Chapter 8:

Land and Soils

8.0 LAND AND SOILS

8.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) document comprises an assessment of the likely effects on land and soils of the proposed construction of a residential development at Glencairn, Murphystown Way, Dublin 18, during the demolition, construction and operational phases of the proposed development. It will also identify the characteristics, predicted impact and mitigation measures arising from the different phases. This chapter was prepared by John Keogh BEng CEng CIEI DipBS PMP, Associate Director (Civils) DBFL Consulting Engineers.

The application site is located adjacent to Glencairn House. The proposed development seeks to demolish an existing house and outbuildings on site and provide for the construction of 341 no. residential units, a childcare facility, open space and all associated site and infrastructural works on a site of c. 9.59 hectares.

The associated site and infrastructural works include foul and surface water drainage, internal roads and footpaths, car parking spaces and bicycle spaces, public open space, landscaping, street lighting, walls and fences. The proposal includes for access to and improvements to the greenway to the south, to Murphystown Way to the west and connections to existing services adjacent to the application site.

The proposal seeks to relocate the entrance portal, i.e. the archway and gates, from the existing location at the entrance to the site, to a new location within the site in closer proximity to the permitted new entrance to Glencairn House (new entrance and boundary to Glencairn House permitted under Reg. Reg.: D17A/0913).

8.2 STUDY METHODOLOGY

Information on land and soils for the subject lands was assembled from the following sources:

- Site Investigation Reports;
- Geological Survey of Ireland (GSI) maps;
- Environmental Protection Agency (EPA) maps.
- Hydrogeological Report (By Bluerock Environmental)

A site investigation of the lands was carried out by IGSL Ltd in June 2017. The site investigations comprised 8 no. rotary core boreholes, 8 no. dynamic probes, 8 no. trial pits (with infiltration tests in 3 pits) and a Geophysical Survey, the results of which were described in an interpretive report. The bedrock Geology Map produced by the Geological Survey of Ireland (GSI) was also consulted.

The IGSL Site Investigation Report dated August 2017 is included under separate cover as part of DBFL Consulting Engineers package of information with this application. A plan showing the locations of investigations is included as an appendix to the report.

In addition, a technical report entitled: ‘Glencairn Housing Development Phase 1 Hydrogeological Site Assessment’ was completed by Blue Rock Environmental in August 2018. This hydrogeological assessment was carried out in order to gain a conceptual understanding of groundwater levels and groundwater flow across the site, making reference to the proposed drainage infrastructure and nearby surface water bodies.

The hydrogeological report is included under separate cover as part of DBFL Consulting Engineers package of information with this application.

The assessment of the potential impact of the proposed development on the land and soils was carried out according to the methodology specified by the EPA and the specific criteria set out in the Guidelines on Information to be Contained in an Environmental Impact Statement (EPA 2002 and 2017 (Draft)), EIA Directive 2014/EU/52, Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA 2003), EPA Draft EIAR Guidelines 2017, Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003), Development Management Guidelines (DoEHLG, 2007) and Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment August 2018.

8.3 THE EXISTING RECEIVING ENVIRONMENT

The site is bordered to the north by the existing M50 Motorway and to the west by Murphystown Way. On the western border is the Green-line LUAS tracks with existing residential development located to the east and further south. Located on the southern boundary of the site is the existing Glencairn House (UK Ambassador's Residence) whose future boundary wall with the application site is the subject of a separate approved planning permission D17A/0913.

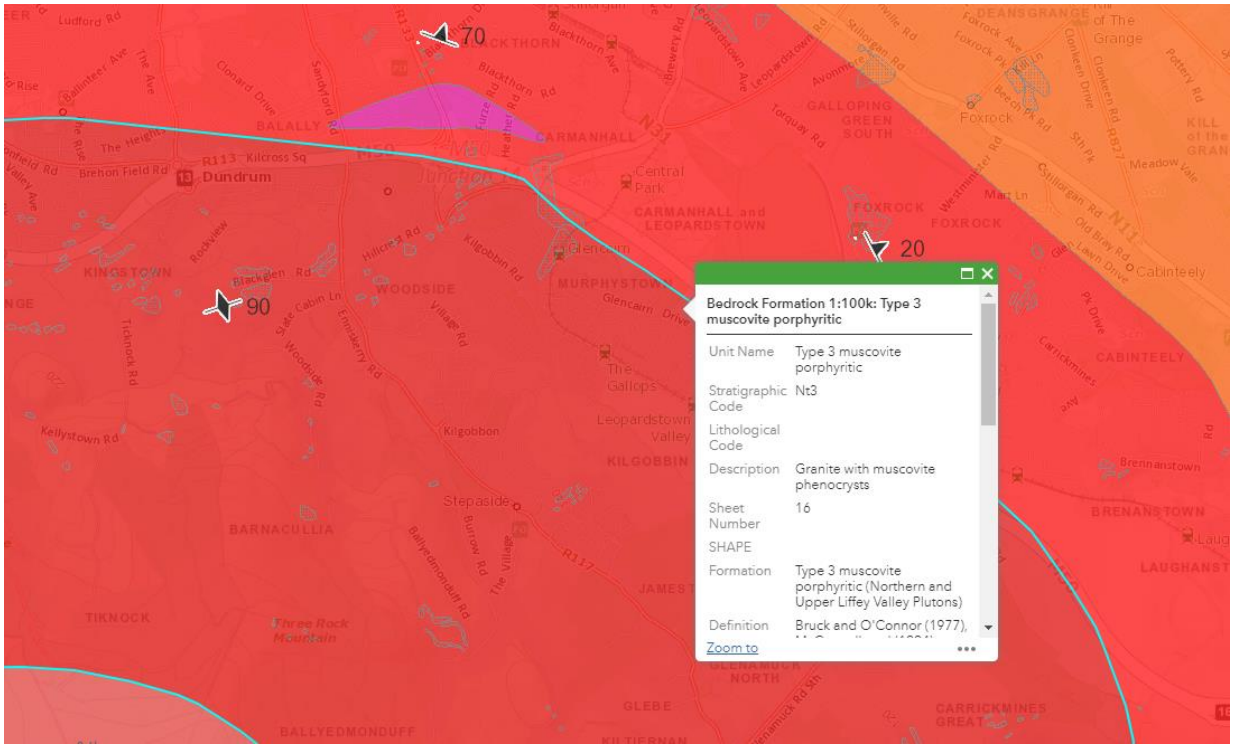
The site slopes at an approximate gradient of 1 in 20 from south-west to north-east towards the M50, near the edge of the M50 is a steep wooded escarpment with an existing open pond/wetland at is base. There are no overhead electrical power lines running through the site.

