Attachment-7-1-2 Emissions to Groundwater Impact Assessment

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1. Soils & Geology

1.1 Introduction

This report assesses the impact on the geological environments of the proposed development. The objectives are to provide a review of baseline conditions across the footprint of the site, to assess the potential impact of the proposed development on the underlying soils and geology, and to provide appropriate mitigation measures for any identified potential impacts, if deemed necessary.

The Soils and Geology chapter of the EIAR was written by Niall Mitchell. Niall is a professional Hydrogeologist and Chartered Engineer with over 20 years' experience in the area of Hydrogeological and Contaminated land investigations and risk assessments, Environmental Impact Assessments, Remediation design and validation, Wastewater disposal and Environmental Due Diligence. He has an honours Civil Engineering degree from NUI, Galway, a Master's degree in Environmental Engineering from Trinity College and a Master's degree in Applied Hydrogeology from Newcastle University. Niall has been involved with high profile projects across the island of Ireland providing hydrogeological and contamination expertise for Environmental Impact Assessments, brownfield/fuel spill/chemical spill site investigations, risk assessments and remediation design. Example projects have included the Corrib Gas Terminal Site, (Co. Mayo), Titanic Quarter Redevelopment (Belfast), Barrow Street Gasholder Site (Dublin), Poolbeg Incinerator Project (Dublin) and Haulbowline Naval Base (Co. Cork). Niall has also provided expertise at Oral Hearing.

1.2 Assessment Methodology

The assessment was undertaken by undertaking the following:

- A desktop study of soils, subsoils and bedrock across the site and the general environs;
  - A review of existing site investigation data pertaining to the site; and,
  - Interpretation of all data collated and EIAR reporting.

The following sources of information were used in the compilation of this assessment:

- Ordnance Survey of Ireland, Discovery Series, Sheet 61;
- Ordnance Survey of Ireland (OSI) online historical maps and aerial photographs;
- Geology of Kildare-Wicklow, Geological Survey of Ireland (GSI) (1:100,000), Sheet 16;
- Soil Map of Ireland (Second Edition, 1980), National Soil Survey of Ireland, An Foras Talúntais;
- National Parks and Wildlife Service on-line database www.npws.ie;
- EPA online water quality mapping; https://gis.epa.ie/EPAMaps/
- Met Eireann - met.ie – monthly climatological data;
- Kildare County Council online planning files and County Development Plan;
- Landslides in Ireland. G.S.I. Irish Landslides Working Group (2006); and,
- Directory of Active Quarries, Pits and Mines in Ireland (3rd Edition) G.S.I. 2002;
- Further information request (PPR 06/2802) by Kildare County Council for the continued operation for the extraction of sand & gravel & all associated processing works at Graney West, County Kildare. Golder Associates (November - 2007)

- Environment Assessment Report 1969-01 v2.00 Re: Application for permission for the development of a Waste Recovery Facility at a disused quarry site in Graney West, Castledermot, Co. Kildare. Environmental Efficiency (February - 2018).

This chapter was undertaken in accordance with the following:

- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002);
- Geology in Environmental Impact Statements a Guide, (IGI, 2002);
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA Document;
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013); and,
- Environmental Protection Agency (EPA) Draft *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports'* (2017).

1.3 Baseline Environment

1.3.1 Site Location and Context

The site in Graney West, Castledermot, Co. Kildare, is approximately 2 km to the south-east of Castledermot village (Figure below), and 12 kilometres from the town of Baltinglass, in Co. Wicklow. The site is located in a rural agricultural area with grazing and tillage being the main agricultural activities. A few historic sand and gravel extraction sites are situated in the broader area of the site. There are 12 no. residential developments within a radius of 500m, mainly to the east, north and south of the application site.

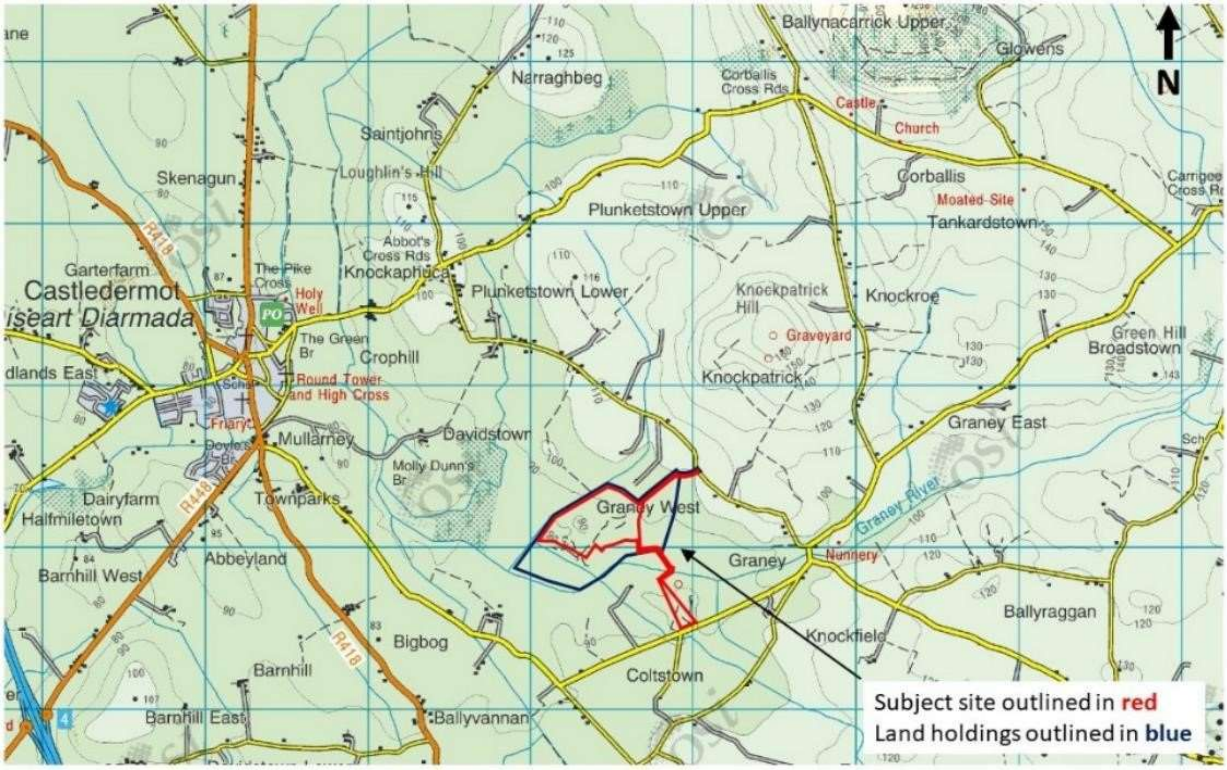

Figure 1: Site location Map

1.4 Site History

The site was previously operated as a sand and gravel quarry pit, a settlement pond, processing areas and ancillary infrastructure. Quarrying activities ceased (circa 2007) within the application site when full extraction of materials occurred. The resulting terrain across the site comprises worked out quarry voids. Sand and gravel soils in these areas were previously extracted, leaving mineral sub-soil/rock exposed at the ground surface. Ground levels across the site have been significantly disturbed over time and lowered by the historical quarrying activities. Original ground levels across the quarry typically ranged between a high of 95 mOD to a low of 81 mOD. Existing quarry floor levels typically vary from a high of 86.7 mOD to a low of 79 mOD.

Quarrying activities will continue to take place in an adjacent field to the north of the site outside the application site boundary in accordance with the existing planning permission (Ref. 06/2802).

There are several quarries located within a 5 km radius predominantly, to the east and into Co. Carlow. The closest large quarry is located 1.1 km to the north-west and there is a smaller quarry located 1.6 km to the east.

1.5 Site Description

The application site covers an area of 19.2 hectares. Pockets of tree groves and vegetative growth occur sporadically throughout the site, with hedgerows existing along sections of the site boundary. A series of settlement lagoons are located in the southern region of the site for the purposes of managing surface water run-off.

The following buildings, facilities, services and infrastructure, utilized in connection with the preexisting quarry activity and farming activities, are currently present on-site.

- Site offices (2 x portable cabins)
- Washing plant and ancillary equipment
- Stockpiling areas and existing retaining walls
- Existing site access road to the east of the site
- Internal haul routes
- Covered, bunded fuel tanks
- Non-permeable concrete area (surrounding residence and farm buildings/structures)
- Covered, slatted effluent tank
- Site boundary trees and vegetation
- Surface water/Foul water drainage infrastructure including drains, pump house, septic tank, soak pit and settlement lagoons (x 3).
- Dwelling house and its curtilage
- Various agricultural buildings and structures used in connection with farming activity, including a cattle shed (with effluent tank), outhouse and horse boxes, horse paddock, silage pit, farm store/machinery repair and racking area.

An existing concreted yard area surrounds the buildings present on-site. Plant and equipment used in connection with pre-existing quarrying activities are also situated in this area and immediately south of the area.

1.6 Proposed Development

Sancom Ltd proposes to operate a Material Recovery Facility (MRF) at the site. The principal activity will involve the use of imported, uncontaminated soil and stone, sourced from construction sites, to backfill and restore the worked-out quarry. A detailed description of the proposed activities are provided in Section 1.4 with a summary outlined below:

- Sancom Ltd intend on accepting a maximum of 1.8 million tonnes of soil and stone material on-site per annum for backfilling over the course of 25 years.
- The proposed activity above will be for the purposes of recovering said materials through land deposition, and to achieve the improvement and development of land and site restoration. The material accepted on-site will be inert and will comprise subsoil, clay, gravels, topsoil, stone and mixtures of such.
- The proposed activity will include the placement of cover soils and seeding and return to use as agricultural grassland.
- In addition to the principal waste activity described above, it is proposed to carry out the following waste recovery activities on-site:
    - Acceptance of top-soil, screening at proposed screening plant and resale of such material,
    - Intake of gravel and sands, washing at existing washing plant and resale of such materials,
    - Intake of concrete, concrete crushing using concrete crushing equipment, mixing with sand and gravel before being fed to the washing plant to form aggregate, and resale of such material, and;
    - Intake of garden waste, shredding and composting of this waste within a silage pit over an underground effluent storage tank, for use for agricultural land spreading.

It is proposed to utilise pre-existing plant and, in addition, install further plant on-site to be used in connection with the proposed development activity

1.7 Previous Investigations

The following reports were reviewed during the compilation of the EIAR chapter on Soils & Geology and pertinent information is contained in the following sections:

1. *Items 1 to 9 of Further Information Request (PPR 06/2802) by Kildare County Council for a Sand and Gravel Quarry at Graney West, County Kildare*, Golder Associates, November 2007.
2. *Environment Assessment Report 1969-01 v2.00 Re: Application for permission for the development of a Waste Recovery Facility at a disused quarry site in Graney West, Castledermot, Co. Kildare*. Environmental Efficiency, February 2018.

1.8 Topography

The site at Graney West falls from north to south, approximately 1:50. Based on a topographical survey undertaken in 2007 the elevation along the northern boundary is approximately 87 mOD while the area in the south of the site is approximately 81.5 mOD. The site slopes towards the River Graney which lies at approximately 80 mOD. The River Graney flows from east to west towards the River Lerr at Castledermot, along the southern boundary of the land holding area. To the north the site, ground levels rise towards Knockpatrick Hill (1.4 km to the northeast of the site) with a topographical high greater than 160 mOD.

1.9 Bedrock

According to GSI sheet 16, the bedrock geology beneath the site, mapped by the GSI "Geology of Kildare-Wicklow" (McConnell, 1994), is Tullow Type 2 Granite, a microcline porphyritic granite with microcline phenocrysts. The geology to the north, west and east is mapped as Tullow Type 2 Equigranular Granite, a pale, fine to course-grained granite. Other formations in proximity to the site include the Tullow Type 1 fine grained granite. These Tullow granites compose the Tullow Pluton of the Leinster Granite intrusion and are typically extremely weathered and broken.

The depth to granite bedrock was recorded at the site ranging between 9.15 and 12.3m during the drilling of deep groundwater boreholes on-site in 2019.

There are no mapped bedrock outcrops within the site boundary; the closest mapped outcrop in the local area to the east along the L8100 road and at Graney Bridge. There is a mapped fault line trending from northwest to southeast i.e. (from Castledermot to Killerrig) and is located approximately 1.8 km to the west-southwest of the site (Figure below).

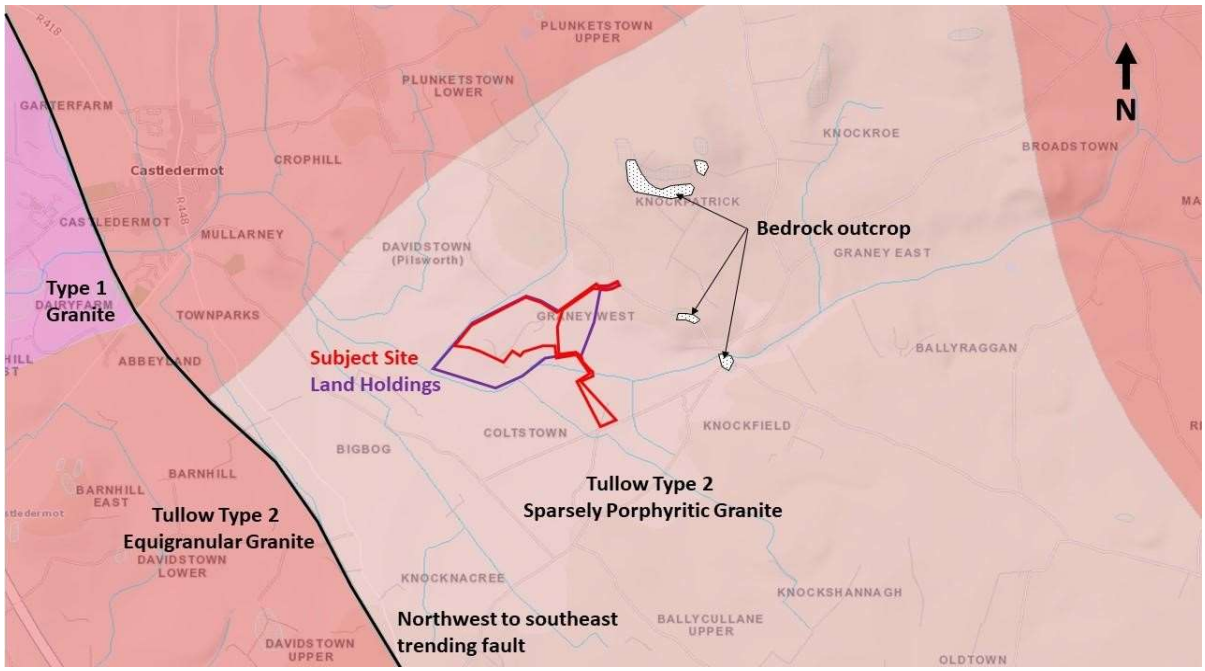

Figure 2: Bedrock Geology Map

1.10 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 is underlain by gravels derived from limestone which extend to the west, north and the east and a narrow band of alluvium along the southwestern site boundary (in the area of the settlement lagoons) which is separate from the River Graney alluvium. Other sediments in the area include Tills derived from limestone and granites and the alluvium along the route of the River Graney (see Figure below).

