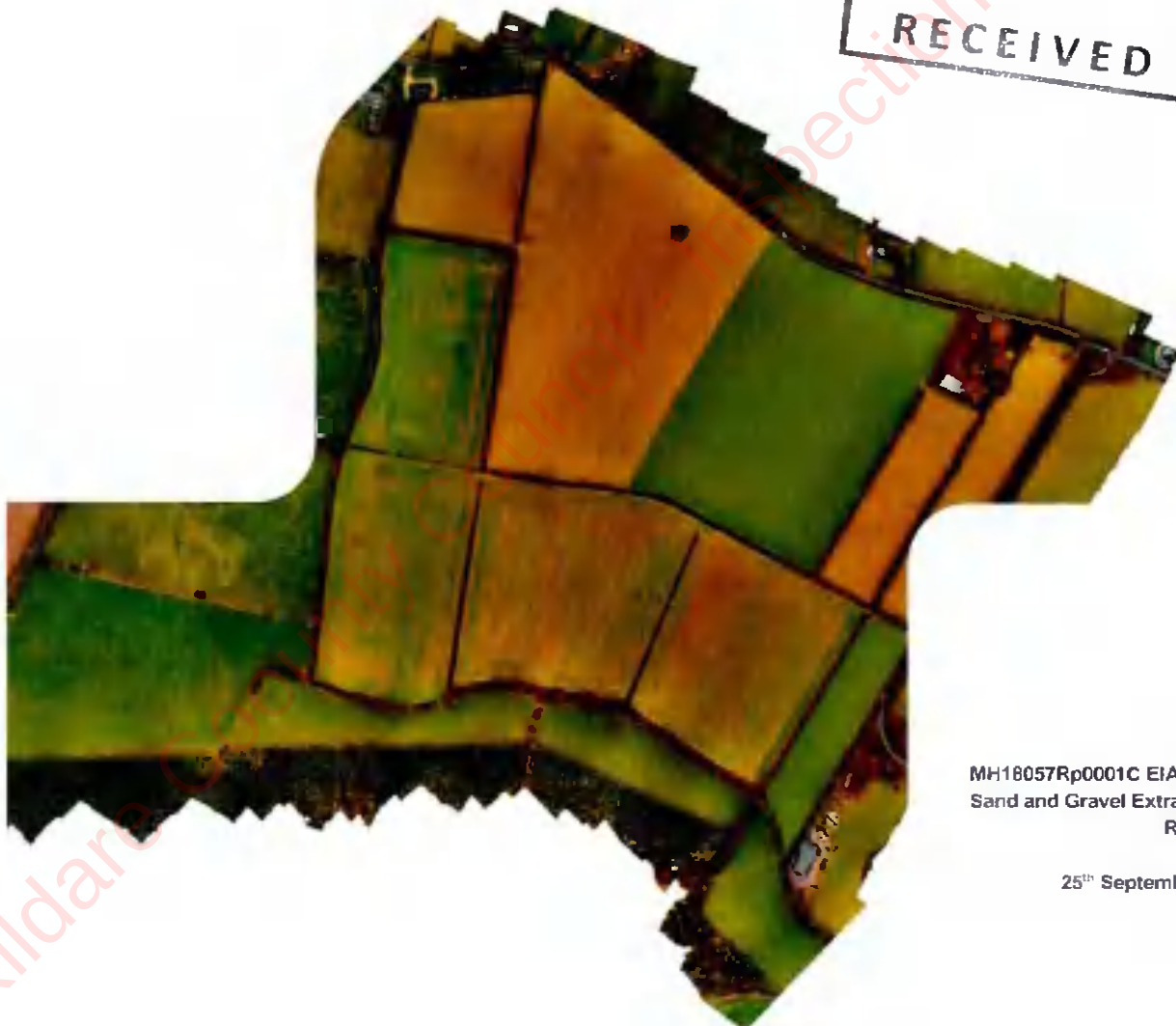


SAND AND GRAVEL EXTRACTION AT RACEFIELD

**Environmental Impact Assessment Report
Volume III: Technical Appendices**



MH18057Rp0001C EIAR Vol III
Sand and Gravel Extraction at
Racefield
F01
25th September 2019

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
F01	Final	Var.	CR	PC	25 th Sept 2019

Approval for Issue

Paul Chadwick



25 September 2019

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Prepared for:

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Fergus Gallagher

Planning and Environmental Manager

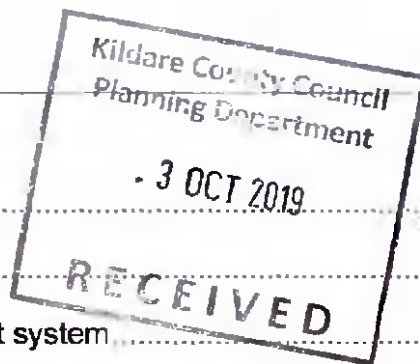
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Appendix 1.1 Consultation Responses



An Roinn Cultúir,
Oidhreacht agus Gaeltachta
Department of Culture,
Heritage and the Gaeltacht



Your Ref: **MH18057Lt0001**
Our Ref: G Pre00134/2019
(Please quote in all related correspondence)

04/07/2019

RPS
West Pier Business Park
Dun Laoire
Co Dublin
A96 N6T7
Via email



Re: Proposed Sand and Gravel Extraction Facility - The proposed development consists of a new sand and gravel extraction development and related ancillary site works over the application site area of c.32.2 hectares (79.6 acres) with extraction over an area of c.17.5 hectares (43.2 acres) at Racefield, Ballyshannon, Co Kildare.

A chara

On behalf of the Department of Culture, Heritage and the Gaeltacht, I refer to correspondence received in connection with the above

Outlined below are heritage-related observations/recommendations of the Department under the stated heading.

Archaeology

Due to the large scale of this development, it is this Department's recommendation that an archaeo-geophysical survey should be carried out on site.

In addition, in order to examine any possible archaeological features identified by geophysics and to investigate further, the overall archaeological potential of the proposed development site, test excavations, as described below, should be carried out across the site.

Geophysical survey and Pre-development testing shall consist of the following

- Geophysical survey should be carried out across the entire site.
- The applicant is required to engage the services of a suitably qualified archaeologist (licensed under the National Monuments Acts 1930–1994) to carry out pre-development testing at the site. No sub-surface work shall be undertaken in the absence of the archaeologist without his/her express consent.



- The archaeologist is required to notify the Department of Culture, Heritage and the Gaeltacht in writing at least four weeks prior to the commencement of site preparations. This will allow the archaeologist sufficient time to obtain a licence to carry out the work.
- The archaeologist shall carry out any relevant documentary research and shall excavate test trenches at locations chosen by the archaeologist, having consulted the proposed development plans.
- Having completed the work, the archaeologist shall submit a written report to the Planning Authority and to the Department of Culture, Heritage and the Gaeltacht.
- Where archaeological material is shown to be present, avoidance, preservation in situ, preservation by record (excavation) and/or monitoring may be required. The Department of Culture, Heritage and the Gaeltacht will advise the Applicant/Developer with regard to these matters.

Nature Conservation

The Department refers to the above proposed development and your request for scoping comments to further inform the content and scope of the associated EIA Report and Appropriate Assessment. Please find scoping comments below.

Due to the recent transposition of the requirements of Directive 2014/52/EU into Irish planning law with effect from 1st September 2018, the following documents and guidelines should be consulted during preparation of any EIAR or EIAR screening document:

- Circular Letter: PL 05/2018 Transposition into Planning Law of Directive 2014/52/EU
- Dept. of Housing, Planning and Local Government (2018), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment,

Other important guidance documents that should be consulted include the following:

- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency, 2017.
- European Commission guidance document on the implementation of the EIA Directive (Directive 2011/92/EU as amended by 2014/52/EU) Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impacts Assessment Report, European Commission, 2017

You should have regard to the DoEHLG's *Quarries and Ancillary Activities: Guidelines for Planning Authorities* (2004), particularly section 3.5 - Natural Heritage; section 3.6 - Landscape (with specific reference to restoration and after-care); and section 4.7 (i) - Landscaping and Restoration of the site. The EPA's *Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-scheduled Minerals)* (2006) should also be referred to as should the European Commission's Guidance Document *Non-energy mineral extraction and Natura 2000* (2011).





You should also consult the requirements of this Department in relation to pre-planning at <https://www.npws.ie/development%20consultations> , in particular the section entitled pre-application consultation/engagement which has recently been updated.

The above observations/recommendations are based on the papers submitted to this Department on a pre-planning basis and are made without prejudice to any observations that the Minister may make in the context of any consultation arising on foot of any development application referred to the Minister, by the planning authority/ies, in her/his role as statutory consultee under the Planning and Development Act, 2000, as amended.

