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 Kimmage to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme). Chapter 4 (Proposed Scheme 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 on 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 infrastructural 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 mitigate or eliminate the 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 Scheme Description) has been designed to meet these objectives.

The design of the Proposed Scheme has evolved through 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 have 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 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 250m (metres) 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:

- Kimmage Road Lower from Kimmage Cross Roads to the Junction with Harold's Cross Road;
- Harold's Cross Road from Harold's Cross Park to the Grand Canal; and
- Clanbrassil Street Upper and Lower and New Street South from the Grand Canal to the Patrick Street Junction.

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, 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. 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 and 2021.

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
Teagasc	Teagasc Soils Data	Surface soils classification and description
Geological Survey Ireland (GSI)	Quaternary Mapping	Geological maps of the site area produced by the GSI and available on GSI online map viewer.
	Bedrock Mapping	
	Aggregate Potential Mapping	
	Mineral Localities	
	Geotechnical viewer	

Source	Name	Description
	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 Protections 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
Department of Communications, Energy and Natural Resources (DCENR)	Minerals Ireland	A booklet contains a list of all current and prospecting mining facilities.
	Historic Mine Sites – Inventory and Risk Classification	Department of the Environment, Climate and Communications

14.2.3.2 Ground Investigation

The details of the existing / 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 'EXT GSI Geotechnical Sites layer' of the Geological Survey of Ireland (GSI) Spatial Resources Map Viewer (GSI 2019a).

Table 14.2: Existing Ground Investigations

GSI Report ID	Title	Year	Author	Location	Scope
R914	Kimmage Road Dublin	1979	Geotechnical Consulting Services Ltd.	Petrol Station at Kimmage Grove, Dublin 12.	Six Cable Percussion boreholes
R911	Mount Argus, Dublin.	1987	IGSL	Mount Argus, Harold's Cross, Dublin 6.	Thirty Trial Pits.
R912	Mount Argus, Dublin.	1989	IGSL	Mount Argus, Harold's Cross, Dublin 6.	Four Cable Percussion boreholes
R915	River Poddle Culvert	1986	IGSL	Kimmage Road Lower, Dublin 12.	Six Cable Percussion boreholes
R961	Development at Harold's Cross	1982	Site Investigations Ltd.	Harold's Cross Road, Dublin 6.	Nine Cable Percussion boreholes
R324	Harold's Cross	1972	The Cementation Co. Ltd, Ireland.	Harold's Cross Road, Dublin 6.	Nine Cable Percussion boreholes
R825	Inner Tangent Ring Road Project	1991	IGSL	Clanbrassil Street Lower, Dublin 8.	Six Cable Percussion boreholes
R6386	Single Storey Dwelling	2005	IGSL	Terenure Road West, Dublin 6	Two Trial Pits
R908	Leo Laboratories	1991	IGSL	Ravensdale Park, Dublin 12	Four Cable Percussion boreholes

GSI Report ID	Title	Year	Author	Location	Scope
R5365	Leo Pharmaceutical Complex	2003	IGSL	Ravensdale Park, Dublin 12	Five Cable Percussion boreholes with Rotary Core Follow-on and three trial pits
R712	Labour Exchange	1986	IGSL	KCR Industrial Estate, Dublin 11.	Seven Cable Percussion boreholes and seven Trial Pits
R913	Harkness Electrical	1991	IGSL	Harold's Cross Road, Dublin 6	Three Trial Pits
R824	Clanbrassil Street Housing	1985	IGSL	Clanbrassil Street Upper, Dublin 6	Three Cable Percussion boreholes
R910	Mount Jerome Cemetery	1983	IGSL	Harold's Cross, Dublin 6	Two Cable Percussion boreholes
R994	Northern Bank Development	1975	Soil Investigation Ltd	South Circular Road, Dublin 8	Three Cable Percussion boreholes
R2225	Residential Development	1994	IGSL	Clanbrassil Street Lower, Dublin 8	Four Cable Percussion boreholes with Rotary Follow-on
R852	Apartments	1991	IGSL	New Row, Dublin 8	Two Cable Percussion boreholes
R5411	Residential/ Commercial Developments	2004	IGSL	Clanbrassil Street Lower, Dublin 8	Five Rotary Core boreholes
R845	Residential/ Commercial Developments	1982	Geotechnical Consulting Services Ltd	New Street South, Dublin 8	Four Cable Percussion boreholes
R5583	Commercial Development	2004	IGSL	Cathedral Court, Dublin 8	Three Cable Percussion boreholes
R2503	Proposed Development at New Street	1995	IGSL	New Street South, Dublin 8	Two Cable Percussion boreholes and Four Rotary Percussive Boreholes
R987	Apartments	1994	IGSL	Patrick Street, Dublin 8	Six Cable Percussion boreholes
R863	Patrick Street Sewer	1989	IGSL	Patrick Street, Dublin 8.	Eleven Cable Percussion boreholes
R2231	Residential Development	1993	IGSL	Patrick Street, Dublin 8.	Five Cable Percussion boreholes with Rotary Follow-on
R995	Site Investigation at Francis Street	1995	IGSL	Francis Street, Dublin 8	Two Cable Percussion boreholes

The scheme-specific ground investigations carried out to inform the Proposed Scheme and EIAR are listed in Table 14.2 and the factual report 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 11 Ground Investigation Final Report	Ground Investigations Ireland	July 2021	Bus Connect Detailed Stage 1 Lot 1- Kimmage	3 No. window samples, 2 No. Cable Percussive boreholes with Rotary follow on and 5 No. Groundwater monitoring wells.

14.2.3.3 Design Information

The information as provided in Chapter 4 (Proposed Scheme Description) and Chapter 5 (Construction) as well as the Plan and Profile Drawings (BCIDD-ROT-GEO_CS-0011_XX_00-DR-CR-0001) in Volume 3 of this EIAR), have been used in the assessment.

14.2.3.4 Scheme Walkover

An initial scheme walkover survey was carried out on 19 February 2020 and 7 July 2021 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, scheme walkover surveys and from Proposed Scheme specific ground investigations.

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 Guidelines.

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 site investigations and studies close to the Proposed Scheme were 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 (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 Attribute (Table 14.8); and
- Box 5.4: Rating of Significant Environmental Impacts at EIA Stage (Table 14.9).

The NRA Guidelines criteria uses the same significance terminology as the EPA Guidelines (EPA 2017). 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 2008)).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. 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) Large existing quarry or pit Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. 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 Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and / or highly fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. 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 Small recent landfill site for mixed wastes Moderately drained and / or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. 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 Small historical and / or recent landfill site for construction and demolition wastes Poorly drained and / or low fertility soils. Uneconomically extractable mineral resource

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

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

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

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.
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 2008))

Magnitude of Impact	Criteria	Typical Example
Large Adverse	Results in loss of attribute	Loss of high proportion of future quarry or pit reserves. Irreversible loss of high proportion of local high fertility soils. Removal of entirety of geological heritage feature. Requirement to excavate / remediate entire waste site. 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. Removal of part of geological heritage feature. Irreversible loss of moderate proportion of local high fertility soils. Requirement to excavate / remediate significant proportion of waste site. 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. Removal of small part of geological heritage feature. Irreversible loss of small proportion of local high fertility soils and / or high proportion of local low fertility soils. Requirement to excavate / remediate small proportion of waste site. 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 (Box 5.1 (NRA 2008))

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 Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems Potential high risk of pollution to groundwater from routine run-off Calculated risk of serious pollution incident during operation >2% annually

Magnitude of Impact	Criteria	Typical Example
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Potential medium risk of pollution to groundwater from routine run-off 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 Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems Potential low risk of pollution to groundwater from routine run-off 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 Environmental Impacts at EIA stage (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 residual impacts. Mitigation by embedded 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 Greater Dublin Area (GDA) 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.

