5.0 SOILS AND GEOLOGY

5.1 Introduction

This Chapter of the EIAR considers and assesses any potential impacts resulting from quarry restoration related activities at the Application Site on the surrounding soils and geology. The proposed development at the Application Site involves the backfill and restoration of an existing sand and gravel quarry using uncontaminated soil and stone. Blasting activities will not be carried out at this site. The current extent of the quarry extends below the water table.

5.2 Methodology

The geological information described in this Chapter is based primarily on data gleaned from the Geological Survey of Ireland (GSI) interactive special data resources map database (www.gsi.ie).

In order to assess impacts on the soil and geology, '*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes*' published by the National Roads Authority (2009) and '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*' published by the Institute of Geologists of Ireland (2013) have been consulted.

5.3 Previous Work

A total of 4 no. boreholes, each of 20 cm in diameter, were drilled on site between the 14th and the 28th of July 2001 by I.G.S.L. following instructions from Goode Concrete (BH1- 3A). A further borehole (BH4) was drilled on site by Dempsey Drilling Contractors following instruction by BMA GeoServices Ltd. The borehole logs are summarised in Table 5.1.

Table 5.1: 2001 Drilling Summary

Depth	Lithology
0-0.2 m	Topsoil
0.2-3.9 m	Clay and sandy silt with occasional lenses of sand
3.9-14 m	Grey-brown fine to coarse gravel with cobbles and boulders, with lenses of brown sand, silty at times.

Four groundwater monitoring boreholes, GMW1-4, were drilled in 2017 and 2018 at the Application Site to provide information on the underlying geology and groundwater at the Site (Figure 5.1).

In 2017, boreholes GMW1 and GMW2 were drilled to depths ca. 12 m and GMW3 was drilled to ca. 24 m. A fourth borehole, GMW4, was drilled on the eastern boundary of the site adjacent to an existing stream in March 2018 and was drilled to a depth of ca. 12 m. Table 5.2 provides a summary of the material encountered in the boreholes.

Table 5.2: Summary Groundwater Borehole Lithologies

Lithology	GMW1	GMW 2	GMW 3	GMW 4
Overburden	0 - ca. 7 m	0 - ca. 6 m	0 - ca. 17 m	0 – ca. 6 m
Top of Bedrock	ca. 7 m	ca. 6 m	ca. 17 m	ca. 6 m
End of BH	ca. 12 m	ca. 12 m	ca. 24 m	ca. 12 m