You are requested to send further communications to this Department's Development Applications Unit (DAU) at manager.dau@chg.gov.ie (team monitored); if this is not possible, correspondence may alternatively be sent to:

The Manager
Development Applications Unit (DAU)
Department of Culture, Heritage and the Gaeltacht
Newtown Road
Wexford
Y35 AP90

Is mise le meas,

Margaret Cloney,
Development Applications Unit
Tel: (053) 911 7434





Roinn Cumarsáide, Gníomhaíthe
ar son na hAeráide & Comhshaoil
Department of Communications,
Climate Action & Environment



Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Catriona Reilly,
Principal Scientist,
RPS Group
West Pier Business Campus,
Dun Laoghaire,
Co Dublin,
A96 N6T7



21 May, 2019.

Re: EIAR Consultation – Proposed Sand and Gravel Extraction Facility, Racefield, Ballyshannon, Co Kildare.

Your Ref: MH18057Lt0001

Our Ref: 19/80

Dear Catriona,

With reference to your letter received on 08 May, 2019, concerning the proposed Sand and Gravel Extraction Facility in Racefield, Co Kildare, Geological Survey Ireland (a division of Department of Communications, Climate Action and Environment) would like to make the following comments.

Geological Survey Ireland provides information on all aspects of the geology of Ireland on our Map Viewer available on the GSI website www.gsi.ie. There are multiple layers of data available including Geology, Groundwater, Quaternary, Landslides, and Geological Heritage. Our newest map is the Physiographic Units map and this is especially designed to give information on land use. We would encourage the use of our [Map Viewer](#) when undergoing the planning process.

Geoheritage

Geological Survey Ireland (GSI) is in partnership with the National Parks and Wildlife Service (NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs) to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Irish Geoheritage Programme (IGH) of GSI, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGS), as adopted under the National Heritage Plan, include additional sites that may also be of national importance but which were not selected as the very best examples for NHA designation. All geological heritage sites identified by GSI are categorised as CGS pending any further NHA designation by NPWS. CGS are now routinely included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system.

County Geological Sites in audited and unaudited counties can now be viewed online under the Geological Heritage tab on the Geological Survey Public Data Online Viewer at: [Geological Survey's Online Viewer](#) or via a direct link at: [Geoheritage Online Viewer](#).

There are no CGSs located within the vicinity of the site. The County Audit for Kildare was completed in 2005 and the full report can be viewed in the Geoheritage Section of our website. With the current plans, there is no envisaged impact on the integrity of County Geological Sites by the proposed developments. However, if the proposed development plan is altered, please contact Siobhán Power at Siobhan.Power@gsi.ie for further information and possible mitigation measures if applicable.

Our aim is not to prevent further quarrying, as the very process of extraction provides Geological Survey Ireland with much valuable data that can be added to our national databases, but our purpose in protecting and promoting geological heritage is partly educational both for the public and the geologist. The IGH programme has numerous working quarries on its database where there are significant geological sections or features exposed

Geological Survey Ireland, Beggars Bush, Haddington Road, Dublin D04 K7X4, Ireland.

Suirbhéireacht Gheolaíochta Éireann, Tor an Bhacáigh, Bothar Haddington, Baile Átha Cliath D04 K7X4 Éire

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within the quarry. In fact, new exposures through quarrying may reveal new features of interest to the geologist, and we have in the past requested that periodic monitoring of the new faces be permitted. We also encourage discussion on end-of-life plans for the quarry and would be happy to recommend ways to promote the geology to the public or develop tourism or educational resources if appropriate.

The Geoheritage Programme tries to promote a partnership between geological heritage and active quarrying, with such measures as those outlined in the 'Geological Heritage Guidelines for the Extractive Industry', which can be downloaded [here](#). This document, written in association with Irish Concrete Federation, acts as a comprehensive guide in the sustainable extraction of natural resources while preserving the geological heritage of Ireland.

3 OCT 2019

Groundwater

It should be noted that our Map Viewer can be used to show Groundwater Vulnerability within a specific area. We recommend using this function when engaging in planning.

Recommendations

Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. Should any significant bedrock cuttings be created, we would ask that they will be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints. In areas where natural exposures are few, or deeply weathered, this measure would permit on-going improvement of geological knowledge of the subsurface and could be included as additional sites of the geoheritage dataset, if appropriate. Alternatively, we ask that a digital photographic record of significant new excavations could be provided. Potential visits from Geological Survey Ireland to personally document exposures could also be arranged.

The data would be added to GSI's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to Beatriz Mozo, Land Mapping Unit, at Beatriz.Mozo@gsi.ie, 01-678 2795.