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 post-glacial landscape also reflects the effects of fluvial (river) processes that have altered the topography, albeit only to a small extent in the region, since the ice sheet retreat. The coastline within the region is characterised by sandy beaches and rock outcrops.

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
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

Soil Code	Description	Location
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 lodgment 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
GCh	Gravels derived from chert	North West Dublin
GLPSsS	Gravels derived from Lower Palaeozoic 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

Soil Type	Description	Location
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 Palaeozoic 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 Palaeozoic 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 direction 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 80 metres 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

Geological Period	Formation	Description	Location
	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 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 (>400 metres 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 (100m^3/d to 400m^3/d); and
- Poor Aquifers are capable of supplying small abstractions (e.g., domestic supplies), or moderate to low yields (<100m^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

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 that the annual groundwater recharge across the region ranges from approximately 1mm/yr (millimetre per year) to 600mm/yr as shown on 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 have 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 Rye Water 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 be an impact on a designated site. Further information regarding the designated sites within the region are 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 basic designation for wildlife is the Natural Heritage Area (NHA). 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 the 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
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

Designation Code	Designated Site
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, proposed Natural Heritage Area (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 in order 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 2021), Bing (Bing 2021) and the Corine Land Cover maps (EPA 2021). The historic land use is based on the following OSI (OSI 2021) 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 Kimmage Road Lower at Kimmage Cross Roads to the Junction with Harold's Cross Road

The Corine Land Cover 2018 classifies the land use of the study area along R817 Kimmage Road Lower from Kimmage Cross Roads to the junction with R137 Harold's Cross Road as a discontinuous urban fabric with a small pocket of green urban area underlying Eamonn Ceannt Park to the north west of the study area.

The historic character of the Kimmage area is defined by former industrial sites such as mills, weirs, quarries and sandpits along the course of the River Poddle. This industrial development occurred in tandem with the development of the houses and their former demesnes at Mount Argos and at Mount Jerome, with the former a major religious centre and the latter a cemetery. The OSI 6-inch mapping indicates that this area was previously dominated by a number of quarries at St. Martin's Park, Kimmage Grove and Whelan Park. There was also a paper mill (east of Mount Argus Park) and a number of flour / corn mills. A historic dispensary was also present at the Harold's Cross Junction.

The OSI 25-inch mapping shows little further development, the River Poddle is clearly visible and there is a laundry and filter beds labelled at the junction of Mount Argus Road and R137 Harold's Cross Road. The quarries are partially filled on the northern side of R817 Kimmage Road Lower at St. Martin's Park.

The OSI 6-inch Cassini mapping shows more development but notably the quarries remain unfilled at Kimmage Grove and Whelan Park.

The OSI 1995 aerial photography show that most of the development in the area had occurred at this stage including the infilling of the quarries.

The OSI 2000 and OSI 2005 aerial photography shows there were no significant developments. The satellite imagery from Google 2021 shows the construction of an apartment block beside Mount Argus Park.

14.3.3.1.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

The Corine Land Cover 2018 classifies the land use of the study area along Harold's Cross Road from Harold's Cross Park to the Grand Canal as a discontinuous urban fabric.

Harold's Cross is one of Dublin's historic suburbs. It saw significant development in the 18th century, in tandem with the focus on industrial development along the River Poddle and the development of the Grand Canal. The OSI 6-inch mapping shows that historically this area was occupied by a number of houses, large gardens, a national school, a convent and an orphanage with no indication of heavy industry. A significant landmark is the Mount Jerome Cemetery to the west of Harold's Cross. Ponds associated with the River Poddle are indicated on this map. The Portobello Barracks, known today as the Cathal Brugha Barracks, are located east of the road near the Grand Canal.

The OSI 25-inch mapping shows some developments at the north of this section near the Grand Canal. A notable feature is the tramway on Harold's Cross Road. Ponds associated with the River Poddle are indicated on this map. An oil works has been constructed at Greenmount, as well as a spinning manufactory. The Harold's Cross Park is now established at the Harold's Cross Junction.

The 6-inch Cassini show further development in this area. A greyhound racecourse has been constructed east of Harold's Cross Park. Notably the OSI 6-inch Cassini mapping shows an 'Oil Works' between Greenmount Avenue and Parnell Road on the western side of Harold's Cross Road.

The OSI 1995 aerial photography shows that there have been no significant developments in this section. The OSI 2000 and 2005 aerial photographs show that there have been no significant developments in this section. The satellite imagery provided by Google Maps (2019) shows that there have been no significant developments in this section.

14.3.3.1.3 Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction

The Corine Land Cover 2018 classifies the land use of the study area along Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction as a discontinuous urban fabric.

The OSI 6-inch mapping shows housing along this section, along with a distillery, a large graveyard (Cabbage Garden) and a chemical works and the Meath hospital. Closer to the canal, houses are depicted with rear gardens and some larger plots of land are under orchard or as yet undeveloped. The northern half of Clanbrassil Street Lower was more densely packed, with small yards replacing gardens to the rear of the properties lining the street and infill buildings, such as workshops and sheds, occupying some of these spaces. There also is a police barracks at St Patrick's Junction and St Patrick's Cathedral complex beyond the junction to the north. The Richmond Penitentiary is located between the South Circular Road and the Grand Canal.

The OSI 25-inch mapping shows there has been much more development along this route, primarily in the form of additional housing between the canal and Daniel Street. The penitentiary has become the Wellington Barracks and the tramway has been constructed along Upper Clanbrassil Street before turning down South Circular Road. Cabbage Garden graveyard is marked as disused by this time, as is the 'French Grave Yd.' which is indicated at the northern end of the large graveyard area. A lime works has also been built south of St Patrick's Junction and a tannery at New Row. The area west of New Street / Clanbrassil Street Lower became synonymous with textile production in the post-medieval period, with industry flourishing in the 18th century, and a weaving mill (St Kevin's Hall) is depicted on this mapping, at Old Mill Court off Clanbrassil Street Lower.

The 6-inch Cassini shows even more developments. The Iveagh Buildings by this time partly occupy the south end of the former Cabbage Garden graveyard. Wellington Barracks had been renamed Griffith Barracks. Notable developments include a biscuit factory at Kevin Street Upper but there is no other change to previously mentioned developments.

The OSI 1995 aerial photography shows that there have been no significant developments in this section. The OSI 2000 aerial photograph shows that there have been no significant developments in this section. The OSI 2005 aerial photograph shows that there have been no significant developments in this section. Some of the original residential terraces have been replaced with larger developments.

The satellite imagery provided by Google Maps (2021) shows that there have been no significant developments in this section. Information provided by this map informs that previously existing buildings have been repurposed. The Griffith Barracks has become Griffith College and the Meath Hospital has become a retirement home.