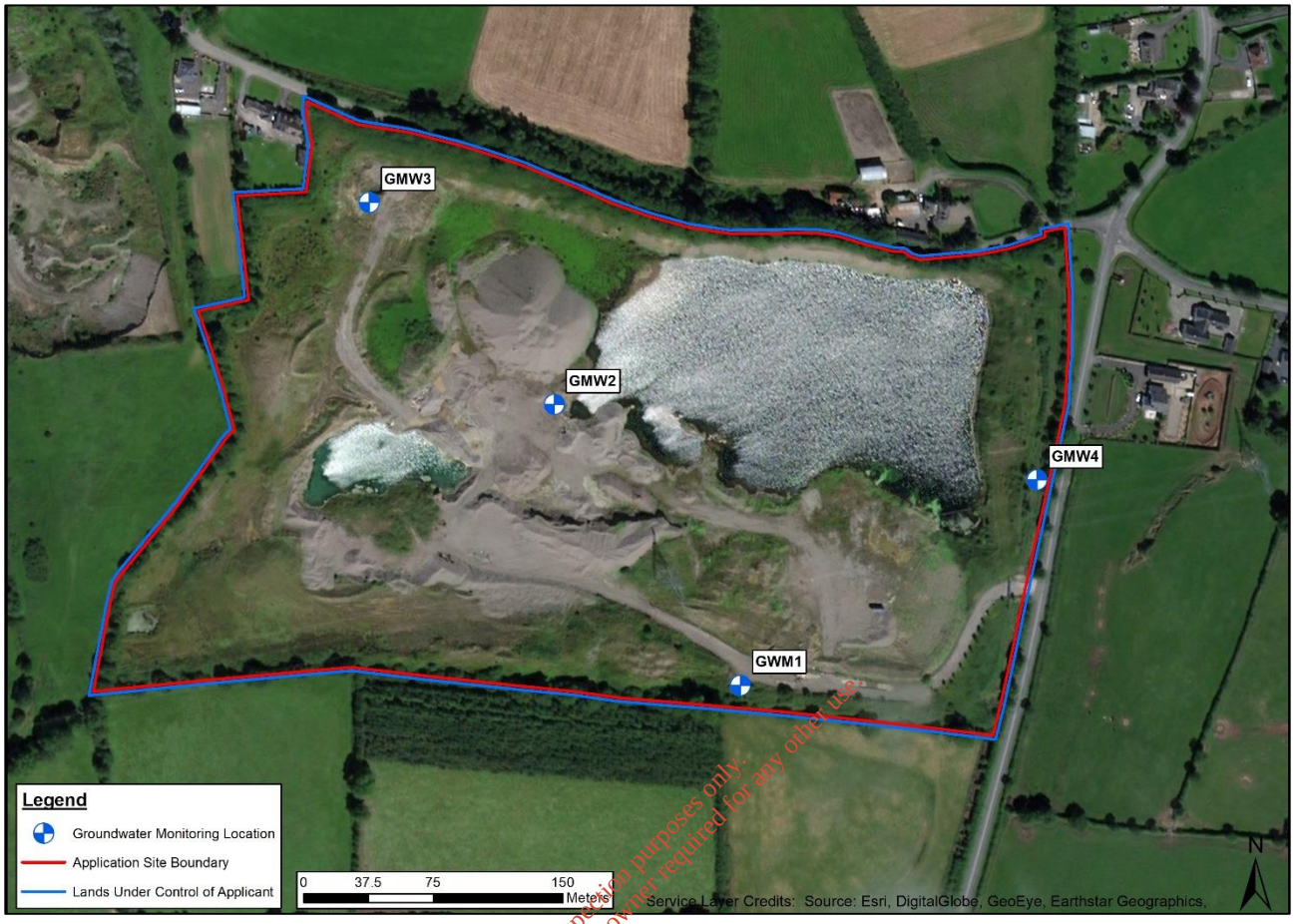

Figure 5.1: Groundwater borehole locations

5.4 Existing Environment

5.4.1 Topography

The Site is located to the west of the Clonuff bridge, along from Carbury to Broadford, approximately 5km north of Carbury. The area north, east and south of the Application Site is dominated by an agricultural landscape with both pasture and arable land uses. Two existing sand and gravel quarries borders the Site immediately to the west, with several residential properties to the east and ribbon developments along local roads. An EPA licenced Site operating as an abattoir and boning hall, Moyvalley Meats, is located within 500 km of the Site.

The topography on site is generally flat with a gentle south easterly slope. The highest point is in the north-west, and slopes towards the River Glash that runs directly adjacent to the eastern site boundary.

5.4.2 Soils

Much of the soil across the Application Site has been removed or excavated by previous quarrying activities. The main soil type on the Site, prior to excavation activities, was mapped as shallow Lithosols (BminSW) derived from mainly calcareous parent materials with minor alluvial soils along the eastern and south-eastern boundaries following the existing stream. The Site is bounded to the north and south by deep poorly drained soils derived from mainly basic parent materials (BminPD). Soils mapped by the GSI in the area of the Application Site are displayed in Figure 5.2.

