subsoil shall be stored, separately, on the northern side of the working corridor. The height of the topsoil bund will be dictated by the optimum height for storing topsoil. However, particular attention will be given to increasing the height of the subsoil bund as appropriate to assist in mitigating noise impacts in this area.

- **Noise and vibration – marine environment**

  During construction activities that create significant acoustic signatures marine mammal observers and a high frequency hydrophone system will be used to establish an operational safe zone around the site. Operations will not commence if sensitive receptors (pinnipeds and cetaceans) are observed within this perimeter. Distances and the timing of these operations will be based on standard international practice at the time of the operation, in agreement with NPWS. This may also require advice from specialist NGO groups such as the IWDG; the timing of these operations may need to be adjusted in consultation.

  Operational strategies, including soft starts, will also be established in advance of the operation.

  Other mitigation measures are included in Chapter 24 Summary of Mitigation Measures of the EIAR.

Surface water

The surface water runoff during construction activities will be managed to prevent flow of silt-laden surface water flowing into watercourses in accordance with the Outline Surface Water Management Plan, which is attached as Appendix 3.

Surface Water runoff during the operational phase of the project will be managed and controlled to limit discharges from the site to pre-development green field runoff rates and prevent pollution of watercourses through the implementation of on-site Sustainable Urban Drainage Systems (SuDS) including swales, filter drains, underground attenuation tanks and rainwater harvesting, in accordance with the outline Surface Water Management Plan. All SuDS systems will be designed in accordance with the SuDS Manual, CIRIA C753, 2015

Terrestrial based construction activities

Flood Prevention

The Proposed Development will be designed in accordance with the report entitled 'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' and the Flood Risk Assessment carried out for the project.

All flood vulnerable infrastructure (i.e. the Wastewater Treatment Plant and Pumping Station) are located within Flood Zone C – low risk.

Similarly, all construction site compounds, storage areas and launch pits (for trenchless technologies) will be located, where possible, within Flood Zone C – low risk. The shafts/construction fronts for any trenchless technologies will be located beyond the floodplain of the summer peak flood of an appropriate return period (1 in 20 years).

The proposed landscaping berm to the north of the treatment plant will be confined to the area outside the Flood Zones A and B.

The proposed access to the treatment plant from the R139 will be constructed over the Mayne River. The existing culverting arrangements at this location will be replaced with a new culvert which will be sized in accordance with the OPW's Section 50 consents so as not to cause an afflux (i.e. backing up of the river increasing the water level) thereby ensuring that there is no change to the existing flooding regime of the Mayne River.

In areas which are liable to flooding, the following measures are to be taken to reduce the potential impact of the works in the event of a flood:

- Immediate removal/disposal of surplus material off site;
- Provision of drainage within soil bunds to reduce the influence upon the surface runoff pathways of flood water;
- Avoidance of direct discharge of surface water from any temporary impervious area to the nearby watercourse without proper attenuation;
- Provision of temporary attenuation ponds if the stream to which surface water from the construction area is due to discharge to has limited capacity.
- The Office of Public Works (OPW) will be contacted for all issues related to watercourse flooding.

Particular care will be taken in siting the tunnelling compound at the Coast Road and in constructing the pipeline at Maynestown to ensure that there is no impact on the flood protection arrangements at the rere of the Myne Road cottages.

Wastewater Treatment Plant

Rainfall run-off from building roofs, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS) with attenuation systems in place to limit discharges from the site to the green field site flow rate. The surface water treatment train approach follows guidance from the Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management) and SuDS Manual (C753) (CIRIA, 2015).

Surface water runoff will be attenuated on site at the Wastewater Treatment Plant using a combination of rainwater harvesting (from roofs of buildings), swales, filter drains and

underground attenuation tanks prior to discharge to the Cuckoo Stream, which bounds the northern edge of the site.

An oil/fuel separator will be provided prior to the connection to the attenuation tank to capture pollutants in run-off on roads and parking areas within the site.

Surface water runoff from the proposed access road from the R139 will be attenuated using swales and infiltration drains prior to discharge to the Mayne River. An oil/fuel separator will be provided prior to discharge to the Mayne River to capture pollutants in run-off from the access road.

Abbotstown Pumping Station

Rainfall run-off from building roof, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS) with attenuation systems in place to limit discharges from the site to the green field site flow rate. The surface water treatment train approach follows guidance from the Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management) and SuDS Manual (C753) (CIRIA, 2015)

Surface water runoff will be attenuated on site at Abbotstown Pumping Station using a combination of rainwater harvesting (from roofs of buildings), swales, filter drains prior to discharge to the existing water course to the south of the site, which is a tributary of the Tolka River.

An oil/fuel separator will be provided prior to discharge to the water course to capture pollutants in run-off from the site.

Regional Biosolids Storage Facility (RBSF)

Rainfall run-off from building roofs, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS). The surface water treatment train approach follows guidance from the *Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management)* and *SuDS Manual (C753)* (CIRIA, 2015)

Surface water runoff will be attenuated on site at the RBSF using a combination of rainwater harvesting (from roofs of buildings), swales, filter drains and underground attenuation tanks prior to discharge to the existing attenuation area within the site.

An and oil/fuel separator will be provided prior to the connection to the existing attenuation area to capture pollutants in run-off on roads and parking areas within the site

Site Compounds

Site compounds will be provided with SuDS storage and soak away systems designed to BRE Digest 365, for any storm water running directly off any impermeable areas of the compounds. Storage compounds will have stoned areas for the clean storage of materials.

Control measures will be put in place for the site compounds as follows:

- They will be set back from waterbodies, and outside of any ecologically sensitive areas.
- The impermeable area within compounds will be minimised to limit surface water runoff.
- Any watercourses that occur in areas of land that will be used for site compound/storage facilities will be fenced off at a minimum distance of 5 m from the watercourse. In addition, measures will be implemented to ensure that silt laden or contaminated surface water runoff from the compounds does not discharge directly to the watercourse.
- Storage of fuels, other hydrocarbons and other chemicals within the construction compounds will not be permitted within 50m of a waterbody. Each site compound will be provided with a variety of drainage containment systems to cater for containment of chemical spills, storm water run-off and foul flows from the site during construction.
- All surface water runoff will be intercepted and directed to treatment systems for the removal of pollutants prior to discharge.
- All compounds will have security to deter vandalism, theft and unauthorised access.
- Surface and storm water will be put through a settling/sedimentation tank, dewatering bags or similar silt retention process before discharge to the local water course.
- Once structures have roofs and down pipes installed, storm water will be discharged into a SuDS based drainage system to prevent run-off and control discharge from the site

Water Course Crossings

For construction of any watercourse crossings, detailed Pollution Control Plan, Emergency Response Plan and Method Statements will be drafted in agreement with Inland Fisheries Ireland (IFI) and other relevant authorities, and having regard to relevant pollution prevention guidelines in particular the IFI document “Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters”. All works in or adjacent to watercourses will comply with the EPA, IFA and OPW requirements.

Water course crossings shall be constructed using tunnelling techniques which will require shafts to be excavated on either side of the crossing. Such shafts shall be located a minimum of 20m from a watercourse.

To protect against the potential pollution of water courses from these construction activities the mitigation measures outlined in the EIAR and the Outline Surface Water Management Plan shall be implemented in full.

- **Marine based construction activities**

  All onboard waste discharge, from dredgers, pipeline survey vessels, maintenance vessels and marine rigs, will follow the guidelines from Annex V of the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL) for domestic waste discharges to the environment. Solid and chemical waste will be treated on board and recycling will take place wherever practicable. No waste is to be disposed of at sea. Bilge water will be treated in accordance with MARPOL standards. All waste discharges will be monitored and recorded as per vessel procedures.

  Any hazardous wastes will be in sealed, labelled drums and stored in lockable chemical cabinets. A record will be kept of the type and quantities of waste arising on each vessel.

  Ballast tanks will be separated from any hydrocarbon storage areas on board the vessels and no potentially contaminated drain systems will be routed to the ballast tanks. De-ballasting shall be undertaken offshore in accordance with International Marine Organisation (IMO) guidelines and away from sensitive environmental areas to prevent introducing marine organisms from outside the project location.

  Project vessels and rigs will be equipped with oil-water separation systems in accordance with MARPOL requirements.

  Any spills on deck will be contained and controlled using absorbing materials. This will be collected in dedicated drums to avoid contamination of deck run-off water. Vessels or rigs without a sewage treatment system will have a suitable holding tank; waste water will then be brought back to shore for treatment by a licensed contractor.

  All chemicals used onboard the project vessels or rigs will be handled in compliance with the relevant Safety Instructions, including Control of Substances Hazardous to Health (COSHH) Handling of Hazardous Materials.

  For each chemical, a Material Safety Data Sheet will be available, as well as an assessment of the hazards associated with the chemical (to personnel, for storage, for emergency response). These will be available at the various places where the chemical is used, and centralised with the Safety Officer on board.

  Chemicals will be stored in compliance with the handling instruction, including separation of incompatible chemicals, provision of adequate firefighting, spill containment and other safety facilities. The only bulk storage on board vessels will be the fuel; all other chemicals will be stored in drums or smaller containers and will be suitably bunded to contain any leaks or spills.

The construction management of the project will be undertaken in accordance with the commitments made in the EIAR to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Sediment Control – Monitoring

Where it is proposed to carry out work adjacent to or across a water course or other water body a water quality monitoring programme will be required at the pre-construction and construction stage.

The monitoring of all aspects of sediment control will be carried out by the Contractor as the responsible party. The responsibilities of the Employer will be discharged by the Employer's Site Representative Team.

Pre-Construction Monitoring

Pre-construction water quality monitoring will be undertaken once a week for a 6-month period, prior to the commencement of the construction works. Samples will be taken for total suspended solids (TSS), turbidity, pH, temperature, dissolved oxygen (DO) and hydrocarbons up and downstream of the proposed working areas and/or crossing points, to build upon the baseline monitoring carried out at the EIAR stage and in order to further establish the baseline water quality conditions prior to construction. Samples for turbidity, pH, DO and temperature will be taken in situ; samples for TSS and hydrocarbons will be sent to an accredited laboratory for analysis.

Construction Monitoring

During construction, the Contractor will monitor the levels of TSS, turbidity, pH, temperature, DO and hydrocarbons at the same locations up and down stream of the works once a week for the duration of the following works:

- Site clearance works, earthworks movements and stockpiling;
- Excavations including those associated with the provision of drainage works; and
- Construction works within and adjacent to watercourses.

The construction monitoring results will be compared with those results established in pre-construction monitoring. In the event of an elevation above pre-construction levels an investigation will be undertaken by the Contractor and remediation measure will be put in place.

In addition, daily visual inspections of the surface drainage and sediment control measures and the watercourses will be undertaken by the Contractor. Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface;

- Floating detritus; or Scums and foams.

These inspections shall be recorded. In the event that such indicators are observed, works will cease, sampling will be immediately undertaken as described for the weekly monitoring and an investigation of the potential cause will be undertaken by the Contractor.

Where the works are identified as the source causing the exceedance the following will apply:

- Irish Water, the NPWS and IFI.
- Works capable of generating sediment and all discharges shall be stopped immediately.
- The contractor will be required to take immediate action to implement measures to ensure that such discharges do not re-occur.

The above monitoring will alert the Contractor to any detrimental effects that particular construction activities may be having on water quality in order that appropriate remedial action can be taken as quickly as possible; and allow the Contractor to demonstrate the success of the mitigation measures employed in maintaining any sediment release within the 'trigger' value established.

Groundwater

Preliminary site investigation works indicate that groundwater will be encountered at levels of less than 3.0m below ground level at most locations within the works. Direct disposal to the nearby watercourse of arisings from excavations and from groundwater dewatering activities will not be allowed as these could impact both on water quality of the watercourse and increased flood risk. Any discharge of such water, after proper treating/de-silting will be discussed and agreed with the landowner and if necessary, discharge consent will be acquired from the concerned authority (EPA, Fisheries etc.) prior to the commencement of work.

Potential impacts on the Baldoyle estuary SAC and the Portmarnock Golf Club irrigation wells will be avoided. The outfall pipeline will be constructed in a manner that will eliminate the pathway between the hazard and the receptor.

The excavation of the tunnel drive shaft at the Fingal County Council public car park in Portmarnock will extend to circa 20 metres in depth and will go through the shallow aquifer. As a mitigation measure this shaft will be excavated using piling techniques and will not involve any dewatering or pumping which could interfere with the irrigation wells' performance. The shaft will be hydraulically sealed from the water bearing sands/gravels.

The outfall pipeline will be tunnelled in bedrock beneath the Baldoyle Estuary and Portmarnock Peninsula. The stiff boulder clay in the overburden will act as a barrier between the groundwater in the rock and the groundwater in the dune sands.

The outfall pipeline in the tunnel will be grouted to eliminate the possibility of a preferential flow path in the annulus outside the pipe.

Regardless of these mitigation measures, the outfall pipeline will not incorporate any abstraction of groundwater or discharge to groundwater.

Groundwater monitoring shall take place at Sillogue Golf Course and at Portmarnock Golf Course prior to construction, during construction and post construction to ensure no adverse impacts on groundwater quality.

- **Portmarnock Golf Club**

  The Outfall Pipeline is routed in close proximity to a number of golf courses in the Portmarnock peninsula. In the course of the public consultation process Portmarnock Golf Club sought assurance that the shallow groundwater wells they use to meet the irrigation requirements of the golf club during the summer months would not be affected by the construction of the proposed outfall pipeline route (marine section). The principal concerns related to disturbance of the groundwater regime either causing a dewatering effect or causing an ingress of saline water thereby compromising water quality.

  Potential effects on the irrigation wells of Portmarnock Golf Club have been mitigated by avoidance in the design of the proposed outfall pipeline route (marine section).

  - This pipeline will be tunnelled in bedrock beneath Baldoyle Estuary and Portmarnock Peninsula. The stiff boulder clay in the overburden will act as a barrier between the groundwater in the rock and in the groundwater in the dune sands from which the irrigation wells draw their water.

  - The pipeline will be grouted to prevent the possibility of preferential flow pathways. As there will be no abstraction or discharge along the line of the pipe there will be no alteration to the flow regime or quality.

  - The drive shaft at Portmarnock will be constructed using piling or caisson construction techniques to avoid the necessity to dewater.

  It is important to the golf course operators that the sources of irrigation are not affected by the works for the Outfall Pipeline. For this reason, it has been agreed with the golf club operators that monitoring of the irrigation sources is undertaken in advance of construction, during construction and for a period post construction. These requirements will be included within the Contractors CEMP.

  In the unlikely event that the works will compromise the ground water supply a temporary supply of potable water will be made available in the construction compound adjacent to the golf course.

Ecology

Extensive mitigation measures are proposed to minimise potential for the construction of the GDD project to impact on terrestrial and marine ecology. These are summarised hereunder, however the full schedule is included in the relevant sections of the EIAR.

- **Marine Ecology**

  In order to mitigate noise and vibration during the Marine Outfall construction, the duration of dredging operations will be minimised.

  Due to the trenchless construction method proposed beneath Baldoyle SAC, the impact to the marine ecology in the sensitive inshore areas during construction will be minimal, although there is a minor risk of an air or bentonite break-out.

  There will be no discharges of untreated water to the estuary.

  Operations will be managed with bunded storage areas and sediment settlement areas.

  Air breakout to the surface will be mitigated through management of pressures.

  In the event of a large air breakout in the Baldoyle estuary, the area affected will be assessed and if required, the natural recovery of the depression will be aided to accelerate its reinstatement. This is usually done by back filling scoured areas with the surrounding surface sediments if safe or appropriate to do so.

  All bentonite usage will be monitored though materials balance calculations, pressure monitoring in the lines and above ground visual assessment of the works to ensure that should breakout occur the volume is minimised.

  A contingency management plan shall be prepared by the Contractor. If survey and monitoring procedures indicate that a break out has occurred, the drilling contractor shall cease pumping and implement the processes detailed in their contingency plan. Regulatory agencies shall immediately be notified regarding a suitable course of action.

  The risk of breakout is likely to occur when:

  - Shallow – passing through weak and saturated soils with little inherent strength
  - Shallow – passing through heavy granular material where bore stability may be difficult to control
  - Deep – If heavy fractured rock causes bore instability and a pre-existing pathway exists to allow drilling fluid to escape to the environment.

  The primary means of mitigation is through the use of appropriate drilling mud formulation and management for the conditions. For shallow sections, especially where these are unavoidable at the beginning and end of the bore, the emphasis is on appropriate drilling

practices for the overburden. Steel casings can also be installed along the alignment from the surface.

For breakouts at depth, the emphasis on environmental mitigation is focused upon containment, control and cleanup. Beyond improving the drilling mud formulation and or drilling processes, which is often sufficient, the leakage path can be sealed with a special lost circulation material. These materials are introduced as slugs into the drill pipe and pumped onto the bore to clog the pathway. Containment measures include the installation of interception devices (e.g., silt fence, staked straw bales, sediment curtains, collection sumps).

In the event of a bentonite break-out, then the site will be monitored for chemical and macro-invertebrate communities to ensure no residual impacts. This may include both benthic and water quality measurements.

There will be monitoring of suspended solids plumes during dredging operations. Tidal restrictions may be necessary at peak plume events

If piling in a caisson for connection with dredging is required, a detailed noise and vibration plan will be prepared. Seasonal factors will be considered.

Potential noise impacts during dredging and Marine Diffuser construction phases of the work will be monitored and NPWS guidelines (DoAHG, 2014) followed to minimise the impact of construction to sensitive receptors (i.e.pinnepeds and cetaceans).

Passive acoustic monitoring will be undertaken and marine mammal observers used to establish a safe zone.

Disturbance of inter-tidal and sub-tidal habitats will be minimised so as to reduce the creation of suspended solids within the marine and estuarine habitats. The tunnelling compound spanning either side of the Baldoyle estuary will be subject to surface water management as part of the CEMP to prevent all runoff into the water courses and the estuary.

Dredging works will involve disposing of dredged material to a barge, depositing and stockpiling parallel to the pipeline trench within the 250m corridor. Dredging carried out close to the Ireland's Eye SAC will be carried out on neap tides where possible. Monitoring of turbidity will be carried out during peak dredging activity and operations restricted to flooding tides if a plume is detected >50 mg/l above background on the Ireland's Eye northern coastline.

- **Invasive species**

  All plant and equipment employed on the construction site (e.g. excavators, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site, and prior to leaving site, to prevent the spread of invasive aquatic /riparian species such as Japanese

knotweed, in accordance with the Office of Public Works Environmental Standard Operating Procedures or IFI Biosecurity Protocols. A sign off sheet will be maintained to confirm cleaning.

Staff involved in the works will be informed as to the presence of invasive species in the area, including Giant Rhubarb downstream along the Tolka River. All staff working on the project will be familiar with the sections within the document 'Guidelines on the Management of Noxious Weeds and Non-Native Plant Species on National Roads' (NRA, 2008) which detail the treatment necessary for each of the aforementioned species, together with the required reporting procedure if encountered.

A buffer zone will be marked around invasive species and plant and equipment that could transport the species within the site will be excluded

4.3 Construction Waste Management Plan

Prior to construction the contractor will develop a Construction Waste Management Plan and procedures that will address the following:

- The mitigation measures set out in Chapter 20 of the EIAR
  - This Outline CEMP; and
  - All current Local and National waste management legislative obligations.

The construction waste management plan (CWMP) will identify how waste arisings are to be controlled and managed during the course of the project, and in particular how waste prevention principles can be applied and how on-site waste can be minimised.

The CWMP will include;

- An analysis of the likely waste arisings/surplus materials
- Specific waste management objectives for the project
- Methods proposed for recycling/reuse of wastes
- Material handling procedures
- Proposals for education of the workforce

The proposed scheme has the potential to generate significant quantities of waste material, the primary sources being;

- Excess material from orbital sewer construction - surplus excavated material
- Excess excavated material from pumping station wet/dry well construction - surplus excavated material
- Excess material from construction of WwTP – surplus excavated material

- Excess material from outfall construction – surplus excavated material & tunnel spoil

Residual waste produced as a result of the construction phases of the proposed should be processed in way that follows the waste hierarchy as outlined in the current European Communities (Waste Directive) Regulations, ranging from reuse to disposal, in terms of preference.

The table below identifies a quantity of surplus material in the order of 220,400m^3. This is surplus excavated material and on the basis of the classification of this material and geotechnical testing carried out to date, a portion of this material can be reused for landscaping, non-structural fill and similar uses, subject to further testing at the detailed design stage.

Table 2: Estimated Quantity of Surplus Excavated Material

	Orbital Sewer Blanch. to Proposed WwTP	Abbotstown P.S.	Proposed WwTP	Outfall Pipeline Corridor (Land Based)	Outfall Pipeline Corridor (Marine Section) - Tunnel	Outfall Pipeline Corridor (Marine Section) - Subsea	NFS Diversion	TOTAL
Quantity of Excavated Material (m^3)	251,500	9,050	270,950	147,500	17,000	688,650	11,250	1,371,375
Quantity of surplus Excavated Material (m^3)	100,600	9,050	48,550	49,200	8,500	-	4,500	220,400
Quantity of Topsoil stripped for reuse – 0.3m over 40m construction width (m^3)	181,810	1,180	88,100	64,550	-	-	7,200	335,640

The contractor shall catalogue the source of all wastes on the proposed scheme and determine if any of the wastes can be recycled or reused.

In the event that materials have to be disposed of, this shall be done in accordance with statutory requirements, using licensed vehicles, delivering to an appropriately licensed or permitted site.

4.4 Communications Plan

The proposed scheme covers a 20km territory in Fingal and borders Dublin City in places, and has a broad stakeholder group including;

- Local communities
- Landowners
- Specific interest groups (including Connolly hospital, Dublin Airport Authority, Fingal County Council, Dublin City Council, Transport Infrastructure Ireland, Irish Rail, An Garda Síochána).

