

**JACOBS**<sup>®</sup>



## **Greater Dublin Drainage Project**

Irish Water

**Environmental Impact Assessment Report: Volume 3 Part A of 6**

**Chapter 7: Population and Human Health: Human Health**

June 2018

## Contents

<b>7.</b>	<b>Population and Human Health: Human Health.....</b>	<b>1</b>
7.1	Introduction.....	1
7.1.1	Relevant Guidelines.....	3
7.2	Methodology.....	4
7.2.1	Introduction.....	4
7.2.2	Health Impact Assessment and Environmental Impact Assessment.....	4
7.2.3	Guidance on the Methodology for Assessing Human Health in Environmental Impact Assessment.....	5
7.2.4	Health Protection.....	6
7.2.5	Health Improvement.....	7
7.2.6	General Amenity.....	7
7.3	Baseline Environment.....	8
7.3.1	Sensitive Receptors.....	8
7.3.2	Community Profile.....	10
7.3.3	Tourism.....	11
7.4	Consultation.....	12
7.5	Literature Review.....	18
7.6	Significance of Health Impacts.....	19
7.7	Impact of the Proposed Project.....	19
7.7.1	Construction Phase.....	20
7.7.2	Operational Phase.....	31
7.8	Mitigation Measures.....	37
7.9	Residual Impacts.....	42
7.10	Conclusion.....	42
7.11	References.....	43

## 7. Population and Human Health: Human Health

**This Chapter identifies the potential areas within this Environmental Impact Assessment Report where potential human health impacts associated with the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project) have been assessed. Human health impacts are assessed in terms of biophysical factors including air, noise and water.**

**Human health has been addressed by assessing the baseline relevant to the Proposed Project, and where appropriate, mitigation measures to reduce/avoid adverse impacts to human health are identified in order to comply with recognised national and international standards.**

**The Proposed Project will ensure that wastewater generated from the continued growth and economic development of the Greater Dublin Area is appropriately treated in order to safeguard human health and the environment, and will be carried out in compliance with the relevant European Union Directives and national regulations on water quality.**

### 7.1 Introduction

This Chapter addresses the potential human health impacts associated with the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project).

The Proposed Project will form a significant component of a wider strategy to meet future wastewater treatment requirements within the Greater Dublin Area (GDA) as identified in a number of national, regional and local planning policy documents. The plant, equipment, buildings and systems associated with the Proposed Project will be designed, equipped, operated and maintained in such a manner to ensure a high level of energy performance and energy efficiency.

The table below includes a summary of the Proposed Project elements. A full description of the Proposed Project is detailed within Volume 2 Part A, Chapter 4 Description of the Proposed Project of this Environmental Impact Assessment Report (EIAR).

Proposed Project Element	Outline Description of Proposed Project Element
Proposed Wastewater Treatment Plant (WwTP)	<ul style="list-style-type: none"> <li>WwTP to be located on a 29.8 hectare (ha) site in the townland of Clonshagh (Clonshaugh) in Fingal.</li> <li>500,000 population equivalent wastewater treatment capacity.</li> <li>Maximum building height of 18m.</li> <li>Sludge Hub Centre (SHC) to be co-located on the same site as the WwTP with a sludge handling and treatment capacity of 18,500 tonnes of dry solids per annum.</li> <li>SHC will provide sustainable treatment of municipal wastewater sludge and domestic septic tank sludges generated in Fingal to produce a biosolid end-product.</li> <li>Biogas produced during the sludge treatment process will be utilised as an energy source.</li> <li>Access road from the R139 Road, approximately 400m to the southern boundary of the site.</li> <li>Egress road, approximately 230m from the western boundary of the site, to Clonshaugh Road.</li> <li>A proposed temporary construction compound to be located within the site boundary.</li> </ul>
Proposed Abbotstown pumping station	<ul style="list-style-type: none"> <li>Abbotstown pumping station to be located on a 0.4ha site in the grounds of the National Sports Campus at Abbotstown.</li> <li>Abbotstown pumping station will consist of a single 2-storey building with a ground level floor area of 305m<sup>2</sup> and maximum height of 10m and a below ground basement 17m in depth with floor area of 524m<sup>2</sup> incorporating the wet/dry wells.</li> <li>The plan area of the above ground structure will be 305m<sup>2</sup> and this will have a maximum height of 10m.</li> <li>A proposed temporary construction compound to be located adjacent to the Abbotstown pumping station site.</li> </ul>
Proposed orbital sewer route	<ul style="list-style-type: none"> <li>The orbital sewer route will intercept an existing sewer at Blanchardstown and will divert it from this point to the WwTP at Clonshagh.</li> <li>Constructed within the boundary of a temporary construction corridor.</li> <li>13.7km in length; 5.2km of a 1.4m diameter rising main and 8.5km of a 1.8m diameter gravity sewer.</li> <li>Manholes/service shafts/vents along the route.</li> <li>Odour Control Unit at the rising main/gravity sewer interface.</li> <li>Proposed temporary construction compounds at Abbotstown, Cappoge, east of Silloge, Dardistown and west of Collinstown Cross to be located within the proposed construction corridor.</li> </ul>
Proposed North Fringe Sewer (NFS) diversion sewer	<ul style="list-style-type: none"> <li>The NFS will be intercepted in the vicinity of the junction of the access road to the WwTP with the R139 Road in lands within the administrative area of Dublin City Council.</li> <li>NFS diversion sewer will divert flows in the NFS upstream of the point of interception to the WwTP.</li> <li>600m in length and 1.5m in diameter.</li> <li>Operate as a gravity sewer between the point of interception and the WwTP site.</li> </ul>
Proposed outfall pipeline route (land based section)	<ul style="list-style-type: none"> <li>Outfall pipeline route (land based section) will commence from the northern boundary of the WwTP and will run to the R106 Coast Road.</li> <li>5.4km in length and 1.8m in diameter.</li> <li>Pressurised gravity sewer.</li> <li>Manholes/service shafts/vents along the route.</li> <li>Proposed temporary construction compounds (east of R107 Malahide Road and east of Saintdoolaghs) located within the proposed construction corridor.</li> </ul>
Proposed outfall pipeline route (marine section)	<ul style="list-style-type: none"> <li>Outfall pipeline route (marine section) will commence at the R106 Coast Road and will terminate at a discharge location approximately 1km north-east of Ireland's Eye.</li> <li>5.9km in length and 2m in diameter.</li> <li>Pressurised gravity tunnel/subsea (dredged) pipeline.</li> <li>Multiport marine diffuser to be located on the final section.</li> <li>Proposed temporary construction compounds (west and east of Baldoyle Bay) to be located within the proposed construction corridor.</li> </ul>
Proposed Regional Biosolids Storage Facility	<ul style="list-style-type: none"> <li>Located on an 11ha site at Newtown, Dublin 11.</li> <li>Maximum building height of 15m.</li> <li>Further details and full impact assessment are provided in Volume 4 Part A of this EIAR.</li> </ul>

The total Construction Phase will be approximately 48 months, including a 12-month commissioning period to the final Operational Phase. The Proposed Project will serve the projected wastewater treatment requirements of existing and future drainage catchments in the north and north-west of the Dublin agglomeration, up to the Proposed Project's 2050 design horizon.

It is noted that Chapter 6 Population and Human Health: Population has considered the potential impacts on the surrounding population relating to factors such as economic activities, tourism, amenity and land use.

This Chapter focuses on identifying the areas within the EIAR where human health impacts have been assessed, drawing on their assessments to ensure that all relevant human health impacts have been appropriately considered to reduce/avoid adverse impacts.

This assessment has been prepared in accordance with the relevant guidelines produced by the Environmental Protection Agency (EPA). Data have been collected primarily through a review of relevant documents listed below and information gathered through the extensive public consultation, as detailed in Chapter 1 Introduction in Volume 2 Part A of this EIAR, and mapping provided by the design team. A literature review on the potential impacts of drainage schemes on human health has also been carried out and is detailed in Section 7.5.

Aspects examined in this Chapter primarily relate to impacts from the Proposed Project on socio-economic activities and on local community health. These two themes are discussed together in some sections of this Chapter but separately in other sections where appropriate.

#### **7.1.1 Relevant Guidelines**

This assessment has been prepared having regard to the following guidelines:

- *Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA 2002);
- *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* (EPA 2003);
- *Advice Notes for Preparing Environmental Impact Statements* (EPA 2015a);
- *Revised Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA 2015b);
- *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA 2017);
- *Guidelines on the treatment of tourism in an Environmental Impact Statement* (Fáilte Ireland 2011);
- *Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment* (European Commission 2003);
- *Night Noise Guidelines for Europe* (World Health Organization (WHO) 2009);
- *The Health Impact Assessment (HIA) Resource and Tool Compilation* (United States EPA 2016);
- *Guidelines for Community Noise* (WHO 1999);
- *Health in Environmental Impact Assessment – A Primer for a Proportionate Approach* (Institute of Environmental Management and Assessment (IEMA) 2017);
- *Health Impact Assessment Guidance* (Institute of Public Health in Ireland 2009);
- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011);
- Air Quality Guidelines. Global Update (WHO 2005);
- *BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise* (British Standards Institution 2014);
- *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (EPA 2016);

- European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009); and
- Bathing Water Quality Regulations 2008 (S.I. No. 79 of 2008).

Please note that the human health impact assessment of the proposed Regional Biosolids Storage Facility aspect of the Proposed Project is addressed in Chapter 3 Population and Human Health in Volume 4 Part A of this EIAR.

## 7.2 Methodology

### 7.2.1 Introduction

This Section sets out the methodology that was used to assess the impact of the Proposed Project on human health.

### 7.2.2 Health Impact Assessment and Environmental Impact Assessment

HIA is defined as a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, programme or project on both the health of a population and the distribution of those effects within the population. Meanwhile, a health assessment in the context of EIA focuses the attention of the assessment on likely significant effects, i.e. on effects that are deemed likely to occur and, if they were to occur, would be expected to be significant (as per the requirements of the EIA Directive).

The IEMA discussion document notes that Health Impact Assessment (HIA) and EIA are separate processes and that, whilst an HIA can inform EIA practice in relation to human health, an HIA alone will not necessarily meet the EIA human health requirement. HIAs are not routinely carried out for major infrastructure schemes in Ireland.

Guidance for performing HIAs was issued by the Institute of Public Health in Ireland in 2009. There are, however, considerable difficulties in performing an HIA, as outlined by the Institute of Public Health, for a project such as a drainage scheme, not least of these is the difficulty of getting baseline health data. It is quite difficult due to patient confidentiality and other reasons to accurately determine levels of even relatively common medical conditions in a relatively defined population that might be affected by such a project. Qualitative and quantitative baseline health data are a vitally important part of the appraisal section of the HIA. In the absence of an accurate baseline, it is very difficult to assess qualitative and quantitative changes that might occur. One could use more generalised data that might exist for larger areas such as a city or county, but these would be at most an estimate of the local baseline and not accurate enough to allow for meaningful interpretation.

The IEMA discussion document notes that the WHO provides an overview of health in different types of impact assessment (WHO Regional Office for Europe 2014) and presents the WHO's perspective on the relationship of HIA to other types of impact assessment as follows:

*'The health sector, by crafting and promoting HIA, can be regarded as contributing to fragmentation among impact assessments. Given the value of impact assessments from a societal perspective, this is a risk not to be taken lightly ... The need ... and justification for separate HIA cannot automatically be derived from the universally accepted significance of health; rather, it should be demonstrated whether and how HIA offers a comparative advantage in terms of societal benefits ...*

*Health issues can, and need to, be included [in impact assessment] irrespective of levels of integration. At the same time, from a civic society perspective, it would be unacceptable for HIA to weaken other impact assessments. A prudent attitude suggests optimizing the coverage of health along all three avenues:*

- *better consideration of health in existing impact assessments other than HIA;*

- *dedicated HIA; and*
- *integrated forms of impact assessment.*

It is clear, therefore, that even the WHO does not support a stand-alone HIA unless it could be demonstrated to have an advantage over an EIAR. It is for these reasons that this health assessment is part of this EIAR and that there is no stand-alone HIA.

### **7.2.3 Guidance on the Methodology for Assessing Human Health in Environmental Impact Assessment**

The recitals to the 1985 and 2011 Environmental Impact Assessment (EIA) Directives refer to ‘human health’ and include ‘Human Beings’ as the corresponding environmental factor. Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (2014 EIA Directive) changes this factor to ‘Population and Human Health’. However, no specific guidance on the meaning of the term ‘Human Health’ has been issued in the context of the 2014 EIA Directive. In addition, no specific guidance on the assessment of human health in the context of EIA has been issued to date.

The 2017 draft EPA *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA 2017) note that ‘*while no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU, the same term was used in the [Strategic Environmental Assessment] SEA Directive (2001/42/EC)*’. The Commission’s SEA Implementation Guidance (section 5.26) states, ‘*The notion of human health should be considered in the context of the other issues mentioned in paragraph (f) and thus environmentally related health issues such as exposure to traffic noise or air pollutants are obvious aspects to study*’. (Paragraph (f) (of Annex I of the SEA Directive) lists the environmental factors including soils, water, landscape, air, etc.)

