# Chapter 14
# Land, Soils, Geology & Hydrogeology

## Contents

# 14. Land, Soils, Geology & Hydrogeology

## 14.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) considers the potential impacts on land, soils, geology and hydrogeology as a result of the Construction and Operational Phases of the Swords to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme). Chapter 4 (Proposed Project Description) includes a full description of the Proposed Scheme.

During the Construction Phase, the potential land, soils, geology and hydrogeology impacts associated with the development of the Proposed Scheme have been assessed. This includes the potential for contamination of soils and groundwater, and the loss of natural soils from excavation activities associated with utility diversions, road resurfacing and road realignments.

During the Operational Phase, the potential land, soils, geology and hydrogeology impacts associated with changes to water supply and the pollution of groundwater and watercourses have been assessed.

Potential impacts in the surface water environment are not considered in this assessment but are considered separately in Chapter 13 (Water).

The assessment has been carried out according to best practice and guidelines relating to land, soils, geology and hydrogeology assessment, and in the context of similar large-scale infrastructure projects.

An assessment is made of the likely significant impacts associated with the Construction and Operational Phases of the Proposed Scheme on these resources. Measures are presented to avoid or reduce potential impacts of the Proposed Scheme on the soils, subsoils, bedrock, geological resources and heritage and hydrogeology.

The aim of the Proposed Scheme when in operation is to provide enhanced walking, cycling and bus infrastructure on this key access corridor in the Dublin region, which will enable and deliver efficient, safe, and integrated sustainable transport movement along the corridor. The objectives of the Proposed Scheme are described in Chapter 1 (Introduction & Environmental Impact Assessment Process). The Proposed Scheme which is described in Chapter 4 (Proposed Project Description) has been designed to meet these objectives.

The design of the Proposed Scheme has evolved through a comprehensive design iteration process with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme undertaken throughout the option selection and design development process has been incorporated, where appropriate.

## 14.2 Methodology

The following Sections outline the legislation and guidelines considered, and the adopted methodology for defining the baseline environment and undertaking the assessment in terms of land, soils, geology and hydrogeology.

The significance of potential impacts of the Proposed Scheme on land, soils, geology and hydrogeology have been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any impact on these attributes.

### 14.2.1 Study Area

The land, soils, geology and hydrogeology study area for the Proposed Scheme extends 250metres (m) either side of the Proposed Scheme boundary which is in accordance with the Institute of Geologists of Ireland (IGI) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (hereafter referred to as the IGI Guidelines) (IGI 2013).

The Proposed Scheme has been divided into sub-sections for ease of presentation and due to the volume of information available. The sub-sections of the Proposed Scheme are as follows:

- Pinnock Hill to Airside Junction;
- Airside Junction to Northwood Avenue;
- Northwood Avenue to Shantalla Road;
- Shantalla Road to Botanic Avenue; and
- Botanic Avenue to Granby Row.

### 14.2.2 Relevant Guidelines, Policy and Legislation

The main documents that have been followed for the preparation of the land, soils, geology and hydrogeology assessment are:

- IGI Guidelines (IGI 2013); and
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (hereafter referred to as the NRA Guidelines) (NRA 2008a).

Though the NRA is now known as Transport Infrastructure Ireland (TII), for the purpose of this Chapter the guidelines mentioned above are referred to as the NRA Guidelines.

In addition, the assessment has been prepared using the following guidelines and legislation:

- Environmental Protection Agency (EPA), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022);
- European Commission (EC), Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (2017);
- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA 2008b);
- Strive Report Series No. 100. Evaluating the Influence of Groundwater Pressures on Groundwater-Dependent Wetlands. Strive EPA Programme 2007–2013 (EPA 2011); and
- Environmental Research Centre Report Series No. 12. A Framework for the Assessment of Groundwater-Dependent Terrestrial Ecosystems under the Water Framework Directive (WFD). Strive EPA Programme 2007–2013 (EPA 2008).

### 14.2.3 Data Collection and Collation

Data was compiled from publicly available datasets, the findings of ground investigations, design information, a scheme walkover survey, and other sources, as outlined below.

#### 14.2.3.1 Publicly Available Datasets

The publicly available datasets listed in Table 14.1 have been acquired and consulted in the assessment of the baseline conditions. All datasets were accessed throughout 2020, 2021 and 2022.

**Table 14.1: Publicly Available Datasets**

| Source | Name | Description |
|---|---|---|
| Ordnance Survey Ireland (OSI) | Current and historical ordnance survey maps | Current and historical survey maps produced by the OSI. |
| OSI | Aerial photography | Current and historical survey maps produced by the OSI. |
| Google | Aerial photography | Current aerial imagery produced by Google |
| Bing | Aerial photography | Current aerial imagery produced by Bing (Bing 2022) |
| Teagasc | Teagasc Soils Data | Surface soils classification and description |
| Geological Survey of Ireland (GSI) | Quaternary Mapping | Geological maps of the site area produced by the GSI and also available on GSI online map viewer. |
| | Bedrock Mapping | |
| | Aggregate Potential Mapping | |
| | Mineral Localities | |
| | Geotechnical viewer | |
| | Groundwater Mapping | |
| | Groundwater Levels | |
| | National Landslide Database | |
| | Karst Database | |
| | Active Quarries and Pits | |
| | County Geological Sites (CGS) and Geological Heritage Areas | |
| | GSI, Memoirs | |
| EPA | Corine Land Cover 2018 | These datasets are based on interpretation of satellite imagery and national in-situ vector data. |
| | Designated Natural Heritage Area (NHA). Special Protection Area (SPA), Special Area of Conservation (SAC) sites | |
| | River Network Map | |
| | EPA Hydro Net | Reports of groundwater level monitoring points. |
| National Parks and Wildlife Service (NPWS) | Mapping within the area of the Proposed Scheme | This dataset provides information on national parks, protected sites and nature reserves |
| National Monuments Service (NMS) | State Mining and Prospecting Facilities | This dataset provides all recorded archaeological monuments (NMS 2019) |
| Department of Communications, Energy and Natural Resources (DCENR) | Minerals Ireland | A booklet containing a list of all current and prospective mining facilities. |
| | Historic Mine Sites – Inventory and Risk Classification | An Inventory of historic mines in Ireland that includes detailed geochemical analysis. |

#### 14.2.3.2 Ground Investigation

The details of the historical ground investigation reports located within the study area which have been used in the assessment of the baseline conditions are presented in Table 14.2. These reports are publicly available from the Geological Survey of Ireland (GSI) Spatial Resources Map Viewer 'EXT GSI Geotechnical Sites layer' (GSI 2019a).

**Table 14.2: Existing Ground Investigations**

| GSI Report ID | Title | Year | Author | Location | Scope |
|---|---|---|---|---|---|
| R86 | Colaiste Choilm | 1994 | Irish Geotechnical Services Ltd. | Colaiste Choilm | 3 Cable Percussion Boreholes |
| R6494 | Swords Development | 2005 | Irish Geotechnical Services Ltd. | Cremona, Swords | 12 Cable Percussion Boreholes, 2 Rotary Core boreholes and 8 trial Pits |
| R5972 | New Commercial Development | 2005 | Irish Geotechnical Services Ltd. | Fosterstown South, Swords | 4 Cable Percussion Boreholes |
| R3078 | Northern Motorway Volume 1A | 1998 | Irish Geotechnical Services Ltd. and Site Investigations Ireland | Airport to Balbriggan By-Pass | 56 Cable Percussion Boreholes, 11 Trial Pits and three Rotary Core Boreholes |
| R1053 | Ulster Bank Swords Road | 1991 | Irish Geotechnical Services Ltd. | Ulster Bank, Swords Road | Two Cable Percussion Boreholes and three Trial Pits |
| R2570 | Proposed Warehousing | 1992 | Irish Geotechnical Services Ltd. | Corballis Park | 7 Cable Percussion Boreholes |
| R7216 | Site Investigation | 2008 | Irish Geotechnical Services Ltd. | Dublin Airport | 28 Trial Pits and 14 Plate Tests |
| R6290 | NDMG Properties Development | 2006 | Irish Geotechnical Services Ltd. | Turnapin Little | 3 Cable Percussion Boreholes and 4 Trial Pits. |
| R1475 | Woodlawn Industrial Estate | 1996 | Irish Geotechnical Services Ltd. | Northern Cross Route, Swords Road, Santry | 10 Trial Pits |
| R5530 | Lidl Supermarket | 2003 | Irish Geotechnical Services Ltd. | Swords Road, Santry, Dublin 9 | Two Window Samples |
| R1057 | Morton Stadium | 1990 | Irish Geotechnical Services Ltd. | Santry Demesne | 2 Cable Percussion Boreholes |
| R5022 | Residential Community Centre | 2002 | Irish Geotechnical Services Ltd. | Domville Court, Santry | 6 Cable Percussion Boreholes and 4 Trial Pits |
| R5877 | Proposed hotel extension | 2004 | Irish Geotechnical Services Ltd. | Bonnington Dublin | 3 Cable Percussion Boreholes and 2 Trial Pits |
| R499 | All Hallows College | 1983 | Site Investigations Ltd. | All Hallows College | 8 Cable Percussion Boreholes and 8 Trial Pits |
| R4943 | Residential development | 2002 | Irish Geotechnical Services Ltd. | St Joseph's Avenue, Drumcondra | 1 Cable Percussion Borehole and 3 trial Pits |
| R2543 | Site Investigation at Drumcondra Railway Station | 1996 | Irish Geotechnical Services Ltd. | Drumcondra Railway Station | 3 Cable Percussion Boreholes, 1 Rotary Core Borehole and 5 trial Pits |
| R6654 | Gaiety Investments | 2006 | Irish Geotechnical Services Ltd. | Sherrard Street Upper | 2 Cable Percussion Boreholes |
| R5920 | Mater Hospital Car Park Development | 2005 | Irish Geotechnical Services Ltd. | Mater Private Hospital, Eccles Street | 29 Window Samples and 4 Trial Pits |
| R779 | Temple Street Children's Hospital | 1985 | Irish Geotechnical Services Ltd. | Temple Street Children's Hospital | 10 Cable Percussion Boreholes |
| R998 | Medical OPD, Temple Street Hospital | 1994 | Irish Geotechnical Services Ltd. | Temple Street Children's Hospital | 2 Cable Percussion Boreholes and 2 Dynamic Probes |
| R6072 | Nerney's Court | 2005 | Irish Geotechnical Services Ltd. | Nerney's Court | 2 Cable Percussion Boreholes and 7 Trial Pits |

| GSI Report ID | Title | Year | Author | Location | Scope |
|---|---|---|---|---|---|
| R2371 | Dublin City LUAS Underground Study | 2000 | Celtic Surveys Ltd | Dublin 1 and Dublin 2 | 43 Cable Percussion Boreholes with Rotary Core Follow On |
| R834 | Investigation | 1991 | Irish Geotechnical Services Ltd. | Wellington Street Lower | 5 Cable Percussion Boreholes |
| R933 | Old IGB premises, Charlotte Quay | 1989 | Irish Geotechnical Services Ltd. | Parnell Square North | 6 Cable Percussion Boreholes |
| R862 | Investigation | 1980 | Irish Soil Laboratories Ltd. | Parnell Square East | 3 Cable Percussion Boreholes |
| R6277 | Parnell Square Development | 2005 | Irish Geotechnical Services Ltd. | Parnell Square East | 2 Cable Percussion Boreholes |
| R776 | 2/3 Parnell Square | 1981 | Irish Soil Laboratories Ltd. | Parnell Square East | 2 Cable Percussion Boreholes |
| R2955 | Commercial Development | 1995 | Irish Geotechnical Services Ltd. | Findlater Place | 1 Cable Percussion Boreholes |
| R2519 | Commercial Development | 1995 | Irish Geotechnical Services Ltd. | Findlater Place | 2 Cable Percussion Boreholes |
| R854 | Housing | 1989 | Irish Geotechnical Services Ltd. | North Great George Street | 4 Cable Percussion Boreholes |

The scheme-specific ground investigations carried out to inform the Proposed Scheme and EIAR are listed in Table 14.3 and the factual reports provided in Appendix 14.2 (Ground Investigation Report) in Volume 4 of this EIAR. These provide useful verification for the data already compiled relating to the baseline environment.

**Table 14.3: Scheme Specific Ground Investigations**

| Title | Contractor | Year | Location | Scope |
|---|---|---|---|---|
| Bus Connects Route 2 Swords to City Centre – Ground Investigation | Causeway Geotech | December 2020 | Swords to Dublin City Centre | 1 No. Cable Percussive Borehole with Rotary Follow on, 3 No. Slit Trench, 2 No. Trial Pits and Groundwater monitoring from one standpipe. |

#### 14.2.3.3 Design Information

The design information as provided in Chapter 4 (Proposed Project Description) and Chapter 5 (Construction) as well as the Plan and Profile Drawings (BCIDB-JAC-GEO_HV-0002_XX_ML_00-DR-CR-9001 in Volume 3 of this EIAR) have been used in the assessment.

#### 14.2.3.4 Scheme Walkover

A scheme walkover survey was carried out on 5 February 2020, 7 July 2021 and 22 March 2023 to inform and verify the review of publicly available datasets.

The findings of the scheme walkover survey including photos and scheme walkover survey notes are included in Appendix A14.1 (Scheme Walkover Summary) in Volume 4 of this EIAR.

### 14.2.4 Appraisal Method for the Assessment of Impacts

The impact assessment for this Chapter has been carried out in accordance with the NRA Guidelines (NRA 2008a) and the IGI Guidelines (IGI 2013).

The likely significant impacts have been assessed by classifying the importance of the relevant attributes and quantifying the magnitude of any likely significant impacts on these attributes as outlined below.

#### 14.2.4.1 Baseline – Initial Assessment

In order to identify and quantify the likely significant impacts of the Construction Phase and Operational Phase of the Proposed Scheme, it is first necessary to undertake a detailed study of the (baseline) geological and hydrogeological environment of the study area for the Proposed Scheme.

The existing land, soils, geology and hydrogeology conditions in the study area have been interpreted from review of existing data, consultation and scheme walkover surveys.

This assessment includes the development of a preliminary Conceptual Site Model (CSM), which describes the ground conditions expected throughout the study area of the Proposed Scheme based on existing literature. Also, as part of this initial assessment, the preliminary generic type of geological / hydrogeological environment is determined. The IGI Guidelines (IGI 2013) provide five types of environments as examples (Types A to E, as described in Step 3 of the IGI Guidance).

#### 14.2.4.2 Baseline – Direct and Indirect Site Investigation

Information gathered on the baseline environment during specific ground investigations for the Proposed Scheme corresponds to the second element of the methodology, 'Direct and Indirect Site Investigation and Studies'.

As part of the second element, relevant Indirect Site Investigations and Studies close to the Proposed Scheme are gathered and assessed. Then, the preliminary CSM is refined accordingly.