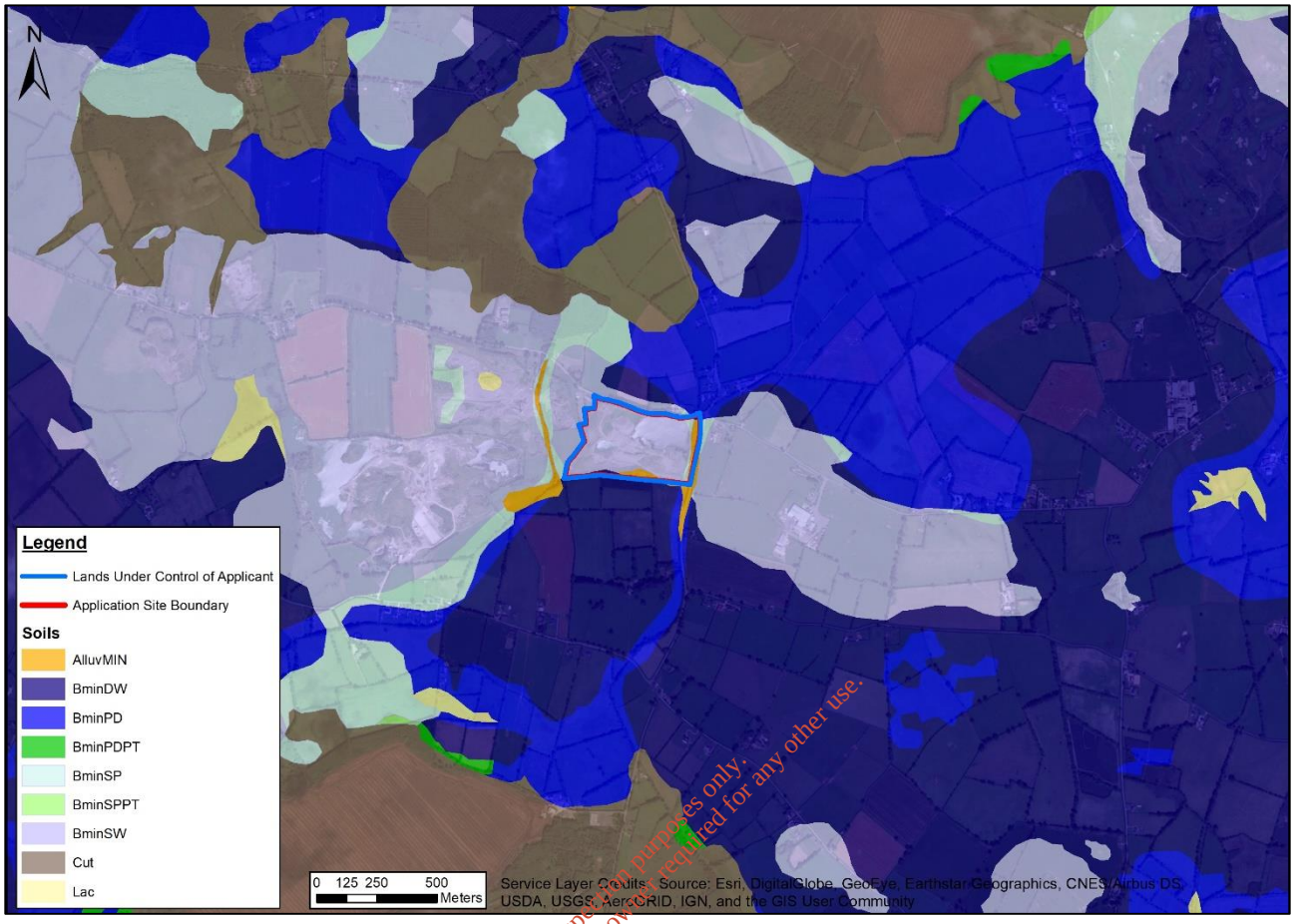

Figure 5.2: Underlying soils at the Application Site

5.4.3 Subsoils

The subsoils underlying the Site are classified as limestone sands and gravels (GLs) which form part of a formation that runs east-west through the Site. Along the east and south site boundaries, following a local stream course, are minor deposits of alluvium. To the north and south of the Site are Carboniferous limestone till facies (TLs) (Figure 5.3).