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 Kimmage Road Lower at Kimmage Cross Roads to the Junction with Harold's Cross Road

The study area begins along R817 Kimmage Road Lower at the Kimmage Cross Roads which is at an elevation between 50mOD and 40mOD. This gradually falls to approximately 30mOD at the R817 Kimmage Road / R137 Harold's Cross Road Junction. The River Poddle runs parallel to the west of the Proposed Scheme corridor. The River Poddle runs largely overground in the southern part of the corridor with some culverts at Ravensdale Park / Poddle Park and at Sundrive Road until just north of Mount Argus Church where it enters a long culvert extending to Mount Jerome Cemetery. The river once again enters a culvert at Our Lady's Hospice in Harold's Cross and flows underground from there as far as the confluence with the River Liffey. According to the OSI topography maps the River Poddle does not appear to influence a change on the topography of the area.

There are no reported geomorphological features within this subsection of the study area.

14.3.3.2.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

The elevation at R137 Harold's Cross Road is 30mOD and falls to 20mOD at the Grand Canal. The culverted River Poddle runs directly to the west of the Proposed Scheme corridor along this subsection.

The GSI Quaternary Geomorphology map shows that there are no glacial features within this subsection of the study area.

14.3.3.2.3 Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction

The elevation at this subsection of the study begins between 30mOD and 20mOD at the Grand Canal and falls to 10mOD close to the R137 Patrick Street Junction. The culverted River Poddle runs directly under the Proposed Scheme corridor along this subsection.

The GSI Quaternary Geomorphology map shows that there are glacial hummocky sands and gravels within this subsection of the study area.

These sands and gravels are located east and west of the junction of R137 New Street and R137 Patrick's Street namely underlying Saint Patrick's Cathedral to the east of the Proposed Scheme and between R110 Dean Street and Carman's Hall to the west.

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.

The predominant soil type within the study area is made ground. Pockets of topsoil (BminSW) are identified in the subsection from Kimmage Road Lower at Kimmage Cross Roads to the Junction with R137 Harold's Cross Road. Here, the Proposed Scheme will intersect the topsoil (BminSW) deposits at the junction of St. Martin's Park and R817 Kimmage Road Lower, to the west of the Proposed Scheme along St. Martin's Drive and to the east of the Proposed Scheme underlying the estate at Kimmage Grove.

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	Widespread	Low	Poorly drained and / or low fertility soils
Topsoil - BminSW	Shallow well drained (Mainly basic)	Widespread	High	Well drained and / or high 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.

14.3.3.4.1 Kimmage Road Lower at Kimmage Cross Roads to the Junction with Harold's Cross Road

The subsoils map show that this subsection of the study area is predominantly underlain by till derived from limestone. There are bedrock outcrops or subcrops to the south of the start of the Proposed Scheme within the study area at the junction of The Orchard and Wainsfort Road and the other lies east of the junction of Sundrive Road and Toungefield Road in the north-west of the study area.

14.3.3.4.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

This subsection of the study area is predominantly underlain by till derived from limestone.

14.3.3.4.3 Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction

From the Grand Canal to the junction of R137 Clanbrassil Street Upper and R811 South Circular Road the study area is underlain by till derived from limestone. From the junction of R137 Clanbrassil Street Upper and R811 South Circular Road to the R137 New Street and R137 Patrick's Street Junction the subsoil under the footprint of the Proposed Scheme is classified as Urban, the surrounding study area is classified as till derived from limestone.

There are localised deposits of Gravels derived from Limestones at the R137 Patrick Street Junction underlying St. Patrick's Cathedral to the east of the Proposed Scheme and between R110 Dean Street and Carman's Hall to the west. These deposits are the Hummocky Sands and Gravels outlined in Section 14.3.3.1.1. There is also a linear alluvial deposit running north-south adjacent to and under R137 New Street and R137 Patrick Street.

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	Low	Low value on a local scale
Glacial gravels - GLs	Gravels derived from limestones	St. Patricks Street	Low	Low value on a local scale
Glacial till - TLs	Till derived from limestones	Widespread	Low	Low value on a local scale
Rock - Rck	Bedrock outcrop or subcrop	Wainsfort Road, Kimmage Cross Roads and east of Sundrive Road	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.

The bedrock encountered within the study area for the Proposed Scheme comprises the Lucan Formation (locally known as Calp Limestone). Bedrock outcrops or subcrops in a number of discrete locations as follows:

- St. Martin's Park;
- St. Martin's Drive;
- Kimmage Grove; and
- Bedford Court.

No major structural bedrock features were identified within 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

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) are presented in Table 14.19 to Table 14.21.

The data presented in the tables are 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 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 along the Kimmage Road Lower from Kimmage Cross Roads to the Junction with Harold's Cross Road Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green urban areas	0	0 to 0.5
Made Ground	Widespread along the Proposed Scheme	0 to 10.5	0.5 to 10.5
Alluvial Deposits	River channels	0.5 to 3	0 to 2
Glacial Till (Brown Boulder Clay)	Widespread along the Proposed Scheme	0.5 to 3	0.3 to 2.7
Glacial Till (Black Boulder Clay)	Widespread along the Proposed Scheme	0.8 to 7.7	0.5 to 5
Limestone Bedrock	Widespread along the Proposed Scheme	4.5 -14.5	Unknown

Table 14.20: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme along the Harold's Cross Road to Harold's Cross Park and to the Grand Canal Section

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Topsoil	Green areas – including parks, large estates, and golf courses	0	0 to 0.2
Made Ground	Widespread along the Proposed Scheme	0 to 0.2	1.3 to 3.7
Glacial Till (Brown Boulder Clay)	Widespread along the Proposed Scheme	1 to 3.9	0.3 to 0.9
Glacial Till (Black Boulder Clay)	Widespread along the Proposed Scheme	1.6 to 4.8	0 to 4.3
Limestone Bedrock	Widespread along the Proposed Scheme	3.6 to 9.2	Unknown

Table 14.21: Summary of Ground Conditions Expected to be Encountered by the Proposed Scheme along the Clanbrassil Street and New Street and from the Grand Canal to the Patrick Street Junction

Strata	General Extent / Location	Depth Range (mBGL)	Thickness Range (m)
Made Ground	Widespread along the Proposed Scheme	0 to 2.6	0.5 to 4.5
Alluvial Deposits	River channels	0.5 to 4.5	0.9 to 2.2
Sand and Gravel Deposits	Riverbed Channels and within till deposits	3.4 to 15	1 to 4
Glacial Till (Brown Boulder Clay)	Widespread along the Proposed Scheme	1.4 to 6.7	0.5 to 4
Glacial Till (Black Boulder Clay)	Widespread along the Proposed Scheme	2.4 to 11	1 to 4.3
Limestone Bedrock	Widespread along the Proposed Scheme	4.6 to 11.4	Unknown

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 14.22 along with their importance as determined by Box 4.1 of the NRA Guidelines (NRA 2008a).

Table 14.22: Soft Soils Within the Study Area

Feature	Description	Location	Importance	Justification for Importance Rating
Alluvium – A (subsoils)	Typically found along current and historic watercourses	R137 New Street and R137 Patrick Street	Low	Volume of soft soil underlying the route 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 14.23 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 carried out by GII at depths ranging from 0.5 to 4.0m BGL.

The main findings of the soil analysis carried out along the Proposed Scheme are as follows (and summarised in Table 14.23):

- Asbestos was detected in one of the recorded results during the scheme specific GI; fiber bundles of Chrysolite which were deemed non-hazardous.
- Elevated concentrations of pH were recorded in the samples described as requiring disposal to hazardous licensed landfill.