#### 14.2.4.3 Gradation of Impacts

The NRA Guidelines (NRA 2008a) provide criteria and examples for determining likely significant impacts. The relevant tables from the NRA Guidelines (NRA 2008a) are as follows:

- Box 4.1: Criteria for Rating Site Attributes – Estimation of Importance of Soil and Geology Attributes (Table 14.4);
- Box 4.3: Criteria for Rating Site Attributes – Estimation of the Importance of Hydrogeology Attributes Table 14.5);
- The magnitude of impacts should be defined in accordance with the criteria provided in the NRA Guidelines. This is outlined in Table 14.6;
- Box 5.1: Criteria for Rating Site Attributes at Environmental Impact Assessment (EIA) Stage – Estimation of Magnitude of Impact on Soil / Geology Attribute (Table 14.7);
- Box 5.3: Criteria for Rating Site Attributes at EIA Stage – Estimation of Magnitude of Impact on Hydrogeology Attributes (Table 14.8); and
- Box 5.4: Rating of Significant Environmental Impacts at EIA Stage (Table 14.9).

The NRA Guidelines criteria uses similar significance terminology as the EPA Guidelines (EPA 2022a). However, it has intermediate steps to justify using that terminology:

- Step 1: Quantify the importance of a feature for geology (Box 4.1) and hydrogeology (Box 4.3);
- Step 2: Estimate the magnitude of the impact on the feature from the Proposed Scheme (Box 5.1, Box 5.3); and
- Step 3: Determine the significance of the impact on the feature from the matrix (Box 5.4) based on the importance of the feature and the magnitude of the impact.

**Table 14.4: Criteria for Rating the Importance of Identified Soils and Geological Attributes (Table C2 (IGI 2013) and Box 4.1 (NRA 2008a))**

| Importance | Criteria | Typical Example |
|---|---|---|
| Very High | Attribute has a high quality, significance or value on a regional or national scale.<br>Degree or extent of soil contamination is significant on a national or regional scale.<br>Volume of peat and / or soft organic soil underlying route is significant on a national or regional scale. | Geological feature rare on a regional or national scale (NHA)<br>Large existing quarry or pit<br>Proven economically extractable mineral resource |

| Importance | Criteria | Typical Example |
|---|---|---|
| High | Attribute has a high quality, significance or value on a local scale.<br>Degree or extent of soil contamination is significant on a local scale.<br>Volume of peat and / or soft organic soil underlying route is significant on a local scale. | Contaminated soil on site with previous heavy industrial usage<br>Large recent landfill site for mixed wastes<br>Geological feature of high value on a local scale (County Geological Site)<br>Well drained and / or high fertility soils<br>Moderately sized existing quarry or pit<br>Marginally economic extractable mineral resource |
| Medium | Attribute has a medium quality, significance or value on a local scale.<br>Degree or extent of soil contamination is moderate on a local scale.<br>Volume of peat and / or soft organic soil underlying route is moderate on a local scale. | Contaminated soil on site with previous light industrial usage<br>Small recent landfill site for mixed wastes<br>Moderately drained and / or moderate fertility soils<br>Small existing quarry or pit<br>Sub-economic extractable mineral resource |
| Low | Attribute has a low quality, significance or value on a local scale.<br>Degree or extent of soil contamination is minor on a local scale.<br>Volume of peat and / or soft organic soil underlying route is small on a local scale. | Large historical and / or recent site for construction and demolition wastes<br>Small historical and / or recent landfill site for construction and demolition wastes<br>Poorly drained and / or low fertility soils.<br>Uneconomically extractable mineral resource |

**Table 14.5: Criteria for Rating the Importance of Identified Hydrogeological Attributes (Box 4.3 NRA 2008a)**

| Importance | Criteria | Typical Example |
|---|---|---|
| Extremely High | Attribute has a high quality or value on an international scale | Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. Special Areas of Conservation (SAC) or Special Protection Areas (SPA) status |
| Very High | Attribute has a high quality or value on a regional or national scale | Regionally important aquifer with multiple well fields.<br>Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status<br>Regionally important potable water source supplying >2500 homes<br>Inner source protection area for regionally important water source |
| High | Attribute has a high quality or value on a local scale | Regionally Important Aquifer<br>Groundwater provides large proportion of baseflow to local rivers<br>Locally important potable water source supplying >1000 homes<br>Outer source protection area for regionally important water source<br>Inner source protection area for locally important water source |
| Medium | Attribute has a medium quality or value on a local scale | Locally Important Aquifer<br>Potable water source supplying >50 homes<br>Outer source protection area for locally important water source |
| Low | Attribute has a low quality or value on a local scale | Poor Bedrock Aquifer<br>Potable water source supplying <50 homes |

**Table 14.6: Definition of Magnitude of Impact (Table 5.1 (NRA 2008a))**

| Magnitude of Impact | Description |
|---|---|
| Imperceptible | An impact capable of measurement but without noticeable consequences |
| Slight | An impact that alters the character of the environment without affecting its sensitivities |
| Moderate | An impact that alters the character of the environment in a manner that is consistence with existing or emerging trends |
| Significant | An impact which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment |

| Magnitude of Impact | Description |
|---|---|
| Profound | An impact which obliterates all previous sensitive characteristics |

**Table 14.7: Criteria for Rating Soil and Geology Impact Significance and Magnitude at EIA stage (Table C4 (IGI 2013) and Box 5.1 (NRA 2008a))**

| Magnitude of Impact | Criteria | Typical Example |
|---|---|---|
| Large Adverse | Results in loss of attribute | Loss of high proportion of future quarry or pit reserves<br>Irreversible loss of high proportion of local high fertility soils<br>Removal of entirety of geological heritage feature<br>Requirement to excavate / remediate entire waste site<br>Requirement to excavate and replace high proportion of peat, organic soils and / or soft mineral soils beneath alignment |
| Moderate Adverse | Results in impact on integrity of attribute or loss of part of attribute | Loss of moderate proportion of future quarry or pit reserves<br>Removal of part of geological heritage feature<br>Irreversible loss of moderate proportion of local high fertility soils<br>Requirement to excavate / remediate significant proportion of waste site<br>Requirement to excavate and replace moderate proportion of peat, organic soils and / or soft mineral soils beneath alignment |
| Small Adverse | Results in minor impact on integrity of attribute or loss of small part of attribute | Loss of small proportion of future quarry or pit reserves<br>Removal of small part of geological heritage feature<br>Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils<br>Requirement to excavate / remediate small proportion of waste site<br>Requirement to excavate and replace small proportion of peat, organic soils and / or soft mineral soils beneath alignment |
| Negligible | Results in an impact on attribute but of insufficient magnitude to affect either use or integrity | No measurable changes in attributes |
| Minor Beneficial | Results in minor improvement of attribute quality | Minor enhancement of geological heritage feature |
| Moderate Beneficial | Results in moderate improvement of attribute quality | Moderate enhancement of geological heritage feature |
| Major Beneficial | Results in major improvement of attribute quality | Major enhancement of geological heritage feature |

**Table 14.8: Criteria for Rating Hydrogeological Impact Significance and Magnitude at EIA stage (Table C5 (IGI 2013) and Box 5.3 (NRA 2008a))**

| Magnitude of Impact | Criteria | Typical Example |
|---|---|---|
| Large Adverse | Results in loss of attribute and/or quality and integrity of attribute | Removal of large proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems<br>Potential high risk of pollution to groundwater from routine run-off<br>Calculated risk of serious pollution incident during operation >2% annually |
| Moderate Adverse | Results in impact on integrity of attribute or loss of part of attribute | Removal of moderate proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems<br>Potential medium risk of pollution to groundwater from routine run-off |

| Magnitude of Impact | Criteria | Typical Example |
|---|---|---|
| | | Calculated risk of serious pollution incident during operation >1% annually |
| Small Adverse | Results in minor impact on integrity of attribute or loss of small part of attribute | Removal of small proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems<br>Potential low risk of pollution to groundwater from routine run-off<br>Calculated risk of serious pollution incident during operation >0.5% annually |
| Negligible | Results in an impact on attribute but of insufficient magnitude to affect either use or integrity | Calculated risk of serious pollution incident during operation <0.5% annually |

**Table 14.9: Rating of Significant Environmental Impacts at EIA Stage (Box 5.4 (NRA 2008a))**

| | | Magnitude of Impact | | | |
|---|---|---|---|---|---|
| | | Negligible | Small | Moderate | Large |
| Importance of Attribute | Extremely High | Imperceptible | Significant | Profound | Profound |
| | Very High | Imperceptible | Significant / Moderate | Profound / Significant | Profound |
| | High | Imperceptible | Moderate / Slight | Significant / Moderate | Severe / Significant |
| | Medium | Imperceptible | Slight | Moderate | Significant |
| | Low | Imperceptible | Imperceptible | Slight | Slight / Moderate |

#### 14.2.4.4 Mitigation Measures, Residual Impacts and Final Impact Assessment

The third element of the recommended steps builds on the outcome of the preceding two elements, by identifying mitigation measures to address potential significant or profound impacts and then assessing the significance of any remaining residual impacts taking these measures into account. Mitigation by design measures which have been incorporated into the design for the Proposed Scheme are also considered in Section 14.5.

The final impact assessment includes a description of any residual impacts. The significance of any residual impact is determined based on the same methodology and reported.

## 14.3 Baseline Environment

### 14.3.1 Introduction

This Section describes the existing conditions and important features in terms of the land, soils, geology and hydrogeology within the study area of the Proposed Scheme. A regional overview is followed by a description of site-specific baseline conditions and a CSM. Features are then identified, and their importance ranked in accordance with the NRA Guidelines (NRA 2008a).

### 14.3.2 Regional Overview

The regional geomorphology, topography, soils and subsoils, bedrock geology and hydrogeology are discussed in this Section for the majority of County Dublin, including the City Centre and extends north to Swords and to Bray in County Wicklow in the south of the region.

#### 14.3.2.1 Regional Topography and Geomorphology

The topography of the region is dominated by the Wicklow Mountains to the south with undulating topography to the north, west and east with localised highs generally synonymous with outcropping rock or near surface bedrock. There is a gradual drop in elevation across the region from west to east approaching the coast.

The landscape of the region principally reflects the erosional and depositional legacy of the last period of glaciation, which ended some 10,000 years ago following the Devensian geological period. Glacial erosion of pre-existing topographic features and deposition of thick glacial drift deposits, mainly till (boulder clay), resulted in a rather subdued post-glacial topography.

The post-glacial landscape also reflects the effects of fluvial (river) processes that have altered the topography, with the River Liffey and its tributaries dominating the region, since the ice sheet retreat. The topography of the area reflects the geomorphology, showing topographic lows moving eastwards to the sea near Dublin City, becoming steeper to the west, north and south towards the Dublin and Wicklow Mountains. The coastline within the region is characterised by sandy beaches and rock outcrops.

There are a large number of geomorphology features across the region including mega scale glacial lineation in the north of the region, streamlined bedrock, numerous meltwater channels, hummocky sands and gravel deposits, drumlins, eskers and glaciofluvial terraces throughout the region (refer to Figure 14.1 in Volume 3 of this EIAR).

The land uses in the region are mainly comprised of urban developments including but not limited to: industrial, commercial, residential and recreational. Moving away from the City Centre there are also marine, agricultural and forested areas in the region.

#### 14.3.2.2 Regional Soils (Teagasc Classification)

Soils comprise the unconsolidated geological deposits which overlie the subsoil (i.e. the topsoil). The main soils within the region, as classified by Teagasc (Teagasc *et al.* 2017), are presented on Figure 14.2 in Volume 3 of this EIAR and have been listed in Table 14.10. The majority of Dublin is underlain by made ground with areas of alluvial, estuarine and marine deposits present that may be associated with recent and ancient water bodies. To the north of the region, there are soils which are deep and well drained as well as poorly drained soils derived from basic parent material. To the south of the region the soil is derived from acidic material.

**Table 14.10: Summary of Soil Types Within the Region**

| Soil Code | Description | Location |
|---|---|---|
| AeoUND | Aeolian undifferentiated | Coast |
| AlluvMin | Alluvial (min) | Along river courses and meltwater channels |
| AminDW | Deep well drained mineral soil (mainly acidic) | South towards Bray |
| AminPD | Mineral poorly drained (mainly acidic) | South towards Bray |

| Soil Code | Description | Location |
|---|---|---|
| AminPDPT | Peaty Gleys Acidic | Near Wicklow Mountains |
| AminSP | Surface water gleys / Ground water gleys shallow | South towards Bray |
| AminSW | Shallow well drained mineral soil (mainly acidic) | South towards Bray |
| AminSRPT | Shallow rocky peaty, non-peaty mineral complexes (mainly acidic) | Near Wicklow Mountains |
| BktPT | Blanket Peat | Near Wicklow Mountains |
| BminDW | Deep well drained mineral soil (mainly basic) | North near Swords |
| BminPD | Mineral poorly drained (mainly basic) | North near Swords |
| BminPDPT | Peaty gleys basic parent materials basic | Near Wicklow Mountains |
| BminSP | Surface water gleys / groundwater gleys shallow | South towards Newcastle |
| BminSPPT | Peaty gleys shallow | Near Wicklow Mountains |
| BminSRPT | Lithosols peats | Near Wicklow Mountains |
| BminSW | Renzinas / Lithosols | Dublin outskirts |
| Cut | Raised bog cutaway / cutover | Near Wicklow Mountains |
| FenPT | Fenpeat | Near Wicklow Mountains |
| Lac | Lacustrine sediments | South near Wicklow Mountains |
| Made | Made ground | Dublin City and outskirts |
| MarSands | Marine sands and gravels | Coast |
| MarSed | Marine / estuarine sediments | Coast |
| Scree | Scree | Near Wicklow Mountains |

#### 14.3.2.3 Regional Subsoils (GSI Quaternary Classification)

Superficial deposits (subsoil) comprise the unconsolidated geological deposits which overlie the solid geology. The subsoils within the region, as classified by the GSI Quaternary mapping (GSI 2016a) are presented on Figure 14.3 in Volume 3 of this EIAR and have been listed in Table 14.11.

During the Pleistocene epoch of the Quaternary, two glaciations covered County Dublin and County Wicklow which gave rise to the deposition of glacial till. Typically, during the ice advance, boulder clays were deposited sub-glacially as lodgement till over the eroded bedrock surface, whilst moraine granular deposits were laid down at the glacier margins.

Subsequently, with the progressive retreat of the ice sheets from the region, granular fluvio-glacial deposits were laid down in places by melt waters discharging from the front of the glacier which are generally encountered as sand and gravel lenses within the glacial till deposits. The glacial deposits can exhibit significant lateral and vertical variations in grain size distributions over short distances.

This glacial till is the predominant subsoil of the region and described as till derived from limestones. The subsoils of the region may also be comprised of made ground where major development has occurred. More recent alluvial deposits (silts and clays and sands and gravels) may be present along historic and recent watercourses.

To the east of the region, along the coast the subsoils consist of estuarine silts and clays and marine beach sands. Outcropping and sub cropping rock and till derived from granites and metamorphic rock are present to the south and west of the region where the topography rises towards the Dublin Mountains and Bray.

