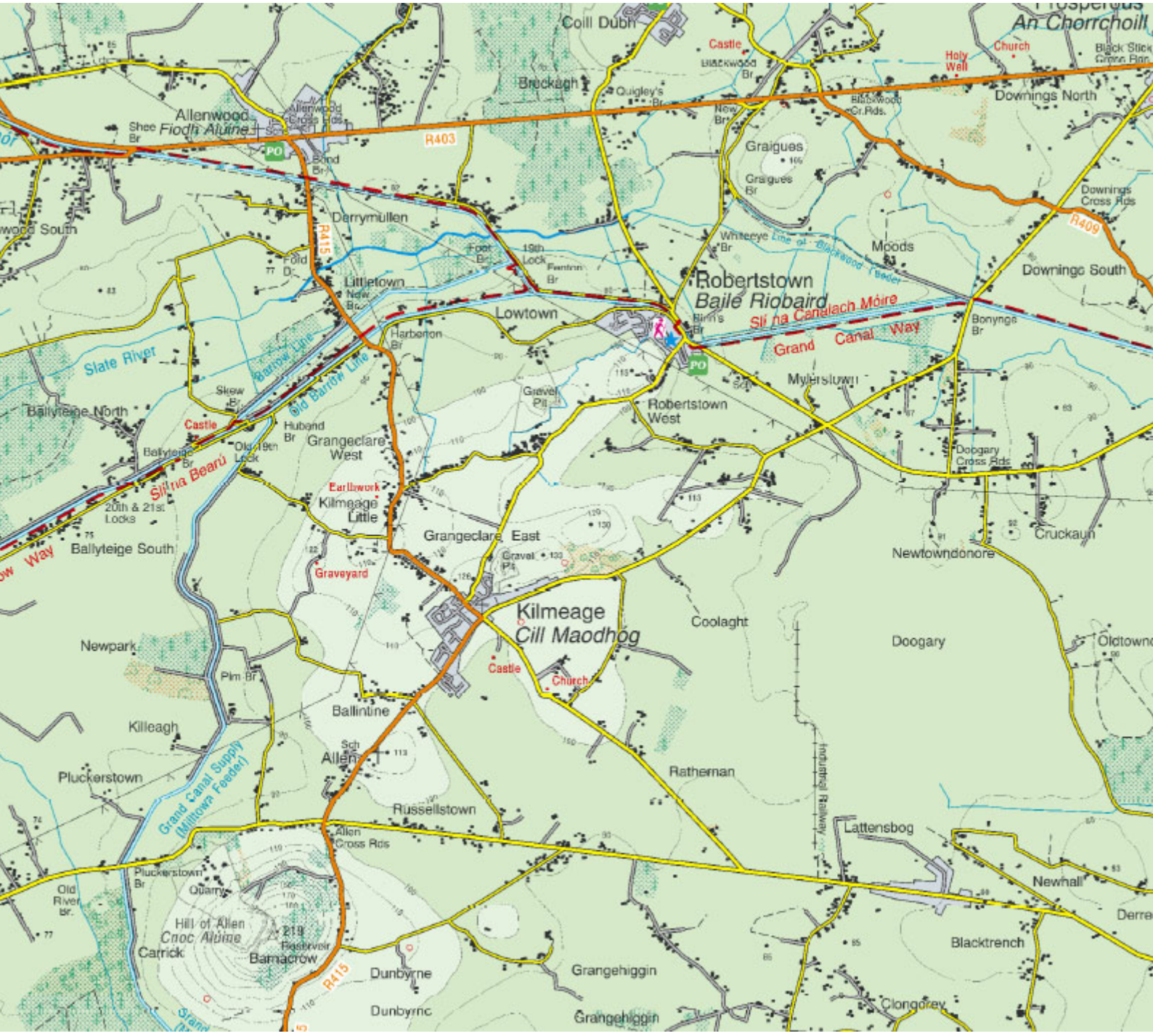
CHAPTER 8

HYDROLOGY AND HYDROGEOLOGY



QUARRY CONSULTING

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CHAPTER 8: Hydrology and Hydrogeology

Introduction

Background

8.1 Hydro-Environmental Services (HES) was engaged by Quarry Consulting, to carry out an assessment of the likely and potential significant effects of a proposed sand and gravel pit and inert waste recovery facility at Kilmeague, Co. Kildare on the hydrological and hydrogeological environment.

8.2 Where the 'Proposed Development' is referred to, this relates to all the project components described in in detail in Chapter 3 of this EIAR.

8.3 Where the 'Proposed Development site' or 'site' is referred to, this relates to everything inside the application site boundary.

8.4 The objectives of the assessment are:

- Produce a baseline study of the existing water environment (surface water and groundwater) in the area of the Proposed Development and associated works;
- Identify likely effects of the Proposed Development on surface water and groundwater during construction, operational and restoration phases of the development;
- Identify mitigation measures to avoid, reduce or offset likely negative effects;
- Assess likely residual effects; and
- Assess cumulative effects of the Proposed Development and other local developments/activities.

Proposed Development Overview

8.5 In summary, the Proposed Development will involve:

- The removal of woodland, vegetation and overlying soils (site preparation works).
- Extraction of sand and gravel (4 million tonnes) on a phased basis from an area of c. 8.65 hectares (ha) to a final floor level at 95 metres above Ordnance Datum (m OD);
- Infilling of the lands using inert waste (3.2 million tonnes) on a phased basis following the extraction of sand and gravel;
- Restoration of the lands back to original ground level and the establishment of native woodland planting;
- All related ancillary development and associated site works including processing (crushing, screening and washing) and stockpiling of materials; installation of infrastructure for the management of water on site and all other related activities.

Statement of Authority

8.6 Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management

consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

8.7 Our core areas of expertise and experience include hydrology and hydrogeology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types.

8.8 This chapter of the EIAR was prepared by Michael Gill, David Broderick and Jenny Law.

8.9 Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of quarry/pit infill developments in Ireland. He has worked on the following quarry and infill assessments: Clasheen Pit (Killarney), Garyhesta (Cork), Middleton (Cork), Killarney East, Kilmeague (Kildare), and Kilmessan (Meath).

8.10 David Broderick P.Geo (BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with 17 years environmental consultancy experience in Ireland. David has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. David has also significant experience in surface water drainage issues, SUDs design, flood risk assessment and modelling.

8.11 Jenny Law (BSc, MSc) is an Environmental Geoscientist holding a first honours degree in Applied Environmental Geosciences from the University College Cork. Jenny has assisted in the preparation of the land, soils and geology and hydrology chapters for various environmental impact assessment reports, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including quarries and strategic housing developments.

Legislative and Policy Context

Relevant Legislation

8.12 The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

8.13 The requirements of the following legislation are complied with:

- S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1994, S.I. No. 101/1996, S.I. No. 351/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001, S.I. 134/2013 and the Minerals Development Act 2017), the Planning and Development Act, and S.I. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/337/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act, 2000, as amended;

- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law;
- S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy) and S.I. No. 722/2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) establishing a framework for the Community action in the field of water policy and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC) on the protection of groundwater against pollution and deterioration. Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD"). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003);
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations 2017, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 106/2007: European Communities (Drinking Water) Regulations 2007 and S.I. No. 122/2014: European Communities (Drinking Water) Regulations 2014, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the "Drinking Water Directive") and EU Directive 2000/60/EC;
- S.I. No. 77/2019: European Communities Environmental Objectives (Surface Waters) Regulations 2019;
- S.I. No. 366/2016: European Communities Environmental Objectives (Groundwater) Regulations 2016; and,
- S.I. No. 99/2023: European Communities Environmental Objectives (Drinking Water) Regulations 2023.

Relevant Guidance

8.14 The assessment was carried out in accordance with the following guidance and tailored accordingly based on professional judgement:

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;

- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006;
- Department of the Environment, Heritage and Local Government; Quarries and Ancillary Activities – Guidance for Authorities (April, 2004);
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals);
- Department of Housing, Local Government and Heritage (2018): Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessments; and,
- European Union (2017): Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).
- EPA Guidance on Soil Recovery Waste Acceptance Criteria (2020); and,
- Consultation Paper Regulation 27(7) National By-Product Criteria for Greenfield Soil and Stone used in Developments" (2022).

Scoping and Consultation

8.15 The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Chapter 2 of this EIAR. Matters raised with respect to the water environment are summarised in **Table 8-1** below.

Table 8-1: Scoping responses for the proposed development.

Consultee	Matters Raised	Reference in Text
Geological Survey of Ireland (GSI)	*"Proposed developments need to consider any potential impact on specific groundwater abstractions and on groundwater resources in general".* *"Bedrock which is Generally Moderately Productive' underlie the proposed sand and gravel pit. The Groundwater Vulnerability map indicates the area covered is classed as 'High' Vulnerability".* *"It should be noted that there is a groundwater drinking water abstraction (Robertstown Public Water Supply (PWS)) with zones of contribution/source protection areas 1.5 km from the proposed sand and gravel pit".*	Para 8.104 – 8.109, 8.198 & 8.220 – 8.222 Para 8.81 – 8.82 Para 8.104 – 8.105
Kildare Co. Co.	**Planning Department:** *"Cumulative assessment of other quarries in the area".* **Water Services:**	Para 8.227 – 8.231

	"Surface water drainage shall comply with GDSDS and a flood risk assessment commensurate with the flood risk identified from recommended sources shall be submitted with any planning application". **Environment:** *"The EIAR shall identify all surface and groundwater receptors and assess the potential impact of the proposed development on same. If required mitigation measures shall be proposed".* *"If it is proposed to extract groundwater for use in the manufacturing process then it shall be necessary to quantify the volume of water intended to be extracted on a daily basis and to assess the potential impact this may have on surrounding groundwater supplies".* *"The cross sections of the site shall demonstrate clearly that extraction activities will remain at least 1m above the water table at all times. Therefore, it shall be necessary to engage a hydrogeologist to carry out an investigate and to demonstrate the highest possible level the water table rises to across the entire site and the cross sections shall clearly show the lowest level of extraction to be at least 1m above this level".*	Site specific FRA attached as **Appendix 8-1.** Para 8.110 – 8.115 Para 8.198 Para 8.74 – 8.80. Refer to Quarry Consulting Drawing No. 6 for cross-section

Schedule of Works

Desk Study

8.16 A desk study of the site and receiving environment was carried out to collate all available and relevant geological, hydrogeological, hydrological and meteorological data for the study area, using the following data sources:

- Geological Survey of Ireland (GSI) online mapping;
- Environmental Protection Agency (EPA) Maps database;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "Catchments" Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 16 (Geology of Kildare - Wicklow); Geological Survey of Ireland (GSI, 1995);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;

- OPW National Indicative Flood Maps (www.floodmaps.ie).

Site Investigations

8.17 A geological resource assessment of the site was carried out by John Colthurst PhD PGeo (July, 2020). Refer to **Appendix 7-1** of the Land, Soils and Geology Chapter.

8.18 The assessment included investigation drilling (5 no. boreholes) which were fitted with standpipes for groundwater level and water quality monitoring.

8.19 A geophysical survey of the site was carried out by APEX Ltd (2022) on 15th December 2022 involving 7 no. 2D resistivity profiles and 1 no. seismic refraction profile.

8.20 Drilling of an additional investigation borehole (BH6) in November 2023.

8.21 With respect to the hydrological and hydrogeological environment, the following works have also been completed by HES in order to address the Water Section of the EIAR:

- Walkover over surveys and drainage mapping at the Proposed Development site were completed on 11th August 2021, 2nd February 2023 and 4th May 2023 whereby water flow directions and drainage patterns were recorded;
- These site walkover surveys were completed by David Broderick (please refer to paragraph 8.10 above for qualifications and experience);
- Groundwater level measurements were completed manually in 5 no. boreholes on 3 no. occasions during the monitoring period (11th August 2021, 2nd February 2023 and 4th May 2023);
- Groundwater level monitoring devices (pressure transducers) were installed in 3 no. boreholes at the site providing continuous groundwater level monitoring (2hr intervals) between 11th August 2021 and 4th May 2023; and,
- Groundwater sampling for laboratory analysis (2 no. boreholes) and unstable field hydrochemistry measurements were completed on 4th May 2023.

Assessment Methodology and Significance Criteria

8.22 The guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 2 of this EIAR.

8.23 In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in **Table 8-2** for hydrology and **Table 8-3** for hydrogeology are used to assess the potential effect that the proposed development may have on them.

Table 8-2: Estimation of Importance of Hydrology Attributes [1]

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	• River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	• River, wetland or surface water body ecosystem protected by national legislation – NHA status. • Regionally important potable water source supplying >2500 homes. • Quality Class A (Biotic Index Q4, Q5). • Flood plain protecting more than 50 residential or commercial properties from flooding. • Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	• Salmon fishery, locally important potable water source supplying >1000 homes. • Quality Class B (Biotic Index Q3-4). • Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale	• Coarse fishery. • Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). • Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	• Locally important amenity site for small range of leisure activities. • Local potable water source supplying <50 homes. • Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. • Amenity site used by small numbers of local people.

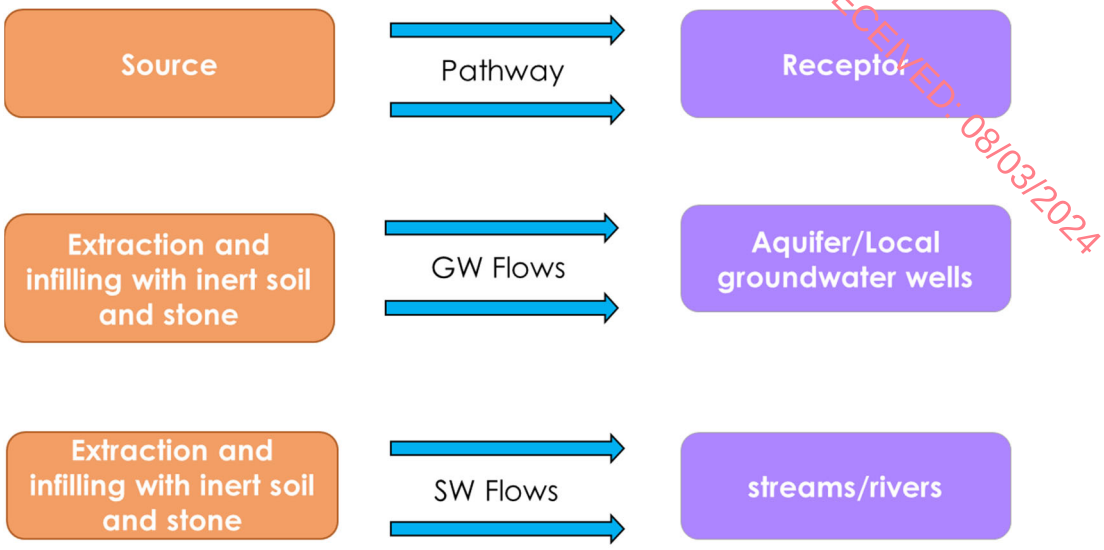
Table 8-3: Estimation of Importance of Hydrogeology Attributes [1]

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

8.24 Once the importance and sensitivity of the geological, hydrological and hydrogeological attribute is established, the conventional source-pathway-receptor model (see graphic below) for groundwater / surface water protection was applied to assess impacts on geology, groundwater and surface water specifically on downstream sensitive ecological receptors and local groundwater supplies.

Overview of the Impact Assessment Process

8.25 The conventional source-pathway-target model (see below, top) was applied to assess potential impacts on downstream environmental receptors (see below, bottom as an example) as a result of the Proposed Development.



8.26 Where potential impacts are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Environmental Protection Agency (May 2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

8.27 The description process clearly and consistently identifies the key aspects of any potential impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

8.28 In order to provide an understanding of the stepwise impact assessment process applied below, we have firstly presented in **Table 8-4** below a summary guide that defines the steps (1 to 7) taken in each element of the impact assessment process in below. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Table 8-4: Assessment Methodology

Attribute	Status / Occurrence	Importance
Step 1	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of sand and gravel extraction and Infilling activities, surface water and groundwater flows are the primary pathways.

Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. These measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by best practice engineering design.
Step 6	Post Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post mitigation effects of the identified potential impact source on the receiving environment.

8.29 Using this defined approach, this impact assessment process is then applied to continued activities which have the potential to generate a source of significant adverse impact on the hydrological/hydrogeological (including wells, streams and water quality) environments.

- **Sources:** In the case of the Proposed Development site the primary potential sources of impact are to groundwater quality whereby the primary potential hazards are suspended solids, leaching and spillages, and accidental release of potential pollutants to the local groundwater causing a deterioration in water quality.
- **Pathway:** The pathway in terms of groundwater flowpaths is via permeable sand and gravels deposits as well as fractures in the underlying bedrock aquifer, and for surface water this will be via potential groundwater baseflow entering watercourses (i.e. no direct pathway to river waterbodies); and,
- **Receptor:** The primary local targets of concern are the underlying locally important aquifer, local wells as well as downstream surface water receptors and designated sites.

Limitations and Difficulties Encountered

8.30 No limitations or difficulties were encountered during the preparation of the Water Chapter of the EIAR.

Baseline Conditions

Site Description and Topography

8.31 The site is located in the townland of Coolaght, Co. Kildare, situated approximately 900m northeast of the centre of Kilmeague village.

8.32 The site is extensively covered in mixed woodland (predominately deciduous) that was planted between 2002 and 2004.

8.33 The surrounding landscape is rural in character, consisting of a mix of pasture and arable land, with extensive areas of low grade agricultural land and bog in the wider area. The latter has predominately been cutover. The wider area also includes several examples of quarries and sand and gravel pits the nearest of which is situated 440m west of the site at Kilmeague village.

8.34 The site is located on a Local hill where the ground slopes away on all sides with the steepest slopes to the north and south. The top of the hill (130m above OD) roughly aligns with the centre of the proposed extraction area / infill area.

8.35 Ground levels within the site rise from approximately 94m above OD in the southeast near the site entrance to 130m above OD in the north-west where the proposed extraction area is located.

8.36 Access to the site is from the L7081 local road to the southeast. This is an existing forestry track that runs from the site entrance to the top of the hill where a communications mast and associated compound is located.

Water Balance

8.37 Long term rainfall and evaporation data was sourced from Met Éireann. The 30-year Annual Average Rainfall (1981 - 2010) recorded at Timahoe South, located approximately 5.5km north of the site, are shown in **Table 8-5** below.

Table 8-5: Annual Average Long-Term Rainfall Data (mm).

Station		X-Coord		Y-Coord		Ht (mOD)		Opened		Closed		
Timahoe South		278500		229000		88		1955		-		Total
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	
76	54	59	52	62	61	51	72	72	77	73	81	790

8.38 The closest synoptic station[1] where the average potential evapotranspiration (PE) is recorded is at Casement Aerodrome, ~28km east of the site. The long-term average PE for this station is 530mm/year. This value is used as a best estimate of the site PE. Actual evapotranspiration (AE) at the application site is estimated as ~504mm/year (which is 0.95 x PE).

8.39 The effective rainfall represents the water available for surface water runoff and groundwater recharge. The effective rainfall for the application site is calculated as follows:

[1] Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

Effective rainfall = AAR – AE

= 790mm/year – 504mm/year

ER = 286mm/year

8.40 Based on recharge coefficient estimates from the Geological Survey of Ireland (GSI), an annual groundwater recharge coefficient of 85% is used for the hydrogeological setting in the area of the site which has "*High permeability subsoil (sand & gravel) overlain by well drained soil*".

8.41 Therefore, groundwater recharge and runoff rates for the site are estimated to be 243mm/year and 43mm/year respectively.

8.42 Based on the proposed site area of ~13.1ha, the annual average groundwater recharge and runoff volumes for the site are calculated to be 31,833m^3 (~87m^3/day) and 5,633m^3 (~15m^3/day) respectively.

Regional and Local Hydrology

8.43 The proposed site is located in the northeastern corner of the Barrow WFD catchment within Hydrometric Area 14 of the Eastern River Basin District and within the Slate River sub-catchment (Slate_SC_010).

8.44 The proposed site is mapped within the Slate_030 river sub basin where the Slate River flows in a westerly direction ~2.5km north of the site. The Grand Canal Main Line East (Barrow) is situated 1.9km north of the site.

8.45 The closest mapped watercourses to the site, both of which are headwater streams of the Slate River, are 1.2km to the northwest and 0.35km to the north.

8.46 Regional and local hydrology mapping is shown as **Figure 8-1** and **Figure 8-2** respectively.

Site Drainage

8.47 There are no natural water features or manmade drainage within the site or adjacent lands. The closest mapped watercourses to the site, both which are headwater streams of the Slate River as described in paragraph 8.44 above.

8.48 Based on GSI mapping, the site has a high recharge rate (recharge coefficient 85%) and therefore the majority of rainfall percolates to ground via the underlying high permeability sands and gravels. This is consistent with the observed lack of drainage features at the site;

8.49 Therefore, the majority of rainfall landing within the site percolates/recharges to ground before moving as groundwater towards the Slate River.

Flood Risk Identification

8.50 This section is a summary of a Stage 2 Flood Risk Assessment carried out for the Proposed Development which is attached as **Appendix 8-1**.

8.51 Catchment Flood Risk Assessment and Management (CFRAM), National Indicative Fluvial Mapping (NIFM), Past Flood Event mapping (https://www.floodinfo.ie/map/floodmaps/) and historical mapping (i.e. 6" & 25" base maps) were consulted to identify those areas of the site as being at risk of fluvial flooding.

8.52 There is no text on local available historical 6" or 25" mapping for the proposed site that identify areas that are "prone to flooding" within the site boundary, or in the immediate vicinity of the site.

8.53 OPW's Past Flood Event mapping was consulted to identify those areas as being at risk of recurring flooding (refer to **Figure 8-3**). There were no reports of flooding at the site or the adjacent lands. The closest mapped flood event, which was a single event, is located at Kilmeague town and dated 22nd November 2017. There are no OPW reports available for this event.

8.54 OPW flood extents mapping and NIFM is available for the Slate River to the north of the site (**Figure 8-4**). The site is mapped outside the 100-year and 1000-year flood zones of the Slate River and is therefore located in Flood Zone C (Low Risk).