Table 14.23: Summary of Potential Sources of Contaminated Land Adjacent to the Proposed Scheme

Feature	Description	Location	Importance	Justification for Importance Rating
Quarries	The OSI mapping shows a number of significant quarries that have now being	St. Martin's Park, Kimmage	Medium	Degree or extent of soil contamination is moderate on a local scale

Feature	Description	Location	Importance	Justification for Importance Rating
	backfilled. The quarries did not straddle Kimmage Road Lower.	Grove, Whelan Park, Sundrive Road		
Petrol Stations and associated industries	During the walkover it was noted that there are a number of potentially polluting industries in this area such as petrol stations and car mechanics	Between Aideen Avenue and Kimmage Grove	Medium	Degree or extent of soil contamination is moderate on a local scale
Paper Mill	The OSI 6-inch mapping shows a paper mill at this location.	East of Mount Argus Park	Medium	Degree or extent of soil contamination is moderate on a local scale
Oil Works	The OSI 6-inch Cassini mapping shows a site labelled “Oil Works”.	Between Greenmount Avenue and Parnell Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Gordon’s Fuel	During the walkover it was noted that there was a potentially polluting industry located to the west of Harold’s Cross Road immediately north of Grand Canal known as Gordon’s Fuels.	West of Harold’s Cross Road immediately north of Grand Canal	Medium	Degree or extent of soil contamination is moderate on a local scale
Underground cables	There is potentially a leaking underground cable running along the grand canal near Gordons Fuel which has potential to contaminate the surrounding ground as per the EPA Investigation into ESB Networks Fluid Filled Underground Electricity Cables (EPA 2020)	Along the grand canal near Gordons Fuel	Medium	Degree or extent of soil contamination is moderate on a local scale
Dispensary	The 6-inch OSI Mapping identifies a dispensary at Harold’s Cross Junction	Harold’s Cross Junction	Medium	Degree or extent of soil contamination is moderate on a local scale
Mount Jerome Cemetery	The Mount Jerome Cemetery is located Harold’s cross Junction, with the River Poodle flowing by its eastern boundary.	Harold’s Cross Junction	Medium	Degree or extent of soil contamination is moderate on a local scale
Distillery	The 6-inch OSI Mapping identifies a dispensary at New Street South.	New Street South	Medium	Degree or extent of soil contamination is moderate on a local scale
Graveyard	The 6-inch OSI Mapping identifies a dispensary at Long Lane.	Long Lane	Medium	Degree or extent of soil contamination is moderate on a local scale
Chemical Works	The 6-inch OSI Mapping identifies a dispensary at Blackpitts.	Blackpitts	Medium	Degree or extent of soil contamination is moderate on a local scale
Meath hospital.	The 6-inch, 25-inch and 6-inch Cassini OSI Mapping identifies the Meath Hospital at Long Lane.	Meath Hospital at Long lane	Medium	Degree or extent of soil contamination is moderate on a local scale
Lime Works	The 25-inch OSI Mapping identifies the lime works at New Street.	New Street	Medium	Degree or extent of soil contamination is moderate on a local scale
Tannery	The 25-inch OSI Mapping identifies the Tannery at New Row.	Tannery at New Row	Medium	Degree or extent of soil contamination is moderate on a local scale
Contaminated soils from recent Site Investigations	Asbestos and exceedances of PAH were found in CP03 near the Stoneboat Bridge above the inert waste levels.	Stoneboat Bridge	Medium	Degree or extent of soil contamination is moderate on a local scale

Feature	Description	Location	Importance	Justification for Importance Rating
Contaminated soils from recent Site Investigations	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of pH.	Sundrive Rd (R11-CP03)	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 14.24.

Table 14.24: Summary List of EPA Licensed Facilities Within the Study Area

Name	Description	Location	Importance	Justification for Importance Rating
Leo Laboratories Limited	IPPC – surrendered	285 Cashel Road, Crumlin	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 two non-metallic mineral locations within the study area.

14.3.3.10.1 Kimmage Road Lower from Kimmage Cross Roads to the Junction with Harold's Cross Road

The crushed rock aggregate potential along this subsection is mainly underlain by rock with a moderate crushed rock aggregate potential. The Proposed Scheme corridor intersects rock with high and very high potential between the junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower. This includes the area with bedrock outcrop at the junction of R817 Kimmage Road Lower and St. Martin's Park. An area of low crushed rock aggregate potential is located at the start of the Proposed Scheme at the Kimmage Cross Roads.

There are no granular aggregate deposits along this subsection of the study area.

14.3.3.10.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

This subsection predominantly comprises of moderate aggregate potential with the exception of the junction of R137 Harold's Cross Road and Greenmount Avenue where there is a localised pocket of high to very high aggregate potential.

There are no granular aggregate deposits along this subsection of the study area.

14.3.3.10.3 Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction

The crushed rock aggregate potential along this subsection of the study area is underlain by moderate aggregate potential.

The GSI granular aggregate potential mapping suggests the Gravels derived from till (hummocky sands and gravels as described in Section 14.3.3.1.1) at the junction of R137 New Street and R137 Patrick Street and between R110 Dean Street and Carman's Hall to the west of the Proposed Scheme have moderate granular potential. The linear alluvial deposits at the junction of New Street and Patrick Street are recorded as having a very low granular aggregate potential.

A summary of the aggregate resources identified in the study area (refer to Figure 14.11 and Figure 14.12 in Volume 3 of this EIAR) are outlined in Table 14.25 along with their importance as determined by the Box 4.1 of the NRA Guidelines (NRA 2008a).

Table 14.25: GSI Aggregate Potential for the Study Area

GSI Aggregate Potential Type	Potential	Location	Importance	Justification for Importance Rating
Crushed rock aggregate potential	Low potential	Kimmage Cross Roads	Low	Uneconomically extractable mineral resource
Crushed rock aggregate potential	Moderate potential	Widespread	Medium	Sub-economic extractable mineral resource
Crushed rock aggregate potential	High potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	Medium	Extractable mineral resource
Crushed rock aggregate potential	Very high potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	High	Marginally extractable mineral resource
Granular aggregate potential	Very Low potential	Linear alluvial deposits at the junction of New Street and Patrick Street	Low	Uneconomically extractable mineral resource
Granular aggregate potential	Moderate potential	R137 New Street and R137 Patrick Street and between R110 Dean Street and Carman's Hall	Medium	Sub-economic extractable mineral resource

14.3.3.11 Geological Heritage Areas

The Geological Heritage Areas (GSI 2019c) within the study area are presented on Figure 14.10 in Volume 3 of this EIAR and detailed in Table 14.26 along with their importance as determined by the NRA Guidelines Box 4.1 (NRA 2008a).

Table 14.26: Geological Heritage Areas

Name (Code)	Description	Location	Importance	Justification for Importance Rating
River Poddle (DC011)	A river which flows northwards through Dublin city; most of its course is diverted underground	From Mount Argus to Wellington Quay	High	Geological feature of high value on a local scale (CGS)

14.3.3.12 Aquifer Type and Classification

The GSI Bedrock Aquifer mapping (GSI 2019b) for the study area (Figure 14.13 in Volume 3 of this EIAR) indicates that there is one aquifer type within the study area as summarised in Table 14.27 along with its importance as determined by Box 4.3 of the NRA Guidelines (NRA 2008a).