Four (4 no.) shell and auger boreholes were drilled (10-13th July 2007) around the perimeter of the site at Graney West. The total depth of the boreholes was between 4.0 and 7.0m. The ground conditions generally comprise firm brown sandy gravelly clay overlying fine sand and dense medium gravels with large cobbles.

The overburden sandy gravel was recorded at depths of between 9.15 and 12.3m during the drilling of deep groundwater boreholes on-site in 2019.

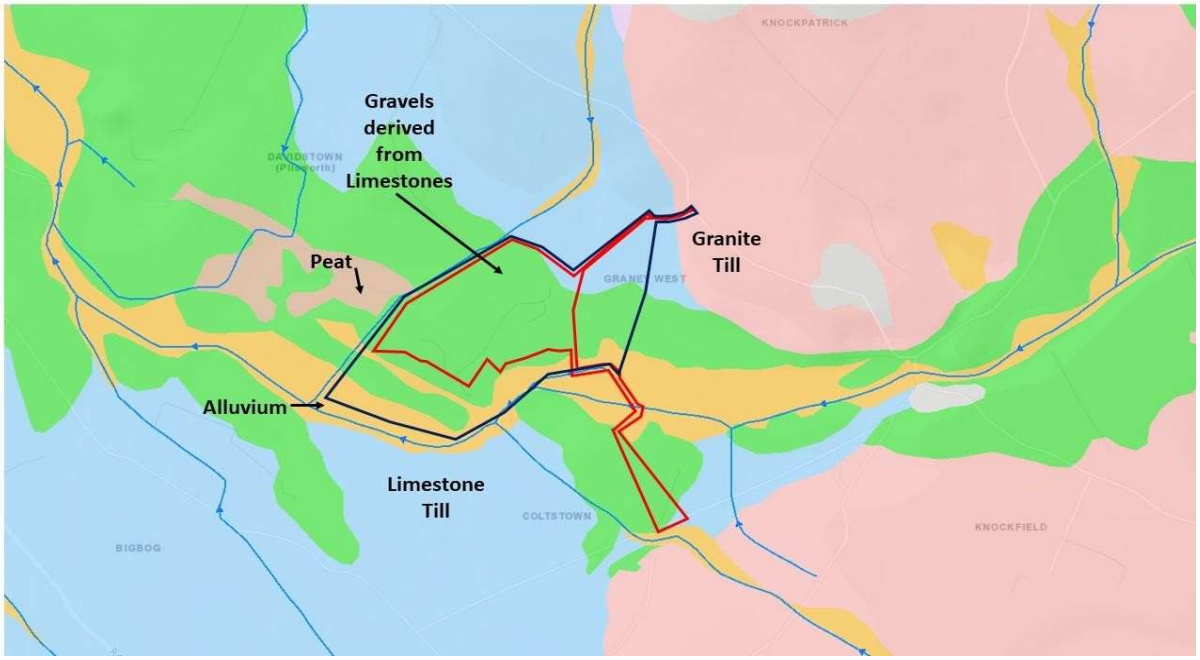

Figure 3: Subsoil Geology Map

1.11 Soils

The present site is almost completely stripped of soil cover to allow excavation of sands and gravel. Prior to the extraction of sands and gravels, the soil types mapped in this area are classified by the GSI as BminSW or shallow well drained mineral soil and BminPD shallow poorly drained mineral soil derived from mainly calcareous plant material (Figure below). According to Teagasc online soil database these soils are known as Elton (*1000c*) fine loamy drift with limestones.

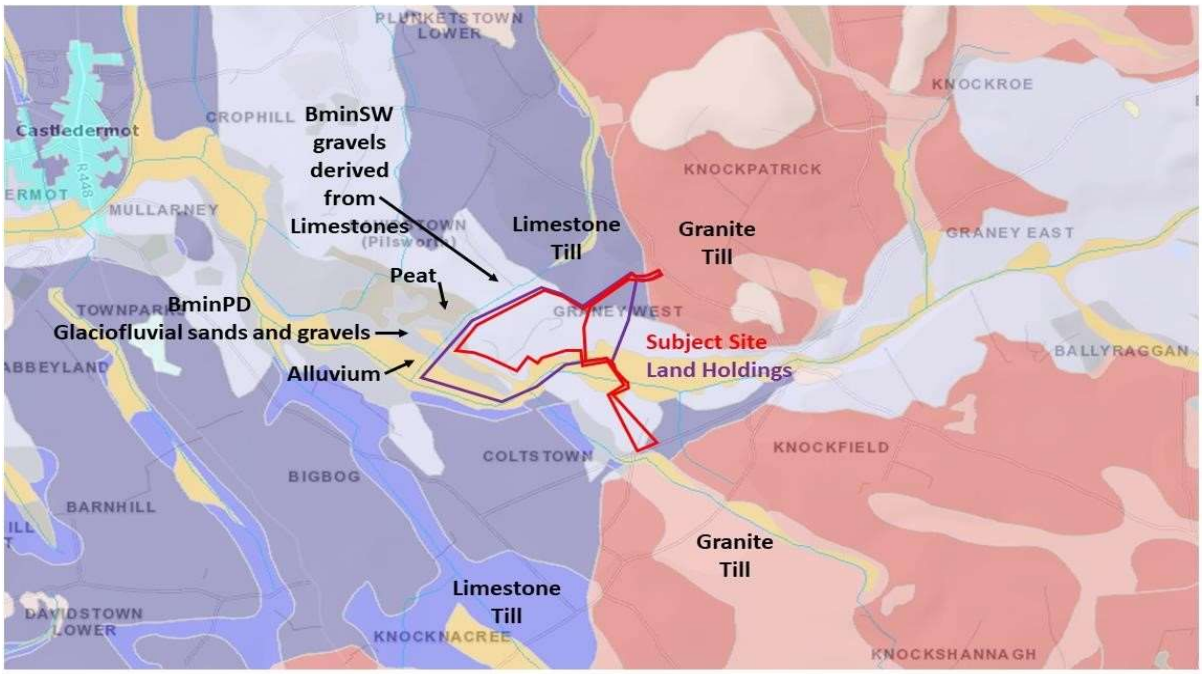

Figure 4: Soils Geology map

1.12 Contamination

No evidence of waste or material is known to be present at the site.

1.13 Designated Protected Areas

There are no sensitive sites located at or near the site at Graney West. The closest sensitive site is the River Lerr at Castledermot (approximately 1.8km northwest of the site). The River Graney flows into the River Lerr at Castledermot. The River Graney and the River Lerr are tributaries of the River Barrow. The River Lerr flows west from Castledermot for approximately 9.5 km to its confluence with the River Barrow near Newacre. The River Barrow and River Nore is a Special Area of Conservation (SAC) selected for a number of habitats and/or species listed on Annex I/II of the E.U. Habitats Directive (listed at https://www.npws.ie/sites/).

1.14 Areas of Geological Heritage Importance

The GSI provides scientific appraisal and interpretative advice on geological and geomorphological sites, and is responsible for the identification of important sites that are capable of being conserved as Natural Heritage Area (NHA). The National Parks and Wildlife Service (NPWS) have the responsibility of designation and management of sites, with appropriate advice from GSI.

At present, the GSI has compiled a list of sites proposed for designation as Natural Heritage Areas (pNHAs). The GSI has also determined a secondary list of County Geological Sites (CGS), which may be considered for protection at local authority functional control level (i.e. may be included in county development plans).

According to the GSI, there are no areas of Geological Heritage Importance in the vicinity of the site or within 10km radius of the site.

1.15 Radon

Radon is a radioactive gas which is naturally produced in the ground from the uranium present in small quantities in all rocks and soils. The RPS has produced a Radon Map of Ireland based on the results of the National Radon Survey where radon measurements were carried out in a number of houses in each 10 km grid square of the OS national grid.

The results were used to predict the percentage of homes in each 10km grid square with radon concentrations in excess of the national reference level of 200 Bq/m^3 (Becquerels per cubic metre). The radon map has five categories: less than 1%, 1-5%, 5-10%, 10-20& and greater than 20%. These categories refer to the number of homes in the 10km grid square that are likely to have radon concentrations above the reference level.

This map was accessed online at http://www.epa.ie/radiation/radonmap/ on the 2nd July 2019. The map shows that between ten and twenty per cent of the homes in this 10km grid square encompassing the proposed development are estimated to be above the Reference Level. This is a High Radon Area.

1.16 Geohazards

Much of the Earth's surface is covered by unconsolidated sediments which can be especially prone to instability. Water often plays a key role in lubricating the slope failure. Instability is often significantly increased by man's activities in building houses, roads, drainage and agricultural changes. Landslides, mud flows, bog bursts (in Ireland) and debris flows are a result. In general, Ireland suffers few landslides. Landslides are more common in unconsolidated material than in bedrock, and where the sea constantly erodes the material at the base of a cliff landslides and falls lead to recession of the cliffs. Landslides have also occurred in Ireland in recent years in upland peat areas due to disturbance of peat associated with construction activities. The GSI landslide database was consulted and the nearest landslide to the proposed development was over 12km to the northeast. There have been no recorded landslide events at the site. Due to the local topography and the underlying strata there is a negligible risk of a landslide event occurring at the site.

In Ireland, seismic activity is recorded by the Irish National Seismic Network. The Geophysics Section of the School of Cosmic Physics at the Dublin Institute for Advanced Studies (DIAS) has been recording seismic events in Ireland since 1978. The station configuration has varied over the years. However, currently there are five permanent broadband seismic recording stations in Ireland and operated by DIAS. The seismic data from the stations comes into DIAS in real-time and are studied for local and regional events. Records since 1980 show that the nearest seismic activity to the proposed location was in the Irish sea (1.0 – 2.0 Ml magnitude) and ~55 km to the south in the Wicklow Mountains. There is a very low risk of seismic activity to the proposed development site.

There are no active volcanoes in Ireland so there is no risk from volcanic activity.

1.17 Characteristics of the Proposed Development

There are a number of elements associated with the operation of the proposed development which have the potential to impact on the environment with respect to soils and geology.

A detailed description of the proposed development is provided in Section 1.6 of this EIAR Report. The activities associated with the proposed development which are relevant to the soils and geology environment are detailed below:

The proposed development is for the importation of inert material for waste recovery on the existing lands comprising a worked-out sand and gravel pit and existing agricultural lands.

- Other than some soil stripping and vegetation removal across parts of the site, there will be no impact to the current soils and geology across the site.
- This assessment therefore will focus on the potential impact of the inert recovery material on the land, soils and geology at the site.

1.18 Potential Impact Assessment

1.18.1 Likelihood of Impacts

It is anticipated that the main environmental factors associated with the soils and geology across the site and within its immediate environs are not likely to be significantly affected by the proposed project.

Contaminated soils or buried waste are not anticipated at the site based on historical site information and the detailed site walkover undertaken.

1.18.2 Assessment Criteria

The significance of potential impacts on geological and hydrogeological sensitive receptors was estimated by implementing the National Roads Authority (NRA) *Design Manual for Roads and Bridges (*DMRB) and IGI Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) style of assessment using geological type attributes and measures to determine the magnitude of the impact on the attribute.

Table 1 below illustrates the criteria for determining the importance of sensitive receptors at the site, while Table 2 demonstrates the criteria for estimating the magnitude of the impact on an attribute and Table 3 presents the resulting estimation of the significance of potential impacts.

Table 1: Estimation of Importance of Sensitive Attributes

Importance	Criterion	Typical Examples
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.	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource

Importance	Criterion	Typical Examples
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	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 high 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	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	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 2: Estimation of the Magnitude of a Potential Impact on an Attribute

Magnitude	Criterion	Typical Example
Major Adverse	Results in loss of attribute and/or quality and integrity of attribute. Severe.	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 effect on integrity of attribute, or loss of part of attribute. Major.	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

Magnitude	Criterion	Typical Example
Minor Adverse	Results in some measurable change in attributes quality or vulnerability. Minor.	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 effect on attribute, but of insufficient magnitude to affect the use or integrity. Not significant.	No measurable changes in attributes
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	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

A qualitative approach was used in this evaluation, generally following the significance classification in the table below and through professional judgement. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect.

Table 3: Estimation of the Significance of Potential Impact

Importance of Attribute	Magnitude of Potential Impact			
	Negligible	Minor Adverse	Moderate Adverse	Major Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant / Moderate	Profound/ Significant	Very Large
High	Imperceptible	Moderate / Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Terms relating to the duration of impacts are as described in the EPA's guidelines on the information to be contained in Environmental Impact Assessment Reports draft (August 2017) as:

- Momentary Effects - Effects lasting from seconds to minutes
- Brief Effects - Effects lasting less than a day
- Temporary Effects - Effects lasting less than a year
- Short-term Effects - Effects lasting one to seven years.
- Medium-term Effects - Effects lasting seven to fifteen years.
- Long-term Effects - Effects lasting fifteen to sixty years.
- Permanent Effects - Effects lasting over sixty years
- Reversible Effects - Effects that can be undone, for example through remediation or restoration

The prediction of potential impacts by the proposed development are summarised in the following sections and tables. The impacts are separated into construction stage impacts and operational stage impacts.

1.18.3 Potential Cumulative Impacts

The EU Guidelines[1] define cumulative impacts as:

"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:

- Incremental noise from a number of separate developments;
- Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and,
- Several developments with insignificant impacts individually but which together have a cumulative effect."