The existing ground consists of topsoil (with some areas of made ground) varying from 0.1m to 0.4m deep. From the observed boreholes and trial pits, the subsoil can be described as soft to firm brown gravelly clay to approximately 1m below ground. From 1m to 2m deep lies a layer of well graded sandy slightly clayey gravel granite. Solid granite bedrock was determined at an average depth of 2.0m, deepening to 3.0m in isolated areas. No groundwater was observed during the site investigation.

8.3.1 Bedrock Geology

The bedrock geology of this area is of the Siluro-Devonian granitic rocks & appinite unit with a small section of the site adjacent to the LUAS tracks in the Type 3 muscovite porphyritic unit area. The bedrock is identified as granite with muscovite phenocrysts. Refer to Figure 8.1 below. Shallow or exposed bedrock is located immediately to the west and northwest of the site with some rock exposures or shallow rock present along the northern boundary of the site likely associated with the escarpment. It is noted that shallow bedrock was encountered at depths between 0.9m and 2.0m below ground during the recent site investigations across the site.

Figure 8.1: Bedrock Mapping of Area by GSI



8.3.2 Subsoil (Quaternary) Geology

The quaternary period is the most recent stage of the geological time period. It marks the period of the Ice Age and the postglacial period which extends to the present day. Most surface deposits were deposited in the Quaternary Period and provide the parent materials for the soils in the area.

Most sediments of the Quaternary period were deposited during the Ice Age itself either directly from the huge ice sheets or by meltwater from the sheets as they melted. Ice sheets would have slowly eroded the underlying bedrock producing sediment. This sediment may include particles of all sizes ranging from clay to boulder and which when spread over the surface by glacial ice, takes the form of till (boulder clay). Alternatively, sediment may be carried and sorted by meltwater and deposited as sand and gravel, with silt and clay deposited separately in lake systems or carried away to the sea. Glacial deposits therefore contain fragments of the type of bedrock over which the ice originally passed.

The Site Investigations reports indicate topsoil generally overlays firm sandy slightly clayey gravel granite terminating on solid granite. No groundwater was observed during trial pitting operations.

8.3.3 Soils

The GSI soils map indicates the predominant soil type in the development area to be Till derived from granites with a small section of the site adjacent to the LUAS tracks being defined as Bedrock outcrop or subcrop.

An extract from the GSI soils map relevant to Murphystown Road is detailed in Figure 8.2 below.

Site investigation information indicates that the subsoil material generally comprises firm sandy slightly clayey gravel granite overlaying granite bedrock.

Teagasc soil maps classify soils beneath the majority of the site as Urban.

Figure 8.2: Extract from GSI Quarternary Mapping - Bedrock Outcrop

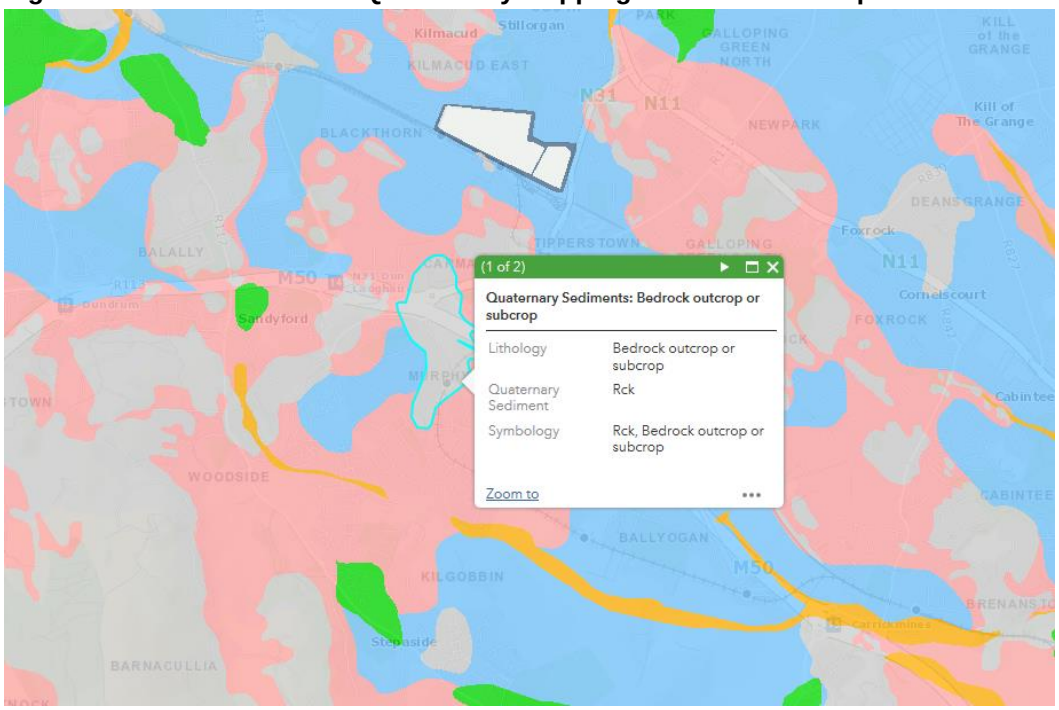
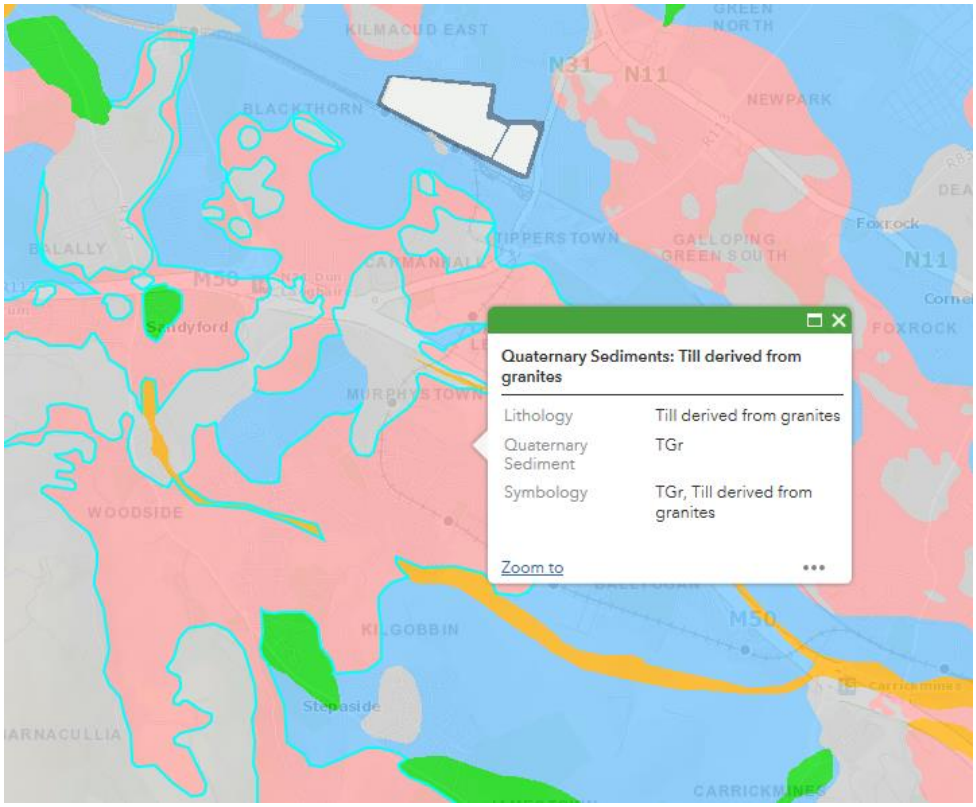