The construction phase of the proposed scheme is likely to take 3 years, so it vital that plans for the works are communicated to the relevant parties. Key routes for communication will be;

- Leaflet drops
- Newsletters providing updates on progress and future plans
- Community briefings
- Liaison with local authorities, An Garda Síochána and other emergency services.

A Community Relations Officer (CRO) will be employed during the construction phase of the development, carrying out the following duties:

- Deal on a one-to-one basis with local stakeholders and notify them before commencement of any works which may generate noise or vibrations. The CRO will distribute information circulars informing people of the progress of the works and any likely periods of significant noise and vibration,
- Be the point of contact for any communications in relation to noise and vibration and communicate with the residents where specific measures are required to minimise noise impacts,
- Be the point of contact for dealing with strategic stakeholders such as Connolly Hospital, Irish Rail, Dublin Airport Authority etc.,
- Act as a contact point for sporting clubs and community facilities in the area,
- Maintain open, transparent and positive relations with members of the public, groups and organisations affected by the works,

Work with Irish Water and the appointed construction contractors to ensure that all effort is made to appease public concern and ensure that information on the nature and duration of works is provided. A Fisheries Liaison Officer will also be appointed and will ensure all fishermen receive timely notifications of any restrictions/exclusion zones in place during the construction of the marine outfall.

The Irish Water Communications Strategy shall be adhered to during the construction period.

5. Wastewater Treatment Plant

5.1 Proposed Site at Clonshagh

This site is located primarily in the townland of Clonshagh, in Fingal. It lies approximately 2.5km south-east of Dublin Airport and the residential areas of Belcamp and Darndale are c. 0.8km to the south. The proposed site has a total area of c.29.8ha.

The lands slope in a west-east direction with a central elevation of approximately 42.3mOD. The land is located in open agricultural land, primarily in tillage, vegetables and grassland.

The Cuckoo Stream (a tributary of the Mayne River) lies immediately north of the site and the Mayne River lies c.400m to the south.

5.2 Access

Construction and operation access for the Regional WwTP will be from the R139 (formerly the N32) with egress to the Clonshaugh Road. A comprehensive traffic management plan will be put in place for the construction period incorporating a left turn in/left turn out policy. That is entry to site would be limited to left turn only from the R139 and egress from the site would be limited to left-turn out only to the Clonshaugh Road.

5.3 Indicative Layout of WwTP

A preliminary indicative layout for the proposed Regional WwTP has been developed for the site. This layout is based on a conventional activated sludge plant (ASP), which would be expected to require the largest footprint, and is shown on Planning Drawing No. 32102902-2120.

The indicative layout can be broken into three zones, with the western zone (Zone 1) containing the inlet works, which includes the preliminary unit treatment processes, and the primary sedimentation tanks. The middle zone (Zone 2) contains the biological treatment tanks and final settlement tanks (clarifiers). The sludge treatment facilities are contained in the eastern zone (Zone 3).

5.4 Odour Control

An odour control system will be designed to ensure that odour does not give rise to any nuisance beyond the boundary of the WwTP. The system will involve extracting air from within the various buildings and tanks on a continuous basis. Fans located outside, adjacent to the odour control unit, will draw air though ducting to the odour control units comprising an organic filer media. The treated air will be emitted to the atmosphere through 6 no. vertical stacks which will extend to a height of maximum height of 24m above ground level.

5.5 External Lighting

External lighting will be provided along the access and egress roads, internal roads, pedestrian routes and around the buildings and other plant rooms. Road-side lighting columns will be approximately 6m high.

5.6 Construction Methodology

Construction of the Regional WwTP will be undertaken using conventional construction methodologies and will involve excavation for building foundations and tanks, reinforced concrete works, erection of structural steel/concrete building frames, erection/building walls (concrete/blockwork); erection of prefabricated cladding panels to walls and roofs of buildings, erection of prefabricated steel tanks, mechanical and electrical fit out of buildings and tanks, installation of below and above ground pipework, construction of screening berms, construction of access/egress roads to site and internal circulation roads, car parks and footpaths, landscaping and final planting.

Over the estimated three-year construction period these activities will be sequentially scheduled by the contractor to optimise his resources and programme moving various work crews from building to building in a sequential manner. A typical sequence of work is outlined below.

- Erect fencing to site and access roads,
- Strip topsoil from site and access roads, set aside for reuse.
- Grade site/access roads to finished profile. Excavated material deposited in screening berms.
- Establish Contractor's compound on site
- Construct access roads (and associated pipework) and site circulation roads to subbase level
- Excavate foundations for first building/tank, move to next building/tank
- Pour concrete foundations/base to first building tank, move to next structure
- Erect structural steel/concrete building frame, or reinforced concrete walls of tanks, move to next structure
- Erect inner/outer walls and roof of building (prefabricated panels), move to next building
- Install doors/windows and make building weather proof, move to next building
- Commence first fix mechanical/electrical fit out of structure (building/tank), move to next building
- Commence second fix mechanical/electrical fit out of structures.
- Erect prefabricated steel tanks (e.g. mesophilic anaerobic digestors)
- Erect bio-gas holding tanks
- Install below ground pipework
- Install above ground pipework

- Commence commissioning work on wastewater and sludge treatment systems
- Finish construction of access roads and internal circulation roads, car parks and footpaths
- Erect permanent site security fencing
- Landscape and plant site.
- Remove temporary construction fencing
- Remove/demobilise contractor's compound
- Hand-over of site to Client/operator.

All excavated material will be re-used on site in construction of the screening berms and landscaping such that quantities of excavated material will balance the fill material required in the screening berms and site landscaping.

There will be between 250– 300 people working on site during peak construction periods.

5.7 Landscaping and Visual

Perimeter Screening

In relation to visual screening, for those boundaries of the proposed WwTP site adjoining the rural context to the east, north and west, a series of flowing organic embankments planted with dense bands (approximately 15m to -20m wide) of hedgerow tree species will provide visual screening of the Proposed Project. The embankments will rise to a maximum height of 4m with gentle outward facing slopes in order to blend with the flat to mildly undulating terrain that surrounds the proposed WwTP site. This will be achieved using a buffer zone width of approximately 60m. Between the mounds, specimen trees will be provided, rising from a more open wildflower meadows context. The dense but linear bands of hedgerow vegetation topping the mounds will reference the hedgerows and tree-lined field boundaries of the agricultural fields in the vicinity. The meadow and specimen trees between the dense sections of hedgerow planting will reference the parkland aesthetic of the nearby demesne landscapes to the east.

In deliberate contrast to the organic and semi-rural boundary treatments of all other site boundaries, the southern boundary will be presented as a bold architectural landscape treatment in order to tie in with the future development of the lands to the south (future IDA Business Park). The buildings along this boundary of the proposed WwTP site will be aligned to provide a consolidated facade to front the future East-West Distributor Road between the proposed WwTP site and the IDA Business Park lands. The buildings will be set back to a sufficient degree in order to reduce their perceived height and bulk within the future street scene. This area will incorporate geometric blocks of dense ornamental shrubs and a 'bosque' or grid of tall narrow specimen trees such as poplars. A plinth wall and system railing will be provided and will be an attractive, subtle and secure physical boundary.

Semi-mature tree planting (minimum 14cm to 16cm girth) will be used for all planting along the southern boundary and internal treelines to aid early establishment. Mixed age classes ranging from semi-mature (minimum 14cm to 16cm girth) down to feathered whips (approximately 1.25m tall) will be utilised for perimeter berms in order to establish a dense screen over a longer period of time. It

is envisaged that it will take up to seven years for all planting to reach a maturity that will afford the intended screening effectiveness.

Internal Planting

Additional treelines and grids will be provided within the southern half of the proposed WwTP site running both perpendicular and parallel to the southern boundary, surrounding car parks and screening tanks. Treelines will also be provided to link between the southern and northern boundaries and to act as both a division of precincts within the proposed site and as a reference to hedgerows and treelines that currently exist within, or connect to, the boundaries of the proposed site.

A high degree of visual permeability will be provided into this side of the site rather than presenting a barrier. These landscape treatments will all combine to give the impression of a campus-style development in order to blend with the future business park neighbours (IDA lands) to the south.

The schematic of the landscape and visual mitigation concept is provided in Chapter 12 of EIAR Vol.3A - Landscape and Visual

Colour Treatment and External Finishes of Buildings

The colour scheme for buildings on the proposed WwTP site has focused on reducing the perceived bulk and massing of the largest structures and blend them with the background context to reduce visual prominence.

The final building heights will be a maximum of 18m. The building colour scheme that shall be applied to the proposed WwTP site is described below:

- A dark plinth around the base of all buildings and tanks (approximately 3m) to tie in with the hedgerow pattern and diminish the perceived vertical height of buildings;
- A medium tone band around the central portion of buildings (up to about 8m) to tie in with the surrounding mature tree lines and field patterns and also to provide a transition between the dark and light tones;
- A light tone top to the tallest buildings (9m+) to reduce the degree of contrast against the sky when seen from surrounding receptor locations – thereby diminishing overall visual presence and perceived vertical massing; and
- 'Horizontal Disruption' of long facades (20m+) by extending the dark tone plinth to the top of those buildings for half of the length of the facades that run perpendicular to site boundaries. Again, this is intended to diminish the perceived lateral bulk of buildings in a subtle way using solid and shade.

5.8 Surface Water Management

5.8.1 Construction Phase

The surface water runoff at the construction sites will be managed to prevent flow of silt laden surface water flowing into the Mayne River or Cuckoo Stream.

5.8.2 Operation Phase

Rainfall run-off from building roofs, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS) with attenuation systems in place to limit discharges from the site to the green field site flow rate. The surface water treatment train approach follows guidance from the Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management) and SuDS Manual (C753) (CIRIA, 2015)

Surface water runoff will be attenuated on site at the Wastewater Treatment Plant using a combination of rainwater harvesting (from roofs of buildings), swales, filter drains and underground attenuation tanks prior to discharge to the Cuckoo Stream, which bounds the northern edge of the site.

A Class 1 By-Pass oil/fuel separator will be provided prior to the connection to the attenuation tank to capture pollutants in run-off on roads and parking areas within the site.

Surface water runoff from the proposed access road from the R139 will be attenuated using swales and infiltration drains prior to discharge to the Mayne River. An oil/fuel separator will be provided prior to discharge to the Mayne River to capture pollutants in run-off from the access road.

6. Pumping Station

The design and modelling undertaken during the development of the GDD project has identified that the Abbotstown Pumping Station will be required to transfer flows from the 9C sewer catchment to the Regional WwTP at Clonshagh.

6.1 Proposed Abbotstown Pumping Station Site

The site is located in the grounds of the National Sports Campus in the townland of Abbotstown. It lies approximately 0.5km east of Connolly Hospital, 0.2km east of St Francis Hospice and approximately 0.2km west of the M50. The proposed site has a total area of c. 0.39ha.

The land slopes in a northeast-southwest direction with a central elevation of approximately 54.7mOD. The land is located in open agricultural land and the Tolka River lies immediately south of the site.

6.1.1 Access

Construction and operation access for the Abbotstown pumping station will be through the grounds of the National Sports Campus.

During construction, temporary access for construction traffic will be taken from the Ballycoolin Road, as shown on Figure 4.

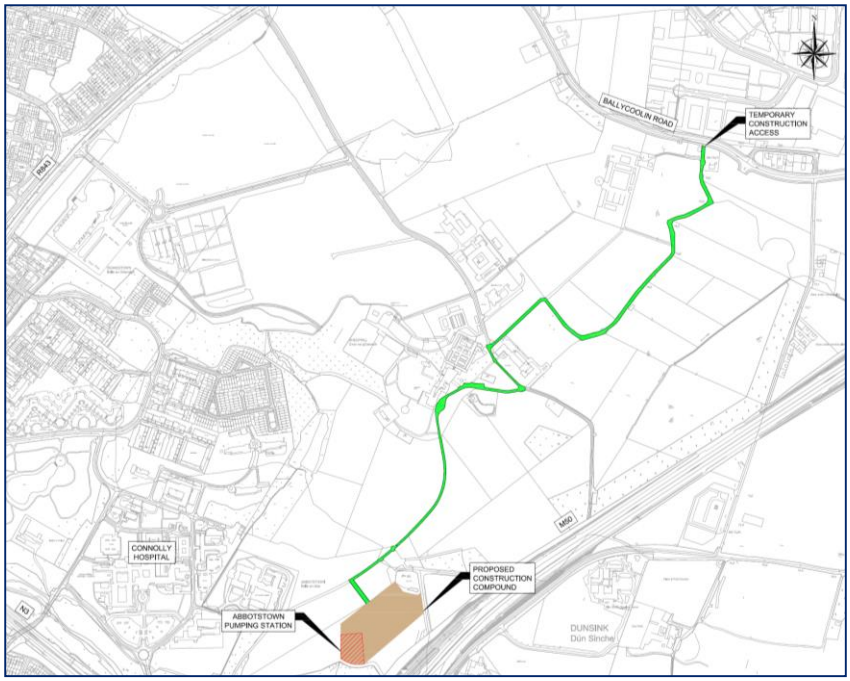


Figure 4: Abbotstown Pumping Station Temporary Access Route for Construction

Irish Water shall acquire a right of way to facilitate permanent access to Abbotstown pumping station for long term operation and maintenance of this pumping station. The proposed access route is indicated on the figure 5 below.

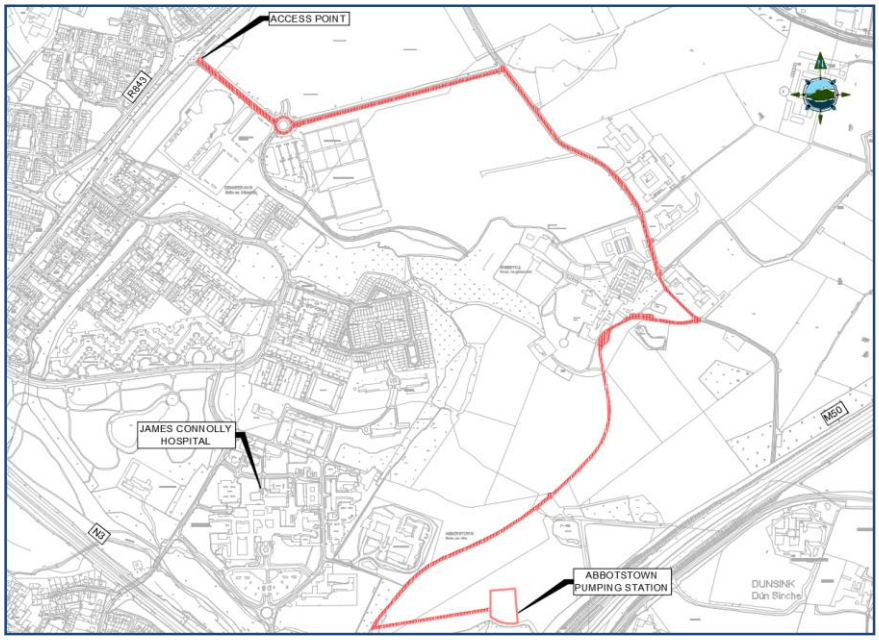


Figure 5: Abbotstown Pumping Station Operational Access Route

6.1.2 Indicative Layout

The proposed Abbotstown pumping station will consist of a single 1-storey building over basement. The above ground building will have a floor area of 305m^2 and maximum height above ground level of 10m and will house the control room, welfare facilities, back-up diesel generator, surge vessels, odour control equipment, septicity control dosing equipment and storage facilities.

The basement will be 17m in depth with floor area of 524m^2 incorporating the wet/dry wells housing the pumps, suction pipework and rising main manifold pipework.

The proposed Abbotstown pumping station will be constructed in reinforced concrete with finishes as shown on Drawing No 32102902 – 2144.

6.1.3 Landscaping and Visual

The proposed Abbotstown pumping station will be a modest scale feature that will be housed in a vernacular structure (that references the nearby St. Francis' Hospice building) surrounded by hard standing for Operational Phase car parking and maintenance procedures. The perimeter of the proposed pumping station will also require security fencing. Subtle screen planting will be provided around the perimeter of the proposed Abbotstown pumping station site and will also be employed to soften the appearance of security fencing. This will 'bed' the proposed site into the surrounding landscape structure. The scale and nature of the Operational Phase appearance of the proposed pumping station somewhat belies the more extensive sub-surface plant contained beneath the site.

Nonetheless, the surface level features will be modest and incongruous in the selected landscape setting, resulting in very limited and localised effects on landscape character.

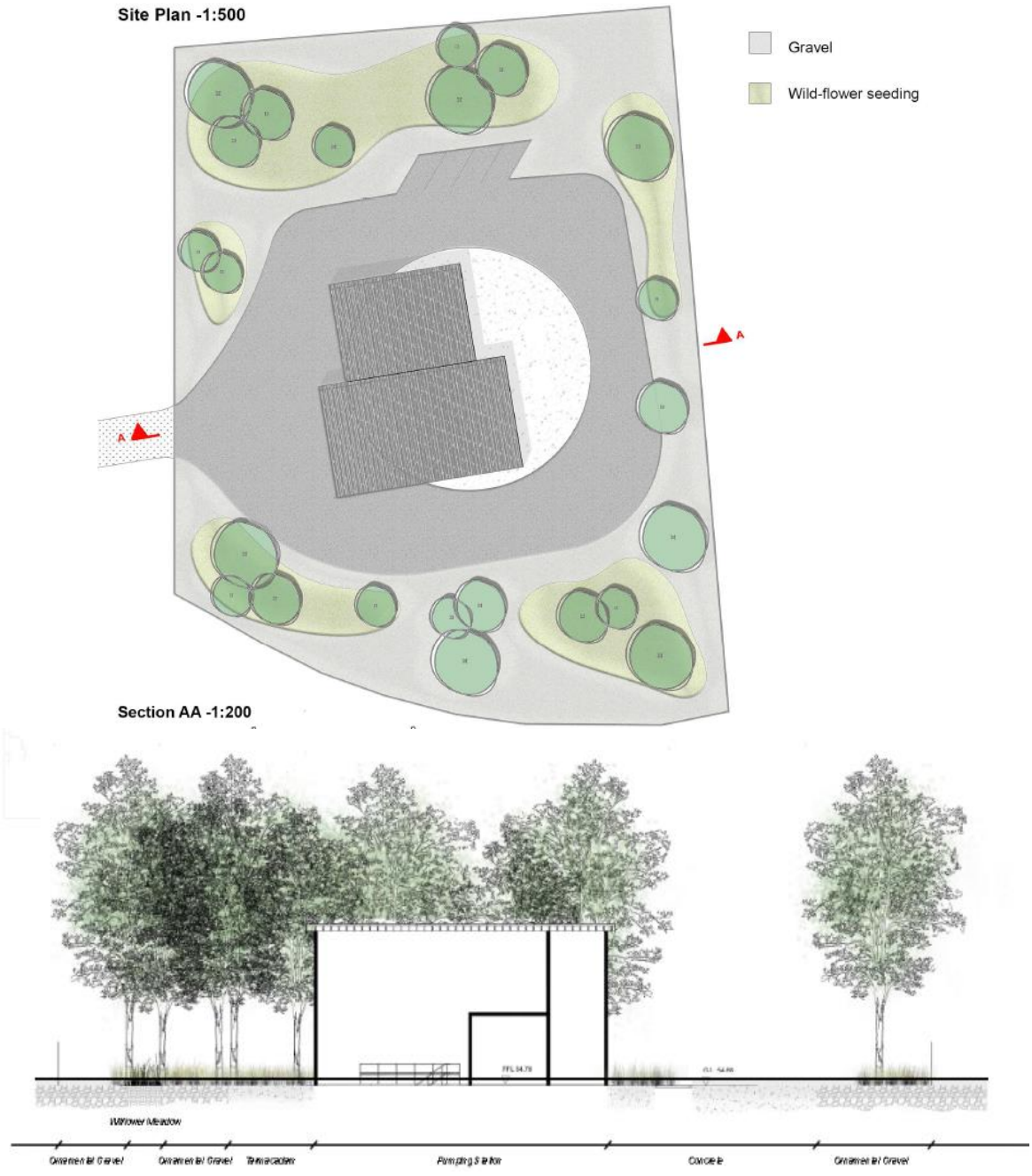


Figure 6: Abbotstown Pumping Station Landscape Plan and Section

6.1.4 Odour Control

An odour control system will be designed to ensure that odour does not give rise to any nuisance beyond the boundary of the Abbotstown Pumping Station site. The system will involve extracting air from the wet well and dry well on a continuous basis. Fans located in the odour control room, will draw air though ducting to the odour control unit comprising an organic filer media. The treated air will be emitted to the atmosphere through 1 no. vertical stack which will extend to a height of maximum height of 10m above roof level of the building

6.1.5 External Lighting

External lighting will be provided along the access road, parking area and around the building. Road-side lighting columns will be approximately 6m high.

6.1.6 Surface Water Management

Rainfall run-off from building roof, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS) with attenuation systems in place to limit discharges from the site to the green field site flow rate. The surface water treatment train approach follows guidance from the Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management) and SuDS Manual (C753) (CIRIA, 2015)

Surface water runoff will be attenuated on site at Abbotstown Pumping Station using a combination of rainwater harvesting (from roofs of buildings), swales, filter drains prior to discharge to the existing water course to the south of the site, which is a tributary of the Tolka River.

A Class 1 By-Pass oil/fuel separator will be provided prior to discharge to the water course to capture pollutants in run-off from the site.

6.1.7 Pumping Station Arrangements

To provide for correct operation and maintenance the design of the pumping station incorporates the following:

- **Below ground wet well**

  The wet well incorporates the inlet pipework, penstocks on the inlet pipework to allow the wet well to be isolated, baffles for even distribution of the incoming flow, suction pipework, access covers to allow access to the wet well and monitoring equipment to monitor the levels within the wet well.