The EPA Guidelines on the Information to be contained in Environmental Impact Statements mirrors this approach and defines cumulative impacts as "The addition of many small impacts to create one larger, more significant, impact".

Therefore, the assessment of cumulative impacts considers the total impact associated with the proposed development when combined with other past, present, and reasonably foreseeable future developments.

The site is a previously excavated sand and gravel quarry. No other quarries or similar type of development that could impact on the soil and geology environment is present in proximity to the site. No further excavation works are proposed across the site. Therefore, it is considered that the overall development will have an imperceptible cumulative impact on the underlying geology.

[1] 1 Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 2009, EC DG XI Environment, Nuclear Safety & Civil Protection Ref: NE80328/D1/3

1.18.4 'Do-Nothing' Impacts

If the proposed project does not go ahead there will be no impact from the proposed site operations on the soils and geology at the site. It is envisaged that the land use would remain unchanged as a former sand and gravel quarry site.

1.18.5 Interaction with Other Impacts

No interactions with other impacts have been identified for the land, soils or geology attributes associated with the proposed development.

1.18.6 Potential Impacts Risks

The table below outlines the range of potential impacts associated with the construction and operational phases of the proposed development.

Table 4: Potential Operational Phase Impacts

No.	Operational Activity	Attribute	Character of Potential Impact	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
1	Excavation Works	Bedrock	It is anticipated that the development of the site preparation works will not be deep enough to intersect or impact the underlying bedrock geology. Therefore, the impact on bedrock is considered to be imperceptible	Medium	Negligible	Imperceptible
2	Excavation Works	Site Subsoils	The subsoils are already exposed at the site from historical quarry operations and the planned site preparation works are not anticipated to excavate significant additional subsoils. Some site preparation works will be required including the construction of a new access road off the L4015, the creation of a permeable carpark and regrading of the ground surface in the stockpiling and sorting area. These will involve localised shallow excavation in areas previous excavated as part of the historical quarrying operations.	Medium	Negligible	Imperceptible
3	Vehicle traffic	Subsoils	There may be a risk of soil pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles. Risks to groundwater and surface water are discussed in more detail in Chapter 9.	Medium	Moderate Adverse	Moderate

No.	Operational Activity	Attribute	Character of Potential Impact	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
4	Fuel Storage/Usage on site	Subsoils	Accidental spillage of contaminants during vehicle movements or refuelling of machinery on site may cause short to long term, moderate to significant impacts to subsoils and to future site users if not stored and used in a an environmentally safe manner. Potential impacts to groundwater are addressed separately within Chapter 9.	Medium	Moderate Adverse	Moderate
5	Contaminated land / waste	Subsoils	The importation of unsuitable or contaminated fill material may pose a risk to the groundwater aquifer and surface waters in proximity to the site. However, any imported fill for filling in the worked-out quarry is expected to be inert and therefore the risk is considered to be imperceptible.	Medium	Negligible	Imperceptible

1.19 Avoidance, Remedial & Mitigation Measures

Mitigation measures are outlined here for the site preparation and operational stage of the proposed inert waste recovery facility. The site preparation stage is relatively short lived and is required before the recovery of the inert material can take place at the site.

1.19.1 Site Preparation Stage

During the site preparation stage some soils will be stripped to facilitate road construction and the construction of some hard-standing areas. Any soils stripped with be temporarily stockpiled on site ready for use in restoration.

In order to preserve the structure and integrity of the soils and limit the effects of erosion on the on the stored soil the following measures will be implemented:

- Soil material placed in stockpiles will be at a safe angle of repose.
- Stockpiles will be re-vegetated where they are in place for a sufficient length of time to justify such a measure; and
- The re-handling of soil material will be minimised as much as possible in order to preserve the integrity of the stripped material. This is also an economically prudent practice.

1.19.2 Site Operational Stage

The following mitigation measures are required during the operational element of the development: If these measures are implemented, the residual risks posed to the underlying subsoils and geology are considered to be imperceptible.

- Topsoiling and landscaping of the works shall be undertaken as soon as finished levels are achieved, in order to reduce weathering and erosion and to retain soil properties. Any existing topsoil shall be retained on site to be used for the proposed development.
- Topsoil shall 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.
- Suitable runoff and sediment control measures shall be designed and implemented prior to and during construction activities. These control measures depend upon weather conditions, site characteristics and operational activities and will ensure protection to the underlying subsoils and groundwater aquifer.
- The provision of wheel wash facilities close to the site entrance shall reduce the deposition of mud, soils and other substances on the surrounding road network.
- Reusable excavated gravels, sands or rock shall be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material.
- An existing bunded, roofed storage area shall be upgraded/repaired for the storage of hazardous materials such as fuels, oils and concrete additives on-site. This area shall be designed in accordance with EPA Guidance IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities, taking into account criteria for bund requirements (e.g. 110% of the capacity of the largest tank or drum within the bunded area; or 25% of the total volume of substance which could be stored within the bunded area, whichever is greater).

- A separate drainage system serving the proposed fuel storage area and re-fuelling area is proposed. Surface water arising in the re-fuelling area will be captured by this drainage system and directed to a silt-trap, an oil interceptor and a soakaway.

Waste fuels and materials shall be stored in designated areas that are isolated from surface water drains or open waters (*e.g.* excavations). Skips shall be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, shall be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fuelling, lubrication and storage areas and site offices shall not be located within 25m of drainage ditches, surface waters or open excavations. Fuel interceptor tanks shall be installed on the site to treat any runoff.

- All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) shall be stored within a secondary containment system (*e.g.* a bund for static tanks or a drip tray for mobile stores and drums). The bunds shall be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund shall be capable of holding 110% of the largest tank of 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage shall be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray shall be capable of holding 25% of the aggregate capacity of the drums stored.
- 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.
- All potentially hazardous materials shall be securely stored on site.
- Back-up plans to deal with the possibility of contamination shall be developed and included in an overall Construction Environmental Management Plan (CEMP).
- Any vehicles utilised during the operation of the development shall be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. The potential impacts are limited by the size of the fuel tank of the largest plant / vehicles used on the site. Precautions shall be taken to avoid spillages. These include:

    a. Use of secondary containment e.g. bunds around oil storage tanks;

    b. Use of drip trays around mobile plant;

    c. Supervising all deliveries and refuelling activities; and,

    d. Designating and using specific impermeable refuelling areas isolated from surface water drains.

- Special environmental and human health contingency plans and procedures, following best-practice guidance and in accordance with Waste Management Legislation and Regulations, shall be developed for the unexpected discovery of contaminated or illegally deposited waste materials, if encountered.
- Adequate security measures shall be installed on the site. Early assessment of the sensitivity of the project and identifying potential locations at risk will assist in the design of the site layout and security measures required. Security measures will include secure fencing, secure site

access, securing site plant and equipment, secure storage of materials, sufficient warning signage, and security lighting.

1.20 Residual Impact Assessment

The residual impacts on land, soil and geology are those impacts which remain following the implementation of the mitigation measures outlined above

1.20.1 Site Preparation Stage

The soils at the site will be stored in accordance with best practice to preserve the structure and integrity of the soils. The soils will be reused at the site for restoration to agricultural land. With this mitigation measure in place, it is considered that the residual impact on soils will be low.

1.20.2 Operational Stage

The recovery of the inert waste material at the site and the restoration of the former landform will facilitate the restoration of soils across the site and the beneficial landuse in terms of agriculture and ecological habitats. The residual impact of the proposed recovery facility therefore will be both positive and beneficial.

1.20.3 Reinstatement

The principal activity which will be undertaken at the application site is backfilling and restoration of lands within an existing sand and gravel quarry. A cover layer comprising 150 mm of topsoil and approximately 350 mm of subsoil shall be placed over the inert backfilled materials on completion of the backfilling activities. This will then be planted with grass in order to promote stability and minimise soil erosion and dust generation. Thereafter the lands will be progressively returned to use as agricultural grassland.

It is envisaged trees planted during the lifetime of the facility along the northern, eastern and south western boundaries will have reached their semi-mature stage and will be retained. Existing vegetation along the western boundary of the site will also be retained. It is envisaged that trees around the perimeter of the site will promote soil stability and minimize soil erosion around the boundary of the fill area where steeper gradients will be present.

On progression and completion, the final landform will be modified as necessary to ensure that surface water run-off across the site is directed to the boundary ditch along the western border of the site. Existing settlement ponds situated on-site will ultimately be filled in.

On completion, all mobile plant and equipment associated with the waste recovery activities will be removed off-site. Any dedicated temporary site accommodation, infrastructure and/or services will also be progressively decommissioned and/or removed off-site.

A Landscape Restoration Plan detailing the final landscape proposal on-site adjoins the Planning Application (Drawing Ref. 1467-002)

1.20.4 Monitoring

Following the restoration of the site monitoring of the site shall be undertaken over a three Year period to ensure that the restored soil and landuse is successful to pastoral agricultural landuse in accordance with the Landscape Restoration Plan.

2. Hydrogeology & Hydrology

2.1 Introduction

This chapter of the EIAR assesses the impact on the hydrogeological and hydrological environments of the proposed development. The objectives are to provide a review of baseline conditions across the footprint of the site, to assess the potential impact of the proposed development on the hydrological and hydrogeological environments and to provide appropriate mitigation measures for any identified potential impacts, if deemed necessary.

2.2 Assessment Methodology

The methodology used in the investigation follows the guidelines and advice notes provided by the Environmental Protection Agency on environmental impact assessments and the Institute of Geologists of Ireland's (IGI) guide or the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

Existing information on the surface water, groundwater and geological features at the site and the surrounding area was collated and evaluated. Monitoring data from the site in relation to groundwater levels and groundwater quality was assessed.

The methodology involved in the assessment can be summarised as follows:

- A desk study, in which existing data and relevant regional data sources for the area were examined;
- Field visits in which aspects of the surface water management at the site and the sites hydrology and hydrogeology were examined;
- Groundwater level monitoring data provided by the client; and
- Analysis of the information gathered.

Unmitigated potential impacts on hydrology and hydrogeology are considered for the initial assessment, before appropriate mitigation measures for the potential impacts identified are discussed, and the identified potential impacts reassessed assuming the identified mitigation measures in place which assess residual risk.

The following sources of information were used in the compilation of this assessment:

- Ordnance Survey of Ireland, Discovery Series, Sheet 61.
- Ordnance Survey of Ireland (OSI) online historical maps and aerial photographs.
- Geology of Kildare-Wicklow, Geological Survey of Ireland (GSI) (1:100,000), Sheet 16.
- County Kildare Groundwater Protection Scheme (2002).
- GSI On-line Groundwater Database. Aquifer Classification, Aquifer Vulnerability.
- GSI New Ross and Ballyglass Groundwater body (GWB).
- Soil Map of Ireland (Second Edition, 1980), National Soil Survey of Ireland, An Foras Talúntais.
- National Parks and Wildlife Service on-line database www.npws.ie.
- EPA online water quality mapping; https://gis.epa.ie/EPAMaps/
- OPW hydro-data (http://www.opw.ie/hydro-data);
- Met Eireann - met.ie – monthly climatological data.

- Kildare County Council online planning files and County Development Plan.
- Further information request (PPR 06/2802) by Kildare County Council for the continued operation for the extraction of sand & gravel & all associated processing works at Graney West, County Kildare. Golder Associates (November - 2007)
- Environment Assessment Report 1969-01 v2.00 Re: Application for permission for the development of a Waste Recovery Facility at a disused quarry site in Graney West, Castledermot, Co. Kildare. Environmental Efficiency (February - 2018).

This chapter was undertaken in accordance with the following:

- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002),
- Geology in Environmental Impact Statements a Guide, (IGI, 2002),
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA Document.
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013),
- DELG/EPA/GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.
- Draft EPA revised Guidelines on information to be contained in Environmental Impact Statements; and Advice Notes for preparing EIS, 2015.

2.3 Baseline Environment

2.3.1 Site Location and Context

The site in Graney West, Castledermot, Co. Kildare, is approximately 2 km to the south-east of Castledermot village (Figure below), and 12 kilometres from the town of Baltinglass, in Co. Wicklow. The site is situated in a rural agricultural area with grazing and tillage being the main agricultural activities. Several historic sand and gravel extraction sites are situated in the broader area of the site. There are 12 no. residential developments within a radius of 500m, mainly to the east, north and south of the application site.