8.55 Due to the elevated location of the site above surrounding lands and the lack of nearby watercourses, the risk of fluvial flooding is very low.

8.56 Pluvial flooding (rainfall) or surface water flooding/ponding issues are also not likely at the site due to the sloping ground and permeable soils and subsoils.

8.57 There are no existing or proposed surface water discharges from the Proposed Development and there is no potential for increased flood risk in downstream watercourses.

Surface Water Quality

8.58 EPA Q-rating values data are available for the Slate River upstream and downstream of the proposed site location. Latest Q values (2020) for the Slate River show that the upstream and downstream monitoring locations both have Q3 (Poor Status).

8.59 Water Framework Directive (WFD) river waterbody quality status and risk status are dealt with further below in the chapter.

Local Hydrogeology

8.60 The site is mapped by the GSI to exist in 2 no. Groundwater Bodies (GWB's). The southern portion of the site is mapped within the Dublin GWB, while the northern portion of the site is mapped within the Kildare GWB.

8.61 Both GWBs comprise bedrock aquifers which are described as having "*poorly productive bedrock*" by the WFD.

8.62 In the general area of the site, these GWBs comprise of Devonian Old Red Sandstones (ORS), Dinantian (early) Sandstones, Shales and Limestones and Dinantian Sandstones. Refer to the Land, Soils and Geology Chapter 7 for bedrock descriptions.

8.63 The Devonian Old Red Sandstones and Dinantian Sandstones are classified as Locally Important Bedrock aquifers (Lm/LI) while the Dinantian (early) Sandstones are classified as a Poor Aquifer (Pl). A bedrock aquifer is shown as **Figure 8-5**.

8.64 These aquifers are not expected to maintain regional groundwater flow paths. Groundwater circulation from recharge to discharge points will more commonly take place over a distance of less than 1km with discharge to local surface waters or springs.

8.65 The majority of groundwater flow will be in the upper weathered zone but flow in conduits is commonly recorded at depths of 30 to 50m below ground level (mbgl).

8.66 The closest mapped gravel aquifer to the site is the Curragh Aquifer which is located 3.5km to the south. The sand and gravel deposits in the area of the site are not mapped as an aquifer by the GSI as the deposit is localised and isolated.

Site Hydrogeology

Hydrogeological Investigations

8.67 Refer to the Land, Soils and Geology Chapter 7 for details on the site investigations which included drilling, geophysics and trial pitting.

8.68 Based on the investigation drilling carried out the site, the thickness of sand and gravel deposits varied between 15.8m (@BH5 where the ground level is approximately 101m above OD) and 46m (@BH6 where the ground level is at approximately 129m above OD).

8.69 BH6 is located close to the central area of the proposed extraction area/infill area where the ground level is highest (i.e. 130m above OD on top of hill).

8.70 Generally, clean sand and gravel deposits with minor silty lenses was encountered in all 5 no. boreholes. Overall, the fines content is <10%.

8.71 The bedrock encountered at the 6 no. boreholes was logged as either fined grained reddish SANDSTONE (@BH2, BH3, BH4 & BH6) and grey/red MUDSTONE (@BH1 & BH5).

8.72 The upper few meters of the SANDSTONE and MUDSTONE is described as weak and weathered. Only very low volumes groundwater inflows were noted in the weathered layer.

8.73 Based on the drilling, the top of bedrock elevation across the site varies between 89m above OD on the northwest of the site (@BH2) to 80.5m above OD on the south of the site (@BH1). The top of bedrock elevation across the north and east of the site range between 83 and 85m above OD.

8.74 The top of bedrock below the highest point of the site (i.e. central area of the proposed extraction/ infill) was met at 83m above OD (BH6).

Groundwater Levels and Gradients

8.75 Groundwater levels were manually dipped in 5 no. boreholes on 3 no. occasions during the monitoring period (refer to **Table 8-6** below for dates and water levels).

8.76 Data loggers were installed in BH1, BH2 and BH3 for continuous water level monitoring between 11th August 2021 and 4th May 2023 (refer to **Table 8-7** below for summary levels and **Figure 8-6** for water level plots). Data loggers were programmed to take readings every 2 no. hours.

Table 8-6: Once off Groundwater Level Measurements

Date	11/08/2021		02/02/2023		04/05/2023	
BH No.	mbgl	m OD	mbgl	m OD	mbgl	m OD
BH1	13.34	87.91	13.35	87.9	13.15	88.1
BH2	32.22	89.66	31.87	90.01	31.69	90.19
BH3	29.69	89.07	29.09	89.67	29.05	89.71
BH4	29.45	87.71	29.86	87.30	29.56	87.60
BH5	13.65	87.58	13.83	87.40	13.55	87.68

Table 8-7: Summary Groundwater Level Monitoring (August 2021 - May 2023)

Date	Ground Level	Top of Bedrock Elevation	Groundwater Level (m OD)	
BH No.	m OD	m OD	max	min
BH1	101.25	80.50	88.437	87.186
BH2	121.88	89.03	90.382	89.441
BH3	118.76	85.11	89.825	88.459

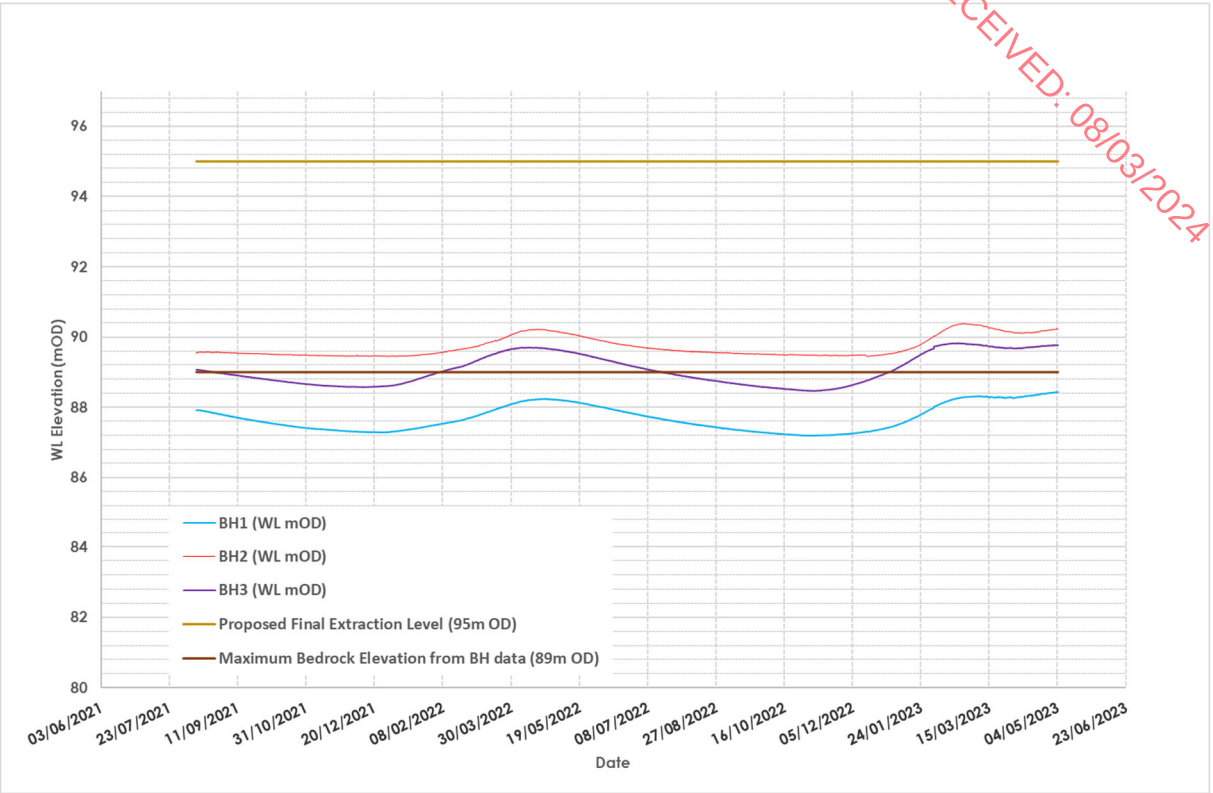
8.77 The depth to groundwater level across the overall site varies from approximately 32mbgl at BH2 to 13.3mbgl at BH1. The depth to groundwater range is largely due to the hilly topography of the site. BH1 is located near the lowest part of the site close to where the site entrance road will be located.

8.78 The groundwater level depth across the proposed extraction area ranges from approximately 32mbgl on the west (@BH2) to 29.5mbgl on the east(@BH4).

8.79 Groundwater level elevation across the site varies from approximately 90.4m above OD (@BH2) on the west to 87.5m above OD on the east (@BH4) which suggests an easterly / northeasterly groundwater flow direction. Refer to **Figure 8-7** attached.

8.80 Based on the long term groundwater level monitoring carried out at BH1, BH2 and BH3, the seasonal groundwater level variation across the site is between approximately 1 – 1.4m.

8.81 The maximum recorded groundwater level over the monitoring period (August 2021 – May 2023) was 90.38m above OD and was recorded at BH2.



Groundwater Vulnerability

8.82 Based on the GSI mapping, the local groundwater vulnerability rating of the proposed site is "High" (refer to the GSI hydrogeological conditions presented in **Table 8-8**). The groundwater vulnerability rating reduces to "Moderate" away to the north and east of the site.

8.83 The mapped vulnerability rating of the site is consistent with the findings of the site investigations which encountered high permeability sand and gravels with unsaturated thicknesses of between 13 to 32m.

Table 8-8: GSI Groundwater Vulnerability Criteria

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)	(<30 m 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 1-2 m below ground surface.

Groundwater Quality

8.84 According to the GSI Dublin GWB description (where the majority of the site is within), the hydrochemical analyses of groundwater from the GWB indicate a very hard water (350-480 mg/l (CaCO3)), with a high alkalinity (300 – 350 mg/l (CaCO3)). Electrical conductivities are also very high, ranging 550-900 µS/cm. This groundwater is a calcium bicarbonate water.

8.85 The Kildare GWB, which occupies the very northern portion of the site has both siliceous and calcareous bedrock strata in this groundwater body and elevated electrical conductivity levels.

8.86 Groundwater sampling of BH1 and BH3 at the proposed was carried out on 4th May 2023 for baseline characterisation. Field hydrochemistry measurements (pH, electrical conductivity, temperature and dissolved oxygen) and laboratory analysis was carried out.

8.87 Results of analysis are shown alongside relevant groundwater and drinking water regulation values (S.I. No. 366/2016 and S.I. No. 99/2023) are shown in **Table 1** attached as **Appendix 8-2**. Certificates of analysis are shown in **Appendix 8-3.**

8.88 Based on groundwater sampling undertaken at the monitoring wells, electrical conductivity ranges between 696 and 803µS/cm. pH values generally ranged between 6.9 and 7.2.

8.89 With regard exceedances relating to S.I. No. 366/2016 and S.I. No. 99/2023, nitrate is notably elevated in both BH1 and BH3 (44.32 & 54.57mg/L respectively).

8.90 Given the greenfield nature of the site, the likely cause is diffuse agricultural sources such as fertiliser in the wider area.

8.91 There were no exceedances with regard metals or hydrocarbons.

Water Framework Directive Status and Risk Result

8.92 Local Groundwater Body (GWB) and Surface water Body (SWB) status and risk result information is available for view from (www.catchments.ie).

8.93 The proposed site is mapped within the Slate_030 river sub basin. The WFD Status and Risk Result for the stretch of the Slate River (Slate_030) immediately downstream site is “Poor” and

"At Risk" respectively. A further 2km downstream, the status improves to "Moderate" while the Risk Result remains as "At Risk".

8.94 Both the Dublin GWB (GWB: IE_EA_G_008) and the Kildare GWB (GWB: IE_SE_G_077) that underlie the proposed site are assigned 'Good Status'[2], this applies to both quantitative status and chemical status.

8.95 With regards risk status the Kildare GWB is deemed to be "Not at risk", whereas the risk status of the Dublin GWB is currently under review.

8.96 A WFD Assessment Compliance report for the Proposed Development is attached as **Appendix 8-4**.

Designated Sites

8.97 Designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). A designated site map for the area of the Proposed Development is shown as **Figure 8-8.**

8.98 The closest designated site to the proposed site is the Grand Canal pNHA (Site Code: 002104) which is located ~1.32km to the north northeast of the site. There is no hydrological or hydrogeological connection between the proposed site and Grand Canal pNHA.

8.99 The site is approximately 2.9km southwest of the Blackwood feeder which is part of the Ballynafagh Lake SAC (Site Code: 001387) and connects the Ballynafagh Lake to the Grand Canal. The Blackwood Feeder is of particular conservation significance for the populations of two rare snail species, Vertigo moulinsiana and Pisidium pseudosphaerium, that it supports. Ballynafagh Lake is a shallow alkaline lake with patches of emergent vegetation in the middle, as well as around the shore and is also a pNHA.

8.100 Ballynafagh Bog SAC (Site Code: 000391) is situated south of Ballynafagh Lake approximately 5km northeast of the site whilst Hodgestown Bog NHA (Site Code: 001393) is located northwest of Ballynafagh Lake approximately 5.5km north of the proposed site.

8.101 Approximately 3.3km south of the proposed site is the Mouds Bog SAC (Site Code: 002331) and pNHA (Site Code: 000395). The site comprises a raised bog that includes both areas of high bog and cutover bog.

8.102 Pollardstown Fen SAC and pNHA (Site Code: 000396) is situated on the northern margin of the Curragh of Kildare, approximately 6.5km south of the site and is hydrologically connected to the Grand Canal pNHA as mentioned above.

8.103 There are no direct surface water connections between the proposed site and any of the above mentioned designated sites.

8.104 As discussed above, groundwater flow direction in the area is to the east / northeast. The closest potentially downgradient designated sites are Ballynafagh Lake and Ballynafagh Bog which are located approximately 5km to the northeast.

2 'Status' means the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 classes: High, Good, Moderate, Poor and Bad (WFD, 2010).

Local Water Supplies

8.105 The proposed site is not located inside any mapped Public Water Supply (PWS) or National Federation Group Water Scheme (NFGWS) groundwater protection zones.

8.106 The Robertstown Public Water Supply source protection area is located approximately 1.2km northeast of the proposed site (refer to **Figure 8-9**). The Robertstown PWS well field draws groundwater from gravels. The Robertstown gravel deposits are part of the extensive body of glacial outwash which characterises this part of County Kildare and forms part of the North Kildare Aquifer (Source Protection Plan for Robertstown Well Field Co. Kildare January 2005).

8.107 The Geological Survey of Ireland (GSI) well database (www.gsi.ie) shows that there are several domestic wells located to the northeast near Robertstown which are potentially down-gradient of the proposed development.

8.108 Private houses within 1km of the proposed site are shown on **Figure 8-9.** For the purpose of impact assessment**,** it is assumed that each of these houses have private wells.

8.109 The closest houses are located along the public road to the south, near the proposed site entrance. There are also houses to the east and northeast (i.e. groundwater flow direction is measured to be easterly / northeasterly). The closest house to the northeast is approximately 500m in distance.

8.110 There are no mapped Article 7 (Abstraction for Drinking Water) drinking water protection areas within 20km of the site.

Receptor Sensitivity

8.111 Based on criteria set out in **Table 8-1** above, groundwater at the site is classed as Medium Importance because the bedrock aquifers are classified as a Locally Important.

8.112 There are no surface water pathways between the proposed site and local river waterbodies such as Slate River and so these river waterbodies are not sensitive to potential effects.

8.113 Groundwater will be the main sensitive receptor with respect of potential oil/fuel leaks and spills from plant and machinery. There is also a proposal for groundwater abstraction at the site which may have quantitative effects (i.e. levels and flows).

8.114 Furthermore, there is a potential pathway to downstream receptors (private wells/designated sites) indirectly via groundwater flow in underlying sand and gravels as well as bedrock.

8.115 However, due to the significant downgradient distance (~5km) to potentially downgradient designated sites such as Ballynafagh Lake and Ballynafagh Bog, they are not likely to be sensitive to hydrological effects.

8.116 All potential contamination sources are to be carefully managed at the site during all phases of the development and mitigation measures are proposed within the EIAR to deal with these potential minor impacts.

Characteristics of Development

Construction Phase – Aggregate Extraction / Woodland & Vegetation Removal

- The removal of woodland, vegetation and topsoil.

- Extraction of sand and gravel on a phased basis from an area of c. 8.65ha to a final floor level at 95mOD which is above the bedrock level.
- The proposed final extraction level of 95m OD is 4.6m above the maximum recorded groundwater level at the site.
- Groundwater abstraction from a proposed on-site well for the purpose of aggregate washing and processing as well as dust suppression / wheelwash top-up.
- Water used for washing/processing and dust suppression and at the wheel wash will be sourced from the proposed on-site groundwater well. The daily demand is expected to be between 50 and 60m^3/day for washing/processing and up to 25m^3/day for wheel wash (maximum estimated daily water usage 85m^3/day.
- Aggregate wash water will be directed to a closed lagoon system for settlement of silt and water recycling. The lagoon will be topped up using the proposed on-site well.
- No proposed licenced discharges to either groundwater or surface water.
- Surface water / drainage management.

Operation Phase – Soil Recovery/Infilling and Aggregate Extraction

8.117 It is proposed to fill the pit void with either:

- Inert soil and stone classified as a waste (imported inert greenfield and non-greenfield soils and stone, and river dredge spoil) operating as a soil recovery facility that will require a waste management licence authorised by the EPA or initially a waste permit authorised by the Local Authority; or,
- Soil and stone by-product (i.e. virgin soil or equivalent to virgin soil and stone and dredge material) which will be notified to the EPA as an Article 27 by-product at the source location, and the Site will be authorised by the Local Authority planning conditions.
- Water usage post extraction/infill phase will just be for dust suppression and for the wheel wash (<25m^3/day).
- Surface water / drainage management.

Restoration Phase / Landscaping

- The extraction area will be infilled on a phased basis with ground levels ultimately being restored back to original levels pre extraction;
- The restored ground will be planted with a suitable mix of woodland planting;
- All existing boundary fences and hedgerows will be retained to ensure that the site is secure;
- All plant and machinery will be removed from the pit void.
- Surface water / drainage management.

Potential Likely and Significant Effects

Construction/Extraction Phase Effects

Earthworks / Removal of Trees, Vegetation and Topsoil and Surface Water Quality Impacts

8.118 There will be a requirement to strip and store topsoil from the proposed site.

8.119 Felling, vegetation and topsoil removal will be an intermittent operation and topsoil will be retained in berms and used during restoration activities such as vegetating the quarry floor.

8.120 Due to the fact that the site does not drain directly to any river waterbody or drain network, no significant effects on river waterbodies are likely due to lack of surface water flowpaths.

8.121 Receptor: Downstream surface waters (Slate River)

8.122 Pathway/Mechanism: Surface water runoff and land drainage

8.123 Pre-mitigation Effect: Negative, reversible, imperceptible, indirect, unlikely, temporary effect on surface water quality.

Impacts on Groundwater Vulnerability Rating due to Aggregate Extraction

8.124 The Proposed Development will involve the extraction of material down to 95m OD (from a maximum ground level of 130m OD) which will decrease the overburden thickness and hence increase the groundwater vulnerability of the locally important aquifer which is currently rated as "High" based on the site hydrogeological conditions.

8.125 Receptor: Groundwater vulnerability rating

8.126 Pathway/Mechanism: Aggregate extraction

8.127 Pre-mitigation Effect: Negative, reversible, slight, direct, likely, temporary effect on groundwater vulnerability rating.

Surface Water and Groundwater Contamination from Oil / Fuel Spills and Leaks

8.128 Excavation of aggregate at the site will be completed using machinery. Such machinery are powered by diesel engines and operated using hydraulics. Unless managed carefully such plant and machinery have the potential to leak hydraulic oils or cause fuel leaks during refuelling operations.

8.129 Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected as best practice mitigation will be implemented.

8.130 Additionally, the lack of surface water flowpaths to river waterbodies thereby significantly reduces the risk to river waterbodies.

8.131 Receptor: Groundwater (Dublin & Kildare GWB) and surface water (Slate River)

8.132 Pathway: Groundwater flowpaths

8.133 Pre-mitigation Effect: Negative, reversible, imperceptible, indirect, unlikely, short term effect on surface water quality.

8.134 Pre-mitigation Effect: Negative, reversible, slight, indirect, unlikely, long term effect on groundwater quality.

Groundwater Quality and Quantity Effects on Local Wells

8.135 The Geological Survey of Ireland (GSI) well database (www.gsi.ie) shows that there are several domestic wells in the area and these wells are mainly located to the northeast of the proposed site towards Robertstown and to the southwest of the site towards Kilmeague.

8.136 Groundwater flow at the proposed site travels in an easterly / northeasterly direction.

8.137 Hydrocarbon spills and leaks have the potential to effect groundwater quality while the proposed abstraction of groundwater for washing and processing has the potential to effect groundwater levels and flows.

8.138 Water used for washing/processing and dust suppression and at the wheel wash will be sourced from the proposed on-site groundwater well. The total daily demand is expected to be a maximum of 85m^3/day.

8.139 Receptor: Local wells

8.140 Pathway: Groundwater flowpaths

8.141 Pre-mitigation Effect: Negative, slight, indirect, unlikely effect on groundwater quality in local wells.

8.142 Pre-mitigation Effect: Negative, imperceptible, indirect, unlikely effect on groundwater levels and yields in local wells.

Hydrological Impacts on Downstream Designated Sites

8.143 The closest designated site to the proposed site is the Grand Canal pNHA located approximately 1.7km north of the site. There are no surface water or groundwater connections between the site and Grand Canal and therefore effects are unlikely.

8.144 Ballynafagh Lake SAC is located approximately 5km to the northeast of the site and is potentially located downstream of the site with regard groundwater flows only.

8.145 Receptor: Ballynafagh Lake SAC

8.146 Pathway: Groundwater flowpaths

8.147 Pre-mitigation Effect: Negative, imperceptible, indirect, long-term, unlikely effect on downstream designated sites such Ballynafagh Lake SAC.

Potential Effects on Surface Water and Groundwater WFD Status

8.148 The Groundwater Bodies (GWB) in which the proposed site Is located are called the Dublin GWB and the Kildare GWB. These GWBs are both currently assigned ‘Good Status’, which is defined based on the quantitative status and chemical status of the GWB.

