Attachment I

Existing Environment & Impact of the Facility

I.1 Assessment of Atmospheric Emissions

I.1.1 Introduction

This section of the report deals with the issue of air quality. It will assess the level of airborne dust and particulate matter associated with the recovery facility at Kilmeage.

I.1.2 Receiving Environment

The principle concern in respect of potential airborne dust emissions from the proposed development is the effect on residential amenity. Properties within the vicinity of the development are shown on Figures B.2.1 to B.2.3.

The materials to be recovered are principally “soils and stone” and inert construction and demolition waste. Any dust generated by the operation will comprise inert particulate matter.

Experience of reclamation workings indicates that mechanical activity is the most significant factor in material erosion and dust generation. Dust emanates from the placement of materials, the movement of vehicles on internal roads loading and processing operations. However, the effect of wind is also an important factor in dust generation and problems may arise at reclamation workings when both factors arise simultaneously.

The impact of fugitive dust will be direct, temporary and non-cumulative and largely confined to the application site.

I.1.3 Ambient Air Quality

The Environmental Protection Agency (EPA) manages the National Ambient Air Quality Network. For monitoring purposes, the country is divided into four air quality zones as follows: 'A' (Dublin); 'B' (Cork); 'C' (Large Towns), and; 'D' (Rural). The Kilmeage area falls into zone D.

The EPA's Air Quality Index for Health (AQIH) is a scale from one to 10 that ranks air quality, and is applied to characterise the current air quality in each zone. A reading of 10 means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The current air quality index for the Rural East AQIH Region in which Kilmeage is situated in is “3 - good” (Refer to Figure I.1.(i) below).

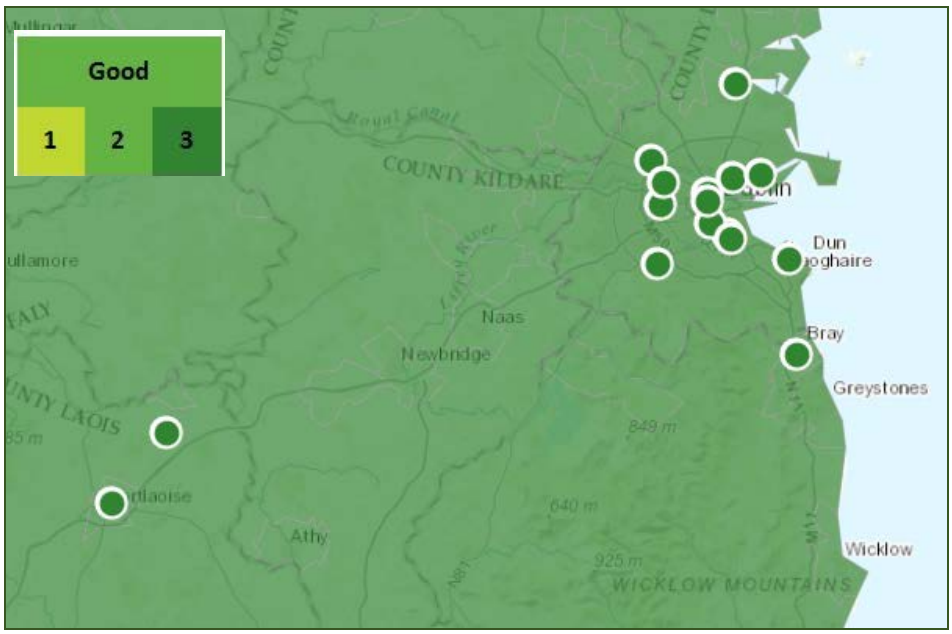

Figure I.1.(i) Air Quality Index for Health Map (EPA June 2016)

The relatively high rainfall of the area, and experience of similar environments elsewhere in Ireland, suggests that baseline dust levels of approximately 40 mg/m^2/day to 60 mg/m^2/day would be expected for an open pastoral landscape during drier periods of the year (May to September).

Condition No. 24 of Planning Permission P.A. Reg. Ref. 03/1773 states that *"the total dust emission arising from the on-site operations associated with the proposed development* ***shall not exceed 130 milligrams per square meter per day****, averaged over a continuous period of 30 days, when measured as deposition of insoluble particulate matter at any position along the boundary of the site".*

The Planning Authority has specified that the dust emissions arising from the development associated with the proposed development shall not exceed 130 mg/m^2/day measured at the site boundary. **This limit is considered to refer to insoluble particulate matter.**

There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standards specify a method of measuring dust deposition – The Bergerhoff Method (German Standard VDI 2119, 1972). Dust monitoring was carried out at the site using a Bergerhoff dust deposition gauge.

The normal recommended standard for dust emissions for this type of development is that "dust deposition shall not exceed 350 mg/m^2/day measured at the site boundaries and averaged over 30 days". This limit refers to total dust (using DIN method).

The above standard of 350 mg/m^2 per day is also in accordance with guidance issued by both the Department of the Environment and the EPA in relation to dust deposition monitoring for these types of developments. As such it is considered that this is a more appropriate emission limit value to apply with respect to the proposed development.

A series of three Bergerhoff dust monitoring stations (D1 to D3) have been established on site as part of the baseline study for the Waste Management Licence Application. Refer also to EIS Section 3.1 - Air. The locations of the stations are shown on Environmental Monitoring Plan Figure F 1.

The results of recent dust monitoring are summarised in the following Table I.1.(ii) and the laboratory test report is included as Attachment I.1.3.1.

Table I.1.(i) Summary of recent dust monitoring results

Station	Easting	Northing	Monitoring Period	Result (mg/m^2/day)
D1	277562	223051	17/10/15 to 16/11/15	145.2
D2	277562	223213	17/10/15 to 16/11/15	93.8
D3	277838	223144	17/10/15 to 16/11/15	**

Note: ** *The dust monitoring gauge at D3 was knocked over due to high winds and as such no results were included in this round of monitoring.*

The results show that the dust levels at the site boundary are within the recognised TA Luft dust deposition limit value of 350 mg/m^2 per day which refers to “total dust”. The results are also below the 130 mg/m^2/day specified by the Council which is taken to relate to insoluble particulate matter only.

Attachment I.1.3.1

Dust Monitoring Results

TEST REPORT NO.: 119781

Analysing
Testing
Consulting
Calibrating

Client: **N&C Enterprises Ltd**
Kilmeague
Naas
Co.Kildare

FTAO: John Sheils

BHP Ref. No.: 15/11/792-794
Order No:
Date Received: 26/11/15
Date Tested: 08/12/15
Test Specification: Nil
Item :See below

BHP
New Road
Thomondgate
Limerick
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Tel +353 61 455399
Fax + 353 61 455447
E Mail johnohalloran@bhp.ie

TEST	Client Reference	Units	Results	Standard Reference
	Sampling period: 17/10/15 to 16/11/15			
Dust Deposition	**D1**	mg/m^2/day	145.2	VDI 4320 Part2
Dust Deposition	**D2**	mg/m^2/day	93.8	VDI 4320 Part2

Additional Information: All locations are inside the EPA Limit of 350 mg/m2/day.

Authorised by:

Colette Hannan

Colette Hannan
Date of Issue: 11/12/15

I.1.4 Assessment of Impacts

I.1.4.1 Direct Impacts

Fugitive dust emissions are generated wherever there is movement of dust relative to the air. The emission of fugitive dust from inert soils and stone backfilling site activities is very dependent on weather conditions. Where nuisance complaints from activities arise, they are generally as a result of a combination of specific site activities and particular weather conditions (e.g. dry, windy).

Within the application area, the following site activities may give rise to potential fugitive dust emissions:

- Internal movement of vehicles
- Tipping and levelling of placed materials
- Loading and Unloading of Vehicles
- Processing Area

They are generally dispersed sources rather than specific point sources, and this dictates the measures required to mitigate potential dust related impacts.

The following flow diagram shows the sources of fugitive dust emissions arising on site and the methods of treatment/ abatement to be employed.

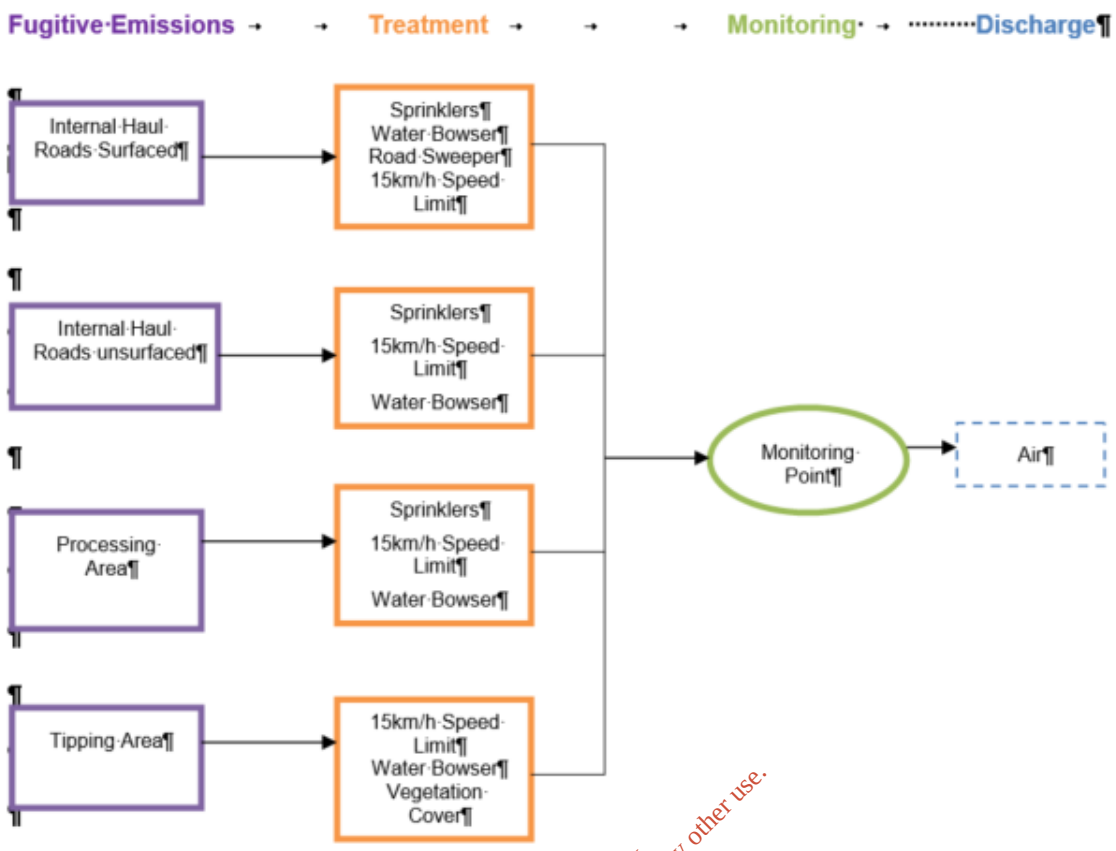

Figure I.1.(ii) Air Emissions - Operational Activities

The impact of fugitive dust will be direct, temporary and non-cumulative and largely confined to the application site.

Various mitigation measures will be implemented to minimise any impacts as much as practical and to ensure the recovery operations will not result in any significant impact on residences or local amenities (Refer to Section I.1.5 below).

Dust monitoring will be carried out in accordance with the within the recognised TA Luft dust deposition limit value of 350 mg/m^2 per day.

The Air Quality Standards Regulations (2002 S.I. No. 271 of 2002) sets limit values for sulphur dioxide, nitrogen dioxide, particulate matter and lead in ambient air. The regulations apply to ambient air quality in the vicinity of land use/development types including waste management facilities. The development requires movement of materials by road, and transport by other methods is not practical in this situation. Given the proximity of the site to the National Road network fuel consumption and therefore exhaust emissions will be reduced relative to more removed locations. The current air quality in the region is known to be “good” (Refer to Section I.1.3 above), and thus the impact on air quality with respect to the recovery facility is considered to be negligible.

I.1.4.2 Indirect Impacts

Apart from the direct impact of the deposition of particulate material, there may be an associated visual impact with fugitive dust generation. This impact will be minimised by the mitigation measures described to minimise dust in Section I.1.5 below.

I.1.4.3 Interaction with other Impacts

There are no interactions with other impacts associated with air quality issues.

I.1.5 Abatement

A number of measures have been adopted to minimise dust emissions to the atmosphere from general site activity, internal haulage, processing and tipping operations as follows:

- During dry weather the haul roads and stockpiles will be sprayed with water to dampen any likely dust blows. A water bowser will be maintained on site for this purpose.
- Consideration will be given to location of mobile plant so as to ensure that any principle dust sources cannot adversely affect sensitive off-site locations.
- Static and mobile wet dust suppression systems will be located at strategic points in the process if required.
- Drop heights will be kept to a minimum by using short conveyors and maintaining stocks under the head drum load out points.
- The site access road between the site entrance and wheel wash has been provided with an asphalt surface. There is no evidence of mud and debris being carried out on to the public road.
- Imported clean construction and demolition waste (concrete and brick) will be used to construct internal haul roads as required.
- A wheel wash facility has been installed on site and all vehicles are required to pass through the wheel wash on exiting the site.
- A sprinkler system has been installed on the site access road and is in operation during periods of dry weather.
- Main site haulage routes within the site shall be maintained with a good temporary surface, as is the case at present.
- All internal roadways will be adequately drained, to prevent ponding.

- A tractor with a road sweeper attachment will be provided to ensure that the site entrance and adjoining public roadway is regularly cleaned. The sweeper will be readily available at short notice to sweep up any materials which may accidentally fall onto the public roadway.
- Suitable vegetation is to be provided on restored areas at the earliest opportunity.

It is considered given the nature of the activity, control and abatement measures and management of the recovery facility that emissions of pollutants (as defined in Waste Management Acts 1996, as amended, and Air Pollution Acts 1992 and 1987 respectively) to the atmosphere are not likely to impair the environment (i.e. be injurious to public health, or have a deleterious effect on flora or fauna or damage property, or impair or interfere with amenities or with the environment).

The active working area of the site will be inspected frequently during dry, windy weather to assess the potential for dust blows, and when necessary, appropriate dust suppression and control measures will be implemented in response.

These measures are considered sufficient to ensure that dust emissions will remain below recognised thresholds for this type of development.

I.1.6 Monitoring

A series of three Bergerhoff dust monitoring stations (D1 to D3) have been established on site as part of the baseline study for the Waste Management Licence Application. Refer also to EIS Section 3.1 - Air. The locations of the stations are shown on Environmental Monitoring Plan Figure F 1.

The results of recent dust monitoring are provided in Attachment I.1.3.1. The results show that the dust levels at the site boundary are within the recognised TA Luft dust deposition limit value of 350 mg/m^2 per day which refers to “total dust”.

Dust fall is measured using the Bergerhoff method as set out in German Standard VDI 2119. The normal recommended standard for dust emissions for this type of development is that “dust deposition shall not exceed 350 mg/m^2/day measured at the site boundaries and averaged over 30 days”. This limit refers to total dust (using DIN method). It is proposed to carryout dust monitoring for the activity on a bi-annual basis.

The above standard is also in accordance with guidance issued by both the Department of the Environment and the EPA in relation to dust deposition monitoring for these types of developments and will continue to be applied.

The applicant proposes to develop an Environmental Management System (EMS). The EMS will include regular dust monitoring to demonstrate that the development is not

having an adverse impact on the surrounding environment. This programme will allow on-going monitoring of fugitive dust emissions from the site, thereby assisting in ensuring compliance with any future requirements or regulations.

I.1.7 Residual Impact

Given the low inherent potential for dust generation and dispersion from the restored lands, the rural location, and the mitigation measures incorporated in the design, it is anticipated that the effect on the existing air quality will be negligible, and no residual impacts are predicted.

I.2 Assessment of Impact on Receiving Surface Water

A detailed Geological and Hydrogeological assessment was commissioned in support of this application. A copy of the assessment prepared by Hydro Environmental Services is attached (Refer to Attachment I.2.1 below). This report addresses geological ground, surface and groundwater issues pertaining to the site.

There are no significant surface water features at or in the vicinity of the site. There is a perched pond to the east of the site, but this is a local feature and has not and will not be impacted by the proposed site development works.

There are no mapped streams/rivers in the vicinity of the site, however the Slate River exists ~2.4km north of the site. The Grand Canal is located ~1.76km north of the site.

There are no significant surface water features within the site boundary. There are no local streams or rivers that can be impacted by the proposed development.

Potential impacts on surface water receptors are therefore not carried forward for impact assessment as there are no local receptors.

There will be no discharge of surface water run-off from the site. No surface water monitoring is proposed as there are no natural water features at or close to the site.

Attachment I.2.1

GEOLOGICAL and HYDROGEOLOGICAL ASSESSMENT

Prepared by

Hydro Environmental Services

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GEOLOGICAL AND HYDROGEOLOGICAL ASSESSMENT AT KILMEAGUE SAND & GRAVEL PIT, CO. KILDARE FOR PROPOSED WASTE MANAGEMENT LICENCE APPLICATION

FINAL REPORT

Prepared for:

J. SHEILS PLANNING & ENVIRONMENTAL LTD

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

DOCUMENT TITLE:	**GEOLOGICAL AND HYDROGEOLOGICAL ASSESSMENT REPORT AT KILMEAGUE SAND & GRAVEL PIT, CO. KILDARE FOR PROPOSED WASTE MANAGEMENT LICENCE APPLICATION**
ISSUE DATE:	**01ST JUNE 2016**
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CURRENT REVISION NO:	**P1314-0_FINAL REV 1**
AUTHOR(S):	**MICHAEL GILL** **GRAINNE BARRON**
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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. 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.

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1.0 INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services were requested by J. Sheils Planning and Environmental Ltd, on behalf of N&C Enterprises Ltd, to carry out a hydrological and hydrogeological assessment for a proposed Waste Management Licence Application (WMLA) at the existing Sand and Gravel Pit facility at Kilmeague, Co. Kildare.

1.2 PROPOSED DEVELOPMENT

The proposed development is to fill the void space of the worked out sand and gravel pit with inert fill. All proposed fill works will be above the water table.