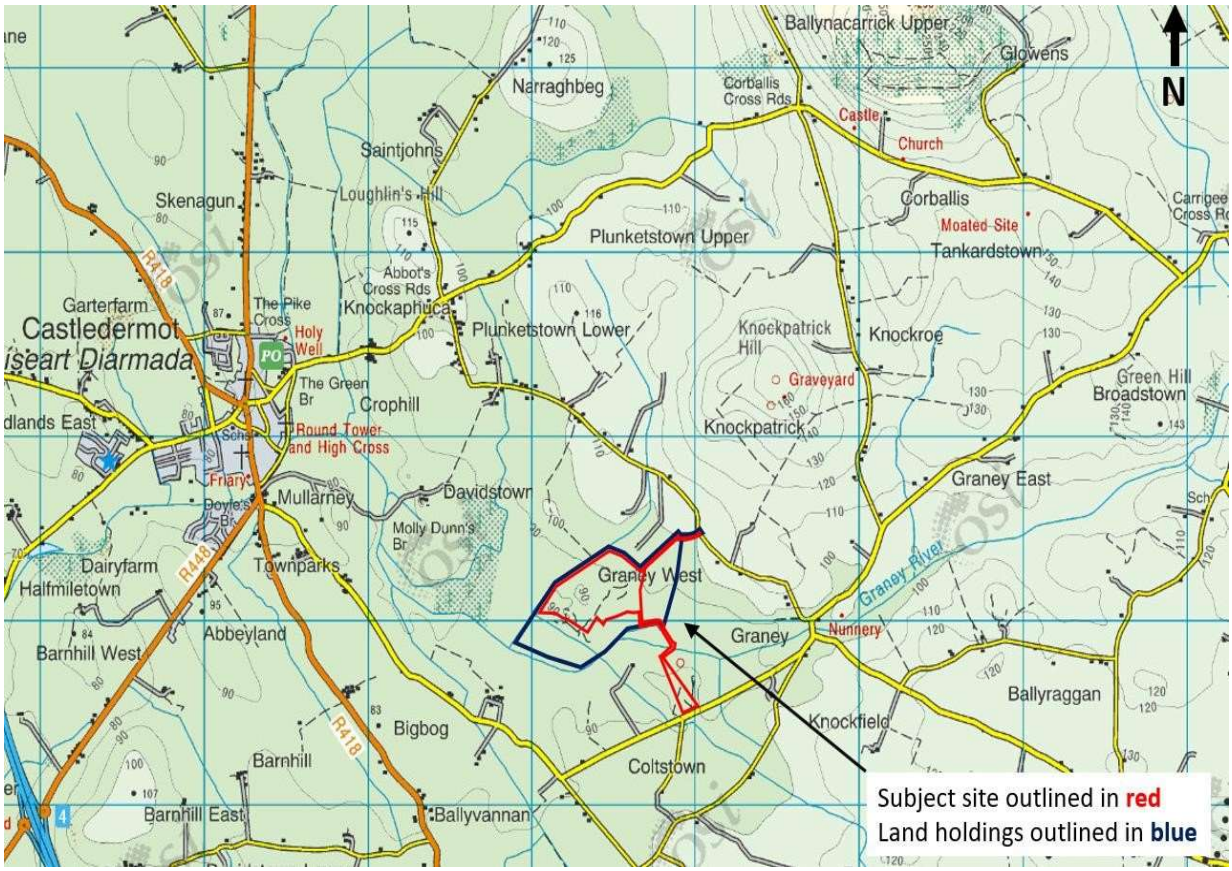

Figure 5: Site Location Map

2.4 Site History

The site was previously operated as a sand and gravel quarry. Quarrying activities ceased (circa 2007) within the application site when full extraction of materials occurred. The resulting terrain across the site comprises worked out quarry voids. Sand and gravel soils in these areas were previously extracted, leaving mineral sub-soil/rock exposed at the ground surface. Ground levels across the site have been significantly disturbed over time and lowered by the historical quarrying activities. Original ground levels across the quarry typically ranged between a high of 95 mOD to a low of 81 mOD. Existing quarry floor levels typically vary from a high of 86.7 mOD to a low of 79 mOD.

Quarrying activities will continue to take place in an adjacent field to the north of the site outside the application site boundary in accordance with the existing planning permission (Ref. 06/2802).

There are several quarries located within a 5 km radius predominantly, to the east and into Co. Carlow. The closest large quarry is located 1.1 km to the north-west and there is a smaller quarry located 1.6 km to the east.

2.5 Site Description

The application site covers an area of 19.2 hectares. Pockets of tree groves and vegetative growth occur sporadically throughout the site, with hedgerows existing along sections of the site boundary. A series of settlement lagoons are located in the southern region of the site for the purposes of managing surface water run-off.

The following buildings, facilities, services and infrastructure, utilized in connection with the pre-existing quarry activity and farming activities, are currently present on-site.

- Site offices (2 x portable cabins)
- Washing plant and ancillary equipment
- Stockpiling areas and existing retaining walls
- Existing site access road to the east of the site
- Internal haul routes
- Covered, bunded fuel tanks
- Non-permeable concrete area (surrounding residence and farm buildings/structures)
- Covered, slatted effluent tank
- Site boundary trees and vegetation
- SW/foul drainage infrastructure; existing SW/foul drains, pump house, septic tank, soak hole and settlement lagoons (x 3).
- Dwelling house and its curtilage
- Various agricultural buildings and structures used in connection with farming activity, including cattle shed (with effluent tank), outhouse and horse boxes, horse paddock, silage pit, farm store and racking area.

An existing concreted yard area surrounds these buildings present on-site. Plant and equipment used in connection with pre-existing quarrying activities are also situated in this area and immediately south of the area.

There are several quarries located within a 5 km radius predominantly, to the east and into Co. Carlow. The closest large quarry is located 1.1 km to the north-west and there is a smaller quarry located 1.6 km to the east.

2.6 Proposed Development

Sancom Ltd proposes on establishing and operating a Material Recovery Facility (MRF) at the site. The principal activity will involve the use of imported, uncontaminated soil and stone, sourced from construction sites, to backfill and restore the worked-out quarry. A detailed description of the proposed activities is provided in Section 2.5 with a summary outlined below:

- Sancom Ltd intend on accepting a maximum of approximately 1.8 million tonnes of soil and stone material on-site per annum for backfilling over the course of 10 to 25 years, depending on market demand for disposal services.
- The proposed activity above will be for the purposes of recovering said materials through land deposition, and to achieve the improvement and development of land and site restoration. The

material accepted on-site will be inert and will comprise subsoil, clay, gravels, topsoil, stone and mixtures of such.

- The proposed activity will include the placement of cover soils and seeding and return to use as agricultural grassland.
- In addition to the principal waste activity described above, it is proposed to carry out the following waste recovery activities on-site:
- Intake of top-soil, screening at existing screening plant and resale of such material,
- Intake of gravel and sands, washing at existing washing plant and resale of such materials,
- Intake of concrete, concrete crushing using concrete crushing equipment, mixing with sand and gravel before being fed to the washing plant to form aggregate, and resale of such material, and;
- Intake of garden waste, shredding and composting of this waste for use for agricultural land spreading.

It is proposed to utilise pre-existing plant and, in addition, install further plant on-site to be used in connection with the proposed development activity.

2.7 Previous Investigations

The following reports were reviewed during the compilation of this EIAR chapter on Hydrology and Hydrogeology and the pertinent information is contained in the subsequent sections:

1. *Items 1 to 9 of Further Information Request (PPR 06/2802) by Kildare County Council for a Sand and Gravel Quarry at Graney West, County Kildare*, Golder Associates, November 2007.
2. *Environment Assessment Report 1969-01 v2.00 Re: Application for permission for the development of a Waste Recovery Facility at a disused quarry site in Graney West, Castledermot, Co. Kildare*. Environmental Efficiency, February 2018.
3. *Surface Water and Groundwater Testing Report for Sancom Ltd*., Environmental Efficiency, March 2020.

2.8 Topography

The site at Graney West slopes from north to south (a fall of approximately 10m in 500m). Based on a topographical survey (2007) the elevation along the northern boundary is approximately 87 mOD while the area in the south of the site is approximately 81.5 mOD. The site slopes towards the River Graney which lies at approximately 80 mOD. The River Graney flows from east to west towards the River Lerr at Castledermot, along the southern boundary of the land holding area. To the north the land elevation increases towards Knockpatrick Hill with a topographical high greater than 160 mOD.

2.9 Subsoils and Bedrock

A detailed description of the subsoils and bedrock across the site is provided in Chapter 7 of the EIAR. A brief summary is provided below:

- According to GSI sheet 16, the bedrock geology beneath the site mapped by the GSI as Tullow Type 2 Granite, a microcline porphyritic granite with microcline phenocrysts. These Tullow granites compose the Tullow Pluton of the Leinster Granite intrusion and are extremely weathered and broken down.
- The depth to granite bedrock was recorded between 9.15 and 12.3m during the drilling of deep groundwater boreholes on-site in 2019.
- There is no mapped bedrock outcrop within the site boundary.
- Subsoils (Quaternary Sediments) underlying the site are comprised of gravels derived from limestones. The overburden was recorded as sandy gravel at depths of between 9.15 and 12.3m during the drilling of deep groundwater boreholes on-site in 2019.

2.10 Hydrogeology

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub-soils. The potential of rock to store and transport water is governed by permeability of which there are two types, inter-granular and fissure permeability. Intergranular permeability is found in sediments, sands, gravels and clays as are also present at the subject site, and fissure permeability, which is found in bedrock, where water moves through (and is stored in) cracks, fissures, fracture planes and solution openings for example. Aquifers are generally classified as rocks or other matrices that contain sufficient void spaces and which are permeable enough to allow water to flow through them in significant quantities.

2.10.1 Aquifer Classification

The GSI has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource into the National Draft Bedrock Aquifer Map. The three main classifications are Regionally Important Aquifers, Locally Important Aquifers, and Poor Aquifers. Each of these types of aquifer is further subdivided and has a specific range of criteria associated with it, such as the transmissivity (m²/day), productivity, yield, and the potential for springs.

Graney West is located in the New Ross Groundwater Body (GWB) which is comprised of both moderately productive and unproductive aquifers. The site is underlain by granite bedrock, classified as a 'Poor Aquifer' which is *generally unproductive except for local zones* (Pl) (Figure 6 overleaf). Irish granites do not provide large groundwater supplies but can generally provide reliable water supplies for domestic and farm supplies. To the north, west and east the bedrock is described as a 'Locally Important Aquifer '- granite bedrock which is *moderately productive only in local zones* (Ll).

The Baltinglass Gravel Aquifer within the Ballyglass GWB is mapped to the east of the site. Although it does not appear to underlie the site, it is noted to be thick enough to constitute a sand & gravel aquifer.

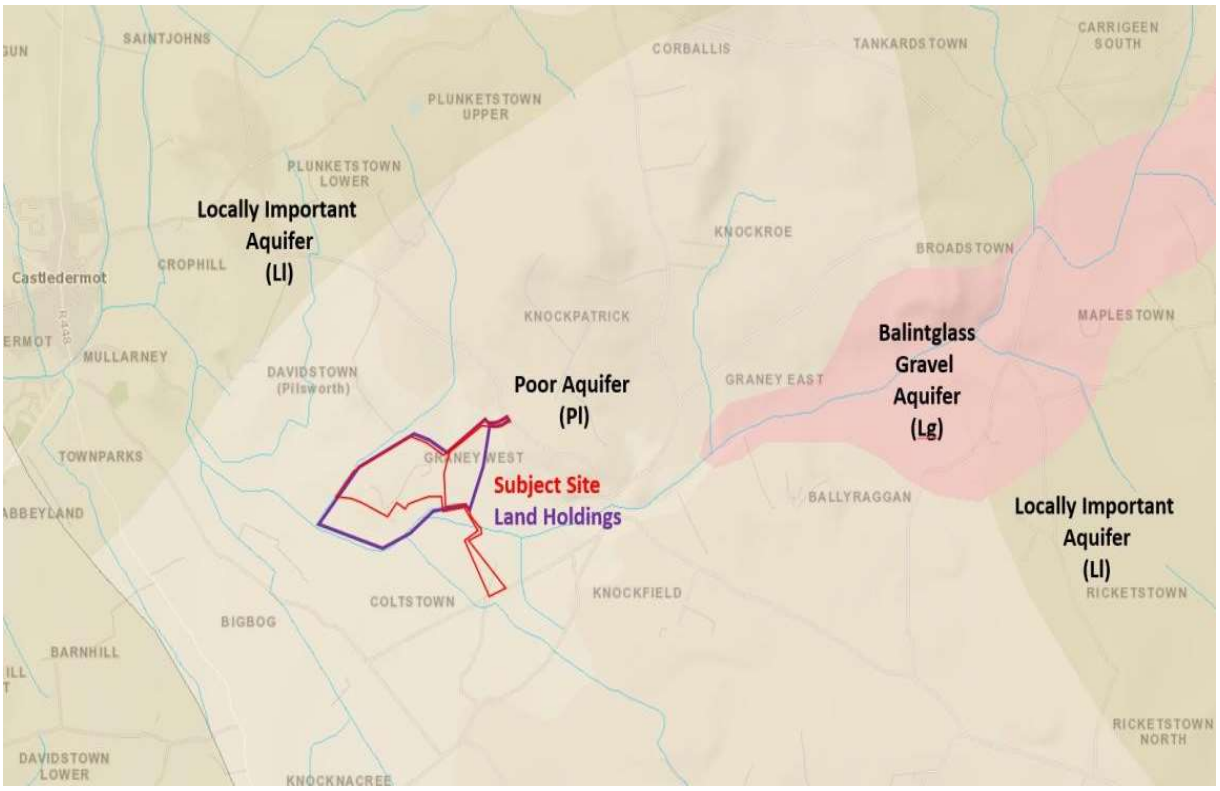

Figure 6: Aquifer Classification

2.10.2 Characteristics and Properties of the Aquifer

There are no available data for the granite aquifers in the New Ross GWB. The granites in this area have undergone tectonic stresses, resulting in faulting and fracturing and are noted to have been extensively weathered to depths of 30m. Increased rock fracturing is likely to be a focus for groundwater flow.

2.10.3 Regional Aquifer Vulnerability

The GSI classify aquifer vulnerability as the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability of groundwater depends on the ability of contaminants to migrate to the underlying aquifer which is dependant predominantly on the permeability and thickness of the subsoils overlying the groundwater body and the types of recharge source (i.e. diffuse or point source) (see Table 5 overleaf). Under the GSI groundwater vulnerability classification scheme the mapped vulnerability at a location applies to the shallowest groundwater target (i.e. aquifer) at the location.

A groundwater vulnerability map is provided in the Figure 7 overleaf and outlines the GSI aquifer vulnerability mapping for the area in the vicinity of the site. Aquifer vulnerability is largely dependent on overburden thickness and the inherent permeability of the bedrock. If bedrock is near or exposed at the surface the groundwater classification will be extreme. A detailed description of the groundwater vulnerability categories can be found in the Groundwater Protection Schemes document (DELG / EPA / GSI, 1999) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater

Vulnerability to Contamination (Fitzsimons et al, 2003). According to the GSI the vulnerability classification for the site is **High (H)**, likely based on the presence of high permeability sand and gravel subsoils.