- **Below ground dry well**

  The dry well incorporates the waste water pumps, isolation valves and discharge pipework, access covers to allow access to the dry well and access stairs to allow operations staff access to the dry well

- **Substation**

  The substation will provide for the connection from electricity network to the pumping station.

- **Control room**

  The control room will provide for the required switch gear and control and automation instrumentation required to operate and monitor the pumping station.

- **Welfare facilities**

  The pumping station shall have an office and w.c./wash room for the staff visiting the pumping station.

- **Back up diesel generator**

  A backup generator shall be provided to ensure a continuity of power to the pumps in the eventuality of a problem with the electricity supply to the pumping station. There will be a fuel tank associated with the generator and the generator will be operated via an automatic transfer switch in the event of power failure

- **Surge Equipment**

  Surge equipment shall be provided to relieve and prevent surges caused by rapid valve closure, pump starts and stops etc.

- **Odour control units**

  An odour control unit shall be provided to allow for extraction and venting of air from the wet well.

- **Dosing and chemical stores**

  Provision for a dosing system and a chemical storage area.

- **Storage for spare parts and equipment.**

Layouts have been developed for Abbotstown pumping station and are shown on Planning Drawings 32102902-2141 to 32102902-2145.

6.2 Construction Methodology

The preliminary design of Abbotstown pumping station indicate that the invert level of the inlet sewer is approximately 17m deep and as a result the base slab for the wet well and dry well will be constructed significantly below the existing ground level.

Construction of the Abbotstown pumping station will be undertaken using conventional construction methodologies and will involve deep excavation for basement wet well/dry well, reinforced concrete works, erection of reinforced concrete building frame, erection/building walls (concrete/blockwork);

erection of prefabricated cladding panels to walls and roofs of building, mechanical and electrical fit out of building, construction of access road car park and footpaths, landscaping and final planting.

Preliminary site investigation indicates rock at approximately 2.5m below ground level. The rock shall be excavated in such a manner as to minimize noise generation. Overburden above the rock will most likely be retained using a temporary retaining wall similar to that shown in Figure 7. All excavated material will be removed off site to an appropriately licenced facility.

Figure 7: Example of Pumping Station Construction within Temporary Retaining Wall

7. Terrestrial Pipelines

The GDD project requires orbital sewers to transfer wastewater to the proposed WwTP at Clonshagh and an outfall pipeline to transfer treated wastewater to the outfall location. The preliminary design of the scheme has determined the requirement for the following pipelines;

1. Orbital Sewer consisting of the following elements;
    - 1800mm diameter gravity sewer, approximately 1,000m in length connecting the 9C sewer to the Abbotstown Pumping Station
    - 1400mm diameter rising main, approximately 5,200m in length, from the proposed Abbotstown pumping Station to the R122 regional road (pipeline chainage 6,200m approximately)
    - 1800mm diameter gravity sewer, approximately 7,500m in length from the R122 regional road to the proposed WwTP at Clonshagh
2. Outfall pipeline from the proposed WwTP to the final discharge point located approximately 1km north-east of Ireland's Eye, with a total length of approximately 11,400m and consisting of the following elements
    - Land based section; 1800mm diameter outfall pipeline, approximately 5,400m in length from the proposed WwTP to the R106 Coast Road north of Baldoyle
    - Marine based section; 2000mm diameter outfall pipeline, approximately 5,900m in length from the R106 Coast Road to the final discharge point, located approximately 1km north-east of Ireland's Eye. The final section of this pipeline will include one or more diffuser valves.
3. NFS Diversion Sewer, 1500mm diameter gravity sewer approximately 600m in length, connecting the North Fringe Sewer (NFS) upstream of the point of diversion to the WwTP.

Pipeline diameters have been determined by modelling undertaken as part of the preliminary design of the GDD scheme.

Table 3: Description of the GDD Drainage System

Description	Chainage	Length (m)
Orbital Sewer comprising:		
Gravity Sewer from Tolka Valley Park to Abbotstown Pumping Station	Ch -0,000 – Ch 1,000	1,000
Rising Main from Abbotstown Pumping Station to East of M2	Ch 1,000 – Ch 6,250	5,250
Gravity Sewer from East of M2 to WwTP	Ch 6,250 – Ch 13,750	7,500
Total Orbital Sewer (Blanchardstown to Clonshagh)	Ch -0,000 – Ch 13,750	13,750
Outfall Pipeline (Land Based)	Ch 0,000 – Ch 5,400	5,400
Outfall Pipeline (Marine Based)	Ch 0,000 – Ch 5,950	5,950
NFS Diversion Sewer	-	600
Gravity Sewer from NFS to WwTP	Ch 0,000 – Ch 600	600

7.1 Proposed Pipeline Routes

The orbital sewer will transfer sewage from the primary and secondary load centres to the proposed Regional WwTP. Treated effluent will be discharged to the Irish Sea via an outfall pipeline from the WwTP to the marine outfall location.

The route of the orbital sewer, outfall pipeline and NFS diversion sewer was determined through a route selection process which evaluated environmental, technical and socio-economic criteria to identify the preferred route corridor.

The route of the orbital sewer is identified on Planning Drawing No. 32102902 - 2000. Preliminary plan and long sections are shown on Planning Drawings 32102902 - 2100 to 32102902 - 2105.

The route of the orbital sewer is identified on Planning Drawing No. 32102902 - 2000. Preliminary plan and long section are shown on Planning Drawings 32102902 - 2106.

The route of the outfall pipeline is identified on Planning Drawing No. 32102902 - 2000. Preliminary plan and long sections are shown on Planning Drawings 32102902 - 2107 and 32102902 - 2108.

7.2 Pipeline Corridors

The pipeline corridors as well as the preliminary design for the pipeline vertical and horizontal alignment are shown on Planning Drawings 32102902 - 2100 to 32102902 - 2108.

A proposed construction corridor will be temporarily acquired for the construction of all proposed pipeline routes, including the proposed orbital sewer route, outfall pipeline route (land based section and marine section) and the NFS diversion sewer. The proposed construction corridor will be a temporary corridor, typically 40m wide along all land based elements of the Proposed Project, and 250m wide for the dredged section of the proposed outfall pipeline route (marine section) which commences at the low tide mark. A proposed wayleave will be acquired for permanent access to all proposed pipeline routes for future operation and maintenance and will typically be a 20m wayleave within the proposed construction corridor. The design has allowed for limited narrowing of the proposed construction corridor and the 20m wayleave to accommodate constraints and specific landowner requirements (refer to Figure 8 and Figure 9).

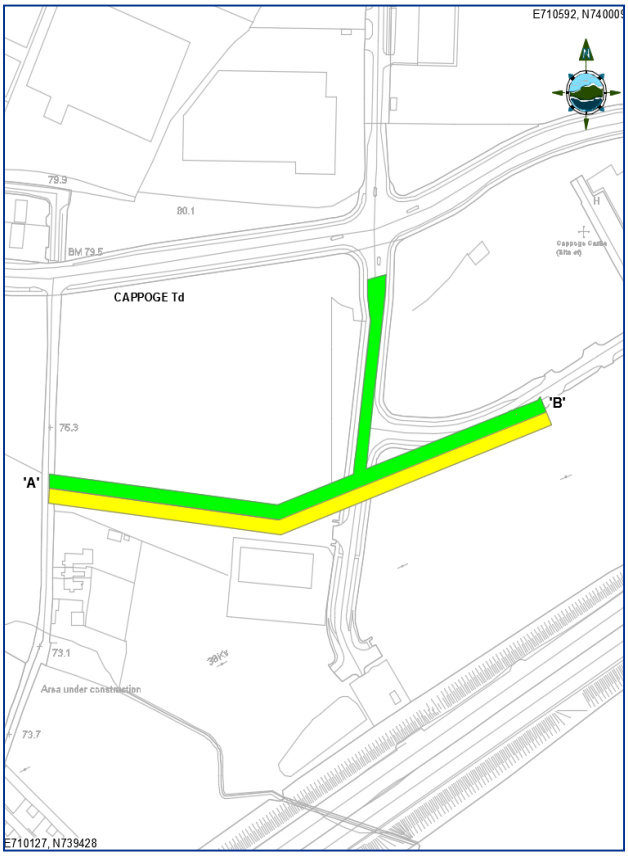


Figure 8: Typical Proposed Construction Corridor and 20m Wayleave Drawing

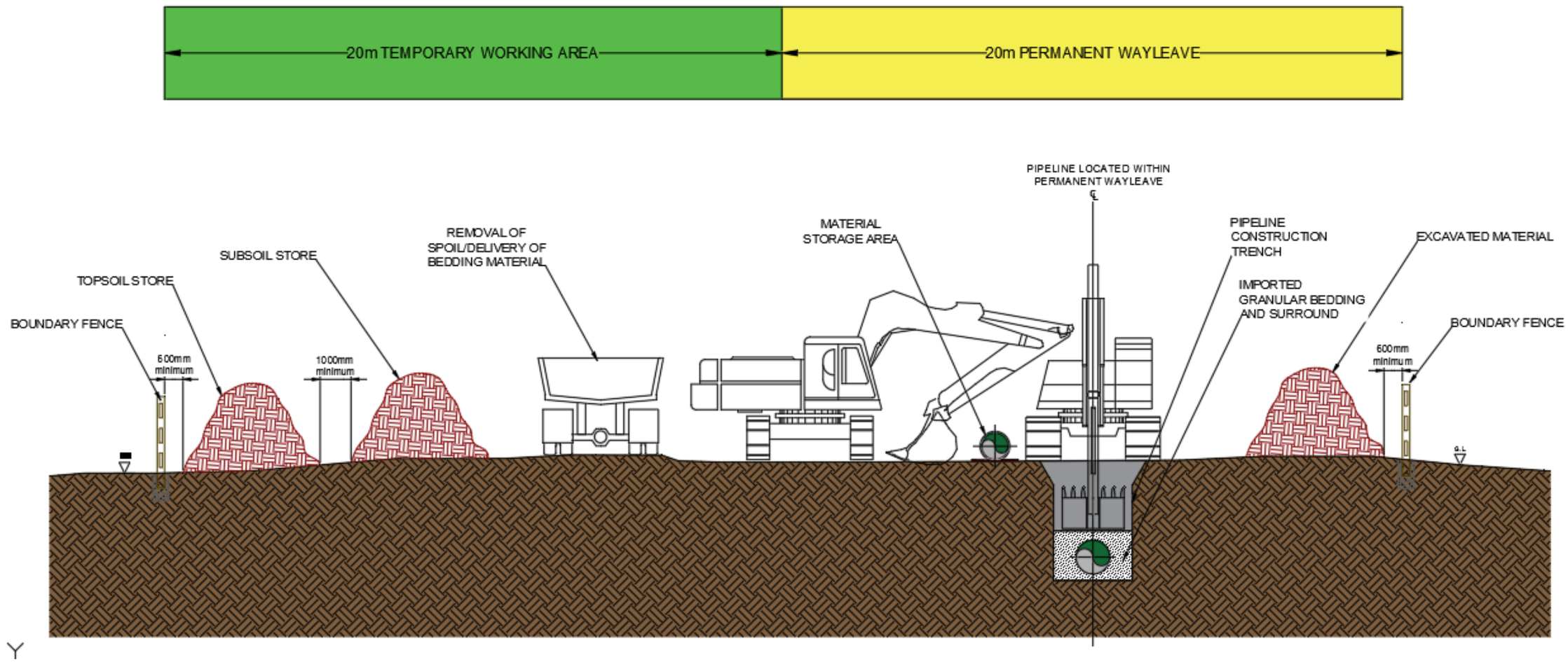


Figure 9: Typical Proposed Construction Corridor (40m) and 20m Wayleave Schematic

7.3 Pipeline Construction Methodology

7.3.1 Construction Overview

In terms of technologies to be considered, due to the topography of the potential routes, the orbital sewer will comprise a combination of gravity sewers and pumped rising mains. The outfall pipeline will operate as a pressurised gravity sewer.

The construction methodology will involve both open cut and trenchless methods. The construction methodology employed for the majority of the orbital sewer construction will be conventional open cut, whereby the proposed construction corridor for the pipe is stripped of topsoil, a trench of suitable dimension is excavated and the pipe is installed, on suitable bedding material, to the lines and levels determined by the design, depending on whether the pipeline is a gravity sewer or a rising main. Following testing of the pipe, it is then surrounded with specified material and the trench is backfilled.

Open cut methodology will not be suitable for all of the proposed pipeline routes, as a number of areas will require the use of trenchless techniques. In particular, the crossing of physical, natural and manmade obstructions, such as significant watercourses, significant topographical features, major roads, railways and major infrastructure, will necessitate the use of trenchless techniques.

Suitable trenchless techniques include pipe jacking and micro tunnelling methods. Trenchless techniques require drive shafts to be constructed at the start of each trenchless section and reception shafts at the end of each section. These shafts will be constructed within the proposed temporary construction compounds located within the proposed construction corridor. At watercourse crossings, the drive and reception shafts will be located a minimum of 20m from the watercourse.

Locations where trenchless techniques will be employed are indicated on Planning Drawing Nos. 32102902 – 2100 to 32102902 - 2107.

7.3.2 Access to Pipeline Corridor & Construction Compounds

Access to the sites of the pipeline route will be via the public road network and along the proposed construction corridor, where practicable. However, in certain circumstances it will not be possible to access the proposed pipeline routes along the proposed construction corridor, and in these circumstances access will be along permanent wayleaves acquired through third party lands. The access points and their locations are listed in Table 7.2 below and are shown on Planning Drawings 32102902 - 2001 to 32102902 - 2014.

To facilitate the construction of the project temporary compounds will be required at various locations, i.e. pumping station, various locations along the pipeline, trenchless crossing locations etc. These temporary construction compounds or satellite compounds will be in place for periods of 1 to 12 months, depending on the location. The satellite compounds will have site office, welfare facilities, parking and materials storage area. The proposed locations of temporary compounds are identified on Planning Drawing 32102902 – 2001 to 32102902 – 2014.

Table 4: Access Points and Locations (Refer to Drawings No. 32102902-1110 to 1112)

Section	Description	Access Points	Access Location
A	Blanchardstown to N2 Road	AP-1A	Existing rear entrance to Connolly Hospital
		AP-1B	Existing entrance to National Aquatic Centre/ Sports Campus
		AP-2	Existing entrance to Premier Business Park
		AP-3	Existing unused road off roundabout on Cappagh Road
		AP-4	New entrance off R135 south of Huntstown Power Station
B	N2 Road to M1 Motorway	AP-5	New entrance off R122 south of Dublin Airport Logistics Park
		AP-6	New entrance off Sillogue Green north of IKEA
		AP-7A	Existing entrance to NCT Centre Northpoint off R108
		AP-7B	Existing entrance to Northside Test Centre off R108
		AP-8A	Existing entrance to compound on Swords Road adjacent to Dardistown Cemetery
		AP-8B	Existing entrance to Quick Park at Dublin Airport
C	M1 Motorway to Dublin Belfast Rail Line	AP-9	New entrance off Clonshaugh Road north of Clayton Hotel Dublin Airport
		AP-10	Existing entrance to Chraobh Chiarain GAA Club off R139
		AP-11A	New entrance off R107 (Malahide Road) south of Kinsealy Garden Centre
		AP-11B	New entrance off R107 (Malahide Road) south of Kinsealy Garden Centre
		AP-12	New entrance off R123 opposite Balgriffin Cottages
D	Rail Line to Baldoyle Bay	AP-13	New entrance off R123 opposite Moyne Park
E	Baldoyle Bay to Tunnel/Dredge Interface	AP-14	Existing entrance at junction of R123 and R126
		AP-15	Existing entrance at Portmarnock Beach Parking on Golf Links Road
F	Tunnel/Dredge Interface to Outfall	Via Irish Sea	Equipment and materials brought to site via Irish Sea

7.3.3 Programme

While the procurement strategy for the GDD project has not been finalised, there will be separate delivery teams (which may or may not be separate contractors) for the various sections of the orbital sewer and outfall pipeline, as defined in Table 7.2. Within each section of the orbital sewer and outfall pipeline separate specialist crews will work on rising mains, gravity pipelines and trenchless crossings.

The construction of the orbital sewer and outfall pipeline (land based) is estimated to take 18 months. Depending on the depth and size of the particular section of pipeline, progress will be in the order of 15 to 30m per day. In advance of pipeline construction, a period will be required for the fencing of the proposed construction corridor, topsoil stripping and archaeological monitoring of the excavations. Post pipeline construction, a period will be required for reinstatement and establishment, particularly where grass is to be planted.

Note: The pipeline could be broken into smaller sections and constructed in parallel or sequentially by multiple crews. The above programme assumes that the total length constructed by one crew.

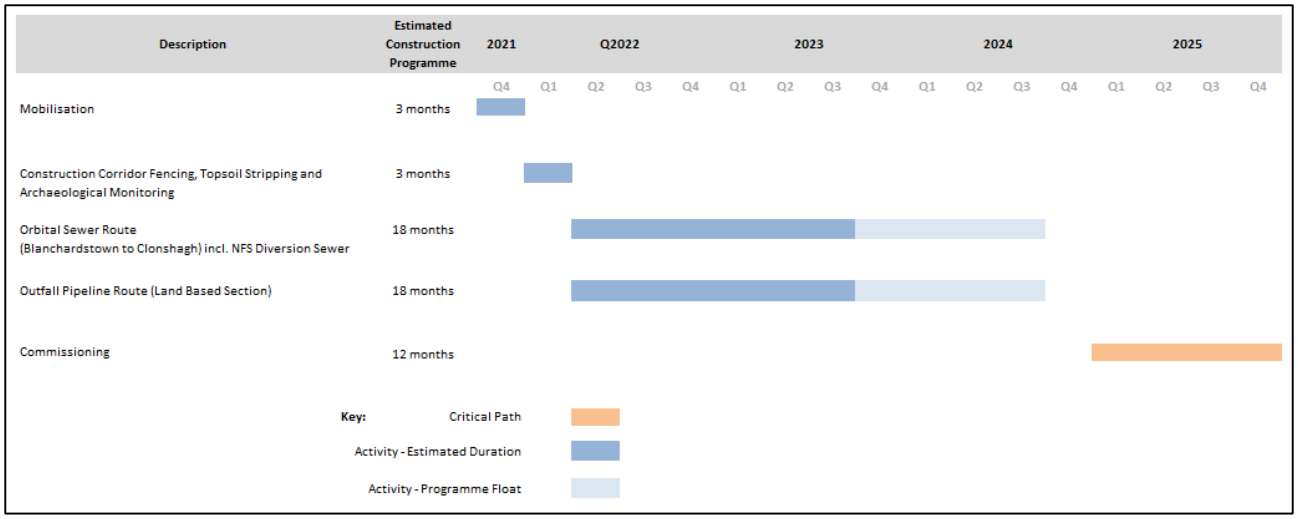


Figure 10: Outline Construction Programme–Terrestrial Pipelines (Part of Overall Programme)

7.3.4 Agricultural Lands and the Orbital Sewer

The majority of the agricultural lands on the orbital sewer and outfall pipeline (land based) routes are located between the M1 and the Dublin to Belfast rail-line.

It is recognised that these lands are highly productive and every effort will be made to minimise the impact of the construction works on these lands, by isolating and separately storing the topsoil and subsoil layers, reinstating all drains and ensuring that there is no cross contamination between different landholdings. To ensure this goal is met, pipeline construction within these lands will be undertaken in accordance with the methodology detailed in this section.

The orbital sewer and outfall pipeline (land based) is divided into a number of discrete sections, separated by physical or natural barriers (Table 7.2 & Planning Drawing Nos. 32102902 - 2001 to 32102902 - 2014). This significantly reduces the risk of cross contamination between land holdings, as there are different access points to sections of the orbital sewer and vehicles cannot travel directly along the proposed construction corridor for long distances.

The division of the orbital sewer into discrete sections also allows the possibility of completing critical sections, such as the sections within agricultural lands to specified sub-schedules if required. This would allow the re-establishment to commence as soon as possible and minimise overall impact on

the lands. Requirements for early completion will be discussed in detail with landowners and included as requirements within the contract documents for the construction of the orbital sewer.

Agricultural Landowners will be provided with as much notice as possible for entry onto their lands. Frequent updates will also be provided on programmed activities.

7.3.5 Terrestrial Pipelines – "Winter" Working

Construction of the pipeline will generally not take place on agricultural lands during the winter months.

For construction purposes, it is assumed that "winter" is defined as the period November to February inclusive.

However, preparatory works may take place during this period. These preparatory works include pre-construction surveys, the removal of sections of hedgerow for pipeline crossings, construction access, erecting fencing and installation of pre-construction drainage along the proposed construction corridor. Other advanced works such as pipe installation by trenchless construction at major crossings, may also be programmed during this period as this will facilitate efficient delivery of the works.

The main pipeline construction activities will be undertaken during the spring, summer and autumn months to take advantage of better weather and light conditions and to reduce the risk of excessive damage to soils along the pipeline route.

7.3.6 Pre Planning

Engagement and consultations have commenced and will continue throughout the project lifetime with all landowners affected by the proposed pipeline route. During the construction planning phase, discussions will centre on queries in relation to the proposed construction works. Particular items to be discussed and agreed in advance of any works commencing may include:

- Particular access requirements for livestock and vehicles to ensure suitable access is maintained throughout the duration of the works;
- Fencing requirements, to ensure the appropriate temporary fencing and gates are used during construction in addition to the fencing type used for permanent reinstatement post construction;
- Presence of any existing drainage, to ensure connections are maintained, or temporary solutions implemented, during construction works and that appropriate permanent solutions are in place on completion of the works; and
- Services, water to troughs, etc.;

Landowner Liaison Officers (LLOs) have been appointed by Irish Water as part of this current planning phase, and will remain in place throughout the construction, reinstatement and handover to address any queries that landowners and stakeholders may have throughout the project.