8.149 The Proposed Development is mapped within the Slate_030 river sub basin. The WFD Status and Risk Result for the Slate River (Slate_030) is 'Poor’ and 'At Risk' respectively.

8.150 Due to the lack of direct surface water flowpaths between the site and local river waterbodies, effects on any nearby river waterbody WFD Status or Risk Result is not expected.

8.151 Groundwater quality and quantity impacts may have the potential to affect the WFD status of the GWB

8.152 Receptor: WFD status of local GWBs (Dublin GWB and Kildare GWB).

8.153 Pathway: Recharge and Groundwater flowpaths

8.154 Pre-Mitigation Effect: Indirect, negative, imperceptible, long term, unlikely effect on groundwater bodies status.

Operational/Infilling Phase Effects

Potential Negative Effects on Groundwater Quality and GWB Status due to Imported Inert Soil and Stone Material

8.155 A certain volume of rainfall falling on the imported material will percolate down through the inert material (percolate before recharging into the underlying locally important bedrock aquifer. Recharge is a potential pathway for contaminants to enter the groundwater system.

8.156 However, infilling of the site with inert soil and stone will pose a very low contamination risk as no harmful contaminants will be present. In addition, inert soil and stone will not contain either organic matter or liquids that will form a source of organic contamination.

8.157 Receptor: Groundwater

8.158 Pathway: Groundwater recharge and flowpaths

8.159 Pre-mitigation Effect: Negative, slight, indirect, long term, likely effect on groundwater quality.

Potential Release of Hydrocarbons

8.160 Similar to the construction phase, plant and machinery will also be required during the Operational phase. Accidental spillage during refuelling of construction plant with hydrocarbons is a pollution risk.

8.161 Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected as long at standard mitigation is implemented.

8.162 Receptor: Local Groundwater Bodies (Dublin GWB and Kildare GWB)

8.163 Pathway: Recharge and Groundwater flowpaths

8.164 Pre-mitigation Effect: Negative, indirect, slight, long term, unlikely effect to local groundwater quality.

Potential Effects on Groundwater Vulnerability

8.165 As discussed above it is proposed to import inert soil and stone and fill the quarry void over an area of approximately 8.65ha. The groundwater vulnerability rating after the infill is complete will be improved as the fill will provide aquifer protection at the site where previously it was reduced by extraction. The groundwater vulnerability rating is currently High.

8.166 It is proposed to import a fill depth of up to a maximum of 36m above the proposed extraction depth of 95m OD. This will reduce the vulnerability rating from High to Moderate according to GSI criteria.

8.167 No mitigation is required with regard groundwater vulnerability during the operational / infilling phase.

8.168 Receptor: Groundwater

8.169 Pathway: Groundwater recharge

8.170 Pre-mitigation Effect: Positive, significant, direct, permanent, likely effect on the local groundwater vulnerability rating

Potential Hydrological Effects on Downstream Designated Sites

8.171 Ballynafagh Lake SAC is located approximately 5km to the northeast of the site and is potentially located downstream of the site with regard groundwater flows.

8.172 Due to the inert nature of the proposed infill material along with the significant downstream distance to the SACs no significant effects on downgradient designated sites is anticipated.

8.173 Receptor: Ballynafagh Lake SAC

8.174 Pathway: Groundwater flowpaths

8.175 Pre-mitigation Effect: Negative, imperceptible, indirect, long term, unlikely effect on downstream designated sites

Potential Effects on Surface Water and Groundwater WFD Status

8.176 The Groundwater Bodies (GWB) in which the proposed site is located are called the Dublin and the Kildare GWB's. These GWBs are both currently assigned 'Good Status', which is defined based on the quantitative status and chemical status of the GWB.

8.177 The Proposed Development is mapped within the Slate_030 river sub basin. The WFD Status and Risk Result for the Slate River (Slate_030) is 'Poor' and 'At Risk' respectively.

8.178 Effects on surface water and groundwater quality as a result of the Proposed Development have the potential to negatively affect the WFD status.

8.179 Receptor: WFD status of downstream surface water bodies (Slate River) and Dublin and Kildare GWB's.

8.180 Pathway: Groundwater flowpaths and baseflow

8.181 Pre-Mitigation Effect: Indirect, negative, imperceptible, long term, unlikely effect on surface water and groundwater bodies status.

Groundwater Quality and Quantity Effects on Local Wells

8.182 Hydrocarbons spills and leaks have the potential to effect groundwater quality, but only small volumes will be present on-site.

8.183 Given the inert nature of the proposed infill material and due to the fact that there will be no licenced discharges to surface water or groundwater from the site means no significant effects on these potential drinking water receptors are likely.

8.184 Only small volumes of water (<25m^3/day) will be abstracted from the proposed on-site well for the wheel wash and dust suppression purposes during the operational/infilling phase and therefore no significant effects on groundwater levels off flows will occur.

8.185 Receptor: Local groundwater supplies.

8.186 Pathway: Groundwater flowpaths

8.187 Pre-mitigation Effect: Negative, imperceptible, indirect, unlikely effect on groundwater supplies/local wells.

Increased Surface Water Flood Risk due to Infilling

8.188 The site will be restored/infilled using imported material which may have a lower permeability/infiltration capacity than the previously extracted sand and gravels.

8.189 Infilling of land can potentially result in flooding of neighbouring properties due to displacement of surface water and/or increased surface water runoff.

8.190 However, as the site is situated on a free draining elevated area, displacement of ponded surface water is an unlikely risk. The topography of the site post restoration will be very similar to the predevelopment greenfield site.

8.191 Also, the proposed infill area is surrounded by well-draining, in-situ sand and gravel deposits that will act a buffer for any runoff from the infill area.

8.192 Receptor: Local flood risk.

8.193 Pathway: Surface water runoff

8.194 Pre-mitigation Effect: Negative, slight, indirect, unlikely effect on local flood risk.

Restoration Phase Effects

8.195 At the end of the infilling/operational process, the infill area will be put back to a similar condition to pre-development by landscaping and tree planting. No additional effects on the water environment are envisaged during the restoration phase, closure and aftercare period of the Proposed Development.

Impact Assessment, Mitigation Measures and Management

Construction/Extraction Phase Mitigation

Earthworks / Removal of Trees, Vegetation and Topsoil and Surface Water Quality impacts

8.196 Impact Assessment and Proposed Mitigation Measures:

8.197 Even though the Slate River and its tributaries are a significant distance from the site (>0.35km) and the topography does not lend itself to surface water runoff towards the river, the following drainage control measures will be implemented nonetheless with regard drainage control:

- Prior to the commencement of overburden stripping works silt fencing will be placed down-slope of the excavation area. These will be embedded into the local soils to ensure all site water is captured and filtered;
- Daily monitoring of the overburden stripping/landscaping earthworks will be completed by a suitably qualified person. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will leave the site;
- Overburden stripping and landscaping works will be scheduled for periods of low rainfall (summer months) to reduce run-off and potential siltation;
- Landscaped areas and perimeter berms will be planted with trees and grasses as soon as possible after formation to reduce the potential of surface water erosion; and,
- Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk. The Construction Industry Research

and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001), which provides information on these issues. This will ensure that surface water arising during the course of overburden stripping and landscaping activities will contain minimum sediment.

Impacts on Groundwater Vulnerability Rating due to Aggregate Extraction

8.198 Impact Assessment and Proposed Mitigation Measures:

8.199 Albeit there will be a slight increase in groundwater vulnerability due to the removal of overburden, there will be no extraction within at least 4.5m of the groundwater table and therefore there will be no effect on the current GSI groundwater vulnerability rating which is "High" (>3m of unsaturated material above the groundwater table).

8.200 The proposed extraction depth (95m above OD) is also 6m above the highest recorded bedrock elevation (89m above OD at BH2). The bedrock elevation at the centre of the extraction/infill area is 83m above OD at BH6).

8.201 The main mitigation with respect groundwater quality protection during the extraction phase will be employment of best practice measures with respect to oil usage and refuelling of plant and machinery which are dealt with in Section 8.197 below.

Surface Water and Groundwater Contamination from Oil / Fuel Spills and Leaks

8.202 Impact Assessment and Mitigation Measures:

- All plant and machinery will be serviced before being mobilised to site;
- Refuelling will be completed in a controlled manner using drip trays (bunded container trays) at all times;
- Drip-trays will be used for fixed or mobile plant in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Oils and lubricants will be stored on drip pallets in a designated hardstand area that will drain to an oil interceptor;
- Procedures and contingency plans will be set up to deal with emergency accidents and spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on site for use in the event of an accidental spillage.

Groundwater Quality and Quantity Impacts on Local Wells

8.203 Impact Assessment and Proposed Mitigation Measures:

- There are no licenced discharges to any surface water or groundwater body and therefore no significant effects on groundwater or surface water will occur.
- No other mitigation is required in addition to the comprehensive drainage controls and mitigation measures presented above with regard oils and fuels.

- There is no proposed aggregate extraction below the groundwater table and therefore no effects on groundwater levels can occur.
- Water used for washing/processing and dust suppression and at the wheel wash will be sourced from the proposed on-site production well. The maximum daily demand is expected to be 85m^3/day.
- Effects on groundwater levels (from groundwater abstraction - 85m^3/day) outside the proposed site area are not expected as the water balance assessment presented in paragraph 8.41 above shows that daily groundwater recharge at the site averages at ~87m^3/day (i.e. the groundwater zone of contribution to the proposed production well will therefore not extend outside the Proposed Development site boundary.
- Therefore, no significant effects on local groundwater wells are likely due to proposed groundwater abstraction, as groundwater levels outside the site will not be significantly affected.
- Also, as the proposed groundwater abstraction volume exceeds 25m^3/day, the abstraction will be registered with the EPA as required by the European Union (Water Policy) (Abstractions Registration) Regulations 2018 (S.I. No. 261 of 2018).

Hydrological Impacts on Downstream Designated Sites

8.204 A series of mitigation measures, designed for the protection of surface and groundwater quality, have been proposed to ensure the protection of receiving waters during the construction/extraction phase of the Proposed Development.

8.205 Also, the lack of dewatering (for extraction purposes), the lack of licenced discharges as well as the absence of direct surface water flowpaths, means the above proposed mitigation is appropriate for protection of downstream designated sites.

Potential Effects on Surface Water and Groundwater WFD Status

8.206 Impact Assessment & Proposed Mitigation Measures:

8.207 Our understanding of these objectives is that surface waters and groundwater, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all. Also, the development will not prevent the local waterbodies or groundwater bodies from achieving 'Good' or 'High' status.

8.208 Due to the relatively small scale of the Proposed Development, the absence of surface water discharges or dewatering requirements and the mitigation measures with regard groundwater protection (refer to Section 8.197), the status of both surface water and groundwater bodies in the vicinity of the site will be at least maintained.

8.209 As such, the Proposed Development is compliant with the requirements of the Water Framework Directive (2000/60/EC) and the Groundwater Directive (2006/118/EC).

Operational/Infilling Phase Mitigation

Potential Negative Effects on Groundwater Quality due to Imported Inert Soil and Stone Material

8.210 The following proposed mitigation measures are applicable to the site under both forms of operation (Inert soil and stone importation and Article 27 by-product material importation).

8.211 Proposed mitigation measures include:

- Sourcing material that is proven to be inert prior to transport to the site;
- Pre-agreed source sites for inert material ensuring; no pollutants, unauthorised material, invasive species;
- Regular checks of incoming loads to ensure suitability of imported material;
- The site will be operated under an Environmental Management System;
- All required pollution prevention measures will be implemented at the site;
- The operator will prepare and implement an emergency response procedure;
- The operator will complete environmental monitoring, including local groundwater and surface water monitoring;
- A phased restoration of the site will be implemented, with both native and imported material.

8.212 The operator will have a documented waste recording procedure for all material entering the site;In addition, it should be noted that there are no licensed discharges to any natural surface waters or groundwater body.

Surface Water and Groundwater Contamination from Oil / Fuel Spills and Leaks

8.213 Impact Assessment & Proposed Mitigation Measures:

8.214 Mitigation measures with regard oils and fuels is the same as the construction/extraction phase.

Potential Effects on Groundwater Vulnerability

8.215 Impact Assessment & Proposed Mitigation Measures:

8.216 Post extraction the site will be infilled with inert material which will increase the thickness of overburden at the site that was previously reduced by aggregate extraction.

8.217 In terms of impacting on the groundwater vulnerability of the site, the importing of the inert fill will have a positive effect on the site in that the groundwater vulnerability rating will be reduced to Moderate from High. No mitigation measures in relation to groundwater vulnerability are required.

Potential Hydrological Effects on Downstream Designated Sites

8.218 A series of mitigation measures, designed for the protection of surface and groundwater quality, have been proposed to ensure the protection of receiving waters during the operational of the Proposed Development.

8.219 The proposed mitigation measures include:

- Detailed mitigation measures for the control of fuels and oils will be the same as the construction phase.

- Detailed measures to ensure the imported material is free from contaminants and potentially harmful material as outlined above in Section 8.206 above.

8.220 The proposed mitigation measures will ensure that there will be no negative change in surface water or groundwater quality. Therefore, significant indirect effects on the potentially downstream designated sites will not occur.

Potential Effects on Surface Water and Groundwater WFD Status

8.221 The operational phase/infilling does not involve any direct surface water or groundwater discharges, or alteration of groundwater or surface water flow patterns in a manner that would negatively effect waterbodies.

8.222 Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during all stages of the Proposed Development.

8.223 Mitigation for the protection of groundwater and surface water quality during the construction and operational phase of the development will ensure the qualitative status of the receiving waters will not be altered by the Proposed Development.

8.224 The proposed operational phase mitigation measures include:

- Detailed mitigation measures for the control of fuels and oils will be the same as the construction phase.
- Detailed measures to ensure the imported material is free from contaminants and potentially harmful material as outlined above in Section 8.206 above.

Groundwater Quality and Quantity Effects on Local Wells

8.225 There are no licenced discharges to any natural surface water or groundwater body and therefore no significant effects on local groundwater supplies will occur.

8.226 Only small volumes of water (<25m^3/day) will be abstracted from the proposed on-site well for the wheel wash and dust suppression purposes during the operational/infilling phase and therefore no significant effects on groundwater levels or flows will occur.

8.227 The proposed operational/infilling phase mitigation measures include:

- Detailed mitigation measures for the control of fuels and oils will be the same as the construction phase.
- Detailed measures to ensure the imported material is free from contaminants and potentially harmful material as outlined above in Section 8.206 above.

Increased Surface Water Flood Risk due to Infilling

8.228 As stated above there is no history of fluvial (river), groundwater flooding or pluvial flooding at the site and therefore there is very low risk of any infill resulting in the displacement of flood water onto adjacent property.

8.229 The topography (contouring/slopes) of the infilled site will be very similar to the pre-development Greenfield scenario.

8.230 Any rain water landing on the site or surface water runoff intercepted by the infilled site will be managed by the proposed restoration plan and drainage network as outlined below:

- On infilling of the site area a perimeter toe drain / drainage ditch will be installed around the perimeter of the infill that will collect local surface water runoff intercepted by the infilled area and direct it to ground via soakaways in the underlying more permeable sand and gravel deposits;
- All rainfall landing on hardstanding surfaces (i.e. roofs and roads etc) will be directed to the surface water drainage system and attenuated at the site prior to discharge to ground using swales. This water will therefore not be allowed to runoff the site in an uncontrolled manner that might cause localised flooding in adjacent properties.
- Finally, the infill ground surface will be topped with native (well-draining) topsoil, vegetated and planted with a suitable mix of woodland planting which will retain rainfall, increase infiltration and reduce the potential for runoff.

'Do-Nothing' Scenario

8.231 If the Proposed Development does not go ahead, the site will remain as a greenfield site with forestry and mixed woodland.

Cumulative Effects

8.232 There will be no licenced surface water or groundwater discharges from the Proposed Development and therefore the potential for cumulative hydrological effects is low.

8.233 Groundwater is the primary receptor for site drainage and runoff, however the main potential contaminant at the application site will be oil and fuels which is a potential risk at all construction/industrial sites. Measures will be put in place to mitigate any minor effects.

8.234 Due to the nature of the groundwater regime and high permeability of the subsoil, there is no runoff from the site, therefore there will be no cumulative impacts on the surface water environment. Similarly, the groundwater regime will remain unchanged and there will be no cumulative impacts on the groundwater regime.

8.235 The other land use activities in the area are existing farming operations, residential land uses, and another small sand and gravel/infill operation to the west of the application site. The potential in-combination effects of these developments are very low.

8.236 Due to the relatively small scale of the Proposed Development and the lack of effects from the development that would affect the wider environment, there will be no significant cumulative effects to the water environment.

Human Health Effects

8.237 Potential health effects in relation to the water environment mainly occur due to direct and indirect contact with contaminated groundwater or surface water. Groundwater is a primary pathway.

8.238 However, as stated above all imported material will be inert soil and stone by-product material and no contamination risk to groundwater and surface water will occur, and therefore effects on human health is not anticipated. There will be best practice controls in place to ensure all

imported material is source checked and is suitable for the restoration works. Spot checks of incoming loads will be carried out on a daily basis.

8.239 Hydrocarbons, in the form of fuels and oils, will be used on-site mainly during the construction and operational stages of the proposed works. However, the volumes will be small in the context of the scale of the project and will be handled in accordance with best practice mitigation measures. The potential residual effects associated with contamination of the water environment and subsequent health effects are negligible.

Residual Effects

Construction/Extraction Phase

Earthworks / Removal of Trees, Vegetation and Topsoil and Surface Water Quality impacts

8.240 Residual Effect: All site construction drainage/runoff water will be managed, contained and released to ground within the site. No effects on river waterbodies will occur due to earthworks/overburden stripping or abstraction proposal.

8.241 Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures outlined above, no significant effects on surface water quality will occur.

Impacts on Groundwater Vulnerability Rating due to Aggregate Extraction

8.242 Residual Effect: As the proposed extraction will not change the vulnerability rating of the site (i.e. High) along with the application of best practice methods with regard oils and fuels, means effects on groundwater vulnerability will be negative, reversible, imperceptible, direct, likely, temporary effect on groundwater vulnerability.

8.243 Significance of Effects: For the reasons outlined above, no significant effects on groundwater vulnerability will occur.

Surface Water and Groundwater Contamination from Oil / Fuel Spills and Leaks

8.244 Residual Effect: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all sand and gravel pit sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effects will be – Negative, indirect, imperceptible, medium term, unlikely impact on groundwater and surface water quality.

8.245 Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures outlined above, no significant effects on surface water or groundwater quality are expected.

Groundwater Quality and Quantity Impacts on Local Wells

8.246 Residual Effect: Due to the lack of licenced surface water and groundwater discharges at the proposed site, lack of significant groundwater level effects due to groundwater abstraction, coupled with the implementation of the proposed operational controls and mitigation measures for the protection of water quality, there will be no residual negative effect on local drinking water supplies.

8.247 Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures outlined above, no significant effects on local groundwater wells are anticipated.

Hydrological Impacts on Downstream Designated Sites

8.248 Residual Effect: Construction/extraction activities at the site potentially pose a threat to designated sites hydrologically linked with the proposed development. However, due to the fact that no surface water or groundwater discharges are proposed, no significance effects will occur. Nevertheless, proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break any potential pathway between the potential source and the downstream designated sites.

8.249 Significance of Effects: No effects on local designated sites will occur.

Potential Effects on Surface Water and Groundwater WFD Status

8.250 Residual Effect: Due to the lack of surface water and groundwater discharges at the proposed site, coupled with the implementation of the proposed operational controls and mitigation measures for the protection of groundwater and downstream surface waters, there will be no residual negative effect on the WFD status of the underlying groundwater bodies or downstream river waterbodies

8.251 Significance of Effects: No effects on surface water and groundwater WFD status will occur.

Operation Phase

Potential Negative Effects on Groundwater Quality due to Imported Inert Soil and Stone Material

8.252 Residual Effect: The importation of inert soil and subsoil is an integral part of the Proposed Development. Proven and effective control measures such as source checks/screening and regular checks of incoming loads to mitigate the risk of contaminated soils being imported to the site are outlined above. Application of these controls will ensure that material brought on-site is inert and free from harmful constituents. The residual effect will be - neutral, imperceptible, indirect, long term, likely effect on groundwater quality.

8.253 Significance of Effects: For the reasons outlined above, no significant effects on groundwater quality will occur.

Potential Effects on Groundwater Vulnerability

8.254 Residual Effect: The application of best practice methods with regard oils and fuels and the proposed restoration plan means effects on groundwater vulnerability will be positive, irreversible, significant, direct, likely, permanent effect on groundwater vulnerability.

8.255 Significance of Effects: For the reasons outlined above, no negative effects on groundwater vulnerability will occur.

Hydrological Impacts on Downstream Designated Sites

8.256 Residual Effect: Operational activities at the site potentially pose a threat to designated sites hydrologically linked with the Proposed Development. However, due to the fact that no surface water or groundwater discharges are proposed, no significance effects will occur. Nevertheless, proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break any potential pathway between the potential source and the downstream designated sites.

8.257 Significance of Effects: No effects on local designated sites will occur.

Potential Effects on Surface Water and Groundwater WFD Status

8.258 Residual Effect: Due to the lack of surface water and groundwater discharges at the proposed site, coupled with the implementation of the proposed operational controls and mitigation measures for the protection of groundwater and downstream surface waters, there will be no residual negative effect on the WFD status of the underlying Dublin and Kildare GWB and the Slate River waterbody.

8.259 Significance of Effects: No effects on surface water and groundwater WFD status will occur.

Effects on Surface Water and Groundwater Drinking Supplies

8.260 Residual Effect: Due to the lack of surface water and groundwater discharges at the proposed site, coupled with the implementation of the proposed operational controls and mitigation measures for the protection of water quality, there will be no residual negative effect on local drinking water supplies or the Robertstown PWS.

8.261 Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures outlined above, no significant effects on local groundwater wells or the Robertstown PWS are anticipated.