**Table 14.11: List of Subsoils (Quaternary) Within the Region**

| Soil Type | Description | Location |
|---|---|---|
| A | Alluvium | Along river channels and meltwater channels |
| Ag | Alluvium (gravelly) | Along river channels and meltwater channels |
| As, | Alluvium (sandy) | Along river channels and meltwater channels |
| Asi | Alluvium (silty) | Along river channels and meltwater channels |
| BktPt | Blanket Peat | Near Wicklow Mountains |
| Cut | Cut over raised peat | Near Wicklow Mountains |
| AcEsk | Eskers comprised of gravels of acidic reaction | Tallaght / Ballymount |

| Soil Type | Description | Location |
|---|---|---|
| GCh | Gravels derived from chert | North-West Dublin |
| GLPSsS | Gravels derived from Lower Paleozoic sandstones and shales | Howth |
| GLs | Gravels derived from limestones | Dublin City |
| GMp | Gravels derived from metamorphic rocks | South towards Bray |
| GGr | Gravels derived from granite | South Dublin |
| Rck | Bedrock outcrop or subcrop | Localised pockets within Dublin City / near Wicklow Mountains |
| Scree | Scree | Near Wicklow Mountains |
| L | Lacustrine sediments | South near Wicklow Mountains |
| Mbs | Marine beach sands | Coast |
| Mesc | Estuarine silts and clays | Portmarnock |
| TdlMr | Tidal Marsh | Bull Island |
| IrSTCSsS | Irish Sea Till derived from Cambrian sandstones and shales | Bray South |
| IrSTLPSsS | Irish Sea Till derived from Lower Paleozoic sandstones and shales | Bray South |
| IrSTLs | Irish Sea Till derived from limestones | South towards Bray |
| TCSsS | Till derived from Cambrian sandstones and shales | Bray South |
| TGr | Till derived from granites | South Dublin |
| TLPSsS | Till derived from Lower Paleozoic sandstones and shales | South Dublin |
| TLs | Till derived from limestones | Dublin City |
| TMp | Till derived from metamorphic rocks | Near Wicklow Mountains |
| TQz | Till derived from quartzites | South towards Bray |
| Ws | Windblown sands | Coast |
| Wsd | Windblown sands and dunes | Coast |
| Dam | Dam | Tallaght |
| Embankment | Embankment | Sandyford |
| Landfill | Landfill | Near Blanchardstown |
| Urban | Urban (made ground) | Dublin City and outskirts |

#### 14.3.2.4 Regional Bedrock Geology

The bedrock geology of the region, as classified by the GSI 1:500,000 Bedrock Geology Map (GSI 2018), are presented on Figure 14.4 in Volume 3 of this EIAR and have been listed in Table 14.12. The region is predominantly underlain by Carboniferous Limestones. The majority of the Dublin City area was a deep marine basin known as the Dublin Basin where these sedimentary rocks were deposited.

To the south of the region, stretching from Dún Laoghaire on the coast in a south to south-west orientation and located beneath much of the Dublin and Wicklow Mountains, are the older Caledonian granites known as the Leinster Granite. This is a large intrusion of igneous rock which occurred during the Devonian Period Mountain building event known as the Caledonian Orogeny.

The oldest rocks in the region are the Cambrian and Ordovician Metasediments which extend from Loughlinstown towards Bray with the Cambrian Bray Head Formation dominating the Bray to Greystones area and synonymous with the Quartzite of the Sugar Loaf.

The structural geology within the region is highly variable and complex. A series of parallel faults running mainly in a north-west to south-east direction are indicated in the north of the region between Blanchardstown and Dublin Airport. Additional faulting in this area is indicated in a north / north-west to south / south-east direction with associated fold axes both synclinal and anticlinal running in a north-east to south-west direction. The contact between the Lucan Formation and the Leinster Granite is characterised by a west-east trending fault. The south of the region is dominated by metamorphic intrusions and north-west / south-east trending faults within the Leinster Granite. The south-eastern section of the region around Bray and Shankill is heavily faulted and folded with a number of west-east thrust faults and numerous north-west / south-east synclinal fold axis.

The depth to bedrock within the region ranges from one metre below ground level (mBGL) in the south-west of the region near Tallaght and the north-west near Blanchardstown to potentially greater than 25mBGL in the Dublin City Centre area and up to 45mBGL in Dublin Port. The bedrock level ranges from 80m above Ordnance Datum (mOD) towards the mountainous and inland parts of the region to approximately -40mOD near Dublin Port.

**Table 14.12: Rock Formation Within the Region**

| Geological Period | Formation | Description | Location |
|---|---|---|---|
| Carboniferous | Visean basinal limestone 'Calp' | (Calp) Dark-grey argillaceous and cherty limestone and shale | Central and north County Dublin |
| | Waulsortian mudbank | Pale grey massive limestone | North-west near the N2 and N3 National Roads, Malahide and Swords |
| | Courceyan Limestone | Argillaceous dark-grey bioclastic limestone and subsidiary shale | North-west |
| | Upper Devonian – Lower Carboniferous Old Red Sandstone | Sandstone, conglomerate and siltstone | North of Swords |
| Caledonian Orogeny (Mountain Building Era) | Caledonian Granite | Granite, granodiorite | South near Bray |
| Silurian | Silurian sandstone, greywacke and shale | Mudstone, greywacke and conglomerate | South-west |
| Ordovician | Middle to Upper Ordovician basic volcanics | Basalt-andesite, tuff, slate and mudstone | North-west |
| | Lower to Middle Ordovician slate | Slate, schist and minor greywacke | South-west |
| | Lower to Middle Ordovician acid volcanics | Rhyolite and rhyolitic tuff | South-west |
| | Lower to Middle Ordovician basic volcanics | Basalt-andesite, tuff and shale | South-west |
| Cambrian | Cambrian Greywacke | Greywacke and Shale | Bray |

### 14.3.2.5 Regional Aquifer Type and Classification

The aquifers of the region (groundwater bearing bodies), as classified by the National Draft Bedrock Aquifer Map (GSI 2019b) are presented on Figure 14.5 in Volume 3 of this EIAR and have been listed in Table 14.13. The GSI (GSI 2019b) has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The aquifer classes and sub-classes are shown in the National Draft Bedrock Aquifer Map. There are three principal types of aquifer, corresponding to whether they are major, minor or unproductive resources whereby:

- Regionally Important Aquifers are capable of supplying regionally important abstractions (e.g. large public water supplies), or excellent yields (>400m cubed per day ($m^3$/d));
- Locally Important Aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100$m^3$/d to 400$m^3$/d); and
- Poor Aquifers are capable of supplying small abstractions (e.g. domestic supplies), or moderate to low yields (<100$m^3$/d).

The lower permeability glacial till soils which overlay the bedrock (gravelly clay/ boulder clay), slow infiltration and restrict recharge to bedrock aquifers. The glacial till is not classified as an aquifer by the GSI.

Under the WFD, the regional hydrogeology has been assessed using the GSI groundwater viewer (GSI 2019b). The regional groundwater bodies (GWB) in the area are (refer to Figure 14.5 in Volume 3 of this EIAR):

- Dublin GWB;
- Swords GWB;
- Kilcullen GWB; and
- Wicklow GWB.

**Table 14.13: Aquifer Types Within the Region**

| Aquifer Type | Location | Description | Code |
|---|---|---|---|
| Locally Important | North and centre of the region | Bedrock which is moderately productive only in local zones | (Ll) |
| | Bray (south-eastern extent of the region | Gravel | (Lg) |
| Poor Aquifer | Most of southern extent of the region | Bedrock which is generally unproductive except for local zones | (Pl) |

### 14.3.2.6 Regional Aquifer Vulnerability

Aquifer vulnerability of a groundwater body is the term used to describe the intrinsic geological and hydrogeological characteristics which determine the ease with which a groundwater body may be contaminated by human activities.

The vulnerability is determined by the travel time and the attenuation capacity of the overlying deposits. The groundwater vulnerability is determined mainly by the permeability and thickness of the subsoils that underlay the topsoil. For example, bedrock with a thick, low permeability overburden is less vulnerable than bedrock with a thin high permeability, gravel overburden.

The GSI aquifer vulnerability classification guidelines (GSI 2019b), which are outlined in Table 14.14, demonstrate that the aquifers are most at risk in areas where subsoils are thin or absent and where karst features such as swallow holes are present. This is due to the ability of potential contaminants to reach the aquifer in a relatively short period and with little or no contaminant attenuation due to the thin or absent overburden. The regional groundwater vulnerability varies significantly across the region, ranging from Rock at Surface (X) to Low (L) vulnerability.

**Table 14.14: Aquifer Vulnerability (GSI, 2019b)**

| Vulnerability Rating | Hydrogeological Conditions | | | | |
|---|---|---|---|---|---|
| | Subsoil Permeability (Type) and Thickness | | | Unsaturated Zone | Karst Features |
| | High Permeability (Sand / Gravel) | Moderate Permeability (e.g. Sandy Subsoil) | Low Permeability (e.g. Clayey Subsoil, Clay, Peat) | Sand / Gravel Aquifers Only) | (<30m Radius) |
| Rock at or close to surface (X) | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |
| Extreme (E) | 0m – 3.0m | 0m – 3.0m | 0m – 3.0m | 0m – 3.0m | Not applicable |
| High (H) | >3.0m | 3.0m – 10.0m | 3.0m – 5.0m | >3.0m | Not applicable |
| Moderate (M) | Not applicable | >10.0m | 5.0m – 10.0m | Not applicable | Not applicable |
| Low (L) | Not applicable | Not applicable | >10.0m | Not applicable | Not applicable |

### 14.3.2.7 Regional Recharge

Recharge is the amount of rainfall that replenishes the aquifer. It is a function of the effective rainfall, the permeability and thickness of the subsoil and the aquifer characteristics. The GSI Groundwater Recharge mapping for the region indicates annual groundwater recharge across the region ranges from approximately 1mm/yr (millimetre per year) to 600mm/yr (Figure 14.6 in Volume 3 of this EIAR).

### 14.3.2.8 Regional Groundwater Abstractions

Groundwater resources describe any large spring, well or boreholes which are used as a groundwater abstraction source by domestic, agricultural, commercial, industrial, local authority or group water scheme users.

The GSI keeps a record of groundwater wells drilled (GSI 2019b). However, the record does not state which wells are currently used for abstraction.

In addition to these abstractions, Dublin City Council (DCC) also maintains a database of groundwater and surface water abstractions. However this data is not available to the public. The EPA has also launched a register of water abstractions, whereby people who abstract 25m$^3$ (cubic metres) of water or more per day are required to register their water abstraction. However this data is not available to the public.

Source Protection Zones (SPZ) reports have been produced by the GSI (GSI 2019b) in conjunction with the EPA for groundwater sources, particularly public water supplies, group water schemes or important industrial supplies. The reports aim to guide development planning and regulation to provide protection to groundwater sources. To date no SPZ reports have been produced with regard to any sites within the study area.

Groundwater is not used extensively for residential or industrial purposes in the area. The majority of potable water used within the region is abstracted elsewhere and piped to the region and therefore groundwater abstraction is not considered further in this Chapter.

#### 14.3.2.9 Groundwater Quality and Levels

Based on professional experience and previous ground investigations in the area, groundwater levels are generally within 5m of the surface in Dublin City and are closer to the surface near rivers and streams. Historical groundwater monitoring is available from a monitoring borehole at the GSI Beggar's Bush Office, Dublin 4 (monitored from 1990 to 2000). Groundwater level monitoring has commenced at Beggar's Bush since August 2018 with the data available online (GSI 2019e). Beggar's Bush lies approximately 2km south-east of the City Centre. There is an inactive EPA monitoring borehole located in Goatstown, Dublin 14 which is approximately 6km south of the City Centre (monitored from 1997 to 2006). The results from both monitoring points show that the groundwater levels have a seasonal range over their entire monitoring record of 0.55m and 0.27m respectively.

The hydro-chemical analyses of groundwater within the Dublin GWB are available at the EPA Ryewater monitoring stations at Carton House, near Maynooth, County Kildare. The limestone groundwater quality is very hard water (350 milligrams per litre (mg/l) to 480mg/l of Calcium carbonate ($CaCO_3$)), with a high alkalinity (300mg/l to 350mg/l ($CaCO_3$)) and conductivities (550 micro siemens per centimetre (µS/cm) to 900µS/cm). The pH is relatively neutral ranging from 6.5 to 7.5.

Further to the south where the region is underlain by granites or the Maulin Formation, the groundwater is softer and less mineralised with hardness values of 100mg/l ($CaCO_3$) to 150mg/l ($CaCO_3$), alkalinity of <50mg/l ($CaCO_3$) and conductivity values of 300µS/cm to 500µS/cm and a lower pH range of 6 to 7.

#### 14.3.2.10 Regional Hydro-Ecology Designated Sites

Designated protected sites within Ireland compiled by the National Parks and Wildlife Service (NPWS) such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) could be groundwater dependent habitats and therefore an impact on the hydrogeology could result in an impact on a designated site. Further information regarding the designated sites within the region is provided in Chapter 12 (Biodiversity). Only the hydrogeology related impacts on groundwater dependant designated sites are assessed within this Chapter.

#### 14.3.2.11 Regional Geological Heritage

The NPWS identifies the Natural Heritage Area (NHA) as the basic designation for wildlife. This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. The GSI is compiling a list of geological / geomorphological sites in need of protection through NHA designation (not available at time of writing). However, these sites will be compiled from the existing database of County Geological Sites (CGS) (GSI 2019c), as listed in Table 14.15.

**Table 14.15: Designated Sites Within the Region.**

| Designation Code | Designated Site |
|---|---|
| CGS, SPA | North Bull Island |
| CGS | Glasnevin Cemetery |
| CGS | Phoenix Park |

| Designation Code | Designated Site |
|---|---|
| CGS | River Poddle |
| CGS | Greenhills Esker |
| CGS | Dodder Terraces |
| CGS | Belgard Quarry |
| CGS | Killiney Bay |
| CGS | Enniskerry Delta |
| CGS | GPO (General Post Office) |
| CGS | Museum Building, Trinity College Dublin |
| CGS | Oscar Wilde Statue |
| CGS | 51 St. Stephens Green |
| CGS | Dublin City Walls |
| CGS | Temple Bar Street Well |
| CGS | Guinness Wells |
| CGS | Kippure |
| CGS | Lucan Esker |
| CGS | Liffey Valley Centre road sections |
| CGS | N4 Lucan cutting |
| CGS | Ballinascorney Quarry |
| CGS | Newcastle Buried channel |
| CGS | Carrickgollogan |
| CGS | Ballycorus |
| CGS | Killiney Hill |
| CGS | White Rock, Killiney |
| CGS | Ballybetagh Bog |
| CGS | Dalkey Island |
| CGS | Killiney Bay |
| CGS | The Scalp |
| CGS | Three Rock Mountain |
| CGS | Blackrock Breccia |
| CGS | Dalkey Hill |
| CGS | Murphystone Quarry |
| CGS | Enniskerry Delta |
| CGS | Glencullen River |
| CGS, pNHA | River Dargle Valley |
| CGS, SAC | Bray Head |

### 14.3.3 Site Specific Environment

The following Section discusses the site-specific conditions (refer to Figure 14.7 to Figure 14.15 in Volume 3 of this EIAR) within the study area for the Proposed Scheme as defined in Section 14.2.1. Where applicable the importance of the attributes for which the impact of the Proposed Scheme is to be assessed are reported in this Section.