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

Table 14.27: 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

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 Kimmage Road Lower from Kimmage Cross Roads to the Junction with Harold's Cross Road

The GSI groundwater vulnerability mapping shows that groundwater vulnerability along this subsection of the study area ranges from low to extreme (X) rock at surface. Between the junction of Wainsfort Road and Wainsfort Drive and the Kimmage Cross Roads the vulnerability is classified as low. From the Kimmage Cross Roads to the R817 Kimmage Road Lower / Priory Road Junction the vulnerability grades from moderate to high with localised areas of extreme centred around rock subcrops or outcrops at the junction of R817 Kimmage Road Lower and St. Martin's Park. From the R817 Kimmage Road Lower / Priory Road Junction onwards the groundwater vulnerability is moderate.

14.3.3.13.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

The vulnerability along this subsection of the study area is predominantly composed of moderate groundwater vulnerability with the exception of the junction of Harold's Cross Road and Greenmount Avenue where there is a localised area of high to extreme groundwater vulnerability.

14.3.3.13.3 Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction

The groundwater vulnerability along this subsection of the study area is moderate.

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 with the exception of the following areas:

- The bedrock outcrops at the junction of R817 Kimmage Road Lower; and
- St. Martin's Park and the subcrop bedrock outcrop at the junction of The Orchard and Wainsfort Road.

The annual recharge at these locations is of 200mm. 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

The Grand Canal pNHA is identified within 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.

14.3.4 Summary of Features of Importance

The importance ranking of the features, based on Box 4.1 of the NRA Guidelines (NRA 2008), 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 14.28 for completeness. Features with an importance ranking of medium or higher are summarised in Table 14.29 and the impact of the Proposed Scheme on these features will be assessed in Section 14.4.

Table 14.28: 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
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	Along River Channels	Low	Low value on a local scale
Subsoils quality and significance	Glacial gravels - GLs	Gravels derived from limestones	St. Patricks Street	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
Subsoils quality and significance	Rock - Rck	Bedrock outcrop or subcrop	Wainsfort Road, Kimmage Cross Roads and east of Sundrive Road	Low	Low value on a local scale
Bedrock quality and significance	Lucan	(Calp) Dark Limestone and shale - Carboniferous	Widespread	Low	Low value on a local scale
Soft Soils	Alluvium - AlluvMIN (soils) / A (subsoils)	Typically found along current and historic watercourses	Typically found along current and historic watercourses	Low	Volume of soft soil underlying the route is small and of a local scale.
Economic Geology	Crushed Rock aggregate potential	Low potential	Kimmage Crossroads	Low	Uneconomically extractable mineral resource
Economic Geology	Granular aggregate potential	Very Low potential	Linear alluvial deposits at the junction of New Street and Patrick Street	Low	Uneconomically extractable mineral resource

Table 14.29: 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)	Widespread	High	Well drained and / or high fertility soils
Economic Geology	Crushed rock aggregate potential	Moderate potential	Widespread	Medium	Sub-economic extractable mineral resource
Economic Geology	Crushed rock aggregate potential	High potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	Medium	Extractable mineral resource
Economic Geology	Crushed rock aggregate potential	Very High potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	High	Marginally extractable mineral resource
Economic Geology	Granular aggregate potential	Moderate potential	R137 New Street and R137 Patrick Street and between R110 Dean Street and Carman's Hall	Medium	Sub-economic extractable mineral resource

Category	Feature	Description	Location	Importance	Justification
Aquifer	Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Locally important aquifer which supplies the local area
County geological site	River Poddle (DC011)	A river which flows northwards through Dublin city; most of its course is diverted underground	From Mount Argus to Wellington Quay	High	Geological feature of high value on a local scale (County Geological Site)
Potential Sources of Contamination	Quarries	The OSI mapping shows a number of significant quarries that have now being backfilled. The quarries did not straddle Kimmage Road Lower.	St Martins Park, Kimmage Grove, Whelan Park, Sundrive Road	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Petrol Stations and associated industries	During the walkover it was noted that there are a number of potentially polluting industries in this area such as petrol stations and car mechanics	Between Aideen Avenue and Kimmage Grove	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Paper Mill east of Mount Argus Park	The OSI 6-inch mapping shows a paper mill at this location.	East of Mount Argus Park	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	“Oil Works” between Greenmount Avenue and Parnell Road.	The OSI 6-inch Cassini mapping shows a site labelled “Oil Works”.	Between Greenmount Avenue and Parnell Road.	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Gordons Fuel	During the walkover it was noted that there was a potentially polluting industry	To the west of Harold’s Cross Road immediately north of Grand Canal known as Gordon’s Fuels	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Underground cable	There is potentially a leaking underground cable running along the grand canal near Gordons Fuel which has potential to contaminate the surrounding ground as per the EPA Investigation into ESB Networks Fluid Filled Underground Electricity Cables 2020 (EPA 2020)	Gordons Fuel	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Dispensary	The 6-inch OSI Mapping identifies a dispensary at Harold’s Cross Junction	Harold’s Cross Junction	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Mount Jerome Cemetery	The Mount Jerome Cemetery is located Harold’s cross Junction, with the River Poodle flowing by its eastern boundary.	Harold’s Cross Junction	Medium	Degree or extent of soil contamination is moderate on a local scale

Category	Feature	Description	Location	Importance	Justification
Potential Sources of Contamination	Distillery	The 6-inch OSI Mapping identifies a distillery at New Street South.	New Street South	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Graveyard	The 6-inch OSI Mapping identifies a graveyard at Long Lane.	Long Lane	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Chemical Works	The 6-inch OSI Mapping identifies a chemical works at Blackpitts.	Blackpitts	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Meath hospital.	The 6-inch, 25-inch and 6-inch Cassini OSI Mapping identifies the Meath Hospital at Long Lane.	Long Lane	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Lime Works	The 25-inch OSI Mapping identifies the lime works at New Street.	New Street	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Tannery	The 25-inch OSI Mapping identifies the Tannery at New Row.	New Row	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Contaminated soils from recent Site Investigations	Asbestos and exceedances of PAH were found in CP03 above the inert waste levels.	Stoneboat Bridge	Medium	Degree or extent of soil contamination is moderate on a local scale
Potential Sources of Contamination	Contaminated soils from recent Site Investigations	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of pH.	Sundrive Rd (R11-CP03)	Medium	Degree or extent of soil contamination is moderate on a local scale.
Licensed Facilities	Leo Laboratories Limited	IPPC – surrendered: 285 Cashel Road, Crumlin	Crumlin	Medium	Light industrial usage

14.3.5 Conceptual Site Model

A tabulated CSM was developed based on all publicly available data along with scheme specific data that as provided.

The Proposed Scheme corridor is predominantly underlain by made ground over alluvium over glacial till over limestone bedrock. The relevant subsections of the Proposed Scheme are presented in Table 14.30 to Table 14.32 along with the fill height (average and maximum), cut height (average and maximum) and the soils and geology at each earthwork areas.