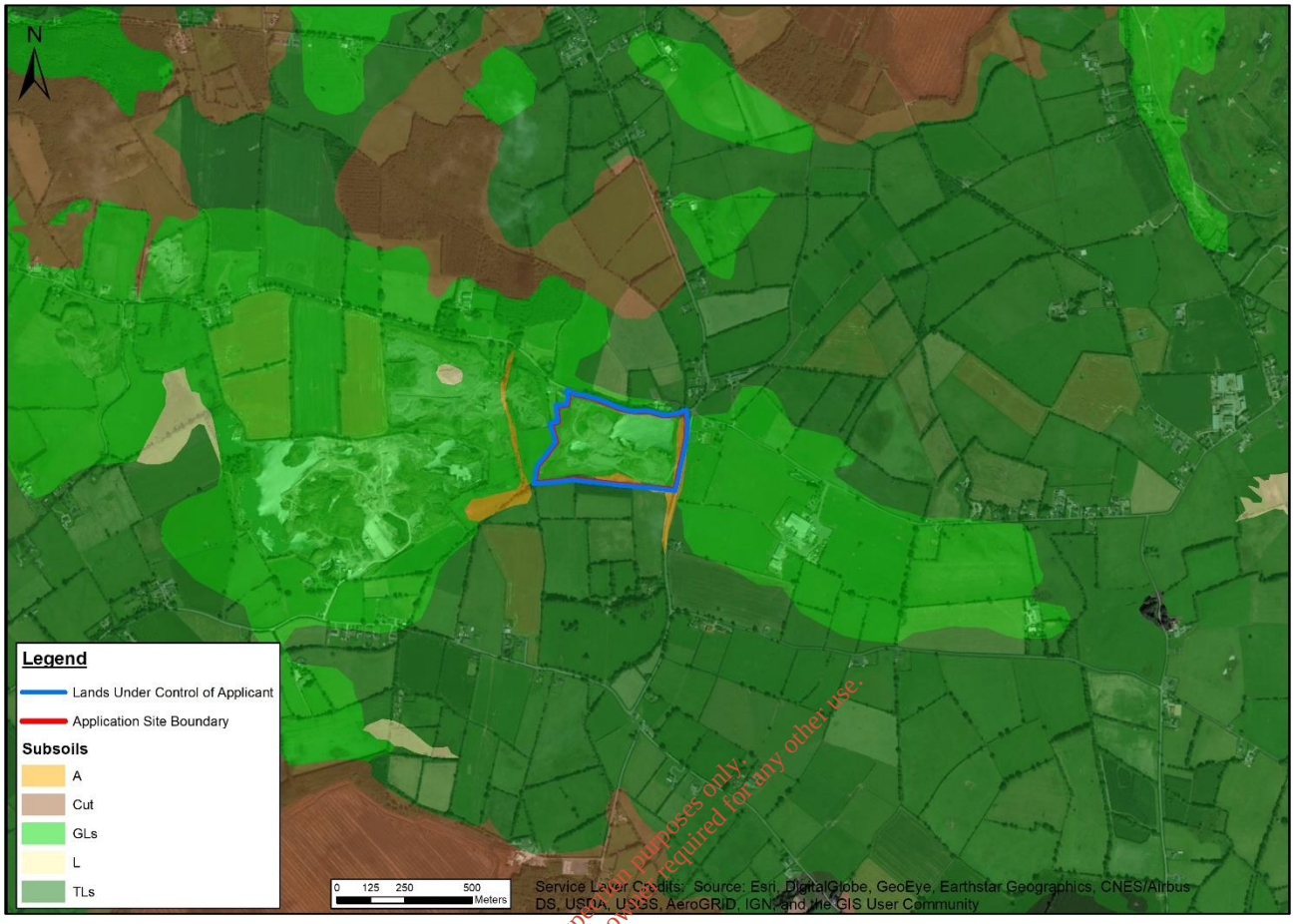

Figure 5.3: Underlying subsoils at the Application Site. (GSI)

5.4.4 Bedrock Geology and Structural Geology

The GSI bedrock 1:500,000 map (www.gsi.ie) shows that the regional geology of the area is comprised of deep marine basinal sediments of the Lucan Formation (Figure 5.4).

The area is located in the "Portarlington Trough", a geologically low area elongated NE-SW which formed a depositional basin between the geologically highs of the Kildare Shelf to the west and the Edenderry Shelf to the east, both of which deposited in shallow water. Material corning from both the adjacent shelf areas is found in the thick sequences of muds and muddy limestones present in the "Portarlington Trough", indicating that this was a sedimentary as well as structural low.

The regional geological map for the area (GSI 1:100,000 from www.gsi.ie) indicates that the area is underlain by dark-grey to black limestone and shale (Calp) of Lower to Middle Carboniferous age. Widespread Quaternary glaciation shaped the landscape of the area, leaving behind mainly non-cohesive glacial and fluvio-glacial sediments, which constitute a thick blanket covering the Carboniferous rocks.

No major fractures or faults are reported on the GSI map in the area adjacent to the site, with the exception of a fault with an East-West direction, which terminates prior to entering the site in its north-west corner.