1.3 SCOPE OF ASSESSMENT

The following program of works has been carried out:

- Desk study, collation and review of all freely available geological, hydrological and hydrogeological data from relevant authorities and institutions;
- Walkover survey of the pit site and mapping of all relevant geological, hydrogeological and hydrological conditions and features at and in the vicinity of the site in question;
- Undertake a trial pit investigation (15 no. trial pits) in the area of the existing sand and gravel pit;
- Installation of 2 no. groundwater monitoring wells (note: 1 no. well and 1 no. groundwater spring exists on the site already). The monitoring wells allow both water level monitoring and baseline groundwater quality sampling to be completed at the site;
- On-site measurement of hydrological field parameters such as electrical conductivity, pH etc were undertaken to determine the hydrochemical makeup of surface water bodies/ponds and groundwater in the vicinity of the site (laboratory analysis of 3 no. groundwater samples) have also been completed;
- Undertake a hydrogeological and hydrological impact assessment in relation to local wells, the local groundwater body, downstream surface water bodies including potential impacts on any local or downstream designated sites;
- Undertake a preliminary flood risk assessment for the site and adjacent lands in terms of potential disruption of surface water and groundwater flowpaths due to the restoration infilling;
- Compile the collected data and relevant previous data (if available) into a conceptual model which will provide an understanding of the geological, hydrogeological and hydrological regimes at and in the vicinity of the pit;
- Preparation of a hydrogeological/hydrological report assessing the potential impacts of the proposed restoration infilling on the environment and provide suitable mitigation measures for the proposed extraction works; and,
- Provide input into developing the restoration plan for the pit in terms of minimising both potential hydrogeological and hydrology impacts.

2.0 ENVIRONMENTAL DESK STUDY

2.1 INTRODUCTION

This section describes the existing environmental conditions at the site. The existing geological and hydrogeological conditions at the site have been interpreted from both desk study information, and from data gathered during a field walkover survey. The main sources of information for this report are outlined as follows:

- An initial desk study of the site area was completed and all available geological and environmental data was gathered and collated;
- Environmental Protection Agency database (www.epa.ie);
- National Parks and Wildlife Service (NPWS) online mapping database (www.npws.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 scale map series, Sheet 16 (Geology of Kildare-Wicklow) Geological Survey of Ireland (GSI, 1995); and,
- Geological Survey of Ireland groundwater database;
- General Soil Map of Ireland 2nd edition (www.epa.ie);
- Ordinance Survey of Ireland – Discovery Series 1:50,000 and OS 1:10,560 maps; and,
- A site walkover survey was completed (on 16th November 2015), trial pits were excavated on 26th November 2015, drilling works were completed between 7th-10th December 2015, and water sampling was completed on 16th December 2015 and 08th March 2016.

2.2 SITE DESCRIPTION

The existing sand and gravel pit (Irish National Grid Co-ordinates: E277527, N222968) is located approximately ~10.7km to the southwest of Clane, Co. Kildare, and ~2.3km southwest of the village of Robertstown along the R415, a third class road connecting Kilmeague with Kildare town runs [east-west] to the south of the site. The sand and gravel pit is just east of Kilmeague village. The topography of the land surrounding the pit is relatively hilly with elevations reaching 133mOD (mOD = metres above Ordnance Datum) to the east of the pit and 126mOD to the west.

The Hill of Allen is located 3.0km to the southwest of the site.

The overall landholding measures approximately ~6.6ha. Landuse in the area to the west and southwest is largely residential, with some commercial use in close proximity to the pit. There is a row of single houses along the southern boundary of the site, and these face to the south on the local road. The land to the northeast and northwest is largely agricultural as shown in **Figure A**.

Figure A: Aerial Photograph of Kilmeague Sand and Gravel Pit

2.3 SITE HISTORY

The proposed site was an operational sand and gravel pit. Sand and gravel extraction at the site has been ongoing since the early 1900's, and continued intermittently until mid-2000's (~2003).

Initial extraction was completed by many different people, and subsequently in about 1995 the site was acquired by Michael Gavin Ltd.

The site is now operated by N & C Enterprises Ltd and the sand and gravel reserve at the site is worked out. There have been some previous backfilling (P.A. Reg. No. 03/1773 & 12/373) of the site along the southern side. The site currently includes a bagging plant, storage, and is distribution centre for gravel and landscaping products.

2.4 SITE GEOLOGY & HYDROGEOLOGY

GSI maps (www.gsi.ie) show the site area is mapped as being overlain by Renzinas/Lithosols soil types (BminSW) with Grey brown Podzolics/basic brown earths (BminDW) in the wider area as shown in **Figure B**. Soil deposits have been removed from the site footprint by the previous site operations, but they remove on the surrounding lands.

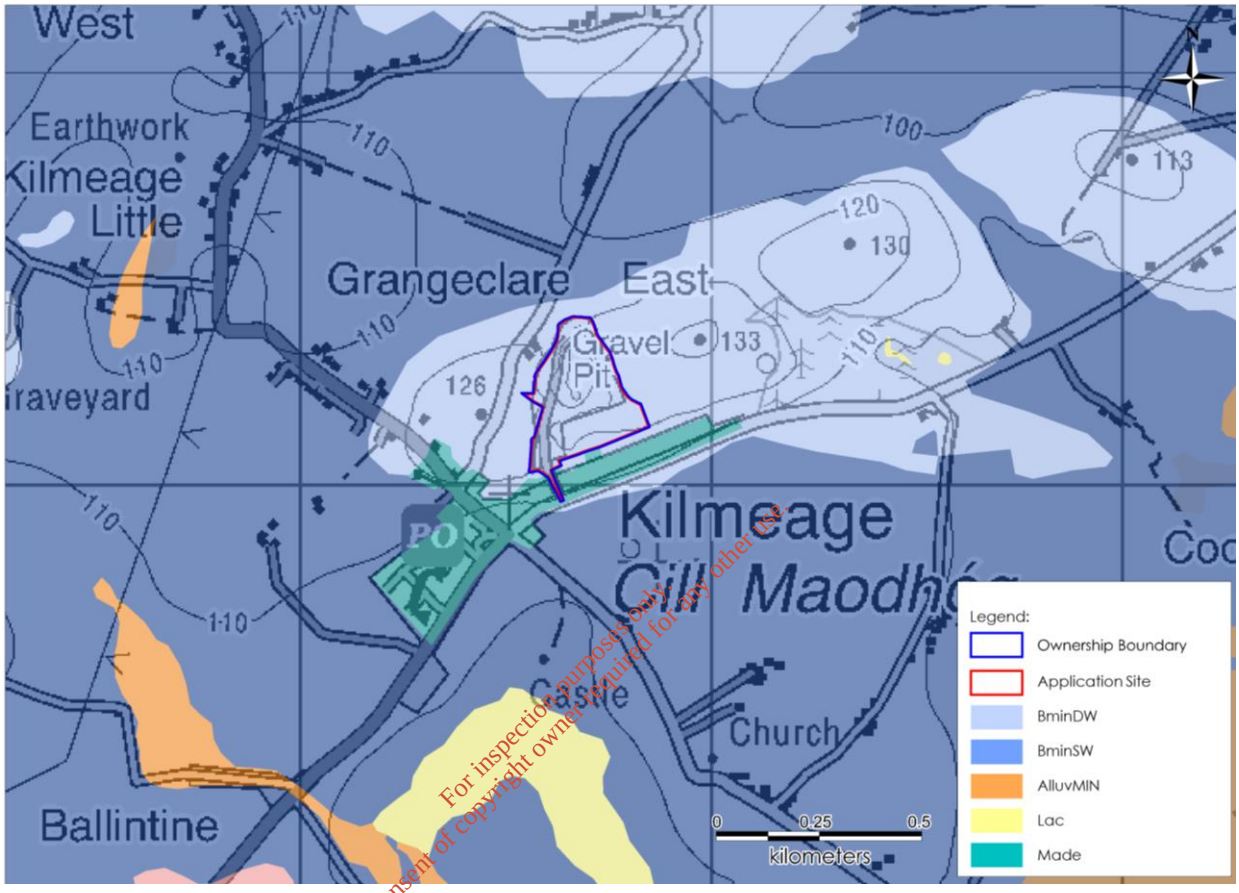

Figure B: Local Soils Map

Subsoils at the site are mapped as being Carboniferous Limestone sand and gravels (GLs). Parts of the site and the surrounding lands are mapped as made ground. See **Figure C**. The former sand and gravel pit has been heavily quarried over the course of its operation and a large void, some 15-20m deep remains.

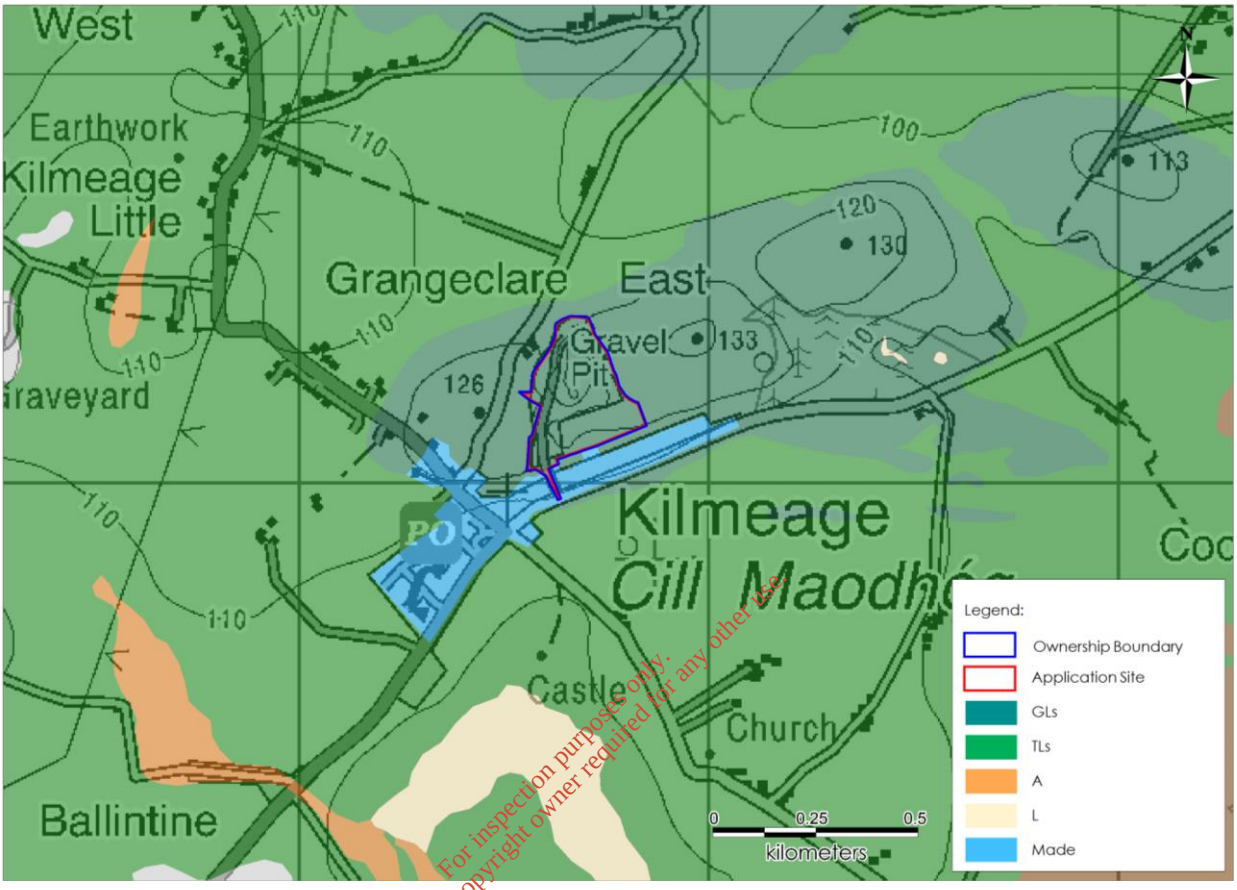

Figure C: Local Subsoils Map

Bedrock geology in the area of the site is mapped as underlain by the Devonian Old red Sandstones (DORS) rock unit type (www.gsi.ie). Refer to **Figure D**.

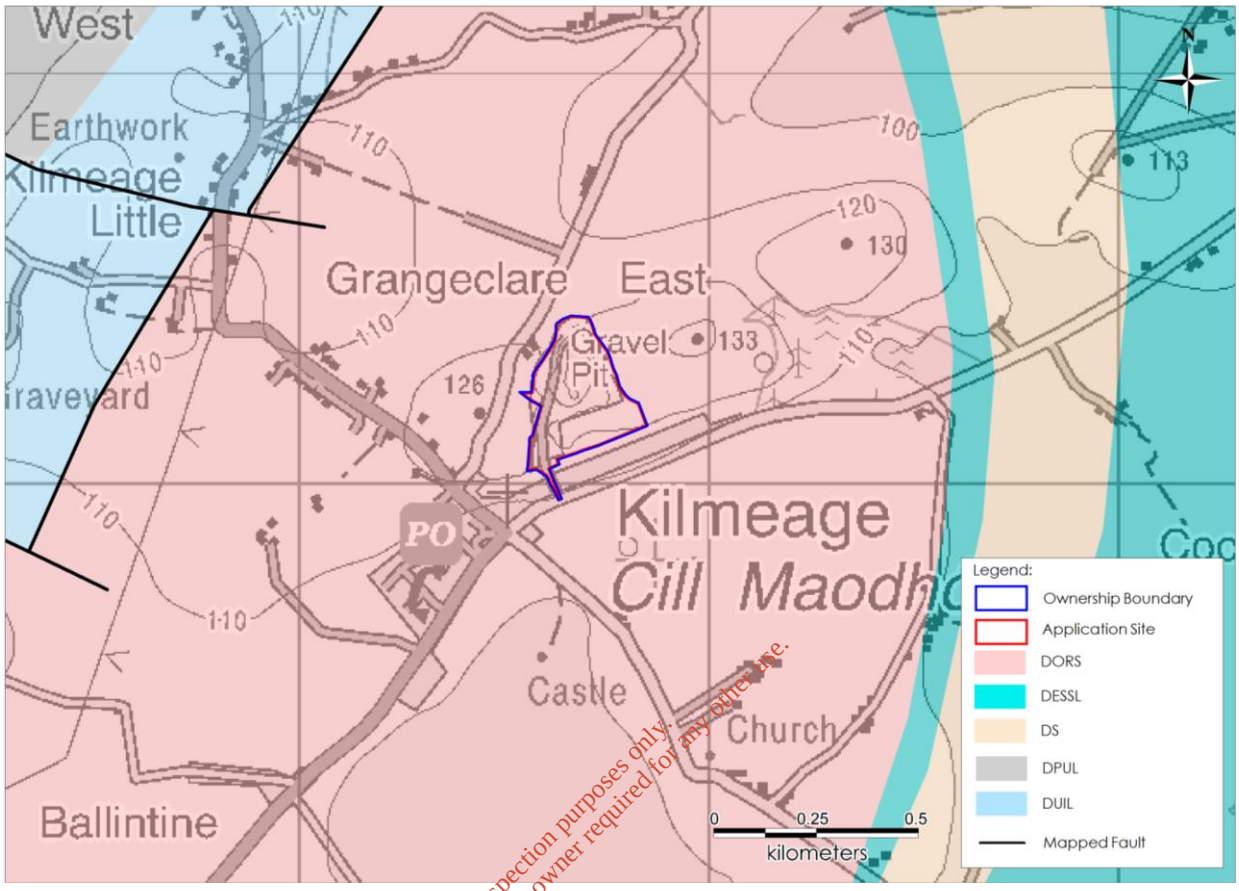

Figure D: Local Bedrock Map

The limestone bedrock mapped at the site has an aquifer classification of LI – Locally Important Aquifer – Bedrock which is Generally Moderately Productive (GSI, 1999 and www.gsi.ie). Please refer to **Figure E**.

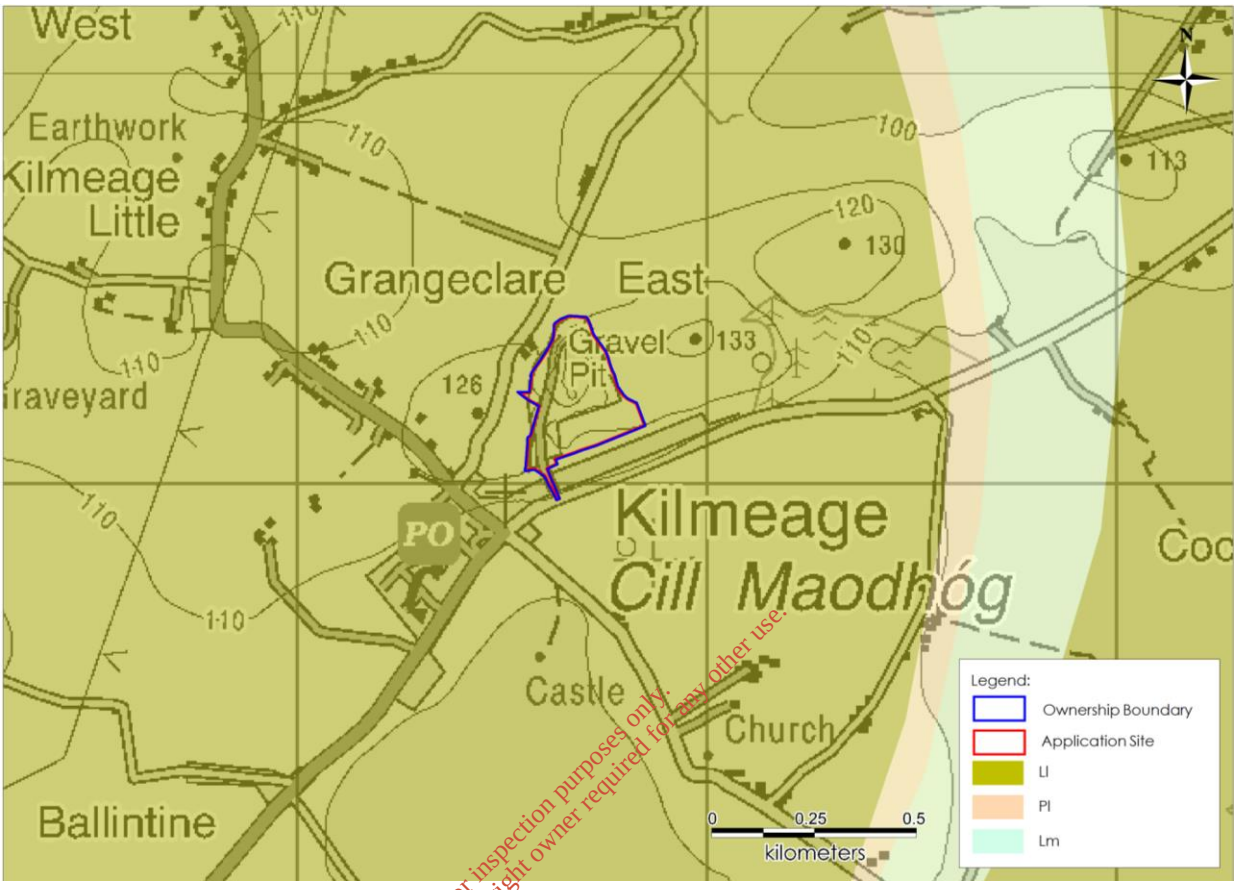

Figure E: Local Bedrock Aquifer Map

Groundwater vulnerability is mapped by the GSI as High (H). The site sits upon two Groundwater bodies (GWB) namely the Kildare (Code: IE_SE_G_077) and the Dublin (Code: IE_EA_G_008).