The LLOs are Irish Waters principle point of contact with landowners and will be the interface between Irish Water and the Contractor on all landowner matters arising during the works. It is responsibility of the LLOs to ensure that channels of communications between the landowners, Irish Water and the Contractor(s) are maintained at all times; and landowners are kept fully informed as the work progresses.

The typical sequence of activities for the pipe line works will include the following:

- Pre-entry agreement outlining landowner's particular requirements;
- Condition Survey - route survey, setting out and photo record of condition
- Corridor Preparation - installation of temporary fencing, access gates and signage,
- Topsoil and Subsoil - soil stripping curtailed between the proposed construction corridor access points
- Construction Corridor - Surface Water Management
- Construction Corridor - haul road construction within the corridor
- Hedgerows – management of hedgerows during construction;
- Pipe Haulage and Distribution - haulage of pipe lengths and stringing along corridor
- Pipe Installation will be carried out in four operations as listed below:
  - Trenching - trench excavation and installation of granular bed to pipe
  - Pipe Installation:
    - Open Excavation - laying the pipe in the trench installing granular material as surround to pipe to 300mm above crown and tie-ins
    - Trenchless - pipe jacking and micro-tunnelling methods under major crossings such as roadways, railways and water courses so as not to disrupt the flow of traffic/ or water above the pipeline route
  - Testing - pressure testing the pipe and
  - Backfill - backfill of the trench and installation of valve chambers

  Whilst these operations may be conducted by different crews they will occur in sequence to each other in order to minimise the duration that the trench is left open. Typically, a maximum length of excavated trench in the order of approximately 50m will be opened at each work front.
- Reinstatement - reinstatement of ground contours, field drainage, topsoil, fencing, hedgerows and
- Commissioning - commissioning of the pipeline.

7.3.7 Commencement of Work

Notice of intention to commence work, within any private lands, shall be given to landowners twenty-eight days in advance of works starting.

7.3.8 Condition Survey

All advance works will be carried out by a team of experienced surveyors and detailed photographic records will be kept during setting out of the works along the corridor and agreed access routes. This will include all features that have the potential to impact, or be affected by the project, such as surface drainage/ watercourses, third party infrastructure, etc.

Before any construction work is commenced Irish Water will prepare a written/visual record of the condition of any affected property. This record will describe the type and condition of boundary fences, any as laid drainage from existing landowner plans and the type and quality of the land affected. A record of any private water supply, boreholes etc. showing locations, the condition of any tracks or private roads crossed by the pipeline will also be recorded. This written record will be backed up by photographs where appropriate.

Irish Water will also prepare a written record of the landowner's particular requirements in relation to temporary fencing, the provision of accesses across the spread, the provision of alternative water supply and the provision of electric fences, etc.

The corridor will be pegged out in accordance with the working width for that location. Prior to anyone undertaking excavation works, the Dial Before You Dig services provided by the various utilities will be availed of to obtain information on the location of underground pipes and cables in and around any proposed dig site. In addition, landowners will be consulted to aid the identification of known services on their lands. Then the full corridor is scanned using a cable avoidance tool (CAT) to confirm the positions of existing services and infrastructure which may affect the works. These services will be marked with Hi-Vis plastic fencing (e.g. Netlon), bunting (for overhead cables) in accordance with ESB Network's 'Code of Practice for Networks Avoiding Danger from Overhead Electricity Lines'), warning signage and bog mat protection where required.

Where unforeseen services are encountered the landowner will be contacted by the Landowner Liaison Officer to discuss and help identify the service so that appropriate controls can be put in place. Where land drains are encountered, their position will be marked and recorded by the global positioning system (GPS) with wooded drain pegs on either side of the trench and referenced back onto the fence lines so that they can be suitably managed during construction and reinstated post construction.

7.3.9 Corridor Preparation

7.3.9.1 Gates

All agreed access gates will be installed before the fencing is completed to ensure that any required landowner access is not impeded. All access gates and fencing locations/ types will be agreed with the landowners in advance of any construction works. All gates will be hung using hinges.

7.3.9.2 Fencing

They will generally match the landowner's use of that location, such as demarcation fencing in arable areas, stock fencing where cattle are kept, post and rail fencing where horses are kept, and heavy duty anti-climb fencing/ hoarding in urban/ security risk areas. Beneath overhead electric lines the fencing will be suitably earthed with rods, if required.

All temporary fencing shall be maintained until reinstatement of the land is completed and shall be removed thereafter. Any fences, walls and hedges removed in the course of the works shall be replaced with appropriate materials in each case.

7.3.9.3 Farm Roadways

Where excavations cross existing farm pathways or roadways, a means of crossing the excavations, acceptable to the landowner, shall be provided. Where an existing access is obstructed adequate facilities for the passage of persons, machinery and stock across the working strip shall be provided. All permanent pathways/roadways affected by the works will be restored to their original state on completion of the works.

7.3.9.4 Drainage

Preliminary site investigation work included the installation of thirty-one standpipes at or near the works sites and along the proposed orbital sewer route. Only two of the standpipes do not record groundwater. In the remaining locations standing water levels during summer months varies from 0.4m below ground level to 7.21m below ground level. Twenty of the standpipes record standing water levels at 3.0m or less below ground level.

Drainage measures for groundwater management may be required in some locations to prevent deterioration of the working areas and excess water collecting in the trench during construction. Existing drainage lines may be rerouted using a drainage trenching machine so that they are not impacted during construction works. These will be installed in accordance with the individual landowner agreements.

Drainage barriers will be created along the excavated trench to prevent groundwater from draining from the surrounding land. These barriers will be placed at manhole and chamber locations for convenience of construction and at suitable locations between manholes where distances exceed 150m.

7.3.9.5 Control of Surface water Runoff

Surface water runoff will be controlled and managed through the implementation of the procedures and mitigation measures outlined in the Outline Surface Water Management Plan.

7.3.9.6 Control of Eelworm and Invasive Species

To prevent the spread of eelworm and potential invasive species, construction activities, including reinstatement, will be carried out on a phased basis on lands that are used for agricultural purposes.

A full clean down of all contactors equipment, machinery, vehicles and footwear shall be undertaken before mobilising and entering each land holding.

The contractor will prepare a plan for implementing the works such that this control method is incorporated into the works programme.

7.3.9.7 Other Works

Other corridor preparation works may consist of the following:

- Erecting advance warning signs at road crossings in accordance with the 'Guidance for the Control and Management of Traffic at Road Works';
- Breaking through the field boundary at the first road crossing, making sure that services are well protected, and, if necessary, laying of bog mats on the access, from the road into the field;
- Preparation of the haul road within the works area;
- Erecting goal posts and bunting across the spread at overhead cable locations (these govern the height at which plant can pass safely underneath) in accordance with ESB Network's 'Code of Practice for Networks Avoiding Danger from Overhead Electricity Lines';
- Breaking through subsequent field boundaries;
- Excavation of trial holes or slit trenches to identify the depth, location and condition of existing services;
- Excavation of trial holes to determine ground conditions, such as ground water levels and identify bed rock locations;
- Installation of watercourse crossings, such as flume pipes as appropriate, to maintain uninterrupted drainage flows;
- Tree pruning and tree protection in accordance with any landowner agreements before the works; and
- Generally carrying out any preparatory work identified by the Land Liaison Officers from any discussions with landowners for the preservation of hedges, trees, buildings or features within the corridor.

Topsoil stripping within a typical construction corridor is illustrated in Figure 11.

Figure 11: Typical Construction Corridor – Topsoil stripping

7.3.10 Topsoil and Subsoil

Topsoil stripping will be curtailed between proposed construction corridor access points in advance of pipeline trenching and installation, i.e. the entire proposed construction corridor will not be stripped at the commencement of the works.

Initially, topsoil will be stripped across the corridor width to its full depth, as determined by Irish Water's Agronomist, and records kept of the depths stripped in each parcel of land. Topsoil would typically have a depth of between 150mm - 400mm across the proposed construction corridor area depending on the rooting depth of the plants growing there. Where practicable the full width of the corridor may not be cleared/ used if it is not necessary to do so for construction works in order to minimise the disturbance. Every care will be taken to prevent topsoil and subsoil mixing.

All topsoil to a depth determined by IW's Agronomist/ Landowner Liaison Officers shall be kept separate and stacked to one side of the working strip on unstripped topsoil. The top layer of subsoil over the trench and running track shall also be stripped to a depth determined by IW's Agronomist and stored separately to the topsoil.

The topsoil and top layer of subsoil stacks will not be stored within 5m of any watercourse. They will be protected during construction activities and kept free from the passage of vehicles and plant. No rubbish will be left on the topsoil stack and first layer of subsoil stack and the stacks will not be stored under overhead services or over underground services. The topsoil stack and first layer of subsoil

stack will be kept free of weeds by chemical spraying with the landowner's consent or by other means of control requested by the landowner and replaced carefully after completion of the works.

All cultivated lawn turf shall be carefully cut, rolled and stacked, and carefully reinstated or replaced with turf of similar quality in accordance with good agricultural practice.

To avoid ridges on the line, a strip of approx. 600mm of topsoil will be left between the subsoil stack and the temporary fencing.

Soil stripping will be carried out during favourable weather conditions when the soil is more dry and friable. Soil handling will be avoided during periods of incessant rainfall. Banksmen will watch over the stacking heap of the topsoil and separately the subsoil being preserved to ensure that mixing of the two does not occur and that material does not get pushed outside the corridor or damage the temporary fencing. A minimum separation distance of at least 1m will be kept between heaps of topsoil and subsoil to prevent cross contamination. Typically, the stockpiles will be up to 3m in height and at a maximum 5m. Stacking heaps will be built neatly and well-shaped to ensure, as far as possible, they are weatherproof. Other measures may be implemented to improve the protection of spoil heaps from construction activities, wind/water erosion or for weed management. The method and level of protection will be dictated by the prevailing weather conditions, level of exposure and operational activities in the vicinity of the stockpiles. Some of these measures may include exclusion zones/ fencing, plastic sheeting, weed spraying, sowing of grass/oats etc. If weed spray is required or if new seeds are being introduced, then the details will be discussed and agreed with the landowner in advance of the measure being implemented. Topsoil removed from the banks of watercourses and ditches will be stacked separately. Gaps will be left in the topsoil heap to permit the maintenance of public easements, surface water management and beneath all overhead cables.

Once the topsoil and a portion of the subsoil have been suitably stockpiled further grading or benching of the remaining ground level may occur to give a level surface and working platform along the side of the trench. If working in a flood plain is unavoidable, special measures will be discussed and agreed with the OPW and EPA. These may include weather monitoring, topsoil wrapping, emergency procedures, and fuel storage constraints.

7.3.11 Construction Corridor – Haul Roads

A construction haul road will run the length of the corridor, within the working width, and will be the route that construction traffic will use for transport in and along the agreed corridor. It will generally bear directly upon the subsoil in good ground; however, to maintain the integrity of the subsoil the Contractor may have to provide a temporary geogrid mattress overlain in stone.

Access/ egress to the proposed construction corridor will be as per that defined in Table 7.2.

7.3.12 Hedgerows

Whilst construction for the pipeline will not take place on agricultural lands during the winter months, preparatory works may take place. These would include pre-construction surveys and the removal of sections of hedgerow (November to February inclusive) for pipeline crossings, construction access, and installation of pre-construction drainage. The main pipeline construction activities will

be undertaken during the summer months to take advantage of better weather and light conditions and mitigate the potential damage to soils along the pipeline route.

Mitigation measures have been outlined in the EIAR with respect to Hedgerows.

7.3.13 Pipe Haulage and Distribution

Pipes are stored temporarily in the Contractors site compounds/ strategic pipe storage depots before being transported to the pipe laying area for unloading when conditions allow. The pipe is transported to site by lorry, or tractor & trailer, in individual lengths (could be up to 13.5m in length), depending on material, diameter and weight. The pipe lengths are then unloaded and placed along the corridor adjacent to the pipe trench in which they are to be laid.

Figure 12 shows pipe being loaded and unloaded.

Figure 12: Pipe Lengths being unloaded using a Vacuum Lift

The pipe haul vehicles used will be suitable for the condition of the haul road in that location. Pipe lengths will be off loaded by side boom/ excavator and laid end to end, parallel to where the trench in which they will be laid will be excavated.

The pipe lengths will be cleaned and prepared, and inspected prior to being lowered into the trench.

Figure 13: Pipe Stringing along the Pipeline Corridor

If a welded pipe system is used, multiple pipe lengths will be joined together at ground level to form the longest possible practical pipe strings that the physical constraints of that location, pipe material, joining method, and available plant, can safely allow. In alternative systems, pipes can be directly lowered into the trench before being joined.

7.3.14 Trenching (Generally)

The main trench excavation will be predominantly open cut (see Figure 14) and carried out with plant such as excavators, as appropriate to the identified soils and ground conditions. Spoil from the trench will be stored adjacent to the excavation at a suitable distance from it on the opposite side of the trench to the stockpiled topsoil and subsoil reserved for reinstatement. Care will be taken to ensure that gaps are left in the stockpiled excavated material to permit the maintenance of public corridors, surface water management and beneath overhead cables.

Before trenching commences dewatering of groundwater may be required to ensure safe working conditions; the trenching operation is only conducted once the pipeline installation and backfill crew are ready to install the pipeline in that location in order to minimise the duration that the trench is opened for. This will be conducted in accordance with the Final Construction Environmental Management Plan.

Figure 14: Trenching using Excavators

The geotechnical investigations will have identified the nature and depth of the sub-soil and rock and allow the Contractor to employ the appropriate plant needed.

7.3.14.1 Rock

Softer or fragmented rock may be broken up by bulldozers fitted with a ripping claw. Harder rock may be broken up by large hydraulic breakers fitted to excavators to break up the rock to formation level. Alternatively, due to rock strength or composition, a rock saw may be employed to cut a trench along the centreline to trench bottom depth. In areas of extremely high strength rock, it may be necessary to employ other methods of rock breaking. One such method involves drilling holes, typically less than 50mm diameter in a grid pattern spacing of 200 – 400mm, into the rock and injecting an expansive mortar which expands rapidly causing the rock to fracture.

At this stage, the broken-up rock from the above methods may not be excavated at this time and may remain in situ until the pipe trenching/ laying crews extract it. If the material is excavated and removed at this time, suitable pegging, bunting and signage will be established for safety around the excavation.

In areas where rock is encountered, it may be broken further, graded, and used during construction such as in pipe bedding and surround material, haul roads, etc. or made available to the respective landowners or transported off site to permitted disposal areas (in accordance with the respective waste regulations).

Areas where rock is likely to be encountered have been identified and included in Chapter 13 Land and Soils of the EIAR; whilst Chapter 9 Noise and Vibration considers the noise impact of hydraulic breakers on the surrounding areas and mitigation measures required.

7.3.15 Pipeline Installation

The pipeline installation methodology is dependent on the chosen pipe material. The suitability of particular materials will be considered further at detailed design and procurement stages of the

project, however the major consideration in the choice of material is likely to be the construction methodology, the application either rising main or gravity sewer, and likelihood of anaerobic conditions in the drainage system.

Concrete, Ductile Iron, Glass Reinforced Plastic (GRP) pipes and Polyethylene pipes are likely to be considered suitable, with specialist pipes being required for trenchless applications.

Special wrappings or linings may be required depending on the specific soil conditions where the pipe is to be laid and the likelihood of anaerobic conditions in the drainage system.

7.3.15.1 Pipe Installation – Open Excavation

Following excavation of the trench, the pipe bedding layer will be prepared and the pipe lifted and lowered into the trench with side booms/ excavators. The trench will be kept free of water during lowering in and tie-in.

Once a pipe is in the trench the connections are secured (see Figure 15).

Figure 15: Open Cut Method for Sewer Construction

(http://www.rocla.com.au/Concrete-Pipe.php) (https://www.vpgroundforce.com/Groundforce/media/Groundforce/Images/Groundforce%20Shorco/Trench%20Boxes/Rolling-Strut-Trench-Box-Thumb.png)

7.3.15.2 Pipeline Installation – Trenchless Methodology

Trenchless construction will involve the tunnelling under major crossings such as roadways, railways and water courses so as not to disrupt the flow of traffic/ or water above the pipeline route. This avoids cutting and reinstating a valuable asset or amenity by conventional open cut excavation and pipeline installation and is preferable where there is environmental, technical and public disturbance justification.

Trenchless methods will be employed at the following locations;

- From connection point with the BRDS system, through Connolly Hospital as far as Abbotstown Pump Station
- Cappagh road
- R135
- M2
- R122
- Sillogue Golf Club
- R108 (Ballymun Rd.)
- R132 (Old Swords Rd).
- M1
- Clonshaugh road
- Malahide Rd.
- R124
- Dublin-Belfast Railway
- various watercourses as listed in Table 7.3.

Pipe jacking and micro-tunnelling methods are suitable trenchless techniques, however this will ultimately be confirmed at the detailed design stage when further information on the ground conditions is acquired. As described above the trenchless sections have the additional benefit of subdividing the pipeline corridor to allow greater flexibility in terms of construction sequencing and also to prevent cross contamination between adjacent lands.

Micro-tunnelling is a remote-controlled excavation method that installs the pipe behind the tunnel face shield by pushing, or 'jacking', pipes from the drive shaft. There is however a limit on the length of a micro-tunnel bore as the tunnel lining must be pushed, or 'jacked' from a drive shaft, and although bentonite is used as a lubricant, friction between the tunnel wall and the surrounding ground will ultimately limit the length that can be installed by this method. Intermediate jacking points can

be introduced to extend the driving distance but the ground conditions and the large jacking forces required will always be the limiting factor.

Tunnelling will require shafts to be excavated on either side of the crossing, one is the drive, or launch or 'jacking' shaft and the other is the receiving or reception shaft. The shafts can be constructed out of interlocking sheet piling or by sinking a shaft constructed from reinforced concrete rings or segments. The drive shaft, from where the tunnel will be jacked from, will have a jacking wall constructed behind the jacking rig of powerful hydraulic jacks. This wall must be strong enough to withstand the pushing forces applied from the hydraulic jacks and spread these loads to the surrounding ground. The shafts and tunnel drive are often deep to ensure they are a suitable distance under the obstacle being crossed. As such they are often below the natural water table and a system of water management should be installed to provide a suitably safe and relatively dry working environment in a deep excavation. These shafts could be up to 10m in diameter and will have suitable fencing installed around them (Figure 16).

The micro-tunnelling process is briefly described hereunder;

- Excavate and prepare Launch/ Reception shaft (10m diameter minimum)
- Set up control container and other auxiliary equipment beside launch/reception shaft
- Setup jacking frame and hydraulic jacks
- Lower micro-tunnelling machine into launch/reception shaft and set up
- Set up laser guidance system
- Setup slurry lines and hydraulic hoses on the micro-tunnelling machine
- Commence Jacking
    - Main jack pushes the micro-tunnelling machine forward
    - When back of tunnel machine reaches face of drive, disconnect slurry lines and hydraulic hoses from jacked section, jacks are retracted.
    - Lower new pipe segment behind the tunnel machine and reconnect slurry lines and hydraulic hoses
    - The Jacks are re engaged to the pipe, jack new pipe segment and excavate and remove spoil
- Repeat until receiving shaft is reached.

Figure 16: Tunnel Jacking Launch Shaft

(North Leixlip Sewerage Scheme – 1500mm diameter crossing of Dublin Sligo rail-line and Royal Canal)

The method of spoil extraction, as detailed below, will be chosen based on operational and environmental constraints:

- Auger System - an auger chain transports the spoils to a skip in the launch pit. When the mud skip is full, the operation is paused to allow the skip to be hoisted to the surface to be emptied.
- Slurry System - the slurry, a mix of bentonite and water, is used to suspend the excavated spoil. It is then pumped out of the excavation, via a system of pipes, to a solids separation system on the surface, at which point the spoil is filtered and separated from the slurry. The filtered slurry is subsequently recirculated and reused within the slurry system. The liquid sludge remaining in the tanks is placed under a soil separator, and dewatered with a centrifuge or a filter press.

The pipe jacking operation is represented schematically in Figure 17.