Increased Surface Water Flood Risk due to Infilling

8.262 Residual Effect: Due to the lack of any flood zones or historic flooding within the site, the infilling of the site back to the original topography and the proposed SuDS drainage measures, the potential for floodwaters to be displaced is considered to be negative, indirect, imperceptible, long-term and unlikely effect.

8.263 Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures outlined above, no significant effects on local flood risk will occur.

Difficulties Encountered

8.264 No limitations or difficulties were encountered in the preparation of this chapter.

Monitoring

8.265 It is proposed that boreholes BH1 – BH5, which are fitted with standpipes and gravel pack, will be used as groundwater monitoring wells during each phase of the development. Monitoring will be completed to satisfy any planning conditions or waste licence requirements.

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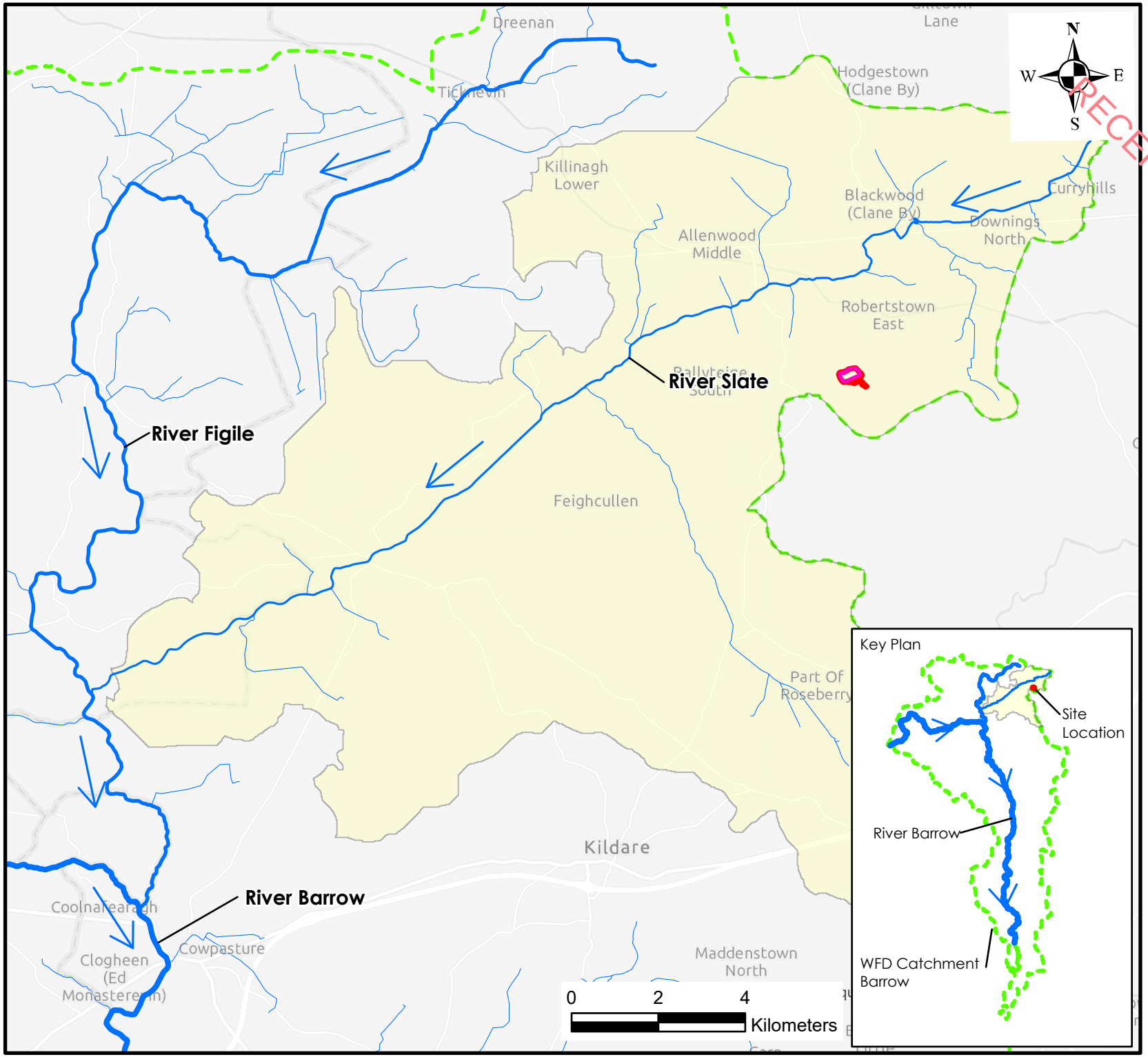
PPG1 - General Guide to Prevention of Pollution (UK Guidance Note).

PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note).

K.T. Cullen & Co. Ltd, 2005: Source Protection Plan for Robertstown Well Field Co. Kildare

FIGURES



Legend

- Application Area
- Extraction - Infill Area
- Watercourses

WFD Catchments

- Barrow

WFD Subcatchments

- Slate_SC_010

Key Plan

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Client: Quarry Consulting	
Job: Kilmeague Sand & Gravel Pit, Co. Kildare	
Title: Regional Hydrology Map	
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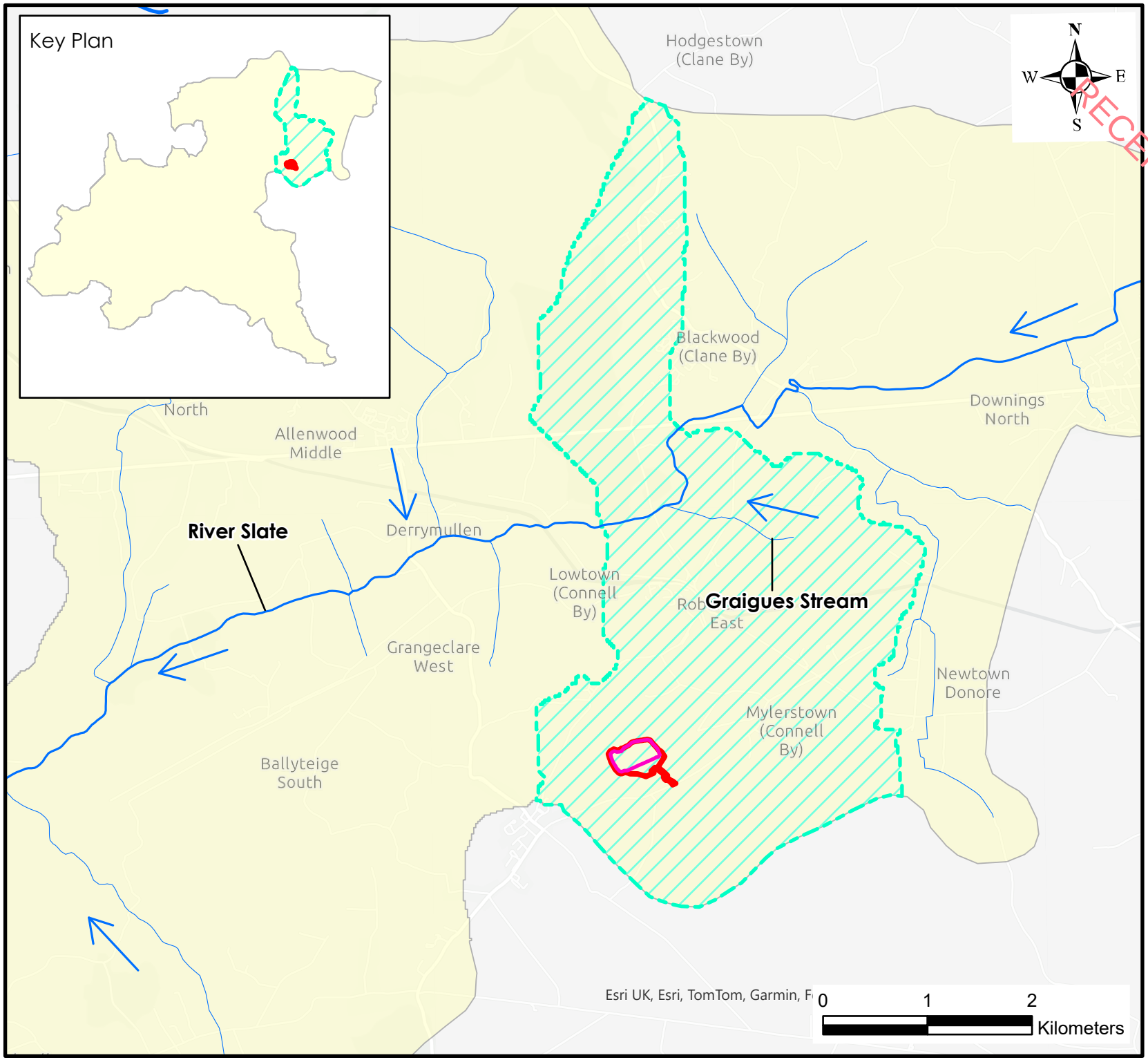

Legend

- Application Area
- Extraction - Infill Area
- Watercourses

WFD Subcatchments

- Slate_SC_010

WFD River Sub-Basins

- SLATE_030

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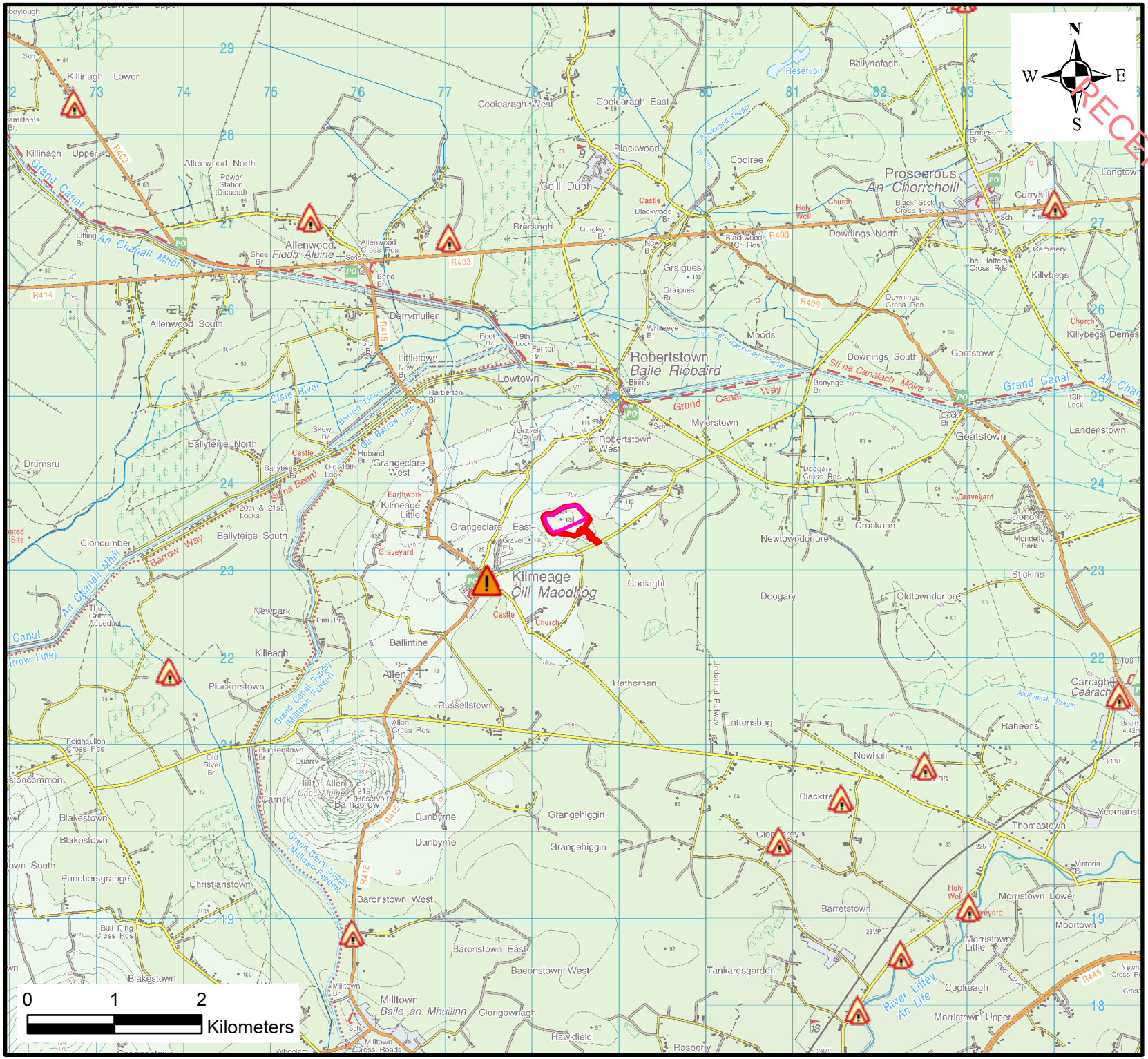

Legend

- Application Area
- Extraction - Infill Area
- Watercourses
- Recurring Flood Event
- Single Flood Event

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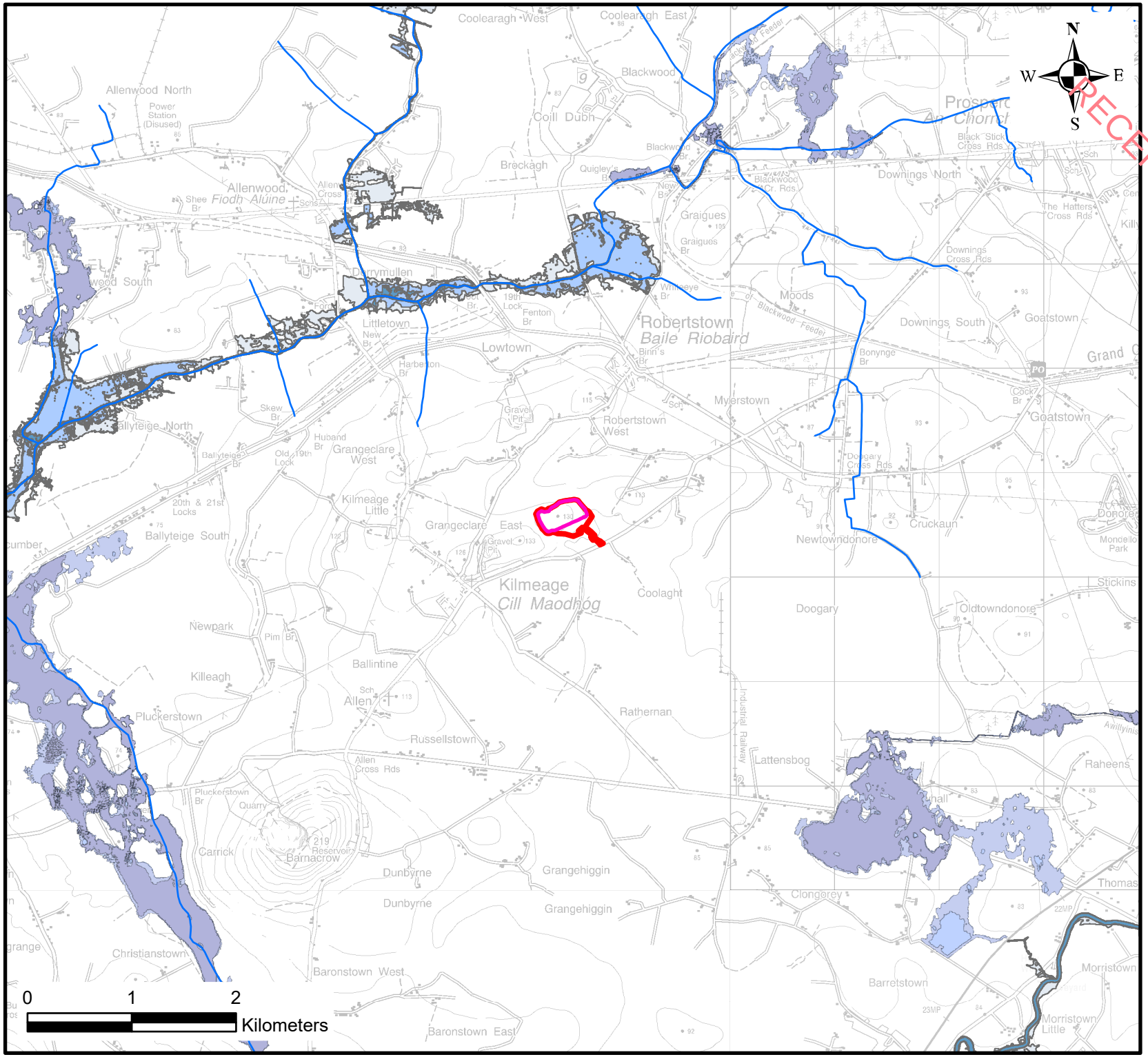

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Job: Kilmeague Sand & Gravel Pit, Co. Kildare

Title: OPW Fluvial Flood Extents Map - CFRAM and NIFM

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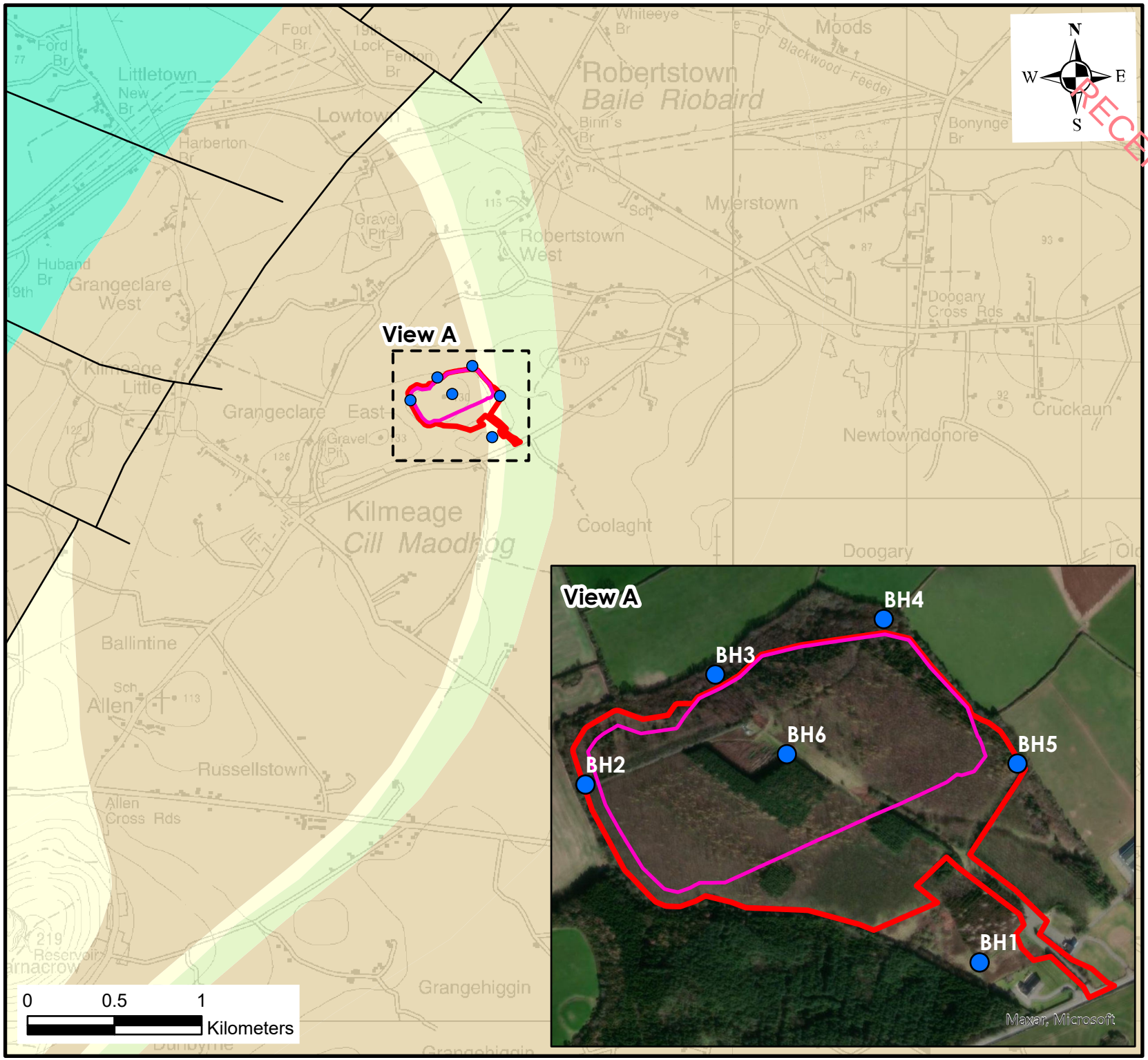

Legend

- Application Area
- Extraction - Infill Area
- Borehole locations
- Mapped Faults