Figure 8.3: Extract from GSI Quarternary Mapping - Till derived from granites



8.3.4 Hydrogeology

The design team has engaged with a hydrogeologist and a detailed hydrogeological assessment (provided under separate cover) has been undertaken to inform and supplement the design. The recommendations of the hydrogeologist have been incorporated into the surface water design.

Regional Hydrogeology

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub soils. Aquifers are rocks or deposits that contain sufficient void spaces and which are permeable enough to allow water to flow through them in significant quantities. The potential of the rock to store and transport water is governed by permeability, of which there are two types, intergranular and fissure permeability.

Intergranular permeability is found in sediments, sands, gravels and clays. Fissure permeability is found in bedrock, where water moves through (and in stored in) cracks, fissures, planes and solution openings.

When considering groundwater, it is important to consider the underlying geology, its complexity including faults, the large amounts of water and rainfall available for recharge and the overlying Quarternary deposits. The bedrock geology of this area is defined as granite with muscovite porphyritic. The bedrock mapping for the area as defined in the GSI is included as Figure 8.1 above.

The Geological Survey of Ireland has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers, Locally Important Aquifers and Poor Aquifers.

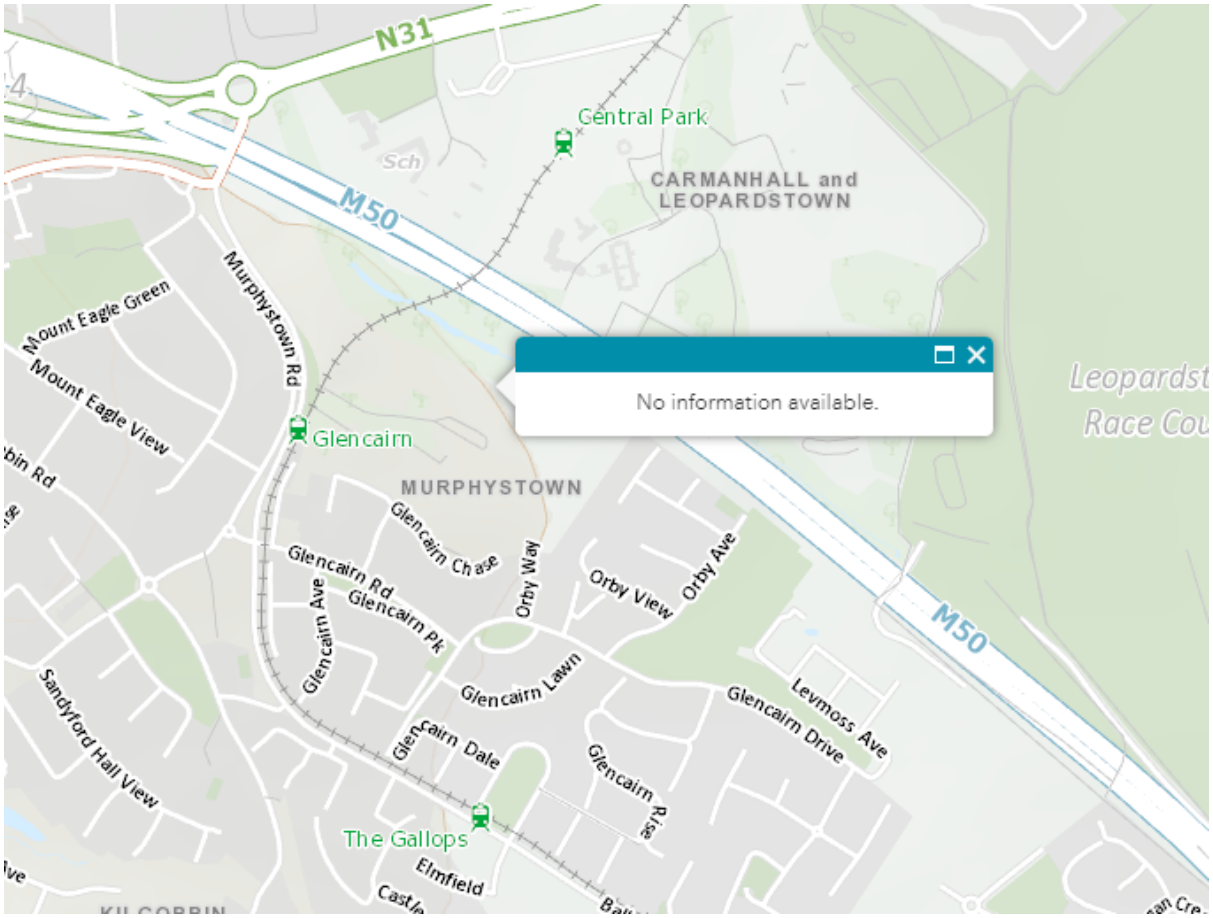
The bedrock underlying the study area is classified by the GSI as a Poor Aquifer which is generally unproductive except for local zones and the site consists primarily of Till (TLs) with no karst features in this area.