There are 7 no. mapped water wells in the area that are used for residential purposes in the vicinity of the proposed site.

2.5 SITE HYDROLOGY

The majority of the site is located in the South Eastern River Basin District (SERBD) in the Barrow catchments (Code: IE14_01) except for the southern tip of the site which is located in the Eastern River Basin District (ERBD), specifically the Liffey catchment (Code: IE19_01) (www.gsi.ie). There are no mapped streams/rivers in the vicinity of the site, however the Slate River exists ~2.4km north of the site. The Grand Canal is located ~1.76km north of the site. The Grand Canal begins at the River Liffey in Grand Canal Dock and continues through to the River Shannon with various branches, including a link to the River Barrow waterway at Athy.

In terms of local hydrology, the majority of the site lies within the Barrow Slate Surface Water Body (SWB) (Code: IE_SE_14_999), while the southern tip sits within the Liffey1_Lower_2 Surface Water Body (SWB) (Code: IE_EA_09_1870_2). Please refer to **Figure F.** Local Groundwater Body (GWB) and Surface water Body (SWB) status reports are available for download from www.wfdireland.ie.

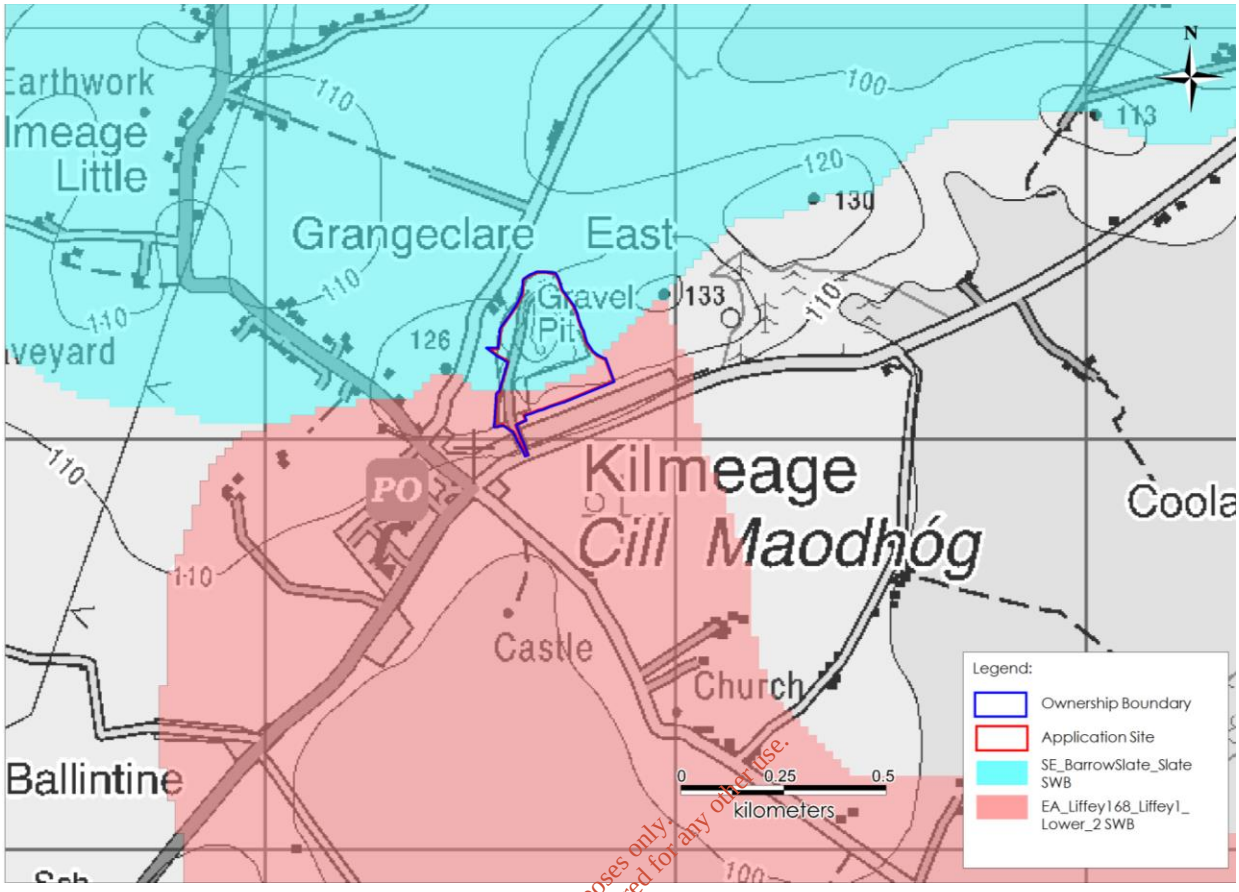

Figure F: Local Hydrology Map

2.6 DESIGNATED SITES

There are a number of designated sites in the vicinity of the study area:

- The Grand Canal a proposed Natural Heritage Area (pNHA) (Site code: 001387) ~1.76km northeast of the site;
- The Ballynafagh Lake Special Area of Conservation (SAC) (Site code: 001387) ~3.5km north west of the site;
- Ballynafagh SAC (Site Code: 000391)and pNHA ~4.8km northwest of the site; and,
- Mouds Bog SAC (Site Code: 002331) and pNHA ~3km south of the site.

None of these designated sites are directly hydrologically/hydrogeologically linked to the proposed development site and so are not of significant relevance to this hydrogeological assessment. **Figure G** shows a designated site map.

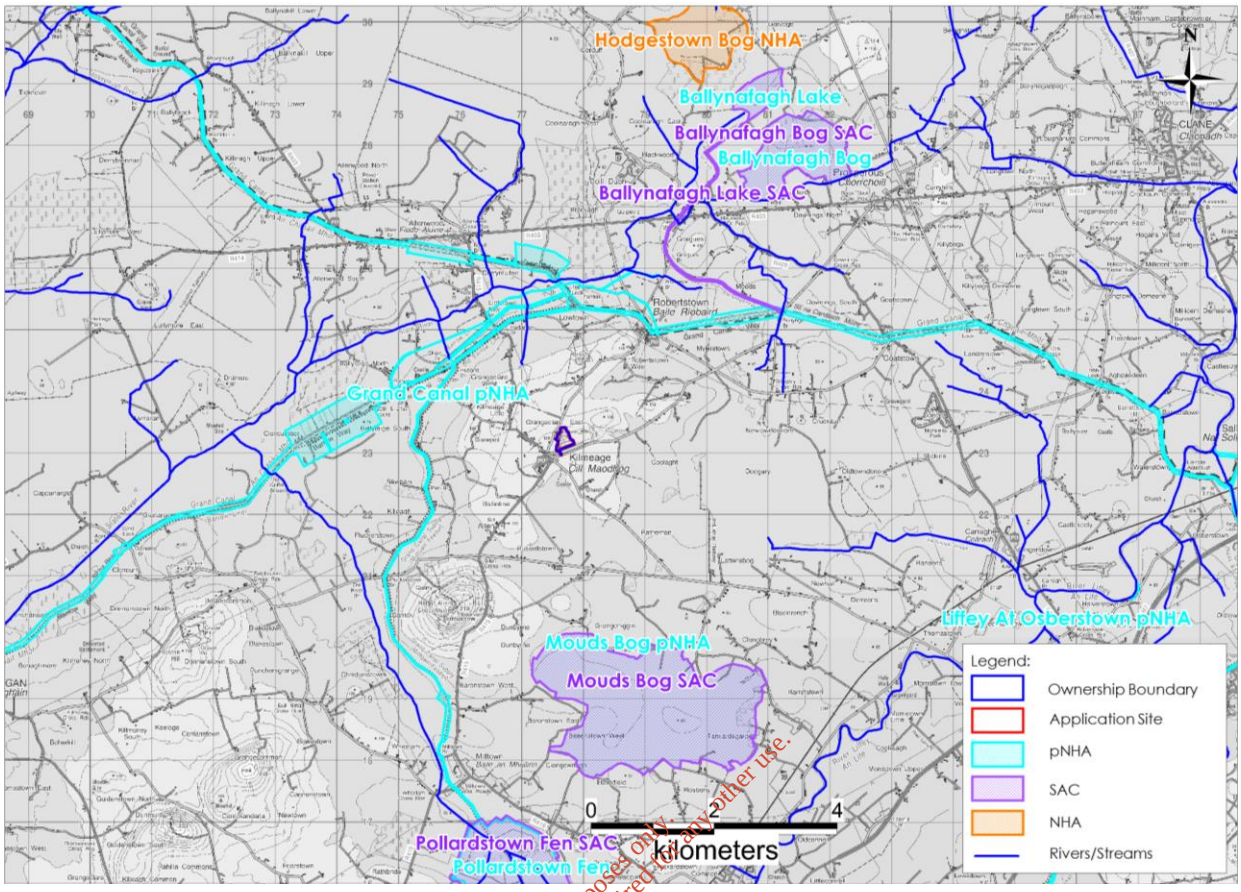

Figure G: Local Designated Sites Map

3.0 2015 SITE INVESTIGATION WORKS

3.1 SITE WALKOVER SURVEY

A site walkover survey was completed by Michael Gill of Hydro-Environmental Services on 16th November 2015. A photographic record of details recorded during the walkover survey is attached as **Appendix I**.

Following on from the initial walkover survey HES also completed trial pitting, groundwater well drilling, and groundwater sampling at the site as outlined below.

3.2 2015 TRIAL PITS

Site investigations included 15 no. trial pits carried out by HES on the 26th November 2015. A Summary of trial pit locations and elevations are shown on **Table 3.1**. In general, trial pit geology consisted of made ground with gravel fill. Subsoil encountered across the site was relatively consistent and comprised of soil and stones comprising brown and grey angular and rounded gravels and cobbles of limestone and sandstone in silty sand matrix, with broken blocks and bricks, and minor broken concrete and concrete pipe, with very occasional plastic, wire/metal, and timber fragments as is consistent with made ground. Trial pit logs are attached in **Appendix II**.

Table 3.1: Trial pit locations, elevations and total depths

Location ID	Easting	Northing	Ground Elevation (m OD)	Total Depth (m)
TP15-01	277621	223201	115.2	2.5
TP15-02	277657	223144	114.31	2.75
TP15-03	277737	223199	113.25	2.9
TP15-04	277741	223149	114.15	2.4
TP15-05	277816	223166	114.46	3.2
TP15-06	277777	223197	112.28	2.5
TP15-07	277627	223173	107.73	2.5
TP15-08	277683	223212	107.73	2.3
TP15-09	277708	223296	101.63	2.4
TP15-10	277613	223210	99.4	2.5
TP15-11	277615	223207	98.72	1.1
TP15-12	277615	223207	99.38	2.0
TP15-13	277644	223304	98.21	1.8
TP15-14	277669	223374	98.21	2.8
TP15-15	277704	223129	115.55	2.3

3.3 WELL DRILLING & WATER LEVEL MONITORING

2 no. groundwater monitoring wells were drilled at the site between 07th and 10th December 2015. The locations of these wells are illustrated on **Figure E** and coordinates are included in **Table 3.2**. Drilling logs for these on site wells are attached as **Appendix III**. These monitoring wells are intended to be permanent water level monitoring locations for the site.

There is also one existing water well at the site (PW-01), and a spring (GW-01) that emerges on the floor of the pit. The locations of these points are also presented in **Table 3.2** and **Figure E**.

Table 3.2: Monitoring point locations and elevations

Location I.D.	Easting	Northing	Elevation (m OD)	Ref Level Surveyed:
MW15-01	277,777	223,119	120.8	Top Of Casing
MW15-02	277,610	223,217	99.94	Top Of Casing
PW-01	277,652	223,205	99.54	Top Of Casing
GW-01(Spring)	277,610	223,217	99.1	Ground level

3.4 WATER SAMPLING

4 no. water samples at locations PW1 (existing well), MW15-01, MW15-02, and GW1 (spring on the site) were taken by HES on the 16th December 2015 and sent for laboratory analysis to an accredited lab (Fitz Scientific, Drogheda). An additional sample was taken from MW15-01 on 8th March 2016. Sample locations are shown on **Figure E** and results are summarised in **Table 3.3.** For comparison Environmental Objectives Ground Water Regulations (S.I. No. 9 2010) are shown in also. Certificates of Water Quality Results are attached in **Appendix IV**.

Field chemistry measurements were also recorded on site on 16th November and 16th December 2015. **Table 3.4** summarises these data.

Table 3.3: Summary of Groundwater quality data

Parameter	Units	Monitoring Location					Groundwater Criteria Assessment (see notes)
		Dec 2015	March 2016	Dec 2015	Dec 2015	Dec 2015	
		MW15-01	MW15-01	MW15-02	PW1	GW1	
Alkalinity	mg/L $CaCO_3$	377.47	396.44	236.79	306.19	360.54	No abnormal change(1)
Ammonia	mg/L as N	**2.20**	0.065	0.072	0.022	0.025	0.3 (1)
Arsenic	µg/L	0.293	0.404	0.780	<0.1	<0.1	7.5 (2)
Barium	µg/L	<1.62	<1.62	<1.62	<1.62	1.819	100 (1)
Boron	µg/L	**370.50**	**121.90**	**20.35**	**16.46**	**35.36**	1 (1)
Cadmium	µg/L	<0.09	0.666	<0.09	<0.09	<0.09	3.75 (2)
Calcium	mg/L	1.56	<0.60	<0.60	0.71	<0.60	200 (1)
Chloride	mg/L	**69.57**	**39.97**	**47.91**	20.59	**27.67**	24 - 187.5 (2, 3)
Chromium	µg/L	<2.14	<2.14	<2.14	<2.14	<2.14	37.5 (2)
Coliforms (Faecal)	cfu/100 ml	0	0	**4**	0	**3**	0 per 100ml (1)
Coliforms (Total)	cfu/100 ml	<10	**10**	**50**	**5**	**10**	0 per 100ml (1)
Conductivity	µS/cm (@ 25˚C)	**1770**	**1084**	613	627	752	1000 (1)
Copper	µg/L	0.919	0.907	0.138	<0.11	<0.11	1500 (2)
Cyanide	µg/L	<5	<5	<5	<5	<5	0.01 (1)
Dissolved Oxygen	mg/L	6.00	8.80	7.8	8.2	9.4	No abnormal change
Fluoride	mg/L	0.02	0.10	0.20	0.18	0.12	1 (1)
Iron	µg/L	46.36	21.44	10.51	2.947	<0.66	200 (1)
Lead	µg/L	0.077	<0.02	0.13	<0.02	<0.02	18.75 (2)
Magnesium	µg/L	<0.27	<0.27	<0.27	<0.27	<0.27	50 (1)
Manganese	µg/L	0.43	13.80	0.13	0.179	0.123	50 (1)
Mercury	µg/L	0.129	0.27	0.144	0.065	0.061	1 (1)
Nickel	µg/L	2.581	1.698	<0.14	<0.14	<0.14	15 (2)
Nitrate	mg/L as NO_3	10.89	2.24	16.73	22.18	**28.07**	25 (1)
Nitrite	mg/L as N	0.202	0.009	0.010	0.003	0.021	0.1 (1)
Nitrogen, total oxidised	mg/L as N	2.67	<0.28	3.79	5.01	6.32	No abnormal change(1)
pH	µg/L	7.60	7.10	7.4	7.3	7.2	>6.5 an <9.5 (1)
Phenols (Total)	µg/L	<0.10	<0.10	0.249	<0.10	<0.10	0.5 (1)
Phosphate (Ortho)	mg/L as P	<0.005	<0.005	<0.005	0.008	<0.005	0.03 (1)
Phosphate (Total)	mg/L as P	<0.024	0.311	0.028	<0.024	<0.024	
Potassium	mg/L	**17.64**	**7.815**	3.135	1.854	1.493	5 (1)
Selenium	µg/L	1.142	0.612	1.535	0.702	1.22	
Silver	µg/L	<0.33	<0.33	<0.33	<0.33	<0.33	
Sodium	mg/L	**471.80**	**1719**	**634**	**436.50**	**692**	150 (2)
Solids (Total dissolved)	mg/L	1515	819	379	379	471	1000 (1)
Sulphate	mg/L	**722.51**	**197.20**	49.17	29.50	33.73	187.5 (2)
TOC	mg/L	4.26	1.63	0.70	0.55	0.67	No abnormal change
TPH (>C10-40)	µg/L	<1	<1	<1	<1	<1	10 (1)
Zinc	µg/L	<0.41	<0.41	<0.41	<0.41	<0.41	100 (1)

(1) EPA (2003) Interim Report - Towards Setting Guideline Values for the Protection of Groundwater in Ireland
(2) SI 9 of 2010 European Communities Environmental Objectives (Groundwater Regulations, 2010, as amended 2012 (SI 149 of 2012)
(3) Assessment of the presence of saline or other intrusions - 24mg/L, Assessment for the impact of groundwater intended for drinking water by pollutants - 187.5mg/L

Table 3.4: Field chemistry data

Location	Temp °C	pH	Dissolved Oxygen mg/l	Conductivity (µS/cm)	Observations
MW15-01	11.38	6.58	4.68	1811	Cloudy, silty
MW15-02	10.8	7.06	-	673	-
PW1 (16/11)	8.1	-	-	623	-
PW1 (16/12)	10.78	6.96	5.54	689	Clear
GW1(spring)	10.11	6.8	9.61	834	-

Figure H: Site Investigations Map

3.5 WATER LEVEL MONITORING

Static groundwater level monitoring was recorded at the site in the on-site wells. Data are recorded in **Table 3.5**.

In addition a continuous datalogger was installed in PW-01 between 16th November 2015 and 16th December 2015. A water level hydrograph for this well is presented as **Figure I** below. The water level in this well varied between 4.2 and 5.2mbRef (reference level = top of steel casing). The minor variations along the hydrograph likely relate to pumping of the well as this is an active water source well for the site.

Based on groundwater data levels from the 16th December 2015 groundwater flow direction at the site is in a south-easterly direction towards the River Liffey.