Table 5: Vulnerability Mapping Criteria (adapted from DELG / EPA / GSI, 1999)

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)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	> 3.0m	3.0 – 10.0m	3.0 – 5.0m	> 3.0m	N/A
Moderate (M)	N/A	> 10.0m	5.0 – 10.0m	N/A	N/A
Low (L)	N/A	N/A	> 10.0m	N/A	N/A

Notes: (1) N/A = not applicable

(2) Precise permeability values cannot be given at present

(3) Release point of contaminants is assumed to be 1-2m below groundwater surface

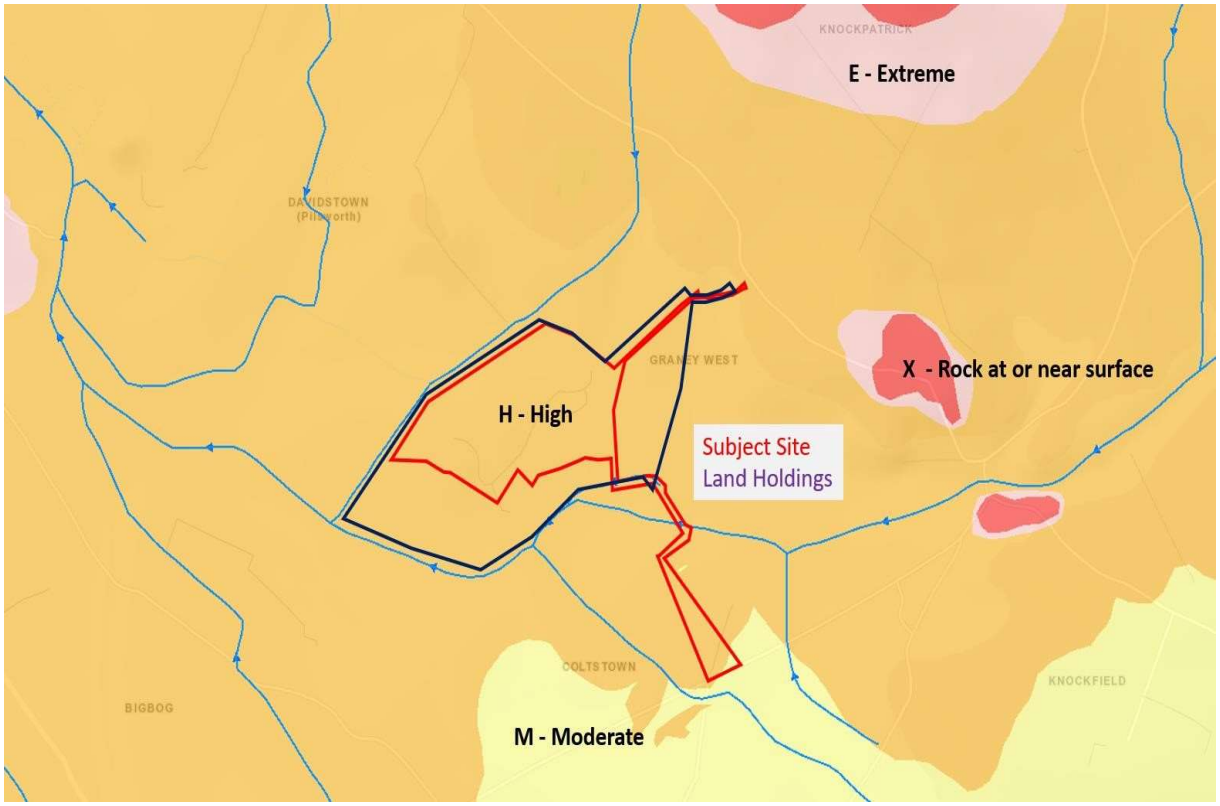

Figure 7::Groundwater Vulnerability Map

2.10.4 Groundwater Water Framework Directive Status

Graney West is located in the New Ross GWB. Work completed for the Water Framework Directive has assigned 'Status' to surface waters and groundwater (http://wfdireland.ie/maps.html). The Water Framework Directive status of the New Ross GWB (IE_SE_G_102) is rated as 'Good' (based upon final RBMP, 2009-2015) with a future projection of 1b probably at risk.

2.10.5 Groundwater Recharge

The GSI has published Groundwater Recharge Mapping for almost all of Ireland. Potential or effective rainfall is the amount of rainfall that is available to infiltrate the ground and that will not evaporate or be taken up by plants. The effective rainfall for the area is 515 mm/year. Groundwater recharge in this area is likely to occur over most of the land surface through the sands and gravels and permeable tills and will discharge in local areas. Due to the low storage capacity of this aquifer a recharge cap of 100 mm/year applies in this area.

Across the existing worked out pit the soils and vegetation has been removed and there is no evapotranspiration, the majority of rainfall will recharge the underlying Sand/Gravel aquifer.

2.10.6 GSI Well Database and Local Groundwater use

The GSI online map identifies the following list of wells within 1 km of the site as outlined in Table 6:

Table 6: Groundwater wells within 1 km

Name	E	N	Well Type	Depth (m)	Bedrock (m)	Well Use	Yield (m^3/d)	GSI yield class
2617NEW236	280360	183500	Dug Well	2.4	2.4	Unknown	21.82	Poor
2617NEW367	280280	183230	Dug Well	2.4	Unknown	Unknown	Unknown	Unknown
2617NEW363	280560	184230	Dug Well	6.1	Unknown	Unknown	Unknown	Unknown
2617NEW365	279770	183580	Dug Well	2.1	Unknown	Unknown	Unknown	Unknown
2617NEW366	279630	183260	Dug Well	1.8	Unknown	Unknown	Unknown	Unknown
2617NEW244	280020	182340	Borehole	9.8	4.6	Unknown	27.28	Poor
2617NEW235	281240	185060	Borehole	16.2	3.7	Unknown	21.82	Poor
2617NEW222	280670	185250	Borehole	27.4	21.3	Agri & Domestic	27.3	Poor
2617NEW248	278680	184680	Borehole	43.6	Unknown	Unknown	5.46	Poor

Well (2617NEW363) listed in the table above was a 6m deep hand-dug well located on-site but has now been decommissioned (see DW1, Figure 8 overleaf). A domestic borehole on-site currently supplies the existing residence and is installed into the bedrock aquifer (see DW2, Figure 8 overleaf).

This is the only well regularly abstracting groundwater from the bedrock aquifer on-site. No other information is available about this borehole.

Groundwater was historically abstracted from two wells installed within the shallow gravels on-site for quarrying and concrete manufacture (see AB1 and AB2, Figure 8 below). AB1 comprised a concrete ring set within a shallow trench. Water was pumped from this point to the concrete batching plant at intermittent intervals. AB2 comprised an excavated pond from which water was pumped to the gravel washing plant. AB2 was reported to have been periodically topped up with water pumped from the nearby Graney River. Historically recorded groundwater level analysis indicated the abstraction from these locations, when in operation, did not significantly impact on groundwater levels in the area.

Most households within the vicinity of the site are connected to the mains water supply. The nearest domestic groundwater abstraction well was found to be 50m north of the quarry site boundary (DW3 Figure 8 below).

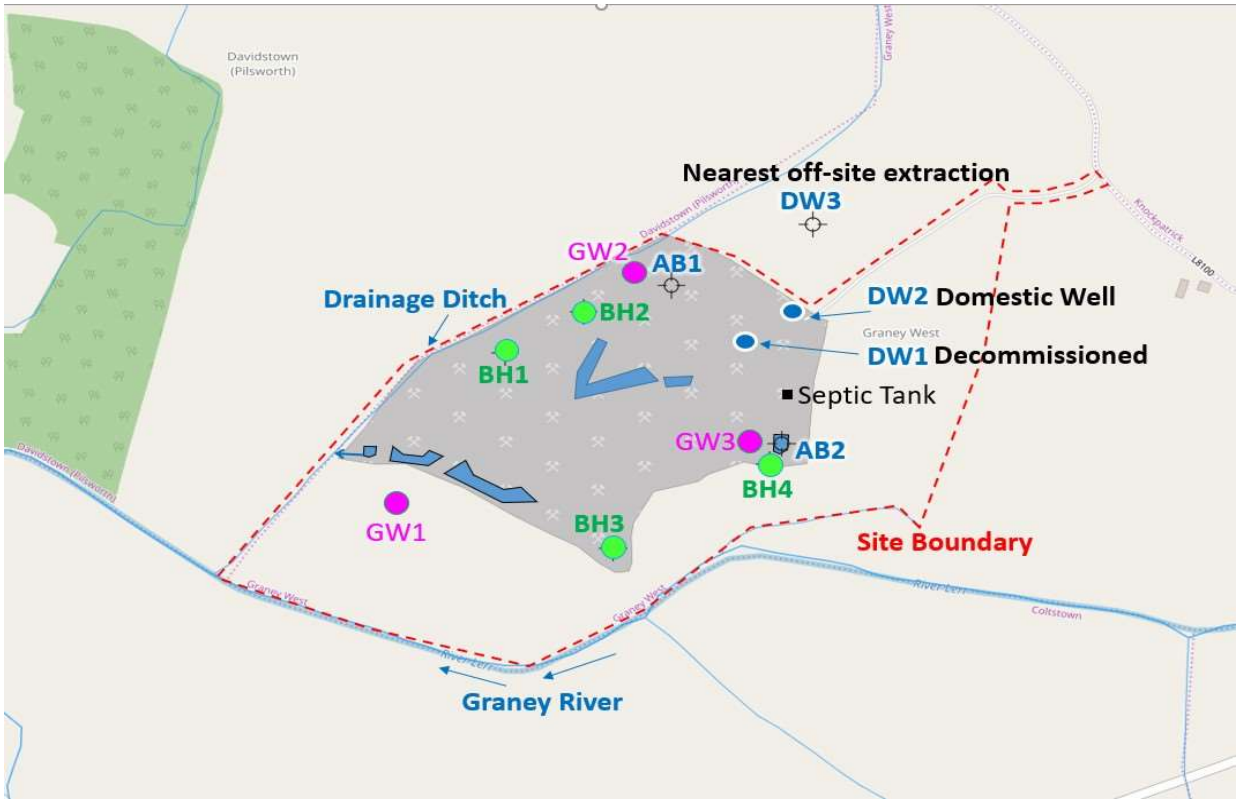

Figure 8: Groundwater Features (Source Open StreetMap)

2.10.7 EPA/GSI Source Protection Zones

As reported by the EPA and GSI, groundwater sources, particularly public, group scheme and industrial supplies, are of critical importance in many regions. Consequently, the objective of source protection zones is to provide protection by placing tighter controls on activities within all or part of the zone of contribution (ZOC) of the source.

There are two main elements to source protection land surface zoning:

- Areas surrounding individual groundwater sources; these are termed source protection areas (SPAs)

- Division of the SPAs based on the vulnerability of the underlying groundwater to contamination.

These elements are integrated to give the source protection zones. Two source protection areas are recommended for delineation:

- Inner Protection Zone (IPA). This area is designed to protect against the effects of human activities that might have an immediate effect on the source and, in particular, against microbial pollution. The area is defined by a 100-day time of travel (TOT) from any point below the water table to the source. In karst areas, it will not usually be feasible to delineate 100-day TOT boundaries, as there are large variations in permeability, high flow velocities and a low level of predictability. In these areas, the total catchment area of the source will frequently be classed as SI.
- Outer Protection Zone (OPZ), encompassing the remainder of the groundwater source catchment area or Zone of Contribution (ZOC). It is defined as the area needed to support an abstraction from long-term groundwater recharge i.e. the proportion of effective rainfall that infiltrates to the water table.

There are no source protection areas or public water supply (PWS) schemes within 3km of the site. No karst features have been identified within 10km of the site.

2.10.8 Site Hydrogeology

Four (4 no.) Shell and Auger boreholes were drilled and installed as groundwater monitoring wells (10-13th July 2007) around the perimeter of the site to a depth. The ground conditions were reported to comprise firm brown sandy gravelly clay overlying fine sand and dense medium gravels with large cobbles. The borehole logs did not record any groundwater strikes during drilling operations.

The monitoring well details are presented in the table overleaf and the locations outlined in the Figure on the previous page. The groundwater levels were recorded during the period of July 2007 which was noted as one of the wettest on record. The groundwater levels ranged between 0.65 and 3.45 mbgl (78.8 and 80.4 mOD). The highest levels were recorded within BH4 located in the southeast of the site and the lowest levels were recorded within BH1 located in the west of the site.

Three (3 no.) of deeper groundwater wells were drilled in 2019 (GW1, GW2 and GW3). In the absence of borehole logs, summary details are outlined in the table overleaf. The wells were drilled to depths of between 25.9 and 74.7m. The depth to bedrock was recorded between 9.15 and 12.3m. The wells were sampled for groundwater quality on 29/06/2019. Groundwater manual dips recorded on the day recorded groundwater levels between 0.74 and 1.6 metres below top of well casing (mbtoc). These wells are reported to yield between 10.91 and 21.82 m^3/day which is consistent with expected yields within this bedrock aquifer. These wells have not been surveyed to Ordnance Datum and therefore groundwater contours have not been produced to-date.

Table 7: Summary Borehole Logs 2007

BH ID	Total Depth (mbgl)	Ground Level (mOD)	Water Level (mbgl)*	Water Level (mOD)*	Screened depth (mbgl)	Lithology
BH1	4.5	79.83	0.9 – 1.0	78.83 – 78.9	1.0 – 4.5	Dense medium gravels with large cobbles (0 - 3.2m) overlying fine brown-grey sand (3.2 - 4.5m).
BH2	7.0	82.93	3.4 – 3.45	79.48 – 79.53	1.0 – 7.0	Firm brown sandy gravelly clay with occasional cobbles (0 - 1.8m) overlying dense medium gravels with large cobbles (1.8 - 6.1m) overlying fine brown granular sand (6.1 - 7.0m).
BH3	4.0	79.85	0.65 – 0.68	79.17 – 79.2	1.0 – 4.0	Firm sand and gravel with large cobbles (0 – 2m) overlying firm fine sand with gravels and occasional cobbles (2.0 – 4.0m)
BH4	4.0	82.76	2.3 – 2.4	80.36 – 80.43	10 – 4.0	Firm brown sandy gravelly clay (0 - 1.2m) overlying dense medium gravels with cobbles (1.2 - 4.0m)
*Recorded on 18th, 23rd and 30th July 2007.						

Table 8: Summary Borehole Logs 2019

BH ID	Total Depth (mbgl)	Ground Level (mOD)	Water Strikes (mbgl)	Water Levels* (mbtoc)	Screened depth (mbgl)	Lithology
GW1	74.7	TBC-	67.1	0.74	24.4 - 74.7	Overburden sandy gravel (0 - 12.3m) overlaying granite (12.3 - 74.7m).
GW2	50.3	TBC	42.7	0.9	18.3 - 50.3	Overburden sandy gravel (0 - 12.3m) overlaying granite (12.3 - 50.3m).
GW3	25.9	TBC	18.3	1.6	13.3 - 25.9	Overburden sandy gravel (0 - 9.15m) overlaying granite (9.15 - 25.9m).
*Recorded on 29th June 2019						

2.10.9 Groundwater levels, Flow Directions and Gradients

Regional groundwater flows toward and discharges to the River Barrow to the southwest. The granites have been subject to a variety of different tectonic stresses and are thought to be extensively weathered to depths of 30m. This fractured zone could be the focus for groundwater flow. Local groundwater flow at the site is expected to follow the topographical relief of the area and flow in a westerly direction from the site towards Castledermot and the River Lerr.