The 2017 draft EPA guidelines note that the above health assessment approach is consistent with the approach set out in the 2002 EPA Guidelines, where health was considered through assessment of the environmental pathways through which it could be affected, such as air, water or soil:

*‘The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment’.*

The 2017 draft EPA guidelines also note that, in an EIAR;

*‘the assessment of impacts on population & human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in the EIAR e.g. under the environmental factors of air, water, soil etc.’, and that,*

*‘assessment of other health & safety issues are carried out under other EU Directives, as relevant. These may include reports prepared under the Integrated Pollution Prevention and Control, Industrial Emissions, Waste Framework, Landfill, Strategic Environmental Assessment [SEA], Seveso III, Floods or Nuclear Safety Directives. In keeping with the requirement of the amended Directive, an EIAR should take account of the results of such assessments without duplicating them’.*

The IEMA’s (2017) *Health in Environmental Impact Assessment – A Primer for a Proportionate Approach* (IEMA discussion document) is a primer for discussion on what a proportionate assessment of the impacts on health should be in EIA and is a useful document when considering what can and should be assessed in the context of EIA. Regard has been had to the general approach advocated in this document when compiling this Chapter.

One of the messages in the IEMA discussion document, in terms of assessing health in EIA, is that there should be a greater emphasis on health outcomes (that is, the potential effects on human health), rather than simply the health determinants (i.e. the agents or emissions which could have the potential to have health effects). The IEMA discussion document noted that, in EIA, there has previously been a strong focus on just the agents or emission levels (e.g. dust) rather than focusing on the effects of these agents/emission levels on human health. This change in emphasis does not mean a complete change in practice. For example, measurement and modelling of dust levels continues to be an essential part of the health assessment.

The IEMA discussion document notes that public health has three domains of practice: health protection, health improvement and improving services and suggests that these three domains be considered in the assessment of health in EIA. Examples of health protection issues to be considered could include issues such as chemicals, radiation, health hazards, emergency response and infectious diseases, whilst health improvement issues could include lifestyles, inequalities, housing, community and employment. Examples of improving services issues could include service planning, equity and efficiencies.

The WHO defined health in its broader sense in its 1948 constitution as '*a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity*' (WHO 1948). Therefore, whilst the EPA (2017) guidance is useful in terms of health protection, for a more holistic assessment as per the IEMA discussion document, it is also worthwhile to look at broader health effects in terms of opportunities for the improvement of health and for improvement of access to services. While it is important to do this, it is also important not to attribute every conceivable event as being a health effect. To further rely on the WHO definition, a health effect would be something that would have a material impact on somebody's physical mental and social well-being, be that positive or negative.

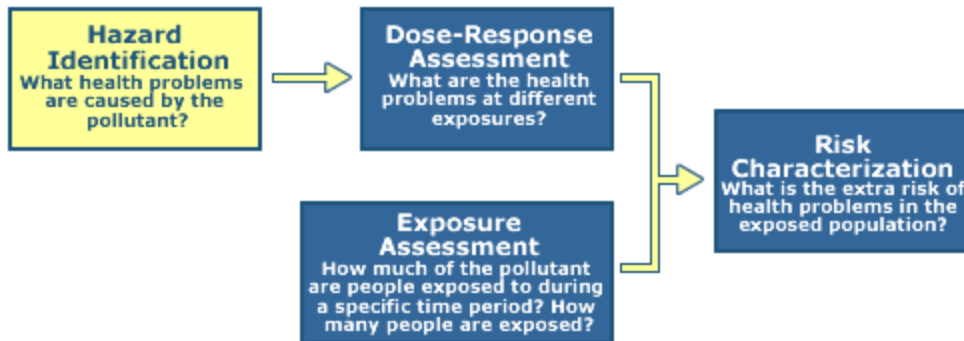
Therefore, health protection, health improvement and improving services and general amenity are all considered in this chapter of the EIAR.

#### **7.2.4 Health Protection**

The assessment of human health for the Proposed Project, in terms of health protection, follows the approach set out in the EPA (2017) guidelines and in the European Commission's SEA Implementation Guidance (2001). It is also similar in nature to the United States EPA (2016) guidance. Health protection is considered through the assessment of the environmental factors (pathways) through which health could be affected such as air, noise, water and soils. The United States EPA guidance includes a four-step approach which is represented graphically in Diagram 7.1.



## The 4 Step Risk Assessment Process



**Diagram 7.1: Four-Step Human Risk Assessment Process**

The potential noise, air, soils and water impacts which could affect human health were identified (Hazard Identification). The scale of these potential impacts (Dose-Response Assessment) and their duration (Exposure Assessment) were assessed, and the significance of the potential impact on human health determined (Risk Characterisation).

When using a recognised Health Based Standard, the Dose-Response Assessment is actually included in the standard. In other words, the authorities or expert committees which recommended the level of the standard will have taken into account the health problems at the different exposure levels and set the level within the standard to prevent these problems from occurring.

### 7.2.5 Health Improvement

Projects that have the potential to have environmental benefits and protect the population from public health dangers, as well as support regeneration, reduce unemployment and improve socio-economic circumstances, could contribute to improving the health and well-being of communities.

The assessment of human health for the Proposed Project, in terms of health improvement, includes an assessment on how the Proposed Project would impact on the socio-economics of the community.

### 7.2.6 General Amenity

The key criterion in relation to general amenity is community well-being, including social sustainability. Direct effects on communities, due to, for example, loss of community facilities such as amenity space, natural areas or opportunities to interact with others, can impact on community well-being or community interaction. Indirect effects may result from changes in environmental quality, for instance from noise or visual intrusion, and are cross-referenced where applicable with relevant chapters of this EIAR. Impact levels are defined in Table 7.1 below.

**Table 7.1: Criteria used in the Assessment of Amenity Impacts**

Impact Level	Significance Criteria
Imperceptible	No noticeable change in the character of the environment
Not Significant	An effect which can cause noticeable changes in the character of the environment, but without significant consequences for the community's well-being, amenity or health
Slight	A small effect on community well-being that can be attributed to the Proposed Project
Moderate	A moderate impact on the community well-being that can be attributed to the Proposed Project
Significant	An effect which has the potential to impact on community well-being such that it affects people's behaviour and quality of life
Very Significant	An effect which has the potential to substantially impact on community well-being such that it affects most people's behaviour and quality of life
Profound	An effect of a scale that significantly impacts on community well-being to an extent that people's behaviour or quality of life is substantially changed, for example where significant health issues arise or where people may wish to relocate

## 7.3 Baseline Environment

### 7.3.1 Sensitive Receptors

The EPA's (2015) *Advice Notes for Preparing Environmental Impact Statements* Draft indicates that neighbouring occupied premises and land uses that should be considered include the following:

- Homes;
- Hospitals;
- Hotels and hotel accommodation;
- Schools and rehabilitation workshops;
- Tourism and recreational facilities; and
- Visitor attractions.

Outlined below is a high level summary of the neighbouring premises and land uses from information provided in Section 6.3 of Chapter 6 Population and Human Health: Population in Volume 3 Part A of this EIAR. Chapter 6 Population and Human Health: Population reviewed the location and details for the above receptors within a study area of 1km for the proposed WwTP site and 500m for the proposed orbital sewer route, Abbotstown pumping station and outfall pipeline route (land based section and marine section).

It is noted that receptors have also been identified within each of the specialist chapters and assessed in line with the study area requirements, guidance and methodologies relevant and specific to those assessments.

It was established that there are, in total, 3,775 residential dwellings located within the study areas for the proposed WwTP site, orbital sewer route, Abbotstown pumping station site and the outfall pipeline route (land based section and marine section). The locations of these dwellings are displayed in Figure 6.3 Residential Buildings within the Proposed Project Study Area.

Healthcare and educational facilities were identified within Section 6.3.7 of Chapter 6 Population and Human Health: Population in Volume 3 Part A of this EIAR. Table 7.2 summarises the details for each of these receptors and includes a list of the relevant Proposed Project elements that they are closest to. Figure 6.8 Healthcare

Facilities within the Proposed Project Study Area and Figure 6.9 Primary and Secondary Level Schools within the Proposed Project Study Area outline the locations of these facilities.

**Table 7.2: Key Sensitive Receptors**

	Sensitive Receptor	Nearby Project Infrastructure
Healthcare Facilities	St. Michael's House Belcamp (Riverside Day Centre, Leisure Centre)	<ul style="list-style-type: none"> <li>Proposed WwTP/SHC site (approximately 500m from the southern boundary)</li> <li>Proposed access road (approximately 200m from the proposed access road to the WwTP site)</li> </ul>
	Connolly Hospital	<ul style="list-style-type: none"> <li>Proposed orbital sewer route (close proximity)</li> <li>Proposed Abbotstown pumping station (approximately 450m)</li> </ul>
	St. Francis' Hospice	<ul style="list-style-type: none"> <li>Proposed orbital sewer route (close proximity)</li> <li>Proposed Abbotstown pumping station (approximately 250m)</li> </ul>
	Cappagh National Orthopaedic Hospital	<ul style="list-style-type: none"> <li>Proposed orbital sewer route (approximately 400m from the proposed orbital sewer route)</li> </ul>
Educational Facilities	St. Francis' Senior and Junior Schools	<ul style="list-style-type: none"> <li>Proposed WwTP site</li> </ul>
	Our Lady Immaculate Senior and Junior National School	<ul style="list-style-type: none"> <li>Proposed WwTP Site</li> </ul>
	Malahide/Portmarnock Educate Together National School	<ul style="list-style-type: none"> <li>Proposed outfall pipeline route (land based section)</li> </ul>
	Saint Nicolas Myra National School	<ul style="list-style-type: none"> <li>Proposed outfall pipeline route (land based section)</li> </ul>
	Scoil Bhríde B National School	<ul style="list-style-type: none"> <li>Proposed orbital sewer route</li> </ul>
	Scoil Bhríde C National School	<ul style="list-style-type: none"> <li>Proposed orbital sewer route</li> </ul>
	St. Francis of Assisi National School	<ul style="list-style-type: none"> <li>Proposed outfall pipeline route (land based section)</li> </ul>
	Belmayne Educate Together National School	<ul style="list-style-type: none"> <li>Proposed outfall pipeline route (land based section)</li> </ul>

The review of receptors also identified that there are no land based tourism facilities or attractions located within the study areas for the proposed WwTP site, orbital sewer route, Abbotstown pumping station and outfall pipeline route (land based section and marine section). However, the coastline has a number of recreational features, including coastal walks, beaches, bathing locations and golf courses, which are popular attractions with locals and tourists. In addition, various commercial and industrial organisations, including business parks and the Carlton Hotel, operate within the study area.

Receptors, and the mechanisms by which they have been considered sensitive, are discussed, as relevant, within the specialist chapters.

### 7.3.2 Community Profile

Physically, the Proposed Project will lie in Fingal County Council, but it will provide additional wastewater treatment capacity for the GDA. The proposed WwTP will be situated on the northern periphery of the built-up area of Dublin City and suburbs. Largely agricultural areas lie to the north, separating the city from the suburbs of Malahide and Swords and the growing hinterland in Fingal.

Evidence shows that different communities have varying susceptibilities to health impacts, both positive and negative, as a result of social and demographic structure, behaviour and relative economic circumstance.

Specific health data for individuals near the Proposed Project are confidential and difficult to establish, as has been detailed in the methodology section above. Despite this, a community profile has been used to establish the baseline and identify unequal distributions in existing factors, such as deprivation or burden of poor health, in order that changes in community exposure to certain health pathways and their degree of impact on the population or community can be assessed.

A group made up of the Health Service Executive, Lenus and the Irish Health Repository has published health profiles for all the Local Authorities areas in Ireland. The most recent profiles published relate to 2015 and have been used to establish a community health profile for the Proposed Project.

The key facts in the health profile relating to Fingal are as follows (Health Service Executive Public Health Profile Working Group 2015a):

- It is the second most affluent Local Authority in Ireland: 85% of its population are either above average or affluent;
- It has a low dependency ratio of 46.0% (i.e. those aged 0 to 14 and 65 years and over as a proportion of those aged 15 to 64), compared to the national rate of 49.3%;
- It has a lower level of households which are Local Authority–rented at 5.3% when compared to the national rate at 7.8%);
- It is the most diverse population nationally with 24.5% of its population being of ethnicities other than white Irish (national 14.9%);
- It has the lowest percentage nationally of those who report their health being bad or very bad, at 1.1%, or who have a disability, at 10.2% (national 1.5% and 13.0% respectively);
- It has the highest birth rate population nationally, at 20.2 per 100,000 population, and the second highest rate for breast-feeding, at 53.7% (national 46.6%);
- Cancer incidence rates are higher than average for female malignant melanoma, male colorectal cancer and male and female lung cancers (county data); and
- It has the lowest suicide rate nationally of 5.6 per 100,000 population.

It is important to realise when viewing these figures that they relate to the entire administrative area of Fingal. They are based on the then census population of 273,991. While we can take these figures as being correct, they do not necessarily accurately reflect the health profile of smaller areas which are close to the Proposed Project area. For example, it identifies that the council area is the second most affluent in Ireland. The map of deprivation

included in the profile shows large areas at average or above average affluence levels. There are nevertheless areas of deprivation where the statistics above simply do not apply. However, it is not possible to get reliable baseline information on small-scale populations for reasons outlined elsewhere in this Chapter. The data above, also qualified in this manner, nevertheless do give a valuable insight into the general area.

As mentioned above, the Proposed Project will border the northern periphery of Dublin City, so it useful to consider the health profile of that area as well.

For Dublin City, the key facts are as follows (Health Service Executive Public Health Profile Working Group 2015b):

- It has a dependency ratio of 38.4% (i.e. those aged 0 to 14 and 65 years and over as a proportion of those aged 15 to 64), compared to the national rate of 49.3%;
- It has a high level of households which are Local Authority–rented at 11.5% (national 7.8%);
- It has a diverse population, with 21.3% of the population not being white Irish;
- It has a higher than average number of persons who report their health as being bad or very bad, at 2% (national 1.5%), or who have a disability, at 14.9% (national 13.0%);
- It has a greater than average birth rate per 1,000 for those aged under 20 of 19% (national rate 12.3%);
- Cancer incidence rates are higher than average for female malignant melanoma, male colorectal cancer and male and female lung cancers (County level data);
- Mortality rates are above national average for heart disease and stroke in those aged under 65 years (County level data); and
- Similar qualifications as outlined above in relation to the Fingal data also apply here.