Table 3.5: Monitoring point groundwater levels

Location I.D.	16/11/2015 w/l mbRef	16/11/2015 (mOD)	16/12/2015 w/l mbRef	16/12/2015 (mOD)
PW-01	4.65	94.89	4.2	95.34
MW15-01	-	-	25.65	95.15
MW15-02	-	-	4.39	95.55

Figure I: Water level hydrograph for PW-01 between 16/11/2015 and 16/12/2015

4.0 GEOLOGICAL ASSESSMENT

4.1 SITE GEOLOGY

The following is based on the available desk study information and the site investigation works completed at the site in late 2015.

4.1.1 Local Site Geology

The natural geology at the site comprises fluvio-glacial sand and gravel deposits over Old Red Sandstone bedrock. In some areas of the site the sand and gravel deposits are up to 28m in depth, and comprises interbedded sand layers, gravel layers and mixed sand and gravels. There is a high clay content in the gravels and this is borne out by the ability of the side walls of the gravels to stand at high angles. The sidewalls of the excavated pit are 15-25m high in places, and there is evidence that these have failed locally causing minor local slope failures. An example of the eastern side wall of the pit is shown on **Figure J**.

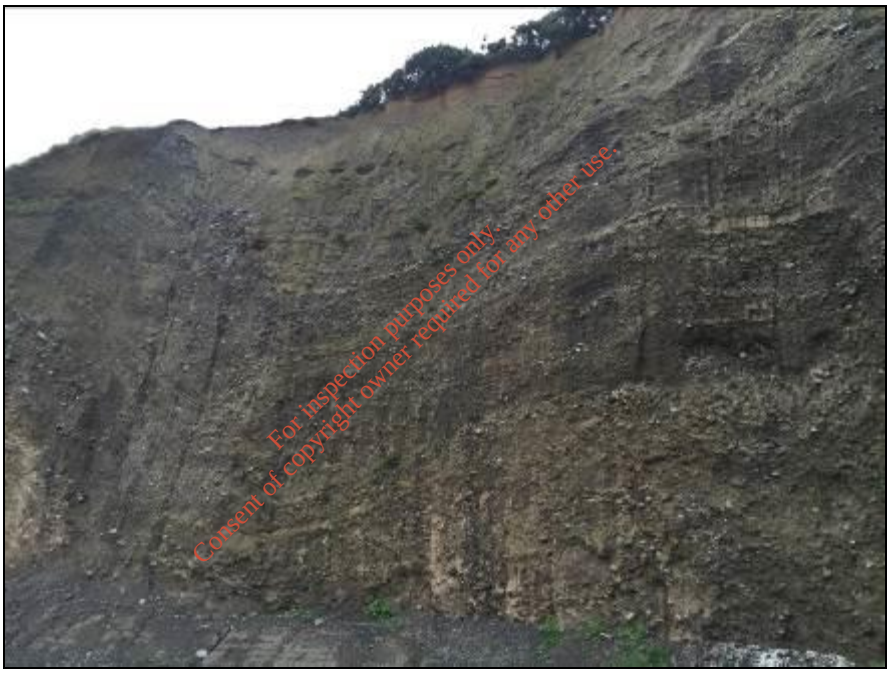

Figure J: Eastern side wall of pit (note almost vertical face)

The trial pits on the floor of the excavated pit show that a laminated clays/lacustrine strata also exists below the sands and gravel, although this appears to be intermitted and not continuous across the site. Where this is present it is solid/hard and dry and relatively impermeable. The spring that emerges on the floor of the pit may be related to groundwater flow above the lacustrine layer, which appears to be mostly present along the western boundary of the pit. An example of the lacustrine deposits found at the site [below the sand and gravel deposits] is illustrated on **Figure K**.

Figure K: Hard laminated clay and lacustrine deposits from TP15-12

The bedrock drilling below the site has proven that the site is underlain by red sandstone. Red sandstone drilling returns from drilling at MW15-02 are shown on **Figure L**.

Figure L: Red sandstone drilling returns from MW15-02

4.1.2 Geohazards

The site at Kilmeague is underlain by Devonian Old Red Sandstone bedrock. There are no known or evident karst solution features at the site. Surface water does seep into the pit excavation, and there is a small spring emergence on the floor of the existing pit, however these seepages are relatively small.

Given the gently undulating nature of the topography around the site and the fact that the underlying subsoil generally comprises glacial till, it is considered that the area around the application site is unlikely to be susceptible to any landslide hazard. No historical landslides are identified in the surrounding area by the Irish Landslides Working Group (GSI, July 2006).

The OPW flood database (www.floodmaps.ie) indicates there is no recorded flooding in the immediate vicinity of the site at Kilmeague. Given the elevated nature of the site above the wider region the risk of flooding at the site or locally as a result of the site infill is considered to be negligible.

4.1.3 Geological Heritage

The subsoil exposures within the existing pit are not considered of sufficient interest or importance to warrant designation or protection for earth science or geological heritage purposes.

The Geological Survey of Ireland web database shows that there are no or proposed Geological National Heritage sites in the immediate vicinity of the application site. The closest geological heritage site is the Hill of Allen to the southwest of the application site.

4.1.4 Agricultural Soils

Soils at the site were removed when extraction of sand and gravel at the site began. The proposed filling of the site and restoration will topsoil over will return the land to some form of agricultural use. This is a small positive impact.

4.1.5 Contaminated Land

As outlined above there was import of fill material to the application site under permit from Kildare County Council. This material was placed on the southern end of the site. There is therefore some Made Ground at the site. This Made Ground largely comprises imported glacial till and sand and gravels, mixed with site won material, and minor C&D content.

4.2 GEOLOGICAL IMPACT ASSESSMENT

The evaluation of impacts on the soil and geology at and in the vicinity of the existing site and proposed waste recovery facility at Kilmeague is based on a methodology similar to that outlined in the '*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes*' published by the National Roads Authority (2009).

The importance of existing soil and geology attributes identified above is assessed in **Table 4.1** below. The significance of the impacts on the soil and geology attributes is assessed in **Table 4.2** below.

Table 4.1: Importance of Geological Attributes in Vicinity of Application Site

Attribute	Status/occurrence	Importance
Geohazards	Erosion of exposed soils on existing slopes and pit boundaries.	Low
Geological Heritage	No heritage feature at or local to the site	None
Agricultural Soils	Productive soil previously removed from the site. Other soil in vicinity of site used for wide range of agricultural activities.	Low
Made Ground	Made ground and site won glacial till materials are of low economic or environmental value.	Low

Table 4.2: Significance of Impacts on Soil and Geology

Attribute	Status/occurrence	Importance
Geohazards	Elimination of risk of slope instability and local landslides.	Small, positive
Geological Heritage	No impact	None
Economic Geology	No further extraction at the site or sterilisation of potential aggregate resource	Negligible
Agricultural Soils	Restoration of former landform and placement of topsoil / subsoil on completion of backfilling will restore lands to basic agricultural use.	Small, positive
Made Ground	Importation of soil, stones and possibly small volumes of inert construction and demolition waste introduces a risk of potential soil contamination	Small, negative

4.2.1 Potential Impacts on Geology

The proposed waste recovery activity, in backfilling and restoring the existing pit void will create a new ground surface above the groundwater level, and will 'smooth' the site topography so as to better integrate it into the surrounding rural landscape.

The restoration of ground level above the groundwater table and the creation of a more uniform topography will facilitate the re-establishment of agricultural soil across the application site and its return to agricultural use.

As this proposal constitutes a small improvement on an attribute of low importance, this impact is assessed as being minor and positive.

In the absence of any controls, the importation of soil, stones and small quantities of inert construction and demolition waste could introduce a risk of potential soil contamination at the application site. The 2015 ground investigation at the site (refer to **Appendix II** and **III**) did not reveal any evidence of systemic soil contamination across the sand and gravel pit site.

Assuming the proposed waste recovery facility is run in accordance with best waste management practice, this risk of potential contamination is likely to remain small. Given that the risk of introducing contamination into existing relatively degraded, low value subsoils and/or rock is small to moderate, the significance of this potential impact is assessed as minor and negative.

4.2.2 Do-nothing Scenario

If the application site is not restored to a similar ground level as the land, and it remains essentially unchanged from its existing layout, the limited, or non-existent soil cover at the site will mean that there is limited, or no protection for groundwater quality. Left unmanaged over time, there is also a small risk that the void slope or face instability could arise around the existing pit, most likely in the form of localised soil slope instability and slope collapse. This is already occurring at the site to a very small extent, and has been managed to date by berming and re-vegetation.

4.2.3 Proposed Mitigation Measures

In order to minimise the risk of importing and introducing contaminated soil to the application site, management systems will be introduced to establish the source of imported materials in advance and to confirm that they are inert and in compliance with the sites acceptance criteria.

Once received at the site a multiple level soil testing regime will be established to test the material for compliance and will include:

- Comprehensive on-site verification, comprising visual inspection and record of all imported soil unloading at the site;
- Basic characterisation testing covering a wide range of parameters to determine the leaching behaviour of the inert soils imported to site; and,
- Frequent compliance testing covering a limited range of key soil parameters.

During backfilling of the pit, all temporary surfaces will be graded (shaped to formed suitable runoff in desired directions) to facilitate over-ground run-off of surface water, thereby minimising the volume of rainfall percolating through the backfilled material. This will further reduce any residual risks of any potential contaminants leaching into the soil and bedrock (or groundwater).

In order to confirm that there are no residual risks to in-situ soil or bedrock, monitoring of groundwater quality will continue for the duration of the pit void backfilling works and for a short aftercare period.

In order to maximise the future agricultural potential of the restored land, a minimum 150mm thick layer of topsoil and 300mm thick layer of subsoil should be placed over the backfilled materials. The final landform will also be graded so as to facilitate over-ground run-off of surface water to the pond area where the runoff will infiltrate to the groundwater.

Suitable nutrient application planning for the restored lands will be developed by an agricultural advisor in order to ensure that the restored lands are not over fertilised while grassland is being established at the restored surface.

4.2.4 Residual Impacts on Soils and Geology Aspects

There will be no significant residual impacts on the geological environment at the site.

4.2.5 Interaction with Other Environmental Receptors

The potential risks associated with the introduction of imported fill / soil when backfilling and restoring the application site could have implications for underlying groundwater quality, were infiltrating rainfall to percolate down through contaminated fill material. However there will be controls in place to ensure contaminated material is not imported to this site. Furthermore this water related aspect this assessment is discussed in more detail in Section 5 below.

When successfully completed however, the proposed backfilling and restoration works will provide an increased thickness of soil and subsoil cover above the existing groundwater table, thereby reducing the potential risk of future groundwater contamination.

5.0 HYDROGEOLOGICAL ASSESSMENT

5.1 SITE HYDROGEOLOGY

There are no significant surface water features at or in the vicinity of the site. There is a perched pond to the east of the site, but this is a local feature and has not and will not be impacted by the proposed site development works.

The majority of the site is located in the South Eastern River Basin District (SERBD) in the Barrow catchments (Code: IE14_01) except for the southern tip of the site which is located in the Eastern River Basin District (ERBD), specifically the Liffey catchment (Code: IE19_01) (www.gsi.ie). There are no mapped streams/rivers in the vicinity of the site, however the Slate River exists ~2.4km north of the site. The Grand Canal is located ~1.76km north of the site.

There are no streams or rivers in the area of the site. There is a small spring in the base of the excavated sand and gravel pit. Groundwater emerging from the spring flows across the floor of the pit, and then enters a soakaway at the northern edge of the site and recharges back into the groundwater system.

The sand and gravel at the site is not mapped as forming part of the Robertstown sand and gravel aquifer. Bedrock aquifer classification for the Old Red Sandstone is Locally Important - Bedrock which is Generally Moderately Productive.

There is some residual deposits remaining in the floor of the pit, and the pit has not been excavated to the regional groundwater table. There is between 2 to 8m of natural subsoils over the water table, and this variation is shallowest in the floor of the existing pit. A groundwater vulnerability of High has been assigned to the site, and the site investigation completed to date corroborates this classification.

Groundwater at the site occurs at approximately 95-96 mOD, and probably has some minor seasonal variations (of 1-2m). Groundwater flow at the site is mapped as being to the southeast towards the River Liffey.

Base line groundwater quality at the site is provided in **Table 3.3.**

Groundwater data from the site indicates several parameters that are elevated above Groundwater Assessment Criteria. Many of the elevations occur on indicator parameters, e.g. EC, chloride, nitrate, ammonia, microbial pathogens, but there are also elevated concentrations of metals such as Boron (in MW15-01). There may be a combination of sources causing these elevated parameters, such as the fill material (from the permit backfilling phase), local septic tanks, or local landspreading of organic wastes.

5.2 HYDROGEOLOGICAL IMPACT ASSESSMENT

The impact of the proposed remediation on hydrology and hydrogeology are assessed in this section. The methodology applied in the assessment is a qualitative risk assessment methodology in which the probability of an impact occurring and the magnitude of the impact, if it were to occur, are considered.

This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the development. This approach allows effort to be focused on reducing risk where the greatest benefit may result. The assessment of risk is outlined below in **Table 5.1**.

Table 5.1: Matrix Used to Assess Potential Impacts

Probability of Occurrence	Magnitude of Potential Impacts			
	Severe	**Moderate**	**Mild**	**Negligible**
High	High	High	Medium	Low
Medium	High	Medium	Low	Near Zero
Low	Medium	Low	Low	Near Zero
Negligible	Low	Near Zero	Near Zero	Near Zero

The magnitude of potential impacts in relation to geology, hydrogeology and hydrology are detailed in **Table 5.2** below.

Table 5.2: Magnitude of Potential Hydrological and Hydrogeological Impacts

Magnitude	Potential Impacts
Negligible	• No impact or alteration to existing important geological environs or important soil settings (*i.e.* valuable agricultural land); • No alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; • No alteration to groundwater recharge or flow mechanisms; and, • No pollution or change in water chemistry to either groundwater or surface water.
Mild	• Some loss of important soils or peat, but which has no long term impact • Minor or slight changes to the watercourse, hydrology or hydrodynamics; • Changes to site resulting in slight increase in runoff well within the drainage system capacity; • Minor changes to erosion and sedimentation patterns; and, • Minor changes to the water chemistry.
Moderate	• Slope failure or instability which may cause foundation problems, loss of extensive areas of important soils or peat, damage to important geological structures / features; • Some fundamental changes to watercourse, hydrology or hydrodynamics; • Changes to site resulting in an increase in runoff within system capacity; • Moderate changes to erosion and sedimentation patterns; and, • Moderate changes to the water chemistry of surface runoff and groundwater.
Severe	• Slope failure or instability which results in loss of life, permanent degradation and total loss of peat environment across the entire development site, loss of important geological structure/feature; • Wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • Changes to site resulting in an increase in runoff with flood potential; • Significant changes to erosion and sedimentation patterns; and, • Major changes to the water chemistry or hydro-ecology.

In addition to their nature and significance, the potential impacts will be assessed in terms of their duration, whether they are direct or indirect impacts, and also if the impact will be cumulative. The following sections identify the potential impacts of the proposed development on the hydrological and hydrogeological environments. It also assesses the likelihood of occurrence of each identified impact in accordance with **Table 5.1** and **Table 5.2**.

5.2.1 Potential Impacts on Surface Water

There are no significant surface water features within the site boundary. There are no local streams or rivers that can be impacted by the proposed development.

Potential impacts on surface water receptors are therefore not carried forward for impact assessment as there are no local receptors.

Impacts on the spring and groundwater are dealt with below.

5.2.2 Potential Impacts on Groundwater

Given the hydrogeological setting, it is considered that the proposed development has the potential to impact on groundwater in terms of both the groundwater quality and the groundwater flow regime. These are considered separately below.

5.2.2.1 Groundwater Quality

During the development and operation of the site there is a risk of groundwater pollution from the following potential sources:

- Accidental spillage of fuels and lubricants by construction plant placing the inert fill and other operational procedures;
- Increase in suspended solids and potential for contaminated runoff entering groundwater during development of the site; and,
- Rogue loads of contaminated material being deposited at the site.

Without mitigation the probability of occurrence of spillage of fuels, lubricants and other potentially contaminative liquids is '***low to medium***' due to the area of the site and number of vehicles that will be using the site and the magnitude of impact likely to be '***moderate***'. Therefore the overall risk to groundwater, without mitigation, is '***low to medium***'.

Without mitigation the probability of occurrence of an increase in suspended solids and potential for contaminated runoff entering groundwater during operation of the facility is '***low***' to '***medium***' due to the time frame over which this may occur and the potential for infiltrating rainfall to mobilise fines in loose backfilled materials and carry them toward the groundwater body (much of the imported fill will be high in silt / clay content). The magnitude of this potential unmitigated impact is '***mild***', the overall risk to groundwater, without mitigation, is '***low***' to '***medium***'.

Without mitigation the probability of occurrence of a rogue load which may have the potential to contaminate groundwater at the site is '***medium***' and the magnitude of impact is considered to be '***moderate***' depending on where the rogue load is deposited. The overall impact is considered to be '***medium***'.

5.2.2.2 Groundwater Flow / Recharge

Without mitigation, or consideration of operational procedures, infilling the void on the pit floor with low permeability inert fill material has the potential to create a low permeability zone or zones and therefore impair recharge/infiltration. This has potential to alter the groundwater recharge patterns at the site. Without mitigation the probability of occurrence is '***medium***' and the magnitude of impact is '***mild***'. Therefore the overall risk to groundwater flow, without mitigation, is '***low***'.

With reference to the potential impact on groundwater flow, the regional permeability of the aquifer is described as being moderate with flow along faults and fissures; however the local

permeability in the pit is moderate to high in the remaining sands and gravels. The groundwater table is below the proposed fill zone, therefore It is not envisaged that the infilling with inert soil material will influence the regional groundwater flow towards the River Liffey in any way. There may be some local alteration to how recharge occurs at the site, but in terms of the overall impacts on the groundwater system this is likely to be negligible. Any runoff that occurs from the infilled void will likely recharge to groundwater at the margins of the fill area, and there will be no net loss of recharge. Without mitigation the probability of occurrence is '***medium***' and the magnitude of impact is '***mild***' and therefore the overall impact on groundwater flow is therefore considered to be '***low***' as limited local groundwater recharge will be maintained in the pit.

Without mitigation, or consideration of operational procedures, infilling the void on the pit floor with low permeability inert fill material has the potential to alter the local spring flow that occurs on the floor of the pit. This has potential to alter the groundwater flow patterns at the site. Without mitigation the probability of occurrence is '***high***' and the magnitude of impact is '***moderate***'. Therefore the overall risk to groundwater flow, without mitigation, is '***high***'.