There are no groundwater wells or springs recorded on the GSI Groundwater Data Viewer mapping on or near the site. Granites with this aquifer classification typically exhibit low storativity.

A site investigation was carried out on in 2017 in order to assess the soil infiltration rates. The assessment of soil infiltration was undertaken by excavating trial pits based on the requirements of BRE Digest 365 and CIRIA SuDS Manual C753. The FSR (Winter Rain Acceptance) SOIL value determined was used to calculate the pre-development characteristics of the in-situ soil and the corresponding greenfield run-off of the site.

The results of these tests are included in the Site Investigation Report and further detail on the methodology used is included within the DBFL Engineering Services Report Appendices.

Figure 8.4: Extract from GSI Groundwater Data Viewer showing groundwater wells and springs

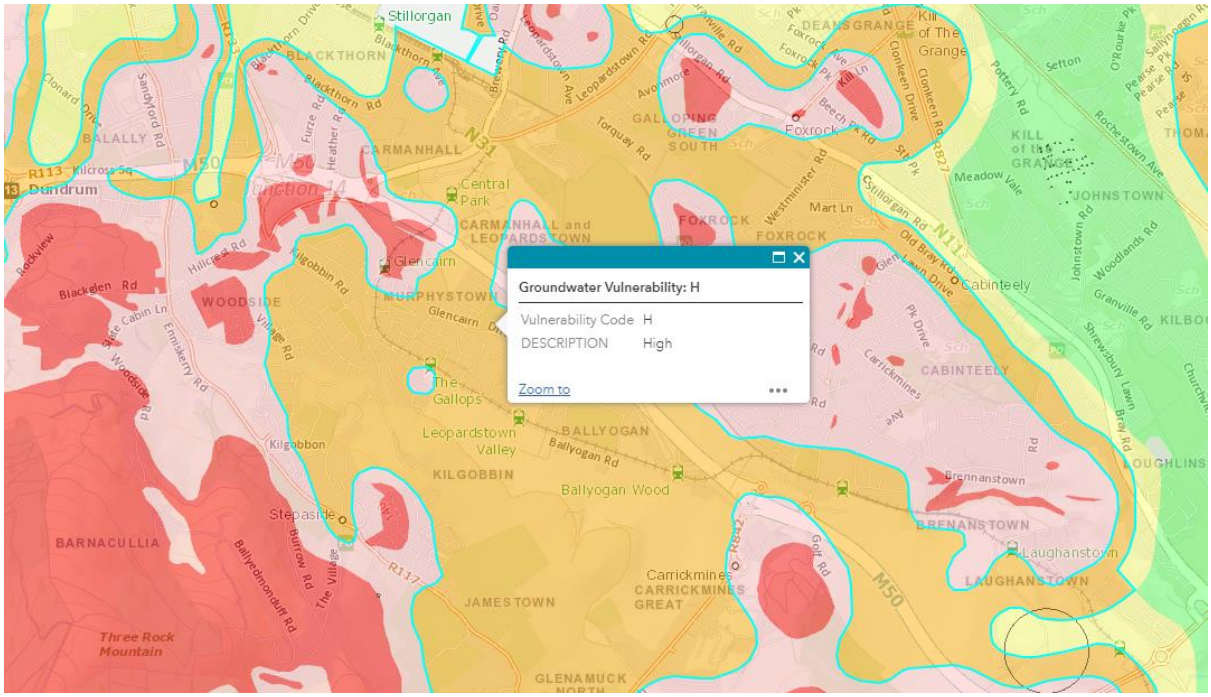


Groundwater vulnerability

Aquifer or groundwater vulnerability is a relative measure of the ease with which the groundwater could be contaminated by human activity and depends on the aquifer's intrinsic geological and hydrogeological characteristics. The vulnerability is determined by the permeability of any overlying deposits. For example, bedrock with a thick, low permeability, clay-rich overburden is less vulnerable than bedrock with a thin, high permeability, gravelly overburden.

Groundwater vulnerability categories are defined by the GSI as – Extreme rock at or near surface or karst (X), Extreme (E), High (H), Moderate (M) and Low (L) for mapping purposes and in the assessment of risk to ground waters. The classifications are based on the thickness and permeability of the sub-soils overlying the aquifer. The GSI has classified the aquifer vulnerability underlying the site as H (high) which infers groundwater or bedrock is present within 3 to 5m of the surface). A small section of the site adjacent to the existing LUAS tracks is has extreme vulnerability (E) with another small section in this area defined as Extreme rock at or near surface or karst (X).