Other Comments

Geological Survey Ireland is the national earth science agency and has datasets on Bedrock Geology, Quaternary Geology, Geological Heritage Sites, Mineral deposits, Groundwater Resources and the Irish Seabed. These comprise maps, reports and extensive databases that include mineral occurrences, bedrock/mineral exploration groundwater/site investigation boreholes, karst features, wells and springs. Please see our [website](#) for data availability.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me, or one of my colleagues in the Geoheritage Programme (Sarah Gatley at Sarah.Gatley@gsi.ie or Siobhán Power at Siobhan.Power@gsi.ie).

Le meas,

Dylan Potter
Contract Geologist
Geoheritage Programme
Geological Survey Ireland



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Ms Caitriona Reilly
Principal Scientist
RPS Group
West Pier Business Campus,
Dun Laoghaire,
Co. Dublin

Kildare County Council
Planning Department

. 3 OCT 2019

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Environmental Health
The Crossings
Dublin Road
Naas
Co. Kildare

Tel: (045) 920 208
(045) 920 267
Fax: (045) 871 864

**HSE EIAR Consultation Report
Environmental Health Service Submission Report**

Date: 30 May 2019

Our reference: 0937

Report to: RPS Group Ltd.
West Pier Business Campus,
Dun Laoghaire,
Co. Dublin

Type of Consultation: EIA Scoping

Applicant: Kilsaran Concrete

Applicant reference number: MH18057Lt0001

Proposed development: Sand and gravel extraction facility at Racefield, Ballyshannon,
Co. Kildare

Nature of Activity: The proposed extraction of sand and gravel from a 142 acre greenfield site currently in agricultural use and owned by Kilsaran Concrete. The site is situated in Racefield, Ballyshannon Co. Kildare and is approximately 2.5km from Calverstown and 7km from Kilcullen. The extraction will be over an area of 79.6 acres and will involve processes including crushing, washing and screening. The proposal includes the provision of on-site welfare facilities, bunded fuel storage, septic tank and a new access to the public road adjacent to the currently vacant

Racefield House along the L8007 local road.

The site of the proposed quarry was visited by Margaret Byrne, Environmental Health Officer on May 22nd 2019. It was noted that the site is in a quiet rural location and that the L8007 local road connects the nearby villages of Ballyshannon, Calverstown and Suncroft. The L8007 is a narrow road with a number of sharp bends.

During site visit it was recorded that there are approximately 15 occupied houses within 1 km of the proposed site entrance. There are also a number of sensitive receptors in the locality, including farms, two primary schools (one in Suncroft and one in Ballyshannon) and a Nursing Home (Suncroft).

Cumulative Impacts of Developments in the Locality

It is noted that the applicant, Kilsaran Concrete, has submitted a licence application/review (EPA Reference Number W0300-010) for an Inert Soil Waste Recovery Facility at Halverstown, Kilcullen in January 2019, which is approximately 5km from the proposed quarry site at Racefield, Ballyshannon.

It is also noted that there are a number of existing quarrying activities in the area surrounding the proposed development.

The EIA should include an assessment of potentially significant cumulative impacts from the proposed development. This should include cumulative traffic, noise, dust and hydrological impact assessment.

General

The Environmental Health Service (EHS) considers the following should be assessed in the Environmental Impact Assessment (EIA)

- a) Any potentially significant emissions to surface water
- b) Any potentially significant emissions to ground water
- c) Any potentially significant emissions to air, including noise, vibration and dust

When assessing the above the existing environment, the assessment methodology and evaluation criteria should be clearly reported in the EIAR. Any mitigation proposed should be identified and the predicted residual impact clear. Assessment should be carried out for both the construction phase and the operation phase of the proposed development.

Public Consultation

The EHS emphasises the need for early and meaningful public consultation in the development process. Accurate information should be obtained regarding the location of sensitive receptors, and there should be on going engagement with these receptors during the EIA process.

The future use of the restored site should be included in the public consultation process.

Reference should be made to the EPA's '*Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006*'

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It is recommended that an Environmental Management System (EMS) is identified in the EIA that includes details of training and reviewing of the effectiveness of the EMS. The EMS should be devised in accordance with international standards such as ISO 14001 2015 and EU EMAS (1993)

Emissions to Surface Water

The EHS notes that it is proposed to have wet excavation and washing of sand/gravel at the proposed quarry. Any potential discharges to surface water resulting from these activities should be assessed, including an assessment of existing baseline water quality and assimilative capacity, if there are proposed discharges to surface water.