5.2.3 Summary of Potential Impacts

A summary of potential impacts without mitigation measures is presented in **Table 5.3** below:

Table 5.3: Summary of Unmitigated Risk and Magnitude of Potential Impacts at Kilmeague Pit

Potential Impact	Spatial Impact, Duration, Direct/Indirect	Probability of Occurrence	Magnitude of Impact	Significance of Effect	Mitigation Required
Groundwater Quality					
Spillages of fuel	Local, Short Term, Direct	Low – Medium	Moderate	Low - Medium	Yes
Release of suspended solids	Local, Long Term, Direct	Low – Medium	Mild	Low - Medium	Yes
Rogue load of contaminated material	Local, Short Term, Direct	Medium	Moderate	Medium	Yes
Groundwater Flow / Recharge to Aquifer					
Impermeable barrier to groundwater flow	Local, Long Term, Direct	Medium	Mild	Low	No
Reduction in recharge to aquifer	Local, Long Term and Direct	Medium	Mild	Low	No
Disruption of local spring flow	Local, Long Term and Direct	High	Moderate	High	Yes

Review of **Table 5.3** indicates that if no mitigation measures are incorporated into the pit backfilling operation, there is potential for the site to have a moderate impact to the aquifer by locally polluting groundwater and altering groundwater flow patterns. The impacts are all local, but range from short-term to long-term. It is considered that if the identified potential impacts on either groundwater quality or groundwater flow were all to occur there would be a cumulative effect, which would increase the significance of the impact to Medium.

It is therefore recommended that the mitigation measures outlined in the following section are incorporated to reduce the potential impacts on groundwater and surface water as outlined above.

5.2.4 Do Nothing Scenario

Were the proposed backfilling of the application site not to proceed as envisaged, it is unlikely that a portion of the land at least could ever be put to productive use and that it would remain as a scar on the landscape. The boundaries of the site would also remain at risk from local slope failure.

5.2.5 Proposed Mitigation Measures

Proposed mitigation measures required to reduce the potential moderate impacts to acceptable levels are identified in this section. These measures either reduce the likelihood of an event occurring, or reduce the magnitude of the consequences should the event occur. It should be noted that several of the mitigation measures proposed would have a positive effect on more than one potential impact.

In order to mitigate against the risk of pollution to groundwater and surface water occurring during operation of the site, the following management measures will be included:

- wherever possible a traffic management system will be put in place to reduce the potential conflicts between vehicles, thereby reducing the risk of a collision;
- a site speed limit would be enforced to further reduce the likelihood and significance of collisions;
- all plant would be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids/liquors;
- refuelling of vehicles would either be undertaken on the sealed hardstand area adjacent to the maintenance shed or from a mobile double skinned fuel bowser in order to minimise the risk of uncontrolled release of polluting liquids/liquors;
- maintenance of plant and machinery would be undertaken in the existing covered workshops or off-site, as appropriate, to minimise the risk of uncontrolled release of polluting liquids;
- spill kits will be made available on-site to stop the migration of any accidental spillages, should they occur;
- the flow path for the spring on the floor of the pit will be maintained by placing a stone drain from the spring emergence to the recharge point in the north of the pit. This will maintain this flow path and prevent backing up of the groundwater flow;
- the provenance of imported waste (inert soil) loads should be recorded and be visually inspected at the site in accordance with a detailed Material Acceptance and Handling Plan. Where possible, imported soils should be tested to confirm they are inert prior to deposition at site; and,
- The key issue with recharges to maintaining the groundwater flow regime below the site is the requirement to maintain a flow link between the spring emergence and the pond in the northern corner of the pit where the spring water recharges back into the ground. In order to maintain this pathway a French drain will be placed with a land drain core, between the spring emergence and the northern recharge area. The drain will be covered with terram, and covered with at least 2m of natural site won sand and gravel. The fill material will be placed over this drain and site won subsoil cover.

These mitigation measures would reduce the potential impacts as follows:

- Spillage of fuels and lubricants from '*low-medium*' to '*low*';
- Increased suspended solids and contaminants in surface water discharges from '*low to medium*' to '*low*'; and
- Contamination from rogue loads from '*medium*' to '*near zero*'.
- Alteration of spring flow from '*high*' to '*low*'.

5.2.6 Residual Impacts on Water and Hydrology Aspects

There are no significant residual impacts with respect to groundwater and/or surface water provided the appropriate mitigation measures are implemented. It is therefore considered that the siting of an inert recovery facility in this location is acceptable and that there will be no significant short term or long term impacts on groundwater and/or surface water.

5.2.7 Interactions with Other Environmental Receptors

There will be no significant interaction from the water environment with other local environmental receptors.

5.2.8 Groundwater Monitoring

A number of measures are proposed in order to monitor any potential impact of the proposed operations on groundwater at the site. No surface water monitoring is proposed as there are no natural water features at or close to the site.

At the present time, it is envisaged that groundwater sampling and testing will be undertaken on a bi-annual basis at the 3 No. groundwater monitoring wells. Groundwater levels in the wells will also be recorded on a bi-annual basis. The existing groundwater monitoring well locations are shown on **Figure E**.

Baseline sampling indicates elevated indicator parameters in MW15-01. In order to assess ongoing water quality in this area of the site it is important to continue to monitor local groundwater quality to establish seasonal trends. Sampling of well MW15-01 should be completed on a quarterly basis.

Groundwater samples will be tested for a range of physical and chemical parameters in order to assess water quality and detect possible contamination at the site. The groundwater quality in the monitoring wells will be tested for the following parameters:

- pH [pH value]
- Suspended Solids (mg/l)
- COD (mg/l)
- Total Coliforms (cfu/100mls)
- Ammonia (mg/l NH_3-N)
- Nitrate (mg/l NO_3)
- Nitrite (mg/l)
- Oils, Fats & Grease (mg/l)
- Phosphorus, total (mg/l as P)
- Ortho Phosphate (mg/l as P)
- Heavy metals (µg/L)
- TPH (mg/l)
- PRO (mg/l)
- DRO (mg/l)

During backfill operations Mw15-02 and PW-01 will need to be replaced as these will be covered over. Prior to this occurring each well will be decommissioned and back grouted to ensure the well annulus does not act as a pathway for migration to the groundwater system.

Groundwater sampling and monitoring will continue as long as backfilling activities continue and for a short period thereafter.

6.0 CONCLUSIONS & RECOMMENDATION

6.1 CONCLUSIONS

The groundwater and surface water regimes at the application site have been assessed with reference to information held by the Geological Survey of Ireland, the Environmental Protection Agency and others. This information has been supplemented with site specific investigation information.

The potential impacts of the proposed development upon hydrogeological and hydrological environment have been identified and assessed, and where appropriate, mitigation measures have been incorporated into the design of the development.

6.2 RECOMMENDATIONS

Further groundwater monitoring should be completed to provide ongoing assessment of groundwater quality and seasonal trends and variations of same below the site.

* * * * * * * * * * * *

7.0 REFERENCES

Environmental Protection Agency	2011	Guidance on the Authorisation of Discharges to Groundwater (2011).
Environmental Protection Agency (EPA)		Interactive Web Database of surface water quality information for local and regional surface watercourses. www.epa.ie.
Geological Survey of Ireland	1995	Geology of Sheet 16 (Geology of Kildare-Wicklow)
Geological Survey of Ireland Information – Groundwater Section	2009	Geological Survey of Ireland Information Libraries– Groundwater Section. Geological Survey Well Database (www.gsi.ie).
Geological Survey of Ireland	2003	Kildare Groundwater Body Report – Summary of initial characterisation.
Geological Survey of Ireland	2003	Dublin Groundwater Body Report – Summary of initial characterisation.
National Roads Authority	2009	*Guidelines for the Assessment of Geology, Hydrology and Hydrogeology for National Road Schemes'* published by the National Roads Authority

APPENDIX I
SITE WALKOVER PHOTOS

APPENDIX II
TRIAL PIT LOGS

TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-01

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277,621
NORTHING: 223,101
ELEVATION: 115.52mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				115.52	0		Ground Surface
							MADE GROUND Soil and stones comprising brown and grey angular and rounded gravels and cobbles of limestone and sandstone, broken blocks and bricks, minor broken patio slabs, and minor broken concrete, in a silty sand matrix with local pockets of boulder clay fill, with very occassional plastic, metal, and timber fragments.
					1		
					2		
				113.02			E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 2.2m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.5m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE as shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-02

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277657
NORTHING: 223144
ELEVATION: 114.31mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				114.31	0		Ground Surface
							MADE GROUND Soil and stones comprising brown and grey rounded cobbles of limestone and sandstone (200-300mm) in a sand matrix with thin Cl. 804 cover (50mm) at ground levelts.
				113.31	1		**MADE GROUND** Boulder Clay fill comprising stiff silty clay with angular and rounded gravels and cobbles in clay matrix with broken blocks and bricks, and with very occassional plastic, metal and timber fragments.
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				111.56	2		E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 3.5m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.75m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-03

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277737
NORTHING: 223199
ELEVATION: 113.25mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				113.25	0		Ground Surface
					1		**MADE GROUND** Soil and stones comprising brown, black and grey angular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix with local pockets of boulder clay fill, with occassional broken blocks and bricks, and minor broken concrete, with very occassional broken slates, plastic, metal, and timber fragments.
					2		
				110.35	3		E.O.H 2.5mbgl Total Depth of Trial Pit
					4		
					5		

REMARKS:

PIT LENGTH: 3.0m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.9m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-04

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277741
NORTHING: 223149
ELEVATION: 114.15mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				114.15	0		Ground Surface
							MADE GROUND Soil and stones comprising brown, black and grey angular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix with local pockets of boulder clay fill, with occassional broken blocks and bricks, and minor broken concrete, with occasional plastic, red bricks, metal, and timber fragments. pocket of black soil encountered at 1.5mbgl, but there was no organic or hydrocarbon smell from this material.
					1		
					2		
				111.75			E.O.H 2.5mbgl
					3		Total Depth of Trial Pit
					4		
					5		

REMARKS:

PIT LENGTH: 3.2m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.4m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-05

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277,816
NORTHING: 223,166
ELEVATION: 111.46mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				111.46	0		Ground Surface
					1		**MADE GROUND** Soil and stones comprising brown, black and grey angular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix with local pockets of boulder clay fill, with occassional whole and half blocks (solid and cavity blocks), and minor broken concrete, very minor broken ceramics, and very occassional plastic, broken red bricks, metal, plaster board, broken drainage pipe, very occassional plastic bottles and timber blocks and fragments. Pocket of black material containing many tree branches and roots encountered between 1 to 2 mbgl, there was an organic smell from this material but no hydrocarbon smell.
					2		
				108.26	3		E.O.H 2.5mbgl Total Depth of Trial Pit
					4		
					5		

REMARKS:

PIT LENGTH: 3.6m
PIT BREADTH: 0.8m
FINAL DEPTH: 3.2m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-06

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277777
NORTHING: 223,197
ELEVATION: 112.28mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				112.28	0		Ground Surface
					1		**MADE GROUND** Soil and stones comprising light brown and grey angular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix, with loose poket of pea gravel at 0.7mbgl, and very occasssional broken ceramics, plastic, and timber fragments.
					2		
				109.78			E.O.H 2.5mbgl
					3		Total Depth of Trial Pit
					4		
					5		
					6		
					7		
					8		

REMARKS:

PIT LENGTH: 2.7m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.5m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-07

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277627
NORTHING: 223,173
ELEVATION: 107.73mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				107.73	0		Ground Surface
					1		**MADE GROUND** Soil and stones comprising brown and grey subangular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix. This appears to be natural sand and gravel material possibly moved from else where in the quarry, with no external fill material evident.
					2		
				105.23			E.O.H 2.5mbgl
					3		Total Depth of Trial Pit
					4		
					5		
					6		
					7		
					8		

REMARKS:

PIT LENGTH: 2.8m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.5m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-08

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277683
NORTHING: 223,212
ELEVATION: 104.61mOD

HYDRO-ENVIRONMENTAL SERVICES

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				107.73	0		Ground Surface
					1		**MADE GROUND** Soil and stones comprising grey/brown subangular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix, with plastic straps, and other minor plastics, occassional timber fragments, and plastic pipes and broken red bricks. Initial layer of large rounded cobbles to 0.4mbgl with thin sand and garvel cover at ground level.
				105.43	2		E.O.H 2.5mbgl
					3		Total Depth of Trial Pit
					4		
					5		
					6		
					7		
					8		

REMARKS:

PIT LENGTH: 2.5m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.3m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-09

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277708
NORTHING: 223296
ELEVATION: 101.63mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				101.63	0		Ground Surface
							MADE GROUND Loose, brown sand and gravel
				100.78	1		**MADE GROUND** Soil and stones comprising grey/brown boulder clay with clasts of limestone and sandstone, with occassional plastics, timber fragments, and occassional broken blocks and red bricks.
				99.23	2		E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 2.7m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.4m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-10

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0 | **DATE STARTED:** 26/11/2015 | **EASTING:** 277613

SITE: Kilmeague, Co. Kildare | **LOGGED BY:** M.Gill | **NORTHING:** 223210

CLIENT: N & C Enterprises | **CONTRACTOR:** N & C | **ELEVATION:** 99.4mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				99.40	0		Ground Surface
							MADE GROUND Soil and stones comprising grey/brown subangular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix.
				98.60			
				98.30	1		**MADE GROUND** Soil and stones comprising grey clay fill
							MADE GROUND Soil and stones comprising red clay fill, with pockets of loose sand and gravel and pea gravel fill. Water inflow from pea gravel fill at 2mbgl. (red clay appears to be natural to site, but has been previously excavated).
				97.30	2		Stiff grey plastic CLAY (marl). (this layer is natural and is undisturbed).
minor water inflow at 2mbgl No olfactory or visual indications of contamination ~5% C&D waste				96.90			E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 3.0m

PIT BREADTH: 0.8m

FINAL DEPTH: 2.5m

EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-11

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277645
NORTHING: 223224
ELEVATION: 98.72mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Minor water inflow at 2mbgl Hole abandoned due surface water inflow to trial pit No olfactory or visual indications of contamination ~5% C&D waste				98.72	0		Ground Surface
							MADE GROUND Soil and stones comprising grey/brown subangular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix.
				97.62	1		E.O.H 2.5mbgl Total Depth of Trial Pit
					2		
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 2.0m
PIT BREADTH: 0.8m
FINAL DEPTH: 1.1m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-12

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277607
NORTHING: 223270
ELEVATION: 99.38mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination ~5% C&D waste				99.38	0		Ground Surface
				99.08			**MADE GROUND** Cl. 804 gravel fill
				98.58			**MADE GROUND** Soil and stones comprising grey clay fill
				97.58	1		Brown/Red laminated CLAY with clasts of limestone and sandstone. Very low permeability natural clay deposit.
				97.38	2		Grey plastic CLAY (marl). E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 2.4m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.0m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-13

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277644
NORTHING: 223304
ELEVATION: 98.21mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
water inflow at 1.4mbgl No olfactory or visual indications of contamination Hole abnadoned due to collapsing side walls due to water inflow.				98.21	0		Ground Surface
							MADE GROUND Soil and stones comprising grey/brown subangular and rounded gravels and cobbles of limestone and sandstone in a silty sand matrix. Possibly reworked natural quarry won material with water sitting on underlying clay layer (i.e. perched water)
					1		
				96.41			E.O.H 2.5mbgl
					2		Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 2.9m
PIT BREADTH: 0.8m
FINAL DEPTH: 1.8m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-14

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277669
NORTHING: 223374
ELEVATION: 99.23mOD

HYDRO-ENVIRONMENTAL SERVICES

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
No olfactory or visual indications of contamination				98.21	0		Ground Surface
							MADE GROUND Cl 804 fill material Loose grey/brown, clayey, very sandy, subangular and rounded GRAVEL of sandstone and limestone, with increasing angular cobbles of sandstone at depth (possible broken weathered bedrock cobbles). Teeth of excavator scrapping along hard surface at 2.6mbgl, and this may be top opf weathered bedrock.
				96.41	2		E.O.H 2.5mbgl Total Depth of Trial Pit

REMARKS:

PIT LENGTH: 4.5m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.8m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE as shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TP15-15

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N & C Enterprises

DATE STARTED: 26/11/2015
LOGGED BY: M.Gill
CONTRACTOR: N & C

EASTING: 277704
NORTHING: 223129
ELEVATION: 115.55mOD

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
Dry - no water encountered No olfactory or visual indications of contamination <5% C&D waste				115.55	0		Ground Surface
							MADE GROUND Cl. 804 fill Soil and stones comprising brown and grey angular and rounded gravels and cobbles of limestone and sandstone in silty sand matrix, with broken blocks and bricks, and minor broken concrete and concrete pipe, with very occassional plastic, wire/metal, and timber fragments.
					1		
					2		
				113.25			E.O.H 2.5mbgl Total Depth of Trial Pit
					3		
					4		
					5		

REMARKS:

PIT LENGTH: 3.0m
PIT BREADTH: 0.8m
FINAL DEPTH: 2.5m
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

PAGE 1 of 1

SCALE as shown

HYDRO-ENVIRONMENTAL SERVICES 22 Lower Main Street Dungarvan Co. Waterford Tel: 058-44122 Fax: 058-44244 Email: info@hydroenvironmental.ie

APPENDIX III
MONITORING WELL DRILLING LOGS

MONITORING WELL LOG

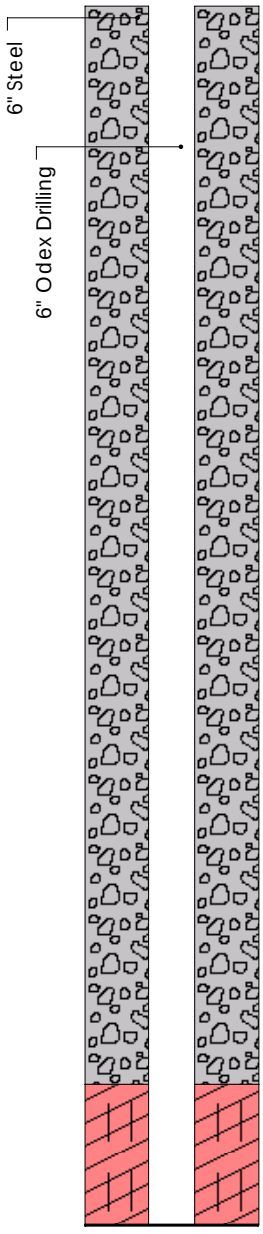
WELL NUMBER: MW15-01

HYDRO-ENVIRONMENTAL SERVICES

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N and C Enterprises Ltd.
DRILLING CONTRACTOR: Leo Dempsey Drilling