#### 14.3.3.1 Current and Historic Land Use

The current and historic land use is discussed to give context to any potential changes to land, soils, geology, and hydrogeology that have the potential to influence the importance of a feature and the magnitude of any impacts. The current land use is based on current aerial imagery and mapping available from Ordnance Survey Ireland (OSI) (OSI 2021), Google (Google 2019), Bing (Bing 2022) and the Corine Land Cover maps (EPA 2018). The historic land use is based on the following OSI (OSI 2022) historic aerial imagery and historic maps:

- OSI 6-inch mapping produced between 1837 and 1842;

- OSI 25-inch mapping produced between 1888 and 1913;
- OSI 6-inch Cassini mapping produced between 1830 and 1930s;
- OSI 1995 aerial photography;
- OSI 2000 aerial photography; and
- OSI 2005 aerial photography.

14.3.3.1.1 Pinnock Hill to Airside Junction

The Corine Land Cover 2018 classifies the land use from Pinnock Hill to Airside Junction as industrial / commercial units, complex cultivation patterns, discontinuous urban fabric, non-irrigated arable land and pastures.

The OSI 6-inch mapping shows the land use within the study area is mostly comprised of agricultural land extending outwards on either side of the Dublin Road. There are two gravel pits directly north of Pinnock Hill.

The OSI 25-inch mapping shows that much of the land remains agricultural. The map identifies a well just south of Pinnock Hill.

There are no significant developments noted in the 6-inch Cassini mapping compared to the OSI 25-inch mapping.

The OSI 1995 aerial photograph, which is in black and white and of poor resolution, shows significant urban development within the study area close to the R132. Much of the surrounding land away from the road remains agricultural.

The OSI 2000 aerial photography shows a continuation of the development including a residential development at Boroimhe to the west of the R132 and a new road and industrial buildings to the east of the R132.

The OSI 2005 aerial photography shows further development of the Boroimhe residential area and the completion of the Airside Retail Park to the east of the R132.

The map provided by Google Maps 2019 shows that development continued in these areas in the form of an extension to the Airside Retail Park and more residential development in Boroimhe.

14.3.3.1.2 Airside Junction to Northwood Avenue

The Corine Land Cover 2018 classifies the land use from Airside Junction to Northwood Avenue as an Airport at Dublin Airport, pastures, industrial / commercial units, discontinuous and continuous urban fabric.

The OSI 6-inch mapping shows that the study area comprises predominantly agricultural land with scattered residential development, the most notable of which are Kilronan House by Kilronan Bridge, and Woodford Academy and Furry Park at Turnapin Lane. Three quarries are located at the village of Cloghran.

The OSI 25-inch mapping shows a spring to the south of the Airside Junction and another in Corballis, north of Toberbunny Bridge. There are also four wells identified: one at the roadside at Nevinstown West, one located at Glebe, another by Cloghran Smithy, and another by the Cloghran Post Office. Of the three quarries in Cloghran, identified in the OSI 6-inch mapping, only two are now recorded, with a school now occupying the space of the northmost quarry. One quarry is noted to be disused. There is a constabulary barracks north of the Santry River.

The Cassini 6-inch map does not show much change in this section. The outlines of the quarries at Cloghran can be seen but they are not labelled. A new school, St Patrick's School, has been constructed south of Cloghran. To the south of the section, there appears to have been some developments around Woodford House, with the addition of an athletic grounds and series of small buildings behind it. A water feature by Toberbunny Bridge is noted to be a disused sewage farm with filter beds.

The OSI 1995 aerial photograph, which is in black and white and of poor resolution, shows significant urbanization with the development of Dublin Airport, the M50 and industrial parks in Dardistown and Turnapin as well as residential development south of the M50. A cemetery is located in Dardistown.

The OSI 2000 aerial photograph show further urban development including a cluster of large car parks and industrial units located opposite the airport and south of the M50.

The OSI 2005 aerial photograph shows further industrial development south of the M50 and north of Northwood Avenue.

The 2019 Google Map imagery shows further developments at Airways Industrial Park and Dublin Airport.

#### 14.3.3.1.3 Northwood Avenue to Shantalla Road

The Corine Land Cover 2018 classifies the land use from Northwood Avenue to Shantalla Road as green urban areas north of Santry Industrial Estate named Santry Demesne, industrial / commercial units and discontinuous urban fabric.

The OSI 6-inch mapping shows land use in the study area is predominately agricultural with dispersed residential development and a cluster of development at Santry. The Santry Demesne comprises a wooded parkland with a small lake through which the Santry River flows.

The OSI 25-inch mapping shows a small increase in development within the study area particularly around Santry.

The 6-inch Cassini mapping shows further small development within the study area around Santry.

The OSI 1995 aerial photograph, which is in black and white and of poor resolution, shows significant urban development including residential areas, a large shopping centre and an industrial estate. The Santry Demesne appears undeveloped with the exception of a new stadium built on the eastern side of the park.

The 2019 Google Map imagery show no significant change in land use since the 1995 aerial photograph was taken.

#### 14.3.3.1.4 Shantalla Road to Botanic Avenue

The Corine Land Cover 2018 classifies the land use from Shantalla Road to Botanic Avenue as land principally occupied by agriculture with significant areas of natural vegetation, green urban areas at Holy Cross College along with discontinuous urban fabric.

The OSI 6-inch mapping shows the study area comprises agricultural land and urban development at Drumcondra. A flour mill can be seen north of the River Tolka and an associated canal.

The OSI 25-inch mapping shows a significant urban expansion of Drumcondra, both north and south of the River Tolka. The flour mill has been removed and its canal converted into a road called Millbourne Avenue. Two college campuses are now present, namely All Hallows College and St Patrick's Training College. There has also been a repurposing of land to the north of Drumcondra at Broomhill and Highfield, which appear to be either parks or estates.

The 6-inch Cassini map further details the growth of Drumcondra, with residential development northwards as far as Griffith Avenue and at Gaeltacht Park north-west of Highfield.

The OSI 1995 aerial photograph exhibits a sizable increase in residential development, with much of the area north of Drumcondra consisting of housing estates. Further development of the college campuses is also evident.

The 2019 Google Map imagery shows no visible changes in the area since the 1995 aerial photograph.

#### 14.3.3.1.5 Botanic Avenue to Granby Row

The Corine Land Cover 2018 classifies the land use from Botanic Avenue to Granby Row as discontinuous urban fabric with green urban areas. From the Royal Canal to Granby Row the land use is classed as continuous urban fabric.

The OSI 6-inch details two distinct areas of land usage divided by the Royal Canal. On the north side of the canal, the land is a mixture of agricultural land use and urban development. On the south of the canal, the area is urban in nature. Outside the residential areas, a notable landmark is the Rotunda Hospital on the corner of Granby Row.

The OSI 25-inch mapping shows significant urbanization on the northern side of the canal. A trainline runs parallel to the canal and Drumcondra Station is present at St Anne's Street North. A printing works is located at Paradise Place, as well as another on Findlater Place. A chemical works can also be found off Temple Street. A tramway runs along Drumcondra Road Lower and Dorset Street Lower. Another tramline runs along North Fredrick Street and Parnell Square East. St Joseph's hospital is located at Hardwick Place and the Mater Misericordiae Hospital is located at the west end of Eccles Street.

The OSI 6-inch Cassini mapping shows a number of burial grounds surrounding the royal canal and Mountjoy prison. The tramline also appears to have been diverted down Dargle Road rather than continuing up to Drumcondra Road Upper.

The OSI 1995 aerial photograph is in black and white and of poor resolution. It is evident that the tramway no longer exists and the construction of the Mater Private Hospital on the east of Eccles Street has been completed.

The 2019 Google Map imagery shows that there have been no significant development or land changes since the 1995 aerial photograph.

#### 14.3.3.2 Geomorphology and Topography

The geomorphology and topography are discussed in order to give context to any potential changes to land, soils, geology, and hydrogeology that could influence the importance of a feature and the magnitude of any impacts. The geomorphology (GSI 2016a) and the topography are shown on Figure 14.7 in Volume 3 of this EIAR.

##### 14.3.3.2.1 Pinnock Hill to Airside Junction

The Proposed Scheme begins at Pinnock Hill south of the Swords Pavilions shopping centre, which according to the OSI 10m contours is at an elevation of approximately 30mOD, rising to 40mOD near the Airside Retail Park.

The geomorphology within this section of the study area is characterised by a glacial meltwater channel along with deglacial landforms comprised of hummocky sands and gravels around the Airside Business Park. Moving south towards Dublin Airport along the R132, the Proposed Scheme intersects a north-west south-east drumlin at Fosterstown North.

##### 14.3.3.2.2 Airside Junction to Northwood Avenue

The Proposed Scheme continues south along the R132, gradually rising from 40mOD to approximately 50mOD at the Cloghran Roundabout. Elevation to the west of the road rises to 60mOD in the vicinity of Dublin Airport. This elevation remains constant until the route reaches Northwood Avenue where it briefly drops to 40mOD.

The EPA river network map shows the study area encountering five rivers: the Gaybrook Stream south of Swords, the Sluice River at Fosterstown South, the Swords-Glebe River which flows into the Ward River, Cuckoo Stream south of Dublin Airport and the River Mayne north of the M50.

The geomorphology within this section of the study area is characterised by north-west south-east trending mega-scale glacial lineations, both north and south of Dublin Airport, and north of the M50. A meltwater channel and glaciofluvial terrace associated with the Sluice River system is encountered along the R132 north of the junction with the Naul Road.

##### 14.3.3.2.3 Northwood Avenue to Shantalla Road

The Proposed Scheme continues at approximately 40mOD before swiftly rising to 50mOD to 60mOD from Northwood Avenue to Shanowen Road, where it descends back to 40mOD until it reaches Shantalla Road. The EPA river network map shows the Proposed Scheme encountering the Santry River south of the M50.

The geomorphology within this section of the study area is characterised by north-west south-east trending mega-scale glacial lineations south of Santry along with a meltwater channel associated with the Santry River.

14.3.3.2.4 Shantalla Road to Botanic Avenue

The Proposed Scheme gradually falls from 40mOD to 50mOD at Shantalla Road to approximately 0mOD to 10mOD at Botanic Avenue along the R132. The EPA river network map shows the Proposed Scheme encountering the River Tolka north of Botanic Avenue.

The geomorphology within this section of the study area is characterised by north-west south-east trending mega-scale glacial lineation south of Collins Avenue. A meltwater channel is encountered along the River Tolka and a glaciofluvial terrace is located to the north of the river.

14.3.3.2.5 Botanic Avenue to Granby Row

The Proposed Scheme continues from 0mOD to 10mOD from Botanic Avenue before rising between 10mOD to 20mOD up to Granby Row in the City Centre. There is a brief dip in elevation to below 10mOD as the Proposed Scheme crosses the 2nd Lock of the Royal Canal, but it rises again after completing the crossing. The EPA river network map shows the Proposed Scheme encountering the Royal Canal.

The geomorphology within this section of the study area is characterised by north-west south-east trending mega-scale glacial lineations south of the River Tolka.

### 14.3.3.3 Soils (Teagasc Soil Classification)

The majority of the soils expected to be encountered within the study area are made ground comprising varying forms of hard standing materials including road pavements and footpaths. However, there are topsoil and other soils present within the study area for which there are a number of classifications on the Teagasc Soil Map (Teagasc *et al.* 2017). The main soils within the study area, as classified by Teagasc (Teagasc *et al.* 2017) are presented on Figure 14.8 in Volume 3 of this EIAR and are listed in Table 14.16 along with their importance with respect to drainage and fertility as determined by Box 4.1 in the NRA Guidelines (NRA 2008a). Where these soils are important features with respect to possible soft soils or contamination their importance is detailed in Section 14.3.3.8 and Section 14.3.3.9.

14.3.3.3.1 Pinnock Hill to Airside Junction

The soils encountered within the study area for this section of the Proposed Scheme from Pinnock Hill to the Airside Junction are classed as topsoil (BminDW and BminPD) with topsoil (BminSW) and alluvium along the alignment of the Gaybrook Stream and Swords Glebe River. Made ground is encountered north of Pinnock Hill along the R132.

14.3.3.3.2 Airside Junction to Northwood Avenue

The soils encountered within the study area for this section of the Proposed Scheme from the Airside Junction to Northwood Avenue are predominantly made ground at Corballis, Dublin Airport, the M50 and at Santry. Topsoils (BminDW and BminPD) are encountered east of Corballis, Toberbunny and south of the M50. Topsoils (BminSW) are encountered at the Naul Road Junction. Alluvium is situated along the alignment of the River Sluice.

14.3.3.3.3 Northwood Avenue to Shantalla Road

The soils encountered within the study area for this section of the Proposed Scheme from Northwood Avenue to Shantalla Road are predominantly made ground. Topsoils (BminDW and BminPD) are encountered at the Santry Demesne south of the M50. Alluvium is encountered along the alignment of the Santry River.

14.3.3.3.4 Shantalla Road to Botanic Avenue

The soils encountered within the study area for this section of the Proposed Scheme from Shantalla Road to Botanic Avenue are predominantly made ground. Topsoils (BminDW and BminPD) are encountered in isolated

pockets east of the junction of the R132 and Collins Avenue, Plunkett College, The Copse Road, Saint Patrick's Teachers Training College and north of the River Tolka. Alluvium is encountered in discontinuous deposits along the alignment of the River Tolka.

14.3.3.3.5 Botanic Avenue to Granby Row

The soils encountered within the study area for this section of the Proposed Scheme from Botanic Avenue to Granby Row are made ground.

**Table 14.16: Soils Within the Study Area**

| Soil Type | Notes/Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Made Ground – Made | Associated with urban development | North of Pinnock Hill along the R132, Corballis, Dublin Airport, the M50 and at Santry | Low | Poorly drained and/or low fertility soils |
| Alluvium – AlluvMIN | Typically found along current and historic watercourses | River Tolka, River Sluice, Santry River, Gaybrook Stream and Swords Glebe River | Low | Moderately drained and/or moderate fertility soils |
| Topsoil – BminSW | Shallow well drained (mainly basic) | Gaybrook Stream and Swords Glebe River, Naul Road Junction | High | Well drained and/or high fertility soils |
| Topsoil – BminDW | Deep well drained (mainly basic) | Pinnock Hill to the Airside Junction, east of Corballis, Toberbunny and south of the M50 | High | Well drained and/or high fertility soils |
| Topsoil -– BminPD | Poorly drained (mainly basic) | Pinnock Hill to the Airside Junction, east of Corballis, Toberbunny and south of the M50 | Low | Poorly drained and/or low fertility soils |

### 14.3.3.4 Subsoil Deposits (GSI Quaternary Classification)

Superficial deposits (subsoil) comprise the unconsolidated geological deposits which overlie the solid geology. The subsoils within the study area, as classified by the GSI Quaternary mapping (GSI 2016a), are presented on Figure 14.9 in Volume 3 of this EIAR. and are listed in Table 14.17 along with their importance with respect to feature quality and significance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a). Where these subsoils are important features with respect to possible soft soils or contamination, their importance is detailed in Section 14.3.3.8 and Section 14.3.3.9.

The main subsoils encountered within the study area are predominately glacial tills. Additionally, there are areas of made ground (Urban), alluvium and gravels as discussed below.