The population of Dublin City is given as 527,612. When one looks at the deprivation map in the health profile, it is clear that the area in the north of Dublin City, adjoining to Fingal, has some of the areas of highest deprivation. This is important to consider because, while the Proposed Project will be physically located in the adjacent Fingal area, it will service the northern part of Dublin City. In other words, the northern part of Dublin City is not likely to be directly affected during the Construction Phase, as it is not within close proximity. However, the Proposed Project will have the potential to benefit the northern part of Dublin City during the Operational Phase as it will provide additional wastewater treatment capacity. Alternatively, there is potential for the area to be adversely affected in a 'do nothing' scenario, where a potential deficit of wastewater facilities could hamper both residential and socio-economic development.

### **7.3.3 Tourism**

Dublin is a major destination for tourists in Ireland. The vast majority of those tourists enter the country through Dublin airport. While the immediate environs of the Proposed Project are not typically regular tourist destinations, a functioning wastewater treatment system is a basic requirement for encouraging tourists to visit. While it would be untrue to state that the Proposed Project going ahead is going to attract more tourists to the area, the corollary is true: that is, the failure to implement adequate sewerage facilities will have detrimental effects, either because facilities such as hotels cannot operate or because of other consequences of this most basic facility.

The ability for the area to attract tourists can bring with it significant socio-economic benefits. Tourists will spend money which leads to job creation. From a human health perspective, these socio-economic benefits are

associated with health benefits, as it has been demonstrated that improved socio-economic status leads to improved health status.

## 7.4 Consultation

Consultation is an essential element of the Proposed Project and supported the determination of perceived health impacts or concerns raised by the public and relevant organisations. Non-statutory public consultations were carried out throughout the development of the Proposed Project, as follows:

- Public Consultation 1: Constraints Consultation (May – June 2011);
- Public Consultation 2: Alternative Sites Assessment (ASA) Phase 1 Preliminary Screening (October – December 2011);
- Public Consultation 3: ASA Phase 2 Emerging Preferred Sites and Routes (May – July 2012); and
- Public Consultation 4: ASA Phase 4 Preferred Sites and Routes (June – August 2013).

Feedback in relation to the Proposed Project as a whole has been documented in various consultation reports, and issues raised during the public consultation process, with specific relevance to health, are summarised in Table 7.3 below.

**Table 7.3: Issues Raised by the Public During Public Consultation (1–4) with Specific Relevance to Health and the Proposed Mitigation Outlined in Associated Environmental Impact Assessment Report Chapters**

Issue Raised/Description	Topic/Relevant Chapter	Conclusion Regarding Human Health
<p>Agriculture – how the spread of waste on land will impact the food chain</p>	<p>Agriculture, Agronomy and Horticulture – Chapter 20 Waste in Volume 3 Part A of this EIAR.</p>	<p>No residual impact to human health resulting from impacts to the human food chain. Appropriate measures will be implemented by the Operator of the proposed WwTP in the production and end-use of 'biosolids' which may be reused on lands. These measures will adhere to the relevant best practice standards and guidelines.</p> <p>Irish Water's (2016) <i>National Wastewater Sludge Management Plan</i> recommends advanced anaerobic digestion of wastewater sludges to produce an end product suitable for reuse on lands as a soil conditioner or fertiliser.</p> <p>Advanced anaerobic digestion will be utilised at the proposed WwTP site to produce a 'biosolid' end product with a high solids content. This term 'biosolids' applies to a fully treated sludge product which is both biologically stable and free of harmful pathogens (bacteria, viruses). If used on agricultural lands, it will be in accordance with the <i>Codes of Good Practice for Use of Biosolids in Agriculture</i> (Department of the Environment and Local Government 1996).</p>
<p>Air quality – how emissions from the Proposed Project, including methane, impact human health Air emissions – the potential for the release of toxic 'sewage gases' and the health impact</p>	<p>Air, Odour and Climate – Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A of this EIAR.</p>	<p>The impacts on air quality are extensively outlined in Chapter 14 Air Quality, Odour and Climate. As can be seen there, no Air Quality Standards (AQS) will be exceeded. It is therefore predicted that there will be no adverse effect on human health. This is entirely in keeping with the standards-based approach outlined by the EPA in its draft guidelines (EPA 2017). There will be no residual impacts on human health relating to emissions and odours associated with the Proposed Project following the implementation of mitigation measures and best practice standards and guidelines as outlined in this EIAR.</p>
<p>Odour impacts from the proposed WwTP, Abbotstown pumping station and outfall pipeline route (marine section).</p>		<p>Construction Phase and Operational Phase air impacts were modelled and are also detailed in Chapter 14 Air Quality, Odour and Climate, along with mitigation measures. A summary of all air quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.</p>
<p>Emissions from the proposed WwTP site – the cumulative impact of emissions from air traffic and the Proposed Project</p>		

Issue Raised/Description	Topic/Relevant Chapter	Conclusion Regarding Human Health
Noise – increased noise levels from construction traffic	Noise and Vibration – Mainly Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR.  Also addressed in Chapter 6 Population and Human Health: Population and Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR.	No significant residual impacts on human health in relation to noise and vibration impacts from the Construction Phase of the Proposed Project, following the implementation of mitigation measures and best practice standards and guidelines.
Noise disturbance impact on physical/mental health – concerns raised regarding the levels of noise from construction, construction traffic and the general operation of the proposed WwTP, particularly at night		Construction Phase and Operational Phase noise impacts were modelled and are detailed in Chapter 15 Noise and Vibration, Volume 3 Part A of this EIAR. Mitigation measures are also detailed in the Chapter. A summary of noise impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.  There will be a negligible cumulative effect in relation to airport noise as can be seen in Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR.
Airport – cumulative impact of the Proposed Project with air traffic noise, which is already causing nuisance to local residents		The potential effects on patients in Connolly Hospital and St. Francis' Hospice have been modelled, and there will be Negligible or, at worst, Slight impact.
Pumping station noise – concerns regarding the impact of noise emanating from the proposed Abbotstown pumping station on the staff and patients at Connolly Hospital and St. Francis' Hospice		



Issue Raised/Description	Topic/Relevant Chapter	Conclusion Regarding Human Health
Impacts of increased traffic – concerns raised regarding the potential for noise pollution, diminished quality of life and the potential for an increase in accidents	Traffic and Transport/Noise and Vibration – Mainly Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR. Also addressed in Chapter 6 Population and Human Health: Population, Chapter 13 Traffic and Transport and Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A of this EIAR.	No significant residual impacts on human health in relation to noise pollution, increased journey times and traffic disruption, following the implementation of mitigation measures and best practice standards and guidelines. Construction Phase and Operational Phase traffic impacts were modelled and are detailed in Chapter 13 Traffic and Transport. Mitigation measures are also detailed in the Chapter. A summary of road safety impacts is provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Aquatic ecology – impact of pollutants in the water on shellfish and, subsequently, human health	Aquatic Ecology and the Environment – Chapter 8 Marine Water Quality in Volume 3 Part A of this EIAR.	No significant residual impacts on human health due to the discharge of treated wastewater into the Irish Sea and on shellfish, following the implementation of mitigation measures and best practice standards and guidelines. Construction Phase and Operational Phase marine water quality impacts were modelled and are detailed in Chapter 8 Marine Water Quality. Mitigation measures are also detailed in the Chapter. A summary of marine water quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Coastal water quality – danger posed to divers due to high turbidity of water  Bathing water quality – concerns raised regarding the possibility of adults and children becoming ill from swimming in ‘untreated waste’	Coastal Water Quality – Chapter 8 Marine Water Quality in Volume 3 Part A of this EIAR.	No significant residual impacts on human health due to the discharge of treated effluent into the Irish Sea, following the implementation of mitigation measures and best practice standards and guidelines. Construction Phase and Operational Phase marine water quality impacts were modelled and are detailed in Chapter 8 Marine Water Quality. Mitigation measures are also detailed in the Chapter. A summary of marine water quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Groundwater – pollution of supplies due to leaks and spillages	Water – Chapter 17 Hydrology and Hydrogeology and Chapter 18	No significant residual impacts on human health relating to the potential for the release of toxins into water supplies, following the implementation of mitigation measures and best practice standards and guidelines. However, there may be health concerns in a ‘do nothing’ scenario if there was insufficient capacity to deal with the

Issue Raised/Description	Topic/Relevant Chapter	Conclusion Regarding Human Health
Drinking water – concerns raised over the potential for pollution of drinking water supplies and ill health as a result of consumption	Soils and Geology in Volume 3 Part A of this EIAR.	sewerage needs of the population. The Proposed Project will help to protect water supplies.  Construction Phase and Operational Phase water quality impacts were assessed and are detailed in Chapter 17 Hydrology and Hydrogeology. Mitigation measures are also detailed in the Chapter. A summary of water quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Flooding/storm events – potential for the release of toxins into water table	Flooding and Storm Events – Chapter 8 Marine Water Quality and Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR.	No significant residual impacts on human health relating to the potential for the release of toxins into the water table, following the implementation of mitigation measures and best practice standards and guidelines.  Construction Phase and Operational Phase water quality impacts were assessed and are detailed in Chapter 8 Marine Water Quality and Chapter 17 Hydrology and Hydrogeology. Mitigation measures are also detailed in these Chapters. A summary of water quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Wastewater – the impact of potential leaks and spillages on health	Water Quality – Chapter 8 Marine Water Quality and Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR.	No significant residual impacts on human health relating to the potential for the release of toxins, following the implementation of mitigation measures and best practice standards and guidelines.  There are potential health effects in a ‘do nothing’ scenario if there is insufficient capacity to safely handle the sewerage requirements of the population.  Construction Phase and Operational Phase water quality impacts were assessed and are detailed in Chapter 8 Marine Water Quality and Chapter 17 Hydrology and Hydrogeology. Mitigation measures are also detailed in these Chapters. A summary of water quality impacts as they relate to human health are provided in Section 7.7 of this Chapter, with mitigation measures summarised in Section 7.8.
Health and safety and the impact on community health (the health of children etc.)	Health and Safety	Comprehensive health and safety procedures will be developed for the Construction Phase and Operational Phase and will adhere to national and international safety standards.  The ‘do nothing’ scenario holds significant health concerns, which will be removed by the completion of the Proposed Project.

Issue Raised/Description	Topic/Relevant Chapter	Conclusion Regarding Human Health
<p>Human Health</p> <ul style="list-style-type: none"> <li>• Cancer;</li> <li>• Eye complaints due to emissions;</li> <li>• Pregnancy issues due to emissions from the proposed WwTP; and</li> <li>• Presence of vermin/flies and disease potential</li> </ul>	<p>Human Health – Chapter 7 Population and Human Health: Human Health in Volume 3 Part A of this EIAR.  Chapter 14 Air Quality, Odour and Climate</p>	<p>No predicted issues. Potential for the release of aerosols has been mitigated with the use of covered tanks, air extraction and OCU systems.  Comprehensive Construction and Operational Management Plans will be developed for the Proposed Project.  The use of covered tanks and enclosed buildings will reduce the potential for vermin/flies.  The 'do nothing' scenario holds significant health concerns, which will be removed by the completion of the Proposed Project.</p>
<p>Leaks, Malfunction and Breakdown</p>	<p>Risk of control failure and accidental emissions</p> <hr/> <p>Transport of sewage – concerns raised about the possibility of a breakdown at the proposed WwTP leading to an increase in the transport of raw sewage to and from the facility</p> <hr/> <p>Chapter 22 Risk of Major Accidents and/or Disasters in Volume 3 Part A of this EIAR.</p>	<p>Comprehensive Construction and Operational Management Plans will be developed for the Proposed Project which will include response and management procedures in the event of a failure or accident.  Sewage will not be transported from the proposed WwTP site in the event of a breakdown.  A total breakdown is unlikely. However, in the event of an occurrence, operational management measures will be implemented to manage this event. These include:</p> <ul style="list-style-type: none"> <li>• Availability of Power Supply: Power supply is proposed to be available from a combination of Electricity Supply Board (looped system), biogas produced at the proposed WwTP site and natural gas used in a Combined Heat and Power system. All pumps will be set up as duty/standby with spare units. This will ensure a redundancy of power supply and that equipment is available at all times;</li> <li>• Flow Management: Flows will be reduced arriving at the proposed WwTP site. This can be achieved through the telemetry system instructing the proposed Abbotstown pumping station and other pumping stations on the network to slow down and stop pumping if necessary and utilise the storage that is available in the upstream catchments;</li> <li>• Sludge Management: To mitigate against total or partial failure of the sludge treatment stream at the proposed WwTP, a number of embedded measures have been included in the design of the Proposed Project. In the event of a problem with the sludge treatment stream, all imports of sludge will be halted. Sludge will be temporarily stored at the satellite centres and the WwTP also will have the facility to store its own sludge temporarily on-site.</li> </ul>

## 7.5 Literature Review

A literature review was carried out using search terms 'sewerage', 'drainage scheme' and 'sewerage scheme' in PubMed (US National Library of Medicine) on 13 April 2018.