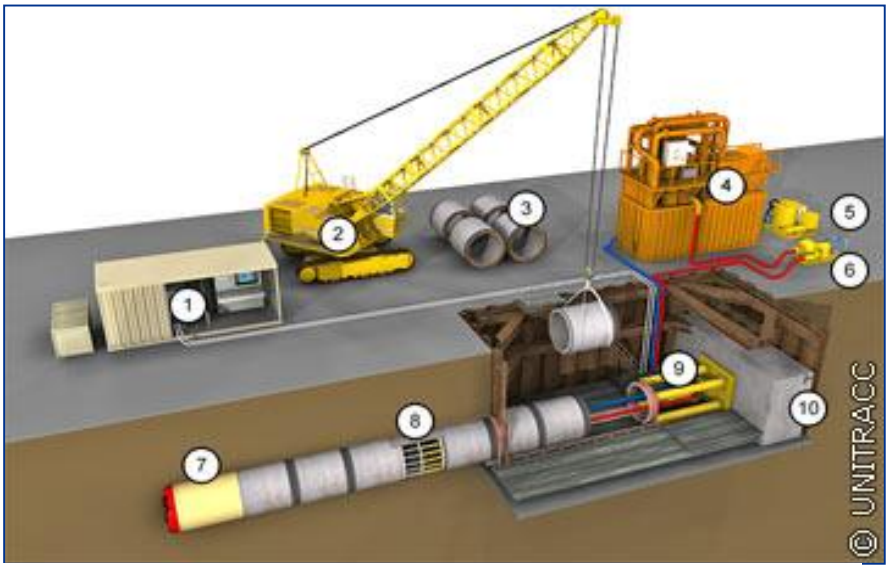


Figure 17: Schematic presentation of micro tunnelling/pipe jacking [Image: S&P GmbH]

Note:

1.Control and steering desk, 2 Crane

3 Jacking pipes, 4 Separation plant

5 Mixing plant, 6 Supply pump

7 Shield machine, 8 Intermediate jacking station

9 Main jacking station, 10 Abutment

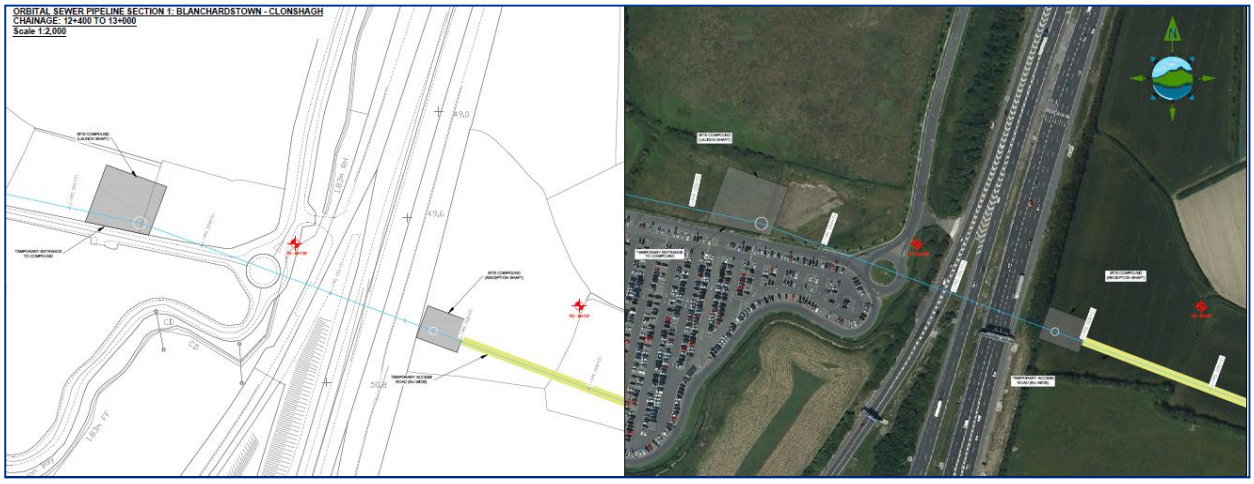


Figure 18: Typical Trenchless Road Crossing

Drawing Nos. 32102902 - 2100 to 32102902 - 2113 indicate locations where trenchless construction of the orbital sewer and outfall pipeline will be necessary.

Following consultation with Inland Fisheries Ireland trenchless construction is the preferred method to be employed at all water course crossings.

7.3.16 Testing

Upon installation of the pipework a hydrostatic/water test will be carried out on complete sections of pipeline to ensure there are no leaks. The pipe will be tested in discrete lengths, the lengths of which will be decided based on operational constraints and the quantity of water available. Water will be re-used in multiple test sections by over-pumping as required with final discharge of the test water via the outfall pipeline

In agreement with Irish Water, water for hydrostatic testing will be taken from the public mains. (assume test in 2km sections on RM, OS test between 2 manholes)

7.3.17 Backfilling

Trench backfill will commence as soon as possible after pipe installation. Depending on the quality of excavated material it may be screened to ensure that stones and debris don't impinge on the pipeline. Wherever possible, excavated material will be utilised to surround the pipe to avoid the impact of importing large quantities of suitable bedding and surround material and the consequences of removing surplus excavated material. This has significant environmental benefits including fewer vehicle movements along the corridor and on public roads. Easement preparation and maintenance issues are also significantly reduced.

If this is not feasible due to the condition of the excavated material, then suitable granular material will be imported for the backfill around the pipe. Once suitable material is generated or imported it will be carefully placed around and over the pipeline to 300mm above crown of pipe.

The reconnection of land drains altered during construction, which are not being replaced by an easement or header drain will be carried out as part of the backfill operation. After the installation of the pipeline the backfill will be compacted in layers up to the underside of the severed drains which are to be permanently reinstated by cross connection. The replacement drain will extend into the undisturbed ground on each side of the trench for a suitable distance to ensure a properly supported connection can be made (typically 1m or more). The undisturbed ground will be excavated by hand and a good connection formed to the existing drain. The pipeline trench backfill will then be compacted up to the subsoil surface level.

Surplus excavated material will be removed off site.

7.3.18 Reinstatement

Generally, the reinstatement operations start with restoration of the subsoil by scarifying/ ripping it with Flat Lift Rippers pulled by a Dozer, to a minimum uniform depth of 300mm taking care not to damage the field drainage and other services. The depth of ripping will be selected to scarify/ loosen any material compacted during construction. In all cases the depth of ripping shall exceed the depth of subsoil compaction. All surface stones and roots over 150mm in diameter will be picked up and removed. Re-grading subsoil will be conducted including side slopes where applicable using excavators / dozers / graders.

The spreading of subsoil and later topsoil will be carried out during favourable weather conditions when the soil is more dry and friable. Soil handling will be avoided during period of incessant rainfall. The subsoil stockpiled for reinstatement will be pulled back from the fence line using excavators to allow Dozers to push it evenly back across the corridor and leaving it generally level. Then the separately stockpiled topsoil will be pulled back from the fence line using excavators to allow Dozers to push it evenly back across the corridor and leaving it generally level so as to present a neat and level appearance (the level of the trench area shall be the same as that of the undisturbed surrounding around one year after restoration is completed).

Reinstatement of ditch banks, boundary fences/ walls and the replacement of "Hedge mound", as far as possible, using an excavator will be carried out during this time; all stones/ roots in excess of 50mm in diameter from the surface will be removed. The topsoil will then be given a final inspection, and corrected accordingly, to ensure it is neat and level in appearance. Generally, all areas will be restored to pre-existing ground conditions allowing for some settlement. Depths of spread over the corridor width could be expected to be of the order of 80mm – 100mm with breaks at natural low points/ water courses. This allows for the gradual settlement of the disturbed material over time as well as re-establishing the best natural drainage through the location.

If for some reason it is necessary to import topsoil onto the site, the topsoil will be checked for quality, consistency, and soil structure ensuring that no stones or debris are contained within the topsoil. The source and supplier of the topsoil will be inspected and approved by Irish Water's Agronomist for the suitability for the proposed location. In all situations, the topsoil from that parcel of land which was cleared, stockpiled and protected during construction will be the priority for use during reinstatement.

Reseeding is carried out on completion of the topsoil spreading (see Figure 19), if required; the rate of seeding, time and method of sowing, including application of fertiliser, shall be in accordance with good agricultural practice. Driving over the land, where topsoil has been put back, will be kept to a minimum, particularly in wet weather. Mechanical equipment heavier than standard tractors and trailers will not be allowed to travel back over the top soil.

Where areas of specific specialist re-instatement are required, e.g. species rich grasslands, etc., then the methods employed will be in accordance with the Final Construction Environmental Management Plan.

At bends, changes in gradient and at specific locations along the pipeline route manholes shall be constructed. Covers shall be provided to these manholes to facilitate future access.

Ventilating columns will be required at specific locations along the orbital sewer such as at the head of gravity sewers, at odour control units and at strategic locations along the orbital sewer. The columns are typically 150mm steel columns up to 6m high.

Figure 19: Land Reinstatement

The machines used for the reinstatement of topsoil and subsoil will be of a suitable ground bearing pressure to minimise compaction as much as is practicable.

7.3.18.1 Weeds

Where a weed problem exists as a result of the work, chemical sprays will be used in accordance with the Sustainable Use (of pesticides and herbicides) Directive. All ground/ boundary walls/ fences within the working strip, and any other ground disturbed by the operations, will be restored to a condition equivalent to that existing before the commencement of the works.

7.3.19 Commissioning

Upon completion of reinstatement, handover of the corridor will be discussed with the landowner through the Landowner Liaison Officers. This will include an inspection and photo survey of the works section to ensure that all works have been completed in accordance with the landowner agreement for formal handover to the landowner. If this inspection identifies any outstanding works, these will be completed by the contractor prior to handover.

7.4 Pipeline Crossings of Infrastructure

The routing of the pipeline corridors for the orbital sewer and the outfall pipeline necessitates the crossing of infrastructure which occur within the pipeline corridor. The significant crossings are summarised hereunder with full details, including drawings indicating the location of such crossings are available in the 'Engineering Specialist Report for Crossings, (Jacobs/Tobin), December 2017'.

	Pipeline Corridor	Approx.Chainage	Description
Aviation transmission infrastructure	Orbital Sewer (Blanchardstown – Clonshagh)	13,370m	Aviation fuel pipeline
Gas Transmission Infrastructure	Orbital Sewer (Blanchardstown – Clonshagh)	2,160m	900mm dia. Gas main
	Orbital Sewer (Blanchardstown – Clonshagh)	2,600m	900mm dia. Gas main
	Orbital Sewer (Blanchardstown – Clonshagh)	11,700m	450mm dia Gas main
Electrical Power Transmission Infrastructure	Orbital Sewer (Blanchardstown – Clonshagh)	1980m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	2,300m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	3,400m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,550m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,820m	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,840m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,870m	220kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,890m	220kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	4,900m	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,070	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,110m	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,110m	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,150m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,150m	110kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,180m	220kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	5,370m	110kV U/G Cable
	Orbital Sewer (Blanchardstown – Clonshagh)	11,680m	38kV O/H Power Line
	Orbital Sewer (Blanchardstown – Clonshagh)	12,410m	38kV O/H Power Line
	North Fringe Sewer Diversion	0,485m	38kV O/H Power Line
	Outfall Pipeline (Land Based Section)	2,300m	38kV O/H Power Line
	Outfall Pipeline (Land Based Section)	3,150m	38kV O/H Power Line
	Outfall Pipeline (Land Based Section)	3,530m	38kV O/H Power Line

	Outfall Pipeline (Land Based Section)	3,660m	38kV O/H Power Line
Strategic Trunk Sewer Pipelines	Orbital Sewer (Blanchardstown – Clonshagh)	11,700m	900mm trunk sewer
	Orbital Sewer (Blanchardstown – Clonshagh)	13,380m	300mm sewer (TBC)
	Outfall Pipeline (Marine Based Section)	0,100m	300mm rising main (TBC)
Strategic Trunk Water Supply Pipelines	Orbital Sewer (Blanchardstown – Clonshagh)	3,550m	24" , 450mm and 800mm North Fringe trunk main from Ballycoolen to Cappagh, Dublin City (2No)
	Orbital Sewer (Blanchardstown – Clonshagh)	10,650m	400mm supply to Dublin Airport along the R132 Old Swords Road (3No)
	Orbital Sewer (Blanchardstown – Clonshagh)	13,380m	24" trunk main between Swords and Clonshaugh, Dublin City (1No)
	Outfall Pipeline (Land Based Section)	4,800m	450 and 560mm trunk main between Swords and Donaghmede, Dublin City (2No)
Existing Rail Infrastructure	Outfall Pipeline (Land Based Section)	4,570m	Dublin – Belfast Rail line
Planned Rail Infrastructure	Orbital Sewer (Blanchardstown – Clonshagh)	3,650m	Metro West Line
	Orbital Sewer (Blanchardstown – Clonshagh)	7,520m	Metro West Line
	Orbital Sewer (Blanchardstown – Clonshagh)	9,370m	Metro North Line
Submarine Fibre Optic Cable	Outfall Pipeline (Marine Section)	4,500m	Submarine Fibre Optic Cable
National Primary Roads & Motorways	Orbital Sewer (Blanchardstown – Clonshagh)	5,500m	N2
	Orbital Sewer (Blanchardstown – Clonshagh)	12,650m	M1
Regional & Other Roads	Orbital Sewer (Blanchardstown – Clonshagh)	3,440m	Cappagh Road
	Orbital Sewer (Blanchardstown – Clonshagh)	5,350m	R135
	Orbital Sewer (Blanchardstown – Clonshagh)	6,250m	R122
	Orbital Sewer (Blanchardstown – Clonshagh)	9,100m	R108
	Orbital Sewer (Blanchardstown – Clonshagh)	11,650m	R132 (Swords Road)
	Orbital Sewer (Blanchardstown – Clonshagh)	13,380m	Clonshaugh Road
	Outfall Pipeline (Land Based Section)	1,860m	R107 (Malahide Road)
	Outfall Pipeline (Land Based Section)	3,890m	R124
	Outfall Pipeline (Marine Section)	0090m	R106 (Coast Road)
	Outfall Pipeline (Marine Section)	0850m	Golf Links Road
	Pipeline Corridor	**Approx.Chainage**	**Description**

Local Roads	Orbital Sewer (Blanchardstown – Clonshagh)	2,620m	Local Road West of Premier Business Park
	Orbital Sewer (Blanchardstown – Clonshagh)	2,860m	Premier Business Park
	Orbital Sewer (Blanchardstown – Clonshagh)	6,780m	Dubber Cottages
	Orbital Sewer (Blanchardstown – Clonshagh)	7,990m	Sillogue Green

Table 5: Infrastructure Crossed by the Pipeline Corridor

7.5 Pipeline Crossings of Watercourses

The routing of the pipeline corridors for the orbital sewer and the outfall pipeline necessitates the crossing of a number of watercourses which occur within the pipeline corridor. The significant crossings are summarised hereunder with full details, including drawings indicating the location of such crossings are available in the 'Engineering Specialist Report for Crossings, (Jacobs/Tobin), December 2017'.

Micro-tunnelling requires shafts to be excavated on either side of the crossing, a minimum of 20m from watercourses.

Table 6: Watercourses and Infrastructure Crossed by the Pipeline Corridor

	Pipeline Corridor	Approx.Chainage	Description
Watercourses	Orbital Sewer (Blanchardstown – Clonshagh)	0,680m	Tributary of Tolka River
	Orbital Sewer (Blanchardstown – Clonshagh)	8,310m	Santry River
	Orbital Sewer (Blanchardstown – Clonshagh)	10,560m	Mayne River
	Outfall Pipeline (Land Based Section)	0050m	Cuckoo Stream
	NFS Sewer Diversion	0025m	Mayne River

8. Outfall Pipeline (Marine Section)

1.1 Outfall Pipeline (Marine Section) Construction

The preferred option for the construction of the outfall pipeline (marine based) is a combination of micro-tunnelling and sub-sea pipe laying (dredging) techniques. The micro-tunnelled section will commence at the west side of the Baldoyle Estuary and the tunnel section will progress beneath Baldoyle Estuary and terminate seaward of the Baldoyle Bay SAC/SPA below the low water level mark, a distance of approximately 2,000m in total.

The sub-sea pipe section will involve the excavation of a trench from the tunnel termination point to the outfall location (c. 4.0km), the trench will be 5m deep trapezoidal trench – 5.0m wide at base. Excavated material will be temporarily stored on the sea bed within the working corridor and parallel to the pipeline trench.

The sub-sea pipeline, a LLLD (Long Length Large Diameter) Polyethylene (PE) pipe of 2.0m diameter, will be installed by “float and sink” method.

8.1.1 Micro-tunnelled Section

Micro-tunnelling techniques will be used from the open fields immediately west of the R106 Coast Road to approximately 600m offshore terminating below the low tide level.

The micro tunnel section is 2m internal diameter, constructed at depths ranging between 15m and 20m below ground level using a micro-tunnelling machine, with pipe sections installed as the tunnelling machine progresses.

The tunnel section will require temporary construction compounds onshore, in the open field immediately west of the R106 Coast Road and in the grassed area adjacent to the public car park off the Golf Links Road, immediately north of Portmarnock Golf Club. At these compounds, the launch/reception shafts would be constructed, tunnelling equipment would be located and the tunnel materials would be stored temporarily. Waste material from the tunnel would be removed and disposed of in accordance with waste management legislation. Preliminary analysis estimates that the micro-tunnelling would progress at a rate of approximately 60m per week and that the tunnelling would take in the region of 12 months including for site mobilisation. An outline programme for these works is provided in Figure 20.

Figure 20: Tunnel Compound Locations

The micro-tunnelling compound area will require an area of approximate dimension 200m x 100m and will contain the following plant and facilities:

- Office area including car parking;
- Launch/ Reception Shaft with Jacking Station;
- Tunnelling equipment including;
    - Tunnel Boring Machine (TBM)
    - Control Unit
    - Hydraulic pump units
    - Generators
    - Bentonite mixing plant
    - Water separation plant
- Storage area for jacking pipes, fuel, bentonite, topsoil, surface water;
- Crane; and
- Excavator.

A typical arrangement for the micro-tunnelling compounds is illustrated in Figures 22 and 23.

Micro tunnelling would operate on a continuous 24 hour/ 7-day basis. The construction of the micro-tunnelled section of the outfall pipeline (marine section) is estimated to take 15 months.

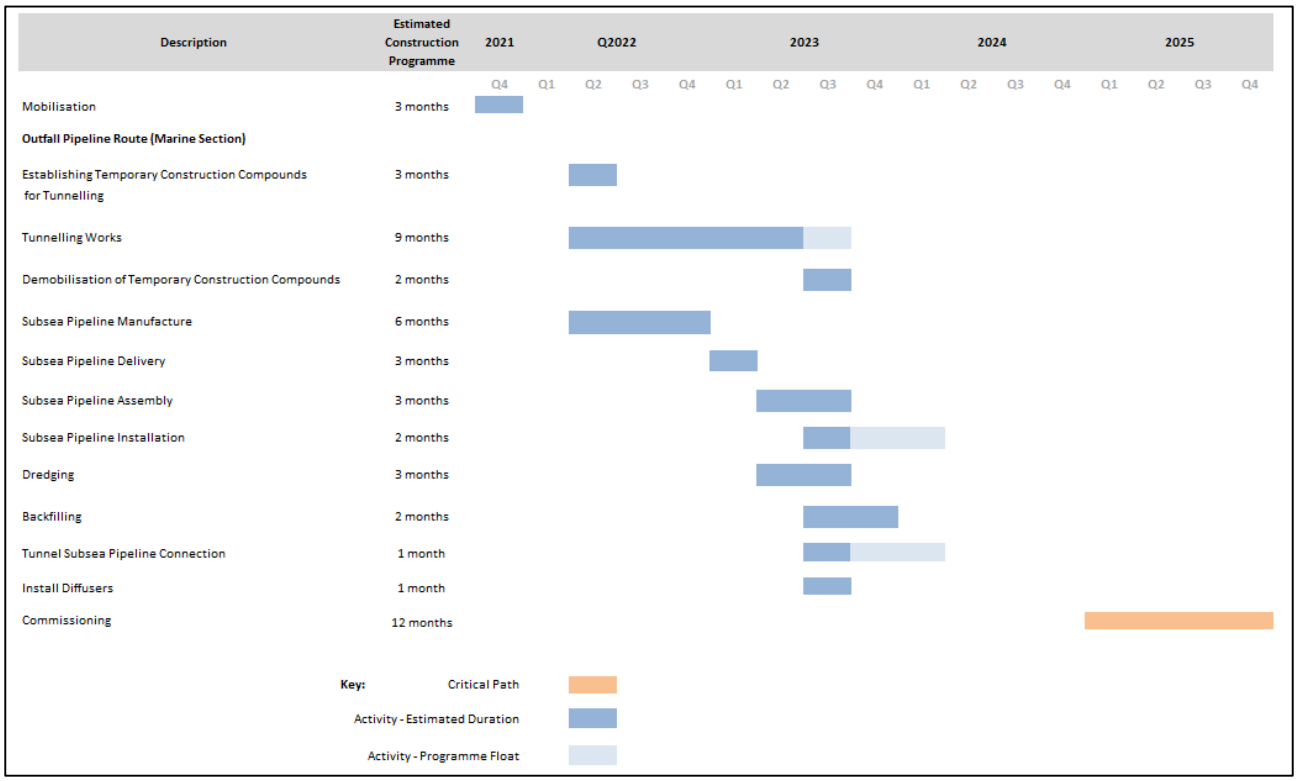


Figure 21: Outline Construction Programme–Marine Based Pipelines (Part of Overall Programme)