14.3.3.4.1 Pinnock Hill to Airside Junction

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately till derived from limestones. Gravels derived from limestones are encountered at Pinnock Hill south of Swords. An area of lacustrine deposits is present at the north of the Proposed Scheme at Pinnock Hill west of Lakeshore Drive. Alluvium is encountered along the alignment of the Rivers Swords Glebe and Gaybrook Stream.

#### 14.3.3.4.2 Airside Junction to Northwood Avenue

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately glacial tills derived from limestones. Gravels derived from limestones are found north of Dublin Airport at Fosterstown south. Alluvium is encountered along the alignment of the River Sluice.

#### 14.3.3.4.3 Northwood Avenue to Shantalla Road

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately glacial tills derived from limestone. There is alluvium encountered along the alignment of the Santry River. Alluvium is also encountered to the east of Shantalla Road.

#### 14.3.3.4.4 Shantalla Road to Botanic Avenue

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately glacial tills derived from limestone. There is alluvium associated with the River Tolka along with gravels derived from limestones on its north bank. Made ground (Urban) is encountered south of the River Tolka. On the eastern side of the Proposed Scheme made ground (Urban) is encountered along Richmond Road.

#### 14.3.3.4.5 Botanic Avenue to Granby Row

The subsoils encountered within the study area for this section of the Proposed Scheme are predominately made ground (Urban) with glacial tills derived from limestone. Pockets of alluvium are encountered within the City Centre at O'Connell Street, Henry Street and Marlborough Place.

**Table 14.17: Subsoils Within the Study Area**

| Subsoil Type | Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Made Ground – Urban | Associated with urban development | Widespread | Low | Low value on a local scale |
| Alluvium – A | Typically found along current and historic watercourses | Rivers Swords Glebe, Gaybrook Stream and River Sluice, Pockets within the City Centre at O'Connell Street, Henry Street and Marlborough Place. | Low | Low value on a local scale |
| Lacustrine – L | Associated with current and historic lakes | Pinnock Hill west of Lakeshore Drive | Low | Medium value on a local scale |
| Glacial gravels – GLs | Gravels derived from limestones | Pinnock Hill south of Swords, north of Dublin Airport at Fosterstown south, River Tolka | Low | Low value on a local scale |
| Glacial till – TLs | Till derived from limestones | Widespread | Low | Low value on a local scale |

### 14.3.3.5 Bedrock Geology

The bedrock geology of the study area, as classified by the GSI 1:100,000 Bedrock Geology Map (GSI 2018), are presented on Figure 14.10 in Volume 3 of this EIAR. and have been listed in Table 14.18 along with their importance with respect to feature quality and significance as determined by Box 4.1 in the NRA Guidelines (NRA 2008a). Where the bedrock is an important feature with respect to economic geology its importance is detailed in Section 14.3.3.10.

#### 14.3.3.5.1 Pinnock Hill to Airside Junction

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Malahide Formation from Pinnock Hill to the Airside Junction along the R132.

A north-east south-west trending fault is present at Pinnock Hill within the Malahide Formation.

14.3.3.5.2 Airside Junction to Northwood Avenue

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Malahide formation from Airside Junction to the Naul Road Junction. From the Naul Road Junction to Cloghran Waulsortian Limestones are encountered along with areas of outcropping rock. From Cloghran to Toberbunny the Tober Collen Formation is encountered. The Lucan Formation is encountered from Toberbunny to Northwood Avenue.

A north-east south-west trending anticlinal fold is situated at Fosterstown south. A north-east south-west trending fault is located between the contacts of the Malahide and Waulsortian Limestones at the Naul Road Junction with the R132.

14.3.3.5.3 Northwood Avenue to Shantalla Road

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation. A north-east south-west trending synclinal fold is encountered along the alignment of the Santry River.

14.3.3.5.4 Shantalla Road to Botanic Avenue

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation. No major structural bedrock features were identified along this section of the study area.

14.3.3.5.5 Botanic Avenue to Granby Row

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation. No major structural bedrock features were identified along this section of the study area.

**Table 14.18: Rock Formations Within the Study Area**

| Formation | Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Lucan | (Calp) Dark Limestone and shale – Carboniferous | Widespread | Low | Low value on a local scale |
| Tober Colleen Formation | Calcareous shale, limestone conglomerate – Carboniferous | Cloghran to Toberbunny | Low | Low value on a local scale |
| Waulsortian Limestones | Massive unbedded lime-mudstone – Carboniferous | Naul Road Junction to Cloghran | Low | Low value on a local scale |
| Malahide Formation | Argillaceous bioclastic limestone, shale – Carboniferous | Airside Junction to the Naul Road Junction | Low | Low value on a local scale |

### 14.3.3.6 Ground Investigation

A summary of the ground conditions encountered by historical ground investigations adjacent to the Proposed Scheme and the scheme-specific ground investigations (listed in Section 14.2.3.2) is presented in Table 14.19 to Table 14.23.

The data presented in the tables is indicative and strata depth and presence will vary by location. The historical ground investigation data was carried out for purposes and projects other than this EIAR. Therefore, although the historical ground investigation data provides a useful indication of ground conditions, the quality of the data cannot be verified.

**Table 14.19: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Pinnock Hill to Airside Junction**

| Strata | General Extent / Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Topsoil | Green areas – including parks, large estates and golf courses | 0 | 0.3 to 0.4 |

| Strata | General Extent / Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Made Ground | Not found at all locations. | 0 | 0 to 1.0 |
| Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels) | Widespread | 0.3 to 1.0 | 1.9 to 9.4 |

**Table 14.20: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Airside Junction to Northwood Avenue**

| Strata | General Extent/Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Topsoil | Green areas – including parks, large estates and golf courses | 0.0 | 0.15 to 0.8 |
| Made Ground | Not found at all locations. | 0.0 to 0.2 | 0.0 to 3.0 |
| Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels) | Widespread | 0.15 to 3.00 | 0.9 to 5.4 |

**Table 14.21: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Northwood Avenue to Shantalla Road**

| Strata | General Extent/Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Made Ground | Widespread | 0.0 | 0.5 to 3.8 |
| Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels) | Widespread | 0.5 to 3.8 | 1.90 to 5.20 |

**Table 14.22: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Shantalla Road to Botanic Avenue**

| Strata | General Extent/Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Topsoil | Green areas – including parks, large estates and golf courses | 0.0 | 0.1 to 0.4 |
| Made Ground | Widespread | 0.0 to 0.4 | 0.7 to 3.5 |
| Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels) | Widespread | 1.20 to 3.5 | 1.6 to 9.55 |
| Bedrock | Widespread | 9.1 to 13.05 | N/A |

**Table 14.23: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme from Botanic Avenue to Granby Row**

| Strata | General Extent/Location | Depth Range (mBGL) | Thickness Range (m) |
|---|---|---|---|
| Topsoil | Green areas – including parks, large estates and golf courses | 0.0 | 0.0 to 0.6 |
| Made Ground | Widespread | 0.0 | 0.3 to 4.2 |
| Glacial Till (Brown Boulder Clay with lenses of fluvioglacial sands and gravels) | Widespread | 0.3 to 4.2 | 0.7 to 27.9 |
| Bedrock | Widespread | 24.1 to 29.3 | N/A |

#### 14.3.3.7 Karst

Karst is a type of geological feature characterised by caves, caverns and other types of underground drainage resulting from the dissolution of the underlying bedrock. This typically occurs in areas of high rainfall with soluble rock.

There are no karst features identified within the study area in the GSI karst database (GSI 2019b). Consequently, the risk of karst is deemed negligible due to the geology of the region not being known to contain karst features and will not be further assessed.

#### 14.3.3.8 Soft and / or Unstable Ground

Soft soils consist of peat, fine grained alluvium or very soft cohesive material. Their presence within the study area could result in an impact if they require excavation and are therefore considered important features. Various sources of information were consulted in establishing these areas within the study area namely:

- Teagasc soil map (Teagasc *et al.* 2017);
- GSI Quaternary Map (GSI 2016a);
- Ground investigation data;
- Scheme walkover survey; and
- GSI Landslide Events (GSI, 2017).

The GSI database (GSI 2017) shows no recorded landslide events within the study area and therefore unstable ground is not considered further in this assessment.

The soft soils identified within the study area are detailed in Table 14.24 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

**Table 14.24: Soft Soils Within the Study Area**

| Feature | Description | Location | Importance | Justification for Importance rating |
|---|---|---|---|---|
| Alluvium – AlluvMIN (soils) / A (subsoils) | Typically found along current and historic watercourses | Rivers Swords Glebe, Gaybrook Stream and River Sluice, Pockets within the City Centre at O'Connell Street, Henry Street and Marlborough Place. | Low | Volume of soft soil underlying the study area is small and of a local scale. |
| Lacustrine – L | Associated with current and historic lakes | Pinnock Hill west of Lakeshore Drive | Low | Volume of soft soil underlying the study area is small and of a local scale. |

#### 14.3.3.9 Contaminated Land

Considering the location of the Proposed Scheme in the urban environment, there are likely to be some sources of contamination within the made ground throughout the study area. Therefore the assessment of contaminated land is focused on the footprint and directly on either side of the Proposed Scheme unless there is likely to be a pathway connecting the possible source of contamination to the footprint of the Proposed Scheme.

Various sources of information were consulted in assessing the Proposed Scheme for locations of potential contaminated land:

- CORINE land cover mapping (EPA 2018);
- Teagasc soil map (Teagasc *et al.* 2017);
- EPA (EPA 2019);
- OSI mapping (OSI 2019);
- The scheme specific ground investigations carried out to inform the Proposed Scheme and this EIAR as listed in Table 14.3. These provide useful verification for the data already compiled relating to the baseline environment; and

- Local authority archives and databases as listed in Table 14.1.

The known potential sources of contamination relevant to the Proposed Scheme identified within the study area are detailed in Table 14.25 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Soil analysis was carried out on samples retrieved during the ground investigations at depths ranging from 0.5 to 3.0m BGL.

The main findings of the soil analysis carried out along the Proposed Scheme are as follows (and summarised in Table 14.25):

- Asbestos was not detected in any of the recorded results during the scheme specific GI carried out by Ground Investigation Ireland; and
- Two samples were classified as non-hazardous based on limited information. No waste acceptance categorization was carried out on these samples and further testing is required.

**Table 14.25: Summary of Potential Sources of Contaminated Land Adjacent to the Proposed Scheme**

| Feature | Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Quarry | Industrial (25-inch Mapping) | Cloghran | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Gravel Pit | Industrial (6-inch Mapping) | North of Pinnock Hill | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Sewage Farm | Industrial (6-inch mapping) | Toberbunny | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Flour Mill | Industrial (6-inch Mapping) North of the River Tolka | North of the River Tolka | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Printing Works | Industrial (25-inch Mapping) Paradise Place | Paradise Place | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Printing Works | Industrial (25-inch Mapping) Findlater Place | Findlater Place | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Chemical Works | Industrial (25-inch Mapping) Temple Street | Temple Street | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Historic Landfill | Castlemoate House South of the Naul Road north of Dublin Airport | Castlemoate House South of the Naul Road north of Dublin Airport | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Petrol Station | Several Petrol Stations found along the route (Nevinstown, Dublin Airport, Santry, Swords Road) | Nevinstown, Dublin Airport, Santry, Swords Road | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Contaminated soils from recent Site Investigations | Two samples were classified as non-hazardous based on limited information. No waste acceptance categorization was carried out on these samples and further testing is required. | Drumcondra Road Lower (R2-CPRC02 & R2-TP01) | Medium | Degree or extent of soil contamination is moderate on a local scale. |

A summary of the facilities within the study area along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a) is presented in Table 14.26.

**Table 14.26: List of EPA Licensed Facilities Within the Study Area**

| Name | Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Anglo Beef Processors Ireland | Industry – Licensed: Cloghran, Swords | Cloghran, Swords | Medium | Light industrial usage |
| Dublin Aerospace Ltd. | Industry – Licensed: Dublin Airport | Dublin Airport | Medium | Light industrial usage |
| Computer Plating Specialists Ltd. | Industry – Surrendered: Santry Avenue Industrial Estate | Santry Avenue Industrial | Medium | Light industrial usage |
| Independent Newspapers Ltd. | Industry – Licensed: 90 Middle Abbey Street, Dublin 1 | 90 Middle Abbey Street | Medium | Light industrial usage |
| Mater Misericordiae University Hospital | Industry – Licensed: Eccles Street, Dublin 7 | Eccles Street, Dublin 7 | Medium | Light industrial usage |

#### 14.3.3.10 Mineral / Aggregate Resources

Considering the location of the Proposed Scheme in the urban environment, there are unlikely to be many opportunities to extract mineral or aggregate resources, however the following datasets were consulted in order to assess the impact of the Proposed Scheme on the economic geology of the study area:

- GSI: Aggregate potential mapping (GSI 2016b; GSI 2016c);
- GSI: Mineral localities (GSI 2014); and
- GSI: Active quarries (GSI 2019d).

No active pits, mines or quarries were identified within the study area. There are no mineral locations within the study area.

The crushed rock aggregate potential is highly variable from Pinnock Hill to Granby Row. The granular aggregate potential is highly variable as discussed below. A summary of the aggregate resources identified in the study area (refer to Figure 14.11 to Figure 14.12 in Volume 3 of this EIAR) are outlined in Table 14.27.

##### 14.3.3.10.1 Pinnock Hill to Airside Junction

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low.

The Granular aggregate potential ranges from very low to moderate associated with the Gaybrook Stream and the Swords Glebe River.

##### 14.3.3.10.2 Airside Junction to Northwood Avenue

The GSI aggregate potential mapping shows the crushed rock aggregate potential in the study area ranges from low to very high. Most of the study area is mapped as low crushed rock aggregate potential. Areas of moderate to high crushed rock potential were identified between the River Sluice to Cloghran. A localised pocket of high to very high crushed rock potential was located at Cloghran north of Dublin Airport.

The Granular aggregate potential ranges from very low to high. The high aggregate potential is associated with the Sluice River.

##### 14.3.3.10.3 Northwood Avenue to Shantalla Road

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low.

The Granular aggregate potential ranges from very low to low associated with the Santry River and with an alluvium deposit east of Shantalla Road.

14.3.3.10.4 Shantalla Road to Botanic Avenue

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low.

The Granular aggregate potential is very high north of the River Tolka.

14.3.3.10.5 Botanic Avenue to Granby Row

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area is low with an area of moderate aggregate potential south of the River Tolka.

The Granular aggregate potential encountered is high in pockets in the city centre at O'Connell Street, Henry Street and Marlborough Place. There is also an area of low potential just south of the River Tolka.