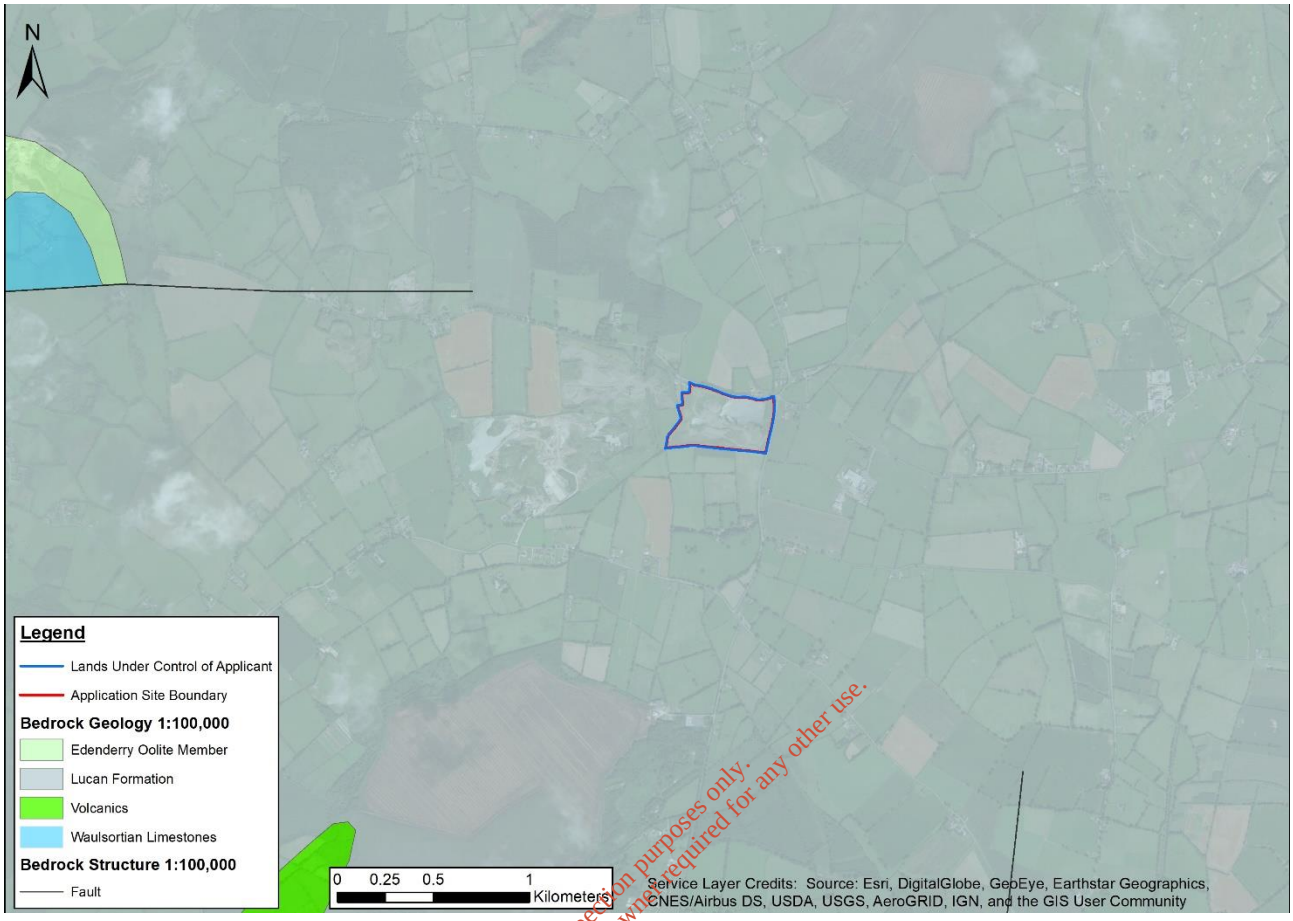

Figure 5.4: Underlying bedrock geology at the Application Site, (GSI)

5.5 Proposed Waste Acceptance Criteria (WAC)

The proposed restoration is a backfilling activity, which is a recovery operation where suitable waste is used for reclamation purposes in excavated areas (EU 2010). The Waste Framework Directive requires that waste is recovered without causing harm to the environment. Unlike landfills, soil recovery facilities do not have any engineered basal liners, caps, or other engineering controls to protect groundwater from contamination. Because of this, it is a requirement that the waste being recovered is uncontaminated natural soil and stone.

The restoration will use the waste acceptance methodology and criteria outlined in the EPA's draft guidance document which addresses the licence requirement for licensed Soil Recovery facilities to have Waste Acceptance Criteria. The proposed waste acceptance criteria outlined in EPA 2017 and to be adopted for Ballinderry establishes soil trigger values that are reflective of natural concentrations of key parameters, e.g. virgin soil. The adoption of these proposed guidelines will meet the aim of ensuring that the recovery activity does not introduce new hazards and is in keeping with European Commission guidance.