Bedrock Aquifer

- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

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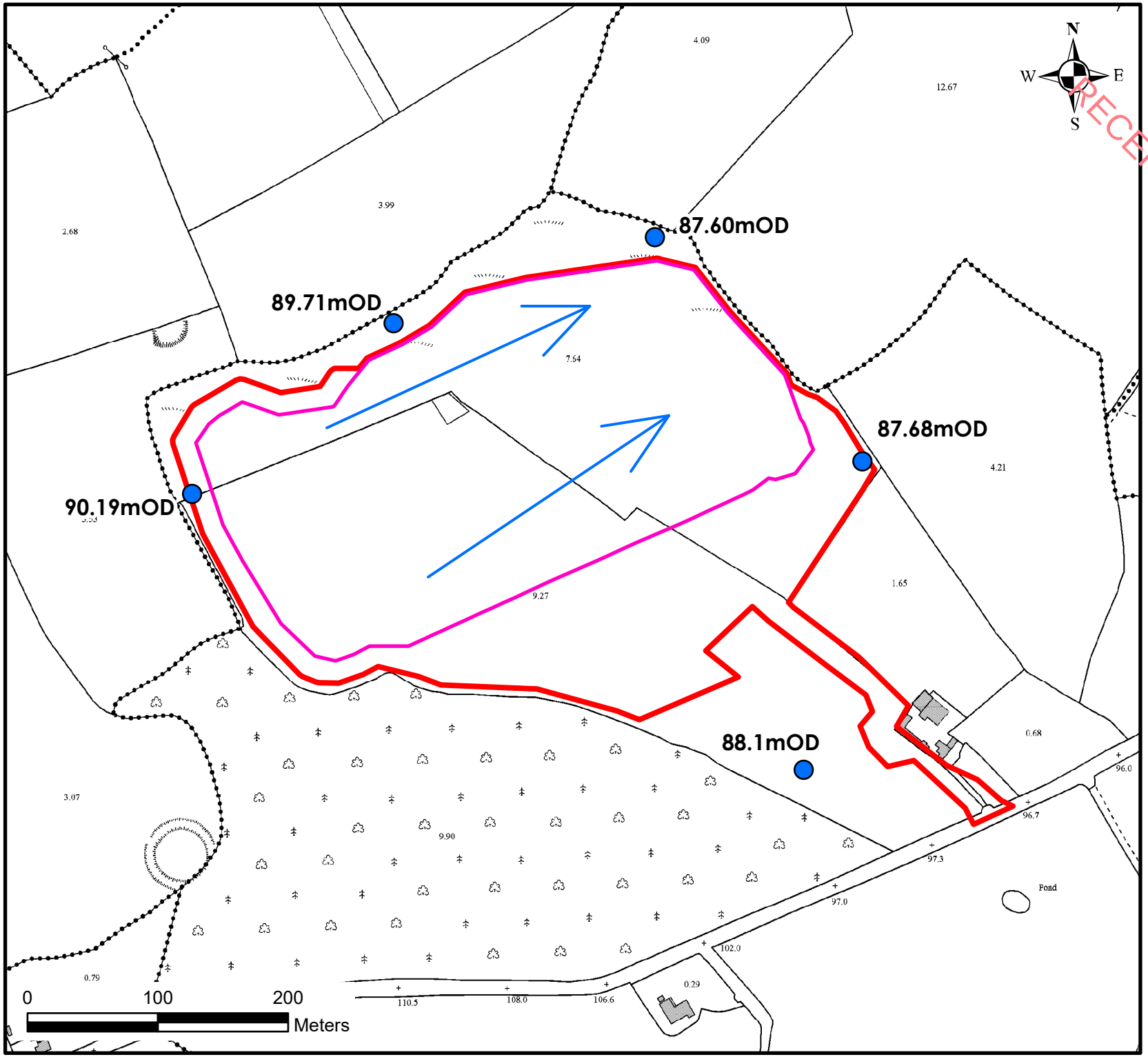

Legend

- Application Area
- Extraction - Infill Area
- Groundwater levels [mOD]
- Groundwater flow direction

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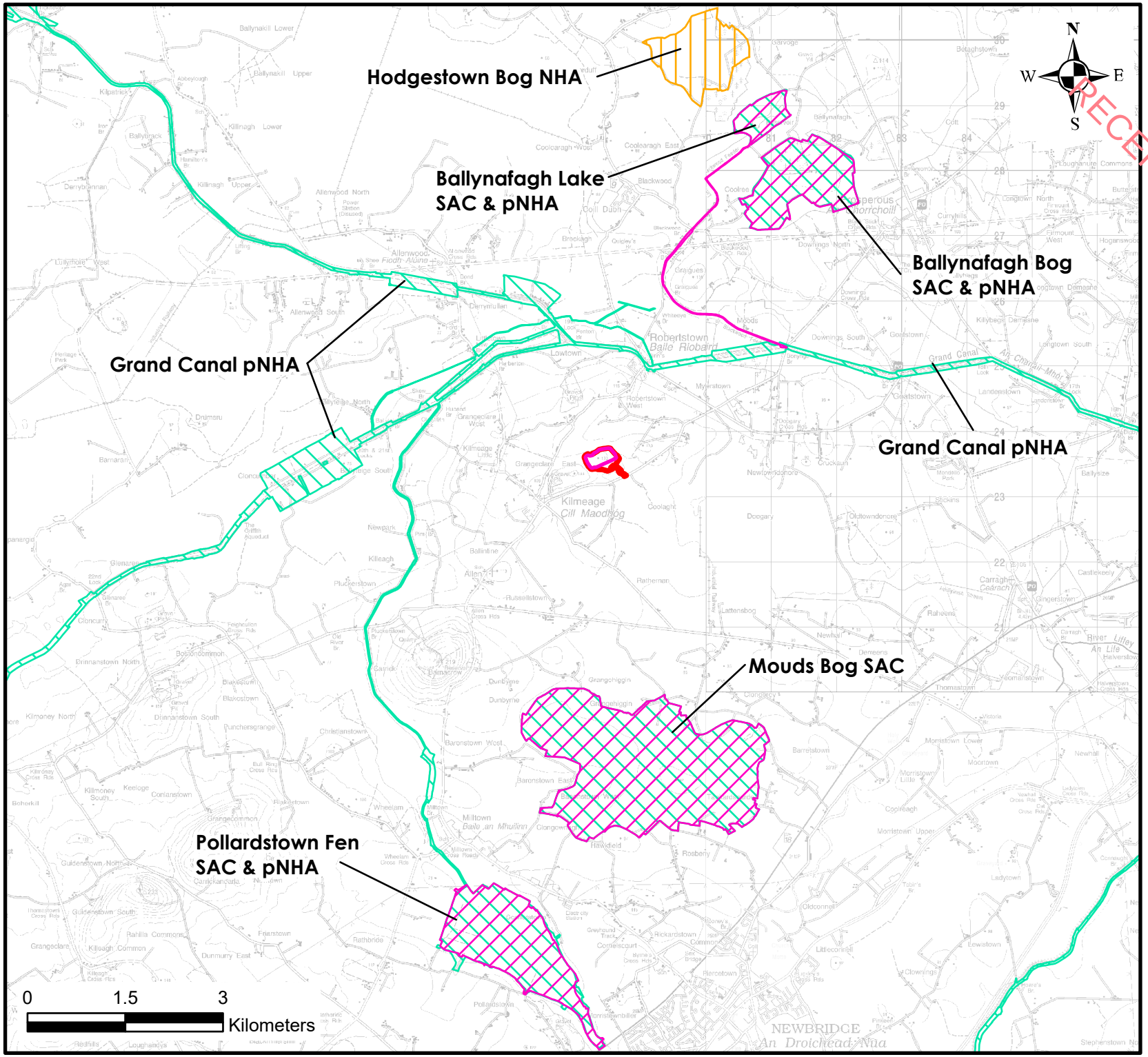

Legend

- Application Area
- Extraction - Infill Area
- SAC
- pNHA
- NHA

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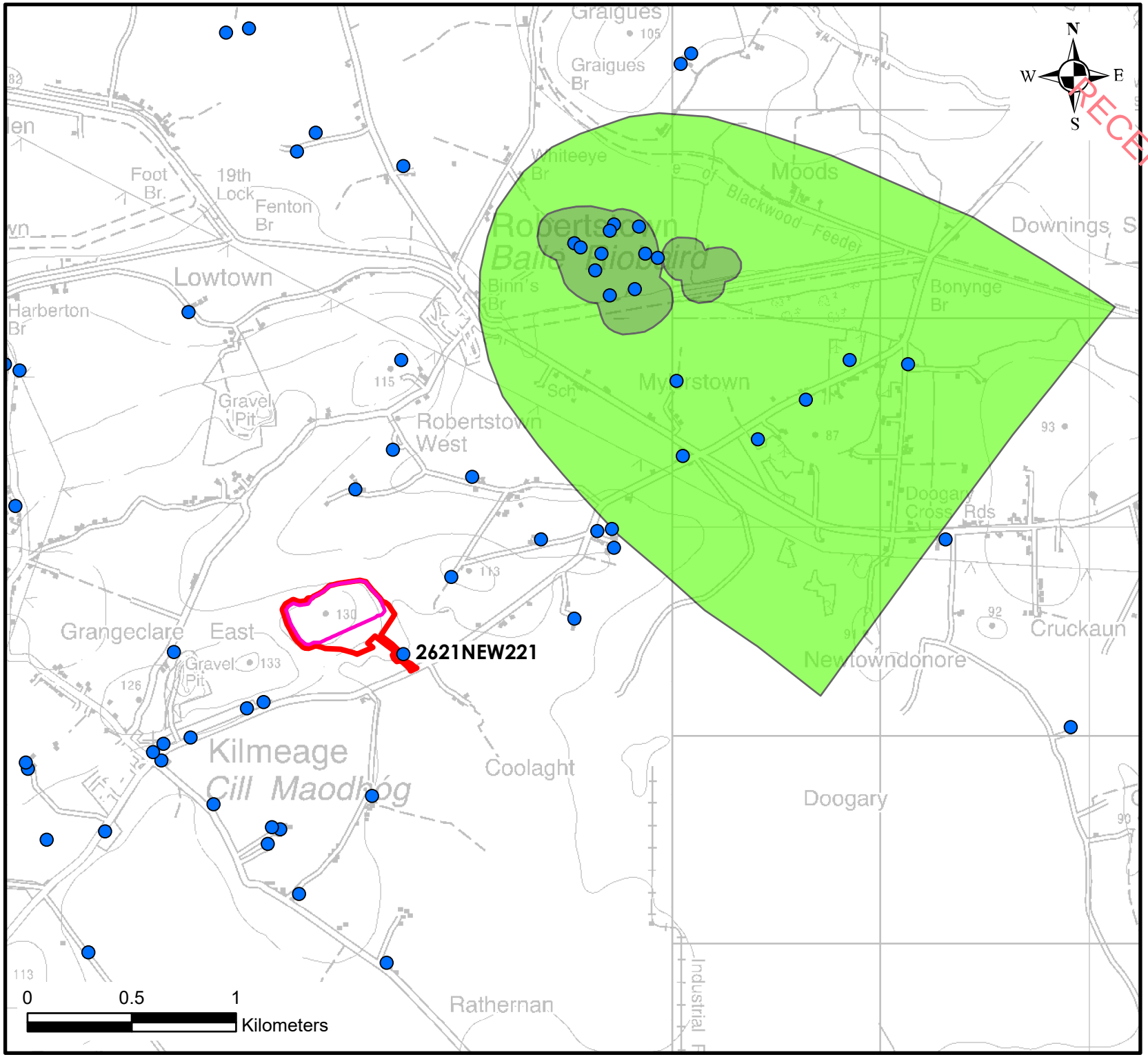

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APPENDICES

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PROPOSED AGGREGATE EXTRACTION AND INERT SOIL RECOVERY FACILITY KILMEAGUE, CO. KILDARE

STAGE 2 - FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:
Quarry Consulting

Prepared by:
Hydro-Environmental Services

DOCUMENT INFORMATION

DOCUMENT TITLE:	**PROPOSED AGGREGATE EXTRACTION AND INERT SOIL RECOVERY FACILITY KILMEAGUE, CO. KILDARE – FLOOD RISK ASSESSMENT**
ISSUE DATE:	**1ST MARCH 2024**
PROJECT NUMBER:	**P1512-0**
PROJECT REPORTING HISTORY:	**-**
CURRENT REVISION NO:	**P1512-0_FINAL F0**
AUTHOR(S):	**MICHAEL GILL** **DAVID BRODERICK** **JENNY LAW**
SIGNED:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client, and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site-specific, and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

TABLE OF CONTENTS

FIGURES IN TEXT

TABLES IN TEXT

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by Quarry Consulting to carry out a Flood Risk Assessment (FRA) with regard a proposed sand and gravel pit and inert soil recovery facility at Kilmeague, Co. Kildare.

Where the 'Proposed Development' is referred to, this relates to all the project components described in in detail in Chapter 3 of the accompanying EIAR.

Where the 'Proposed Development site' or 'site' is referred to, this relates to everything inside the application site boundary.

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009).

1.2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This report was prepared by Michael Gill, David Broderick and Jenny Law.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with 22 years ofenvironmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

David Broderick (P.Geo, BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with 17 years environmental consultancy experience in Ireland. David has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. David has significant experience in surface water drainage issues, SUDs design, flood risk assessment and modelling.

Jenny Law (BSc, MSc) is an environmental geoscientist holding an honours degree in applied environmental geosciences from the University College Cork. Jenny has assisted in the preparation of the land, soils and geology and hydrology chapters for various environmental impact assessment reports, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including several wind farm developments and strategic housing developments.

1.3 REPORT LAYOUT & METHODOLOGY

This Stage 2 FRA report has the following format:

- Section 2 describes the proposed site setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the local surface water catchments in the vicinity of the proposed development site;
- Section 4 deals with a site-specific flood risk assessment (FRA); and,
- Section 5 presents the FRA report conclusions.

As stated above this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources and field surveys:

- Base maps – Ordnance Survey of Ireland;
- OPW Past Flood Event Maps and flooding mapping for Ireland (www.floodmaps.ie);
- Geological Survey of Ireland databases (www.gsi.ie);
- EPA hydrology maps (www.catchment.ie); and,
- Site Walkovers, drainage mapping and sites investigations by HES.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the proposed site along with a description of the Proposed Development.

2.2 SITE DESCRIPTION AND TOPOGRAPHY

The site is located in the townland of Coolaght, Co. Kildare, situated approximately 300m from the nearest point of Kilmeague village to the southwest.

The site is extensively covered in mixed woodland (predominately deciduous) that was planted between 2002 and 2004.

The surrounding landscape is rural in character, consisting of a mix of pasture and arable land, with extensive areas of low grade agricultural land and bog in the wider area. The latter has predominately been cutover. The wider area also includes several examples of quarries and sand and gravel pits the nearest of which is situated 440m west of the site at Kilmeague village.

The site is located on a prominent hill where the ground slopes away on all sides with the steepest slopes to the north and south. The top of the hill (130m OD) roughly aligns with the centre of the proposed extraction area / infill area.

Ground levels within the site rise from approximately 94m OD in the southeast near the site entrance to 130m OD in the north-west where the proposed extraction area is located.

Access to the site is from the L7081 local road to the southeast. This is an existing forestry track that runs from the site entrance to the top of the hill where a communications mast and associated compound is located.

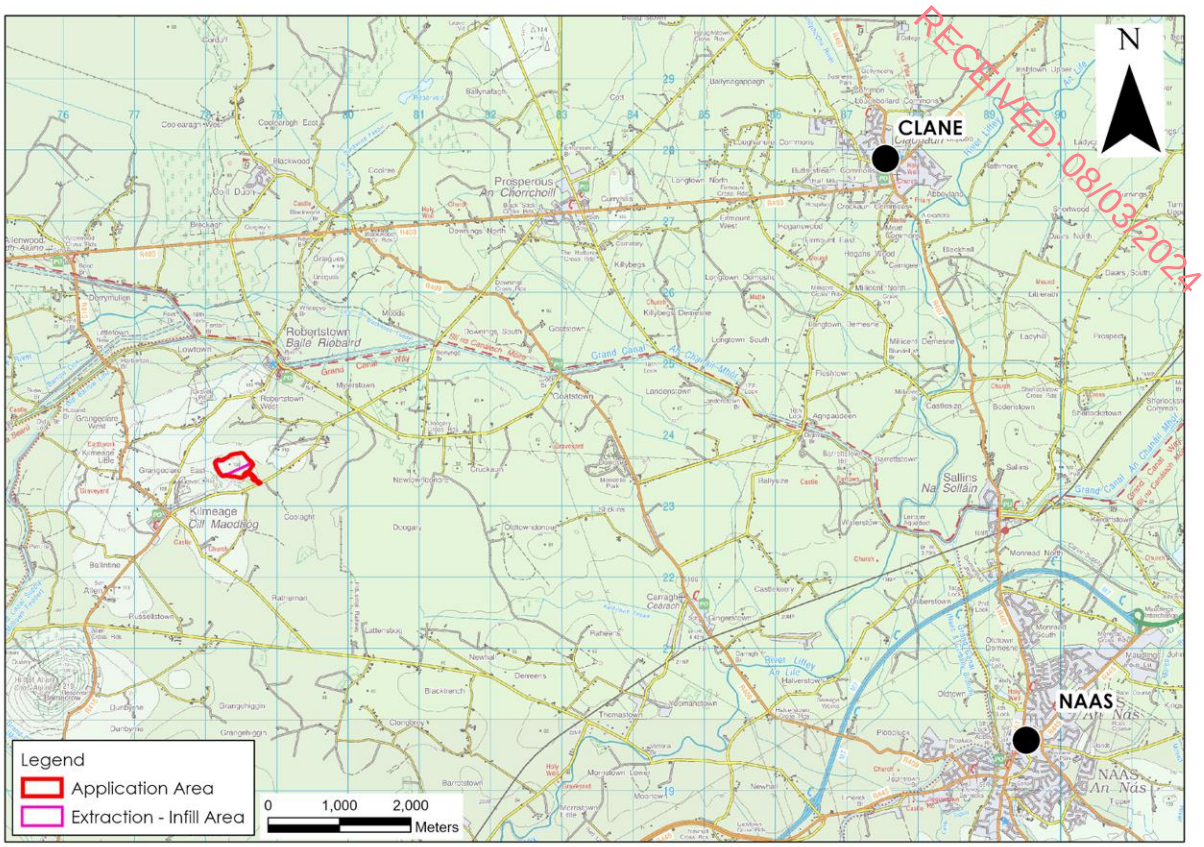

Figure A: Site Location Map

2.3 PROPOSED DEVELOPMENT DETAILS

In summary, the Proposed Development will involve:

- The removal of woodland, vegetation and overlying soils;
- Extraction of sand and gravel (4 million tonnes) on a phased basis from an area of c. 8.5 hectares (ha) to a final floor level at 95 metres above Ordnance Datum (m OD);
- Infilling of the lands using inert waste (3.2 million tonnes) on a phased basis following the extraction of sand and gravel;
- Restoration of the lands back to original ground level and the establishment of native woodland planting; and,
- All related ancillary development and associated site works including processing (crushing, screening and washing) and stockpiling of materials; installation of infrastructure for the management of water on site and all other related activities.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the Proposed Development site and the surrounding area.

3.2 BASELINE HYDROLOGY

3.2.1 Regional and Local Hydrology

The proposed site is located in the northeastern corner of the Barrow WFD catchment within Hydrometric Area 14 of the Eastern River Basin District and within the Slate River sub-catchment (Slate_SC_010).

The proposed site is mapped within the Slate_030 river sub basin where the Slate River flows in a westerly direction ~2.5km north of the site. The Grand Canal Main Line East (Barrow) is situated 1.9km north of the site.

The closest mapped watercourses to the site, both of which are headwater streams of the Slate River, are 1.2km to the northwest and 0.35km to the north.

A local hydrology map is shown as **Figure B** below.

3.2.2 Site Drainage

There are no natural water features or manmade drainage within the site or adjacent lands. The closest mapped watercourses to the site, both which are headwater streams of the Slate River as described in Section 3.2.1 above.

Based on GSI mapping, the site has a high recharge rate (recharge coefficient 85%) and therefore the majority of rainfall percolates to ground via the underlying high permeability sands and gravels. This is consistent with the observed lack of drainage features at the site.

Therefore, the majority of rainfall landing within the site percolates/recharges to ground before moving as groundwater towards the Slate River.

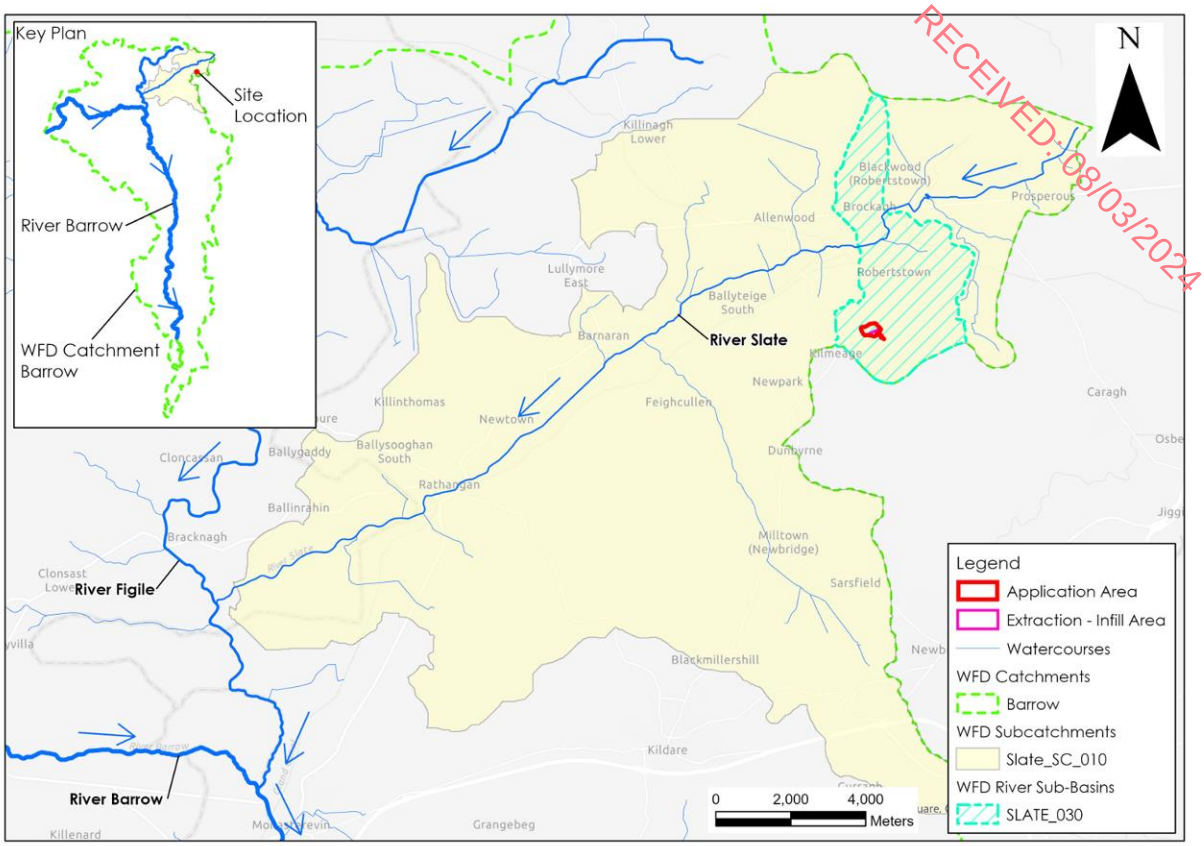

Figure B: Local Hydrology Map

3.2.3 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall 1981 – 2010) recorded at Timahoe South (approximately 5.5km north of the site), the closest rainfall station to the Proposed Development site with long-term SAAR data, is 790mm (www.met.ie).