Groundwater levels recorded in July 2007 within the shallow monitoring wells BH1 to BH4 indicate that groundwater is flowing in westerly direction across the site towards the Graney River and following the topographical relief of the area (Figure 9 below).

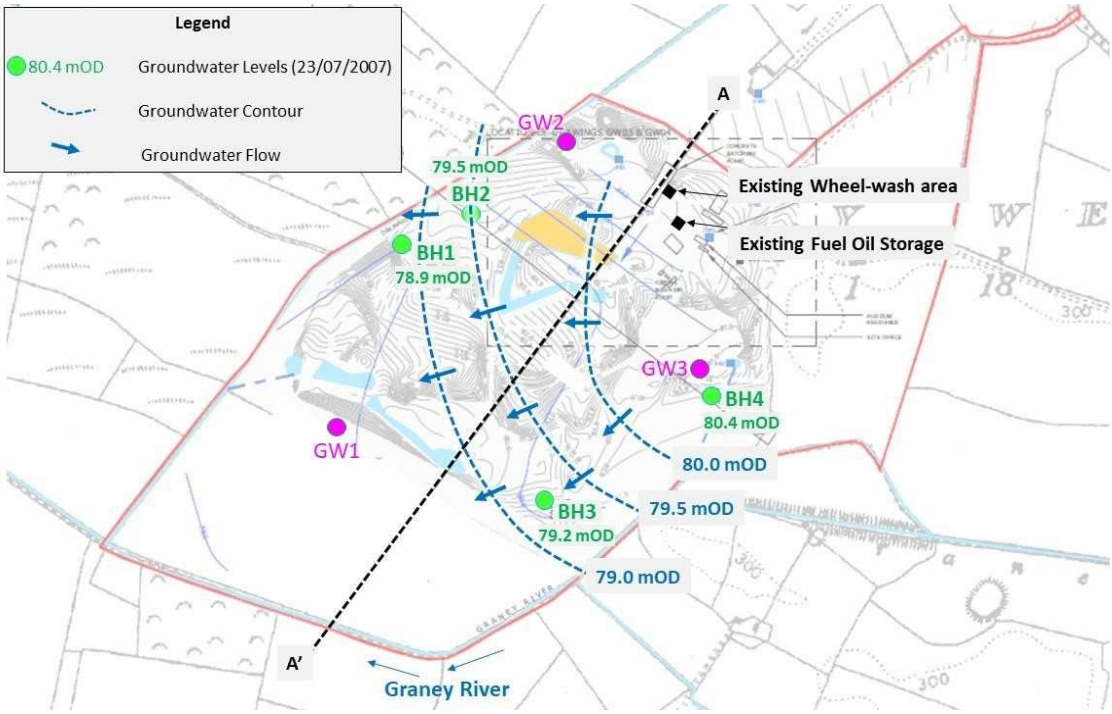

Figure 9: Groundwater Flow (Source: Adapted from Golder 2007)

2.10.10 Cross-section through the site

Based on the geological and hydrogeological data collated previously across the site, a conceptual understanding of groundwater flow (see the Figure above) was provided in the 2007 Golder report. This interpretation is considered accurate and broadly represent current site conditions. The cross-section A-A' is delineated in Figure 10 overleaf. Groundwater level at the site is interpreted to be in hydraulic continuity with the ponds in the southwest of the site and with the River Graney.

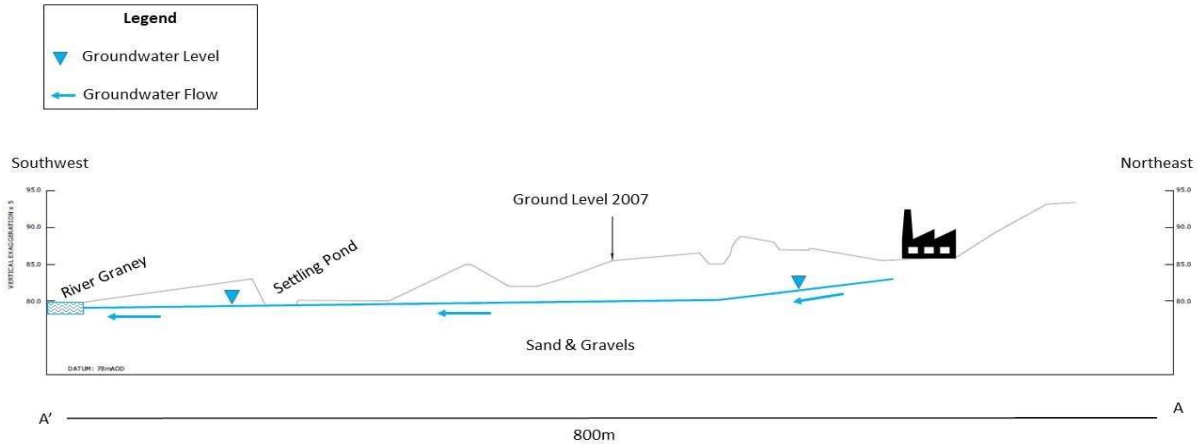

Figure 10: Cross Section A_A (Source Golder, 2007)

2.10.11 Site Groundwater Quality

Groundwater sampling was undertaken on 29/06/2019 following the drilling of three deep groundwater boreholes on-site (GW1, GW2 and GW3). The groundwater monitoring locations are detailed in the table below. All samples were sent for testing to Concept Life Sciences (CLS) Laboratory based in Manchester. CLS are a UKAS accredited laboratory. The laboratory certificates of analysis are contained in Appendix 1 of the EIAR .

Table 9: Groundwater Monitoring Point Details

Monitoring Well	Location Detail	Grid Coordinates
GW1 (2181/X)	Downgradient - below the runoff settlement ponds in the southwestern region of the site.	52.901138, -6.809682
GW2 (2181/Y)	Side gradient - in the northern region of the site.	52.904177, -6.805426
GW3 (2181/Z)	Upgradient - in the eastern region of the site.	52.901796, -6.803060

The results were compared with Groundwater Threshold Values (GTV) prescribed by the Groundwater Regulations 2010, as amended in 2016, where possible. Where, a GTV is not prescribed for a particular parameter, results are compared with an EPA Interim Guideline Value (IGV), were possible. The results are summarised as follows:

- Water hardness was very hard in all 3 no. monitoring wells (400 – 410 mg/l). The IGV is 200 mg/l based on the average hardness of various Irish aquifers. The GSI Preliminary Groundwater Total Hardness map does indicate that the site is located within a hard water area.

- Slightly elevated levels of Aluminium were recorded at 0.4 mg/l within all monitoring wells above the GTV (0.15 mg/l). This is attributed to natural background levels and from any historical site activities.
- All heavy metals were below their respective threshold levels.
- All inorganics were below their respective threshold levels with the exception of Nitrates and Ammoniacal Nitrogen. Slightly elevated Nitrate levels were recorded between 45 and 56 mg/l above the GTV of 37.5 mg/l. Elevated levels of Ammoniacal Nitrogen was recorded between 0.1 and 1.0 mg/l above the GTV of 0.175 mg/l. Both parameters were highest in the upgradient well GW3 and are attributed upgradient agricultural activity in the catchment area. No historical activities at the site were attributed to the source of these elevated levels.
- Low levels of hydrocarbons (TPH) were recorded within monitoring well GW2 at a level of 30 µg/l). The GTV for TPH is 7.5 µg/l. GW2 is located in the northern region of the site and partially downgradient of the former fuel storage area. Although the levels are not considered significant in terms of environmental risk, historical fuel storage practices may have resulted in some localised spillages in this area that may have locally impacted on groundwater quality.
- A trace level above the laboratory limit of detection of the Phenanthrene (0.01 ug/l) was recorded in the downgradient monitoring well GW1 in the south of the site. However, the level is below the GTV for PAH Total (0.075 ug/l); and
- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and all Volatile Organic Compounds (VOCs) were below the laboratory limit of detection.

2.11 Hydrology

2.11.1 Regional Catchment

The River Graney, located in the South Eastern River Basin District hydrometric area 14 subcatchment 6, is a stream which rises near Knockpatrick Hill and Corballis Hill and flows into the River Lerr at Castledermot. The River Graney and the River Lerr are tributaries of the River Barrow. The River Lerr flows west from Castledermot for approximately 9.5 km to its confluence with the River Barrow near Newacre (see Figure 11 overleaf).

The Barrow catchment is underlain in its flat northern area by limestones of varying purity which continue down the western side of the catchment and sustain good groundwater resources in places. On the eastern side of the catchment where the site is located, granites dominate, culminating in the summits of the Blackstairs Mountains.

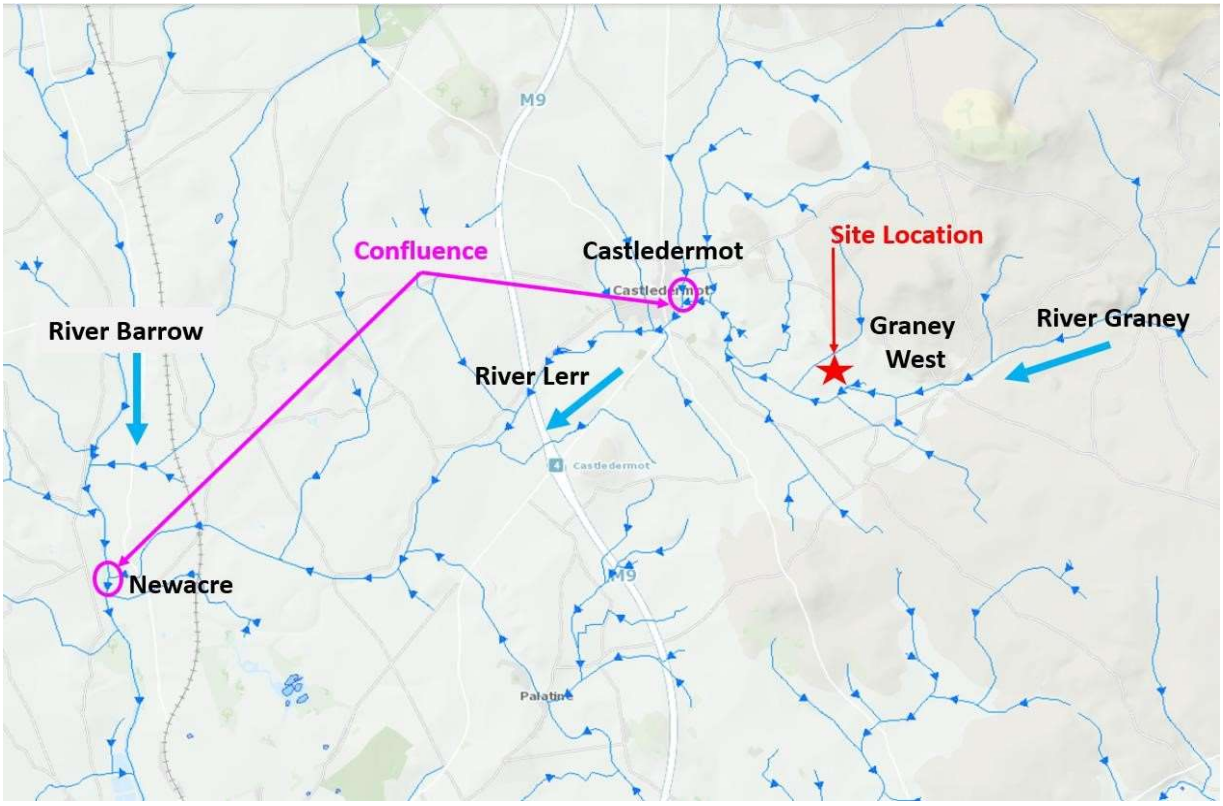

Figure 11: Regional Hydrology (Source GSI)

2.11.2 Local Surface Water Catchment

The River Graney flows to the south of the site from east to west within 100m of the southern site at its closest point. There are a number of existing settling lagoons from historical quarrying operations in the northern, southwestern, eastern and central areas of the site (Figure 12). The small pond in the north was predominantly groundwater fed from a proximate abstraction well and used for a water supply to the former concrete batching plant.

The surface water catchment immediately up-gradient of the site has an approximate maximum area of 11 Ha. This area is at a higher elevation to the Graney West site and the topographical relief of the area indicates that local rainfall and subsequent surface water flow to the north of the site is likely to be towards the Graney River to the south of the site. There is a drainage ditch along the northwestern boundary of the site which intercepts this surface runoff into the Graney River thereby bypassing the site (Figure 12). The Old Mill race watercourse, which is part of the River Graney, is present along the southeastern boundary of the site.

The extracted quarry has a catchment of approximately 18.3 Ha. Hardstanding areas are limited, and the exposed sand and gravel stratum is likely to result in rainfall percolation through the subsoil down to the water table. During heavy rainfall runoff has been observed to flow towards the abstraction sump pond in the east of the site (AB2) or south towards the ponds in the southern region of the site. During periods of extended and high rainfall, the pond in the southwestern region of the site overflows and discharges into the River Graney via a discharge pipe.