5.5.1 Waste Acceptance Criteria – Source Sites

Only soil and stones from green-field sites and non-greenfield sites where the risk of contamination from chemical or solid materials is low will be accepted using the methodology outlined in Table 5.3, subject to meeting the soil trigger values outlined in Table 5.4.

Table 5.3: Waste Acceptance Methodology for Backfill Material (modified from EPA 2017)

Material Type	Minimum Criteria
Greenfield soil and stone:-	Letter of suitability for the first 5,000 tonnes of material received, and a further letter of suitability for each subsequent 5,000 tonnes of material received. Each letter of suitability shall be signed by a suitably qualified person and shall state the following: ■ The waste is greenfield soil and stone ■ A description of the source and nature of the soil and stone ■ The location of the source of the soil and stone (including a map showing the source site boundary) ■ The material is suitable for use as backfill within the facility ■ The material will not cause environmental pollution at the facility There is no requirement for testing greenfield soil and stone, unless directed by the Agency. However, it is advisable that the suitably qualified person relies on soil test results to confirm the greenfield status of the source site before signing the letter of suitability. When the material arrives at the soil recovery facility, a visual check is required to verify that the material is greenfield soil and stone.
Non-greenfield soil and stone:-	Prior to accepting material from each individual source site, the licensee shall obtain information on the past use of the site and shall reject non-greenfield sites where soil or groundwater contamination has been identified or where there is an increased risk of contamination being present. Soil and stone should not be accepted from sites where activities in the past have involved the manufacture or storage of hazardous substances e.g. chemical manufacturing facilities, oil storage facilities, retail filling stations. Up to 2% contamination with non-natural materials is acceptable within the soil and stone, i.e. anthropogenic or man-made substances such as rubble, concrete, bricks, metal and bitumen that are non-natural to the environment from which the material was extracted. There is no allowance for chemical contamination. Basic characterisation, compliance testing and on-site verification shall be undertaken, including waste classification. Contaminant concentrations within the soil and stone must comply with soil trigger levels agreed with the EPA.

5.5.2 Soil Trigger Levels

The proposed soil trigger levels below are for key parameters that demonstrate that the material is equivalent to virgin soil and is uncontaminated. Levels for metals are derived from 90th percentile concentrations in Ireland's existing National Soils database (Teagasc 2007). Furthermore, soil accepted for recovery should be free of anthropogenic contaminants such as organic compounds and asbestos fibres which are key contamination indicators in non-greenfield soils.

Table 5.4: Soil Trigger Levels for Ballinderry Soil Recovery Facility

Parameter in Soil	Soil Trigger Level
Arsenic	16 mg/kg
Cadmium	1.3 mg/kg
Total Chromium	75 mg/kg
Copper	35 mg/kg
Mercury	0.2 mg/kg

Parameter in Soil	Soil Trigger Level
Nickel	42 mg/kg
Lead	48 mg/kg
Zinc	126 mg/kg
TOC	3 %
Total BTEX *	0.05 mg/kg
TPH or EPH *	50 mg/kg
Total PAHs *^	1 mg/kg
Total PCBs *¬	0.05 mg/kg
Asbestos fibres	No asbestos detected

* The soil trigger levels for these parameters are consistent with detection limits reported by accredited environmental testing laboratories.
^ Total concentration of the following 17 compounds: Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[g,h,i] perylene, Benzo[a]pyrene, Chrysene, Coronene, Dibenzo[a,h]anthracene, Fluorene, Fluoranthene, Indeno[1,2,3-c,d]pyrene, Phenanthrene and Pyrene.
¬ Total concentration of the following seven PCB congeners: PCB-28, PCB-52, PCB- 101, PCB-118, PCB-138, PCB-153 and PCB-180.

5.6 Assessment

The evaluation of impacts on the soils and geology at and in the vicinity of the Application Site is based on a methodology similar to that outlined in the '*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes*' published by the National Roads Authority (2009) and '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'* published by the Institute of Geologists of Ireland (2013).

The importance of existing soil and geology attributes identified above is assessed in Table 5.5 below.