It is perhaps not surprising that there is a dearth of information on the potential health effects of a project such as the Proposed Project. There is plenty of information on the adverse health effects of not having efficient sewerage systems and the impact of this on public health. There are numerous reports, mainly from developing countries, of very significant adverse effects on public health.

An example of this would be an article by Norman et al. (2010), which reviewed the effects of the presence of sewerage systems on diarrhoeal disease and related outcomes. This was a systemic review and meta-analysis.

The review concluded that pooled estimates show that sewerage systems typically reduce diarrhoea incidence by about 30% (RR 0.70, 95% CI 0.61-0.79), or perhaps as much as 60% when starting sanitation conditions are very poor. Studies with objective outcome measures showed an even stronger pooled effect than studies that assessed diarrhoea incidence with interviews, while sensitivity analysis indicated that the effect remains even if strong residual confounding is assumed. Sewerage interventions seem to reduce the incidence of diarrhoea and related outcomes.

While Dublin is not directly comparable to a developing country environment, the principle remains the same, regardless of the location, i.e. there are genuine public health concerns in the absence of an efficient and modern drainage and sewerage system, capable of meeting the demands upon it.

There is a dearth of published papers for projects similar to the on Proposed Project. However, the article *Environmental response to sewage treatment strategies: Hong Kong's experience in long term water quality monitoring* (Mar Pollut Bull. 2011) reviewed the potential effects of a project similar to the Proposed Project, except on a much larger scale, in Hong Kong.

The paper concluded, '*In many coastal cities around the world, marine outfalls are used for disposal of partially treated wastewater effluent. The combined use of land-based treatment and marine discharge can be a cost-effective and environmentally acceptable sewage strategy.*'

When the term 'wastewater treatment plant' was searched, there were considerably more articles. However, the vast majority of these relate to microbiological impacts and functional efficiency of the treatment rather than any potential environmental or neighbourhood effects.

When the term 'odour' was added to that search, some further references were found. It included an article by Lewkowska et al. (2016) entitled *Characteristics of odors emitted from municipal wastewater treatment plant and methods for their identification and deodorization techniques*. Whilst recognising that odours are seldom, if ever, harmful in the physical sense, the article did recognise that odours emitted from municipal WwTPs belong to a group of pollutants, which is the main cause of people complaining about atmospheric air quality. This can in turn lead to lack of public trust. This article, and others, discusses odour abatement techniques and procedures. Please refer to Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A for a detailed outline of the proposed odour abatement techniques for the Proposed Project.

## 7.6 Significance of Health Impacts

There is a difficulty in assigning levels of significance to human health impacts. In medicine, as in all science, the concept of statistical significance is used. This involves attaching a value to significance, often expressed as a percentage level of confidence in the data. Confidence measures of 95% or even 99% are often used to measure levels of certainty or changes that are not due to chance alone.

This is a valid approach for the study of the impacts on a population, but it does not absolutely exclude a response on an individual. However, it is difficult to assign levels of significance to individual human health impacts without detailed information about that individual. Thus, the significance of health impacts is assessed on a group or community basis rather than on an individual basis. There is such a variability in human response that one could never identify all possible individual impacts and so, in accordance with the guidance referred to above, it is considered to be more appropriate to assess the significance of health effects at a population level. The significance criteria for the assessment of the health of communities are therefore as outlined in Table 7.4 below.

**Table 7.4: Criteria used in the Assessment of Community Human Health Protection Impacts**

Impact Level	Significance Criteria
Imperceptible	No significant human health impacts are apparent.
Slight	A small impact on individual reported symptoms, but no change in health status can be attributed to the Proposed Project.
Moderate	A moderate impact on health status of an individual, but no change in morbidity or mortality can be attributed to the Proposed Project.
Significant	The Proposed Project has the potential to impact on individual health status with an associated change in morbidity.
Very Significant	The Proposed Project has the potential to impact on the health status of groups of people.
Profound	The Proposed Project has the potential to impact on the health status of communities.

Asthma can be used as an example when using these criteria:

- An Imperceptible effect would be one with no measurable effect on asthma;
- A Slight effect might be a temporary increase in symptoms in an individual but no change in the severity of the underlying condition or treatment required;
- A Moderate effect might be an individual increasing their use of inhalers attributable to the Proposed Project but no change in underlying condition and no effect on the vast majority of asthmatics;
- A Significant effect might be an individual becoming asthmatic or an individual's asthma becoming measurably more severe as a result of the Proposed Project;
- A Very Significant effect might be a group of individuals becoming asthmatic or their asthma becoming measurably more severe as a result of the Proposed Project; and
- A Profound effect might be a measurable increase in the incidence or severity of asthma in a community as a result of the Proposed Project.

## 7.7 Impact of the Proposed Project

Environmental issues which have the potential to impact human health have been considered in detail within the relevant chapters throughout this EIAR. The assessment of human health in this Chapter has been based on the

assessment standards adhered to within the specialist chapters but has also been informed by professional judgement and submissions received following public consultation.

In summary, the chapters contained in Volume 3 Part A of this EIAR in which human health issues are considered are as follows:

- Chapter 8 Marine Water Quality;
- Chapter 13 Traffic and Transport;
- Chapter 14 Air Quality, Odour and Climate;
- Chapter 15 Noise and Vibration;
- Chapter 17 Hydrology and Hydrogeology; and
- Chapter 18 Soils and Geology.

### 7.7.1 Construction Phase

The key potential human health impacts during the Construction Phase of the Proposed Project include:

- Emissions to air from construction activities and construction vehicles;
- Noise and vibration impacts to sensitive receptors during construction works;
- Impacts to road safety;
- Flooding and impacts to water quality during construction;
- Impacts to construction workers as a result of excavation of contaminated lands; and
- Psychological impacts

#### Air Quality

##### *Appropriate Standards*

The starting point in selecting the appropriate standard to apply is the relevant European legislation. The current applicable directive is Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (Clean Air for Europe Directive).

Table 7.5 shows the limit or target values specified by the five published directives that set down limits for specific air pollutants. The directives cover:

- Sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and oxides of nitrogen, particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) and lead;
- Carbon monoxide (CO) and benzene;
- Ozone; and
- Arsenic, cadmium, nickel and benzo(a)pyrene

The standards used in Chapter 14 Air Quality, Odour and Climate include the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), which incorporate the Clean Air for Europe Directive's limit values for the pollutants SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, benzene and CO. The Clean Air for Europe Directive combines the previous Air Quality Framework Directive (96/62/EC) and its subsequent daughter directives (including 1999/30/EC and 2000/69/EC). Provisions were also made for the inclusion of new ambient limit values relating to PM<sub>2.5</sub>. These are appropriate and robust standards.

**Table 7.5: Limit Values of Clean Air for Europe Directive 2008/50/EC**

Pollutant	Limit Value Objective	Averaging Period	Limit Value ( $\mu\text{g}/\text{m}^3$ )	Limit Value (parts per billion (ppb))	Basis of Application of the Limit Value	Limit Value Attainment Date
SO <sub>2</sub>	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1 Jan 2005
SO <sub>2</sub>	Protection of human health	24 hours	125	47	Not to be exceeded more than three times in a calendar year	1 Jan 2005
NO <sub>2</sub>	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1 Jan 2010
NO <sub>2</sub>	Protection of human health	calendar year	40	21	Annual mean	1 Jan 2010
PM <sub>10</sub>	Protection of human health	24 hours	50		Not to be exceeded more than 35 times in a calendar year	1 Jan 2005
PM <sub>10</sub>	Protection of human health	calendar year	40		Annual mean	1 Jan 2005
PM <sub>2.5</sub> – Stage 1	Protection of human health	calendar year	25		Annual mean	1 Jan 2015
PM <sub>2.5</sub> – Stage 2	Protection of human health	calendar year	20		Annual mean	1 Jan 2020
Lead	Protection of human health	calendar year	0.5		Annual mean	1 Jan 2005
Carbon monoxide	Protection of human health	8 hours	10,000	8,620	Not to be exceeded	1 Jan 2005
Benzene	Protection of human health	calendar year	5	1.5	Annual mean	1 Jan 2010

As discussed previously, AQS are set to protect vulnerable people, such as those with respiratory illnesses, the old and infirm. Slightly higher levels of oxides of nitrogen above the standards may have no effect on the vast majority of the population but may be significant for vulnerable people. Hence, the human health impact assessment has relied on compliance with the AQS to determine whether significant impacts will arise on human health or not.

The table above shows that the pollutant limit values have been set with the objective of protecting human health. Therefore, provided these levels are not exceeded, there will be no adverse effects on human health due to air emissions. Please refer to Chapter 14 Air Quality, Odour and Climate, Section 14.5 in Volume 3 Part A of this EIAR for a detailed assessment of air quality impacts associated with the Construction Phase of the Proposed Project.

The following is an overview of the results of the impact assessment with respect to human health. The air quality impact assessment states that dust and particulate matter are the primary sources of construction related impacts for all of the Proposed Project elements.

### *Proposed Abbotstown Pumping Station*

The potential air quality impacts arise from emissions of particulate matter and may result in deposition of dust around the proposed Abbotstown pumping station site and track-out onto the roads nearby. The magnitude of the potential emissions associated with the Construction Phase is assessed as medium.

The assessment shows that the most significant potential impacts are those associated with the site excavations and construction activity. A short-term Slight adverse impact is predicted for the closest receptors during the Construction Phase with potential short-term impacts from traffic on the surrounding roads within approximately 50m of the proposed Abbotstown pumping station site. There will be no lasting impact, and the short-term impact will be managed by means of an effective Construction Environmental Management Plan (CEMP) incorporating the mitigation measures outlined in Section 14.8 of Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A of this EIAR. The CEMP will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

There is concern about a fungal disease, 'invasive Aspergillosis', which may be contracted as a result of disturbance of materials that release fungal spores into the atmosphere. Aspergillus is a ubiquitous organism and is present everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place. Even simple activities, such as cutting the grass, can generate significant quantities. The vast majority of people are immune to this. However, Invasive Aspergillosis is a disease which is detrimental to persons with suppressed immune systems, such as hospital patients, and is therefore of concern because of the proposed Abbotstown pumping station site's close proximity to Connolly Hospital and St. Francis' Hospice. Vulnerable patients are mostly placed in specially designed units with highly filtered air and, as such, are protected from external sources.

The *National Guidelines for the prevention of Nosocomial Aspergillosis During Construction/Renovation Activities* (Health Protection Surveillance Centre 2018) deals specifically with construction works occurring within or adjacent to hospitals. The guidelines state that the fungal spores responsible for invasive Aspergillosis can originate from a number of sources such as construction, demolition, renovation, disturbance of soil, removal of fibrous insulation material, removal of suspended ceiling tiles and from poorly maintained air ventilation systems.

The dispersion of spores (or indeed dust or any other substance) which are released at a particular location depends on a significant number of factors, including, for example the rate, temperature and height of the release, wind speed and direction, rainfall, topography; and the potential for physical or chemical interactions and the concentrations of the substances released and other factors. Dispersion of fungal spores released as a result of any activity is a function of time and distance; spores would be completely dispersed, i.e. no measurable concentration, at approximately 250m from the source of the release.

The National Guidelines (Health Protection Surveillance Centre 2018) note that the fundamental requirements in preventing Aspergillus infection arising from construction works are, first, to minimise the dust generated during construction and, second, to prevent dust infiltration into patient care areas. All construction works within the vicinity of Connolly Hospital and St. Francis' Hospice will be carried out in accordance with the requirements of the National Guidelines.



### *Proposed Orbital Sewer Route*

The potential air quality impacts arise from emissions of particulate matter and may result in deposition of dust around the proposed orbital sewer route site and track-out onto the roads nearby. The magnitude of the potential emissions associated with construction is assessed as low. The most significant potential impacts are those associated with soil stripping and excavation. A temporary insignificant adverse impact is predicted for the closest receptors during the Construction Phase. There will be no lasting impact, and the temporary impact will be managed by means of an effective CEMP. Since the magnitude of any effects is assessed as low and temporary, Significant adverse human health effects are not predicted.

### *Proposed Outfall Pipeline Route*

In general, receptors located close to the construction site boundary are considered high sensitivity with sensitivity decreasing with increasing distance from the source. This reflects the exponential decrease in dust levels as distance increases. The receptor sensitivity in the immediate vicinity of the proposed outfall pipeline route varies from low to high depending on the proximity of residences and/or other sensitive receptors, including ecological sites.

The assessment shows that the most significant potential impacts are those associated with soil stripping and excavation. There is predicted to be a temporary insignificant adverse impact on the closest receptors during the Construction Phase. There will be no lasting impact, and the temporary impact will be managed by means of an effective CEMP. As the magnitude of any effects is assessed as low and temporary, significant adverse human health effects are not predicted.

### *Proposed Wastewater Treatment Plant*

The potential air quality impacts arise from emissions of particulate matter and may result in deposition of dust around the proposed WwTP site and track-out onto the roads in the vicinity. The magnitude of the potential emissions associated with construction is assessed as medium.

The assessment shows that the most significant potential impacts are those associated with soil stripping and excavations, landscaping and construction traffic. A temporary Slight adverse impact is predicted for the closest receptors during the Construction Phase, with potential short-term impacts from traffic on the surrounding roads within about 50m of the proposed WwTP site. However, all dust levels will not exceed AQS. This means that the potential effect on human health is Slight. There will be no lasting impact, and the short-term impact can be managed by means of an effective CEMP.

## Noise

### *Construction Phase Noise Criteria*

As set out in Chapter 15 Noise and Vibration, there is no specific Irish legislation which sets out environmental noise limits that must be achieved. Therefore, the assessment criteria that are presented in Chapter 15 Noise and Vibration are based on guidelines set out by regulatory bodies such as the EPA, WHO and Department of Communications, Climate Action and Environment, whose guidance and standards are based on international best practice.