Figure 8.5: Extract from GSI Groundwater Vulnerability Mapping

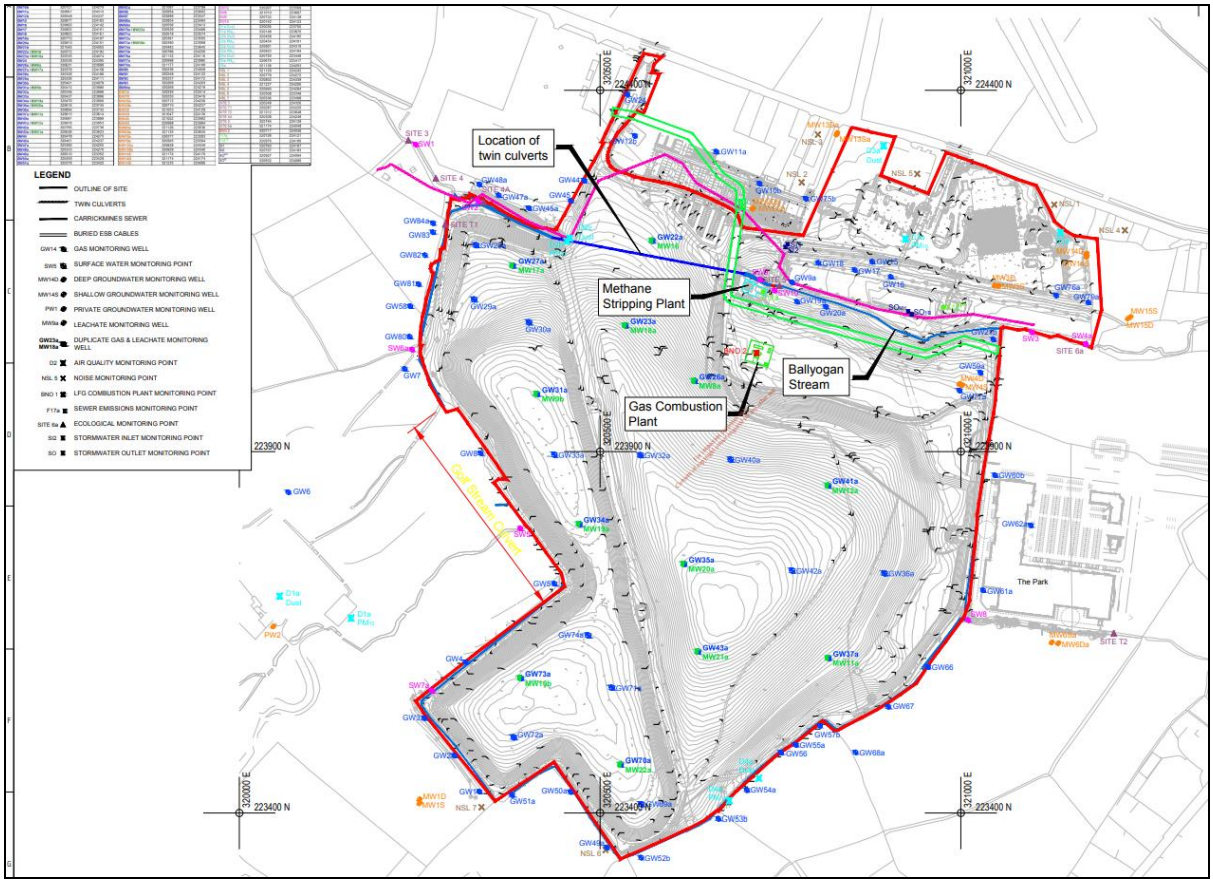


Local groundwater usage and source protection area

The GSI online map does not identify any significant or notable abstraction wells within the vicinity of the proposed development. No groundwater protection zones are marked in proximity to the site.

The Carrickmines landfill facility located 1.8 km southeast of the site has an extensive monitoring well network which is used to assess groundwater quality in the vicinity of the landfill. A review of the annual environmental report for this site indicates that the Stepaside golf course, which is located c. 1.7km from the site, has a groundwater supply well (PW1). No information on depth to groundwater or yield was on record for this installation.

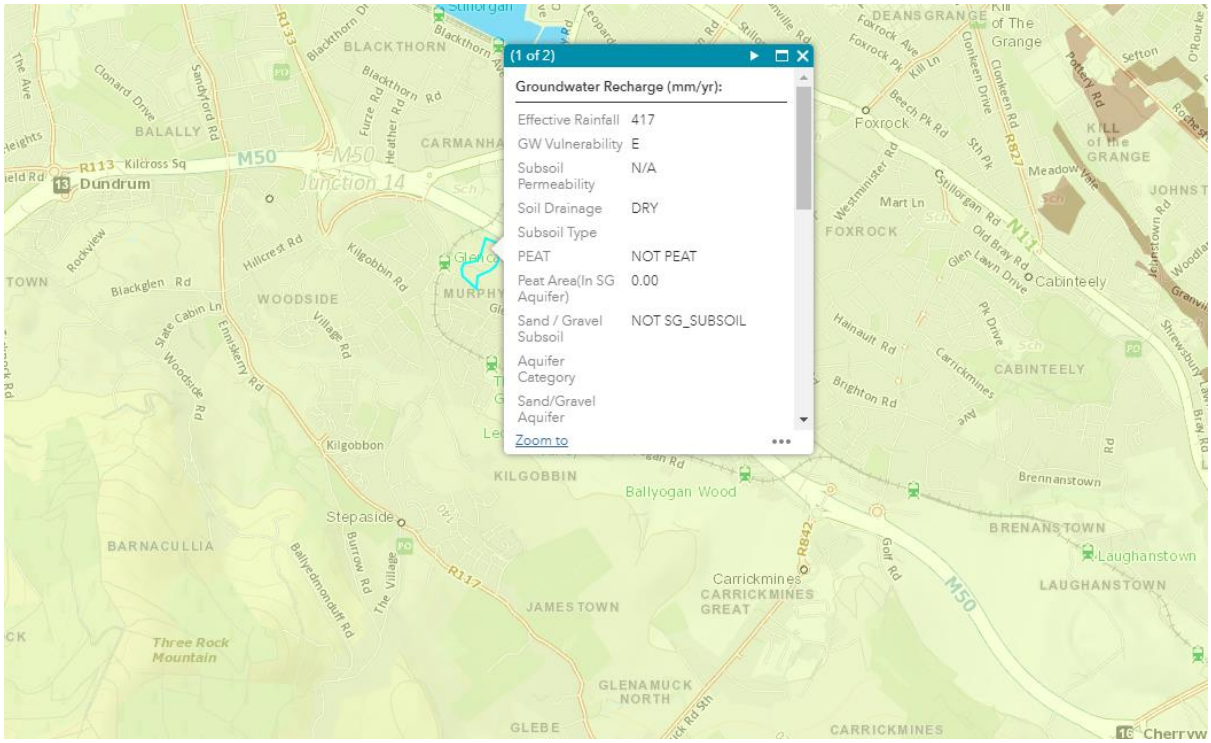
Figure 8.6: Extract from Monitoring report for Ballyogan Landfill