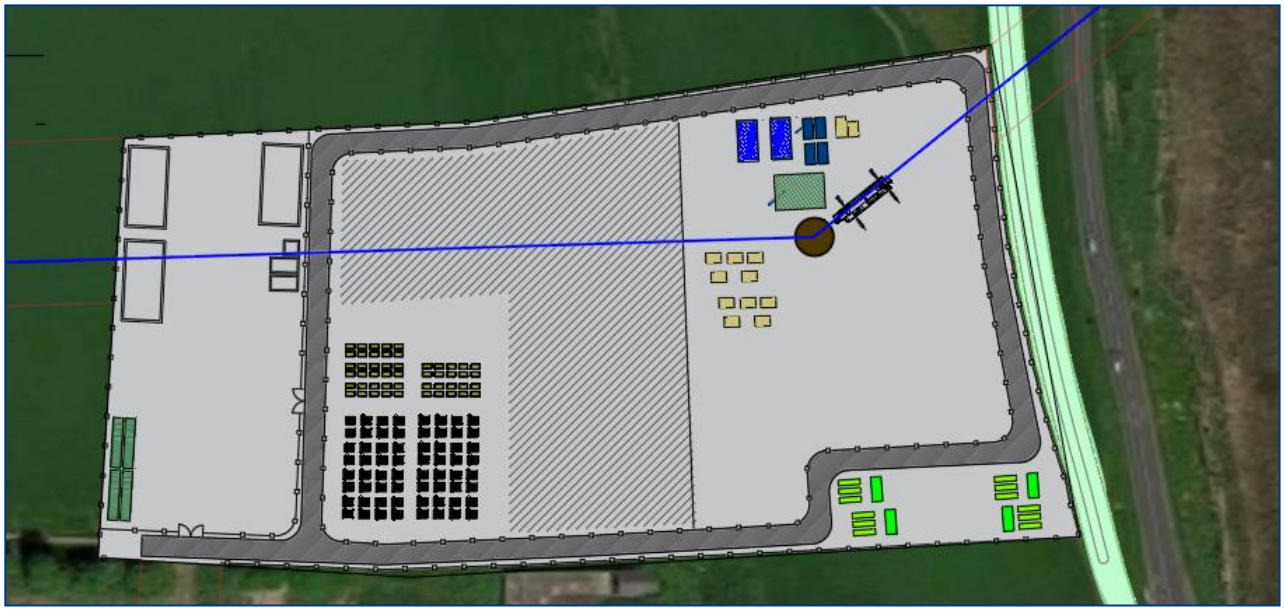
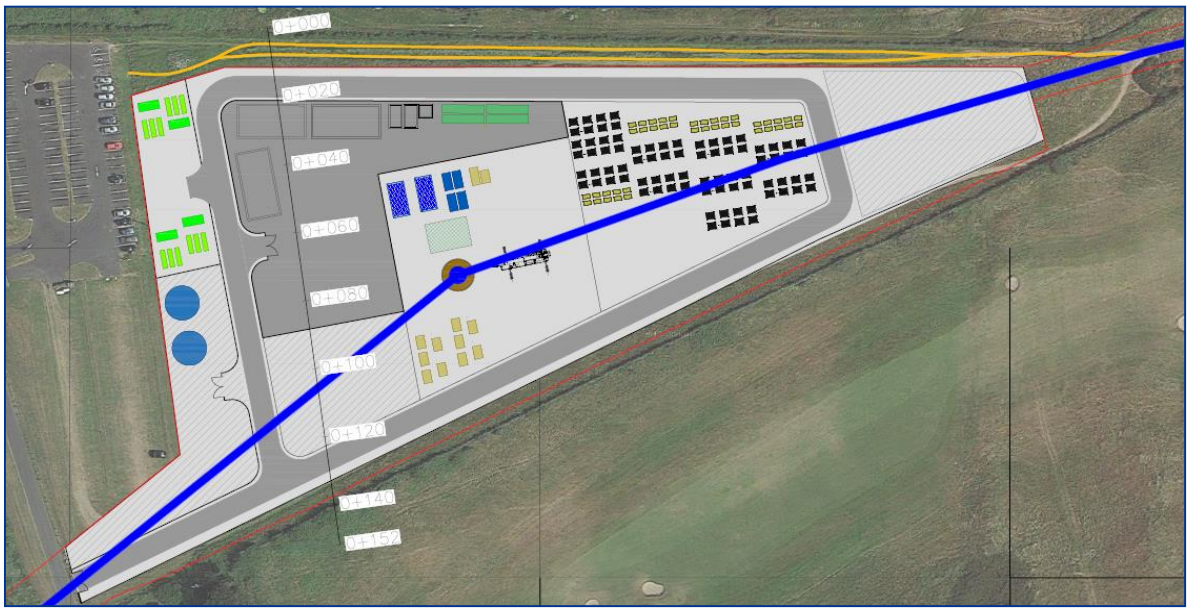


Figure 22: BaldoyleTunnel Compound Arrangement



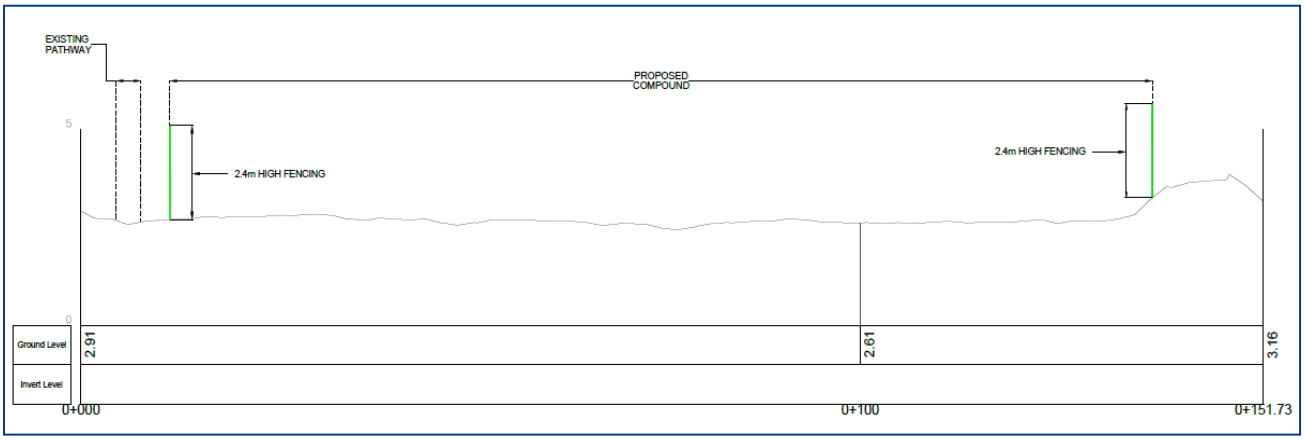


Figure 21: Portmarnock Tunnel Compound Arrangement

Figure 22: Micro Tunnel Alignment (extract from Drawing 32102902-2113)

The micro-tunnelling process is briefly described hereunder;

- Set up site -compound fencing,
- Topsoil stripping, importing of granular material to protect working area.
- Excavate and prepare Launch/ Reception shaft (10m diameter minimum)
- Set up control container and other auxiliary equipment beside launch/reception shaft
- Setup jacking frame and hydraulic jacks
- Lower micro-tunnelling machine into launch/reception shaft and set up
- Set up laser guidance system
- Setup slurry lines and hydraulic hoses on the micro-tunnelling machine
- Commence Jacking
    - Main jack pushes the micro-tunnelling machine forward
    - When back of tunnel machine reaches face of drive, disconnect slurry lines and hydraulic hoses from jacked section, jacks are retracted.
    - Lower new pipe segment behind the tunnel machine and reconnect slurry lines and hydraulic hoses
    - The Jacks are re engaged to the pipe, jack new pipe segment and excavate and remove spoil
- Repeat until receiving shaft is reached.

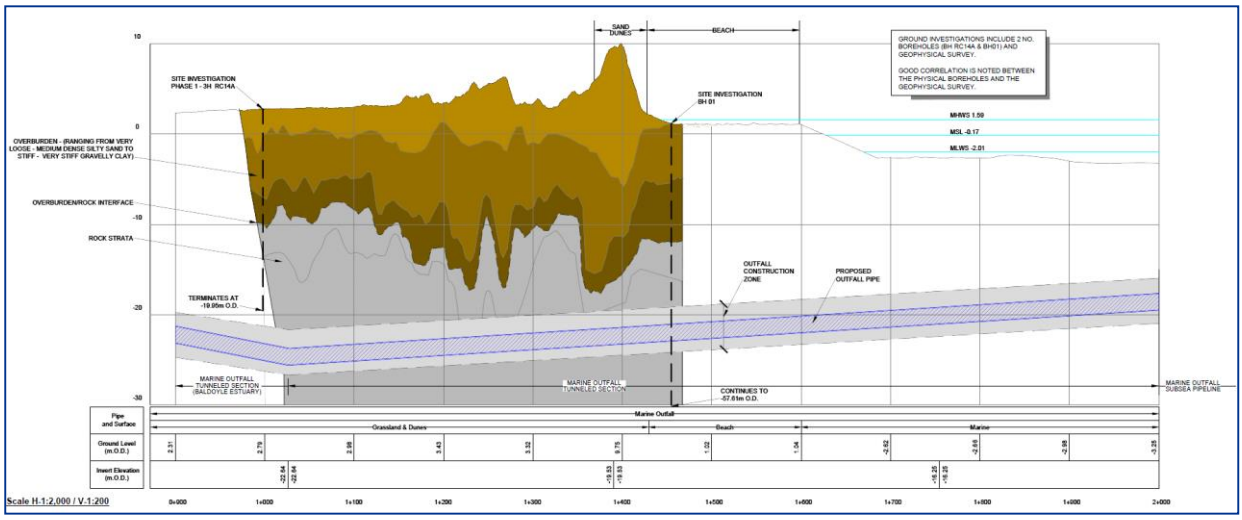


Figure 23: Micro Tunnel Profile (extract from Drawing 32102902-2113)

Figure 24: Micro-Tunnelling Machine lowered into Tunnel Shaft

Figure 25: Micro-Tunnelling Machine Launch Shaft

Figure 26: TBM Reception Shaft

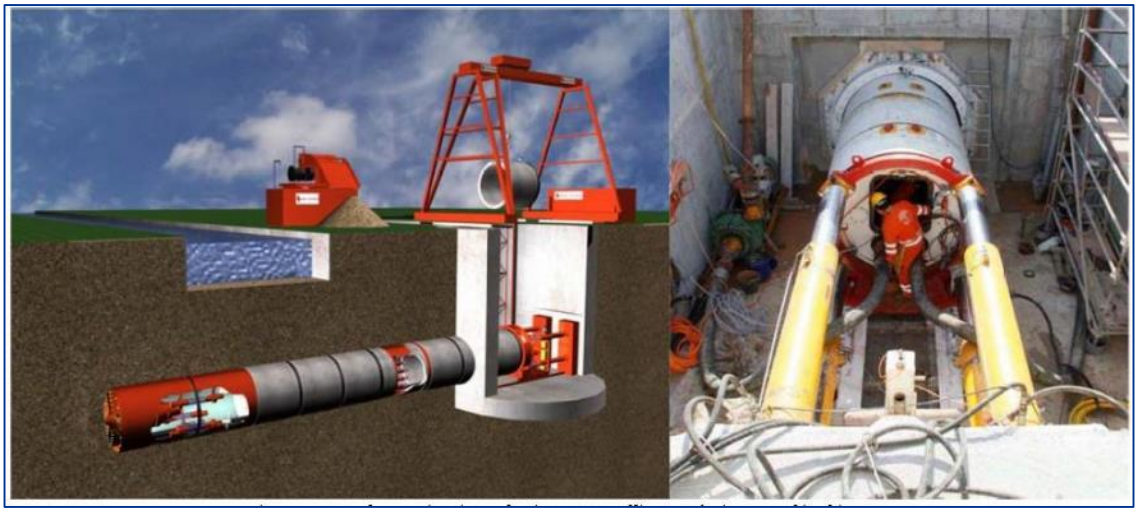


Figure 27: Tunnel Schematic & Micro-Tunnelling Machine commencing

It is possible that the micro-tunnelling machine will be recovered via a 10m cofferdam structure as illustrated in Figure 30. The cofferdam structure will be constructed from a jack up platform using an interlocking sheet piling methodology. The interlocking sheet piles will be driven from the jack up platform to create the cofferdam structure using vibratory hammers, impact hammers or using a hydraulic method of installation. All access to the works will be from the seaward side. Once constructed the cofferdam will be emptied of water. The micro-tunnelling machine will be driven into the cofferdam structure and recovered from there using a crane mounted on the jack-up platform.

Alternatively, the micro-tunnelling machine could be recovered in a 'wet' recovery procedure via a pre-excavated trench filled with granular material (excavated from elsewhere along the pipeline trench) without the necessity to construct a cofferdam. In this procedure, the micro-tunnelling machine is driven into the granular material in the trench. The granular material is then carefully excavated from around the micro-tunnelling machine which is then recovered using a crane mounted on a jack-up platform.

Figure 28: Construction of Cofferdam

8.2 Subsea Pipeline

8.2.1 Sequence of Activities for Pipeline Installation

The installation methodology for flexible PE pipes in long lengths is typically;

Step 1 Dredging of trench (parallel operation to pipe assembly)

Step 2 Pipe assembly into long strings, including addition of concrete ballast. (length of string will be dependent on contractor's methodology, typically in range of 1.3 – 2.5km (parallel operation to dredging of trench)

Step 3 Towing the assembled pipe string (s) to the outfall site.

Step 4 Installing the pipe string into the dredged trench using the 'float' and sink' method

8.2.2 Step 1 - Dredging of Trench

The sub-sea pipe section will involve the excavation of a trench within a 250m wide working corridor from the tunnel termination point to the outfall location (c4.0km). A summary of the construction methodology for the sub-sea pipeline is provided hereunder;

- Dredge from tunnel interface to outfall location
- Trapezoidal trench -5m deep, 5.0m wide at base
- Dredged material disposed to a barge, deposited and stockpiled parallel to the pipeline trench within the 250m corridor and
- Sub Sea Pipeline: LLLD (Long Length Large Diameter) PE pipe 2.0m diameter installed by "float and sink" method.
- The excavated material will be returned to trench once the pipe is in place, with a minimum cover to the installed pipe of 2m.
- The main equipment required is;

Marine Equipment
Backhoe dredger
Trailer suction hopper dredger
Multicat support vehicle
Hopper barge
Tugs
Floating pontoons
Cranes/excavators

A backhoe dredger (BHD) or trailer suction hopper dredger (TSHD) could be used for the construction of the trench from the tunnel reception pit seawards. It is likely a combination of both pieces of plant would be used with the BHD used in shallower waters and TSHD in the deeper section (water > 20m deep).

The release of spoil material by a hopper barge will be controlled and will only take place every 7 hours.

Figure 29: Typical Sub-Sea Pipeline Equipment – Backhoe Dredger

Figure 30: Typical Sub-Sea Pipeline Equipment – Trailer Suction Hopper Dredger

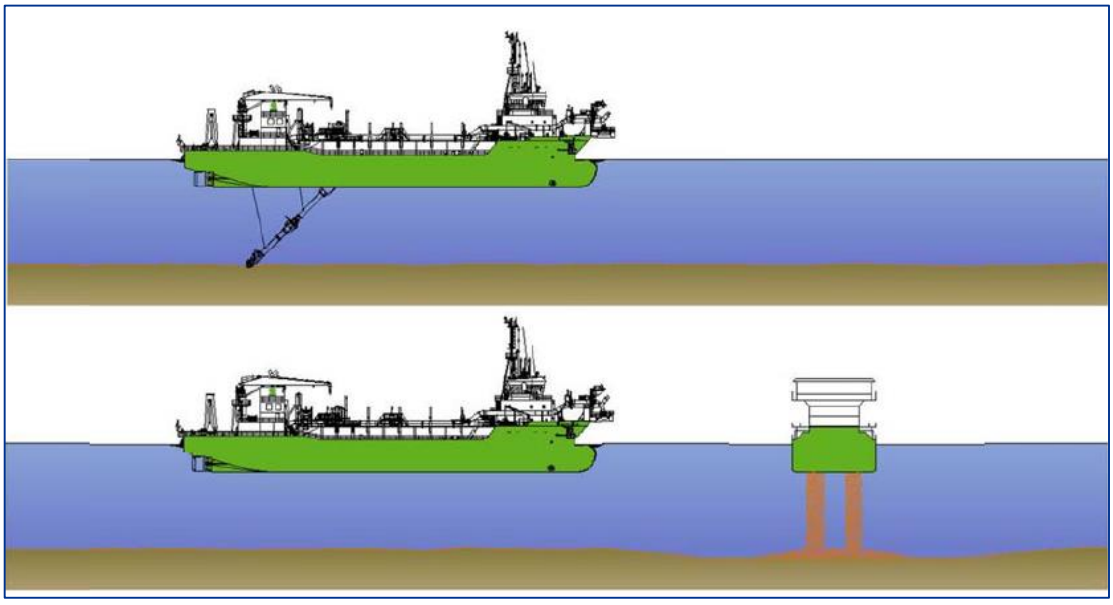


Figure 31: Typical Sub-Sea Trench Construction with TSHD

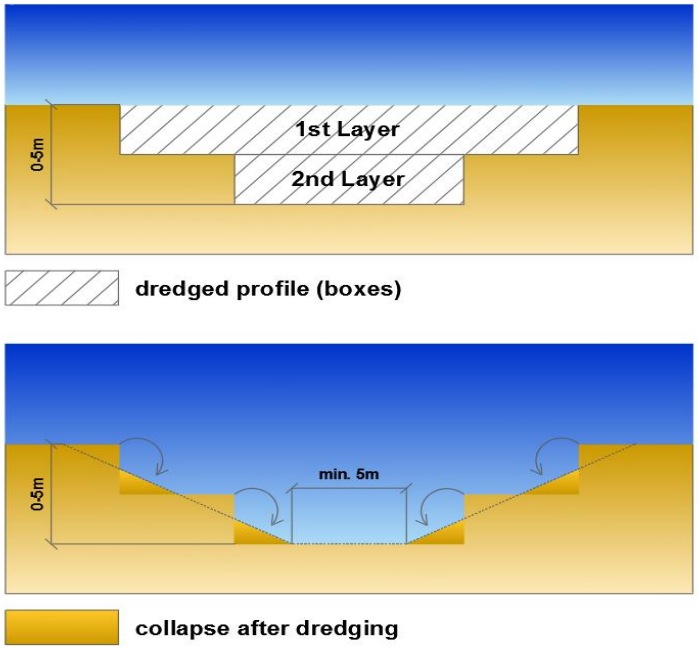


Figure 32: Trailer Suction Hopper Dredger Excavation Sequence

8.2.3 Step 2 - Pipe Assembly

LLLD (Long Length Large Diameter) PE pipes are towed by sea to the pipe assembly area from manufacture. The pipes are towed in maximum lengths of 650m with up to ten of these pipe lengths being towed at a single time, refer Figure 35.

Figure 33: Transport of Long Lengths of Pipe to Site – copyright PipeLife Norge AS

The pipes are then assembled into string lengths defined by the Contractor with the use of mechanical joints or flanged connections as per Figure 36.

Figure 34: Connection of Long Pipe Strings

Both ends of the LLLD pipes are blanked off at both ends of the pipeline string allowing the pipe to stay slightly pressurised to aid floating. Concrete weight collars are then dropped on and secured in place. There are a number of alternative designs for concrete weight collars, such as rectangular, circular or starred ballast blocks or alternatively continuous concrete collars. The actual type used will be dependent on contractor's design, pipeline parameters and contractor's installation methodology.

Pipe assembly can take place alongside a quay wall at a Port or in sheltered waters. In a Port mobile cranes, operating on the quay walls would lift the concrete collars into place. Collars would be delivered by road to the port (Figure 37).

Figure 35: Typical Ballasting and Pipe Assembly Location off Quay wall

In sheltered water, a floating jack up platform supported by floating vessels would be used. Collars would be delivered on a daily basis by ship to assembly location (Figure 38).

Figure 36: Concrete Ballast and pipe assembly being installed on floating pipe in sheltered water

Possible locations for the pipe assembly areas are Dublin Port and/or adjacent to the marine pipeline corridor.

8.2.4 Step 3 - Towing

The pipe strings and associated concrete weight collars are towed using tugs. to the outfall pipeline site and placed over the dredged trench.

8.2.5 Step 4 - Float and Sink Method

The proposed methodology is to install the sub-sea pipeline section by the float and sink method. The pipe string is slowly filled with water from one end and then gradually lowered into the trench via a S curve (Figure 39 and 40). When multiple strings are in place, the connection between strings can be made by a number of methods;

- Making a mechanical connection underwater with the use of divers
- Making a mechanical connection on the surface between strings as the pipe is being sunk

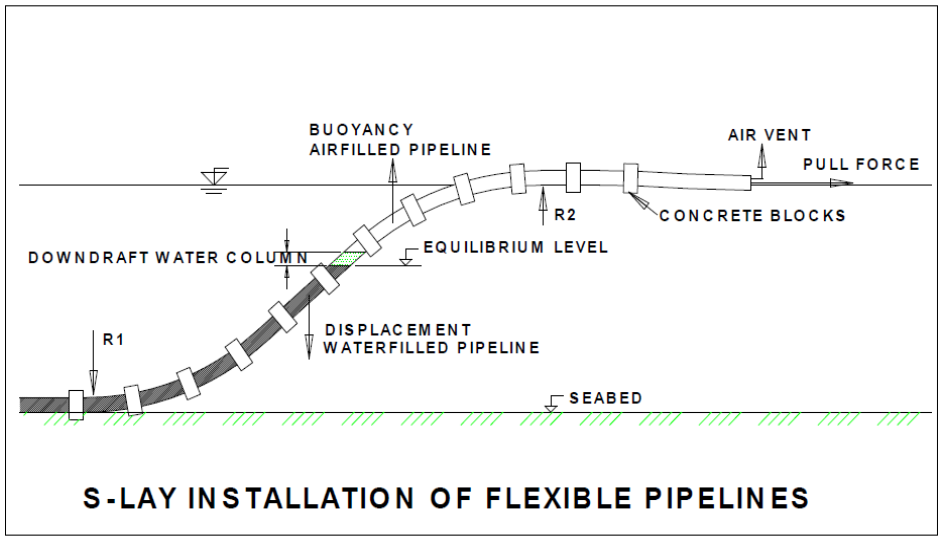


Figure 37: Step 4 - Principle of installation of flexible PE pipes in long lengths

Figure 38: Step 4 - Submersion by water filling/air evacuation - copyright PipeLife Norge AS

8.3 Tunnel/Sub-Sea Pipeline interface

The tunnelled section will terminate approximately 600m offshore and this will be the interface point between the two sections of the marine outfall, i.e. the tunnelled section and the section constructed by subsea pipe construction techniques.

The Tunnel Boring Machine (TBM) will terminate into a temporary structure (cofferdam or in a pre-excavated trench filled with granular material) which will facilitate the retrieval of the TBM.