Table 5.5: Importance of geological attributes in the vicinity of the Application Site

Attribute	Status	Importance
Geohazards / Geotechnical	The Application Area is located in an area of low seismic activity.	Low
Geological Heritage	No heritage important locations in site area. Not an unusual geological unit.	Negligible
Economic Geology	The site is located in an area of high economic geology although the site has now stopped production.	High
Agricultural Soils	Other soils adjacent of Site are used for agricultural activities including grazing and tillage. Overburden is glacial till and is common.	Low
Made Ground	There is currently no Made Ground at the Application Site. Made ground will be formed by the proposed activities at the Application Site.	High

The significance of the impacts on the soils and geology attributes is assessed in Table 5.6 below.

Table 5.6: Significance of impacts on soil and geology

Attribute	Status	Magnitude of Impact
Geohazards / Geotechnical	The plan is for infilling the current pit and restoring and rehabilitating the ground surface, thus mitigating any potential geotechnical / geohazard risks.	Negligible
Geological Heritage	The infill will not have an effect on geological heritage locality or impact on common bedrock at the Site.	Negligible

Attribute	Status	Magnitude of Impact
Economic Geology	The proposal will facilitate infill of uncontaminated soil and stone into the current workings and rehabilitating the ground at the Site.	Small
Agricultural Soils	Topsoil will be replaced on completion of backfilling activities.	Small Adverse
Made Ground	The proposed waste acceptance procedures and criteria will ensure that the made ground created by the restoration activities do not introduce new hazards to the Site.	Small

By the nature of quarrying, the overburden and aggregate resource has been removed which resulted in a direct and irreversible impact on the sand and gravel resource, however these impacts were considered to be of a major beneficial economic impact. This application will be to infill the existing excavated quarry at Ballinderry and to rehabilitate the site and to return it to agricultural fields. Backfill will be conducted using uncontaminated soil and stone, equivalent to virgin material, sourced from locations off site. Once backfill is completed topsoil will be used to restore the Site to agricultural land.

5.7 Mitigation, Compensation and Enhancement Measures

The following mitigation measures will be adopted for the proposed restoration activities to reduce any potential impacts on the receiving soils and geology environment:

- The proposed waste acceptance methodology and criteria will ensure that only uncontaminated soil and stone from suitable sites will be imported to the Site for restoration;
- All refuelling of mobile plant will be undertaken with care on designated fuelling areas which will be composed of a hardstanding surface with an associated interceptor. These practices will have little or no effect on glacial till/overburden or bedrock material;
- Any processing plant and / or mobile plant on the Site be regularly maintained, and where plant is damaged or leaking, this will be dealt with as part of ongoing operational management of the Site;
- Dumping of dry dusty rock material will only occur during the correct environmental conditions;
- Re-handling of the topsoil will be kept to a minimum to preserve the integrity of the material;
- Groundwater monitoring of existing wells on site prior, during and after the completion of proposed works; and
- The Site manager will ensure compliance with relevant safety and statutory legislation and best practices.

5.8 Residual Impacts

In the long-term, there will be no deleterious effects on the remaining aggregate, bedrock or groundwater at the Site.

5.9 Cumulative Impacts

As a result of the mitigation measures implemented at the Application Site, it is considered that any impacts associated with the backfilling related activities undertaken at the Application Site will not contribute to the cumulative impacts of any surrounding developments/quarries within the area. Potential cumulative impacts on other environmental elements such as surface water quality, groundwater quality, ecology, noise and dust are examined in other chapters of this EIAR.

5.10 References

- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.
- 2011/753/EU: Commission Decision of 18 November 2011 establishing rules and calculation methods for verifying compliance with the targets set in Article 11(2) of Directive 2008/98/EC of the European Parliament and of the Council.
- Environmental Protection Agency. 2017. Draft Guidance Note on Soil Recovery Waste Acceptance Criteria and Development of Soil Trigger Values for EPA-Licensed Soil Recovery Facilities. December 2017. Accessed - http://www.epa.ie/pubs/consultation/soilrecoveryconsultation/ - 16 May 2018.
- European Commission. 2012. Guidelines on the interpretation of key provision of Directive 2008/98/EC on waste.
- European Commission. Guidance on the interpretation of the term backfilling. Available at http://ec.europa.eu/eurostat/documents/342366/4953052/Guidance-on-Backfilling.pdf/c18d330c-97f2-4f8c-badd-ba446491b47e.
- Geological Survey of Ireland website, www.gsi.ie; online mapping services (Accessed: 14/05/2018).
- Institute of Geologist of Ireland (2013). Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.
- National Roads Authority (2009). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Teagasc Agriculture and Food Development Authority. 2007. National Soils Database: End of Project Report.