Table 14.30: Conceptual Site Model - Kimmage Road Lower at Kimmage Cross Roads to the Junction with Harold's Cross 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			
Kimmage Cross Roads to Ravensdale Park	260	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	
Kimmage Cross Roads to Ravensdale Park- Stone Boat Boardwalk at Mount Argus	40	Structure	No Cut / Fill due to existence of structure				The project specific GI indicates made ground deposits up to 3.5mbgl overlying glacial till. Limestone bedrock was encountered at 4.4mbgl.	0.5	The structure will be approximately 40m long and 4m wide and independently supported by 13 bored piles
Lower Kimmage Road - Ravensdale Park / Sundrive / Harold's Cross	1,200	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	

Table 14.31: Conceptual Site Model - Harold's Cross Road from Harold's Cross Park to the Grand Canal

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Harold's Cross	760	At Grade	0	0	0.5	0.5	Road pavement and foundation on boulder clay	0.5	

Table 14.32: Conceptual Site Model - Clanbrassil Street and New Street from the Grand Canal to the Patrick Street 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			
Grand Canal Bridge / Upper Clanbrassil Street Ramp	90	At Grade	0	0	0	0	Road pavement and foundation on fill of boulder clay	0.5	
Clanbrassil Street Upper / Lower and New Street South	960	At Grade	0	0	0	0	Road pavement and foundation on boulder clay	0.5	
Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction- Cycle / Pedestrian Bridge to West of Robert Emmet Bridge	24	Structure	No Cut / Fill due to existence of structure				The project specific GI indicates made ground deposits up to 3.7mbgl overlying glacial till. Limestone bedrock was encountered at 8.90mbgl.	0.5	The footbridge will be approximately 24m long and 6m wide. The structure will be independently support by two piers atop single bored piles. The cycle / pedestrian bridge will over span the piers to concrete abutments.

Subsection	Length (m)	Dominant Earthworks Type	Cut (m)		Fill (m)		Ground Conditions	Average Thickness of Made Ground (m)	Additional Notes
			Max	Avg	Max	Avg			
Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction- Pedestrian Bridge to East of Robert Emmet Bridge	25	Structure	No Cut / Fill due to existence of structure				The project specific GI indicates made ground deposits up to 3.7mbgl overlying glacial till. Limestone bedrock was encountered at 8.90mbgl.	0.5	The footbridge will be approximately 25m long and 3.5m wide. The structure will be independently supported by two piers atop single bored piles. The footbridge will over span the piers to concrete abutments.
Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction- Retaining wall on northern approach to Robert Emmet Bridge	58	Structure	No Cut / Fill due to existence of structure				The project specific GI indicates made ground deposits up to 3.7mbgl overlying glacial till. Limestone bedrock was encountered at 8.90mbgl.	0.5	The retaining wall will be approximately 58m long and up to 3.5m high.
Clanbrassil Street and New Street from the Grand Canal to the Patrick Street Junction- Ramp on eastern Approach to Robert Emmet Bridge	50	Structure	No Cut / Fill due to existence of structure				The project specific GI indicates made ground deposits up to 3.7mbgl overlying glacial till. Limestone bedrock was encountered at 8.90mbgl.	0.5	Existing ramp at the edge of the road will be widened by a cantilever over the existing retaining wall to accommodate a 2m wide footpath. It will also be lengthened a little to approximately 20m long to provide a suitable gradient and to fit with the levels of the proposed eastern footbridge over the canal. Very limited new foundations will be required as the existing wall foundations can support most of the ramp cantilever.

14.3.5.1 Environment Type

The environment across the study area has been categorised in accordance with the IGI Guidelines (IGI 2013). 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 is 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 Scheme 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 CEMP in Volume 4 of this EIAR.

14.4.1.1 Kimmage Road Lower at Kimmage Cross Roads to the Junction with Harold's Cross Road

- Installation of cycle tracks on the eastern and western side of Kimmage Road Lower for typically 60m.
- At Corrib Road, Ravensdale Park a 2m wide median island is to be installed for 200m, with 40 trees introduced. Sewer diversions will be required to allow for a 2m deep trench in the middle of the road, for tree roots.
- A parallel cycleway will be developed to the west, requiring a new boardwalk structure over the River Poddle. The 40m long Stone Boat Boardwalk at Mount Argus View will be supported by 13 bored piles installed in the riverbank.
- A number of construction activities are planned along 80m of Harold's Cross Park South. The footpath will be removed on the northern / park side of the road, with granite kerbs to be reused in 0.5m wide rubbing strips. The road will be widened by 1m to enable two-way traffic, with on-street parking on the southern side of the road. Signal controls will also be provided at the eastern side of the junction.

Construction Compound K1 will be constructed in the public car park between Sundrive Road and Mount Argus Way.

14.4.1.2 Harold's Cross Road from Harold's Cross Park to the Grand Canal

Works that will occur along the Proposed Scheme at R137 Harold's Cross Road relevant to the land, soils, geology and hydrogeology include:

- Road widening by up to 2m with encroachment into a forecourt area at one apartment building, at 15 private gardens and at one office building with new boundary walls and various accommodation works;
- Full pavement reconstruction, demolition of old concrete road pavement and footpaths;
- New surface water sewers and gullies;
- Provision for new water mains and additional utility ducts; and
- Car park with 22 spaces on an open lawn area at the front of Our Lady's Hospice.

Construction Compound K2 will be located in a green area at the entrance to the grounds of Our Lady's Hospice off the western side of R137 Harold's Cross Road.

14.4.1.3 Clanbrassil Street and New Street South from the Grand Canal to the Patrick Street Junction

Works occurring along the Proposed Scheme near Robert Emmet Bridge / R137 Clanbrassil Street Upper relevant to the land, soils, geology and hydrogeology include:

- Offline cycle / pedestrian bridges will be installed on each side of the existing Robert Emmet Bridge, supported by four new piled foundations;
- The road will be widened by 2m on fill and a retaining wall up to 3.5m high will be constructed on a spread footing foundation on the west side of the road. The existing bungalow to the west of the road will be demolished and the access to Gordon's Fuels / Waterways Ireland lands will be realigned through what is now the bungalow. Structural fill will be required to allow for road widening. Full pavement reconstruction is expected over the full road width; and
- Minor works along the road carriageway edges to provide cycle tracks along Clanbrassil Street Lower and New Street South.

Construction Compound K3 will be located on a small public open space at St. Patrick's Court west of R137 Clanbrassil Street Lower, opposite Lombard Street West.

14.4.1.4 Operational Phase

The impact assessment for the Operational Phase has been outlined in terms of impact analysis of the Proposed Scheme on the local environment from a land, soils, geology and hydrogeology perspective. This is outlined 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 14.4.1 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.

The Proposed Scheme will have the following potential impacts on land, soils, geology and hydrogeology as discussed below and summarised in Table 14.33:

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

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 considered.

14.4.3.1 Loss and Damage of Topsoil

Topsoil is a non-renewable resource which if removed or damaged can result in a permanent irreversible negative impact. There are a number of ways this could happen:

- 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 the Construction Phase;
- 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 (including piling) in areas of contaminated ground during 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 a few 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. Topsoil will be encountered when establishing Construction Compound K2 at Our Lady's Hospice and at Construction Compound K3 at St. Patricks Court on R137 Clanbrassil Street. Topsoil will also be encountered for 120m along Harold's Cross Road where road widening by 2m will take place and where there will be an encroachment into 15 private gardens and at one office building.

The magnitude of these impacts of Proposed Scheme on the topsoil is small adverse as it will result in a permanent irreversible loss of a small proportion of local high fertility topsoil and / or a high proportion of locally low fertility topsoils within the study area.