Construction noise is temporary in nature and is usually experienced over a short- to medium-term period. This characteristic requires it to be considered differently to other longer-term noises. Construction activities on larger-scale construction projects such as this one will inevitably result in noise being generated.

There is no Irish guidance specifically published for the short- to medium-term construction work such as that required for the Proposed Project. Construction noise impacts are assessed in terms of the requirements of BS 5228-1 (British Standards Institution 2014) and Annex E of the standard, which details acceptable construction noise limits for differing scenarios. Annex E.2 states that noise levels between 07:00 and 19:00 outside the nearest window of the occupied room closest to the site boundary should not exceed:

- 70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise; and
- 75 decibels (dBA) in urban areas near main roads in heavy industrial areas.

International best practice dictates that noise limits in the range 65dB(A) - 75dB(A)  $L_{Aeq,1hr}$ <sup>1</sup> are generally acceptable in the community during daytime construction activities.

Transport Infrastructure Ireland (formerly the National Roads Authority) is the only government body in Ireland to publish construction noise limits, which are presented in *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (National Roads Authority 2004).

The guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration. The guidelines point out that there is no published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, they say that Local Authorities, where appropriate, should control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The guidelines present indicative noise levels that are typically deemed acceptable during the construction phase of road developments, but are commonly adopted on other linear projects.

In relation to human health, the most authoritative guidelines are those issued in relation to the community effects of noise by the WHO. The WHO issued guidance on community noise in 1999 (WHO 1999), and in 2009, the WHO issued the *Night Noise Guidelines for Europe* (WHO 2009) which explore the effects of night-time noise. The WHO's (2009) night noise guidelines refer to the  $L_{night}$  parameter which relates specifically to noise levels over the night-time period. It stated that, in the two European countries studied (Switzerland and the Netherlands), almost 50% of the population are exposed to night-time noise in excess of 45dB  $L_{night}$ .

These guidelines quote some health effects occurring at quite low night-time levels and propose an ideal noise level of 40dB  $L_{night}$  outside residences. They do, however, accept that this is essentially unachievable in the foreseeable future and therefore propose an interim value as 55dB  $L_{night}$  outside instead.

It should also be stated that the effects detected at lower night-time levels (below 55dB  $L_{night}$ ) are relatively benign, in terms of health effects, such as increased mobility (tossing and turning) while asleep. More significant health effects are only linked to much higher noise levels, usually in excess of 70dB  $L_{night}$ .

In most urban environs, it would be expected that many areas have existing noise levels at or above 55dB  $L_{night}$ , and Dublin is no different. In this context, any assessment of potential impacts must take into account the baseline or existing noise levels.

---

<sup>1</sup>  $L_{Aeq,1hr}$  is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over 1 hour.

The proposed construction noise criteria applicable at the nearest facades of the NSRs that may be impacted by the construction works for the Proposed Project are summarised as follows:

- Monday to Friday (07:00 to 19:00) 70dB L<sub>Aeq,1hr</sub>
- Saturdays (08:00 to 16:30) 65dB L<sub>Aeq,1hr</sub>
- Monday to Friday (19:00 to 22:00)<sup>[1]</sup> 60dB L<sub>Aeq,1hr</sub>
- Sundays and Bank Holidays (08:00 to 16:30)<sup>[1]</sup> 60dB L<sub>Aeq,1hr</sub>
- Night-time (22:00 to 07:00)<sup>[1]</sup> 45dB L<sub>Aeq,1hr</sub>
- All other times<sup>[1]</sup> 45dB L<sub>Aeq,1hr</sub>

Note 1 above refers to the fact that construction activity at these times, other than that required in respect of specific underground tunnelling works and emergency works, will require the explicit permission of the LA.

Please refer to Chapter 15 Noise and Vibration, Section 15.4 in Volume 3 Part A of this EIAR for a detailed assessment of the human health impacts associated with the Construction Phase of the Proposed Project. The following is an overview of the results of the impact assessment with respect to human health.

#### *Proposed Wastewater Treatment Plant and Abbotstown Pumping Station*

The predicted noise levels associated with each phase of construction works, excavation and site preparation, general site activities and building construction, at both the proposed Abbotstown pumping station and WwTP sites, are all well below the assessment criteria of 70dB L<sub>Aeq,1hr</sub> and 65dB L<sub>Aeq,1hr</sub> for Saturdays at the named Noise Sensitive Receptor (NSR) locations. Similarly, all other NSRs in the vicinity of the proposed works are much further removed than the named NSRs and will consequently experience a lower noise impact than those named. In these circumstances, the assessed effect on human health is an Imperceptible impact.

The results indicate that the predicted daytime construction noise levels associated with site works will not exceed the assessment criterion for construction works of 70dB L<sub>Aeq,1hr</sub> at any of the NSR locations. The Impact Rating for daytime construction activities at the NSRs resulted in an Imperceptible impact at all NSR locations with the exception of NSRs R2 (out-patient day centre building in front of Connolly Hospital), R3 (St. Francis' Hospice) and R4 (Dunsink Lane house). The impact is assessed as Not Significant at NSR R2, Moderate for Stage 1 works and Slight for Stage 2 and Stage 3 works at NSR R3 and Not Significant at NSR R4 for Stage 1 works. The duration of effect is classified as temporary for each stage of works, and the noise impacts will be transient in nature. Again, in these circumstances the assessed effect on human health is an Imperceptible impact.

These construction works will be below the Saturday noise criterion at all NSR locations. Consequently, there are no restrictions on these works for Saturdays.

It should also be noted that the noise model did not provide any screening reductions, and the use of site hoarding around the site perimeter during construction would further reduce the noise impacts experienced at the nearest NSRs.

This will result in a Slight or Imperceptible effect on human health.

#### *Proposed Orbital Sewer Route and Outfall Pipeline Route (Land Based Section)*

The noise associated with the proposed orbital sewer route works and the proposed outfall pipeline route (land based section) involves the laying of pipework along a defined route from Blanchardstown to Baldoyle via the

proposed WwTP site. These works will be completed within the proposed construction corridor (40m width) which will frame the entire route. These works will involve two different construction methodologies, namely open-cut trench works and trenchless (microtunnelling) techniques.

With respect to the open-cut trench works, the predicted noise at all NSRs within 70m of any open-cut trench construction was assessed. The proposed construction noise criterion of 70dB  $L_{Aeq,1hr}$  will be exceeded at five NSR locations along the proposed pipeline routes for a very short period of time, in the order of days. These five NSRs are:

- R7 – Premier Business Park at 30m from the works;
- R16 – Bank Building at 25m from the works;
- R17 – Collinstown Cross Industrial Park at 25m from the works;
- R28 – Emsworth House at 25m from the works; and
- R29 – Teagasc/Educate Together School at 25m from the works.

However, the use of standard construction site hoarding positioned along the boundary of the proposed pipeline routes, between the works and the NSRs, will reduce the noise levels experienced at all NSRs to within the proposed criteria level. Hence, with this mitigation, the residual effect on human health is assessed as negligible. All other NSRs will be exposed to noise levels that are significantly below the adopted criteria during the open-cut trench construction works for the proposed pipeline routes. The Saturday noise criterion of 65dB  $L_{Aeq,1hr}$  will also be adhered to by ensuring any works with the potential to exceed this limit will be scheduled to be undertaken on a weekday or will be completed with a construction site hoarding in place if required.

Microtunnelling works associated with the proposed orbital sewer route and the proposed outfall pipeline route (land based section) will be required during the Construction Phase at a number of different locations. Microtunnelling will be carried out at 19 locations in total, including two locations near Connolly Hospital and along the proposed orbital sewer route and outfall pipeline route for road crossings, rail-line crossings, watercourse crossings and to cross Silloge Park Golf Club. These tunnelling events will for the most part be of very short duration, typically just a few days of active tunnelling, and be a significant distance from the nearest NSRs. The tunnelling works near Connolly Hospital will be more significant, and it is anticipated that works will take up to six months to complete the almost 1km of tunnelling at this location. Once commenced, it is envisaged that the tunnelling works will continue 24 hours per day, where possible, until the tunnelling is completed.

The construction of the launch shafts is considered the noisiest element of the proposed temporary construction compound works. The NSRs nearest to the 19 locations where microtunnelling works are proposed were assessed. The results of the assessment indicated that predicted daytime launch shaft construction works will not exceed the criterion of 70dB  $L_{Aeq,1hr}$  at all locations. The Impact Rating for daytime construction activities at the named NSRs resulted in an Imperceptible rating at seven of the NSR locations, a Not Significant rating at six of the NSR locations, a Slight rating at three of the NSR locations, and a Significant rating at three of the NSR locations.

As well as the noise associated with construction of the launch shafts, modelling was also carried out for the operation of the Tunnel Boring Machine (TBM), the associated plant and also the plant for the handling and removal of the tunnel spoil. There will be no movement of tunnel spoil outside of daytime hours, which will minimise the night-time noise-generating activities. Again, the noise was modelled at the NSRs nearest to the 19 microtunnelling locations.

The results of the daytime assessment indicate that predicted daytime TBM construction works will not exceed the noise assessment criterion of 70dB  $L_{Aeq,1hr}$  at all locations. The Saturday noise criterion of 65dB  $L_{Aeq,1hr}$  will also be satisfied at all NSR locations. Generally, once microtunnelling works have commenced, it is planned to operate continuously throughout the day and night. However, it is possible to stop the microtunnelling works if in rock and to recommence again later, and this option will be considered, where practicable. As the works at Connolly Hospital are in rock, this option can be considered. The Impact Rating for daytime TBM construction activities at the named NSR locations resulted in an Imperceptible rating at 17 of the NSR locations and a Not Significant rating at two of the NSR locations.

The results of the night-time assessment indicate that predicted night-time TBM construction works will meet the noise assessment criterion of 45dB  $L_{Aeq,1hr}$  at all locations, with the exception of two locations at Connolly Hospital (R1 and R2), a private residence on Clonshaugh Road (R19), St. Michael's House (R21), the Educate Together School on the R107 Malahide Road (R29) and the cottage on the R124 Road (R31).

The West Wing building of Connolly Hospital is considered noise sensitive at night-time, as there are occupied wards located on the ground, first and second floors of this building. Mitigation will be required for these works at this hospital location. Mitigation is also required for the night-time TBM works approaching R19 on the Clonshaugh Road, R21 (St. Michael's House) and R31 on the R124 Road. The out-patient unit at the front of Connolly Hospital (R2) is an outpatient-only unit, so there are no patients or hospital personnel in this building during night-time hours; consequently, this location is not an NSR outside of daytime hours. Similarly, the Educate Together national school on the R107 Malahide Road is not inhabited during night-time hours and therefore is not considered as an NSR outside of daytime hours. The night-time noise assessment criterion of 45dB  $L_{Aeq,1hr}$  is therefore not applicable at these locations. The mitigation measures proposed for the TBM works near the West Wing building of Connolly Hospital may not result in meeting the proposed noise criteria of 45dB  $L_{Aeq,1hr}$  at this location, but the associated impact rating is classified as Not Significant due to the existing high baseline noise level at this location. The predicted noise levels for night-time TBM works falls within the 45dB  $L_{Aeq,1hr}$  assessment criterion for all other relevant NSRs once the proposed mitigation measures are implemented.

The Impact Rating for night-time TBM construction activities at the named NSR locations resulted in an Imperceptible rating at 11 of the NSR locations, a Not Significant rating at seven of the NSR locations and a Moderate rating at one NSR location.

Groundborne noise was also modelled as part of the microtunnelling noise assessments. 'Groundborne noise' refers to a perceived noise heard as a result of the propagation of a vibration at acoustic frequencies through the ground or through a structure. Groundborne noise tends to be the same in all rooms in a house or building, with a slight reduction on higher floors. Groundborne noise may be observed without passing through air and can cause a greater effect than would be expected from airborne noise at a similar level, particularly during the night-time. Underground tunnelling has the potential to generate groundborne noise depending on the type of ground being tunnelled and the foundations of the receiving buildings, amongst other factors, and therefore is required to be assessed for this Proposed Project.

The WHO's (1999) *Guidelines for Community Noise* recommends that indoor guideline values for bedrooms are 30dB  $L_{Aeq}$  for continuous noise and 45dB  $L_{AMax}$  for single sound events. The tunnelling activity is planned to operate continuously once commenced until completion and will therefore operate through the night, so the 30dB  $L_{Aeq}$  guide value is adopted as the impact assessment criterion for private residences during night-time works. There are three residences where groundborne noise is predicted to exceed the guide limit of 30dB  $L_{Aeq}$ ,

namely the cottage at Cappagh Road (R8), the house at Clonshaugh Road (R19) and the house on Golf Links Road (R35). The properties at Cappagh Road and the Clonshaugh Road may experience indoor noise levels above 30dB  $L_{Aeq}$  for between one and two days, and the property on Golf Links Road may experience indoor noise levels above 30dB  $L_{Aeq}$  for up to 10 days. It is important to note that the predicted groundborne levels are an estimate based on the BS 5228 (British Standards Institution 2014) empirical formula, while in practice it is possible that the impact will be much lower.