**Table 14.27: GSI Aggregate Potential for the Study Area**

| GSI Aggregate Potential Type | Potential | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Crushed rock aggregate potential | Low potential | Widespread | Low | Uneconomically extractable mineral resource |
| Crushed rock aggregate potential | Moderate potential | River Sluice to Cloghran, south of the River Tolka. | Medium | Sub-economic extractable mineral resource |
| Crushed rock aggregate potential | High potential | Cloghran north of Dublin Airport | Medium | Extractable mineral resource |
| Crushed rock aggregate potential | Very High potential | Cloghran north of Dublin Airport | High | Marginally extractable mineral resource |
| Granular aggregate potential | Very Low potential | Santry River | Low | Uneconomically extractable mineral resource |
| Granular aggregate potential | Low potential | Santry River | Low | Uneconomically extractable mineral resource |
| Granular aggregate potential | Moderate potential | Santry River | Medium | Sub-economic extractable mineral resource |
| Granular aggregate potential | High potential | Sluice River, O'Connell Street, Henry Street and Marlborough Place | Medium | Extractable mineral resource |
| Granular aggregate potential | Very High potential | Drumcondra | High | Marginally extractable mineral resource |

### 14.3.3.11 Geological Heritage Areas

There are no Geological Heritage Areas (GSI 2019c) within the study area.

### 14.3.3.12 Aquifer Type and Classification

The GSI Bedrock Aquifer mapping (GSI 2019b) for the study area (refer to Figure 14.13 in Volume 3 of this EIAR) indicates that there are two aquifer types within the study area, as summarised in Table 14.28 along with their importance as determined by Box 4.3 of the NRA Guidelines.

The GSI Gravel Aquifer mapping (GSI 2019b) show there are no gravel aquifers within the study area.

**Table 14.28: Aquifer Types Within the Study Area**

| Aquifer Type | Description | Location | Importance | Justification for Importance Rating |
|---|---|---|---|---|
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Widespread | Medium | Locally important aquifer which supplies the local area |
| Poor Aquifer (PI) | Bedrock which is generally unproductive except for local zones | North of Cloghran Roundabout to south of Collinstown Cross | Low | Low yielding aquifer |

### 14.3.3.13 Groundwater Vulnerability

Groundwater vulnerability (GSI 2019b) within the study area ranges from 'extreme' where bedrock is close to or at the surface to 'low' vulnerability in areas where thick subsoil deposit is present as shown on Figure 14.14 in Volume 3 of this EIAR.

#### 14.3.3.13.1 Pinnock Hill to Airside Junction

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from low to extreme. Areas of moderate vulnerability were identified at the Swords Glebe River reducing to low vulnerability moving south.

#### 14.3.3.13.2 Airside Junction to Northwood Avenue

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area as low. Areas of moderate to extreme vulnerability were identified north of the Airside Junction where bedrock outcrops are recorded signifying the presence of shallow bedrock.

#### 14.3.3.13.3 Northwood Avenue to Shantalla Road

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area as low.

#### 14.3.3.13.4 Shantalla Road to Botanic Avenue

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area as low.

#### 14.3.3.13.5 Botanic Avenue to Granby Row

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area as low.

### 14.3.3.14 Groundwater Recharge

The rate of groundwater recharge corresponds to the soil type as shown in Figure 14.8 and Figure 14.15 in Volume 3 of this EIAR. The study area predominately has an annual recharge range of 51mm (millimetres) to 100mm in urban areas. Where there is topsoil or alluvium present instead of made ground the annual recharge is typically 1mm to 50mm.

### 14.3.3.15 Hydro-Ecology

Groundwater dependent habitats within the study area that have the status of SPA, SAC, NHA or proposed National Heritage Area (pNHA) are listed in Table 14.29 along with their importance as determined by Box 4.3 of the NRA Guidelines.

The Royal Canal pNHA is identified within the study area. The canal is protected from groundwater ingress or leakage by a liner and therefore not considered to be in hydraulic connectivity with the surrounding groundwater. As such the canal is not considered a groundwater dependent habitat and is not considered further as part of this assessment.

**Table 14.29: Groundwater Dependent Habitats Within the Study Area**

| Designated Site | Description | Importance | Justification for Importance Rating |
|---|---|---|---|
| Santry Demesne pNHA | Potential alluvial woodland | Very High | Very high value on a local scale |

### 14.3.4 Summary of Features of Importance

The importance ranking of the features, based on Box 4.1 of the NRA Guidelines (NRA 2008a), established for the baseline conditions is summarised below.

Features with an importance ranking of low are not considered further as they will not result in a significant impact according to Box 5.4 of the NRA Guidelines (NRA 2008a) and are summarised in Table 14.30 for completeness. Features with an importance ranking of medium or higher are summarised in Table 14.31 and the impact of the Proposed Scheme on these features will be assessed in Section 14.4.

**Table 14.30: Summary of Land, Soils, Geology and Hydrogeology Features with Low Importance Within the Study Area**

| Category | Feature | Description | Location | Importance | Justification |
|---|---|---|---|---|---|
| Soil Fertility | Made Ground – Made | Associated with urban development | Widespread | Low | Poorly drained and / or low fertility soils |
| Soil Fertility | Topsoil – BminPD | Poorly drained (mainly basic) | East of Corballis, Toberbunny and Santry Demesne south of the M50 | Low | Poorly drained and / or low fertility soils |
| Soil Fertility | Alluvium – AlluvMIN | Typically found along current and historic watercourses | River Sluice, River Tolka | Low | Low value on a local scale |
| Subsoils quality and significance | Made Ground – Urban | Associated with urban development | Widespread | Low | Low value on a local scale |
| Subsoils quality and significance | Alluvium – A | Typically found along current and historic watercourses | Rivers Swords Glebe and Gaybrook Stream, Shantalla Road, River Tolka, Pockets within the City Centre | Low | Low value on a local scale |
| Subsoils quality and significance | Lacustrine – L | Associated with current and historic lakes | Pinnock Hill west of Lakeshore Drive | Low | Low value on a local scale |
| Subsoils quality and significance | Glacial gravels – GLs | Gravels derived from limestones | Pinnock Hill south of Swords, River Tolka | Low | Low value on a local scale |
| Subsoils quality and significance | Glacial till – TLs | Till derived from limestones | Widespread | Low | Low value on a local scale |
| Bedrock quality and significance | Lucan | (Calp) Dark limestone and shale – Carboniferous | Toberbunny to Granby Row | Low | Low value on a local scale |
| Bedrock quality and significance | Tober Colleen Formation | Calcareous shale, limestone conglomerate - Carboniferous | Cloghran to Toberbunny | Low | Low value on a local scale |
| Bedrock quality and significance | Waulsortian Limestones | Massive unbedded lime-mudstone – Carboniferous | Naul Road Junction to Cloghran | Low | Low value on a local scale |
| Bedrock quality and significance | Malahide Formation | Argillaceous bioclastic limestone, shale – Carboniferous | Airside Junction to the Naul Road Junction | Low | Low value on a local scale |
| Soft Soils | Alluvium – AlluvMIN (soils) / A (subsoils) | Typically found along current and historic watercourses | Rivers Swords Glebe and Gaybrook Stream, Shantalla Road, River Tolka, Pockets within the City Centre | Low | Volume of soft soil underlying the route is small and of a local scale. |
| Soft Soils | Lacustrine – L | Associated with current and historic lakes | Pinnock Hill west of Lakeshore Drive | Low | Volume of soft soil underlying the route is small and of a local scale. |
| Economic Geology | Crushed rock aggregate potential | Low potential | Widespread | Low | Uneconomically extractable mineral resource |
| Economic Geology | Granular aggregate potential | Very Low potential | Santry River | Low | Uneconomically extractable mineral resource |
| Economic Geology | Granular aggregate potential | Low potential | Santry River | Low | Uneconomically extractable mineral resource |
| Aquifer | Poor Aquifer (Pl) | Bedrock which is generally unproductive except for local zones | North of Cloghran Roundabout to south of Collinstown Cross | Low | Low yielding aquifer |

**Table 14.31: Summary of Land, Soils, Geology and Hydrogeology Features with Medium to Extremely High Importance Within the Study Area**

| Category | Feature | Description | Location | Importance | Justification |
|---|---|---|---|---|---|
| Soil Fertility | Topsoil – BminSW | Shallow well drained (mainly basic) | Naul Road Junction | High | Well drained and/or high fertility soils |
| Soil Fertility | Topsoil – BminDW | Deep well drained (mainly basic) | East of Corballis, Toberbunny and Santry Demesne south of the M50 | High | Well drained and/or high fertility soils |
| Potential Sources of Contamination | Quarry | Industrial (25-inch Mapping) | Cloghran | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Gravel Pit | Industrial (6-inch Mapping) | North of Pinnock Hill | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Sewage Farm | Industrial (6-inch mapping) | Toberbunny | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Flour Mill | Industrial (6-inch Mapping) North of the River Tolka | North of the River Tolka | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Printing Works | Industrial (25-inch Mapping) Paradise Place | Paradise Place | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Printing Works | Industrial (25-inch Mapping) Findlater Place | Findlater Place | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Chemical Works | Industrial (25-inch Mapping) Temple Street | Temple Street | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Historic Landfill | Castlemoate House South of the Naul Road north of Dublin Airport | Castlemoate House South of the Naul Road north of Dublin Airport | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Petrol Station | Several Petrol Stations found along the route (Nevinstown, Dublin Airport, Santry, Swords Rd) | Nevinstown, Dublin Airport, Santry, Swords Rd | Medium | Degree or extent of soil contamination is moderate on a local scale |
| Potential Sources of Contamination | Contaminated soils from recent Site Investigations | Non-Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of Mineral Oil. | Drumcondra Rd Lower (R2-CPRC02) | Medium | Degree or extent of soil contamination is moderate on a local scale. |
| Licensed Facility | Anglo Beef Processors Ireland | Light industrial usage | Santry River | Medium | Light industrial usage |
| Licensed Facility | Dublin Aerospace Ltd. | Light industrial usage | Sluice River, O'Connell Street, Henry Street and Marlborough Place | Medium | Light industrial usage |
| Licensed Facility | Computer Plating Specialists Ltd. | Light industrial usage | Drumcondra | Medium | Light industrial usage |

| Category | Feature | Description | Location | Importance | Justification |
|---|---|---|---|---|---|
| Licensed Facility | Independent Newspapers Ltd. | Light industrial usage | Widespread | Medium | Light industrial usage |
| Licensed Facility | Industry – Licensed: Eccles Street, Dublin 7. | Mater Misericordiae University Hospital | Santry | Medium | Light industrial usage |
| Economic Geology | Crushed rock aggregate potential | Moderate potential | Cloghran | Medium | Sub-economic extractable mineral resource |
| Economic Geology | Crushed rock aggregate potential | High potential | North of Pinnock Hill | Medium | Extractable mineral resource |
| Economic Geology | Crushed rock aggregate potential | Very High potential | North of River Tolka | High | Marginally extractable mineral resource |
| Economic Geology | Granular aggregate potential | Moderate potential | Toberbunny | Medium | Sub-economic extractable mineral resource |
| Economic Geology | Granular aggregate potential | High potential | Paradise Place | Medium | Extractable mineral resource |
| Economic Geology | Granular aggregate potential | Very High potential | Findlater Place | High | Marginally extractable mineral resource |
| Aquifer | Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Temple Street | Medium | Locally important aquifer which supplies the local area |
| Groundwater dependant habitat | Santry Demesne (000178) | Potential alluvial woodland | South of the Naul Road north of Dublin Airport | Very High | Very high value on a local scale |

### 14.3.5 Conceptual Site Model

A Conceptual Site Model (CSM) was developed based on all publicly available data along with project-specific data.

The Proposed Scheme is predominantly underlain by made ground over glacial till over limestone bedrock. The relevant subsections of the Proposed Scheme are presented in Table 14.32 to Table 14.36 along with the fill height (average and maximum) cut height (average and maximum) and the soils and geology at each earthwork areas.

**Table 14.32: Conceptual Site Model – Pinnock Hill to Airside Junction**

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Pinnock Hill Junction to Airside Junction | 780 | At Grade | 0 | 0 | 0 | 0 | Made Ground, local deposits of alluvium and glacial till overlying the Malahide formation consisting of Limestone. | 0.0 to 1.0 | The conversion of the Pinnock Hill roundabout to a signalised junction, |

**Table 14.33: Conceptual Site Model – Airside Junction to Northwood Avenue**

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Airside Junction to Airport Roundabout | 1920 | At Grade | 0 | 0 | 0 | 0 | Made Ground, local deposits of alluvium and glacial till overlying the Malahide limestone formation and to the south, a small area of Waulsortian Limestone consisting of massive unbedded lime-mudstone. . | 0.0 to 3.0 | The Cloghran roundabout will be converted to a fully signalised junction with pedestrian and cycle facilities. Pavement reconstruction, widening and resurfacing of the roads and the construction of new footpaths and cycle tracks and new kerbs. |
| Retaining Wall (RW022) | 50 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Precast Concrete Retaining Wall. RW022 is located on the west side of R132 Dublin Road north of Cloghran roundabout. The proposed widening at this location encroaches on an existing cutting which supports agricultural land. |
| Retaining Wall (RW026) | 30 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW027) | 85 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Minor retaining wall along the Proposed Scheme |

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Airport Roundabout to Old Airport Road | 1380 | At Grade | 0 | 0 | 0 | 0 | Made Ground and glacial till overlying the Tober Colleen Formation described as calcareous shale, limestone conglomerate | 0.0 to 3.0 | Pavement reconstruction, widening and resurfacing of the roads and the construction of new footpaths and cycle tracks and new kerbs. |
| Old Airport Road to Northwood Avenue | 2240 | At Grade | 0 | 0 | 0.2 | 0.2 | Made Ground, local deposits of alluvium and glacial till overlying the Tober Colleen Formation to the northern part of this section and to the south, the Lucan Formation comprised primarily of dark limestone and shale. | 0.0 to 3.0 | Pavement reconstruction, widening and resurfacing of the roads and the construction of new footpaths and cycle tracks and new kerbs. |
| Retaining Wall (RW008) | 40 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW009) | 50 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW010) | 70 | Structure | No cut/fill due to existence of structure | | | | Based on desk study made ground over glacial till at this location | 0.0 to 3.0 | Precast Concrete Retaining Wall. RW010 is located on the west side of R132 Swords Road. Supports car dealership. |

**Table 14.34: Conceptual Site Model – Northwood Avenue to Shantalla Road**

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Northwood Avenue to Omni Park Shopping Centre Entrance | 660 | At Grade | 0 | 0 | 0 | 0 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | Pavement reconstruction, widening, resurfacing of the roads, and construction of new footpaths, and cycle tracks, and new kerbs |
| Retaining Wall (RW028) | 60 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW014) | 35 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW015) | 30 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | Minor retaining wall along the Proposed Scheme |
| Omni Park Shopping Centre Entrance to Shantalla Road Junction | 630 | At Grade | 0 | 0 | 0.7 | 0.7 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | Pavement reconstruction, widening, resurfacing of the roads, and construction of new footpaths, and cycle tracks, and new kerbs |
| Retaining Wall (RW016) | 70 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | In-situ Concrete Gravity Wall. RW016 is located on the west side of the R132 Swords Road. It is proposed to set back the residential wall and provide off-street residential parking at this location. |
| Retaining Wall (RW017) | 25 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | In-situ Concrete Gravity Wall. RW017 is located on the east side of the R132 Swords Road. The proposed widening at this location encroaches into the front gardens of several residential properties. |
| Retaining Wall (RW018) | 70 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale | 0.5 to 3.8 | In-situ Concrete Gravity Wall. RW018 is located on the east side of the R132 Swords Road. The proposed widening at this location impacts the front gardens of a row of properties. |