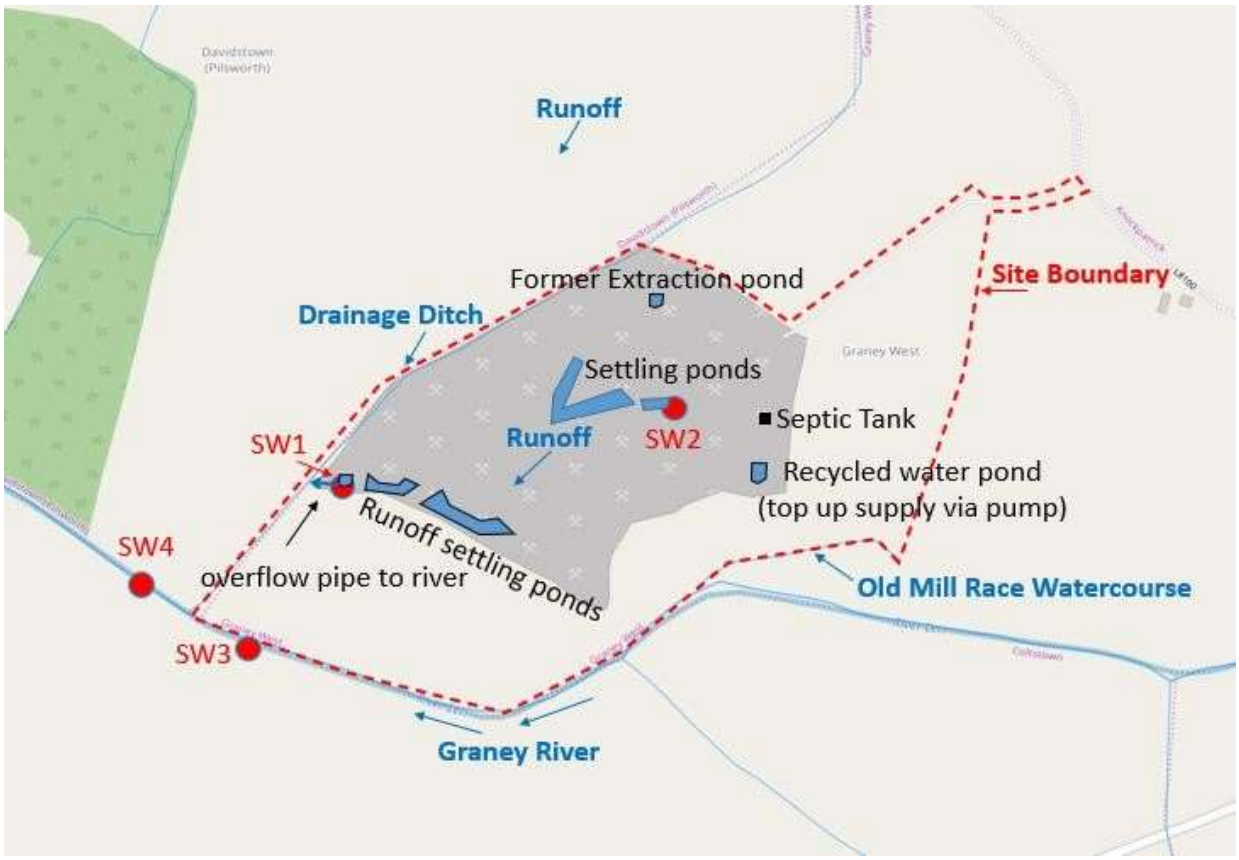

Figure 12: Existing Site Drainage Layout (Source OpenstreetMap)

Figure 13: Settlement Pond in the southwest of the site

2.11.3 Water Framework Directive Studies

The EPA water quality mapping provides the most recent river water quality Q-values:

- Upstream - at the station *Bridge in Graney* (RS14G070200 on the L4016 road) was 34 '*Moderate*' in 2017; and,
- Downstream - at *Lerr River confluence* (RS14G070310) was 3 '*Poor*' in 2018.

The WFD.ie website contains the data for the first cycle of River Basin Managements Plans (RBMP) for the period from 2009 to 2015. Based on these data the River Graney, Tributary of Barrow (IE_SE_14_620) was classified as having Moderate overall status and a risk category 1a "At risk" of not achieving good status by 2015. The River Lerr has Poor to Moderate status and is also at risk.

The Catchments.ie website contains the material in relation to the second and subsequent cycles of RBMPs. Based on these data the Graney (Lerr)_(IE_SE_14G070310) remains 'At risk' due to agriculture and hydromorphology pressures and the waterbody date to meet its environmental objective is 2027.

2.11.4 Surface Water Quality

Surface water sampling was undertaken by Environmental Efficiency Consultants (EEC) at 4 no. locations at the site on the 11th December 2018. Grab samples were collected at the locations presented in the Figure below and outlined in the table overleaf. All samples were sent for testing to CLS accredited laboratory based in Manchester.

Table 10: Surface Water Monitoring Point Details

Monitoring Point	Location Detail	Grid Coordinates
SW1	Site Outfall Point	52.901711, -6.810465
SW2	Settlement Lagoon	52.902510, -6.805178
SW3	River Graney Upstream	52.899680, -6.813093
SW4	River Graney Downstream	52.900185, -6.814523
Source: SW & GW Testing Report 2019 for Sancom Ltd. March, 2020		

The results were compared with the Environmental Quality Standards prescribed by the Surface Water Regulations 2009 as amended in 2015 and 2019. The results are summarised as follows:

- pH, Temperature, Conductivity and Chemical Oxygen Demand (COD) of the 4 no.

  samples were within the normal range for surface waters.
- Biological Oxygen Demand (BOD) were recorded at 0 mg/l all samples.
- Suspended Solids and Orthophosphate were recorded below the laboratory limits of detection.
- Nitrates levels were recorded detected on-site at low to moderate levels (7.7 – 21 mg/l). Elevated levels ranging between 41 and 42 mg/l were recorded within the River Graney in both upstream and downstream locations from the site. There is no surface water EQS for

Nitrates but for comparative purposes the groundwater threshold is 37.5 mg/l. The high nitrates are attributed to agricultural activity (fertiliser runoff) in the catchment area.

- Slightly elevated levels of Total Petroleum Hydrocarbons (TPH) were detected within SW2 settlement lagoon only (i.e. 40 µg/l). This settlement lagoon is located near the buildings and hardstanding areas. Vehicle re-fuelling or fuel storage is the most likely source. This level exceeds The Irish Drinking Water Regulations, 1988 (S.I. No. 81 of 1988) threshold of 10 µg/l and the 2016 GTV of 7.5 µg/l.

2.11.5 Flood Risk

There have been no recorded instances of flooding on-site. The OPW's Preliminary Flood Risk Assessment undertaken in 2012 classifies the site as a Fluvial flood risk zone at risk of a one in a hundred-year fluvial flood event. The OPW flood maps (http://www.floodinfo.ie/) indicates that the site is not within a flood risk zone.

2.11.6 Designated Protected Areas

There are no sensitive sites connected directly to the site at Graney West. However, the River Graney flows into the River Lerr at Castledermot which is a tributary of the River Barrow. The River Barrow and River Nore is a Special Area of Conservation (SAC, 002162) selected for a number of Qualifying Interests (listed at https://www.npws.ie/sites/)/.

2.12 Characteristics of the Proposed Development

There are a number of elements associated with the operation of the proposed development which have the potential to impact on the environment with respect to Hydrogeology and Hydrology.

A detailed description of the proposed development is provided in Section 2.6 of the EIAR. The activities associated with the proposed development which are relevant to the water environment are detailed below:

2.12.1 Waste Materials

Inert waste material will be brought via an internal haul road to a stockpiling and sorting area situated in the southern region of the site. Here, the materials will be inspected and manually and mechanically separated into the following waste streams:

- Sub-soil and overburden (Low Code 17 05 04)
- Top-soil (LoW Code 17 05 04)
- Sand and Gravel (LoW Code 17 05 04)
- Concrete (LoW Code 17 01 01)
- Biodegradable garden waste (LoW Code 20 02 01)

The various segregated waste streams will be directed to a number of processes on-site. Unauthorised wastes identified at this stage will be brought directly to the waste inspection / quarantine area on-site.

Sub-soil and overburden material will be brought via an internal haul road to the proposed fill area to the north of the application site for infilling.

Sand and Gravel will be brought to a sand and gravel stockpiling area situated adjacent for storage prior to processing at an adjacent, pre-existing sand and gravel washing plant on-site.

Top-soil will be directed to the soil screening plant situated adjacent to the stockpiling and sorting area for processing.

Concrete will be directed to the concrete jaw crusher plant situated adjacent to the stockpiling and sorting area for processing prior to being mixed with sand and gravel before being fed to the washing plant to form aggregate.

Biodegradable garden waste will be directed to a hard-standing concrete area to the north of the site where it will await processing in a green waste shredder proposed to be situated in this area, prior to being dispatched for storage and decomposition at a hardstanding, impervious, bunded composting area situated adjacent.

It is expected there will be a negligible quantity of residual waste generated when carrying out any of the above waste activities.

2.12.2 Potential for Groundwater Contamination

It is not proposed to accept any contaminated material and the vast majority of waste brought on-site will be inert construction and demolition waste. Such waste is unreactive both biologically and chemically.

Biodegradable garden waste will be accepted on-site for composting. It is proposed that this waste will be transferred without delay to a bunded composting area on-site for curing/maturation. Composting curing/maturation will take place on a bunded area which drains to an 180,000 litre slatted effluent storage tank to prevent the discharge to the environment of potentially polluting materials associated with this process. This effluent storage tank will be regularly inspected and emptied, cleaned and serviced when necessary.

The storage of fuel oil on-site is the principal risk to groundwater contamination on site via vertical migration through the permeable subsoil into the bedrock. It is proposed that refuelling shall take place in a designated, roofed and appropriately designed hardstanding refuelling area which drains to a silt trap and an oil interceptor to protect against oil spills.

A wheel wash shall be installed on the site access road 100 metres from the site entrance to prevent tracking of dusty material and mud along the proposed site access road and public roads. The first 100 metres of the proposed site access road will be laid with asphalt. It is proposed that the wheel wash unit will be served by an integrated silt tank and oil interceptor. The wheel-wash unit on-site will be a self-contained unit that utilises recycled water originating from a groundwater abstraction point (by way of bowser). The silt tank/oil interceptor will be in place for when excessive rainfall causes overflow from the system. The wheel wash system will be desludged and cleaned ca. every 6 months at a minimum or as needed by an appropriate provider. Waste sludge from the unit will be dispatched to an appropriate authorised destination waste facility.

It is also proposed that any hazardous materials spilled on-site will be dealt with promptly using an emergency response procedure including on-site spill-kits.

2.12.3 Proposed Source of Water Supply

There is no public water supply to the site. The water requirement for site activities would be mainly for the washing of sand and gravels. Water for these purposes would be sourced from a groundwater abstraction point and a settlement lagoon present on-site.

Water for the sand and gravel washing plant shall be drawn from the recycled water pond to the southeast of the site via two supply lines. A 150 mm diameter line will feed the main washing plant and a 100 mm diameter line will supply the sand cyclone; both are driven by submersible electric pumps. The washing plant discharge will be piped by gravity feed to the primary and secondary settling ponds to the west of the application site for treatment, before returning to the recycled water pond via a 225 mm diameter gravity line. The primary settling pond is large with ample space for maintenance and silt storage. Top up water will be supplied from a groundwater abstraction well on site when required. This supply would be controlled by a water level device in the recycled water pond.

2.12.4 Proposed Drainage

The settlement lagoons will allow the settlement of all suspended solids. Overflow from the last of these lagoons will be via a 300 mm diameter concrete pipe to a drain which flows into the Graney River (estimated flow 3 l/s). Water also leaves the site by percolation through gravels at the southern section of the site.

2.12.5 Proposed Foul Drainage

There is an existing septic tank system on-site into which all-domestic effluent from the staff toilet drains. It is anticipated that only 2 part-time staff will work at the facility.

It is proposed to utilise an existing effluent sealed storage tank on-site (180,000 litres capacity) which underlies the proposed composting area to serve this area. It is proposed that this effluent storage tank shall be periodically emptied by an authorised waste contractor and disposed of at another appropriately licensed site, as such there will be no discharges to the environment from the composting area.

2.12.6 Proposed Surface Water Disposal

Surface water runoff from the site will be directed to the existing settling lagoons at the quarry site by the natural topography of the site as well as an existing drainage system serving (1) roofs of residential and farm buildings and non-permeable concrete areas and (2) the washing plant.

A separate drainage system serving the proposed re-fuelling area is proposed. Surface water falling on the re-fuelling pad will be directed to this drainage system and will be served by a silt-trap, an oil interceptor and a soakaway before draining by natural topography to the settling lagoons on-site.

The settlement lagoons will allow the settlement of all suspended solids and, where needed, the water would then be pumped back to the washing plant by via a pump house and recycled within the process. Overflow from the last of these lagoons is via a 300 mm diameter concrete pipe to the Graney River. Surface water also leaves the site by percolation through gravels to ground and underlying groundwater.

As the site is infilled over time, the settlement ponds in the southwestern region of the site will be infilled with inert material and replacement temporary settlement ponds installed as part of a rolling program of infilling across the site.

2.13 Potential Impact Assessment

2.13.1 Likelihood of Impacts

It is anticipated that the main environmental factors associated with the hydrogeology and hydrology across the site and within its immediate environs are not likely to be significantly affected by the proposed project.

Contaminated soils or buried waste are not anticipated at the site based on historical site information and the detailed site walkover undertaken. Any contaminated soils or buried waste are anticipated to be localised.

2.13.2 Assessment Criteria

The significance of potential impacts on geological and hydrogeological sensitive receptors was estimated by implementing the National Roads Authority (NRA) *Design Manual for Roads and Bridges (*DMRB) and IGI Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) style of assessment using geological type attributes and measures to determine the magnitude of the impact on the attribute.

Table 11 illustrates the criteria for determining the importance of sensitive receptors at the site, Table 12 demonstrates the criteria for estimating the magnitude of the impact on an attribute and Table 13 presents the resulting estimation of the significance of potential impacts.

Table 11: Estimation of Importance of Sensitive Attributes

Importance	Criterion	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	River, wetland or surface water or groundwater body ecosystem protected by EU legislation. Aquifer providing a regionally important drinking water resource or supporting site protected under wildlife legislation
High	Attribute has a high quality and rarity on local scale	Aquifer providing locally important resource or supporting peat ecosystem (undesignated)
Medium	Attribute has a medium quality and rarity on local scale	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Eroding bog
Low	Attribute has a low quality and rarity on local scale	Non-aquifer. Cutover blanket bog.