The Connolly Hospital (West Wing) is located within 28m of the proposed tunnelling works. Potential noise levels of up to 49dB  $L_{Aeq}$  are predicted here. Using the BS 5228 empirical formula, the criterion of 30dB  $L_{Aeq}$  in occupied rooms will only be met in sections of this building that are at least approximately 63m away from the actual tunnelling works themselves. There are occupied wards located on the ground, first and second floors of this building, and as such, this building is considered an NSR, particularly at night-time. In order to comply with the 30dB  $L_{Aeq}$  criterion, it will be required that tunnelling works are only carried out during daytime hours once they are within approximately 63m of this hospital building. This option will be available as the tunnelling works within this distance from the hospital will be carried out in rock (where the TBM can be stopped during the microtunnelling works). On-site noise measurements during the construction works will be used to precisely define the distance from the hospital building where night-time works can be carried while still complying with the 30dB  $L_{Aeq}$  criterion.

Predicted groundborne sound pressure levels at the industrial unit on the R132 Swords Road (31dB  $L_{Aeq}$ ) and the school on the R107 Malahide Road (40dB  $L_{Aeq}$ ) are not required to be assessed against the 30dB  $L_{Aeq}$  criterion, as these locations only house daytime activities, so the indoor guideline values for bedrooms of 30dB  $L_{Aeq}$  is not applicable. Predicted groundborne noise sound pressure levels at all other locations where microtunnelling works will be carried out are within the proposed criterion of 30dB  $L_{Aeq}$ .

Again, it is important to note that these effects are temporary. Mitigation primarily relates to the times at which tunnelling will be allowed. With the proposed mitigation, and in particular with tunnelling works only being allowed during daytime hours, the residual assessed effect on human health is an Imperceptible impact.

#### *Proposed Outfall Pipeline Route (Marine Section)*

Noise modelling for the launch and reception shaft construction works during the daytime only, and also for the TBM works during both daytime and night-time, was carried out. Noise levels have been calculated for each of the nearest NSR locations.

The construction of the launch and reception shafts comply with the proposed noise criteria of 70dB  $L_{Aeq,1hr}$  for weekdays and 65dB  $L_{Aeq,1hr}$  for Saturdays at the named NSR locations, therefore the Impact rating was classified as Imperceptible and Not Significant at the nearest NSR locations to the proposed works.

The operation of the TBM machine will be continuous, so both the daytime and night-time impacts have been assessed. The marine TBM construction works will result in an Imperceptible impact at the nearest NSRs (R33 and R34) to proposed temporary construction compound no. 9 (West of Baldoyle Bay) for both daytime and night-time works. The significance of the impact of the TBM construction works at proposed temporary construction compound no. 10 (East of Baldoyle Bay) will result in an Imperceptible impact for daytime works and a Significant impact for night-time works at the nearest NSR location (R35). The use of a localised acoustic screen in front of the stationary noise generating TBM plant in the proposed temporary construction compound will result in the impact rating dropping to Moderate for night-time impacts at R35.

In all cases for the proposed outfall pipeline route (marine section) microtunnelling works which take place up to the low tide mark, the highest predicted construction noise levels are below the daytime construction noise criterion of 70dB  $L_{Aeq,1hr}$  and the 65dB  $L_{Aeq,1hr}$  criterion for Saturdays. The microtunnelling works are also below the night-time construction noise criterion of 45dB  $L_{Aeq,1hr}$ .

Therefore, the impact on human health is assessed as Imperceptible.

#### *Construction Traffic Noise*

The construction traffic impact assessment has determined that, during the morning peak hour, noise levels are calculated to increase at some residential properties that are 15m from the haul routes. The highest potential impact is calculated to be an increase in noise levels of 4dB on the L3090 Road and Cappagh Road haul routes. The Impact Rating for the NSRs on this haul route is classified as Moderate. All other impacts are classified as minor or negligible, and all predicted construction traffic noise levels are well within the assessment criterion of 70dB  $L_{Aeq,1hr}$ .

It should be noted that, at all NSR locations, the existing daytime noise environment is dominated by passing road traffic, and passing aircraft to a lesser extent, and consequently, the noise levels generated by the construction traffic is not expected to change the character of the existing noise environment in any observable manner. Therefore, the impact on human health is assessed as Imperceptible.

#### Traffic and Transport

##### *Road Safety*

Section 13.11.3 of Chapter 13 Traffic and Transport in Volume 3 Part A looked at other road issues such as road safety and unplanned events. A Road Safety Audit was prepared for the entrances and internal road layout for the Proposed Project (see Appendix A13.6 in Volume 3 Part B of this EIAR), with main findings being incorporated into the design to ensure no significant effects to road safety.

##### *Unplanned Events*

Chapter 13 Traffic and Transport also lists a number of unplanned events which could occur, such as incidents along the proposed haul routes, at proposed access/egress areas or within the proposed sites. Such events could include road collisions, flooding or spillage along a haul route. An outline risk assessment was carried out with risk control measures proposed to reduce risk to human health.

##### *Fear, Intimidation and Pedestrian Amenity*

In order to assess fear and intimidation in regard to additional traffic from the Proposed Project, a review of the existing Vulnerable Road User's amenities was carried out.

Footpaths are present along the R139 Road and cycle lanes are provided in places. Limited footpaths and cycle lanes are present along Clonsaugh Road; however, these are discontinuous and not present at the proposed exit from the proposed WwTP.

Due to its location on the fringe of Dublin City and near Swords, it is possible that staff could access the proposed WwTP by public transport or by walking and cycling. A footway will be installed along the proposed access road, frontage to the site and internal roads within the proposed WwTP to facilitate Vulnerable Road Users. Therefore, fear and intimidation are considered Not Significant for the Proposed Project.

#### Marine Water Quality

There are eight stretches of beach which have been designated as bathing water protected areas along the north County Dublin coastline. Of these eight, only Portmarnock Velvet Strand Beach has Blue Flag status. No impacts to marine water quality or any of these beaches are predicted as a result of construction (dredging) activities. No impacts to human health are predicted as a result. Please see Section 8.4.1 of Chapter 8 Marine Water Quality in Volume 3 Part A of this EIA for further details.

#### Hydrology and Hydrogeology

Please refer to Section 17.6 of Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIA for a detailed assessment of the human health impacts associated with the Construction Phase of the Proposed Project. The following is an overview of the results of the impact assessment with respect to human health.

The assessment has considered potential impacts through desktop studies and public surveys. With respect to hydrology, the focus was flooding and surface water quality, while the hydrogeology assessment looked at impacts to yield and quality of water in groundwater wells (public supply and domestic/private) as well as saline intrusion into the groundwater.

A Flood Risk Assessment was undertaken for the Proposed Project (see Appendix A17.1 in Volume 3 Part B of this EIA). The proposed WwTP site and the proposed Abbotstown pumping station site are located in an area with a low risk of flooding (classified as Flood Zone C). Pipelines are not vulnerable to flooding. The assessment did find that there was an increased risk of localised flooding in the streams and rivers near the Proposed Project; however, the significance of this impact was categorised as Not Significant. With respect to water quality, the hydrology assessment found that the significance of impacts from accidental spillages or contaminated site runoff is Slight. Therefore, no significant hydrological impacts to human health are predicted.

The hydrogeology impact assessment found that there are no public supply wells near the Proposed Project. Therefore, there is no potential for impacts on public supply yields or quality. Similarly, it was found that domestic wells are generally not used in the area as mains water is supplied throughout the area. The hydrogeology assessment did categorise the possibility of saline intrusion compromising the water quality for the Portmarnock Golf Club irrigation wells as Significant. However, as these wells are used for irrigation of the Golf Course, there is no risk to human health. Therefore, no significant hydrogeological impacts to human health are predicted.

#### Soils and Geology

##### *Contaminated Land*

Please refer to Section 18.5 of Chapter 18 Soils and Geology in Volume 3 Part A for a full discussion of the Construction Phase impacts with respect to contaminated land. The proposed orbital sewer route will pass near to two historical unregulated landfills at Baleskin and Ballymun. A small volume of contaminated material will need to be excavated and removed off-site to a suitably licensed waste facility. From a human health perspective, the excavation of contaminated material may pose a risk to the health of the construction workers at the site during excavation and management of the material. This matter will need to be risk assessed by the appointed



contractor(s). The competent authority for this is the Health and Safety Authority. Due to the relatively small amount of excavation required, the impact significance was assessed as Moderate/Slight.

However, from a public health perspective, controls will ensure no contaminated material can leave the construction site in uncontrolled circumstances. As a result, the risk to public health is Not Significant.

#### Psychological Impacts

For virtually every proposal for any development, there are concerns about potential adverse effects on a person's overall psychological well-being. This is a difficult matter to assess, as there are no direct measurements that can be used. While great detail can be provided in predicting, for example, odour and noise emissions, the same scientific certainty cannot be used when predicting psychological impacts. It is not possible to use a standards-based approach.

There are various degrees of psychological impact, and these can be both positive and negative. An example of a positive impact is a person looking forward to a better utility. An example of adverse effect is annoyance, where somebody could be annoyed by outside noise, dust deposition or temporary traffic delays associated with Construction Phase. However, annoyance in itself is not a medical impact. However, if someone developed a psychological illness, such as anxiety or depression, this would be a medical impact.

There is potential for adverse effects on psychological health as a result of the Proposed Project, for example anxiety and stress experienced by those may be worried about vermin issues, health and odour issues.

The community will also experience annoyance from the temporary impacts of traffic management and other effects during the Construction Phase. Construction by its very nature is transient, but it is expected that construction activities will cause some annoyance due to road diversions and temporary road closures. The potential effects will be minimised by the use of appropriate traffic management. In addition, the 'do nothing' scenario would potentially lead to more long-term annoyance than the temporary construction traffic impacts if the sewerage system is not capable of meeting the demands of the population.

There has been a considerable amount of construction in Ireland over the last few decades. However, there is no documented evidence from these projects to link construction activities with psychological health in Ireland.

#### **7.7.2 Operational Phase**

The key potential human health impacts during the Operational Phase of the Proposed Project include:

- Health Improvements;
- Emissions to air from operational parts of the Proposed Project;
- Noise impacts to sensitive receptors during operation;
- Road safety impacts; and
- Impacts to beach-goers and bathers during operation of the marine outfall.

#### Health Improvement

An efficient and functioning wastewater system is a necessity for both residential and economic development in a modern economy. New developments cannot be considered in areas where there are not sufficient utilities to deal with human activity and living. In simple terms, new and better housing cannot be considered in areas where there is no capacity to handle sewerage, one of the most fundamental requirements. A similar consideration is the development of factories, shops, offices and areas of entertainment or recreation.

The Proposed Project has the potential to provide opportunities for health improvements by providing the essentials for residential and economic development.

Employment, income and housing are among the most significant determinants of long-term health. Many epidemiological studies consistently show better health outcomes are associated with higher socio-economic status and better residential conditions.

Consequently, poor economic circumstances and poor housing can influence health throughout life, where communities subject to socio-economic deprivation or poor housing are more likely to suffer from morbidity, injury, mental anxiety, depression and tend to suffer from higher rates of premature death than those less deprived. Some of the most reliable methods to improve health within a community are to raise its socio-economic status and improve the housing stock. Projects that have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance could contribute to improving the health and well-being of socio-economically deprived communities.

In social health terms, economic development also brings the opportunity for reducing inequities in society. Long-term unemployment, for example, is detrimental to the individual, family and society. It has the potential to transfer across generations, so that families where the head of household is long-term unemployed are themselves far more likely to become or stay unemployed. This has the potential to create and sustain social inequities. The economic development opportunities provided by the Proposed Project have the potential to allow new and better quality housing, to create more employment and reduce the risk of long-term unemployment and to allow the development of retail and entertainment facilities, as well as other human activities. This, in turn, can lead to greater opportunities for equity in society.

#### [Air Quality](#)

Please refer to Section 14.6 of Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A of this EIAR for a detailed assessment of the human health impacts associated with the Operational Phase of the Proposed Project. The following is an overview of the results of the impact assessment with respect to human health.

Sensitive human receptors were identified within the study area that are considered representative of the worst-case locations where members of the public are likely to be exposed to a potentially significant change in pollutant concentrations associated with the Proposed Project. Fifty-two sensitive receptors located near to the elements of the Proposed Project were included in the assessment as detailed in Appendix A14.5 in Volume 3 Part B of this EIAR. Predictions are presented in Appendix A14.5 in Volume 3 Part B of this EIAR for every modelling scenario and meteorological year assessed for the proposed Abbotstown pumping station site, the proposed Odour Control Unit at Dubber and the proposed WwTP at Clonshagh.

#### [Proposed Abbotstown Pumping Station Odour Control Unit](#)

Model executions were completed to assess the incremental additions to ground level concentrations of odour as a result of emissions from the proposed Abbotstown pumping station. This was done to allow for a comparison of the predictions with the relevant AQS and guidelines. The predicted ground level odour concentration as a result of the emissions will not exceed the assessment standard of  $1.5\text{OU}_E/\text{m}^3$  for the 98<sup>th</sup> percentile predictions for stack heights of 9m and 10m. This is a very conservative assessment criterion, and there is therefore confidence that the facility can easily operate within the required performance criteria and without causing adverse impacts. Even under peak conditions, the performance standard is achieved. Therefore, the impact on human health is assessed as Imperceptible.

### *Proposed Abbotstown Pumping Station Generator*

In the event of a power failure, the generator may be used to maintain operations at the proposed Abbotstown pumping station, and regular use is required to ensure ongoing effective operation. Model executions were completed to assess the incremental additions to ground level concentrations of PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub> and CO over specified averaging intervals to allow comparison of the predictions with the relevant AQS and guidelines. The data for each of the assessed air quality parameters demonstrated that emissions from the facility will not cause AQS to be exceeded. The data for the sensitive human receptors clearly demonstrate that emissions associated with the proposed Abbotstown pumping station will not cause a breach in any AQS or guideline value. Therefore, the impact on human health is assessed as Imperceptible.