As the topsoil is of medium importance, the resulting significance of this permanent small adverse impact will be Slight.

14.4.3.2 Excavation of Potentially Contaminated Land

The excavation of made ground results in the production of excess material that will require placement elsewhere in the Proposed Scheme or removal off site, and / or the mobilisation of possible contaminants. The entirety 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 EPA Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (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 14.23 and include historic quarries, petrol stations, a paper mill, oil works, underground cables and Gordon's Fuels.

The magnitude of this impact will be 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 will be Slight.

14.4.3.3 Loss of Future Quarry or Pit Reserve

The sterilisation of land through development, or the excavation of soil and rock during construction, can diminish future quarry and pit reserves, which have been shown to have been utilised in the past in the area, such as the historic quarries on R817 Kimmage Road Lower as seen from the OSI mapping. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils and geology area.

The magnitude of this impact will be negligible as it results in an insufficient permanent irreversible change on a local scale to affect the integrity of the land and soils as a potential future quarry or pit reserve above the Do Nothing scenario.

As the aggregate potential is of medium to high importance the resulting significance of this negligible impact will be Imperceptible and will not be considered further.

14.4.3.4 Loss or Damage of Proportion of Geological Heritage Area

The sealing, contamination or excavation of soil and rock during construction can affect the value of Geological Heritage Areas. This can result in a permanent irreversible loss of the in-situ characteristics of the land, soils, geology and hydrogeology of the area.

The River Poddle CGS comprises the route of the river which flows northwards through Dublin City and into the River Liffey. Most of its course has been diverted underground. According to the GSI, both the subsurface channelisation of most of the River Poddle, along with the lore surrounding its name contribute to its importance as a GHA. The Proposed Scheme will be developed in the vicinity of the River Poddle CGS and therefore there is a potential to encounter this feature during construction and potentially cause damage or loss during piling and/or excavation.

However, the magnitude of this impact is negligible as the Proposed Scheme will result in an insufficient permanent irreversible change on a local scale to affect the integrity of the CGS.

As the River Poddle CGS is of high importance the resulting significance of this negligible impact will be Imperceptible.

14.4.3.5 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 resource. 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 and though close to the surface in areas, there will be minimal excavation into the limestone rock as part of the Proposed Scheme. The magnitude of this impact will be negligible as it will result in no measurable change which may affect the integrity of the underlying aquifer. As the aquifer is a locally important aquifer of medium importance, the predicted resulting significance of this negligible impact is imperceptible and will not be discussed 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 runoff during construction. As the aquifer is a locally important aquifer of medium importance the resulting significance of this temporary moderate adverse impact is Moderate.

14.4.3.6 Change to Groundwater Regime

Localised pumping of excavations is expected to be required as part of the Construction Phase 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 will be Imperceptible and therefore will not be considered further

Table 14.33: Summary of Predicted Construction Phase Impacts

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Loss or Damage of Topsoil									
Topsoil	BminSW	Widespread	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Slight
Excavation of Potentially Contaminated Ground									
Potential Sources of Contamination	Quarries	St Martins Park, Kimmage Grove, Whelan Park, Sundrive Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Petrol Stations and associated industries –	between Aideen Avenue and Kimmage Grove	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Paper Mill –	East of Mount Argus Park	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	"Oil Works"	Between Greenmount Avenue and Parnell Road.	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Gordons Fuel	To the west of Harold's Cross Road immediately north of Grand Canal known as Gordon's Fuels	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Underground leaking Cable – near Gordons Fuel	Gordons Fuel	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Dispensary	Harold's Cross Junction	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Mount Jerome Cemetery	Harold's Cross Junction	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Distillery	New Street South	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Graveyard	Long Lane	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
Potential Sources of Contamination	Chemical Works	Blackpitts	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Meath hospital.	Long Lane	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Lime Works	New Street	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Tannery	New Row	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Asbestos and exceedances of PAH were found in CP03 near the Stoneboat Bridge above the inert waste levels.	Stoneboat Bridge	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Potential Sources of Contamination	Hazardous classed samples for Waste acceptance criteria along the Proposed Scheme for high levels of pH.	Sundrive Rd (R11-CP03)	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Licensed Facilities	Leo Laboratories Limited	Crumlin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight
Loss of Future Quarry or Pit Reserve									
Crushed rock aggregate	Moderate to high potential	Widespread with areas of high potential located at Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Crushed rock aggregate	Very high potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Magnitude	Significance
		Mount Argus View and R817 Kimmage Road Lower							
Granular aggregate	Moderate potential	R137 New Street and R137 Patrick Street and between R110 Dean Street and Carman's Hall	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible
Loss or Damage of Proportion of Geological Heritage Area									
River Poddle	County geological site (DC011)	From Mount Argus to Wellington Quay	High	Loss or damage of proportion of Geological Heritage Area	Negative	Permanent	Local	Negligible	Imperceptible
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

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 resources.

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 Operational Phases of the Proposed Scheme. A summary of the pre-mitigation and post-mitigation impacts is contained in Table 14.34.

14.5.1 Construction Phase

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 reuse 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 Road 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 will 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 Loss or Damage of Proportion of Geological Heritage Area

While unlikely, if the subsurface of the River Poddle is encountered by the appointed contractor during any of the works related to the Proposed Scheme, the appointed contractor in consultation with the NTA will provide the GSI with relevant construction information to supplement their existing CGS Report.

14.5.1.4 Pollution of Soil and Groundwater

Good construction management practices, as outlined in the Construction Industry Research and Information Association (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 these recommendations to minimise, as far as possible, the risk of soil, groundwater and surface water contamination.

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

- Employing only a 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 at the time of construction and will be fully bunded;
- Good housekeeping on-site (daily site clean-ups, use of disposal bins, etc.) will be applied during the entire Construction Phase;
- Potential pollutants will be adequately secured against vandalism in containers in a dedicated secured area;
- Potential pollutants will be properly contained, according to codes of best practice;
- Thorough control will be implemented during the entire Construction Phase to ensure that any spillage is identified at an early stage and subsequently effectively contained and managed; and
- Spill kits will be provided and will be kept close to the storage area and staff will be trained on how to use spill kits correctly.

An Environmental Incident Response 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.