**Table 14.35: Conceptual Site Model – Shantalla Road to Botanic Avenue**

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Shantalla Road Junction to Griffith Avenue | 1470 | At Grade | 0 | 0 | 0.5 | 0.5 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 1.0 to 3.5 | Pavement reconstruction, widening, resurfacing of the roads, and construction of new footpaths, and cycle tracks, and new kerbs |
| Retaining Wall (RW019) | 140 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 1.0 to 3.5 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW020) | 150 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 1.0 to 3.5 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW021) | 35 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 1.0 to 3.5 | Minor retaining wall along the Proposed Scheme |
| Retaining Wall (RW029) | 80 | Structure | No cut/fill due to existence of structure | | | | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 1.0 to 3.5 | RW029 is located on the east side of the N1 encroaching into fencing that forms the boundary to Highfield Hospital. Directly behind the wall is an access road for the hospital located approximately 2m to 3m above the highway level. |
| Griffith Avenue to Botanic Avenue | 1680 | At Grade | 0 | 0 | 0 | 0 | Made Ground, local deposits of alluvium and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale.<br>Local deposits of alluvium are expected.<br>GI carried out at Frank Flood Bridge indicates made ground to 3.50m. | 1.0 to 3.5 | Pavement reconstruction, widening, resurfacing of the roads, and construction of new footpaths, and cycle tracks, and new kerbs |
| Frank Flood Bridge | 19.48 | Structure | No cut/fill due to existence of structure | | | | GI carried out at Frank Flood Bridge indicates made ground to 3.50m, glacial till to 13.05m overlying Limestone | 3.5 | The proposed pedestrian / cycle bridge will be a two-span steel bridge, with an intermediate support located on the southern bank of the river channel. The bridge pier will be set back from the existing river wall, and the bridge will be located 3m upstream of the existing bridge. The bridge will comprise central varying depth box girder with a tie down arrangement at the north of the structure. The length of the main (north) span is approximately 38m with a south span of approximately 12m, the total span |

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| | | | | | | | | | being approximately 50m. A 4m back span will be provided at the north of abutment to accommodate the moment restraint at this location. The distance between the deck soffit and the ground will vary, however a minimum clearance of 1.5m will be provided at the abutments. |

**Table 14.36: Conceptual Site Model – Botanic Avenue to Granby Row**

| Subsection | Length (m) | Dominant Earthworks Type | Cut (m) | | Fill (m) | | Ground Conditions | Average Thickness of Made Ground (m) | Additional Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Avg | Max | Avg | | | |
| Botanic Avenue to North Fredrick Street | 750 | At Grade | 0 | 0 | 0 | 0 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 0.3 to 4.2 | Minor pavement reconstruction and resurfacing of the footpaths, and new kerbs. |
| North Fredrick Street to Granby Row | 250 | At Grade | 0 | 0 | 0 | 0 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 0.3 to 4.2 | Minor pavement reconstruction and resurfacing of the footpaths, and new kerbs. |
| Parnell Square including North Frederick Street | 700 | At Grade | 0 | 0 | 0 | 0 | Made Ground and glacial till overlying the Lucan Formation comprised primarily of dark limestone and shale. | 0.3 to 4.2 | Minor pavement reconstruction and resurfacing of the footpaths, and new kerbs. |

#### 14.3.5.1 Environment Type

The environment across the study area has been categorised in accordance with the IGI Guidelines. It has been classified as:

Type A environment which corresponds to a passive geological / hydrogeological environment – examples include areas of thick low permeability subsoils, areas underlain by poor aquifers, recharge areas, historically stable geological environments.

## 14.4 Potential Impacts

This Section presents potential impacts that may occur due to the Proposed Scheme, in the absence of mitigation. This informs the need for mitigation or monitoring to be proposed (refer to Section 14.5). Predicted 'residual' impacts taking into account any proposed mitigation are presented in Section 14.6.

### 14.4.1 Characteristics of the Proposed Scheme

A detailed description of the Proposed Scheme and construction activities are provided in Chapter 4 (Proposed Project Description) and Chapter 5 (Construction).

This Section outlines the key design features, characteristics and construction activities of the Proposed Scheme of relevance to land, soils, geology and hydrogeology.

A Construction Environmental Management Plan (CEMP) is provided in Appendix A5.1 in Volume 4 of this EIAR.

#### 14.4.1.1 Pinnock Hill to Airside Junction

- The conversion of the Pinnock Hill roundabout to a signalised junction;
- Full pavement reconstruction and resurfacing of roads, footpaths and cycle tracks with new kerbs; and
- Various utility diversions and / or protections will be required, including electricity overhead lines and underground cables, water distribution, gas mains and telecommunications infrastructure.

#### 14.4.1.2 Airside Junction to Northwood Avenue

- The Cloghran roundabout will be converted to a fully signalised junction with pedestrian and cycle facilities;
- Pavement reconstruction, widening and resurfacing of the roads and the construction of new footpaths and cycle tracks and new kerbs;
- A principal retaining wall (RW022) will be constructed north of the Cloghran Junction, approximately 50m in length and maximum 2m in retained height;
- A minor retaining wall (RW026) will be constructed opposite Metro Point Business Park, approximately 30m in length;
- A minor retaining wall (RW027) will be constructed along Swords Road, south of Cloghran Junction, approximately 85m in length;
- Boundary walls will be constructed, and gates will be relocated along Swords Road, north and south of the Airside Junction;
- The Construction Compound (SW1) will be located at the Cloghran Junction;
- Minor widening of the Airport Roundabout circulatory carriageway;
- A principal retaining wall (RW010) will be constructed along Swords Road, north of Northwood Avenue, approximately 70m in length and maximum 2.5m in retained height;
- A minor retaining wall (RW008) will be constructed at GreatGas Express, approximately 40m in length. A minor retaining wall (RW009) will be constructed at Royal College of Surgeons Sports Ground, approximately 50m in length. Boundary walls, and fencing will be constructed along Swords Road, and multiple gates will be relocated;
- The entrance to Collinstown Cross Industrial Estate will be relocated;
- The Construction Compound (SW2) will be located south-west of Collinstown Cross, with access / egress from Old Airport Road; and
- Various utility diversions and / or protections will be required, including electricity overhead lines and underground cables, gas mains and telecommunications infrastructure.

#### 14.4.1.3 Northwood Avenue to Shantalla Road

- The construction activities at Section 3a will comprise pavement reconstruction, widening, resurfacing of the roads, and construction of new footpaths, and cycle tracks, and new kerbs.

Construction activities will also consist of additional signage, new road markings, new and amended traffic signal infrastructure, new street furniture and landscaping works;

- A minor retaining wall (RW028) will be constructed along Santry Park, approximately 60m in length;
- A minor retaining wall (RW014) will be constructed at Santry AIB, approximately 35m in length. Boundary walls, and fencing will be constructed along Swords Road, and multiple gates will be relocated;
- The Construction Compound (SW3) will be located on Coolock Lane;
- Principal retaining walls (RW015, RW016, RW017, RW018), approximately 30m, 70m, 25m and 70m in respective length and maximum 1.5m in retained height will be constructed at properties on both sides of Swords Road through Santry Village. Boundary walls and gates will also be relocated throughout Santry Village, and driveways will be reconstructed; and
- Various utility diversions and / or protections will be required, including electricity overhead lines and underground cables, water distribution, and telecommunications infrastructure.

#### 14.4.1.4 Shantalla Road to Botanic Avenue

- The construction activities will comprise pavement reconstruction, widening, and resurfacing of the roads, and the construction of new footpaths, and cycle tracks, and new kerbs;
- A principal retaining wall (RW029), will be constructed along Swords Road, at Highfield Hospital, approximately 80m in length and maximum 1.5m in retained height;
- A minor retaining wall (RW019) will be constructed north of Collins Avenue Junction, approximately 140m in length;
- A minor retaining wall (RW020) approximately 150m in length will be constructed at Whitehall Colmcille GAA Club;
- A minor retaining wall (RW021) will be constructed at Plunket College, approximately 35m in length. Boundary walls, and fencing will be constructed along Swords Road, and multiple gates will be relocated;
- The Construction Compound (SW4) will be located at Collins Avenue Junction;
- Various utility diversions and / or protections will be required; including electricity overhead lines and underground cables, water distribution, gas mains and telecommunications infrastructure;
- A new pedestrian and cycle bridge will be constructed to the west of the existing Frank Flood Bridge (Structure Reference: BR01); and
- The Construction Compound (SW5) will be located at Frank Flood Bridge.

#### 14.4.1.5 Botanic Avenue to Granby Row

- The construction activities will comprise minor pavement reconstruction and resurfacing of the roads, footpaths, and cycle tracks, and some new kerbs.

#### 14.4.1.6 Operational Phase

The impact assessment for the Operational Phase has been undertaken in terms of impact analysis of the Proposed Scheme on the local environment from a land, soils, geology and hydrogeology perspective. This is set out in the following Sections.

### 14.4.2 'Do Nothing' Scenario

In the Do Nothing Scenario the Proposed Scheme would not be implemented and there would be no resulting impacts on the land, soils, geology and hydrogeology along the route of the Proposed Scheme. The impact would therefore be neutral.

### 14.4.3 Construction Phase

The potential land, soils, geology and hydrogeology impacts during the Construction Phase for the relevant construction activities described in Section 14.3.5 are presented in this Section, along with their impact

significance. These potential impacts also relate and interact with other environmental factors which are described within the EIAR. Specific interactions are outlined in Section 14.1.

The Proposed Scheme will have the following potential impacts on the land soils geology and hydrogeology as discussed below and summarised in Table 14.37.

- Loss or damage of topsoil;
- Excavation of potentially contaminated ground;
- Loss of future quarry or pit reserve;
- Loss or damage of proportion of aquifer;
- Change to groundwater regime; and
- Loss or damage of a groundwater dependant habitat.

Though the magnitude of the impact may vary depending on the scale of activities and location of the Proposed Scheme relative to the impacted important feature, in order to ensure a robust assessment, only the maximum magnitude or 'worst case' of the impact of the Proposed Scheme is discussed.

#### 14.4.3.1 Loss or Damage of Topsoil

Topsoil is a non-renewable resource which if removed or damaged can result in a permanent irreversible negative impact. The potential ways in which this can occur as a result of the Proposed Scheme are as follows:

- There is the potential for materials on site to be spilled resulting in the pollution of the topsoil. For example, raw or uncured concrete and grouts, washed down water from exposed aggregate surfaces, cast-in-place concrete from concrete trucks, fuels, lubricants and hydraulic fluids for equipment used on the development site, bitumen and sealants used for waterproofing concrete surfaces can all potentially impact on soils and groundwater during Construction Stage;
- These excavated soil materials will be stockpiled using appropriate methods to minimise the impacts of weathering. Materials that are stockpiled incorrectly can be exposed to erosion and weathering which reduces the quality of the resource;
- Excavations in areas of contaminated ground during the construction works may mobilise pollution contained in the soils into the nearby topsoil;
- Permanent damage of topsoil through waterlogging, sealing, washout of fines and erosion. This would be due to the trafficking of plant, regrading of slopes, laying of hardstanding surfaces and storage of materials in areas not intended to be paved as part of the Proposed Scheme; and
- Excavation and disposal of topsoil instead of its reuse or reinstatement.

Topsoil will be encountered in numerous areas across the Proposed Scheme as discussed in Section 14.3.3.3. Where topsoil is stripped to accommodate the works outlined above, all of the above impacts are likely to occur at these locations.

The magnitude of these impacts of the Proposed Scheme on topsoil will be Small Adverse as it will result in a permanent irreversible loss of a small proportion of locally high fertility topsoil and / or a high proportion of locally low fertility topsoils within the study area. As the topsoil is of high importance the resulting significance of this permanent small adverse impact is Slight.

#### 14.4.3.2 Excavation of Potentially Contaminated Ground

The excavation of made ground results in the production of excess material that requires placement elsewhere in the Proposed Scheme or removal off-site and / or the mobilisation of possible contaminants. The majority of the Proposed Scheme will encounter made ground as discussed in Section 14.3.3.1 and Section 14.3.3.3.

Exposure of locations of contamination and excavation of contaminated soil may potentially lead to a risk to the surrounding environment or underlying soil if not dealt with in an appropriate manner in accordance with the Environmental Protection Agency guidance on Land Contamination (EPA 2013). The underlying soil could be impacted from the exposure of previous buried hazardous material, in an unlicensed dumping site for example.

Potential sources of contamination relevant to the Proposed Scheme identified within the study area are detailed in Table 14.25 and include historic quarries and gravel pits, a historic flour mill and printing works, petrol stations, and a number of Integrated Pollution Control (IPC) licenced facilities including a historic landfill site at Castlemoate House South of the Naul Road north of Dublin Airport.

The magnitude of this impact is Small Adverse as it results in the excavation of a small proportion of contaminated land. As the potential contaminated ground is of medium importance the resulting significance of the permanent small adverse impact is Slight.

#### 14.4.3.3 Loss of Future Quarry or Pit Reserve

The excavation of soil and rock during construction can diminish future quarry and pit reserves. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils and geology area. There are three historic quarries and two gravel pits within the study area of the Proposed Scheme, however they have long been infilled.

The magnitude of this impact is negligible as it results in an insufficient permanent irreversible change on a local scale to affect the integrity of the land and soils above the Do Nothing scenario. As the aggregate potential is of medium to high importance the resulting significance of this negligible potential impact is Imperceptible and will not be considered further.

#### 14.4.3.4 Loss or Damage of Proportion of Aquifer

The removal of a proportion of an aquifer can reduce its ability to provide baseflow to groundwater dependant habitats and / or water supplies and results in an irreversible loss of the in-situ characteristics of the land, soils, geology and hydrogeology. Likewise, the mobilisation of contaminants into the aquifer either through accidental spillage or disturbance of contaminated ground during excavation will reduce the quality of the groundwater within the aquifer.

The underlying limestone bedrock is defined as a locally important aquifer, where there is anticipated to be minimal excavation into the limestone rock as part of the Proposed Scheme. The magnitude of this impact is Negligible as it results in an insufficient permanent irreversible change on a local scale to affect the integrity of the underlying aquifer. As the aquifer is a locally important aquifer of medium importance the resulting significance of this negligible impact is Imperceptible and will not be considered further.

In addition to the above impact, potential pollutants from routine run-off during construction or mobilisation of pollution from the disturbance of contaminated ground during construction activities (particularly excavations) have the potential to alter the groundwater quality temporarily in the study area. The magnitude of this impact is Moderate Adverse as it results in a temporary potential medium risk of pollution to groundwater from routine run-off during construction. As the aquifer is a locally important aquifer of medium importance, the resulting significance of this temporary moderate adverse potential impact is Moderate.

#### 14.4.3.5 Change to Groundwater Regime

Localised pumping of excavations may be required as part of the Construction Phase at structures and deep trenches in order to allow works to be carried out in dry excavations. This could lead to a temporary change in the groundwater levels and flow within the locally important aquifer underlying the Proposed Scheme.

Since the pumping is expected to be limited, localised and temporary, the magnitude of this impact is considered negligible. As the importance of the locally important aquifer is medium, the resulting significance is Imperceptible and therefore will not be considered further.