### *Dubber Odour Control Unit*

Model executions were completed to assess the incremental additions to ground level concentrations of odour as a result of emissions from the proposed Odour Control Unit at Dubber. This was done to allow for a comparison of the predictions with the relevant AQS and guidelines. The predicted ground level odour concentration as a result of the emissions will not exceed the assessment standard of 1.5OU<sub>E</sub>/m<sup>3</sup> for the 98<sup>th</sup> percentile predictions for stack heights of 5m and 7m. As noted earlier, this is a very conservative assessment criterion, and there is therefore confidence that the facility can easily operate within the required performance criteria and without causing adverse impacts. Even under peak conditions, the performance standard is achieved. The data from the sensitive human receptor locations demonstrate that emissions associated with the OCU at Dubber will not cause a breach in any AQS or guideline value, and will not cause a nuisance as a result of the emissions. Therefore, the impact on human health is assessed as Imperceptible.

### *Proposed Wastewater Treatment Plant Combined Heat and Power System*

The Combined Heat and Power System will provide power for the facility by using the biogas generated in the wastewater treatment process. The system can also run on natural gas. There will be no requirement for generators at the facility as all power needs will be satisfied by biogas. Model executions were completed to assess the incremental additions to ground level concentrations of odour, PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub> and CO over specified averaging intervals to allow comparison of the predictions with the relevant AQS and guidelines. The data for each of the assessed air quality parameters demonstrated that emissions from the facility will not cause AQS to be exceeded. The data for the sensitive human receptors clearly demonstrate that emissions associated with the operation of the proposed WwTP will not cause a breach in any AQS or guideline value. Therefore, the impact on human health is assessed as Imperceptible.

### *Traffic Impacts*

The existing annual average concentrations of NO<sub>2</sub> and PM<sub>10</sub> are less than 75% of the AQS, and the predicted change in concentrations of both substances is in the range 2% to 5%. Using this methodology, the potential impact of the proposed WwTP Operational Phase traffic emissions on air quality is assessed as negligible for both NO<sub>2</sub> and PM<sub>10</sub>, the principal emissions associated with traffic. Due to the very low staff numbers for the proposed Abbotstown pumping station, the traffic impacts will be negligible compared with the existing background traffic. Therefore, the Operational Phase air quality impacts associated with traffic for the proposed Abbotstown pumping station will be Imperceptible. Therefore, the impact on human health is assessed as Imperceptible.

## Noise

Please refer to Section 15.5 of Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR for a detailed assessment of the human health impacts associated with the Operational Phase of the Proposed Project. The following is an overview of the results of the impact assessment with respect to human health.

### *Proposed Wastewater Treatment Plant*

The results of the daytime assessment indicate that daytime operational noise levels predicted at the nearest NSRs range from 32dB  $L_{Aeq,1hr}$  to 40dB  $L_{Aeq,1hr}$ , which is significantly below the daytime criterion of 55dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed WwTP will make no measurable change to the prevailing daytime ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the evening time assessment indicate that evening time operational noise levels predicted at the nearest NSRs range from 29dB  $L_{Aeq,1hr}$  to 33dB  $L_{Aeq,1hr}$ , which is significantly below the evening time criterion of 50dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed WwTP will make no measurable change to the prevailing evening time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the night-time assessment indicate that night-time operational noise levels predicted at the nearest NSRs range from 26dB  $L_{Aeq,1hr}$  to 32dB  $L_{Aeq,1hr}$ , which is significantly below the night-time criterion of 45dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed WwTP will make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The noise rating level does not exceed the background sound level any of the NSR locations, which shows that the predicted operational noise (or specific sound source) will have a very low impact and will be Imperceptible at the nearest NSRs. Therefore, the impact on human health is assessed as Imperceptible.

### *Proposed Abbotstown Pumping Station*

The results of the daytime assessment indicate that daytime operational noise levels predicted at the nearest NSR (R3) is 23dB  $L_{Aeq,1hr}$ , which is significantly below the daytime criterion of 55dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed Abbotstown pumping station will make no measurable change to the prevailing daytime ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the evening time assessment indicate that evening time operational noise levels predicted at the nearest NSR (R3) is 23dB  $L_{Aeq,1hr}$ , which is significantly below the evening time criterion of 50dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed Abbotstown pumping station will make no measurable change to the prevailing evening time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the night-time assessment indicate that night-time operational noise levels predicted at the nearest NSR (R3) is 23dB  $L_{Aeq,1hr}$ , which is significantly below the night-time criterion of 45dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed Abbotstown pumping station will make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The noise rating level does not exceed the background sound level at any of the NSR locations, which shows that the predicted operational noise (or specific sound source) will have a very low impact and will be Imperceptible at the nearest NSRs. Therefore, the impact on human health is assessed as Imperceptible.

#### *Proposed Odour Control Unit at Dubber*

The results of the daytime assessment indicate that daytime operational noise levels predicted at the nearest NSR (R10) is 27dB  $L_{Aeq,1hr}$ , which is significantly below the daytime criterion of 55dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed OCU will make no measurable change to the prevailing daytime ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the evening time assessment indicate that evening time operational noise levels predicted at the nearest NSR (R10) is 27dB  $L_{Aeq,1hr}$ , which is significantly below the evening time criterion of 50dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed OCU will make no measurable change to the prevailing evening time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The results of the night-time assessment indicate that night-time operational noise levels predicted at the nearest NSR (R10) is 27dB  $L_{Aeq,1hr}$ , which is significantly below the night-time criterion of 45dB  $L_{Aeq,1hr}$ . The results of the assessment indicate that the operation of the proposed OCU will make no measurable change to the prevailing night-time ambient noise environment. Since there will be no increase in the noise levels experienced at the nearest NSRs, the impact is classified as being of Imperceptible significance and long-term duration.

The noise rating level does not exceed the background sound level at any of the NSR locations, which shows that the predicted operational noise (or specific sound source) will have a very low impact and will be Imperceptible at the nearest NSRs. Therefore, the impact on human health is assessed as Imperceptible.

#### *Operational Traffic Noise*

For the purposes of assessing potential noise impacts, the relative increases in noise levels associated with traffic movements on existing roads and junctions with and without the Proposed Project have been considered. The two-way traffic flows for the PM peak period used in the assessment have been taken from the Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR. Traffic accessing the site will approach along the R139 Road and turn left into the site from here. Traffic departing the site will exit to the left via Clonshaugh Road. The NSRs situated along the R139 Road and Clonshaugh Road have been assessed for traffic noise impacts by calculating the change in noise level associated with the increase in overall traffic movements along these routes.

The predicted increase in noise levels at the NSRs along Clonshaugh Road and the R139 Road due to additional vehicular traffic associated with the Proposed Project is 0.1dB, which is barely perceptible, so the noise impact is classified as Negligible. Therefore, the impact on human health is assessed as Imperceptible.

## Traffic and Transport

### *Road Safety*

Section 13.11.3 of Chapter 13 Traffic and Transport in Volume 3 Part A looked at other road issues such as road safety and unplanned events. A Road Safety Audit was prepared for the entrances and internal road layout for the Proposed Project (see Appendix A13.6 in Volume 3 Part B of this EIAR), with main findings being incorporated into the design to ensure no significant effects to road safety.

### *Unplanned Events*

Chapter 13 Traffic and Transport also lists a number of unplanned events which could occur, such as incidents at proposed access/egress areas or within the proposed sites. The main such event with respect to the Operational Phase is road collisions. An outline risk assessment was carried out with risk control measures proposed to reduce risk to human health.

### *Fear, Intimidation and Pedestrian Amenity*

In order to assess fear and intimidation in regard to additional traffic from the Proposed Project, a review of the existing Vulnerable Road User's amenities was carried out.

Footpaths are present along the R139 Road and cycle lanes are provided in places. Limited footpaths and cycle lanes are present along Clonshaugh Road; however, these are discontinuous and not present at the proposed exit from the proposed WwTP.

Due to its location on the fringe of Dublin City and near Swords, it is possible that staff could access the proposed WwTP by public transport or by walking and cycling. A footway will be installed along the proposed access road, frontage to the site and internal roads within the proposed WwTP to facilitate Vulnerable Road Users. Therefore, fear and intimidation are considered Not Significant for the Proposed Project.

## Marine Water Quality

There are eight stretches of beach which have been designated as bathing water protected areas along the north County Dublin coastline. Of these eight, only Portmarnock Velvet Strand Beach has Blue Flag status. A modelling study was undertaken to assess the potential impacts of the proposed outfall pipeline route under three water quality modelling scenarios, representing average daily flow conditions, flow to full conditions and a process failure scenario. The results of this modelling were analysed against Environmental Quality Standards and bathing water standards. The modelling exercise concluded that the proposed outfall pipeline route discharge point will have an Imperceptible impact on the designated bathing waters and the Blue Flag beach. This included a process failure scenario where the *Escherichia coli* (*E. coli*) maximum values still did not exceed the Bathing Water Quality Regulations 2008 (S.I. No. 79 of 2008) mandatory value of 500/100ml in 95% or more of samples taken in the season to ensure 'good' classification of bathing water beaches. The modelling predicted no compliance failures at any of the designated bathing water beaches or Blue Flag beaches as a result of an *E. coli* plume caused by process failure. Please refer to Section 8.4.2 of Chapter 8 Marine Water Quality in Volume 3 Part A of this EIAR for further details. Therefore, the impact on human health is assessed as Imperceptible.

### Hydrology and Hydrogeology

The Operational Phase impact assessment in Section 17.6 of Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR predicted no hydrology or hydrogeology related human health impacts associated with the Operational Phase of the Proposed Project.

### Soils and Geology

The Operational Phase impact assessment in Section 18.6 of Chapter 18 Soils and Geology in Volume 3 Part A of this EIAR found no soils or geology related human health impacts associated with the Operational Phase of the Proposed Project.

## **7.8 Mitigation Measures**

The Proposed Project will be designed and constructed to best industry standards and practices. The Proposed Project aims to reduce health risks to employees, local residents and the community it will serve. The characteristics of the Proposed Project are presented in Chapter 4 Description of the Proposed Project in Volume 2 Part A of this EIAR.

During the Construction Phase and Operational Phase, comprehensive mitigation measures will be implemented in order to minimise/prevent the potential for human health impacts caused by the Proposed Project. Mitigation measures are outlined in detail within each of the following sections for the below relevant chapters in Volume 3 Part A of this EIAR:

- Chapter 8 Marine Water Quality, Section 8.5;
- Chapter 13 Traffic and Transport, Section 13.11;
- Chapter 14 Air Quality, Odour and Climate, Section 14.8;
- Chapter 15 Noise and Vibration, Section 15.7;
- Chapter 17 Hydrology and Hydrogeology, Section 17.5 and Section 17.7;
- Chapter 18 Soils and Geology, Section 18.7; and
- Chapter 24 Summary of Mitigation Measures.

### Air Quality

The preliminary design of the proposed Abbotstown pumping station and the proposed WwTP has incorporated several mitigation measures to minimise the impact of the Proposed Project. These include the following measures:

- All buildings at the proposed Abbotstown pumping station will be fully enclosed to contain all process activities;
- All gases at the proposed Abbotstown pumping station will be contained and treated in Odour Control Units;
- Stack heights for all emission sources will be optimised to ensure that AQS are met;
- All tanks and structures at the proposed WwTP will be covered;
- Layout of the site of the proposed WwTP has been optimised to promote effective dispersion of emissions;
- All activities in buildings at the proposed WwTP will be fully enclosed, including sludge intake in the SHC;

- Odours at the proposed WwTP will be contained at source and will be treated in Odour Control Units; and
- Two-stage and three-stage Odour Control Units will be put in place, where necessary.

The Construction Phase of the Proposed Project will be carefully managed, and a Dust Management Plan will be formulated to ensure that construction activities are managed to minimise dust emissions associated with construction activities. In order to mitigate against air quality effects at receptors during the Construction Phase, Best Practice Measures will be adopted. These measures will include techniques such as those outlined in the Institute of Air Quality Management's (2014) *Guidance on the Assessment of Dust from Demolition and Construction*.

The appointed contractor(s) will be required to produce an Air Quality and Dust Management Plan (AQDMP) as part of their CEMP, including Best Practice Measures to control dust and, in particular, measures to prevent dust nuisance. The principal objective of the AQDMP is to ensure that dust emissions do not cause significant nuisance at receptors near the Proposed Project, and the AQDMP will include measures such as enclosure of material stockpiles, hard surfacing of heavily used areas and covering of vehicles carrying spoil. Please refer to Section 14.8 in of Chapter 14 Air Quality, Odour and Climate in Volume 3 Part A of this EIAR for measures specific to maintaining AQS with respect to site planning, construction traffic and site activities.

#### Noise

Please refer to Section 15.7 of Chapter 15 Noise and Vibration in Volume 3 Part A of this EIAR for a comprehensive description of proposed mitigation measures to reduce impacts to sensitive receptors which are related to noise.

The main mitigation measure to be undertaken is the preparation of a Noise and Vibration Management Plan (NVMP) by the appointed contractor(s) prior to the commencement of any site works. The NVMP will be developed as part of the overall CEMP developed by the appointed contractor(s) and will be approved by Irish Water. The NVMP will detail how the appointed contractor(s) will comply with the noise criteria set out in this EIAR and will deal specifically with construction activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the Construction Phase. The NVMP will detail the provision and installation of localised acoustic screens and the best practice noise measures that the appointed contractor(s) will adhere to for construction activities and the noise and vibration monitoring programme that the appointed contractor(s) will undertake during the construction works.