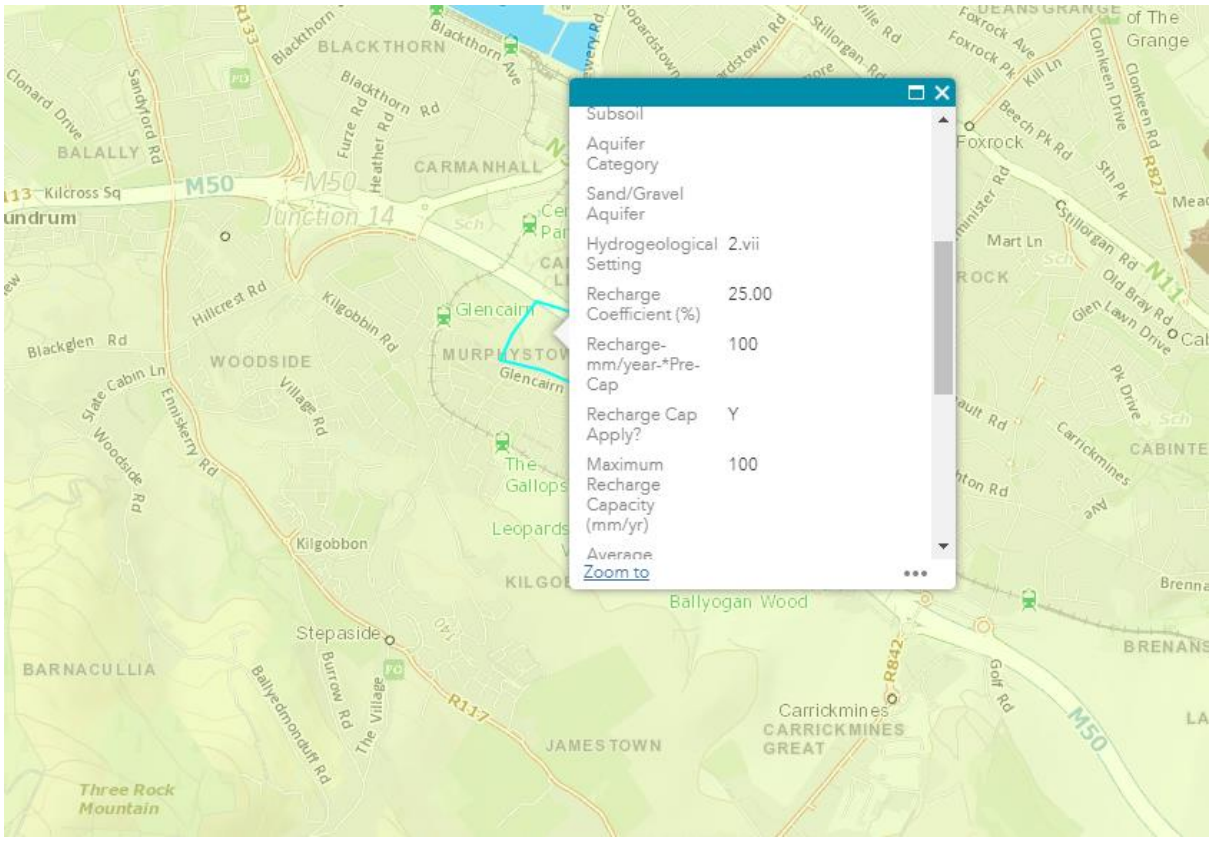


Recharge

Effective rainfall is the amount of rainfall available as either recharge to ground or run-off to surface water after evaporation or taken up by plants and is 417mm/yr. The recharge coefficient, which is the proportion of effective rainfall to recharge groundwater, varies from 25% on the eastern side of the site to 60% on the western. 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. According to GSI the maximum recharge capacity to the bedrock is 100 mm/yr across the site.

Figure 8.7: Extract from GSI Groundwater Data Viewer





Site Hydrogeology

Site investigation data shows no groundwater level in the trial pits at the time of investigation (refer to Site Investigation Report under separate cover).

The characteristics of the underlying granite bedrock and local topography appear to have a strong influence in the hydrogeology of the site. Groundwater is present within the upper levels of the bedrock with no groundwater present within the subsoils. Groundwater flows follow the topographical relief of the area and generally flow in a north easterly direction towards the escarpment and Racecourse stream.

It is anticipated that groundwater does provide some baseflow to the Racecourse Stream and the existing basins.

Groundwater Quality

Under the requirements of the Water Framework Directive, the Dublin groundwater body was classified as having an overall good status for water quality and quantity 2010-2015. However, it is classified as 'at risk' of not achieving at least good ecological or good chemical status/potential by 2015. No site specific water quality data is available from the site investigation.