The average potential evapotranspiration (PE) at Casement Aerodrome, ~28km east of the site is taken to be 530.5mm/yr (www.met.ie). The actual evapotranspiration (AE) is calculated to be 504mm/yr (95% PE). Using the above figures the effective rainfall (ER) for the area is calculated to be (ER = SAAR – AE) 286mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A**, below presents return period rainfall depths for the area of the Proposed Development site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods.

Table A: Return Period Rainfall Depths (mm) for the Proposed Site

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.5	5.7	9.5	13
15 mins	5.7	9.4	15.6	21.4
30 mins	7.4	12	19.5	26.4
1 hours	9.7	15.3	24.4	32.7
6 hours	19.2	28.8	43.7	56.5
12 hours	25.1	36.9	54.7	69.9
24 hours	32.7	47.1	68.5	86.4
2 days	38.2	53.5	75.7	93.8

3.3 GEOLOGY

The published soils map (www.epa.ie) for the area shows that the site is mapped to be overlain by shallow well drained mineral soil (BminSW) while deep well drained mineral soils (BminDW) are mapped in the surrounding lower lying land areas.

Based on the GSI subsoils map (www.gsi.ie), gravels derived from limestones are mapped within the site and these deposits are mapped to extend further to the east and west of the site also.

Tills derived from limestones are mapped in the surrounding areas with cutover raised bogs further afield. The closest bogs are located approximately 1km to the southeast.

Refer to the Land, Soils and Geology Chapter 7 of the EIAR that accompanies the planning application for details on the site investigations which included drilling, geophysics and trial pitting.

Based on the investigation drilling carried out at the site, the thickness of sand and gravel deposits varied between 15.8m (@BH5 where the ground level is approximately 101m OD) and 46m (@BH6 where the ground level is at approximately 129m OD).

BH6 is located close to the central area of the proposed extraction area/infill area where the ground level is highest (i.e. 130m OD on top of hill).

3.4 HYDROGEOLOGY

The Devonian aged Old Red Sandstone consists of Red conglomerate, sandstone & mudstone and are classified by the GSI as a Locally Important Aquifer (Ll) - Bedrock which is Moderately Productive only in Local Zones. The basal Carboniferous Ferbane Mudstone and Cloghan Sandstone mapped directly east of the site are described as a Poor Aquifer (Pl) - Bedrock which is Generally Unproductive except for Local Zones and a locally Important Aquifer (Lm) - Bedrock which is Generally Moderately Productive, respectively.

The site is mapped by the GSI to overly 2 no. Groundwater Bodies (GWB's). The majority of the site is underlain by the Dublin GWB, whilst the very northern portion of the site is mapped to overly the Kildare GWB. These groundwaterbodies are classified as "Poorly productive bedrock".

The depth to groundwater level across the overall site varies from approximately 32mbgl at BH2 to 13.3mbgl at BH1. The depth to groundwater range is largely due to the hilly topography of the site. BH1 is located near the lowest part of the site close to where the site entrance road will be located.

The groundwater level depth across the proposed extraction area ranges from approximately 32mbgl on the west (@BH2) to 29.5mbgl on the east(@BH4).

Groundwater level elevation across the site varies from approximately 90.4m OD (@BH2) on the west to 87.5m OD on the east (@BH4) which suggests an easterly / northeasterly groundwater flow direction.

3.5 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites includes Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The closest designated site to the site is the Grand Canal pNHA (Site Code: 002104) which is located ~1.32km to the north of the site. There is no hydrological connection between the site and Grand Canal pNHA.

The site is also approximately 2.9km southwest of the Blackwood feeder which is part of the Ballynafagh Lake SAC (Site Code: 001387) and connects the Ballynafagh Lake to the Grand Canal.

Ballynafagh Bog SAC (Site Code: 000391) is situated south of Ballynafagh Lake approximately 5km northeast of the site whilst Hodgestown Bog NHA (Site Code: 001393) is located northwest of Ballynafagh Lake approximately 5.5km north of the proposed site.

Approximately 3.3km south of the proposed site is the Mouds Bog SAC (Site Code: 002331) and pNHA (Site Code: 000395). The site comprises a raised bog that includes both areas of high bog and cutover bog.

Pollardstown Fen SAC and pNHA (Site Code: 000396) is situated on the northern margin of the Curragh of Kildare, approximately 6.5km south of the site and is hydrologically connected to the Grand Canal pNHA as mentioned above.

As discussed above, groundwater flow direction in the area of the site is to the east / northeast. The closest potentially downgradient designated sites are Ballynafagh Lake and Ballynafagh Bog which are located approximately 5km to the northeast.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

This section of the report details the site-specific flood risk assessment carried out for the proposed development and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

As per the guidance (DOEHLG, 2009), the stages of a flood risk assessment comprises:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment – quantitative appraisal of potential risk to a proposed development*.

4.2 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for these purposes according to OPW guidelines:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported

silts/clays referred to as alluvium build up within the flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

The Teagasc soils map (www.epa.ie) shows that shallow well drained mainly basic mineral soil (BminSW) is mapped over the majority of the site. No alluvial soils are mapped at the site.

4.3.2 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the local area that would identify lands that are "liable to flood" within or in the vicinity of the Site .

4.3.3 OPW National Past Flood Event Mapping

OPW's Past Flood Event mapping was consulted to identify those areas as being at risk of recurring flooding (refer to **Figure C** below). There were no reports of flooding at the site or the adjacent lands. The closest mapped flood event, which was a single event, is located at Kilmeague town and dated 22nd November 2017. There are no OPW reports available for this event.

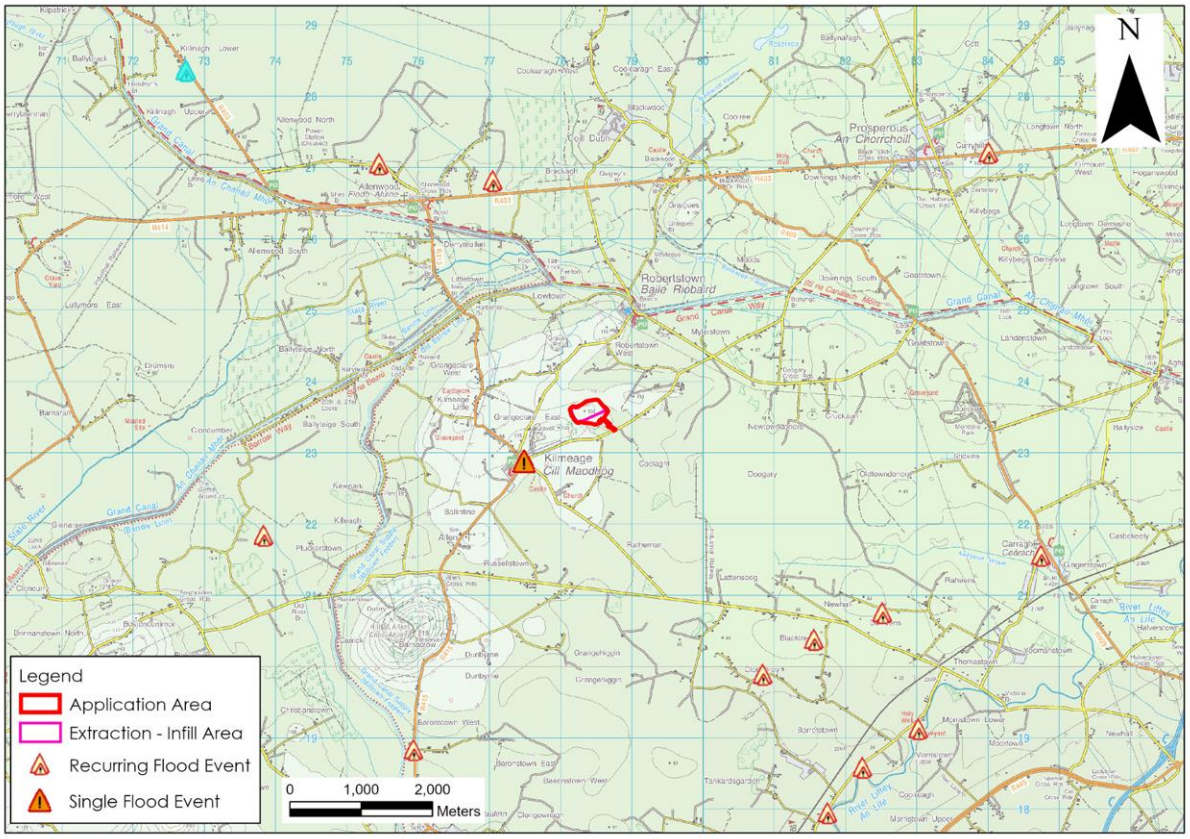

Figure C: OPW Past Flood Mapping (www.floodinfo.ie)

4.3.4 CFRAM Maps – Flood Extent Mapping

Catchment Flood Risk Assessment and Management (CFRAM)[1] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland.

CFRAM mapping does not cover this area of land where the proposed site is. CFRAM mapping is however, available along the Slate River, situated ~2.5km north of the site with high, medium and low probabilties. No CFRAM mapping extents encroach onto the proposed site.

4.3.5 National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not take into account the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.8** below.)

There are no NIFM mapping extents within or in the vicinity of the site. The nearest NIFM mapping extents to the site are along the Awillyinish (Stream) approximately 2.8km southeast of the development.

National Indicative Fluvial Mapping for the present day is included on **Figure D** below.

As such, the proposed development site is located in Fluvial Flood Zone C, where the probability of fluvial flooding is low (less than 0.1%).

[1] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

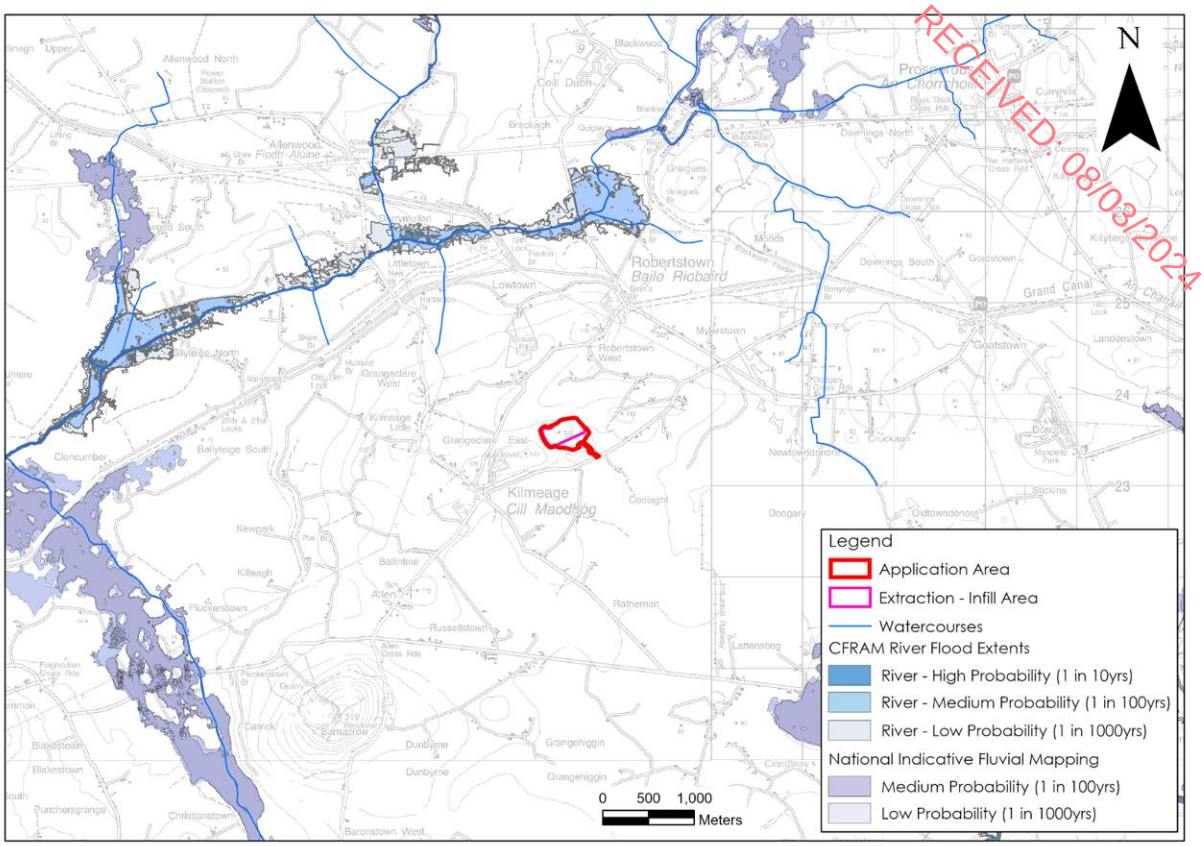

Figure D: OPW NIFM and Flood Extents Mapping (Present-Day Scenario)

4.3.6 Winter 2015/2016 Surface Water Flooding

The GSI Winter 2015/2016 flood map (www.floodinfo.ie) does not show the occurrence of any flooding within the area of the site during the 2015/2016 event.

The nearest area with recorded Winter 2015/2016 flooding is mapped 1.18km west off the site and is of particularly small scale.

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the area of the site.

Furthermore, no modelled high, medium or low probability groundwater flood zones are mapped in the site or in the surrounding lands.

4.3.8 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall. The CFRAM Programme has modelled flooding associated with potential future climate change scenarios.

National Indicative Fluvial Mapping has been completed for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme. These flood zones have also been modelled for 2 no. potential future climate change scenarios, with the Mid-

Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively.

However as stated above no CFRAM modelling or NIFM mapping has been completed in the vicinity of the site.

These modelled future flood extents do not deviate significantly from the current scenario as shown in **Figure D** above and remain remote from the site.

4.3.9 Coastal Flooding

The Proposed Development site is located ~50km from the coast. Therefore, the Proposed Development site is not at risk of coastal / tidal flooding.

4.3.8 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, the proposed site is within the Flood Zone C, with less than 0.1% chance of flooding.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the site can be described using the Source – Pathway – Receptor Model (S-P-R).

There are no apparent sources of flooding at the proposed site having considered tidal, fluvial and pluvial sources. Groundwater flooding is also not considered to be an issue at the proposed site.

Due to the elevated location of the site above surrounding lands and the lack of nearby watercourses, the risk of fluvial flooding is very low.

Pluvial flooding (rainfall) or surface water flooding/ponding issues are also not likely at the site due to the sloping ground and permeable soils and subsoils.

There are no existing or proposed surface water discharges from the Proposed Development site and therefore these is no potential for increased flood risk in downstream watercourses.

4.4.2 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it has been determined that flooding is unlikely to be problematic in the area of the site Proposed for Development. The assessment of flood risk for the Proposed Development site is outlined in **Table B.**

Table B: S-P-R Assessment of Flood Sources for the Site

Source	Pathway	Receptor	Comment
Tidal	Not applicable	Land and infrastructure.	The site is ~50km from the coast. There is no risk of coastal flooding.
Fluvial	Flooding from stream	Land and infrastructure	CFRAM and NIFM fluvial mapping extents do not encroach the site boundary. Therefore, the Proposed Development site is located in Fluvial Flood Zone C.
Pluvial	Ponding of rainwater on site	Land and infrastructure.	Minimal risk of pluvial flooding at the Proposed Development site given the topography and altitude of the site and the well drained soils/subsoil.
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on local hydrogeological regime and site investigations, there is no risk from groundwater flooding at the Proposed Development site.

4.5 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[2] is shown in **Table C** below.

The proposed site can be categorised as "Highly Vulnerable Development" as it is associated with aggregate extraction and infilling within the site. The entire Proposed Development site is located in fluvial Flood Zone C according to CFRAM and NIFM mapping.

Therefore, the Proposed Development is appropriate from a flood risk perspective and a Justification Test is not required.

[2] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Table C: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	**Appropriate**
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: Taken from Table 3.2 (DoEHLG, 2009)
Bold and underlined: *Applies to this project*

4.6 PROPOSED DEVELOPMENT DRAINAGE

As stated above there is no history of fluvial (river), groundwater flooding or pluvial/surface water flooding at the site and therefore there is very low risk of any infill resulting in the displacement of flood water onto adjacent property.

The topography (contouring/slopes) of the infilled site will be very similar to the pre-development Greenfield scenario.

Any rain water landing on the site or surface water runoff intercepted by the infilled site will be managed by the proposed restoration plan and drainage network as outlined below:

- On infilling of the site area a perimeter toe drain / drainage ditch will be installed around the perimeter of the infill that will collect local surface water runoff intercepted by the infilled area and direct it to ground via soakaways in the underlying more permeable sand and gravel deposits;

- All rainfall landing on hardstanding surfaces (i.e. roofs and roads etc) will be directed to a roadside drainage system and attenuated at the site prior to discharge to ground using swales. This water will therefore not be allowed to runoff the site in an uncontrolled manner that might cause localised flooding in adjacent properties; and,

- Finally, the infill ground surface will be topped with native (well-draining) topsoil, vegetated and planted with a suitable mix of woodland planting which will retain rainfall, increase infiltration and reduce the potential for runoff.

5. REPORT CONCLUSIONS

5.1 CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed site at Kilmeague, Co. Kildare. From this study:
  - No instances of historical flooding were identified in historic OS maps;
  - No instances of recurring flooding were identified on OPW maps within the Proposed Development site;
  - The GSI Groundwater Flood Mapping does not record any historic or predictive groundwater flood zones within the Proposed Development site; and;
  - No portion of the site was identified within the OPW CFRAM/NIFM Flood Zones A and B.
- As the Proposed Development will not discharge water from its site, there is no potential of increased flood risk downstream of the site;
- All surface water runoff generated at the site will be managed in a sustainable manner; and,
- The overall risk of flooding posed by the Proposed Developemnt and associated works within the the site is negligible.

* *

6. REFERENCES

AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

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Table 1
Kilmeague Sand and Gravel Pit, Co. Kildare
Groundwater Sampling Data (04/05/2023)

Parameter	Units	BH01	BH03	Drinking Water Regs (S.I. 99/2023)	Groundwater Regs (S.I. 366/2016)
Biochemical Oxygen Demand (BOD)	mg/l	<1	<1	-	-
Chemical Oxygen Demand (COD)	mg/l	<8	<8	-	-
Total Dissolved Solids (TDS)	mg/l	475	294	-	-
Total Nitrogen	mg/l	8.37	10.64	-	-
Sulphate (SO_4)	mg/l	17.5	11	250	187.5
Phosphate (Ortho/MRP) as P	mg/l	<0.05	<0.05	-	0.03
Chloride	mg/l	24.5	18.9	-	187.5
Nitrite (as NO2)	mg/l	<0.01	<0.01	0.05	0.375
Nitrate (as NO3)	mg/l	***44.32***	**<u>54.57</u>**	50	37.5
Total Phosphorus as P	mg/l	<0.2	<0.2	-	-
Boron (dissolved)	mg/l	<210	<210	1000	750
Cadmium (dissolved)	mg/l	<0.0001	0.000143	0.005	-
Copper (dissolved)	mg/l	<0.003	<0.003	2	-
Iron, dissolved	mg/l	<0.005	**<u>0.294</u>**	0.2	-
Lead, dissolved	mg/l	<0.00051	0.00172	0.005	0.0075
Magnesium, dissolved	mg/l	12.3	16.25	-	-
Manganese, dissolved	mg/l	0.00204	0.023	0.05	-
Nickel, dissolved	mg/l	0.00305	0.00443	0.02	-
Potassium, dissolved	mg/l	1.39	0.5	-	-
Sodium	mg/l	8.28	7.38	200	-
Zinc, dissolved	mg/l	0.0022	0.012	-	0.075
Ammonia N	mg/l	0.017	0.021	0.5	0.175
pH (field measurement)	pH Units	7.2	6.9	6.5 - 9.5	-
Conductivity (field measurement)	µS/cm	696	803	2500	1875
TPH>C10-C21	µg/l	<0.1	<0.1	-	-
TPH>C21-C40	µg/l	<0.1	<0.1	-	-
TPH>C6-C10	µg/l	<0.1	<0.1	-	-
TPH Total	µg/l	<10	<10	-	75
Oils, fats and grease	mg/l	<30	<30	-	-
Coliforms	MPN/100ml	<1	<1	-	-
Faecal Coliforms	cfu/100ml	<1	<1	0	-
E Coli	MPN/100ml	<1	<1	-	-

Bold and italics - exceeds GW Regs (SI 366/2023) TV value
<u>Bold Underlined</u> - exceeds Drinking Water Reg (SI 99/2023) paramter value

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Waterford
IRELAND

Certificate Code: **AR-23-M3-023543-01**
Page Number: **Page 9 of 16**
PO reference:

Sample number	966-2023-00021940	Received on	05/05/2023
		Analysis started on	05/05/2023
Your sample reference	Kilmeague BH3		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/05/2023
Time Sampled	12:00		

Test Code / Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Biochemical Oxygen Demand (BOD) [M3003]								
Biochemical oxygen demand (BOD) 5d		05/05/23 17:24	EW001	1		<1	mg/l	C6
Chemical Oxygen Demand (COD) [M3004]								
Chemical oxygen demand (COD)		08/05/23 09:24	EW094	8		<8	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		01/06/23 09:03	EW046	15		294	mg/l	C6
Total Nitrogen [M3007]								
Total Nitrogen		08/05/23 17:09	EW140	1		10.64	mg/l	C6
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		12/05/23 16:17	EW175	1		11.0	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		12/05/23 16:17 [7D]	EW175	0.05		<0.05	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		12/05/23 16:17	EW175	5		18.9	mg/l	C6
Nitrite (as N) - Gallery [M3016]								

Signed: _____ 30/06/2023

Aoife De Barra - Organics & Instrumentation Team Lead

NOTES

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5. "*" indicates the test was sub-contracted
6. No date of sampling was supplied, sample stability cannot be assessed, results may be compromised.
7A. This result is compromised as it was tested outside of stability times.
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Certificate Code: **AR-23-M3-023543-01**
Page Number: **Page 10 of 16**
PO reference:

Nitrite (as N) - Gallery	12/05/23 16:17 [7D]	EW175	0.01	<0.01	mg/l	
Nitrate (as N) - Gallery [M301A]						
Nitrate (as N) - Gallery	12/05/23 16:17 [7D]	EW175	1	12.32	mg/l	
Total Phosphorus-TP [M3045]						
Total Phosphorus-TP	09/05/23 10:57	EW146	0.2	<0.2	mg/l	C6
Boron - Dissolved [M3163]						
Boron (B)	10/05/23 10:06	EW188	0.21	<0.21	mg/l	C6
Cadmium - Dissolved [M3164]						
Cadmium (Cd)	10/05/23 10:06	EW188		0.143	µg/l	C6
Copper - Dissolved [M3168]						
Copper (Cu)	10/05/23 10:06	EW188	0.003	<0.003	mg/l	C6
Iron - Dissolved [M3172]						
Iron (Fe)	10/05/23 10:06	EW188	5	294.423	µg/l	C6
Lead - Dissolved [M3173]						
Lead (Pb)	10/05/23 10:06	EW188	0.51	1.727	µg/l	C6
Magnesium - Dissolved [M3174]						
Magnesium (Mg)	10/05/23 10:06	EW188	1.11	16.252	mg/l	C6
Manganese - Dissolved [M3175]						
Manganese (Mn)	10/05/23 10:06	EW188		23.381	µg/l	C6
Nickel - Dissolved [M3178]						
Nickel (Ni)	10/05/23 10:06	EW188		4.435	µg/l	C6
Potassium - Dissolved [M3180]						
Potassium (K)	10/05/23 10:06	EW188	0.15	0.503	mg/l	C6
Sodium - Dissolved [M3184]						

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Sodium (Na)		10/05/23 10:06	EW188	1.5	7.383	mg/l	C6
Zinc - Dissolved [M3194]							
Zinc (Zn)		10/05/23 10:06	EW188	1	12.0	µg/l	C6
Ammonia (Gallery) [M3278]							
Ammonia as N		12/05/23 16:17	EW175		0.021	mg/l	
pH [M3282]							
pH		05/05/23 17:25 [7A]	EW158		7.5		
Conductivity [M3283]							
Conductivity		05/05/23 17:25	EW153	100	643.5	µS/cm	C6
TPH 3 Band (C6-10-21-40) in water [M502B]							
TPH >C10-C21	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH >C21-C40	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH >C6-C10	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH Total >C6-C40	*	06/05/23 12:37		10	<10	µg/l	YA
Oils, fats and grease water (HEM) gravimetric [RZPGR]							
Oil, fat and grease (HEM)	*	05/05/23 15:42		10	<30	mg/l	JV
Faecal Coliforms E (Water) [IE Env] <1 >100 /100 ml (0) m-FC Agar-F							
Faecal Coliforms	*	05/05/23 15:42		1	< 1	cfu/100 ml	
Coliforms E (Water) [IE Env] <1 >2 420 /100 ml (0) Colilert-18-Q MDW							
Coliforms	*	05/05/23 15:42		1	< 1	MPN/100 ml	
Escherichia Coli E (Water) [IE Env] <1 >2 420 /100 ml (0) Colilert-18-Q							
Escherichia coli	*	05/05/23 15:42		1	< 1	MPN/100 ml	

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[4] Accreditiation Information

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JV: SFS-EN ISO/IEC 17025:2017 FINAS T039
YA: Accredited (External Subcontractor)

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Sample number	966-2023-00021941	Received on	05/05/2023
		Analysis started on	05/05/2023
Your sample reference	Kilmeague BH1		
Sample Matrix	Ground water		
Sample Condition on Arrival	Satisfactory	Sample Date	04/05/2023
Time Sampled	12:00		

Test Code / Analyte	SUB [5]	Analysis Started	Method	LOQ [3]	SPEC [2]	Result	Units	ACCRED [4]
Biochemical Oxygen Demand (BOD) [M3003]								
Biochemical oxygen demand (BOD) 5d		05/05/23 17:24	EW001	1		<1	mg/l	C6
Chemical Oxygen Demand (COD) [M3004]								
Chemical oxygen demand (COD)		08/05/23 09:24	EW094	8		<8	mg/l	C6
Total Dissolved Solids (TDS) [M3006]								
Total dissolved solids @ 180°C		11/05/23 10:14	EW046	15		475	mg/l	C6
Total Nitrogen [M3007]								
Total Nitrogen		08/05/23 15:36	EW140	1		8.37	mg/l	C6
Sulphate mg/L - Gallery [M300N]								
Sulphate mg/L - Gallery		12/05/23 16:17	EW175	1		17.5	mg/l	C6
Phosphate (Ortho/MRP) as P - Gallery [M300P]								
Phosphate (Ortho/MRP) as P - Gallery		12/05/23 16:17 [7D]	EW175	0.05		<0.05	mg/l	
Chloride mg/L - Gallery [M300S]								
Chloride mg/L - Gallery		12/05/23 16:17	EW175	5		24.5	mg/l	C6
Nitrite (as N) - Gallery [M3016]								

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Nitrite (as N) - Gallery	12/05/23 16:17 [7D]	EW175	0.01	<0.01	mg/l	
Nitrate (as N) - Gallery [M301A]						
Nitrate (as N) - Gallery	12/05/23 16:17 [7D]	EW175	1	10.005	mg/l	
Total Phosphorus-TP [M3045]						
Total Phosphorus-TP	08/05/23 12:38	EW146	0.2	<0.2	mg/l	C6
Boron - Dissolved [M3163]						
Boron (B)	10/05/23 10:06	EW188	0.21	<0.21	mg/l	C6
Cadmium - Dissolved [M3164]						
Cadmium (Cd)	10/05/23 10:06	EW188		<0.1	µg/l	C6
Copper - Dissolved [M3168]						
Copper (Cu)	10/05/23 10:06	EW188	0.003	<0.003	mg/l	C6
Iron - Dissolved [M3172]						
Iron (Fe)	10/05/23 10:06	EW188	5	<5	µg/l	C6
Lead - Dissolved [M3173]						
Lead (Pb)	10/05/23 10:06	EW188	0.51	<0.51	µg/l	C6
Magnesium - Dissolved [M3174]						
Magnesium (Mg)	10/05/23 10:06	EW188	1.11	12.335	mg/l	C6
Manganese - Dissolved [M3175]						
Manganese (Mn)	10/05/23 10:06	EW188		2.041	µg/l	C6
Nickel - Dissolved [M3178]						
Nickel (Ni)	10/05/23 10:06	EW188		3.055	µg/l	C6
Potassium - Dissolved [M3180]						
Potassium (K)	10/05/23 10:06	EW188	0.15	1.391	mg/l	C6
Sodium - Dissolved [M3184]						

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Sodium (Na)		10/05/23 10:06	EW188	1.5	8.286	mg/l	C6
Zinc - Dissolved [M3194]							
Zinc (Zn)		10/05/23 10:06	EW188	1	2.20	µg/l	C6
Ammonia (Gallery) [M3278]							
Ammonia as N		12/05/23 16:17	EW175		0.017	mg/l	
pH [M3282]							
pH		05/05/23 17:25 [7A]	EW158		2.6		
Conductivity [M3283]							
Conductivity		05/05/23 17:25	EW153	100	563.6	µS/cm	C6
TPH 3 Band (C6-10-21-40) in water [M502B]							
TPH >C10-C21	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH >C21-C40	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH >C6-C10	*	06/05/23 12:37		0.1	<0.1	µg/l	
TPH Total >C6-C40	*	06/05/23 12:37		10	<10	µg/l	YA
Oils, fats and grease water (HEM) gravimetric [RZPGR]							
Oil, fat and grease (HEM)	*	05/05/23 15:41		10	<20	mg/l	JV
Faecal Coliforms E (Water) [IE Env] <1 >100 /100 ml (0) m-FC Agar-F							
Faecal Coliforms	*	05/05/23 15:41		1	< 1	cfu/100 ml	
Coliforms E (Water) [IE Env] <1 >2 420 /100 ml (0) Colilert-18-Q MDW							
Coliforms	*	05/05/23 15:41		1	< 1	MPN/100 ml	
Escherichia Coli E (Water) [IE Env] <1 >2 420 /100 ml (0) Colilert-18-Q							
Escherichia coli	*	05/05/23 15:41		1	< 1	MPN/100 ml	

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WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT

PROPOSED AGGREGATE EXTRACTION AND INERT SOIL RECOVERY FACILITY KILMEAGUE, CO. KILDARE

FINAL REPORT

Prepared for:

QUARRY CONSULTING

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

DOCUMENT TITLE:	**WATER FRAMEWORK DIRECTIVE ASSESSMENT PROPOSED AGGREGATE EXTRACTION AND INERT SOIL RECOVERY FACILITY KILMEAGUE, CO. KILDARE**
Issue Date:	**4th March 2024**
Project Number:	**P1512-0**
Project Reporting History:	**P1512-0**
current revision no:	**FINAL_REV F0**
Author:	**MICHAEL GILL** **DAVID BRODERICK** **JENNY LAW**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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FIGURES (IN TEXT)

TABLES IN TEXT

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Quarry Consulting, to complete a Water Framework Directive (WFD) Compliance Assessment for proposed aggregate extraction and inert soil recovery facility Kilmeague, Co. Kildare.

Where the 'Proposed Development' is referred to, this relates to all the project components described in in detail in Chapter 3 of the accompanying EIAR.

Where the 'Proposed Development site' or 'site' is referred to, this relates to everything inside the application site boundary.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the Proposed Development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures if such water bodies are identified and define any residual potential impacts.

This WFD Assessment is intended to supplement the EIAR submitted as part of the planning application.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including quarries.

This WFD assessment was prepared by Michael Gill, David Broderick and Jenny Law.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions.

David Broderick (BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with 17 years environmental consultancy experience in Ireland. David has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. David has significant experience in surface water drainage issues, SUDs design, flood risk assessment and modelling.

Jenny Law (BSc, MSc) is an Environmental Geoscientist holding a first honours degree in Applied Environmental Geosciences from the University College Cork (2022). Jenny has assisted in the preparation of the land, soils and geology and hydrology chapters for various environmental impact assessment reports, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including wind farm developments and strategic housing developments.

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed development, include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027; and,
- Ensure waters in protected areas meet requirements;
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Furthermore, the Department of Housing, Local Government and Heritage are currently reviewing the submissions made on the Draft River Basin Management Plan (2022 - 2027) which was out for public consultation in Q4 of 2021 and Q1 of 2022. The draft plan will be updated with a view to finalisation and publication in Q3/Q4 of 2022. As of March 2024, the plan has not been published while the draft plan is available to view at https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water, groundwater bodies and protected areas with potential to be affected by the proposed development and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

The proposed development site is located in the northeastern corner of the Barrow WFD catchment within Hydrometric Area 14 of the Eastern River Basin District and the Slate sub-catchment (Slate_SC_010).

Locally, the Proposed Development site is mapped within the Slate_030 river sub basin where the Slate River flows in a westerly direction ~2.5km north of the site. The Grand Canal Main Line East (Barrow) is situated 1.9km north of the site. The closest mapped watercourses to the site, both which are headwater streams of the Slate River, are 1.2km to the northwest and 0.35km to the north.

The site area rises forming a hill. There are no mapped watercourse features or land drains mapped by the EPA, present within the site or between the site and the Slate River or Grand Canal Main Line East (Barrow) to the north. A local hydrology map is shown as **Figure A** below.

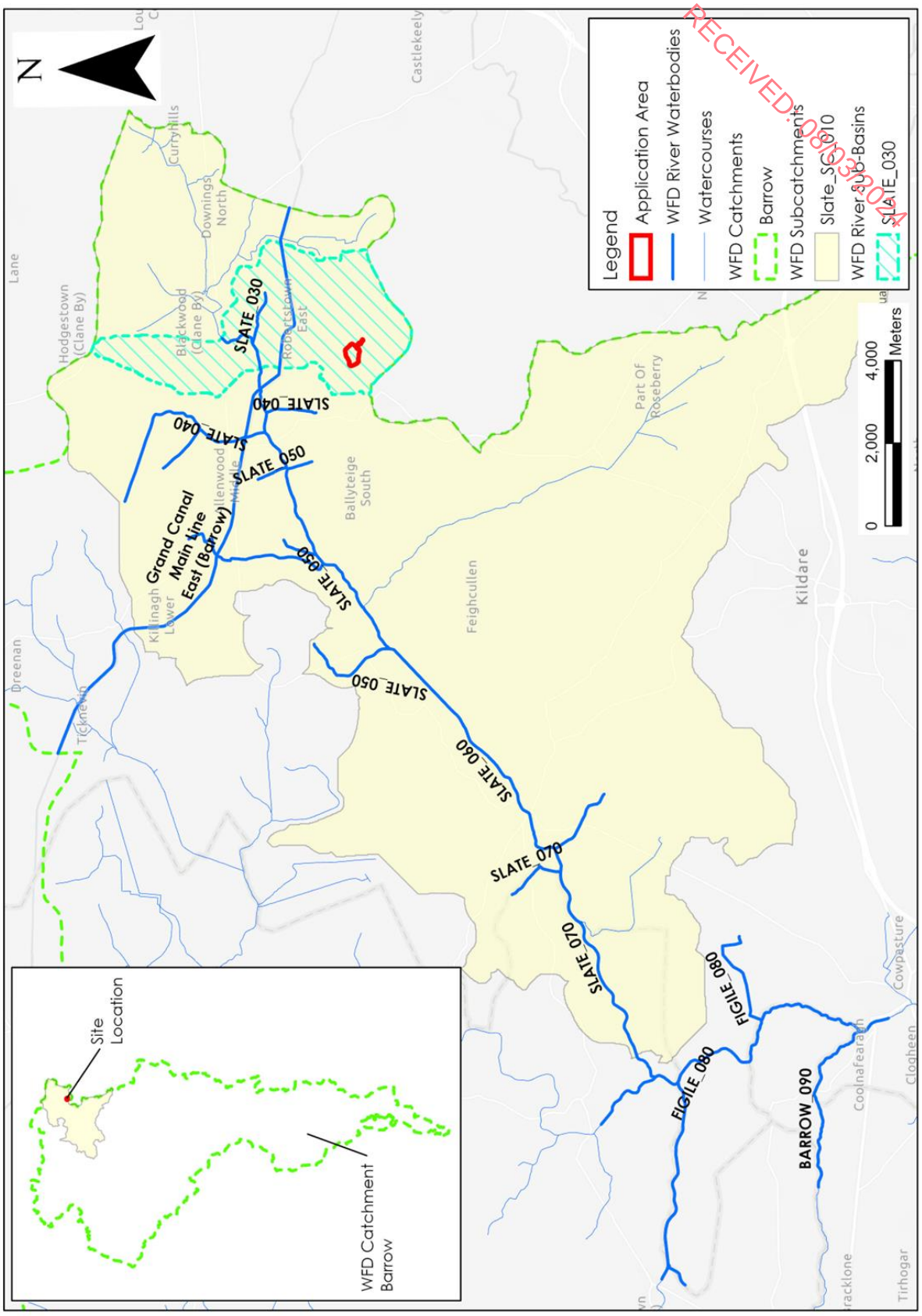

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the Proposed Development are shown in **Table A**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB.

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

The Grand Canal Main Line East (Barrow), 1.9km north of the site received "Good" status in the 2016-2021 WFD Cycle. The Grand Canal Main Line East (Barrow) is "Not at risk" of failing to meet its WFD objectives in the future.

The Proposed Development is mapped within the Slate_030 river sub basin. The Slate_030 river waterbody achieved "Poor" Status in the latest WFD cycle and so too did the Slate_040 river waterbody downstream. The Slate_050, Slate_060 and Slate_070 river waterbodies all achieved "Moderate" Status in the latest WFD cycle. For a brief period, the Rathangan Demesne_010 river waterbody is mapped between the Slate_060 and Slate_070 water bodies near the town of Rathangan. The Rathangan Demesne_010 river waterbody also achieved a "Moderate" Status.

The Slate River segments Slate_030, _040, _050, _060 & _070 are all "At risk" of failing to meet their WFD objectives by 2027. Excess nutrients and morphological impacts remain the most prevalent issues in the Barrow catchment impacting on the Slate_030, Slate_050 and Slate_070 respectively in Cycle 3. The risk status of the Rathangan Demesne_010 river waterbody is currently "Under review".

The Slate River (Slate_070) feeds into the Figile River (Figile_080) which in turn discharges into the River Barrow (Barrow_090). The Figile_080 and the Barrow_090 achieved "Good" and Poor" status respectively. The risk status for the Figile_080 river waterbody is currently being reviewed whilst the Barrow_090 has been deemed to be "at risk". Several significant pressures have been found to be impacting negatively on the Barrow_090 including agriculture, domestic wastewater, hydromorphology, invasive species and urban run-off.

The SWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

Table A: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Risk Status (2nd Cycle)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3rd Cycle)	3rd Cycle Pressures
	Barrow Catchment					
Grand Canal Main Line East (Barrow)	Unassigned	At risk	Good	Good	Not at risk	-
Slate_030	Unassigned	Under review	Poor	Poor	At risk	Agriculture & forestry
Slate_040	Poor	At risk	Poor	Poor	At risk	Peat Drainage & Extraction
Slate_050	Moderate	At risk	Moderate	Moderate	At risk	Hydromorphology & Peat Drainage & Extraction
Slate_060	Moderate	At risk	Moderate	Moderate	At risk	Urban run-off
Rathangan Demesne_010	Unassigned	Under review	Unassigned	Moderate	Under review	-
Slate_070	Good	Not at risk	Moderate	Moderate	At risk	Agriculture, hydromorphology, Peat Drainage & Extraction & urban wastewater
Figile_080	Unassigned	Under review	Moderate	Good	Under review	-
Barrow_090	Poor	At risk	Poor	Poor	At risk	Agriculture, domestic wastewater, hydromorphology, invasive species & urban run-off

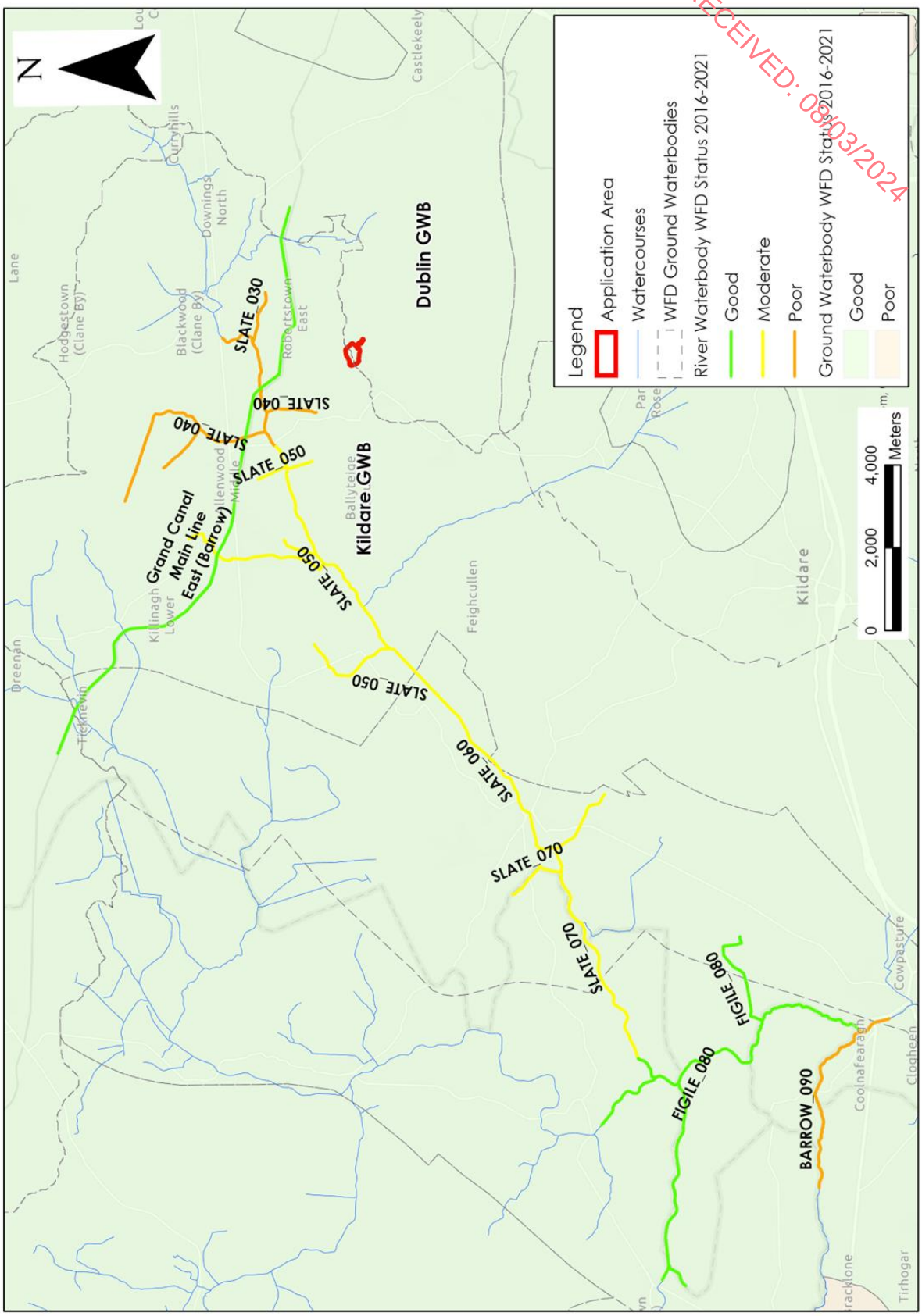

Figure B: WFD Surface Waterbody Status (2016-2021)

2.4 GROUNDWATER BODY IDENTIFICATION

The site is mapped by the GSI (www.gsi.ie) to overly 2 no. Groundwater Bodies (GWB's). The majority of the site is underlain by the Dublin GWB, whilst the very northern portion of the site is mapped to overly the Kildare GWB.