The construction works will be managed through the use of construction noise limits which the appointed contractor(s) will work within. Best practice control measures, including choice of plant, scheduling of works on-site, provision of temporary acoustic screening, on-site noise monitoring and other measures, will be employed in order to ensure noise limits are not exceeded. Best practice noise management procedures for the control of noise and vibration from construction activities as presented in BS 5228 (British Standards Institution 2014) will be followed. Such measures to be adhered to will include the following:

- Good on-site work practices;
- Selection of quiet plant;
- Acoustic screens and barriers;
- Noise control;
- Communications with the community;



- Monitoring; and
- Noise auditing.

#### Traffic and Transport

In order to control risks to road safety, a number of suggested controls are listed in Section 13.11.3 of Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR. These include:

- Carry out a Stage 2 Road Safety Audit at detailed design stage;
- Maintain hedgerows to maintain optimum visibility;
- Maintain road signage and add signage where necessary;
- Maintain road surfacing and improve where necessary;
- Maintain lighting along road and improve where necessary;
- Maintain road drainage and improve where necessary;
- Maintain a stock of salt and chips and apply prior to snow/frost fall;
- Apply temporary signage where needed to notify public of risk and/or road closures;
- Walkways to be maintained and kept clear;
- Personnel to use internal walkways and wear high-vis;
- Supervision of Heavy Goods Vehicles to enforce safe procedures; and
- It is recommended that cycle lanes and pedestrian facilities are installed along the access road, frontage to the site and internal roads within the proposed WwTP to facilitate pedestrians and cyclists.

#### Marine Water Quality

Please refer to Section 8.5 of Chapter 8 Marine Water Quality in Volume 3 Part A of this EIAR for the mitigation measures with respect to marine water quality impacts. The following is an overview of the mitigation measures.

Disposal of dredged material will only take place on local flooding tides to ensure suspended sediments are not transported to sensitive receptors around Ireland's Eye. The timing of the flood tide will be confirmed with reference to Howth Harbour tide gauge.

Turbidity and suspended sediment concentrations of the receiving waters will be monitored during the course of the dredging operations.

Suspended sediment concentrations will have to be monitored during the course of the operations as part of the Construction Environmental Management Plan as the consenting authority will more than likely issue conditions on any dredging licence stipulating a suspended sediment limit, beyond which mitigation measures have to be implemented.

The dredging operation will be modified to reduce water column dispersion and/or spread of material along the bottom. An operational modification to clamshell dredging will be considered, if water column concentrations of dredged material are exceeded for proposed hopper dredge discharge.

### Hydrology and Hydrogeology

The mitigation described in Section 17.5 of Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR is embedded in the design, and the potential impact as designed was assessed. Additional mitigation measures are described in Section 17.7 of the same chapter. The Proposed Project will be designed in accordance with the report entitled *The Planning System and Flood Risk Management: Guidelines for Planning Authorities* (Office of Public Works 2009) and the Flood Risk Assessment carried out for the Proposed Project. (Appendix A17.1 in Volume 3 Part B of this EIAR). With these safeguards, it is considered that the proposed WwTP and the proposed Abbotstown pumping station will not be vulnerable to flooding. Climate change has been considered under the Fingal East Meath (FEM) Flood Risk Assessment Management Study (FRAMS) Project (Halcrow Barry Consultants 2011) and the River Tolka Flooding Study (M.C. O'Sullivan & Co. 2003).

The surface water drainage design of the proposed WwTP and the proposed Abbotstown pumping station sites and access roads will incorporate Sustainable Drainage System principles, with attenuation systems in place to limit discharges from the site to the greenfield-site flow rate. Consequently, there will be no impact on the nearby water courses.

Mitigation measures for the management of hydrology and hydrogeology impacts include, but are not limited to:

- All temporary construction compounds, storage areas and launch pits (for trenchless techniques) will be located within Flood Zone C – low risk;
- Immediate removal/disposal of surplus material off-site will be implemented;
- Drainage within soil bunds will be provided to reduce the influence upon the surface runoff pathways of flood water;
- Direct discharge of surface water from any temporary impervious area to the nearby watercourse without proper attenuation will be avoided;
- Temporary attenuation ponds will be provided if the stream to which surface water from the construction area is discharged has limited capacity;
- The shafts/construction fronts for any trenchless techniques will be located beyond the floodplain of the summer peak flood of an appropriate return period (i.e. 1 in 20 years). (For 10% risk over a two-year construction period, the required return interval for construction period flood is approximately 20 years, as per *Flood and Reservoir Safety* (Institute of Civil Engineers UK 2015));
- The surface water runoff at the construction sites will be managed to prevent flow of silt-laden surface water flowing into adjoining surface watercourses. To achieve this, the appointed contractor(s) must comply with the CIRIA publication *Control of water pollution from linear construction projects. Technical Guidance (C648)* (CIRIA 2006);
- For the construction on any watercourse crossings, a detailed Pollution Control Plan (PCP), Sediment and Erosion Control Plan (SECP), Emergency Response Plan (ERP) and Method Statements (MS) will be drafted and will have regard to relevant pollution prevention guidelines. All works in or adjacent to watercourses will comply with the EPA, Inland Fisheries Ireland and OPW requirements;
- Direct disposal of water from excavations and from temporary groundwater dewatering to the nearby watercourse will not be allowed, as these could both impact on water quality of the watercourse and increase 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, Inland Fisheries Ireland, etc.) prior to the commencement of work;

- On-site fuel storage and refuelling of plant and vehicles will be undertaken on impermeable and bunded areas and away from any rivers or other watercourses; and
- The appointed contractor(s) will inspect and monitor the water quality of surface waters near any works, particularly in relation to increased silt levels. This monitoring process will form part of the Construction Environmental Management Plan for the Construction Phase.

Further mitigation measures are detailed in Section 17.7 of Chapter 17 Hydrology and Hydrogeology in Volume 3 Part A of this EIAR.

### Soils and Geology

With respect to managing and mitigating against impacts from ground contamination, the following mitigation measures are required. For more details, please refer to Section 18.7 of Chapter 18 Soils and Geology in Volume 3 Part A of this EIAR.

Excavations in made ground will be monitored by an appropriately qualified person to ensure that, should any hotspots of contamination be encountered, they are identified, segregated and disposed of appropriately. Any identified hotspots shall be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. Care will be taken to ensure that the hotspot does not cross-contaminate clean soils elsewhere along the alignment.

Potential soil and water pollution will be minimised by the implementation of good construction practices. Such practices will include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance. The Construction Industry Research and Information Association (CIRIA) provides guidance on the control and management of water pollution from construction sites in their publication *Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors* (Masters-Williams et al. 2001), and this shall be reflected in the CEMP. A contingency plan for pollution emergencies will also be developed by the appointed contractor(s) prior to work and regularly updated, which would identify the actions to be taken in the event of a pollution incident. The CIRIA document recommends that a contingency plan for pollution emergencies will address the following:

- Containment measures;
- Emergency discharge routes;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location, and provision for 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the relevant environmental protection authority;
- Audit and review schedule;
- Telephone numbers of statutory water undertakers and local water company; and
- List of specialist pollution clean-up companies and their telephone numbers.

## 7.9 Residual Impacts

All relevant chapters include a detailed description of residual impacts. A summary of predicted residual impacts is presented in Table 7.6 below.

**Table 7.6: Summary of Predicted Residual Impacts**

Construction Phase	Impact Significance	Residual Significance
Emissions to air from construction activities and construction vehicles	Slight to Imperceptible	Slight to Imperceptible
Noise and vibration impacts to sensitive receptors during construction works	Moderate to Imperceptible	Moderate to Imperceptible
Impacts to road safety	Slight	Imperceptible
Flooding and impacts to water quality during construction	Slight to Imperceptible	Imperceptible
Impacts to construction workers as a result of excavation of contaminated lands	Moderate to Slight	Slight
Psychological impacts	Imperceptible	Imperceptible
Operational Phase		
Health improvement	Significant Positive	Significant Positive
Emissions to air from operational activities and operational traffic	Imperceptible	Imperceptible
Noise and vibration impacts to sensitive receptors during operation	Imperceptible	Imperceptible
Impact to marine water quality and bathing areas from E. coli	Imperceptible	Imperceptible

## 7.10 Conclusion

The overriding purpose of the Proposed Project is to provide a long-term sustainable drainage solution that will cater for existing and future development in the GDA by implementing the key recommendation of the GSDS *Final Strategy Report* (Dublin Drainage Consultancy 2005) and the SEA of the GSDS (FCC 2008). The Proposed Project will ensure that wastewater generated from the continued growth and economic development of the GDA is appropriately treated in order to safeguard human health and the environment and will be carried out in compliance with the relevant EU Directives and national regulations on water quality.

There is potential for socio-economic gain, including economic growth and residential development. Improved socio-economic status is well recognised as resulting in a positive impact on health outcomes. There is the potential for increased employment and reduced unemployment, particularly long-term unemployment. If this is achieved, there will also be benefits in terms of social health, including decreased social inequality.

From a community perspective, there are clear benefits in terms of health protection, opportunities for health improvements and access to services. There are, however, a limited number of individuals, primarily those living close to the construction of the Proposed Project, for whom there may be Slight adverse impacts in terms of noise and air quality during the Construction Phase. These impacts will be minimised by use of mitigation measures.

Overall, the impacts in relation to human health of the Proposed Project are overwhelmingly positive.

## 7.11 References

British Standards Institution (2014). BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise.

Department of the Environment and Local Government (1996). Codes of Good Practice for Use of Biosolids in Agriculture.

Dublin Drainage Consultancy (on behalf of Dublin City Council) (2005). Greater Dublin Strategic Drainage Study Final Strategy Report.

Environmental Protection Agency (2002). Guidelines on the Information to be Contained in Environmental Impact Statements.

Environmental Protection Agency (2003). Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

Environmental Protection Agency (2015a). Advice Notes for Preparing Environmental Impact Statements.

Environmental Protection Agency (2015b). Revised Guidelines on the Information to be Contained in Environmental Impact Statements.

Environmental Protection Agency (2016). Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).

Environmental Protection Agency (2017). Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

European Commission (2003). Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment.

Fáilte Ireland (2011). Guidelines on the treatment of tourism in an Environmental Impact Statement.

Fingal County Council (2008). Strategic Environmental Assessment of the Greater Dublin Strategic Drainage Study.

Halcrow Barry Consultants (on behalf of Fingal County Council, Meath County Council and the Office of Public Works) (2011). FEM-FRAMS Fingal East Meath Flood Risk Assessment and Management Study.

Health Protection Surveillance Centre (2018). National Guidelines for the Prevention of Nosocomial Aspergillosis.

Health Service Executive Public Health Profile Working Group (2015a). Health Profile 2015 Dublin Fingal.

Health Service Executive Public Health Profile Working Group (2015b). Health Profile 2015 Dublin City.

Institute of Air Quality Management (2014). Guidance on the Assessment of Dust from Demolition and Construction.

Institute of Environmental Management and Assessment (2017). Health in Environmental Impact Assessment – A Primer for a Proportionate Approach.

Institute of Public Health in Ireland (2009). Health Impact Assessment Guidance.

Irish Water (2016). National Wastewater Sludge Management Plan.

Implementation of Directive 2001/42/EC on the Assessment of the Effects of Certain Plans and Programmes on the Environment, European Commission, (2001)

Lewkowska, P., Cieřlik, B., Dymerski, T., Konieczka, P. and Namieřnik, J. (2016). Characteristics of odors emitted from municipal wastewater treatment plant and methods for their identification and deodorization techniques. *Environmental Research*, 151: 573–586.

Masters-Williams, H., Heap, A., Kitts, H., Greenshaw, L., Davis, S., Fisher, P., Hendrie, M. and Owens, D. (2001). Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors.

M.C. O’Sullivan & Co for Dublin Drainage Consultancy (on behalf of Dublin City Council) (2003). River Tolka Flooding Study

National Roads Authority (2004). Guidelines for the Treatment of Noise and Vibration in National Road Schemes.

Norman, G., Pedley, S. and Takkouche, B. (2010). Effects of sewerage on diarrhoea and enteric infections: a systematic review and meta-analysis. *The Lancet Infectious Diseases*, 10(8): 536–544.

Office of Public Works (2009). The Planning System and Flood Risk Management: Guidelines for Planning Authorities.

United States Environmental Protection Agency (2016). The Health Impact Assessment (HIA) Resource and Tool Compilation: A Comprehensive Toolkit for New and Experienced HIA Practitioners in the U.S.

World Health Organization (1948). Constitution of the World Health Organization.

World Health Organization (1999). Guidelines for Community Noise.

World Health Organization (2005). Air Quality Guidelines – Global Update 2005.

World Health Organization (2009). Night Noise Guidelines for Europe.

World Health Organization Regional Office for Europe (2014). Health in Impact Assessments: Opportunities not to be missed.

Xu, J., Lee, J.H.W., Yin, K., Liu, H. and Harrison, P.J. (2011). Environmental response to sewage treatment strategies: Hong Kong's experience in long term water quality monitoring. *Marine Pollution Bulletin*, 62(11): 2,275–2,287

#### Directives and Legislation

Air Quality Standards Regulations 2011 – S.I. No. 180 of 2011

Bathing Water Quality Regulations 2008 – S.I. No. 79 of 2008

European Communities Environmental Objectives (Surface Waters) Regulations 2009 – S.I. No. 272 of 2009

European Union (1985). Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment [1985].

European Union (2011). Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment [2011].

European Union (2014). Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment [2014].

European Union (2001). Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment [2001].

European Union (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe [2008].