Table 14.34: Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post- Mitigation Significance
Loss or Damage of Topsoil											
Topsoil	BminSW	Widespread	High	Loss or damage of topsoil	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Excavation of Potentially Contaminated Ground											
Potential Sources of Contamination	Quarries	St Martins Park, Kimmage Grove, Whelan Park, Sundrive Road	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Petrol Stations and associated industries –	between Aideen Avenue and Kimmage Grove	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Paper Mill –	East of Mount Argus Park	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	'Oil Works'	Between Greenmount Avenue and Parnell Road.	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Gordons Fuel	To the west of Harold's Cross Road immediately north of Grand Canal known as Gordon's Fuels	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Underground leaking Cable – near Gordons Fuel	Gordons Fuel	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Dispensary	Harold's Cross Junction	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Mount Jerome Cemetery	Harold's Cross Junction	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post- Mitigation Significance
Potential Sources of Contamination	Distillery	New Street South	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Graveyard	Long Lane	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Chemical Works	Blackpitts	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Meath hospital.	Long Lane	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Lime Works	New Street	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Tannery	New Row	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Potential Sources of Contamination	Ground Conditions from the R11 Ground Investigation. Asbestos and exceedances of PAH were found in CP03 above the inert waste levels.	near the Stoneboat Bridge	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Licensed Facilities	Leo Laboratories Limited	Crumlin	Medium	Excavation of potentially contaminated ground	Negative	Permanent	Local	Small adverse	Slight	Negligible	Imperceptible
Loss of Future Quarry or Pit Reserve											
Crushed rock aggregate	Moderate to high potential	Widespread with areas of high potential located at Junction of Ravensdale Park and R817 Kimmage Road	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post- Mitigation Significance
		Lower and the junction of Mount Argus View and R817 Kimmage Road Lower									
Crushed rock aggregate	Very high potential	Junction of Ravensdale Park and R817 Kimmage Road Lower and the junction of Mount Argus View and R817 Kimmage Road Lower	High	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Granular aggregate	Moderate potential	R137 New Street and R137 Patrick Street and between R110 Dean Street and Carman's Hall	Medium	Loss of future quarry or pit reserve	Negative	Permanent	Local	Negligible	Imperceptible	Negligible	Imperceptible
Loss or Damage of Proportion of Geological Heritage Area											
River Poddle	County geological site (DC011)	From Mount Argus to Wellington Quay	High	Loss or damage of proportion of Geological Heritage Area	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	Widespread	Medium	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	Widespread	Medium	Loss or damage of proportion of aquifer through pollution.	Negative	Temporary	Local	Moderate Adverse	Moderate	Small adverse	Slight
Change to Groundwater Regime											

Feature	Description	Location	Importance	Impact	Quality	Duration	Scale	Pre-Mitigation Magnitude	Pre- Mitigation Significance	Post-Mitigation Magnitude	Post- Mitigation Significance
Locally Important Aquifer (LI)	Bedrock which is moderately productive only in local zones	Widespread	Medium	Change to groundwater regime	Negative	Temporary	Local	Negligible	Imperceptible	Negligible	Imperceptible

14.5.2 Operational Phase

With the implementation of the proposed design, 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 to be taken in the event of any accidental spillages and this will reduce the potential for any impact.

14.6 Residual Impacts

14.6.1 Construction Phase

With the employment of the mitigation measures outlined in Section 14.5.1, it is considered that there will be no significant residual impacts on land, soils, geology and hydrogeology as a result of the construction of the Proposed Scheme.

14.6.2 Operational Phase

It is considered that there will be no significant residual impacts on land, soils, geology and hydrogeology as a result of the operation of the Proposed Scheme.

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).

14.7 References

Bing Maps (2019). Bing Maps. [Online] Available at: https://www.bing.com/maps/

DCENR (2019). Exploration and Mining Viewer. [Online] Available from spatial.dcenr.gov.ie/ExplorationAndMining/SpatialViewer/index.html

EPA (2008). Environmental Research Centre Report Series No. 12. A Framework for the Assessment of Groundwater-Dependent Terrestrial Ecosystems under the Water Framework Directive. Strive EPA Programme 2007 – 2013.

EPA (2011). Strive Report Series No. 100. Evaluating the Influence of Groundwater Pressures on Groundwater-Dependent Wetlands. Strive EPA Programme 2007 – 2013.

EPA (2013). Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites

EPA (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. May 2022.

EPA (2018). Corine Landcover 2018. [Online] Available from https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/fb5d2fa9-95fe-4d3f-8aed-e548348a40ea

EPA (2019). EPA Maps. [Online] Available from https://gis.epa.ie/EPAMaps/

GSI (2014). GSI Minerals Active Quarries Database. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Minerals/ActiveQuarries2014/FeatureServer

GSI (2016a). Quaternary geology of Ireland – Sediments Map. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Quaternary/QuaternarySediments16/MapServer

GSI (2016b). Aggregate Potential Mapping - GSI 2016 – Crushed Final Scores. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/APM/APM16_FinalScoresCrushedRockAggregate/MapServer

GSI (2016c). Aggregate Potential Mapping - Pits and Quarry Locations. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/APM/APM16_PitsAndQuarries/MapServer

GSI (2017). Landslide Events GSI 2017. [Online] Available from https://utility.arcgis.com/usrsvcs/servers/6e99fe8736394f389aaf1aac5a407132/rest/services/Landslides/LandslideEvents/FeatureServer

GSI (2018). GSI 100k Bedrock Map. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/Bedrock/Bedrock100k_Seamless_2018/MapServer

GSI (2019a) Geotechnical Viewer. [Online] Available from https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

GSI (2019b) Groundwater Viewer. [Online] Available from https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=bc0dba38f3f5477c8fd400f66b5eedcd

GSI (2019c) Geological Heritage. [Online] Available from https://www.gsi.ie/en-ie/data-and-maps/Pages/Geoheritage.aspx#Nationwide

GSI (2019d). GSI Mineral Localities. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/PublicViewer/MineralLocalities/FeatureServer

GSI (2019e). GSI Groundwater Level Data Viewer. [Online] Available from https://gwlevel.ie/

Google Maps (2019) Google Maps. [Online] Available from http://www.google.com/maps/

IGI (2013) Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environmental Impact Statements.

Masters-Williams H, Heap H, Kitts H, Greenshaw L, Davis S, Fisher P, Hendrie M and Owens D (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532D), CIRIA, London

NMS (2019). National Monuments Service - Archaeological Survey of Ireland. [Online] Available from https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland

NPWS (2020). Proposed / Designated NHA, SPA, SAC Sites. [Online] Available from http://webgis.npws.ie/npwsviewer/, accessed 2020

NRA (2008a). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

NRA (2008b). Environmental Impact Assessment of National Road Schemes – A Practical Guide.

OSI (2019). Current and historical Ordnance Survey maps and aerial photography available for the study area. [Online] Available from http://map.geohive.ie/mapviewer.html

Teagasc, Agency, E. P. and Ireland, G. S. (2017). Teagasc Soils Data - Surface Soils Classification and Description. [Online] Available from https://secure.dccae.gov.ie/arcgis/rest/services/THIRD_PARTY/TeagascSoils/MapServer

TII (2013) Specification for Road Works Series 600 - Earthworks (including Erratum No. 1, dated June 2013) CC-SPW-00600

Directives and Legislation.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration

S.I. No. 122/2014 - European Union (Drinking Water) Regulations 2014

S.I. No. 149/2012 - European Communities Environmental Objectives (Groundwater) (Amendment) Regulations 2012

S.I. No. 219/2008 - European Communities (Water Policy) (Amendment) Regulations 2008

S.I. No. 261/2018 - European Union (Water Policy) (Abstractions Registration) Regulations 2018

S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009

S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations 1988

S.I. No. 327/2012 - European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2012

S.I. No. 350/2014 - European Union (Water Policy) Regulations 2014

S.I. No. 366/2016 - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016

S.I. No. 386/2015 European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015

S.I. No. 389/2011 - European Communities Environmental Objectives (Groundwater) (Amendment) Regulations 2011

S.I. No. 413/2005 - European Communities (Water Policy) (Amendment) Regulations 2005

S.I. No. 464/2017 - European Union (Drinking Water) (Amendment) Regulations 2017

S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003

S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010

S.I. No. 93/2010 - European Communities (Water Policy) (Amendment) Regulations 2010

Water Services Acts (2007 to 2017)