The GSI (2014) states that there are smaller gravel deposits in the area of the Dublin GWB which is more predominantly composed of moderate permeability karstified limestone. The site represents an area of the smaller gravel deposits mentioned, which will be of the most permeable of the subsoils in this GWB, including glacial deposits and alluvial gravels. The general groundwater flow direction in this aquifer is towards the coast and also towards the River Liffey and Dublin City. This aquifer is not expected to maintain regional groundwater flow paths. Groundwater circulation from recharge to discharge points will more commonly take place over a distance of less than a kilometer (GSI, 2014).

According to the Kildare GWB characterization report, the gravel aquifer of the Curragh is found overlying the eastern boundary of this groundwater body which is situated just 3.5km south of the site. The report states that where gravel aquifers occur there will be little or no interaction between the bedrock groundwater and the surface water bodies.

2.5 GROUNDWATER BODY CLASSIFICATION

Both the Dublin and Kildare GWB's achieved "Good" status in the latest cycle (2016 – 2021). The Dublin GWB is currently under review with regard to its risk status, whilst the Kildare GWB is "Not at risk" (refer to **Table B**).

The GWB status for the 2016-2021 WFD cycle are shown on **Figure B.**

Table B: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Risk Status (2nd Cycle)	Overall Status (2013-2018)	Overall Status (2016-2021)	Risk Status (3rd Cycle)	Pressures
Dublin	Good	Not at risk	Good	Good	Under review	-
Kildare	Good	Not at risk	Good	Good	Not at risk	-

2.6 PROTECTED AREAS IDENTIFICATION

2.6.1 Nature Conservation Designations

Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

The closest designated site to the site is the Grand Canal pNHA (Site Code: 002104) which is located ~1.7km to the north of the site. There is no hydrological connection between the site and Grand Canal pNHA.

The site is approximately 2.9km southwest of the Blackwood feeder which is part of the Ballynafagh Lake SAC (Site Code: 001387) and connects the Ballynafagh Lake to the Grand Canal. The Blackwood Feeder is of particular conservation significance for the populations of two rare snail species, Vertigo moulinsiana and Pisidium pseudosphaerium, that it supports. Ballynafagh Lake is a shallow alkaline lake with patches of emergent vegetation in the middle, as well as around the shore and is also a pNHA.

Ballynafagh Bog SAC (Site Code: 000391) is situated south of Ballynafagh Lake approximately 5km northeast of the site. Hodgestown Bog NHA (Site Code: 001393) is located northwest of Ballynafagh Lake approximately 5.5km north of the proposed site.

Approximately 3.3km south of the proposed site is the Mouds Bog SAC (Site Code: 002331) and pNHA (Site Code: 000395). The site comprises a raised bog that includes both areas of high bog and cutover bog.

Pollardstown Fen SAC and pNHA (Site Code: 000396) is situated on the northern margin of the Curragh of Kildare, approximately 6.5km south of the site and is hydrologically connected to the Grand Canal pNHA as mentioned above.

2.6.2 Bathing Waters

Bathing waters are those designated under the Bathing Water Directive (76/160/EEC) or the later revised Bathing Water Directive (2006/7/EC).

There are no bathing water sites located in the vicinity of the site. The site is ~40km west of Sandymount Strand (IEEABWC090_0000_0300), the nearest coastline/ bathing water site (as the crow flies).

2.6.3 Nutrient Sensitive Areas

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The EPA carried out a review of Nutrient Sensitive Areas (NSAs) downstream of large urban wastewater discharges in 2020. Once the regulations are in place, and nutrient sensitive areas have been identified, additional nutrient removal must be applied (if not already applied) to wastewater treatment plants discharging to the sensitive area. If this treatment was in place the objective was deemed to have been met.

The Barrow River (_070 -_130) NSA associated with the Portarlington urban wastewater agglomeration is located downstream of the Slate River.

The NSA objectives of the Barrow River (_070 -_130) NSA are being met.

2.6.4 Shellfish Areas

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no Shellfish protected area sites within the vicinity of the Proposed Development. The closest Shellfish protected areas is the Malahide (IEPA2_0057) shellfish area, ~50km to the east of the site.

2.6.5 Drinking Water

There are no Drinking Water Protected Area's (DWPA) in the vicinity or downstream of the proposed development.

The nearest DWPA is the Liffey_040 DWPA approximately 20km southwest from the site, mapped within the Liffey and Dublin Bay catchment.

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 8 no. river water bodies that are located in the vicinity or downstream of the Proposed Development site. In addition, the Grand Canal Main Line East (Barrow) is 1.9km north of the site. Furthermore, the Proposed Development Site is underlain by 2 no. groundwater bodies.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 8 no. SWBs located in the vicinity or downstream of the Proposed Development site.

While the proposed works are situated within the Slate_030 river sub-basin no direct drainage pathways exist between the site and any mapped surface watercourses within the river sub-basin, therefore the potential for water quality impacts is very low. However, to err on the side of caution the Slate_030 river waterbody and the Grand Canal Main Line East (Barrow) within the vicinity of the site have been screened in.

The remaining lower reaches of the Slate (Slate_040 through to _070), the Figile River (Figile_080) and the Barrow (Barrow_090) have been screened out as there are no direct drainage pathways between the site and the Slate River and with any of its downstream counterparts. The Proposed Development has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, both the Dublin and the Kildare GWB's have been screened in due to their location directly underlying the Proposed Development site. The Proposed Development works must not in any way result in a deterioration in the status of this GWB and/or prevent it from meeting the characteristics required for good status in the future.

The groundwater vulnerability rating within the Proposed Development site may be altered, as the overlying overburden will be stripped within the site. The groundwater vulnerability rating is currently "High".

3.3 PROTECTED AREAS

The closest designated site to the site is the Grand Canal pNHA located approximately 1.7km north of the site. There are no surface water or groundwater connections between the site and Grand Canal and therefore effects are unlikely. However, to err on the side of caution the Grand Canal Main Line East (Barrow) within the vicinity of the Proposed Development site has been screened in.

Ballynafagh Lake SAC is located approximately 5km to the northeast of the site and is potentially located downstream of the site with regard groundwater flow. Therefore, the Ballynafagh Lake SAC has been screened in to the assessment.

Ballynafagh Bog SAC is situated south of Ballynafagh Lake approximately 5km northeast of the application site. Hodgestown Bog NHA (Site Code: 001393) is located northwest of Ballynafagh Lake approximately 5.5km north of the proposed site. Impacts on the Ballynafagh Bog SAC and the Hodgestown Bog NHA can be discounted given the intervening lands, the distance separating the Site from the Proposed Development. There is no potential for the Proposed Development to impact the designated sites and thus the Ballynafagh Bog SAC and Hodgestown Bog NHA have been screened out.

Mouds Bog SAC/ pNHA is approximately 3.3km south of the site. No hydrological connections exist between the site and Mouds Bog, therefore there is no potential for the Proposed Development to impact the designated site and thus Mouds Bog SAC/pNHA has been screened out.

Pollardstown Fen SAC/ pNHA is approximately 6.5km south of the site and is hydrologically connected to the Grand Canal pNHA as screened in above. However, there is no surface water connection between the site and the Pollardstown Fen SAC/ pNHA as Pollardstown Fen SAC/ pNHA discharges into Grand Canal and not vice versa. Therefore, there is no potential for the Proposed Development to impact the designated site and thus Pollardstown Fen SAC/ pNHA has been screened out.

The bathing waters at Sandymount Strand and Shellfish areas at Malahide, have been screened out due to their distal location from the proposed development site. The Proposed Development has no potential to cause a deterioration to the bathing, or shellfish areas.

The Barrow River (_070 -_130) NSA has been screened out as there are no direct drainage pathways between the site and the Slate River and any of its downstream counterparts, including the Barrow_090 river waterbody which is delineated within the NSA.

The Liffey_040 DWPA is screened out of the assessment as it has no hydrological linkage to the site and because of its distal location 20km southwest from the site.

3.4 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table C.**

Table C: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	Artificial River	Grand Canal Main Line East (Barrow)	**Yes**	Although no direct drainage pathways exist between the site and the Grand Canal Main Line East (Barrow), to err on the side of caution the Grand Canal Main Line East (Barrow) has been screened in as it is the nearest waterbody to the site within the Barrow Catchment.
	River	Slate_030	**Yes**	Although no direct drainage pathways exist between the site and the Slate_030, to err on the side of caution the Slate_030 river waterbody has been screened in as the works are situated within the Slate_030 river sub-basin.
	River	Slate_040	No	The Slate_040 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Slate_050	No	The Slate_050 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Slate_060	No	The Slate_060 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Rathangan Demesne_010	No	The Rathangan Demesne_010 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Slate_070	No	The Slate_070 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Figile_080	No	The Figile_080 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.
	River	Barrow_090	No	The Barrow_090 SWB has been screened out as no direct drainage pathways exist between the site and the Slate River, prohibiting the potential for surface water quality effects to extend any significant distance downstream of the Proposed Development Site.

Ground water Body	Groundwater	Dublin GWB	**Yes**	The proposed development site overlies the Dublin GWB. An assessment is required to consider potential impacts of the proposed development on this GWB.
	Groundwater	Kildare GWB	**Yes**	The northern portion of the application site overlies the Kildare GWB. An assessment is required to consider potential impacts of the proposed development on this GWB.
Protected Areas	Nature Conservation Designations	Grand Canal pNHA	**Yes**	Although no direct drainage pathways exist between the site and the Grand Canal pNHA, to err on the side of caution the Grand Canal pNHA has been screened in as it is the nearest waterbody to the site within the Barrow Catchment.
		Ballynafagh Lake SAC/ pNHA	**Yes**	Ballynafagh Lake SAC is located approximately 5km to the northeast of the site and is potentially located downstream of the site with regard groundwater flows. Therefore, the Ballynafagh Lake SAC has been screened in to the assessment.
		Ballynafagh Bog SAC	No	Impacts on the Ballynafagh Bog SAC can be discounted given the lack of flow pathways, the intervening lands, the distance separating the Site from the Proposed Development and the Grand Canal Main Line East (Barrow) acting as a hydrological buffer between the site and the proposed development. The application site has no potential to impact this SAC.
		Hodgestown Bog NHA	No	Impacts on the Hodgestown Bog NHA can be discounted given the lack of flow pathways, the intervening lands, the distance separating the Site from the Proposed Development and the Grand Canal Main Line East (Barrow) acting as a hydrological buffer between the site and the proposed development. The application site has no potential to impact this NHA.
		Mouds Bog SAC/ pNHA	No	No hydrological connections exist between the site and Mouds Bog, therefore there is no potential for the Proposed Development to impact the designated site and thus Mouds Bog SAC/pNHA has been screened out.
		Pollardstown Fen SAC/ pNHA	No	Impacts on the Pollardstown Fen SAC/ pNHA can be discounted given that there is no surface water connection between the application site and the Pollardstown Fen SAC/ pNHA as Pollardstown Fen SAC/ pNHA discharges into Grand Canal and not vice versa, the intervening lands and the distance separating the Site from the Proposed Development. The application site has no potential to impact this SAC/pNHA.
	Bathing Waters	Sandymount Strand	No	Sandymount Strand bathing waters have been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact these Bathing Waters.
	Nutrient Sensitive Areas	Barrow River (_070 -_130) NSA	No	The Barrow River (_070 -_130) NSA has been screened out as there are no direct drainage pathways between the site and the Slate River and any of its downstream counterparts, including the Barrow_090 river waterbody which is delineated within the NSA.

	Shellfish waters	Malahide	No	Malahide Shellfish waters have been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact these Shellfish Waters.
	Drinking Waters	Liffey_040 DWPA	No	The Liffey_040 DWPA has been screened out due to its distal location from the proposed development site. The proposed development has no potential to impact this DWPA.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

In summary, the Proposed Development will involve:

- The removal of woodland, vegetation and overlying soils;
- Extraction of sand and gravel (4 million tonnes) on a phased basis from an area of c. 8.5 hectares (ha) to a final floor level at 95 metres above Ordnance Datum (m OD);
- Infilling of the lands using inert waste (3.2 million tonnes) on a phased basis during and following the extraction of sand and gravel;
- Restoration of the lands back to original ground level and the establishment of native woodland planting; and,
- All related ancillary development and associated site works including processing (crushing, screening and washing) and stockpiling of materials; installation of infrastructure for the management of water on site and all other related activities.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Impacts on Surface Water Quality/ Quantity

Construction phase activities including removal of soil and overburden from the proposed extraction areas and access road construction will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils. The main risk will be from surface water runoff from bare soil and stockpiles during construction works.

Hydrocarbons will also be used during the construction phase. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters at all construction sites. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Construction phase activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity and contamination which in turn could affect the water quality and fish stocks of downstream watercourses.

However, there is no existing or proposed direct surface water connections between the Proposed Development Site and nearby surface watercourses. The only possible hydraulic connections are via small rates of surface water runoff and via vertical migration through the unsaturated zone in the gravel aquifer followed by lateral migration and discharge into nearby surface watercourses.

The potential for surface water quality effects is therefore very low due to the local hydrogeological regime (high rates of groundwater recharge) and the short term-nature of the work during the construction phase.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the proposed development in the unmitigated scenario are outlined in in **Table D**.

Table D: Potential Impacts on receiving surface water quality during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Grand Canal Main Line East (Barrow)	IE_14_AWB_GCMLE	Good	Good
Slate_030	IE_SE_14S010036	Poor	Poor

4.2.1.2 Potential Impacts on Groundwater Quality

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk and have the potential to impact on groundwater quality in the underlying groundwater bodies.

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the Proposed Development in the unmitigated scenario are outlined in **Table E**.

However, due to the small volumes present on-site, effects on WFD status are unlikely.

Table E: Potential Impacts on Groundwater Quality / Quantity during the Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Dublin GWB	IE_EA_G_008	Good	Good
Kildare GWB	IE_SE_G_077	Good	Good

4.2.1.3 Potential Impacts on Protected Areas

Grand Canal pNHA

The Grand Canal pNHA comprises the canal channel and the banks on either side of it. The canal supports important habitats such as hedgerows, tall herbs, calcareous grassland, reef fringe, open water, scrub and woodland. Diverse ranges of species use the site including the Annex II species such as otter and white-clawed crayfish. The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. Associated canal structures and buildings also contribute to the setting and historic character of the canal.

As outlined above, there is no existing or proposed direct surface water connections between the site and the Grand Canal pNHA.

The risk of potential impacts on the Grand Canal pNHA are low given the lack of flow pathways, the intervening lands and the distance separating the Grand Canal pNHA from the Proposed Development.

Ballynafagh Lake SAC/ pNHA

The site is approximately 2.9km southwest of the Blackwood feeder which is part of the Ballynafagh Lake SAC and connects the Ballynafagh Lake to the Grand Canal. The Blackwood Feeder is of particular conservation significance for the populations of two rare snail species, Vertigo moulinsiana and Pisidium pseudosphaerium, that it supports. Ballynafagh Lake is a shallow alkaline lake with patches of emergent vegetation in the middle, as well as around the shore and is also a pNHA.

Ballynafagh Lake SAC is located to the northeast of the site and is potentially located downstream of the site with regard groundwater flows.

However, as outlined above, there is no existing or proposed direct surface water connections between the site and the Ballynafagh Lake SAC. The only possible hydraulic connections are via small rates of surface water runoff and via vertical migration through the unsaturated zone in the gravel aquifer followed by lateral migration and discharge into the Ballynafagh Lake SAC. Furthermore, the Slate River will act as a hydrological buffer prohibiting groundwater flows from entering the SAC.

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Potential Impacts on Groundwater Quantity / Quality

The risks to groundwater quality are the same as those described in **Section** Error! Reference source not found.. All works during the operation phase of the Proposed Development will be located above the groundwater table.

Therefore, no groundwater dewatering will be required and there is no potential for groundwater quantity effects. Also, all imported infill material will be inert.

A summary of potential status change to the underlying GWBs, arising from groundwater quality impacts during the operation stage of the Proposed Development in the unmitigated scenario are outlined in **Table F**.

Table F: Potential Impacts on Groundwater Quality / Quantity during the Operational Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Dublin GWB	IE_EA_G_008	Good	Good
Kildare GWB	IE_SE_G_077	Good	Good

4.2.2.2 Potential Impacts on Surface Water Quality

During the operation phase, the extraction of sand and gravel at the Proposed Development Site will involve the removal and excavation of subsoils. The main risk will be from surface water runoff from areas of bare soil and stockpiles.

Hydrocarbons will also be used on-site throughout the operation phase. Accidental spillage of petroleum hydrocarbons is a significant pollution risk to surface waters at all quarry sites.

However, due to the bowl-shaped nature of the extraction areas, no direct hydrological pathways will occur between the Proposed Development Site and downstream SWBs. During the operational phase there will be no discharge to surface watercourses. All surface water within the Proposed Development Site will infiltrate to ground. The potential to affect surface water quality is through hydraulic continuity with groundwater.

A summary of potential status change to SWBs during the operation phase of the Proposed Development in the unmitigated scenario are outlined in **Table G**.

Table G: Potential Impacts on receiving surface water quality during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Grand Canal Main Line East (Barrow)	IE_14_AWB_GCMLE	Good	Good
Slate_030	IE_SE_14S010036	Poor	Poor

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the proposed development. These are outlined below.

4.3.1 Mitigation and Development Phase

4.3.1.1 Earthworks (removal of Vegetation Cover) Resulting in Suspended Solids Entrainment in Surface Water Bodies (Construction Phase)

Even though the Slate River and its tributaries are a significant distance from the site (>0.35km) and the topography does not lend itself to surface water runoff towards the river, the following drainage control measures will be implemented nonetheless with regard drainage control:

- Prior to the commencement of overburden stripping works silt fencing will be placed down-slope of the excavation area. These will be embedded into the local soils to ensure all site water is captured and filtered;
- Daily monitoring of the overburden stripping/landscaping earthworks will be completed by a suitably qualified person. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter will leave the site;
- Overburden stripping and landscaping works will be scheduled for periods of low rainfall (summer months) to reduce run-off and potential siltation;
- Landscaped areas and perimeter berms will be planted with trees and grasses as soon as possible after formation to reduce the potential of surface water erosion; and,
- Good construction practices such wheel washers and dust suppression on site roads, and regular plant maintenance will ensure minimal risk. The Construction Industry Research and Information Association (CIRIA) provide guidance on the control and management of water pollution from construction sites ('Control of Water Pollution from Construction Sites, guidance for consultants and contractors', CIRIA, 2001), which provides information on these issues. This will ensure that surface water arising during the course of overburden stripping and landscaping activities will contain minimum sediment.

4.3.1.2 Potential Negative Effects on Groundwater Body Quality and Quantity due to Extraction (Operational Phase)

- There are no licenced discharges to any surface water or groundwater body and therefore no significant effects on groundwater will occur.
- No other mitigation is required in addition to the comprehensive drainage controls and mitigation measures presented above with regard oils and fuels.
- There is no proposed aggregate extraction below the groundwater table and therefore no effects on groundwater levels can occur.
- Water used for washing/processing and dust suppression and at the wheel wash will be sourced from the proposed on-site production well. The maximum daily demand is expected to be 85m^3/day.
- Significant effects on groundwater body water balance (from groundwater abstraction - 85m^3/day) are not expected due to the relatively low pumping volumes.

- Also, as the proposed groundwater abstraction volume exceeds 25m³/day, the abstraction will be registered with the EPA as required by the European Union (Water Policy) (Abstractions Registration) Regulations 2018 (S.I. No. 261 of 2018).

4.3.1.3 Potential Negative Effects on Groundwater Body Quality due to Imported Inert Soil and Stone Material (Operational Phase)

The following proposed mitigation measures are applicable to the site under both forms of operation (Inert soil and stone importation and Article 27 by-product material importation).

Proposed mitigation measures include:

- Sourcing material that is proven to be inert prior to transport to the site;
- Pre-agreed source sites for inert material ensuring; no pollutants, unauthorised material, invasive species;
- Regular checks of incoming loads to ensure suitability of imported material;
- The site will be operated under an Environmental Management System;
- All required pollution prevention measures will be implemented at the site;
- The operator will prepare and implement an emergency response procedure;
- The operator will complete environmental monitoring, including local groundwater and surface water monitoring;
- A phased restoration of the site will be implemented, with both native and imported material.

The operator will have a documented waste recording procedure for all material entering the site;In addition, it should be noted that there are no licensed discharges to any natural surface waters or groundwater body.

4.3.1.4 Mitigation - Release of Hydrocarbons During Construction and Operational Phases

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- All plant and machinery will be serviced before being mobilised to site;
- Refuelling will be completed in a controlled manner using drip trays (bunded container trays) at all times;
- Drip-trays will be used for fixed or mobile plant in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Oils and lubricants will be stored on drip pallets in a designated hardstand area that will drain to an oil interceptor;
- Procedures and contingency plans will be set up to deal with emergency accidents and spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on site for use in the event of an accidental spillage.

4.4 RESTORATION PHASE – LIKELY EFFECTS AND MITIGATION MEASURES

At the end of the infilling/operational process, the infill area will be put back to a similar condition to pre-development by landscaping and tree planting. No additional effects on the water environment are envisaged during the restoration phase, closure and aftercare period of the Proposed Development.

Table H: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Potential Status Change - Unmitigated	Assessed Status with Mitigation Measures
SWB				
Grand Canal Main Line East (Barrow)	IE_14_AWB_GCMLE	Good	Good	Good
Slate_030	IE_SE_14S010036	Poor	Poor	Poor
GWB				
Dublin GWB	IE_EA_G_008	Good	Good	Good
Kildare GWB	IE_SE_G_077	Good	Good	Good

5. WFD ASSESSMENT CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the Proposed Development Site are defined in **Section 2** above.

The Proposed Development does not involve any dewatering or licensed discharges to surface water bodies or groundwater bodies. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction and operational phase of the Proposed Development.

Mitigation for the protection of surface water and groundwater during the construction, operation and restoration phases of the development will ensure the qualitative status of the receiving waters will not be altered by the Proposed Development.

As such, the Proposed Development will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) (Note that a full list of legislation complied with in relation to hydrology and hydrogeology is included in Section 7.22 to 7.25 of the EIAR).

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