After installing the bulkheads, removal of the TBM can be undertaken. The cofferdam is then removed. The dredged trench is then completed and the pipe installed as close as possible to the

tunnel section. At this stage, the connection is made. The connection can be made by a number of methods;

- Inserting the HDPE spool piece sufficiently into the tunnel and sealing the annulus between the tunnel and the HDPE marine outfall pipe to form a water tight seal.
- Making a mechanical connection between the tunnel and the outfall pipeline, using flanges or similar (Figure 41)

Figure 39: Subsea flanged connection between sections by divers

8.4 Marine Diffuser

The diffuser allows the effluent to be released from the pipeline to mix with (or diffuse into) the surrounding sea water. The diffuser section is normally located along the final or end section of the pipeline.

The diffuser section consists of one or more vertical riser pipes (Figure 42) which are attached to the main pipeline after it is lowered into the trench. The actual diffuser valves (Tideflex duckbill valves or similar – refer Figure 43) are then attached to the riser pipes.

The main pipeline will be supplied with pre-installed flanged openings (capped) for the diffusers. Once the pipe is lowered into the trench divers will remove the flanged caps and attach the riser pipes via bolted connections. The trench is then backfilled. Divers will then attach the diffuser valves (Figure 44), again using bolted connections, to the end of the riser pipes which are protruding above

the reinstated sea bed. Protective covers – precast concrete or steel (Figure 45) are then placed over the diffuser valves.

Figure 40: Marine Riser – Multi Port

Figure 41: Marine Riser Valves

Figure 42: Marine Riser above Seabed

Figure 43: Typical Precast Concrete Protection for Outfall Riser

8.5 Sub-Sea Fibre Optic Cable

A sub-sea fibre optic cable crosses the route of the outfall pipeline at approx. ch 4,500m. This cable has to be protected in-situ while the dredging and pipelaying operations progress. The method of protecting this cable using interlocking sheet piles and installing the outfall pipeline under it is outlined hereunder

Interlocking sheet piles will be installed either side of the fibre optic cable to support the sides of pipeline trench. This will enable the width of trench to be kept to a minimum and allow the cable to be supported during the installation of the outfall pipe.

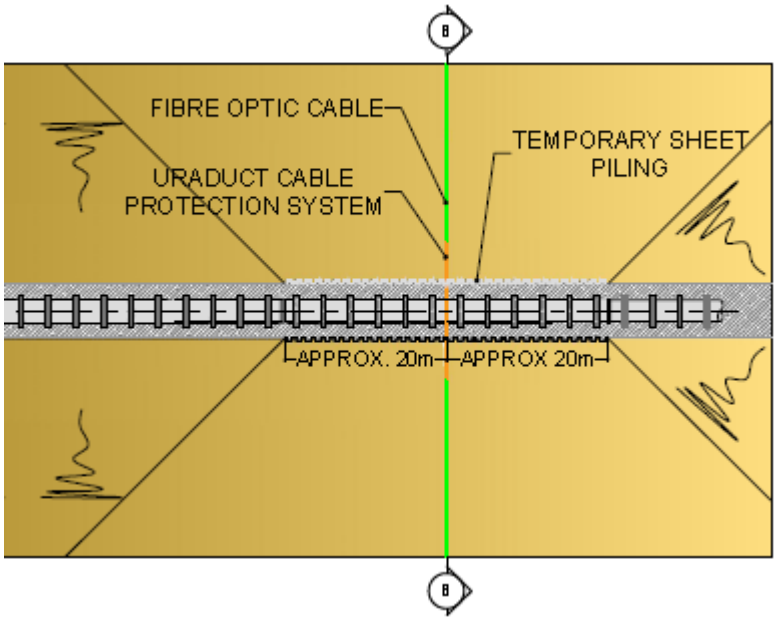


Figure 44: Fibre Optic Cable Crossing

Once supported, the cable can be shielded with a suitable conduit to provide additional protection. This will allow the contractor to carefully excavate below the supported cable. Following excavation of a suitable trench, an appropriate length of PE pipeline can be pulled in to the trench beneath the cable. This short length of PE pipeline is then connected to the overall outfall, by means of subsea connections, in a similar manner to that described above.

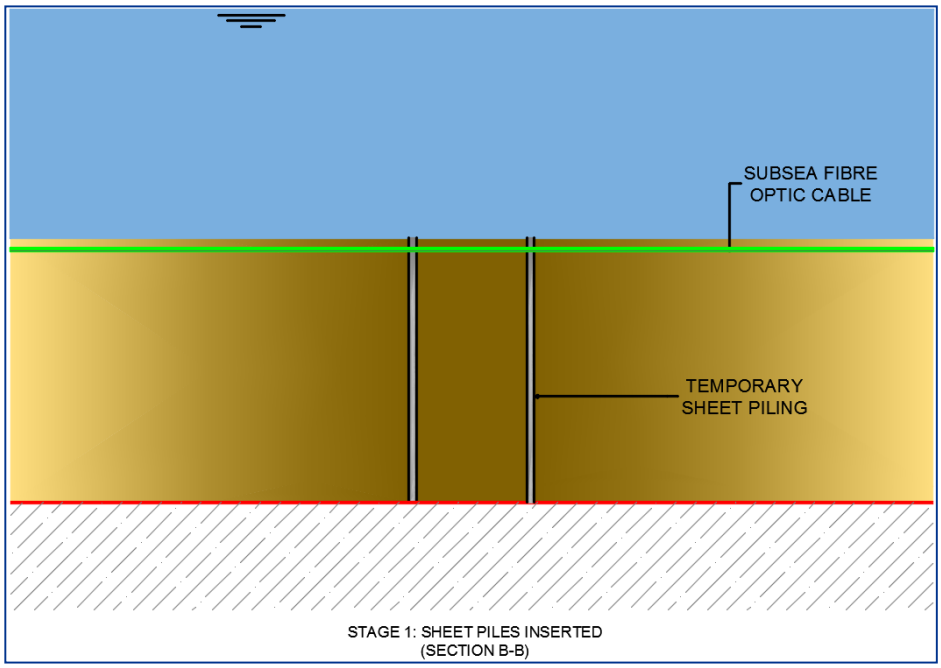


Figure 45: Fibre Optic Cable Crossing – Stage 1 – Install Sheet Piles

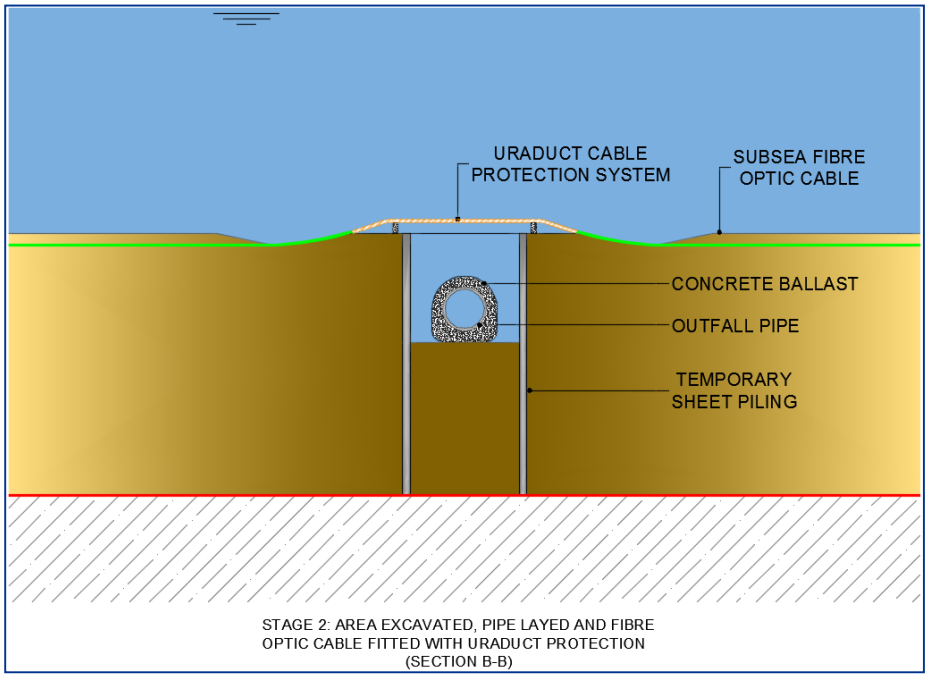


Figure 46: Fibre Optic Cable Crossing – Stage 2– Install Outfall Section

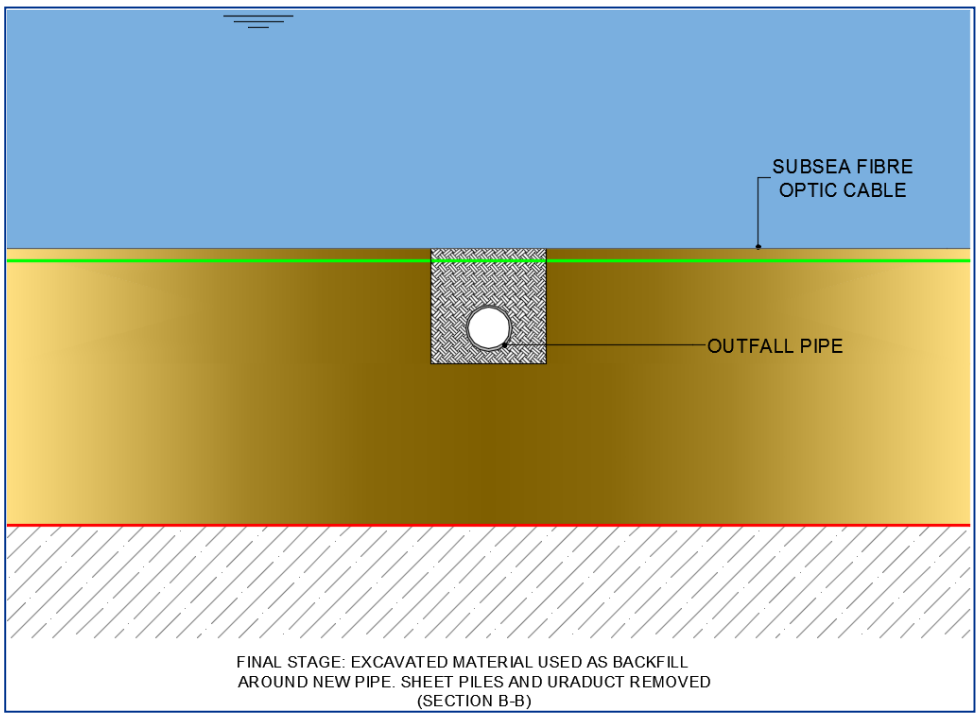


Figure 47: Fibre Optic Cable Crossing – Stage 3 – Backfill Trench

9. Regional Biosolids Storage Facility (RBSF)

9.1 Location

The location for the proposed RBSF is at a site in Newtown, Dublin 11. It comprises approximately 11 hectares of partially developed land and is situated off the R135 road, on the western side of the N2 national road. It is approximately 1.6km north of Junction 5 (Finglas) on the M50 motorway and 1.5km west of Dublin Airport. The proposed site is to be known as the Regional Biosolids Storage Facility (RBSF). The location of the RBSF is shown in Figure 50.

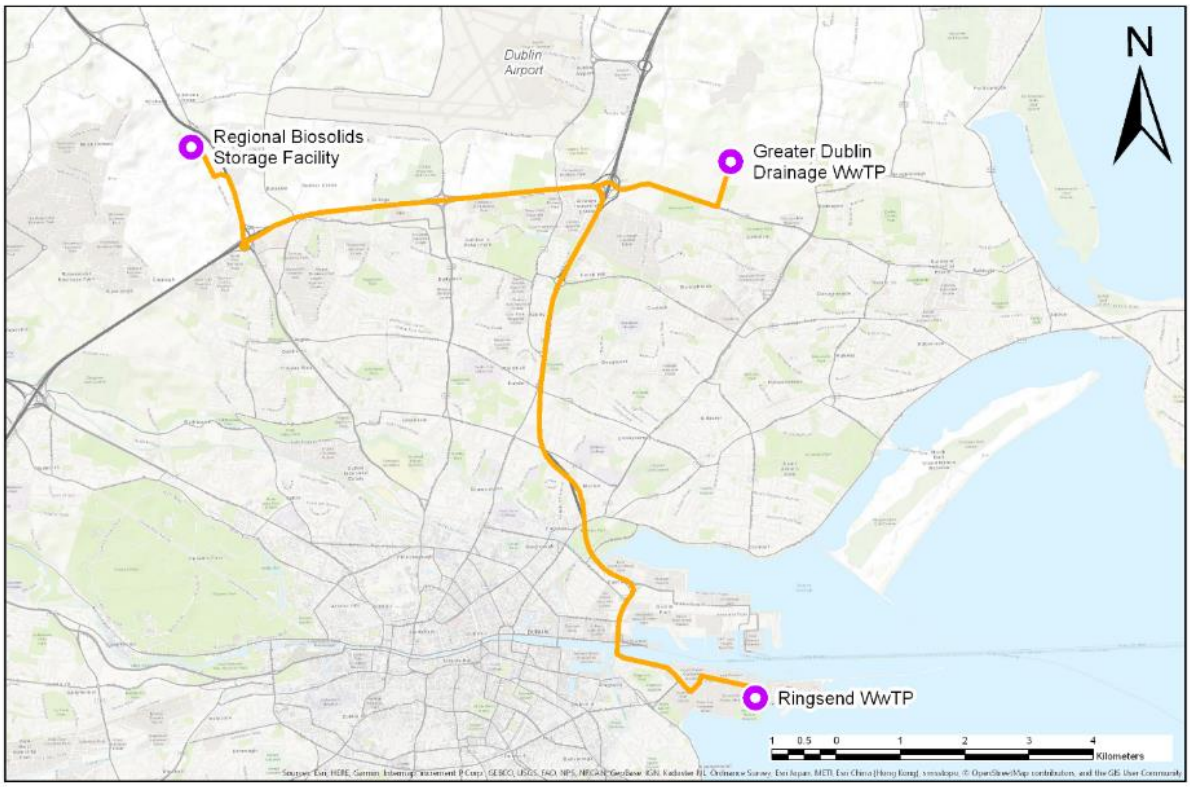


Figure 48: Location of RBSF and biosolids sources

9.2 Proposed Works

9.2.1 Site Layout

The site is owned by Fingal County Council and the local authority was granted approval by ABP in 2006 for a waste recovery facility at the proposed RBSF site. The planned activities included recovery of construction and demolition waste, wastewater sludge treatment, biological waste treatment and waste transfer for municipal waste. Details of the previous planning application are provided in Volume 4, Section 2. Certain enabling works, including drainage works, internal access roads, boundary fencing, and electricity and telecommunications infrastructure have been carried out at the proposed RBSF on the basis of the 2006 approval.

The site is accessed from the R135. Vehicles arriving to the site from the M50 approach from the south and turn left into the site. The road outside the site includes a clearly marked left turning slip lane for the site. Vehicles leaving the site turn left on to the R135 for all routes.

The site comprises mainly sections of grassland separated by a road network. The development works that were completed include a road network, boundary fencing, administrative building, weighbridge areas, drainage systems, and other site services. An ESB 110kV overhead transmission line and a 38kV underground cable both cross the southwestern corner of the site. The existing site layout is shown in Figure 51 and drawing Y17702-PL-003 in Volume 5, Part B of the EIAR. The site boundary is shown as a purple line.

Figure 49: Location of RBSF and biosolids sources

The site generally slopes from east to west. There is a difference of approximately 2 to 3 metres between the highest and lowest areas on the site. A tributary of the Huntstown Stream, which in turn is a tributary of the River Ward, flows along the western and southern boundary of the site. The site naturally drains to this watercourse.

The proposed RBSF will be located in the northern part of the site as shown in Figure 52. There is no development proposed in the southern part. This area is reserved for possible future requirements, which would require planning consent under a separate application before it could proceed.

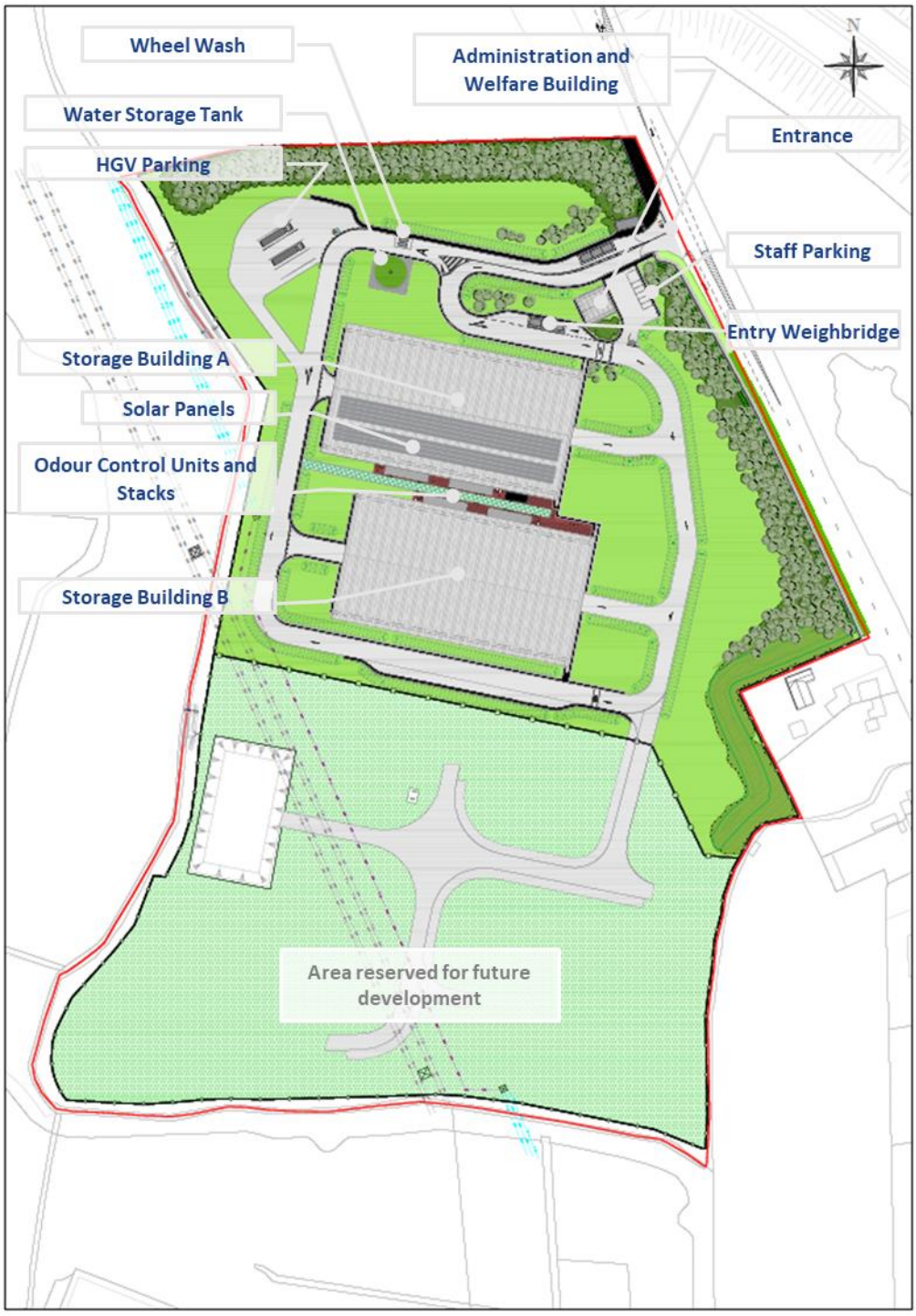


Figure 50: RBSF proposed site layout

9.2.2 Biosolids Storage Buildings

The required storage volume requirements will be provided in two storage buildings. Each building will be approximately 105m long and approximately 50m wide.

The two storage buildings will be located centrally, toward the northern end of the site. Their location allows the utilisation of some of the existing infrastructure on the site and is such that, a new internal road can be provided around the perimeter of the buildings. The road will allow vehicular access to the storage buildings and for vehicles to travel past the buildings and around the site in one direction. The distance from the site boundary and the buildings is at least 25m on the western side of the site and 70m on the eastern side. The longest side of each building will be orientated northwest to southeast and the buildings will be parallel to one another. The location of the storage buildings is shown in Figure 52 and on drawing Y17702-PL-004 in Volume 5, Part B of the EIAR.

At the highest point, the roof level will be approximately 15.2m above ground level and the eaves level of the building will be approximately 12m above ground level. Haulage vehicles bringing biosolids to and from the storage facility will access the buildings from the eastern end and will exit from the western end. Entry and exit doors for vehicles will be located at either end of each building. In addition to security doors at each entry and exit point for HGVs, a lightweight inner door (known as a fast-action door) that can be opened and closed quickly will be provided so that the duration that the doors are open is minimised. Separate doors will be provided for pedestrian access.

Haulage vehicles will tip biosolids inside the buildings (only) during operation. The building height is determined by the tipping height of the trailers of the haulage vehicles when they are within the building.

The architectural design of the storage buildings incorporates a curved roof. The curved roof profile results in a visual blurring of the buildings' roof apex. The roof is visually separated from the walls by a 'shadow band' and the footprint of the buildings is staggered. The slanting front façade of both buildings extends beyond the side walls of the building into the landscape. The external envelope will comprise insulated metal cladding panels, which will clad the entire perimeter of the building. As shown in the architectural drawings, Y17702-PL-007 and Y17702-PL-009, provided in Volume 5, Part B of the EIAR, the colour of the panels will generally be grey and silver. This architectural design is provided to enhance the visual perception of the development from the most prominent views of the site.

The architectural design is described in further detail in the Architectural Concept Statement, which is enclosed with the SID application for the Proposed Development.

Storage Capacity

The storage capacity of the buildings is related to the quantities of biocake and biofert expected be stored at the facility. Biocake can be stacked between 3m to 4m high and biofert can be stacked approximately 7m high, thus making the storage of biofert more efficient.