#### 14.4.3.6 Loss or Damage of a Groundwater Dependent Habitat

Groundwater dependent habitats may be potentially impacted through accidental contamination of the groundwater which supports them, the alteration of groundwater levels and / or the reduction in the groundwater contribution to the ecosystem. The characteristics which determine the potential impact are:

- The proximity to the feature;

- The level of hydraulic connection between the feature and the section of aquifer at the proposed road development, i.e. is the feature in the same aquifer unit as the proposed road development, or is there a hydraulic divide between the feature and the proposed road development;
- The groundwater flow direction in the vicinity;
- The level of cut of the proposed road development, which may determine the degree of variation in the groundwater level and also the extent of dewatering which may occur; and
- The water quality of the feature and the groundwater from which it receives its baseflow.

Localised pumping of excavations is expected to be required as part of the construction phase at structures and deep trenches in order to allow works to be carried out in dry excavations. This could lead to a temporary change in the groundwater levels and base flow to groundwater dependant habitats.

The Santry Demesne pNHA is located immediately west of the Proposed Scheme where the proposed design is at grade. There is no proposed cutting associated with the Proposed Scheme. Between Northwood Avenue and the Omni Park Shopping Centre where the Santry Demesne is located, the Proposed Scheme includes widening of footpaths and construction of new cycle tracks.

There is a risk of pollutants entering the groundwater as a result of spillages or accidents where mitigation measures are not implemented. The magnitude of this impact is considered Moderate Adverse. The importance of Santry Demesne is very high, and the resulting significance is Significant.

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**Table 14.37: Summary of Predicted Construction Phase Impacts**

| Feature | Description | Location | Importance | Impact | Quality | Duration | Scale | Magnitude | Significance |
|---|---|---|---|---|---|---|---|---|---|
| **Loss or Damage of Topsoil** | | | | | | | | | |
| Topsoil – BminSW | Shallow well drained (Mainly basic) | Naul Road Junction | High | Loss or damage of topsoil | Negative | Permanent | Local | Small Adverse | Slight |
| Topsoil – BminDW | Deep well drained (Mainly basic) | East of Corballis, Toberbunny and Santry Demesne south of the M50 | High | Loss or damage of topsoil | Negative | Permanent | Local | Small Adverse | Slight |
| **Excavation of Potentially Contaminated Ground** | | | | | | | | | |
| Potential Sources of Contamination | Quarry | Cloghran | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Gravel Pit | North of Pinnock Hill | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Sewage Farm | Toberbunny | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Flour Mill | North of the River Tolka | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Printing Works | Paradise Place | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Printing Works | Findlater Place | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Chemical Works | Temple Street | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Historic Landfill | Castlemoate House South of the Naul Road north of Dublin Airport | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Petrol Station - Several Petrol Stations found along the route (Nevinstown, Dublin Airport, Santry, Swords Rd) | Nevinstown, Dublin Airport, Santry, Swords Rd | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Potential Sources of Contamination | Two samples were classified as non-hazardous based on limited information. No waste acceptance categorization was carried out on these samples and further testing is required. | Drumcondra Rd Lower (R2-CPRC02 & R2-TP01) | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |

| Feature | Description | Location | Importance | Impact | Quality | Duration | Scale | Magnitude | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Licensed Facilities | Anglo Beef Processors Ireland | Cloghran, Swords | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Licensed Facilities | Dublin Aerospace Ltd. | Dublin Airport | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Licensed Facilities | Computer Plating Specialists Ltd. | Santry Avenue Industrial Estate | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Licensed Facilities | Independent Newspapers Ltd. | 90 Middle Abbey Street, Dublin 1 | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| Licensed Facilities | Mater Misericordiae University Hospital | Eccles Street, Dublin 7. | Medium | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight |
| **Loss of Future Quarry or Pit Reserve** | | | | | | | | | |
| Crushed rock aggregate potential | Moderate potential | River Sluice to Cloghran, south of the River Tolka. | Medium | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible |
| Crushed rock aggregate potential | High potential | Cloghran north of Dublin Airport | Medium | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible |
| Crushed rock aggregate potential | Very High potential | Cloghran north of Dublin Airport | High | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible |
| Granular aggregate potential | Moderate potential | Santry River | Medium | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible |
| Granular aggregate potential | High potential | Sluice River, O'Connell Street, Henry Street and Marlborough Place | Medium | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible |
| Granular aggregate potential | Very High potential | | High | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible |

| Feature | Description | Location | Importance | Impact | Quality | Duration | Scale | Magnitude | Significance |
|---|---|---|---|---|---|---|---|---|---|
| **Loss or Damage of Proportion of Aquifer** | | | | | | | | | |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Widespread | Medium | Loss or damage of proportion of aquifer through excavation | Negative | Permanent | Local | Negligible | Imperceptible |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Widespread | Medium | Loss or damage of proportion of aquifer through pollution. | Negative | Temporary | Local | Moderate Adverse | Moderate |
| **Change to Groundwater Regime** | | | | | | | | | |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Widespread | Medium | Change to groundwater regime | Negative | Temporary | Local | Negligible | Imperceptible |
| **Loss or Damage to Groundwater Dependant Habitat** | | | | | | | | | |
| Santry Demesne (000178) | Potential alluvial woodland | Santry | Very High | Loss or damage to proportion of proposed National Heritage Area | Negative | Temporary | Local | Moderate Adverse | Significant |

### 14.4.4 Operational Phase

#### 14.4.4.1 Contamination

The Operational Phase has the potential to lead to occasional accidental leakage of oil, petrol or diesel, allowing contamination of the surrounding environment. While the likelihood of an accidental spillage may increase in comparison to the Do Nothing scenario, the magnitude of the impact is negligible.

Therefore, the significance of the impact is Imperceptible on any of the land, soils, geology and hydrogeology.

## 14.5 Mitigation and Monitoring Measures

The following Sections outline the mitigation and monitoring measures associated with the impacts identified in Section 14.4 for both the Construction and the Operational phases of the Proposed Scheme. A summary of the pre-mitigation and post-mitigation impacts is contained in Table 14.38.

### 14.5.1 Construction Phase

Construction techniques that comply with the requirements of statutory bodies in terms of noise, vibration, soil and groundwater contamination and disposal of contaminated material for both soil and rock cuttings will be adopted as per the CEMP in Appendix A5.1 in Volume 4 of this EIAR. A summary of the pre-mitigation and post-mitigation impacts is contained in Table 14.38.

#### 14.5.1.1 Loss or Damage of Topsoil

Excavated topsoils will be stockpiled by the appointed contractor using appropriate methods to minimise the effects of weathering. Care will be taken in reworking this material to minimise dust generation, groundwater infiltration and generation of runoff.

All topsoil or subsoil shall be assessed for re-use within the Proposed Scheme by the appointed contractor ensuring the appropriate handling, processing and segregation of the material. Where practical the removal of topsoil from the Proposed Scheme will be avoided. All earthworks will be undertaken in accordance with TII Specification for Works (SPW) Series 600 Earthworks (TII 2013) and project-specific earthworks specifications ensuring that all excavated material and imported material is classified using the same methodology to allow maximum opportunity for the reuse of materials on site.

The impact of the production of excess material for removal off site is discussed in Chapter 18 (Waste & Resources).

#### 14.5.1.2 Excavation of Potentially Contaminated Ground

The appointed contractor shall ensure that excavations shall be kept to a minimum, using shoring or trench boxes, where appropriate. For more extensive excavations, a temporary works designer shall be appointed by the appointed contractor to design excavation support measures in accordance with all relevant guidelines that minimises the excavation of contaminated ground.

The appointed contractor will be responsible for regular testing of excavated soils to monitor the suitability of the soil for reuse.

Samples of ground suspected of contamination will be tested for contamination by the appointed contractor during the detailed ground investigation and ground excavated from these areas will be disposed of to a suitably licensed or permitted site in accordance with the current Irish waste management legislation.

Any dewatering in areas of contaminated ground shall be designed by the appointed contractor to minimise the mobilisation of contaminants into the surrounding environment.

#### 14.5.1.3 Pollution of Soil and Groundwater

Good construction management practices, as outlined in the CIRIA guidance Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters-Williams *et al.* 2001) will be employed by the appointed contractor to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater. The construction management of the site will take account of these recommendations to minimise as far as possible the risk of soil, groundwater and surface water contamination.

Measures to be implemented to minimise the risk of spills and contamination of soils and waters include:

- Employing only competent and experienced workforce, and site-specific training of site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures;

- Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system, e.g. by a roll-over bund, raised kerb, ramps or stepped access;
- The location of any fuel storage facilities shall be considered in the design of all construction compounds. These are to be designed in accordance with relevant guidelines and codes of best practice and will be fully bunded;
- Good housekeeping at the site (daily site clean-ups, use of disposal bins, etc.) during the entire Construction Phase;
- All concrete mixing and batching activities will be located in areas away from watercourses and drains;
- Potential pollutants to be adequately secured against vandalism;
- Provision of proper containment of potential pollutants according to codes of best practice;
- Thorough control during the entire Construction Phase to ensure that any spillage is identified at early stage and subsequently effectively contained and managed; and
- Spill kits to be provided and to be kept close to the storage area. Staff to be trained on how to use spill kits correctly.

An Environmental Incident Response Plan will be implemented by the appointed contractor, which will identify the actions to be taken in the event of a pollution incident. It will address such aspects as containment measures, emergency discharge routes, a list of appropriate equipment and clean up materials and notification procedures to inform the relevant environmental protection authority. Refer to Appendix A5.1 (CEMP) in Volume 4 of this EIAR.

Sediment control methods are outlined in the Surface Water Management Plan in Appendix A5.1 (CEMP) in Volume 4 of this EIAR and these will be implemented by the appointed contractor.

The CEMP also addresses good construction management practices that will be employed to prevent the risk of pollution of the existing land, soils, geology and hydrogeology during construction.

### 14.5.2 Operational Phase

With the implementation of the Proposed Scheme, no additional mitigation measures for land, soils, geology and hydrogeology are considered necessary for the operation of the Proposed Scheme.

In the Operational Phase the infrastructure will be maintained by the local authority and will be subject to their management procedures to ensure that the correct measures are taken in the event of any accidental spillages and this will reduce the potential for any impact.

## 14.6 Residual Impacts

No significant residual impacts have been identified either in the Construction or Operational Phases of the Proposed Scheme, whilst meeting the scheme objectives set out in Chapter 1 (Introduction & Environmental Impact Assessment Process).

### 14.6.1 Construction Phase

With the efficacious implementation of the above mitigation measures, there will be no significant residual impacts on land, soils, geology or hydrogeology as a result of the Construction Phase of the Proposed Scheme.

### 14.6.2 Operational Phase

No significant residual impacts on land, soils, geology and hydrogeology as a result of the Operational Phase of the Proposed Scheme have been identified.

**Table 14.38: Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation and Monitoring Measures**

| Feature | Description | Importance | Location | Impact | Quality | Duration | Scale | Pre-mitigation Magnitude | Pre-mitigation Significance | Post-mitigation Magnitude | Post-mitigation Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Loss or Damage of Topsoil** | | | | | | | | | | | |
| Topsoil – BminSW | Shallow well drained (Mainly basic) | High | Naul Road Junction | Loss or damage of topsoil | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Topsoil – BminDW | Deep well drained (Mainly basic) | High | East of Corballis, Toberbunny and Santry Demesne south of the M50 | Loss or damage of topsoil | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| **Excavation of Potentially Contaminated Ground** | | | | | | | | | | | |
| Potential Sources of Contamination | Quarry | Medium | Cloghran | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Gravel Pit | Medium | North of Pinnock Hill | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Sewage Farm | Medium | Toberbunny | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Flour Mill | Medium | North of the River Tolka | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Printing Works | Medium | Paradise Place | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Printing Works | Medium | Findlater Place | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Chemical Works | Medium | Temple Street | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Historic Landfill | Medium | Castlemoate House South of the Naul Road north of Dublin Airport | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |

| Feature | Description | Importance | Location | Impact | Quality | Duration | Scale | Pre-mitigation Magnitude | Pre-mitigation Significance | Post-mitigation Magnitude | Post-mitigation Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Potential Sources of Contamination | Petrol Station – Several Petrol Stations found along the route (Nevinstown, Dublin Airport, Santry, Swords Rd) | Medium | Nevinstown, Dublin Airport, Santry, Swords Rd | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Potential Sources of Contamination | Two samples were classified as non-hazardous based on limited information. No waste acceptance categorization was carried out on these samples and further testing is required. | Medium | Drumcondra Rd Lower (R2-CPRC02 & R2-TP01) | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Licensed Facilities | Anglo Beef Processors Ireland | Medium | Cloghran, Swords | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Licensed Facilities | Dublin Aerospace Ltd. | Medium | Dublin Airport | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Licensed Facilities | Computer Plating Specialists Ltd. | Medium | Santry Avenue Industrial Estate | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Licensed Facilities | Independent Newspapers Ltd. | Medium | 90 Middle Abbey Street, Dublin 1 | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| Licensed Facilities | Mater Misericordiae University Hospital | Medium | Eccles Street, Dublin 7. | Excavation of contaminated ground | Negative | Permanent | Local | Small Adverse | Slight | Negligible | Imperceptible |
| **Loss of Future Quarry or Pit Reserve** | | | | | | | | | | | |
| Crushed rock aggregate potential | Moderate potential | Medium | River Sluice to Cloghran, south of the River Tolka. | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| Crushed rock aggregate potential | High potential | Medium | Cloghran north of Dublin Airport | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| Crushed rock aggregate potential | Very High potential | High | Cloghran north of Dublin Airport | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible | Negligible | Imperceptible |

| Feature | Description | Importance | Location | Impact | Quality | Duration | Scale | Pre-mitigation Magnitude | Pre-mitigation Significance | Post-mitigation Magnitude | Post-mitigation Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Granular aggregate potential | Moderate potential | Medium | Santry River | Loss of future quarry or pit reserve | Negative | Temporary | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| Granular aggregate potential | High potential | Medium | Sluice River, O'Connell Street, Henry Street and Marlborough Place | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| Granular aggregate potential | Very High potential | High | Findlater Place | Loss of future quarry or pit reserve | Negative | Permanent | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| **Loss or Damage of Proportion of Aquifer through Excavation** | | | | | | | | | | | |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Medium | Widespread | Loss or damage of proportion of aquifer through excavation. | Negative | Permanent | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Medium | Widespread | Loss or damage of proportion of aquifer through pollution. | Negative | Temporary | Local | Moderate Adverse | Moderate | Negligible | Imperceptible |
| **Change to Groundwater Regime** | | | | | | | | | | | |
| Locally Important Aquifer (LI) | Bedrock which is moderately productive only in local zones | Medium | Widespread | Change to groundwater regime | Negative | Temporary | Local | Negligible | Imperceptible | Negligible | Imperceptible |
| **Loss or Damage to Groundwater Dependant Habitat** | | | | | | | | | | | |
| Santry Demesne (000178) | Potential alluvial woodland | Very High | Santry | Loss or damage to proportion of proposed National Heritage Area | Negative | Temporary | Local | Moderate Adverse | Significant | Negligible | Imperceptible |

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