Groundwater Flood Risk

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. If the groundwater level rises above surface level, it can pond at local points and cause periods of flooding.

8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The residential development consists of 243 no. apartments and 98 no. houses, to be provided as follows:

- 45 no. 1-bed apartments;
- 174 no. 2-bed apartments;
- 24 no. 3-bed apartments;
- 39 no. 3 storey, 4-bed (Type A1) houses;
- 7 no. 3 storey, 4-bed (Type A2) houses;
- 3 no. 3 storey, 5-bed (Type A3) houses;
- 14 no. 2 storey, 3-bed (Type B1) houses;
- 3 no. 2 storey with dormer, 4-bed (Type B2) houses;
- 17 no. 2 storey, 3-bed (Type C1) houses;
- 1 no. 2 storey, 3-bed (Type C2) houses;
- 4 no. 2 storey, 3-bed (Type C3) house;
- 2 no. 2 storey, 5-bed (Type D1) houses; and
- 8 no. 2 storey, 5-bed (Type D2) houses.

The 243 no. apartments are proposed to be provided within 6 no. apartment buildings of 4 and 5 no. storeys in height, including undercroft basements, 1 no. 4 storey apartment building (with childcare facility at ground floor level) and adjacent surface car parking, and a 2 no. storey apartment building with adjacent surface parking. The houses consist of 2 and 3 storey terraced, semi-detached and detached dwellings. Bin and cycle storage areas are proposed within the apartment blocks and bin stores are proposed for the houses. A recycling bring bank, 3 no. electricity sub-stations and a DRI unit for gas services are proposed for the site.

Surface water drainage (including Sustainable Drainage Systems - SuDS), foul water drainage, water supply and road network will be constructed to service the proposed development.

It is envisaged that all structural loads will be carried to either bedrock or the over-lying layers of stiff brown clay, by use of conventional foundations. These will generally be situated beneath load bearing walls.

Surplus materials from these excavations will be disposed of off-site.

8.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

The predicted impacts of the proposed development with regard to the soil environment will be assessed for the construction and operational phases.

8.5.1 Construction Phase

It is anticipated that the development site works and excavation proposals will not be deep enough to impact the underlying bedrock geology during the construction phase with the exception of the undercroft/basement car-parks where some 2m maximum depth of rock will need to be excavated over a limited area.

In the limited areas where some of the undercroft/basement car-park to the north-western corner of the site is close to the existing LUAS tracks, specific precautions will be employed. These will include stitch drilling and are more particularly described in the Construction Management Plan accompanying this application. It is therefore considered that the greatest impact of the construction will arise from the extensive stripping and wide scale excavation of soils and sub-soils to prepare and construct the development.

The main volume of excavation will be from the planned basement and undercroft car-parking to be constructed as part of the proposed apartment buildings to the west of the site near to the Murphystown Road, in addition, excavation will be necessary for the proposed underground surface water attenuation systems. Reusable excavated soils and rock will be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material. It is anticipated that the impact on soils arising from the construction phase will be short term and moderate.

The initial development of the site would involve extensive stripping of the topsoil (approximately the upper 300mm of soil). Excavation of subsoil layers would be required to facilitate site development works, in particular the construction of foul and surface water sewers and underground surface water storage structures (attenuation). It is envisaged that non-reusable excavated material will be removed off-site.

Removal of the upper soil layers would be necessary across a large area of the site. Top-soil will initially be stripped from the lands and stored for later re-use in the landscaping for the developments. It is envisaged that there will be surplus top-soil produced by the site. This surplus will be removed off-site.

In addition, the installation of the proposed surface water storage structures will require a significant quantity of subsoil to be excavated to provide sufficient storage volumes for storm events. The construction of swales would require a shallow excavation up to approximately 500mm below existing ground level.

Earthworks and the removal of topsoil would expose subsoil layers to the effects of weathering and may result in the erosion of soil, particularly in times of adverse weather conditions. Surplus subsoil caused by excavations for foundations, roads and drainage should be stockpiled and taken off-site to a licensed landfill facility.

Increased traffic associated with the construction works would have the effect of compacting existing subsoil layers within the site. The regular movement of heavy machinery and plant to and from the site would also result in an increased risk to the integrity of the surrounding road network, as well as facilitating the unwelcome transfer of mud and dust to surrounding access routes in the absence of mitigation.

It will be necessary to import materials to site; in particular large volumes of stone will be required for construction of the roads, foundations and services. Also, large quantities of concrete, bricks, steel, tar etc. will all be delivered to site by lorry. Road levels have been designed in accordance with TII Design Manual for Roads and Bridges (DMRB) as well as the Design Manual for Urban Roads and Streets (DMURS), with an aim to balance cut and fill earthworks throughout the site.

Landscaping for the developments will reduce the initial impact from the construction phase and will protect the soils again from weathering and erosion. The impacts on the underlying bedrock geology arising from the construction phase will be minimal. A maximum depth of approximately 2m of the solid granite will have to be excavated to reach formation level for a small localised extent of the undercroft/basement carparks. The greatest impact will be to the soils from the construction activity as soil levels will be greatly altered throughout. However final landscaping should reduce and address these impacts. It is anticipated that the impact on soils arising from the construction phase will be short term and moderate.

There is a potential risk of localised contamination from construction materials leeching into the underlying soils by exposure, dewatering or construction related spillages resulting in a Permanent Negative impact on the soils. In the case of soils, the magnitude of this impact is Small Adverse as it may result in the requirement to excavate/remediate a small proportion of contamination or result in a low risk of pollution to the soils. As a result, its significance is Imperceptible for all important soils features.

There is a potential risk of localised contamination of the groundwater due to construction activities i.e. construction spillages, leaks etc. resulting in a Permanent Negative impact on the groundwater, however, the gravelly clay will limit the potential for contamination to infiltrate into the underlying aquifer. Limited shallow excavations into the bedrock are anticipated for construction of part of the undercroft/basement carparks. For these reasons, the impact on the groundwater contained within the bedrock aquifer is considered as Small Adverse.