The two storage buildings could store over 48,000m^3 of biofert. However, it is estimated that the volume of biofert at Ringsend WwTP requiring storage will only reach approximately 12,700m^3. On the other hand, the storage buildings will have an approximate capacity of 26,200m^3 if all biosolids were in the form of biocake.

9.2.3 Administration and Welfare Building

A building for general management of operations and welfare facilities for staff working at the facility will be provided near the entrance gate. The building will contain an office, a meeting room, a canteen, toilets and a changing room with shower. A parking area will be provided beside the Administration and Welfare Building and will provide up to 10 parking spaces for staff and visitors.

The architectural design incorporates a curved roof to compliment the design of the storage buildings. The overall dimensions of the one-story building will be 10m wide and 13m long. The height of the ridge will be approximately 3.8m above ground level.

9.2.4 Weighbridges

The operator of the RBSF will be required to keep records of biosolids quantities arriving to, and departing from, the site. Two weighbridges will be provided at the RBSF. A weighbridge for weighing haulage vehicles will be located on the entrance road approximately 150m from the entrance to the site, allowing arriving vehicles to queue safely away from the public road. A separate lane will be provided at the weighbridge to allow vehicles to pass by parked vehicles.

A second weighbridge will be provided on the exit route from the site to weigh vehicles leaving the RBSF. The design proposes that the weighbridges will be automatically operated and controlled from the administration building. Neither of the existing weighbridge kiosks will be retained.

9.2.5 HGV Parking Area

A parking area for 4 haulage vehicles will be provided in the northwest corner of the site. This area is provided for HGVs to park during working breaks or for checking vehicles before recommencing their journeys.

9.2.6 Electrical Services

The existing electricity substation at the northeast corner of the site is 4.8 m long by 4.3 m wide. It will be rebuilt at the same location to bring it into line with current ESB standards. A new customer electrical room will adjoin the substation. This room is a requirement identified during consultation with ESB. Overall, the footprint of the substation and customer electrical room will be approximately 9.2m long and 4.4m wide. They are shown on drawing Y17702-PL-006 in Volume 5, Part B of the EIAR.

Electrical supply will be brought from the customer electrical room to a mechanical and electrical control building (referred to hereafter as ‘Control Building’) and onward to the mechanical and electrical equipment within the storage buildings. Where feasible existing underground ducting routes on the site will be retained. The Control Building will be located between the storage buildings.

Solar Panels are proposed on the roof of Storage Building A to contribute to the energy requirements of the RBSF. These are discussed in section 9.3.9.

9.2.7 External Lighting

External lighting will be provided along the internal roads, pedestrian routes and around the buildings and other plant rooms. It is possible that a portion of the existing lighting columns and associated

ducting and chambers on the site will be retained and incorporated in the proposed site layout. This will be subject to review at detailed design stage. Road-side lighting columns will be approximately 6m high and the lighting columns in the HGV parking area will be 8m high. They are shown on drawing Y17702-PL-014 and Y17702-PL-023 in Volume 5, Part B of the EIAR.

9.2.8 Water Supply

An existing water supply on the site will provide potable water to the Administration and Welfare Building and it will supplement the supply to the Wheel Cleaning Area. The watermain will be extended around the storage buildings to provide a water supply for firefighting purposes as shown on drawing Y17702-PL-020 and Y17702-PL-021 in Volume 5, Part B of the EIAR. The watermain will be supplied by a fire water holding tank located to the southwest corner of the two storage buildings, as shown on drawing Y17702-PL-020 and Y17702-PL-024 in Volume 5, Part B of the EIAR.

9.2.9 Wheel Cleaning Area

A wheel cleaning area will be provided in the northeast corner of the site beside the HGV parking area, near the exit route for HGVs. Within the storage buildings, biosolids will be stored in bays either side of the vehicle route through each building, therefore minimising the amount of biosolids material that can get caught in the tyres of the HGVs passing through. Nonetheless, there is potential for HGVs to track the material out of the building as they exit. The wheel cleaning will be provided to clean the HGVs and prevent tracking biosolids beyond this area or on to the public road.

Details of an indicative system is provided on drawing Y17702-PL-024 in Volume 5, Part B of the EIAR. Water for wheel cleaning equipment will be mainly supplied from a rainwater harvesting system, in accordance with Irish Water policy to incorporate water conservation designs for non-potable applications within its facilities, where appropriate. The supply may be supplemented by a mains water, when required. Typical wheel cleaning systems recycle approximately 50% of the water used. The wash down material from HGVs will be collected in a silt chamber, in which silt and solids will settle out. The overflow water from the silt chamber will flow to a wash-down separator where oil and fuel will be captured. It will then flow to the foul drainage system on the site and in turn, will discharge to the public sewer. Solid material collected in the settlement chamber will be removed by a licenced contractor who will haul the material to an appropriate waste facility.

9.2.10 Surface Water Drainage

Rainfall run-off from building roofs, road surfaces and other impermeable areas within the area of the proposed development will be conveyed in a new drainage system, incorporating a treatment train comprising of sustainable drainage systems (SuDS). The surface water treatment train approach follows guidance from the Greater Dublin Strategic Drainage Study (Glossary, Volume 3, Environmental Management) and SuDS Manual (C753) (CIRIA, 2015). The proposals are summarised as follows:

Rainwater Harvesting System

A rainwater harvesting system, incorporating a storage tank, will collect run off from the roofs of both storage buildings and will be designed in accordance with Section 11.3 of the SuDS Manual.

Permeable pavement

A maintenance access road between the buildings will be constructed of reinforced grass or a similar permeable pavement.

Swales

Dry Swales (a grassed channel with a filter drain directly beneath) will convey other surface run-off, including roads and footpaths, to an underground attenuation area at the northwest corner of Storage Building A. Dry swales are proposed following consultation with DAA (the authority responsible for the operation of Dublin Airport). DAA raised concern regarding the potential for areas of open water to develop and attract birds. The incorporation of a filter drain (referred to as a 'dry swale') will avoid standing water within the swales.

There is an existing underground attenuation area, comprising of plastic storage units surrounded in filter stone, in the northwest corner of the site. It will be expanded to cater for the RBSF element of the Proposed Upgrade Project. There is an existing discharge point from this attenuation area into the adjacent watercourse which will be retained. At the discharge point to the stream a flow control device will be provided to limit discharge flows to acceptable levels (equivalent to the greenfield run-off). An emergency shut-off device will also be provided in order to prevent discharge to the stream in the event of a fuel spillage from a vehicle or wash-out from the storage buildings due to firefighting water.

Swales and detention basins will be lined with a geotextile membrane to mitigate against risk of pollution to groundwater. In addition to the SuDS features, grit traps will be provided in the sumps of road gullies. Furthermore, and oil/fuel separator will be provided prior to the connection to the existing retention area to capture pollutants in run-off on roads and parking areas within the site.

The swales, permeable pavement and detention basin will be constructed in accordance with details provided in the SuDS Manual (C753). Chambers and surface water pipes will be in accordance with the Greater Dublin Region Code of Practice for Drainage Works (Dublin Region Local Authorities).

9.2.11 Foul Drainage

Foul drainage requirements will be accommodated in the existing foul drainage network on the site. Foul drainage pipes currently drain to a pump station in the southern part of the site. This pump station is connected to the public sewer via an existing rising main, which connects to a pump station outside the site on the opposite side of the R135.

Provision of foul drainage is required for the following elements of the proposed development:

Administration and Welfare Building

Wastewater from the Administration and Welfare Building from general daily activities, such as showers, toilets and canteen.

Wheel Cleaning Area

Wastewater from the Wheel Cleaning Area, as described in the earlier paragraphs in this section.

Storage Buildings

Surface run-off at the entrance to the storage buildings will be connected to the foul drainage network, rather than the surface water network, due to the potential for biosolids content. Any run-off due to cleaning or other water usage within the buildings will be directed to the same foul drainage system in the same manner.

9.2.12 Odour Control

An odour control system has been designed to ensure that odour does not give rise to any nuisance beyond the boundary of the RBSF. The system will involve extracting air from within the storage buildings on a continuous basis. Fans located outside, between the storage buildings, will draw air though ducting to an outside odour control unit comprising an organic filer media. The treated air will be emitted to the atmosphere through vertical stacks which will extend to a height of approximately 3m above the roof level of the storage buildings. Furthermore, each building will be split into two zones, which can be operated independently. This results in a total of four separate stacks. The indicative location of the stacks of shown in drawing Y17702-PL-004, provided in Volume 5, Part B of the EIAR. The assessment of odour at the RBSF is provided in Volume 4, Section 10. In conjunction with the odour control units, separate entrance and exit routes for HGVs are provided in the design of the storage buildings and the doors at these access/egress points will be fitted with fast action doors to minimise the length of time that the doors will be open.

9.2.13 Landscape

The most prominent view of the site by the public is from the R135 road along the boundary on the eastern side of the site. Landscaped berms and planting will be provided in the areas between the buildings on the site and the eastern boundary to provide a visual screen. The visual impact of the proposed scheme is assessed in Volume 4, Section 14 of the EIAR.

9.3 Construction Phase

9.3.1 Programme

It is proposed to transition to the use of the RBSF from the existing storage facility at Thornhill, County Carlow. The initial phase of construction for the RBSF will involve the construction of one storage building in 2020. The construction works are estimated to last 12 months. The second building is likely to be constructed in 2024 to meet requirements at that stage following the transition from the Thornhill facility and will last for approximately 9 months. An indicative programme for the construction works for the initial phase is shown in Figure 53.

If necessary, it is expected that both buildings can be constructed in 2020 with little or no extension to the overall construction programme presented in Figure 53. However, additional construction staff and resources would be required during the construction period. The assessment of this scenario is considered in Volume 4 and in particular, in relation to traffic which is discussed in Volume 4, Section 13: Traffic.

Task No.	Task Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
1	Mobilisation and Site Set Up												
2	Demolition												
3	Earthworks and Excavation												
4	Roads												
5	Drainage												
6	Storage Building Concrete Foundations												
7	Storage Building Concrete Ground Slab												
8	Storage Building Retaining Walls												
9	Structural Steel and Roof Trusses												
10	Roofing												
11	Cladding												
12	Mechanical and Electrical												
13	Administration and Welfare Building												
14	Landsacping and Planting												
15	Comissioning												

Figure 51: RBSF construction works programme - initial phase

9.3.2 Construction Activities

Fingal County Council was granted section 175 approval by An Bord Pleanála (Ref. 06F.EL2045) dated 21 April 2006 for a waste recovery facility at the proposed RBSF site. Certain enabling works, including drainage works, internal access roads, boundary fencing, and electricity and telecommunications infrastructure have been carried out at the proposed RBSF site on the basis of that approval. Generally, there are few constraints on the site that will confine access, establishment of site offices and welfare facilities and general construction operations. The design for the RBSF is relatively straightforward. The construction of the RBSF will involve works similar in nature to works for a warehouse or a large storage unit in an industrial estate.

A summary of the main construction activities is summarized as follows:

Mobilisation and Site Set-Up

Mobilisation and site set-up will involve erection of site offices (portacabins), staff welfare and temporary lighting. The site can be accessed at the exiting entrance on the R135. Internal roads are already in place on part of the site.

Demolition Works

The existing structures on the site proposed for demolition are identified on drawing Y17702-PL-003 and include the security/weighbridge kiosk at the site entrance, the weighbridge kiosk near the eastern boundary, an electrical substation (not commissioned) near the site entrance and the existing administration building. These buildings are small relative to the scale of the proposed development at the RBSF site, as shown in Table 9-1. Therefore, the material arising from the demolition works can be processed on site and reused in the proposed works. The demolition work is likely to be carried out by an excavator, using a specialist grab device if required.

Table 7: Dimensions of buildings to be demolished

Building	Dimensions (metres)		
	Length	Width	Height
Administration Building	12	7	4.8
Security/Weighbridge Kiosk	6.5	3.5	5
Weighbridge Kiosk	5.5	3.5	5
Electrical Substation	4.8	4.3	3

In addition, approximately 400m of internal roads will be reconstructed or removed. This will be carried out by pavement milling machines which will grind the road surface and convey the material to a nearby tipper truck. A high proportion of existing road surface and construction sublayers can be reused in the construction of the new roads on the site. If there is a surplus of reclaimed road surfacing material on the RBSF site it can be provided to a pavement contractor and re-used elsewhere.

While the demolition works are shown at the early stage of the programme in Figure 52 the contractor may consider using the existing administration building as a temporary site office and sections of the existing roads as temporary construction routes. This would result in the demolition of the building and removal of roads occurring later in the in the programme.

Earthworks and Excavation

Earth moving machinery such as tipper trucks and large excavators will excavate topsoil and high ground. A large proportion of topsoil material can be retained on site for use in landscaping.

A site investigation carried out in 2017 indicates that the ground conditions are relatively stable, and it is expected that this will provide good bearing capacity for construction of the buildings proposed for this project. Foundations for the Storage Buildings will be approximately 1 metre below the finished ground level at the deepest locations. The design of the buildings does not require deep excavations and piling is not expected. At the highest point of the site, the existing ground level is approximately 1.5 metres above the proposed finished ground levels.

The proposed floor levels of the buildings are such that the volumes of excavated and fill material will be generally balanced. Therefore, if the excavated material is suitable it is possible that it could be used on the site as fill material or to form landscaped areas.

Roads

While the design has incorporated as much of the existing roads as is practical, new roads will be constructed around the storage buildings and will link back to the entrance. Excavations to less than 0.5 metre below finished road level will be required in order to build the road foundation and pavement layers. In low areas, suitable fill material obtained from the

excavations or imported to the site, if necessary, will be used to build up the roads to an appropriate level. Bulldozers, compaction rollers and paving machines will be required to construct the roads.

Drainage

Sustainable drainage systems such as swales and detention basins to be provided as part of the drainage regime are shallow grass or planted depressions in the ground and do not require deep excavation. The underground attenuation area and the rainwater harvesting storage tank will be located to the northwest corner of the storage buildings. The construction of both will involve excavations to a depth of approximately 2.5m and will extend over an area of approximately 1200m^2.

Storage Building Concrete Foundations, Floor Slab, Retaining Walls

The foundations for the storage buildings will be constructed with a stone aggregate fill and reinforced concrete. The concrete floor slab will be approximately 300mm deep and increased in depth at the perimeter and internal retaining walls. Aggregate will be delivered to site in tipper trucks and compacted in-situ with compaction rollers. Reinforcement steel is expected to be pre-formed before delivery to site and assembled on site. A small portion will be cut on site using cutting saws. Concrete will be delivered in concrete delivery trucks and poured using concrete pumps or from concrete buckets lifted by a crane.

Retaining walls will be 7m high and will be constructed from reinforced concrete. Reinforcement steel is expected to be pre-formed before delivery to site but a small portion will be cut on site. Concrete shutters will be assembled on site. Concrete will be delivered in concrete delivery trucks and poured using concrete buckets lifted by a crane.

Structural Steel and Roof Trusses

Structural steel columns will be prefabricated before delivery and installed on top of the concrete retaining walls using a crane. Steel roof trusses are expected to be assembled on site and lifted into location using a crane and assemble using hand-held power tools.

Roofing and Cladding

Prefabricated insulated metal cladding and roof cladding panels will be installed after structural steel assembly and will involve the use of mobile elevated working platforms and hand-held power tools.

Administration and Welfare Building

The Administration and Welfare Building is similar in scale to three-bed domestic bungalow. The construction of the building will involve standard construction techniques for a building of this nature. The external cladding, which is a material similar to the proposed storage buildings, and the curved roof are the most unique features of its design.

Ancillary Works

The electrical substation will be rebuilt at its existing location in accordance with latest ESB specifications. ESB will bring an underground cable across the R135 from a connection point

on the opposite side of the road. The cable will cross site boundary and travel a short distance to the proposed substation.

Both weighbridges and the wheel washing system will be proprietary systems that will be supplied and, it is expected, installed by specialist subcontractors.

It is not expected that tower cranes will require to be erected for the RBSF construction. The large footprint of the two buildings and the relatively short programme would make it unsuitable for the erection of tower cranes. Concrete pours, erection of structural steel columns and roof trusses are expected to be achieved by use of mobile cranes. The contractor will be required to consult with the Dublin Airport Authority in relation to the potential height of cranes.

Construction traffic numbers are discussed in Volume 4, Section 13: Traffic. It is worth noting that there is a potential concrete supplier (Huntstown Quarry) 1km to the south of the RBSF site. Concrete delivery vehicles will comprise a large proportion of the peak construction traffic.

9.3.3 Operational Phase

9.3.4 Processes

There will be no processes at the RBSF. The main activities will be the delivery, loading/unloading and storage of biosolids all within the storage buildings. There will be no treatment of the biosolids.

9.3.5 Biosolids Haulage Traffic

Biosolids will be transported to the RBSF from the Ringsend WwTP (and GDD WwTP if permitted) in articulated trucks with tipping trailers. The trailers each have a capacity of approximately 40 m3. These haulage vehicles, referred to hereafter as HGVs, are approximately 14 m long and have 6 axles. In transporting biosolids to the RBSF, HGVs will operate throughout the year and the generated traffic volumes will be relatively constant.

The transportation of biosolids from the RBSF to spread lands or local storage facilities will be seasonal. The spread lands currently used for application of biosolids produced at the existing Ringsend WwTP are located in South Leinster and parts of Munster. There is currently no proposal to change the location of the spread lands. The peak periods for traffic will be the spring and autumn. Past records from the existing storage facility show that approximately 80% of the total annual trips to spread lands occur during the months of February, March, August and September. The remaining traffic occurs mainly in January, April, May and October.

The estimated traffic volumes to the RBSF is provided in Volume 4, Section 13.

9.3.6 HGV Circulation

The HGVs will enter the site and circulate around the RBSF on a one-way route. HGVs will be weighed at the entrance weighbridge and will travel onwards to the eastern end of one of the storage buildings.

The HGVs will be confined to a central 10m wide corridor within the storage buildings. Storage bays will be located on either side of the corridor. Biosolids will be unloaded and a loader vehicle will move the biosolids to a nearby bay. Conversely, when transporting to spread lands, the loader will move biosolids from a storage bay to a waiting HGV in the central corridor.

The haulage trailers can reach a height of over 10 m when raised up for tipping out materials. The roof level of the buildings is designed to accommodate this requirement.

HGVs will exit the building at the western end and travel on the one-way road to the exit weighbridge to be weighed before leaving site.

9.3.7 Odour Control

Odour will be managed through the operation of an odour control system, which will involve extracting air from the storage buildings through an organic filter material. In addition, the following measures will be implemented during the operation phase of the project:

- HGV trailers will be covered until entering the Storage Buildings.
- HGVs will enter the storage buildings through fast-action doors.
- Pedestrian access will be provided through separate self-closing pedestrian doors.
- Implementation of odour monitoring plan in conjunction with Operation Environmental Management Plan (OEMP).

9.3.8 Monitoring

The biosolids will be loaded/unloaded and stored within storage buildings. The biosolids material and the atmosphere within the buildings will be monitored by operations staff for levels of odour, heat and dust. Similarly, the environment will be monitored within the boundary of the RBSF site.

Operations staff will also ensure that the conditions of the Certification of Registration issued by the National Waste Collection Permit Office (NWCPO) under the Waste Management (Facility Permit and Registration) Regulations, SI No. 821 of 2007 (as amended) will be adhered to.

The Operation Environmental Management Plan (OEMP) will document the necessary procedures for monitoring to be followed by operations staff.

9.3.9 Energy Efficiency

Irish Water's commitments, in terms of energy efficiency, are designed to reflect the national target set out in the Public-Sector Energy Efficiency Strategy (DCCAE, 2017). As set out in "The National Framework for Sustainable Development in Ireland – Our Sustainable Future" energy efficiency is one of the key areas of opportunity in the transition to an innovative, low carbon and resource efficient society. Irish Water's Energy Policy sets aims to be "33% more energy efficient in the abstraction, treatment, distribution, collection, treatment and the return to the environment of every cubic meter of water and wastewater against a 2009 baseline".

Photovoltaic (PV) technology, commonly referred to as solar panels, is incorporated within the design to generate clean renewable energy to contribute to the power requirement at the RBSF facility. This

aligns with the existing energy management regime at Ringsend WwTP. By providing such technology, the project satisfies specific Development Plan objectives of the local authority in terms of a renewable energy contribution to the development.

A feasibility study into the solar contribution potential was carried out by specialists as part of the initial design phase. This study will be re-examined at detailed design stage in order to capture advances in solar technology, thus increasing efficiencies in the power output available from solar panels.

From the initial study, the optimum solution found that a solar panel area of approximately 1,545m² would be required. This arrangement is shown on drawing Y17702-PL-004. The design model predicts an energy yield from such a system of 219,930kWh per annum, which equates to a carbon footprint reduction of 113,704kg of CO2 per annum. The fans for the odour control units will operate continuously and so PV technology cannot provide the total energy demand. However, it is estimated the inclusion of PV technology will contribute to in the order of 40% of the sites annual energy demand.

10. Sources of Information

- WRc Design Guide for Marine Treatment Schemes Volumes I, II, III, IV
- Ciria C 159 Sea Outfalls – construction, inspection and repair
- Dredging " A Handbook for Engineers"
- Discussions and meetings with experienced Contractors and subsequent submissions
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects
- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects as published by the Department of the Environment, Communications and Local Government (2006).
- CIRIA Report No. 133 Waste Minimisation in Construction.
- NRA Guidelines for the Management of Waste from National Road Construction Projects.
- CIRIA (Construction Industry Research and Information Association) guidance on 'Control of Water Pollution from Construction Sites' (CIRIA Report No C532, 2001); and
- CIRIA (Construction Industry Research and Information Association) guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).
- Various online resources
- Dublin Drainage Consultancy (2005). Greater Dublin Strategic Drainage Study. Final Strategy Report.
- CIRIA (2015). The SuDS Manual (C753).