Table 12: Estimation of the Magnitude of a Potential Impact on an Attribute

Magnitude	Criterion	Typical Example
Major Adverse	Results in loss of attribute and/or quality and integrity of attribute. Severe.	Loss of aquifer water supply by dewatering or major contamination event Potential high risk of pollution to groundwater from routine run-off

Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute. Major.	Partial loss or change to aquifer characteristics Potential medium risk of pollution to groundwater from routine run-off Loss in peat margins or loss in recharge to a potential SAC Annex 1 habitat.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability. Minor.	Potential low risk of pollution to groundwater from routine run-off Risk of pollution from accidental spillage. Localised peat extraction on bog
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity. Not significant.	No measurable impact upon aquifer and no perceivable risk of pollution from accidental spillages Slight impact on peat by animal hoofs etc
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Insignificant risk of contamination to groundwater due to surface sealing.
Moderate Beneficial	Results in loss of attribute and/or quality and integrity of attribute. Severe.	Loss of aquifer water supply by dewatering or major contamination event Potential high risk of pollution to groundwater from routine run-off
Major Beneficial	Results in effect on integrity of attribute, or loss of part of attribute. Major.	Partial loss or change to aquifer characteristics Potential medium risk of pollution to groundwater from routine run-off Loss in peat margins or loss in recharge to a potential SAC Annex 1 habitat.

A qualitative approach was used in this evaluation, generally following the significance classification in the table below and through professional judgement. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect.

Table 13: Estimation of the Significance of Potential Impact

Importance of Attribute	**Magnitude of Potential Impact**			
	Negligible	**Minor Adverse**	**Moderate Adverse**	**Major Adverse**
Extremely High	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant / Moderate	Profound/ Significant	Very Large
High	Imperceptible	Moderate / Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Terms relating to the duration of impacts are as described in the EPA's guidelines on the information to be contained in Environmental Impact Assessment Reports draft (August 2017) as:

- Momentary Effects - Effects lasting from seconds to minutes
- Brief Effects - Effects lasting less than a day
- Temporary Effects - Effects lasting less than a year
- Short-term Effects - Effects lasting one to seven years
- Medium-term Effects - Effects lasting seven to fifteen years
- Long-term Effects - Effects lasting fifteen to sixty years
- Permanent Effects - Effects lasting over sixty years
- Reversible Effects - Effects that can be undone, for example through remediation or restoration

The prediction of potential impacts by the proposed development are summarised in the following sections and tables. The impacts are separated into construction stage impacts and operational stage impacts.

2.13.3 'Do-Nothing' Impacts

If the proposed project does not go ahead there will be no impact from construction or operations on groundwater or surface water across the site to the River Graney. It is envisaged that the site would remain as an exploited former quarry site.

2.13.4 Potential Impacts Risks

Tables 14 and 15 overleaf outline the range of potential impacts associated with the construction and operational phases of the proposed development.

The risks have been separated under Construction/Site Preparation Works and Site Operation Activities. Both direct and indirect impacts have been considered.

2.13.5 Construction Works Potential Impacts

Table 14: Potential Impacts during construction phase

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
1	Excavation activities	Groundwater Surface Water	The nature of the proposed development is the backfilling of a worked-out quarry using inert waste material to backfill and restore existing voids on site. This will not require any deep excavation of the subsurface with the exception of localised site preparation works. No excavation works into the water table will be undertaken.	High	Negligible	Imperceptible
2	Fuel storage/usage onsite	Groundwater Surface Water	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to groundwater and surface water if not stored and used in an environmentally safe manner.	High	Moderate/Adverse	Significant /Moderate
3	Wheel Wash Wastewater	Groundwater Surface Water	Wastewater arising from the wheel wash has the potential to contaminate groundwater beneath the site and surface water lagoons on the site.	High	Minor Adverse	Moderate / Slight
4	Construction Traffic	Groundwater Surface Water	There may be a risk of groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles.	High	Minor Adverse	Moderate / Slight

2.13.6 Operational Phase Potential Impacts

Table 15: Potential Impacts during Operational Phase

No.	Operational Activity	Attribute	Character of Potential Impact	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
1	Fuel Storage	Groundwater Surface Water	Inappropriate storage of fuels and chemical on site could potentially result in the release to ground and surface water and impacting on the quality of these water features.	High	Moderate/ Adverse	Significant/Moderate
2	Contaminated imported fill	Groundwater Surface Water	The proposed restoration will use inert material only. However, in the event of the unintentional importation of non-inert material there is the potential to impact on groundwater quality.	High	Moderate/ Adverse	Significant/ Moderate
3	Wheel Wash Wastewater	Groundwater Surface Water	Wastewater arising from the wheel wash has the potential to contaminate groundwater beneath the site and surface water lagoons on the site.	High	Minor Adverse	Moderate /Slight
4	Construction Traffic	Groundwater Surface Water	There may be a risk of groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles over permeable ground.	High	Minor Adverse	Moderate /Slight
5	Vandalism	Groundwater Surface Water	Pollution due to vandalism of fuel stores or plant poses a risk to groundwater and future site users.	High	Moderate/ Adverse	Significant/ Moderate
6	Wastewater Treatment	Groundwater	All foul water generated from toilets will be appropriately treated within a suitably designed and installed wastewater treatment system, (e.g. septic tank and percolation area).	High	Negligible	Imperceptible
7	Composting curing/maturation	Groundwater Surface Water	Intake of garden waste, shredding and composting of this waste could potentially leach into the groundwater and be transported to proximate rivers/streams if not appropriately stored.	High	Moderate / Adverse	Significant/ Moderate

2.14 Avoidance, Remedial & Mitigation Measures

The significant predicted impacts detailed under the tables above are resolved under the mitigation measures set out below. All mitigation measures identified are considered suitable to ensure all risks identified are appropriately mitigated with a residual long-term and imperceptible risk to groundwater and surface water by the proposed development.

- The proposed infilling operations will be above the groundwater level; the infilling will increase the thickness of unsaturated material above the water table at the site and this is considered positive as it offers the groundwater additional protection.
- Proposed abstraction of groundwater during the operational phase of the works will be intermittent and at low levels Therefore, no impact on groundwater levels across the site are anticipated.
- A series of settlement lagoons are situated on-site for the treatment of site surface water run-off containing elevated levels of particles. These settling lagoons will be cleaned and dredged as necessary.
- As the site is infilled over time, the settlement ponds in the southwestern region of the site will be infilled with inert material and replacement temporary settlement ponds installed as part of a rolling program of infilling across the site.
- In the event of substantial rainfall and the build-up of surface water run-off, most surface water runoff from the site will be directed to the settling lagoons to ensure appropriate levels of treatment prior to any discharge to the river.
- Surface water run-off arising on existing and proposed non permeable areas will be directed via topography toward a drain east of the dwelling on-site which in turn will direct this water to the pond to the south east of the site.
- The settlement lagoons to be utilised at the site shall facilitate the settlement of all settleable solids within surface water runoff across the site. Where necessary, the water in the last of the lagoons located at the centre of the site will be pumped back to the washing plant via a pump house and recycled within the process. Overflow from the last of the lagoons situated to the south west of the site is via a 300 mm diameter concrete pipe to the Graney River. It is anticipated that water will overflow from this pond on rare occasions during exceptional heavy rainfall periods. The quality of this water during this event is anticipated to be sufficiently treated to ensure no risk is posed to the river. In addition, this pond will be backfilled as part of the infilling works with no surface water discharging to the river anticipated once ground levels have risen.
- An oil interceptor serving the proposed visitor and staff car park shall be appropriately installed to treat runoff from this area. Runoff shall drain to the pond to the south east of the site before being utilising within the wash plant on site.
- A surface water drainage inspection, maintenance and monitoring programme shall be established and surface water emanating from at-risk site locations (e.g. re-fuelling area) and contained in receiving water bodies (e.g. lagoons) shall be monitored on a periodic basis.

- An existing bunded, roofed storage area shall be upgraded for the storage of hazardous materials such as fuels, oils and concrete additives on-site. This area shall be designed in accordance with EPA Guidance IPC Guidance Note on Storage and Transfer of Materials for Scheduled Activities, taking into account criteria for bund requirements (e.g. 110% of the capacity of the largest tank or drum within the bunded area; or 25% of the total volume of substance which could be stored within the bunded area, whichever is greater).

- A separate drainage system serving the proposed fuel storage area and re-fuelling area shall be constructed. Surface water runoff or spills arising in the re-fuelling area will be captured by this drainage system installed across concrete hardstanding and directed to a silt-trap, an oil interceptor before being discharged to ground via a soakaway.
- Oil which accumulates within the petrol interceptor shall be regularly removed by an appropriately licensed contractor. In addition, the petrol interceptor shall be appropriately maintained in accordance with the manufacturer's specification.
- Testing of bund integrity shall be conducted upon commencement of site operations and every three years thereafter in accordance with good practice to verify the water tightness and integrity of bunds on-site. Where bund testing fails a programme of works shall be established by a Chartered Engineer to fix the bund and ensure its water tightness and integrity.
- Waste fuels and materials shall be stored in designated areas that are isolated from surface water drains or open waters (*e.g.* excavations). Waste skips will be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, will be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fuelling, lubrication and storage areas and site offices will not be located within 25m of drainage ditches, surface waters or open excavations. Fuel interceptor tanks will be installed on the site to treat any runoff.
- All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) shall be stored within a secondary containment system (*e.g.* a bund for static tanks or a drip tray for mobile stores and drums). The bunds shall be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund shall be capable of holding 110% of the largest tank of 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage shall be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray shall be capable of holding 25% of the aggregate capacity of the drums stored.
- Regular monitoring of water levels within drip trays and bunds due to rainfall shall be undertaken to ensure sufficient capacity is maintained at all times.
- The wheel wash unit shall be served by an integrated silt tank and oil interceptor. The wheel wash unit on-site will be a self-contained unit that utilises recycled wate. The silt tank/oil interceptor shall be in place for when excessive rainfall causes overflow from the system. The wheel wash system shall be desludged and cleaned ca. every 6 months at a minimum or as needed by an appropriate provider. Waste sludge from the unit shall be dispatched to an appropriate authorized destination waste facility.

- Monitoring prior to, during and post site works of surface water quality shall be undertaken to ensure minimum disturbance of water quality in the Graney River. During the construction phase, the monitoring programme shall include daily checks, weekly inspections and monthly audits to ensure compliance with the Construction Environmental Management Plan. This shall be undertaken in consultation with the wishes of Kildare County Council.
- Back-up plans to deal with the possibility of contamination or fuel spills, *e.g.* pumping of wells or sumps to collect contaminated groundwater or surface water for treatment shall be undertaken and included in an overall Environmental Management Plan (EMP) and Emergency Operation Plan (EOP). In accordance with the CIRIA document (2001) a contingency plan for pollution emergency shall address the following:
    - Containment measures;
    - Emergency discharge routes;
    - List of appropriate equipment and clean-up materials;
    - iv. Maintenance schedule of equipment;
        - Details of trained staff;
        - Details of staff responsibilities;
        - Notification procedures to inform the relevant environmental protection authority;
        - Audit and review schedule; and,

        ix. List of specialist pollution clean-up companies and their telephone numbers.
- Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective should be removed from site immediately or positioned in a place of safety until such time that it can be removed.
- An interceptor maintenance and inspection programme shall be implemented - the interceptors on-site shall be inspected every 6 months by suitably qualified persons and should be cleaned and serviced regularly as necessary
- Composting curing/maturation will take place on a bunded area which drains to an 180,000-litre slatted effluent storage tank to prevent the discharge to the environment of potentially polluting materials associated with this process. This effluent storage tank will be regularly inspected and emptied, cleaned, and serviced when necessary.
- A septic tank will be in place to manage domestic wastewater on-site and shall be appropriate designed and installed at the site.
- Waste Acceptance Procedures will be in place to ensure that hazardous waste or putrescible waste are prevented from arriving on-site and, were found to be present on-site, temporarily stored in a bunded waste quarantine area prior to being dispatched off-site to an authorized waste facility within 24 hours
- Emergency Response Procedures will be in place to ensure the prompt and thorough response to any spills of hazardous materials. Spill kits will be present on-site for this purpose.

- Waste Acceptance Procedures will be in place to ensure that hazardous waste or putrescible waste are prevented from arriving on-site and, were found to be present on-site, temporarily stored in a bunded waste quarantine area prior to being dispatched off-site to an authorized waste facility within 24 hours.
- Restoration of topsoil and overburden shall be carried out on an on-going basis to reduce the vulnerability of groundwater to possible contamination.
- The sowing of grassland species on a phased basis and additional planting of scrub and native trees along the perimeter shall enhance the nutrient retention at the site and preventing further nutrient load into receiving surface and groundwater receptors.
- Adequate security measures shall be installed on the construction site. Security measures will include secure fencing, secure site access, securing site plant and equipment, secure storage of materials and sufficient warning signage.
- All grout/concrete washout facilities shall be established away from exposed excavations and surface waters and into dedicated skips on site. The activities shall be monitored, and the skips will be appropriately located and secured.
- In the event of a major spillage the contractor's Emergency Operating Plan (EOP) shall be followed. The first action will be to stop the source of pollution and contain the spillage.
- The positive, albeit relatively low levels of hydrocarbons detected within GW2, suggest that groundwater has been impacted most likely from inappropriate and historical fuel storage practices on site. The upgrading and repair of the existing fuel bund shall minimise any future potential impact to groundwater in this area.

It is considered that the proposed development, taking account of the previous works undertaken at the site, will have a long-term and imperceptible impact on the hydrogeological and hydrological conditions at the site and the surrounding area.

2.15 Predicted Impacts

The nature of the development dictates that the greatest potential impact on the underlying aquifer and proximate streams/rivers associated with the soil recovery facility will be during the operational phase of the works. It is predicted that the hydrogeological and hydrological impacts associated with the development will be short to long-term and imperceptible to moderate. Implementation of the proposed mitigation measures as detailed in the EIAR shall ensure that the residual impacts will be long-term and imperceptible.

2.16 Monitoring

Monitoring prior to, during and post construction works of groundwater and surface water quality shall be undertaken to ensure minimum disturbance of water quality in the general vicinity of the site. The monitoring programme shall include daily checks, weekly inspections, and monthly audits to ensure

compliance with the Construction & Demolition Waste Management Plan (C&DWMP) and the CEMP. This shall be undertaken in consultation with the requirements of Kildare County Council.

Groundwater quality monitoring shall be undertaken within the three groundwater monitoring points on-site (GW1, GW2 and GW3). Surface water monitoring shall be undertaken at all locations previously detailed. An agreed program of monitoring shall be developed in consultation with Kildare County Council.

2.17 References

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- Wright., G. (1988) 8th Annual Seminar, IAH (Irish) Group. Portlaoise, Ireland.