DATE STARTED: 07/12/2015
DATE FINISHED: 10/12/2015
LOGGED BY: M. Gill
DRILLING TYPE: DTH

EASTING: 277781
NORTHING: 223121
ELEVATION: 99.94



Elevation	Meters Below Ground Surface	Comments	Formation Description
99.94	0		Ground Surface
	5		Dry, loose, grey and brown, slightly silty, SAND and GRAVEL with lenses of free SANDS and rounded GRAVELS. Interbedded SAND and GRAVEL beds with small CLAY/SILT content with occasional cobble lenses.
	10		
	15		
	20	Difficult Drilling though gravel/cobbles loose	
	25		
	30		
	35		
	40		
	45		
	50		
	55		
	60		
	65		
	70		
	75		
	80		
	85		
	90		
7.94	95	Small water strike 50gal/hr	**BEDROCK** Red, old red sandstone bedrock, solid with no fracturing/weathering.
-4.06	100		
	105		End of Hole - 104mbgl
-10.06	110		

REMARKS

Logged following air rotary drilling

PAGE 1 of 1

SCALE As Shown

HYDRO-ENVIRONMENTAL SERVICES 22 Lower Main Street Dungarvan Co. Waterford Tel: 058-44122 Fax: 058-44244 Email: info@hydroenvironmental.ie

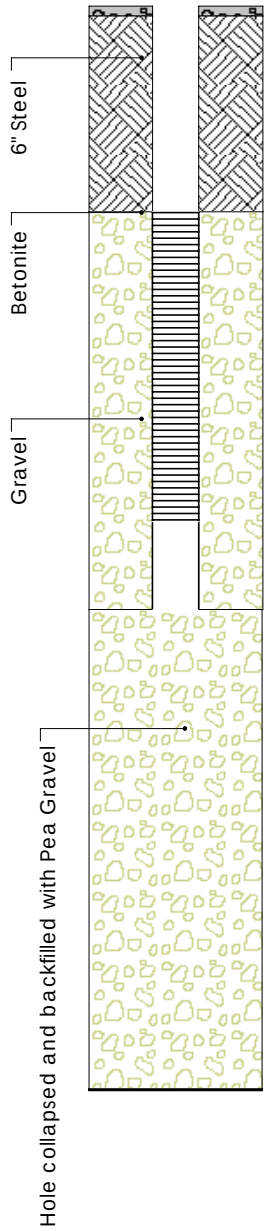
MONITORING WELL LOG

WELL NUMBER: MW15-02

PROJECT NUMBER: P1314-0
SITE: Kilmeague, Co. Kildare
CLIENT: N and C Enterprises Ltd.
DRILLING CONTRACTOR: Leo Dempsey Drilling

DATE STARTED: 07/12/2015
DATE FINISHED: 07/12/2015
LOGGED BY: M. Gill
DRILLING TYPE: DTH

EASTING: 277678
NORTHING: 223374
ELEVATION: 120.8

Well Completion Description	Flush Colour	H2O Inject.	Water Strikes	Comments	Elevation	Meters Below Ground Surface	Lithology	Formation Description
					120.80	0		Ground Surface
								Loose SAND and GRAVEL.
					118.80			
								Brown clayey SAND and GRAVEL (TP15-15).
					114.80	5		
								Loose angular GRAVEL and broken rock.
					113.30			
								Soft Red Sandstone from 7.5 to 21mbgl. Alternating beds of red and pale red sandstone and siltstone.
						10		
						15		
						20		
				Difficult Drilling though gravel/cobbles loose	99.80			End of Hole - 21mbgl.
						25		Total Depth of Borehole

6" Steel
Betonite
Gravel
Hole collapsed and backfilled with Pea Gravel

REMARKS

Logged following air rotary drilling

PAGE 1 of 1

SCALE As Shown

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APPENDIX IV
ORIGINAL LABORATORY DATA SHEETS

Fitz scientific
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email info@fitzsci.ie

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Customer	**Michael Gill** **Hydro-Environmental Services** **22 Town Court** **Youghal Road** **Dungarvon** **Co Waterford**	***Lab Report Ref. No.***	**7820/012/01**
		Date of Receipt	**16/12/2015**
		Sampled On	**16/12/2015**
		Date Testing Commenced	**16/12/2015**
		Received or Collected	**Delivered by Customer**
		Condition on Receipt	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - MW15 - 01**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Ground Water)	102	Colorimetry	377.47	mg/L CaCO3	UKAS
Ammonia (Ground Water)	114	Colorimetry	2.20	mg/L as N	UKAS
Arsenic (Ground Water)	177	ICPMS	0.293	ug/L	UKAS
Barium (Ground Water)	177	ICPMS	<1.62	ug/L	UKAS
Boron (Ground Water)	177	ICPMS	370.5	ug/L	UKAS
Cadmium (Ground Water)	177	ICPMS	<0.09	ug/L	UKAS
Calcium (Ground Water)	184	ICPMS	1.56	mg/L	UKAS
Chloride (Ground Water)	100	Colorimetry	69.57	mg/L	UKAS
Chromium (Ground Water)	177	ICPMS	<2.14	ug/L	UKAS
Coliforms (Faecal)	140	Filtration/ Incubation 44C/ 24H	0	cfu/100ml	
Coliforms (Total)	157	Filtration/Incubation	<10	cfu/ 100ml	
Conductivity (Ground Water)	112	Electrometry	1770	uscm -1@25C	UKAS
Copper (Ground Water)	177	ICPMS	0.919	ug/L	UKAS
Cyanide	138	Colorimetry	<5	ug/L	
Dissolved Oxygen (mg/l)	715	DO Meter	6.0	mg/L	
Fluoride (Ground Water)	115	Colorimetry	0.02	mg/L	UKAS
Iron (Ground Water)	177	ICPMS	46.36	ug/L	UKAS
Lead (Ground Water)	177	ICPMS	0.077	ug/L	UKAS
Magnesium (Ground Water)	184	ICPMS	<0.27	mg/L	UKAS
Manganese (Ground Water)	177	ICPMS	0.43	ug/L	UKAS
Mercury (Ground water)	178	ICPMS	0.129	ug/L	UKAS
Nickel (Ground Water)	177	ICPMS	2.581	ug/L	UKAS
Nitrate (Ground Water)	103	Colorimetry	2.460	mg/L as N	UKAS
Nitrite (Ground Water)	118	Colorimetry	0.202	mg/L as N	UKAS

Signed : A Harmon ***Date : 06/01/2016***

Aoife Harmon - Technical Supervisor

UKAS TESTING 2802

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU (Drinking water) Regulations (SI 122 2014)
For bacterial analysis a result of 0 means none detected in volume examined
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		Received or Collected	**Delivered by Customer**
		Condition on Receipt	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - MW15 - 01**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Nitrogen (Total Oxidised) (Ground W	151	Colorimetry	2.67	mg/L as N	UKAS
pH (Ground Water)	110	Electrometry	7.0	pH Units	UKAS
Phenols (Total)	223	GCMS	<0.10	ug/L	
Phosphate (Ortho) Ground Water	117	Colorimetry	<0.005	mg/L as P	UKAS
Phosphate (Total) Ground Water	166	Colorimetry	<0.024	mg/L as P	UKAS
Potassium (Ground Water)	184	ICPMS	17.64	mg/L	UKAS
Selenium (Ground Water)	177	ICPMS	1.142	ug/L	UKAS
Silver	177	ICPMS	<0.33	ug/L	
Sodium (Ground water)	184	ICPMS	471.80	mg/L	UKAS
Solids (Total Dissolved)	105	Filtration/ Evaporation @ 180C	1515	mg/L	
Sulphate (Ground Water)	119	Colorimetry	722.51	mg/L	UKAS
Temperature (On receipt)	715	Thermometer	12.6	degree C	
TOC (Groundwater)	316	TOC Analyser	4.26	mg/L	UKAS
TPH (>C10-40)	188	GC-FID	<1	ug/L	
Zinc (Ground Water)	177	ICPMS	<0.41	ug/L	UKAS

Signed : A Harmon ***Date : 06/01/2016***

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	Hydro-Environmental Services	***Date of Receipt***	**16/12/2015**
	22 Town Court	***Sampled On***	**16/12/2015**
	Youghal Road	***Date Testing Commenced***	**16/12/2015**
	Dungarvon	***Received or Collected***	**Delivered by Customer**
	Co Waterford	***Condition on Receipt***	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - MW15 - 02**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Ground Water)	102	Colorimetry	236.79	mg/L CaCO3	UKAS
Ammonia (Ground Water)	114	Colorimetry	0.072	mg/L as N	UKAS
Arsenic (Ground Water)	177	ICPMS	0.78	ug/L	UKAS
Barium (Ground Water)	177	ICPMS	<1.62	ug/L	UKAS
Boron (Ground Water)	177	ICPMS	20.35	ug/L	UKAS
Cadmium (Ground Water)	177	ICPMS	<0.09	ug/L	UKAS
Calcium (Ground Water)	184	ICPMS	<0.60	mg/L	UKAS
Chloride (Ground Water)	100	Colorimetry	47.91	mg/L	UKAS
Chromium (Ground Water)	177	ICPMS	<2.14	ug/L	UKAS
Coliforms (Faecal)	140	Filtration/ Incubation 44C/ 24H	4	cfu/100ml	
Coliforms (Total)	157	Filtration/Incubation	50	cfu/ 100ml	
Conductivity (Ground Water)	112	Electrometry	613	uscm -1@25C	UKAS
Copper (Ground Water)	177	ICPMS	0.138	ug/L	UKAS
Cyanide	138	Colorimetry	<5	ug/L	
Dissolved Oxygen (mg/l)	715	DO Meter	7.8	mg/L	
Fluoride (Ground Water)	115	Colorimetry	0.20	mg/L	UKAS
Iron (Ground Water)	177	ICPMS	10.51	ug/L	UKAS
Lead (Ground Water)	177	ICPMS	0.127	ug/L	UKAS
Magnesium (Ground Water)	184	ICPMS	<0.27	mg/L	UKAS
Manganese (Ground Water)	177	ICPMS	0.13	ug/L	UKAS
Mercury (Ground water)	178	ICPMS	0.144	ug/L	UKAS
Nickel (Ground Water)	177	ICPMS	<0.14	ug/L	UKAS
Nitrate (Ground Water)	103	Colorimetry	3.780	mg/L as N	UKAS
Nitrite (Ground Water)	118	Colorimetry	0.010	mg/L as N	UKAS

Signed : A Harmon ***Date : 06/01/2016***

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		Date of Receipt	**16/12/2015**
		Sampled On	**16/12/2015**
		Date Testing Commenced	**16/12/2015**
		Received or Collected	**Delivered by Customer**
		Condition on Receipt	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - MW15 - 02**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Nitrogen (Total Oxidised) (Ground W	151	Colorimetry	3.79	mg/L as N	UKAS
pH (Ground Water)	110	Electrometry	7.4	pH Units	UKAS
Phenols (Total)	223	GCMS	0.249	ug/L	
Phosphate (Ortho) Ground Water	117	Colorimetry	<0.005	mg/L as P	UKAS
Phosphate (Total) Ground Water	166	Colorimetry	0.028	mg/L as P	UKAS
Potassium (Ground Water)	184	ICPMS	3.135	mg/L	UKAS
Selenium (Ground Water)	177	ICPMS	1.535	ug/L	UKAS
Silver	177	ICPMS	<0.33	ug/L	
Sodium (Ground water)	184	ICPMS	634.00	mg/L	UKAS
Solids (Total Dissolved)	105	Filtration/ Evaporation @ 180C	379	mg/L	
Sulphate (Ground Water)	119	Colorimetry	49.17	mg/L	UKAS
Temperature (On receipt)	715	Thermometer	12.4	degree C	
TOC (Groundwater)	316	TOC Analyser	0.70	mg/L	UKAS
TPH (>C10-40)	188	GC-FID	<1	ug/L	
Zinc (Ground Water)	177	ICPMS	<0.41	ug/L	UKAS

Signed : A Harmon ***Date : 06/01/2016***

Aoife Harmon - Technical Supervisor

UKAS TESTING 2802

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Customer	**Michael Gill**	***Lab Report Ref. No.***	**7820/012/03**
	Hydro-Environmental Services	***Date of Receipt***	**16/12/2015**
	22 Town Court	***Sampled On***	**16/12/2015**
	Youghal Road	***Date Testing Commenced***	**16/12/2015**
	Dungarvon	***Received or Collected***	**Delivered by Customer**
	Co Waterford	***Condition on Receipt***	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - PW1**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Ground Water)	102	Colorimetry	306.19	mg/L CaCO3	UKAS
Ammonia (Ground Water)	114	Colorimetry	0.022	mg/L as N	UKAS
Arsenic (Ground Water)	177	ICPMS	<0.1	ug/L	UKAS
Barium (Ground Water)	177	ICPMS	<1.62	ug/L	UKAS
Boron (Ground Water)	177	ICPMS	16.46	ug/L	UKAS
Cadmium (Ground Water)	177	ICPMS	<0.09	ug/L	UKAS
Calcium (Ground Water)	184	ICPMS	0.71	mg/L	UKAS
Chloride (Ground Water)	100	Colorimetry	20.59	mg/L	UKAS
Chromium (Ground Water)	177	ICPMS	<2.14	ug/L	UKAS
Coliforms (Faecal)	140	Filtration/ Incubation 44C/ 24H	0	cfu/100ml	
Coliforms (Total)	157	Filtration/Incubation	5	cfu/ 100ml	
Conductivity (Ground Water)	112	Electrometry	627	uscm -1@25C	UKAS
Copper (Ground Water)	177	ICPMS	<0.11	ug/L	UKAS
Cyanide	138	Colorimetry	<5	ug/L	
Dissolved Oxygen (mg/l)	715	DO Meter	8.2	mg/L	
Fluoride (Ground Water)	115	Colorimetry	0.18	mg/L	UKAS
Iron (Ground Water)	177	ICPMS	2.947	ug/L	UKAS
Lead (Ground Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Ground Water)	184	ICPMS	<0.27	mg/L	UKAS
Manganese (Ground Water)	177	ICPMS	0.179	ug/L	UKAS
Mercury (Ground water)	178	ICPMS	0.065	ug/L	UKAS
Nickel (Ground Water)	177	ICPMS	<0.14	ug/L	UKAS
Nitrate (Ground Water)	103	Colorimetry	5.010	mg/L as N	UKAS
Nitrite (Ground Water)	118	Colorimetry	0.003	mg/L as N	UKAS

Signed : A Harmon ***Date : 06/01/2016***

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	22 Town Court	***Sampled On***	**16/12/2015**
	Youghal Road	***Date Testing Commenced***	**16/12/2015**
	Dungarvon	***Received or Collected***	**Delivered by Customer**
	Co Waterford	***Condition on Receipt***	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - PW1**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Nitrogen (Total Oxidised) (Ground W	151	Colorimetry	5.01	mg/L as N	UKAS
pH (Ground Water)	110	Electrometry	7.3	pH Units	UKAS
Phenols (Total)	223	GCMS	<0.10	ug/L	
Phosphate (Ortho) Ground Water	117	Colorimetry	0.008	mg/L as P	UKAS
Phosphate (Total) Ground Water	166	Colorimetry	<0.024	mg/L as P	UKAS
Potassium (Ground Water)	184	ICPMS	1.854	mg/L	UKAS
Selenium (Ground Water)	177	ICPMS	0.702	ug/L	UKAS
Silver	177	ICPMS	<0.33	ug/L	
Sodium (Ground water)	184	ICPMS	436.50	mg/L	UKAS
Solids (Total Dissolved)	105	Filtration/ Evaporation @ 180C	379	mg/L	
Sulphate (Ground Water)	119	Colorimetry	29.50	mg/L	UKAS
Temperature (On receipt)	715	Thermometer	12.1	degree C	
TOC (Groundwater)	316	TOC Analyser	0.55	mg/L	UKAS
TPH (>C10-40)	188	GC-FID	<1	ug/L	
Zinc (Ground Water)	177	ICPMS	<0.41	ug/L	UKAS

Signed : A Harmon **Date : 06/01/2016**

Aoife Harmon - Technical Supervisor

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Customer	**Michael Gill**	***Lab Report Ref. No.***	**7820/012/04**
	Hydro-Environmental Services	***Date of Receipt***	**16/12/2015**
	22 Town Court	***Sampled On***	**16/12/2015**
	Youghal Road	***Date Testing Commenced***	**16/12/2015**
	Dungarvon	***Received or Collected***	**Delivered by Customer**
	Co Waterford	***Condition on Receipt***	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - GW1**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Ground Water)	102	Colorimetry	360.54	mg/L CaCO3	UKAS
Ammonia (Ground Water)	114	Colorimetry	0.025	mg/L as N	UKAS
Arsenic (Ground Water)	177	ICPMS	<0.1	ug/L	UKAS
Barium (Ground Water)	177	ICPMS	1.819	ug/L	UKAS
Boron (Ground Water)	177	ICPMS	35.36	ug/L	UKAS
Cadmium (Ground Water)	177	ICPMS	<0.09	ug/L	UKAS
Calcium (Ground Water)	184	ICPMS	<0.60	mg/L	UKAS
Chloride (Ground Water)	100	Colorimetry	27.67	mg/L	UKAS
Chromium (Ground Water)	177	ICPMS	<2.14	ug/L	UKAS
Coliforms (Faecal)	140	Filtration/ Incubation 44C/ 24H	3	cfu/100ml	
Coliforms (Total)	157	Filtration/Incubation	10	cfu/ 100ml	
Conductivity (Ground Water)	112	Electrometry	752	uscm -1@25C	UKAS
Copper (Ground Water)	177	ICPMS	<0.11	ug/L	UKAS
Cyanide	138	Colorimetry	<5	ug/L	
Dissolved Oxygen (mg/l)	715	DO Meter	9.4	mg/L	
Fluoride (Ground Water)	115	Colorimetry	0.12	mg/L	UKAS
Iron (Ground Water)	177	ICPMS	<0.66	ug/L	UKAS
Lead (Ground Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Ground Water)	184	ICPMS	<0.27	mg/L	UKAS
Manganese (Ground Water)	177	ICPMS	0.123	ug/L	UKAS
Mercury (Ground water)	178	ICPMS	0.061	ug/L	UKAS
Nickel (Ground Water)	177	ICPMS	<0.14	ug/L	UKAS
Nitrate (Ground Water)	103	Colorimetry	6.340	mg/L as N	UKAS
Nitrite (Ground Water)	118	Colorimetry	0.021	mg/L as N	UKAS