The potential likely and significant impact on hydrogeology during the construction phase is considered to be short term, temporary and moderate without mitigation measures in place.

8.5.2 Operational Phase

The day-to-day activities of the completed development would be unlikely to have any direct impact on the groundwater environment. Minor impacts may include reduced infiltration and therefore reduced recharge volumes entering the groundwater. This is directly related to the creation of impermeable development areas which pending their arrangement could increase run-off volumes and reduce existing “greenfield” infiltration potential. The risk of spills or leaks of fuels and oils from residential vehicles may impact if the surface water system is not designed to address this.

On completion of the construction phase, it is not envisaged that there would be a further direct impact on the soil or geological structure. Ensuring appropriately designed and constructed site services will protect the soils and geology from future contamination arising from operation of the developments.

The impacts on soils and geology arising from the operational phase will be temporary and imperceptible.

8.6 POTENTIAL CUMULATIVE IMPACTS

Given the scale of the proposed residential development, and the capacity of the surrounding environment to accommodate a development of this nature, it is not likely to give rise to any significant effects cumulatively or, in combination with, other developments in the area.

8.7 DO NOTHING IMPACT

If the proposed development did not proceed there would be no impact on the existing soils or geology of the site. It is envisaged that the land use would remain unchanged as primarily greenfield along with residential uses associated with the gate lodge and existing dwelling on site.

8.8 REMEDIAL AND MITIGATION MEASURES

8.8.1 Construction Phase

In order to minimise the impact of construction on the site's soils and geology the following mitigation measures should be implemented.

L&S CONST 1:

- Existing topsoil should be retained on site to be used for the proposed development. Topsoil should be stored in an appropriate manner on site for the duration of the construction works and protected for re-use on completion of the main site works.
- Top-soiling and landscaping works should take place as soon as finished levels are achieved, in order to reduce weathering and erosion and to retain soil properties.
- The construction phase should be monitored, in particular in relation to the following;
  - Protection of topsoil stockpiled for re-use;
  - Adequate protection from contamination of soils for removal;
  - Cleanliness of adjoining road network;
  - Prevention of oil and petrol spillages;
  - Dust control.
- Where feasible, the extent of excavation works and depths for dwellings and roads should be limited through design to minimize disturbance of the original soil and subsoil formations and to retain soil structure. This will also help to reduce the volumes of backfill and material to be removed off-site.
- Reusable excavated gravels, sands or rock should be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material.
- Excavated materials should be visually assessed for signs of contamination. Should material appear to be contaminated, soil samples should be analysed by an appropriate testing laboratory. Contaminated material should be treated in accordance with the Waste Management Regulations, 1998.
- Excess fill, unsuitable material and suitable material will be removed off-site. Removal should be in accordance with the relevant Waste Management Regulations.

- Oil and fuel stored on site should be stored in designated areas. These areas shall be bunded and should be located away from surface water drainage.
- Refuelling of construction machinery shall be undertaken in designated areas located away from surface water drainage. Spill kits shall be kept in these areas in the event of spillages.
- Hazardous waste shall be dealt with in accordance with the Waste Management (Hazardous Waste) Regulations, 1998.
- All potentially hazardous materials shall be securely stored on site.

8.8.2 Operational Phase

No significant long-term impact on the soil resulting from the proposed operational phase of the development is predicted. Once the development is completed, risks to the land and soils will be from pollutants deriving from the use of the dwellings and/or from contaminated surface water run-off.

L&S OPERAT 1: The surface water run-off from the development should be collected by an appropriately designed system. This system should ensure that contaminants are removed prior to discharge e.g. via a light liquids separator or by an appropriate treatment train of Sustainable Urban Drainage Systems as outlined in the Greater Dublin Strategic Drainage Study (GDSDS). Any separators and drainage systems should be maintained and operated by the facilities management company (prior to taking in charge by the Local Authority) in accordance with the manufacturers recommendations.

L&S OPERAT 2: All waste generated by the everyday operation of the development should be securely stored within designated collection areas. These should have positive drainage collection systems to collect potential run off. Operational waste should be removed from site using licensed waste management contractors.

8.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

Construction Phase

The proposed development will alter the current land use from primarily greenfield to a residential development and associated public open space and landscape areas. The impact on soil, geology and hydrogeology from accidental spillages of fuel and lubricants used during the construction phase of the development is predicted to be minimal when stored and used in a responsible manner. After implementation of the mitigation measures recommended above for the construction phase, the proposed development will not give rise to any significant long term adverse impact. Moderate negative impacts during the construction phase will be short term only in duration.

Operational Phase

There are no long term impacts on soils.

8.10 MONITORING

Soil removed during the construction phase is to be monitored to maximise potential for re-use on site. Monitoring of any hazardous material stored on-site will form part of the proposed Construction & Waste Management Plan. A dust management/monitoring programme should be implemented during the construction phase of the development. The quantities of topsoil, subsoil and rock removed off site will be recorded.

8.11 REINSTATEMENT

In open space areas where finished ground levels are altered and extensive excavation of topsoil and subsoil is required, the areas should be seeded and landscaped in a timely manner to ensure weathering of subsoils is limited.

8.12 INTERACTIONS

The design team has been in regular contact with each other throughout the design process to minimise environmental impacts and to ensure a sustainable and integrated approach to the design of the proposed development. There is an interaction between soil and waste management which may require the removal of soil off site to a suitable licensed facility.

There is an interaction between geology for the site and hydrogeology.

8.13 DIFFICULTIES ENCOUNTERED IN COMPILING

No particular difficulties were encountered in completing this section.

8.14 REFERENCES

- Site Investigations Report by IGSL
- GSI On Line Mapping
- Teagasc On Line Mapping
- EPA On Line Mapping
- Site Specific Flood Risk Assessment by DBFL
- Engineering Services Report by DBFL
- Hydrogeological Site Assessment Report (By Bluerock Environmental)