Signed : A Harmon ***Date : 06/01/2016***

Aoife Harmon - Technical Supervisor

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU (Drinking water) Regulations (SI 122 2014)
For bacterial analysis a result of 0 means none detected in volume examined
All organic results are analysed as received and all results are corrected for dry weight at 104 C
Results shall not be reproduced, except in full, without the approval of Fitz Scientific
Results contained in this report relate only to the samples tested (P) : Presumptive Results

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** : The test result for this parameter may be invalid as it has exceeded the recommended holding time (BS EN ISO 5667-3:2012)

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Customer	**Michael Gill**	***Lab Report Ref. No.***	**7820/012/04**
	Hydro-Environmental Services	***Date of Receipt***	**16/12/2015**
	22 Town Court	***Sampled On***	**16/12/2015**
	Youghal Road	***Date Testing Commenced***	**16/12/2015**
	Dungarvon	***Received or Collected***	**Delivered by Customer**
	Co Waterford	***Condition on Receipt***	**Acceptable**
Customer PO	**P1314**	***Date of Report***	**06/01/2016**
Customer Ref	**P1314 - GW1**	***Sample Type***	**Groundwater**
Ref 2	**Kilmeague**		
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Nitrogen (Total Oxidised) (Ground W	151	Colorimetry	6.32	mg/L as N	UKAS
pH (Ground Water)	110	Electrometry	7.2	pH Units	UKAS
Phenols (Total)	223	GCMS	<0.10	ug/L	
Phosphate (Ortho) Ground Water	117	Colorimetry	<0.005	mg/L as P	UKAS
Phosphate (Total) Ground Water	166	Colorimetry	<0.024	mg/L as P	UKAS
Potassium (Ground Water)	184	ICPMS	1.493	mg/L	UKAS
Selenium (Ground Water)	177	ICPMS	1.22	ug/L	UKAS
Silver	177	ICPMS	<0.33	ug/L	
Sodium (Ground water)	184	ICPMS	692.00	mg/L	UKAS
Solids (Total Dissolved)	105	Filtration/ Evaporation @ 180C	471	mg/L	
Sulphate (Ground Water)	119	Colorimetry	33.73	mg/L	UKAS
Temperature (On receipt)	715	Thermometer	12.5	degree C	
TOC (Groundwater)	316	TOC Analyser	0.67	mg/L	UKAS
TPH (>C10-40)	188	GC-FID	<1	ug/L	
Zinc (Ground Water)	177	ICPMS	<0.41	ug/L	UKAS

Signed : A Harmon
Aoife Harmon - Technical Supervisor

Date : 06/01/2016

UKAS TESTING 2802

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU (Drinking water) Regulations (SI 122 2014)
For bacterial analysis a result of 0 means none detected in volume examined
All organic results are analysed as received and all results are corrected for dry weight at 104 C

Results contained in this report relate only to the samples tested (P) : Presumptive Results

** : The test result for this parameter may be invalid as it has exceeded the recommended holding time (BS EN ISO 5667-3:2012)

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Customer	**Grainne Barron** **Hydro-Environmental Services** **22 Lower Main Street** **Dungarvan** **35 HK11**	***Lab Report Ref. No.***	**7820/017/01**
		Date of Receipt	**11/03/2016**
		Sampled On	**08/03/2016**
		Date Testing Commenced	**11/03/2016**
		Received or Collected	**Courier :GLS**
		Condition on Receipt	**Acceptable**
Customer PO		***Date of Report***	**05/04/2016**
Customer Ref	**P1314 MW15-01**	***Sample Type***	**Groundwater**
Ref 2			
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Ground Water)	102	Colorimetry	396.44	mg/L CaCO3	UKAS
Ammonia (Ground Water)	114	Colorimetry	0.065	mg/L as N	UKAS
Arsenic (Ground Water)	177	ICPMS	0.404	ug/L	UKAS
Barium (Ground Water)	177	ICPMS	<1.62	ug/L	UKAS
Boron (Ground Water)	177	ICPMS	121.9	ug/L	UKAS
Cadmium (Ground Water)	177	ICPMS	0.666	ug/L	UKAS
Calcium (Ground Water)	184	ICPMS	<0.60	mg/L	UKAS
Chloride (Ground Water)	100	Colorimetry	39.97	mg/L	UKAS
Chromium (Ground Water)	177	ICPMS	<2.14	ug/L	UKAS
**Coliforms (Faecal)	140	Filtration/ Incubation 44C/ 24H	0	cfu/100ml	
**Coliforms (Total)	157	Filtration/Incubation	10	cfu/ 100ml	
**Conductivity (Ground Water at 20C	112	Electrometry	1084	uscm -1@20C	UKAS
Copper (Ground Water)	177	ICPMS	0.907	ug/L	UKAS
Cyanide	138	Colorimetry	<5	ug/L	
Dissolved oxygen (mg/l)	715	DO Meter	8.8	mg/L	
Fluoride (Ground Water)	115	Colorimetry	0.10	mg/L	UKAS
Iron (Ground Water)	177	ICPMS	21.44	ug/L	UKAS
Lead (Ground Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Ground Water)	184	ICPMS	<0.27	mg/L	UKAS
Manganese (Ground Water)	177	ICPMS	13.8	ug/L	UKAS
Mercury (Ground water)	178	ICPMS	0.27	ug/L	UKAS
Nickel (Ground Water)	177	ICPMS	1.698	ug/L	UKAS
**Nitrate (Ground Water)	103	Colorimetry	<0.110	mg/L as N	UKAS
**Nitrite (Ground Water)	118	Colorimetry	0.009	mg/L as N	UKAS

Signed : A Harmon ***Date : 05/04/2016***

Aoife Harmon - Technical Supervisor

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU (Drinking water) Regulations (SI 122 2014)
For bacterial analysis a result of 0 means none detected in volume examined
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Results contained in this report relate only to the samples tested (P) : Presumptive Results

UKAS TESTING 2802

** : The test result for this parameter may be invalid as it has exceeded the recommended holding time (BS EN ISO 5667-3:2012)
This sample was identified as deviant (BS EN ISO 5667-3:2012) due to [HoldingTime] and the test results may be invalid.

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Customer	**Grainne Barron** **Hydro-Environmental Services** **22 Lower Main Street** **Dungarvan** **35 HK11**	***Lab Report Ref. No.***	**7820/017/01**
		Date of Receipt	**11/03/2016**
		Sampled On	**08/03/2016**
		Date Testing Commenced	**11/03/2016**
		Received or Collected	**Courier :GLS**
		Condition on Receipt	**Acceptable**
Customer PO		***Date of Report***	**05/04/2016**
Customer Ref	**P1314 MW15-01**	***Sample Type***	**Groundwater**
Ref 2			
Ref 3			

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Nitrogen (Total Oxidised) (Ground	151	Colorimetry	<0.28	mg/L as N	UKAS
**pH (Ground Water)	110	Electrometry	7.1	pH Units	UKAS
Phenols (Total)	223	GCMS	<0.10	ug/L	
Phosphate (Ortho) Ground Water	117	Colorimetry	<0.005	mg/L as P	UKAS
Phosphate (Total) Ground Water	166	Colorimetry	0.311	mg/L as P	UKAS
Potassium (Ground Water)	184	ICPMS	7.815	mg/L	UKAS
Selenium (Ground Water)	177	ICPMS	0.612	ug/L	UKAS
Silver	177	ICPMS	<0.33	ug/L	
Sodium (Ground water)	184	ICPMS	1719.00	mg/L	UKAS
Solids (Total Dissolved)	105	Filtration/ Evaporation @ 180C	819	mg/L	
Sulphate (Ground Water)	119	Colorimetry	197.20	mg/L	UKAS
TOC (Groundwater)	316	TOC Analyser	1.63	mg/L	UKAS
TPH (>C10-40)	188	GC-FID	<1	ug/L	
Zinc (Ground Water)	177	ICPMS	<0.41	ug/L	UKAS

Signed : A Harmon
Aoife Harmon - Technical Supervisor

Date : 05/04/2016

UKAS TESTING 2802

Acc. : Accredited Parameters by ISO 17025:2005
PVL - Parametric Value Limit as per EU (Drinking water) Regulations (SI 122 2014)
For bacterial analysis a result of 0 means none detected in volume examined
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Results contained in this report relate only to the samples tested (P) : Presumptive Results

** : The test result for this parameter may be invalid as it has exceeded the recommended holding time (BS EN ISO 5667-3:2012)
This sample was identified as deviant (BS EN ISO 5667-3:2012) due to [HoldingTime] and the test results may be invalid.

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Table I.2(i) SURFACE WATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: Not Applicable

Parameter	Results (mg/l)				Sampling method[2] (grab, drift etc.)	Normal Analytical Range[2]	Analysis method / technique
	Date	Date					
pH							
Electrical conductivity EC							
Ammoniacal nitrogen NH_4-N							
Chemical oxygen demand							
Biochemical oxygen demand							
Dissolved oxygen DO							
Calcium Ca							
Cadmium Cd							
Chromium Cr							
Chloride Cl							
Copper Cu							
Iron Fe							
Lead Pb							
Magnesium Mg							
Manganese Mn							
Mercury Hg							

Surface Water Quality (Sheet 2 of 2) Not Applicable

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range	Analysis method / technique
	Date	Date	Date	Date			
Nickel Ni							
Potassium K							
Sodium Na							
Sulphate SO_4							
Zinc Zn							
Total alkalinity (as $CaCO_3$)							
Total organic carbon TOC							
Total oxidised nitrogen TON							
Nitrite NO_2							
Nitrate NO_3							
Faecal coliforms (/100mls)							
Total coliforms (/100mls)							
Phosphate PO_4							

I.3 Assessment of Impact of Sewage Discharge.

On site activities will not discharge to any sewerage system. It is proposed to continue using the existing toilet facility which discharges to a c. 2m diameter holding tank to the rear of the site office. The holding tank is periodically emptied and disposed of offsite by a licensed waste disposal contractor to an appropriate disposal facility. The location of the holding tank is shown on the attached Figure D.1.1.

I.4 Assessment of impact of ground/groundwater emissions

It is envisaged that the inert materials used for the restoration of the site will not cause a pollution risk to the ground/groundwater in the area of the site.

A detailed Geological and Hydrogeological assessment was commissioned in support of this application. A copy of the assessment prepared by Hydro Environmental Services is attached (Refer to Attachment I.2.1 above). This report addresses geological ground, surface and groundwater issues pertaining to the site.

Table I.4(i) GROUNDWATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: PW1-01, MW15-01, MW15-01 **(Refer to Attachment I.2.1 for Results & Grid Ref.)**

Parameter	Results (mg/l)				Sampling method (composite etc.)	Normal Analytical Range	Analysis method / technique
	Date	Date	Date	Date			
pH							
Temperature							
Electrical conductivity EC							
Ammoniacal nitrogen NH_4-N							
Dissolved oxygen DO							
Residue on evaporation (180ºC)							
Calcium Ca							
Cadmium Cd							
Chromium Cr							
Chloride Cl							
Copper Cu							
Cyanide Cn, total							
Iron Fe							
Lead Pb							
Magnesium Mg							
Manganese Mn							
Mercury Hg							
Nickel Ni							
Potassium K							
Sodium Na							

GROUNDWATER QUALITY (SHEET 2 OF 2) (REFER TO ATTACHMENT I.2.1 FOR RESULTS)

Parameter	Results (mg/l)				Sampling method (composite, dipper etc.)	Normal Analytical Range	Analysis method / technique
	Date	Date	Date	Date			
Phosphate PO_4							
Sulphate SO_4							
Zinc Zn							
Total alkalinity (as $CaCO_3$)							
Total organic carbon TOC							
Total oxidised nitrogen TON							
Arsenic As							
Barium Ba							
Boron B							
Fluoride F							
Phenol							
Phosphorus P							
Selenium Se							
Silver Ag							
Nitrite NO_2							
Nitrate NO_3							
Faecal coliforms (/100mls)							
Total coliforms (/100mls)							
Water level (m OD)							

I.5 Ground and/or groundwater contamination

It is envisaged that the inert materials used for the restoration of the site will not cause a pollution risk to the ground/groundwater in the area of the site.

A detailed Geological and Hydrogeological assessment was commissioned in support of this application. A copy of the assessment prepared by Hydro Environmental Services is attached (Refer to Attachment I.2.1 above). This report addresses geological ground, surface and groundwater issues pertaining to the site.

I.6 Noise Impact.

I.6.1 Introduction

This section will determine the existing environment with respect to noise by assessing the level of noise in the vicinity of the site, the potential impacts on the environment, and propose appropriate mitigation measures, if required, by the applicant to avoid, reduce or remedy any significant adverse impacts on the environment.

I.6.2 Methodology

The purpose of a recent baseline study was to assess existing levels of noise associated with the Kilmeage site.

Noise monitoring was also carried out for the 2003 EIS (Refer to EIS Section 3.9). Noise levels at the time were considered to be representative of the proposed development as the site activity was of a similar nature, scale and intensity to the existing pit activity at the time.

Noise measurements surveys were undertaken at a number of noise sensitive locations and the results analysed to determine noise conditions. From these results, an assessment can be made of the impact of the development on the existing noise levels of the area.

The following has been taken into consideration with respect to noise monitoring surveys:

- Measurement of noise levels was undertaken using Type 1 instrumentation;
- Cognisance was taken of the EPA's 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in relation to Scheduled Activities (NG4);
- The surveys were carried out in accordance with 'ISO 1996 Acoustics - Description and Measurement of Environmental Noise: Parts 1/2/3'.

The following parameters were recorded during the noise monitoring survey:

$L_{Aeq, T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval *T* (the sampling interval).

$L_{A10,T}$ the A weighted level of noise exceeded for 10% of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise such as that from road traffic.

$L_{A90,T}$ the A weighted noise level exceeded for 90% of the specified measurement period (T). It is typically used as a descriptor for background noise, giving an indication of the underlying noise level or the level that is almost always their between intermittent noise events.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.

All sound levels in this report are expressed in terms of decibels (dB) relative to 2x1 0^{-5} Pa.

The exponential time weightings – 'fast' (with a nominal exponential-time constant of 125 milliseconds) was used. Fast, is generally the preferred time-weighting, especially for statistical data and for variable noise levels.

L_{eq} is recommended by the International Organisation for Standardisation (ISO) for measuring and rating noises for traffic areas and for the description of environmental noise.

I.6.3 Emission Limit Value

It is proposed that the on-site operations associated with the proposed development shall be carried out only between the hours of **08:00 hours and 18:00 hours** on Mondays to Fridays inclusive and 08:00 hours to 14:00 hours on Saturdays. No operations shall be carried out on Sundays or Bank Holidays. These hours of operation are in compliance with condition number 5 of existing planning permission P.A. Reg. Ref. 03/1773.

The noise levels measured are in compliance with condition number 23 of existing planning permission P.A. Reg. Ref. 03/1773 which states that "*the noise level attributable to all on-site operations between the hours of 08:00-18:00 Monday to Friday inclusive (excluding bank holidays) and 08:00-14:00 Saturdays, from the development shall not exceed 55 dBA Leq(15min), at any point along the boundary of the development site".*

The above Emission Limit Value is also in accordance with the EPA (2016) Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4):

Typical Limit Values for Noise from Licensed Sites
Daytime (07:00 to 19:00hrs) – 55dB LAr,T; *Evening (19:00 to 23:00hrs) – 50dB LAr,T;* *Night-time (23:00 to 07:00hrs) – 45dB LAeq,T*

It is therefore considered that the above EPA **"Daytime"** threshold should be applied for this development as this limit is a recognised standard within the industry and is a limit that is set by most of the Local Authorities.

I.6.4 Receiving Environment

The existing sand and gravel pit is located approximately c.10.7km to the southwest of Clane, Co. Kildare, and c.2.3km southwest of the village of Robertstown along the R415; a third class road connecting Kilmeage with Kildare town runs [east-west] to the south of the site. The sand and gravel pit is just east of Kilmeage village. The Hill of Allen is located 3.0km to the southwest of the site.

The current site area under the ownership of N&C is estimated at c. 6.6 hectares in total, and is depicted on Drawing B2.1. Sand and gravel extraction has ceased on the site and the site is currently used for bagging of imported decorative stone. N&C propose to restore the lands to form a rounded hill that would tie into the ground levels of the surrounding lands.

Land use in the area to the west and southwest is largely residential, with some commercial use in close proximity to the pit. There is a row of single houses along the southern boundary of the site, and these face to the south on the local road. The land to the northeast and northwest is largely agricultural as shown by B.2.1. These residences are not open to view being shielded by existing hedgerows, boundary walls and a screening berm along the southern boundary.

It is evident from the above description that the site is not in an area to be considered as a *"Quiet Area"* as per the Agency definition (*Environmental Quality Objectives - Noise in Quiet Areas, (EPA 2003)*) given the proximity to urban, commercial and industrial development.

The lands are being restored to agricultural use by importation and recovery of inert materials in accordance with a phased restoration scheme. Designated internal haul roads will be used to direct site traffic to the current tipping area. A bulldozer will be used to appropriately grade and compact the material to the desired profile as shown by the detailed plans and sections (Refer to Figures D.1.1 to D.1.6).

It is estimated that c. 20,000 tonnes per annum of construction and demolition waste will be imported to site. Due to relatively small volumes it is likely that a mobile crusher/screening unit will be mobilised to site on a campaign basis and/or 3 monthly intervals. Therefore, noise associated with this activity will be of a relatively short term duration.

I.6.5 Ambient Noise levels

Routine noise monitoring is carried out at nearby residences and site boundaries adjoining same (Refer to Figure F.1.). Continuous noise monitoring is carried out in accordance with ISO 1996/1 "*Acoustics – Description and Measurement of Environmental Noise*" using a Larson Davis Model 812 Sound Level Meter which was calibrated using a Larson Davis Acoustic Calibrator CAL 200. The results of recent noise monitoring (16/11/2015) are included in Table I.6.(i) below.

This data was then analysed to determine the current noise conditions. From these results assessments could be made of the impact of noise from the continuance of recovery operations at this location.

Table I.6(i) Ambient Noise Assessment

Date: 16/11/2015

Station	National Grid Reference (6N, 6E)	Sampling Interval	Sound Pressure Levels			Comments
			$L(A)_{eq}$	$L(A)_{10}$	$L(A)_{90}$	
N1	277562E, 223051N	1129-1143 hrs	45.9	48.3	40.4	Bagging Plant and loading shovel in operation. HGV's being loaded out during course of day by fork lift.
		1145-1200 hrs	49.5	50.0	39.5	
		1519-1534 hrs	49.9	51.9	44.0	
		1550-1605 hrs	52.0	54.3	45.9	
		1605-1620 hrs	51.6	53.5	43.5	
N2	277562E, 223213N	1204-1219 hrs	50.1	51.9	43.6	
		1219-1234 hrs	52.8	55.2	44.0	
		1622-1637 hrs	47.8	49.9	40.0	
		1642-1657 hrs	51.3	49.9	41.2	
N3	277838E, 223144N	1255-1310 hrs	52.4	54.4	42.8	
		1329-1344 hrs	48.8	51.2	41.8	
		1350-1405 hrs	48.2	50.3	41.9	
		1405-1420 hrs	50.3	50.3	39.9	
		1425-1440 hrs	46.8	48.1	41.3	
		1440-1455 hrs	50.5	53.6	40.7	

NOTES: *1. All locations are identified on accompanying Figure F.1.*

2. Weather Conditions – dry and overcast with sunny spells, light WSW breeze, 7-8°C.

Noise monitoring was also carried out for the 2003 EIS (Refer to EIS Section 3.9). Noise levels at the time were considered to be representative of the proposed development as the site activity was of a similar nature, scale and intensity to the existing pit activity at the time.

Noise monitoring was carried for daytime only as the proposed development is limited by planning permission (P.A. Reg. Ref. 03/1773) to between the hours of 08:00-18:00 Monday to Friday inclusive (excluding bank holidays) and 08:00-14:00 Saturdays.

I.6.6 Assessment of Impacts

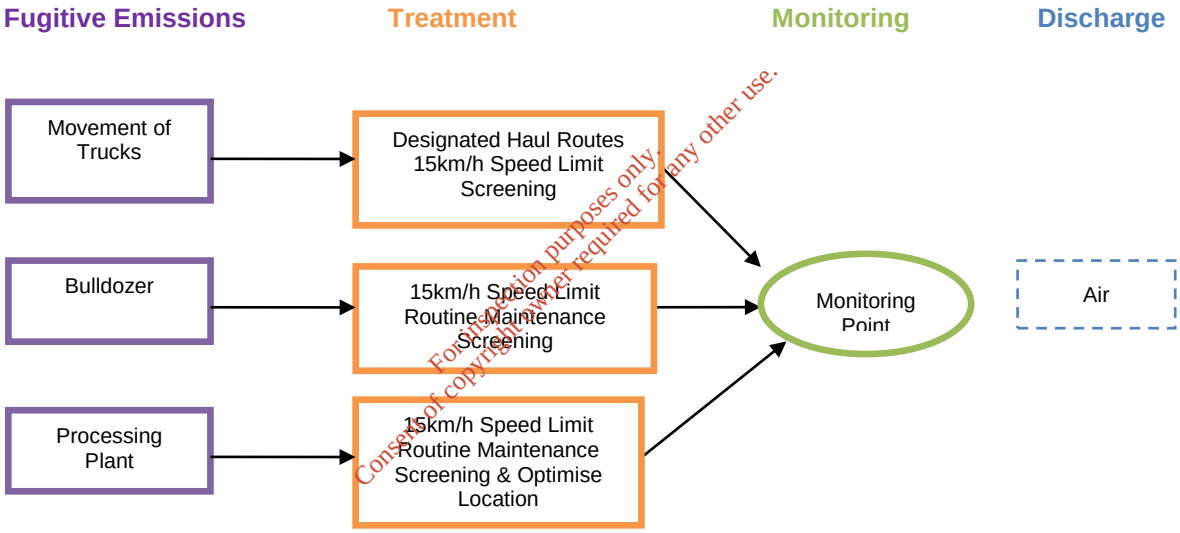
I.6.6.1 Direct Impacts

The main source of noise and vibration on site is from:

- Movement of trucks on internal haul roads and tipping of material
- Bulldozer placing and grading the infill material
- Processing Plant

Given the nature of the development, the location of the above will vary dependent on area of site being restored (Refer to Figures D.1.1 to D.1.4 Site Infrastructure Plans). Relevant details with respect to noise sources are provided in Table E.5.(i).

The following flow diagram shows the main sources of noise emissions arising on site and the methods of treatment/abatement employed.



I.6.(i) Noise Emissions - Operational Activities

It is considered based on both recent and historical monitoring results that the proposed continuance of the restoration of the pit can be carried out between the hours of 08:00-18:00 Monday to Friday inclusive (excluding bank holidays) and 08:00-14:00 Saturdays as per condition No. 23 of existing planning permission P.A. Reg. Ref. 03/1773 and within the accepted EPA Daytime Emission Limit value of – 55dB LAr,T.

Whilst the above limit is considered acceptable with respect to general restoration works, elevated noise levels may be experienced at nearest residences during construction of temporary baffle mounds and restoration works along the southern and western boundaries. However, these works will be of a short-term nature and construction of baffle mounds will provide screening and attenuation of noise at the nearest noise sensitive receptors.

These operations will be intermittent in nature, occurring over several discrete periods over the life of the restoration works. As such it is not considered an ongoing day to day activity.

The Department for Communities and Local Government (DCLG) in the UK launched the planning practice guidance as a web-based resource. Individual sections of the guidance use a specific and unique Reference ID. The Minerals Planning Guidance (Reference ID 27) with respect to "*Assessing environmental impacts from minerals extraction - Noise emissions" (Reference ID: 27-019-20140306)* provides the following guidance.

Reference ID: 27-022-20140306

What type of operations may give rise to particularly noisy short-term activities and what noise limits may be appropriate?

Activities such as soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance.

Increased ***temporary daytime noise limits of up to 70dB(A) LAeq 1h*** *(free field) for periods of up to eight weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.*

Where work is likely to take longer than eight weeks, a lower limit over a longer period should be considered. In some wholly exceptional cases, where there is no viable alternative, a higher limit for a very limited period may be appropriate in order to attain the environmental benefits. Within this framework, the 70 dB(A) LAeq 1h (free field) limit referred to above should be regarded as the normal maximum.

It is considered that an eight-week period per year would be more than adequate to undertake essential site preparation and restoration works and construction of baffle mounds at the southern and western boundaries and consider a temporary daytime noise limits of up to 70dB(A) LAeq 1h as per the above guidance to be appropriate.

I.6.6.2 Indirect Impacts

There are no indirect impacts at the site. It is considered unlikely that the development could contribute to noise issues in a cumulative fashion as there are no other significant industrial or commercial based operations in the locality.

The existing noise monitoring results take account of other existing developments in the locality and show that site activity at the existing facility is within accepted thresholds for this type of development (Refer to Section I.6.5 above).

I.6.6.3 Interaction with other Impacts

There are no interactions with other impacts associated with noise at the site.

I.6.7 Abatement

Noise resulting from the operations can be kept to acceptable levels by the implementation of good design, effective operation and management and by the adoption of 'best practices'. Reducing noise at source wherever possible is the most effective way of minimising the impact but barriers and screens between noise source and receptor can also be used to very good effect.

A number of noise containment measures are proposed:

- The provision of temporary peripheral screen banks to screen site activities from outside views as necessary.
- General site activity will be within the existing pit and below the level of the nearest residences.
- The use of designated haul roads to ensure that site traffic is removed from nearest noise sensitive receptors.
- Regular maintenance of all plant and machinery is an integral part of site management and is important in helping to minimise noise impact.
- All machinery used will be CE certified for compliance with EU noise control limits.
- Other further noise-reducing modifications for any machinery will be fitted wherever practical (e.g., rubber – decked screens, rubber chute linings, etc.)
- Internal haul road gradients will be kept as low as possible to reduce engine / brake noise from heavy vehicles.

- All plant and machinery is switched off when not in use.
- A noise management programme will be defined as part of the EMS.

I.6.8 Monitoring

The operator has established an environmental monitoring programme to include noise monitoring. Noise levels will continue to be monitored in accordance with ISO 1996/1 – *"Acoustics – Description and measurement of environmental noise"*.

It is proposed that noise monitoring will be carried out at three noise monitoring stations (N1 to N3) in the vicinity of the nearest noise sensitive properties (Refer to Figure F 1) in accordance with any monitoring programme agreed with the EPA.

It is proposed that the applicant shall carry out a noise survey of the site operations on at least and annual basis and bi-annually when undertaking works near the southern and western boundaries. The survey programme shall be undertaken in accordance with the methodology specified in the Agency publication Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).

The results of monitoring to date shows that the development can comply with the noise level thresholds as specified and as a consequence the development will have no significant effects regards noise levels in the area.

This programme will allow on-going monitoring of noise emissions from the site, thereby assisting in ensuring compliance with any future requirements or regulations. A noise management programme will be defined as part of the EMS.

Through implementation of the proposed mitigation measures it is considered the development will continue to have no significant effects with regard to noise levels on the local residences, their property, livestock and amenity.

I.6.9 Residual Impact

Through implementation of the proposed mitigation measures it is considered the development will continue to have no significant effects with regard to noise levels on the local residences, their property, livestock and amenity.

The lands are to be restored to agricultural use and therefore there will be no residual impact with respect to the future use of the lands.

I.7 Assessment of Ecological Impacts & Mitigation Measures

An ecological study was commissioned in support of this application. A copy of the assessment prepared by Roger Goodwillie & Associates is attached (Refer to Attachment I.7.1 below).

The site currently comprises an old sand and gravel pit and as such there are no undisturbed lands that will be affected by the continuation of the progressive restoration of the site using imported inert materials.

The lands are to be restored to agricultural use by importation and recovery of inert materials in accordance with a phased restoration scheme. There are no natural habitats within the area under restoration considered worthy of conservation. No significant or likely impacts on the ecology of the area are anticipated.

The site is not included within any area of scientific interest, nor has any special amenity order (e.g. Natural Heritage Area, Special Area of Conservation) been made in relation to any site or area within the vicinity.

It is proposed to reclaim the lands to a condition / gradient suitable for agricultural. Good quality imported soil will be conserved wherever possible to provide the subsoil/top-soil capping. These topsoil's/subsoil's will be handled under dry conditions to minimise compaction. For the purpose of restoration to agricultural the restored soil profile (capping) shall comprise 300mm topsoil over 1200-1350mm of subsoil.

Progressive restoration involving grass seeding of restored areas shall be carried out on a staged basis to reduce the effects of soil erosion, windblown dust, to aid ground stabilisation and as an effective means of weed control. On completion of each phase of development final restoration including grading, seeding and landscaping will be carried out. Final restoration is dependent on the availability of good topsoil/subsoil and subject to suitable weather conditions. The final contours and topography for the site is shown by the Final Restoration Plan Figure D.1.4 and Cross Sections D.1.5 to D.1.6.

Once the topsoil is re-instated it will be seeded with a suitable mix of grasses suitable for pasture in order to quickly stabilise the topsoil. Once the grass sward has become established the restored farmland can be kept either as pasture, hay meadow or arable land. Part of the area has already been restored to pasture.

Attachment I.7.1

ECOLOGY REPORT

Prepared by

Roger Goodwillie & Associates

Restoration of quarry at Kilmeage, Co Kildare

Waste Licence Application

Ecology

Report prepared for N & C Enterprises

November 2015

1. INTRODUCTION

The purpose of this report is to supply ecological information relevant to the application for a waste licence which is made to the EPA. The site details were obtained on a visit in September 2015.

The author is Roger Goodwillie, M.Sc., Member of the Chartered Institute of Ecology and Environmental Management.

2. ECOLOGY

The site is a worked out sand pit north-east of the village of Kilmeage with a trade in decorative stone and other products. It has been active for many years and currently has an almost vertical face on its eastern side with a more stepped profile on the west. It is entered by a ramp from the south.

The main habitats are active quarries and mines (ED4 in Fossitt 2000) and recolonising bare ground (ED3) where there is substantial regrowth of plants. These habitats are seen on the aerial photograph (at end).

The site is mostly dry but there is a small seasonal spring in the base which flows across the floor of the pit, entering a soakaway at the northern edge. Rainwater sinks through the remaining material to enter the groundwater. Field ponds to the east are supported by a heavy soil, capping the underlying stony till.

2.1 Flora

As may be seen in the aerial photograph the majority of the plant life occurs on the margins of the pathways that descend to the lowest point in the NW corner. The first species to establish are wind-dispersed such as coltsfoot *Tussilago farfara*, Bilbao fleabane *Conyza floribunda* and prickly lettuce *Lactuca serriola* but others are also widespread, for example

Medicago lupulina	black medick
Rapistrum rugosum	bastard cabbage
Daucus carota	wild carrot
Equisetum arvense	field horsetail
Polygonum aviculare	knotgrass
Catapodium rigidum	hard grass
Epilobium parviflorum	hoary willowherb
Potentilla reptans	creeping cinquefoil
Arenaria serpyllifolia	sandwort
Reseda luteola	dyer's rocket
Melilotus sp (few plants)	melilot
Diplotaxis tenuifolia (one plant)	wall rocket

One damp path side location where rainwash is concentrated, adds toad rush *Juncus bufonius*, water speedwell *Veronica anagallis-aquatica* and water bent *Polypogon viride*.

The butterfly bush *Buddleja davidii* is also an early colonist and, being perennial, it gives a certain stability to the vegetation. On the eastern side for example it grows with

Hypochaeris radicata	catsear
Arrhenatherum elatius	false oat
Centaurea nigra	knapweed
Silene vulgaris	bladder campion
Crepis biennis	rough hawksbeard
Artemisia vulgaris	mugwort
Papaver rhoeas	corn poppy
P.dubium	long-headed poppy
Cirsium arvense	creeping thistle
C.vulgare	spear thistle
Ulex europaeus	common gorse

The northern point and western side have been stable for some time but the material is still loose and mobile so that small slopes of scree occur in places. Common limestone plants are additional species here, such as

Lotus corniculatus	birdsfoot trefoil
Pilosella officinarum	mouse-eared hawkweed
Leontodon hispidus	rough hawkbit
Crepis capillaris	smooth hawksbeard
Blackstonia perfoliata	yellow wort
Hieracium sect. Stelligera	hawkweed
Linum catharticum	fairy flax
Sanguisorba minor (mainly at entrance)	salad burnet

These tend to be covered by shrubby growth towards the southern point where there is least traffic activity. Willows *Salix cinerea*, *S.caprea* and rose-bay *Chamerion angustifolium* occur as well as one plant of welted thistle *Carduus crispus*. There is also a small pile of topsoil supporting annual mercury *Mercurialis annua*, American willowherb *Epilobium ciliatum*, charlock *Sinapis arvensis*, scentless mayweed *Tripleurospermum inodorum* and groundsel *Senecio vulgaris*.

There is no Japanese knotweed or other invasive alien on site as far as is known.

2.2 Adjacent habitats

Houses and gardens surround the southern half of the quarry with an industrial premises and overgrown ground on the west. The eastern side is a grassland field, often mown for silage. It is separated from the quarry by an open hedge of gorse and blackthorn.

2.3 Fauna

There are no mammals in the quarry itself with the exception of a few rabbits on the NE side. No evidence of foxes or badgers was seen and the habitat is also unsuitable for bats, not having a tree or scrub cover.

The only typical nesting bird is the sand martin, of which there are small numbers at 10-20 nests. The bird is essentially an opportunist, finding and exploiting new nest sites as they become available because of erosion, either natural (riverbanks) or man-made (quarries).

Other bird species seen were pied wagtail, goldfinch, linnet, jackdaw and rook.

2.4 Evaluation

The habitats available on site are widely found in sand pits but, probably because of the age of the quarry, have attracted a good diversity of flowering plants. They include a suite of recent introductions like prickly lettuce *Lactuca serriola*, bastard cabbage *Rapistrum rugosum*, water bent *Polypogon viride* and wall rocket *Diplotaxis tenuifolia* but there is also space for native species such as welted thistle *Carduus crispus* and the hawkweed *Hieracium* sp. While some of these plants are of interest, none are rare or protected and they would not justify leaving the pit open.

Sand martins will probably continue to nest as long as there is a suitable lens of fine material to support their burrows. They are an amber-listed bird of conservation concern (Colhoun & Cummins 2013) as they have declined all over Europe.

There are four Natura 2000 sites within 15km – Mouds Bog SAC, Pollardstown Fen SAC, Ballynafagh Lake SAC and Ballynafagh Bog SAC – but none of them has a hydrological link with the quarry.

3. IMPACT OF DEVELOPMENT

3.1 Features of development

The development involves the importation of inert material for the recovery of construction and demolition waste and the phased restoration of the quarry. Some crushing and screening will be done and the materials stockpiled for onward sale or construction of haul roads. Good quality imported soil will be conserved wherever possible to provide the subsoil/top-soil capping. These soils will be handled under dry conditions to minimise compaction and used as a final 30cm deep layer.

Restoration will be for agricultural use and it will be carried out on a phased basis to reduce the effects of soil erosion and windblown dust, to aid ground stabilisation and as an effective means of weed control. Final restoration is dependent on the availability of good topsoil and subject to suitable weather conditions. The site will be landscaped and the hedges restored where necessary.

3.2 Impacts & mitigation

The physical impact of the recovery of inert waste in the quarry and its restoration to farmland will be considerable in local terms as it will lead to the disappearance of most of the existing flora and fauna. The plants and animals that require open soils and disturbance to grow will diminish. On the other hand, the local development of hedges will tend to diversify the larger fauna such as birds and mammals.

Apart from the physical impacts there is always a risk of oil spills or unsuitable waste being deposited. However, the mitigation measures contained in the Geological and Hydrogeological Assessment report prepared for the Waste Licence Application will prevent or minimise this risk.

Monitoring of groundwater and aerial emissions will be installed so that compliance with standards can be maintained.

Dust pollution, if any, will not cause ecological change in the surroundings as there is no great difference in pH between the substrate and the incoming fill. There are also no sensitive habitats in the near surroundings. Re-vegetation will be carried out on completed sections on an on-going basis to limit the material exposed.

Final restoration will include the removal of all machinery and structures and the smoothing of the contours to facilitate the establishment of grassland and grazing animals.

4. CONCLUSION

The impact of inert waste recovery on this site will be considerable in local terms but will not result in any loss of heritage values in the locality. The changes will be both negative (loss of open habitats) and positive (gain of woody species).

References

Colhoun, K. & Cummins, S. 2013. Birds of conservation concern 2014-2019. *Irish Birds* 9, 523-544

Fossitt, J.A. 2000. *A guide to habitats in Ireland*. Heritage Council.