Any proposed emissions of treated effluent to surface or ground water should be assessed in the EIA.

The EIA should assess any potential impacts from surface water run-off and identify drainage requirements and any settlement ponds or lagoons. This assessment should include details of how any lagoons are to be adequately sealed with an impermeable material to prevent leaching to groundwater.

The EIA should include details of the fuels and chemicals to be used and stored on site and the method proposed for the bunding of fuel and chemical storage tanks.

In order to minimise the wastage of water, consideration should be given to the collection of rain water for activities such as wheel washing and dust suppression.

Emissions to Groundwater

The Environmental Health Service is aware that there are a number of private wells in the vicinity of the proposed development. It is recommended that detailed information is gathered on the location of private wells serving properties within the vicinity of the proposed quarry. The EIA should include proposals for sampling private wells before work commences, at least biannually during the operation of the quarry and twice within the first year following cessation of operations at the site.

Reference should be made in the EIA to the Geological Survey of Ireland's (GSI) '*Groundwater Protection Scheme for Co. Kildare*' to determine if there are vulnerable groundwater sources or aquifers in the vicinity of the proposed development.

Emissions to Air, Including Noise, Vibration and Dust

The EIA should assess any potentially significant impacts from dust during the construction and operation of the proposed development. Predicted dust generation during the operation of the site should not exceed 350mg/m² /day when averaged over a thirty day period, using the Bergerhoff Method as specified in the German TA Luft Air Quality Standards (TA Luft 1986). The EIAR should identified dust minimisation methods that are to be used to reduce dust generation from activities on the proposed site.

The EIA should assess any potential significant impacts from noise and/or vibration during the construction and operation of the site. In particular, any impacts from the predicted change in the existing noise environment and from any intended blasting.

Consideration should be given to noise reduction measures recommended in the EPA's '*Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006*' in particular those relating to adequate screening of the site, maintenance of plant and machinery,

reducing truck movements within the site and efficient methods of blasting. Details of the proposed noise mitigation measures to be employed should be included in the EIAR

The existing background noise level should be considered when assessing the impact of noise from the proposed development on local receptors.

Details of the location and frequency of any proposed noise monitoring should be included in the EIAR.

Staff Welfare Facilities

The EHS notes on the consultation letter that a new septic tank will be installed as part of the proposed development. Specification details for the septic tank and how it is proposed to empty/treat any effluent from the tank must be included in the EIAR.

The developer must ensure that all water provided for staff for drinking and food preparation purposes is potable and should meet the requirements of the Drinking Water Regulations (S.I No. 122 of 2014).

Potential for future health gain from the restoration of the proposed development

A Decommissioning and Site Restoration Plan for the proposed quarry should be put in place. The potential to provide a facility on site which will provide an opportunity for health gain for the wider community should be considered, for example, walkways, cycle paths, woodland paths, pitch and putt course or an amenity park.

Any queries in respect of this scoping report should be forwarded to Ms. Terri Mullee Principal Environmental Health Officer, Health Service Executive, Silverstone House, Ballymoss Rd, Sandyford Industrial Estate, Dublin 18 D18A7K7 tel: 01 2802566



Ms. Caitriona Reilly
Principal Scientist
RPS Group Ltd.
West Pier Business Campus
Dún Laoghaire
Co. Dublin
A96 N6T7



Dáta | Date
24 May 2019

Ár dTag | Our Ref.
TII19-105644

Bhur dTag | Your Ref.
MH18057Lt0001_Consultation Letter

Re: EIAR Scoping Response for Proposed Sand and Gravel Extraction Facility, Racefield, Ballyshannon, Co. Kildare on behalf of Kilsaran Concrete Unlimited Company.

Dear Ms. Reilly,

Transport Infrastructure Ireland (TII) acknowledges receipt of the above EIAR consultation document of 2 May 2019 in respect of the above proposed project.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid application referred.

The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidance as outlined in the Spatial Planning and National Roads Guidelines for Planning Authorities (2012). Regard should also be had to other relevant guidance available at www.TII.ie.

In this instance, the EIAR is to be prepared in conjunction with Appropriate Assessment Screening/NIS for a sand and gravel pit within a total stated land ownership unit of c. 57.6 ha. at Racefield, Ballyshannon co. Kildare. An application site area will be c. 32.2 ha. with an extraction over c. 17.5 ha. to include access to the public local road (L8007). The ownership and application unit indicated is located approximately 7.5 km south of the M7 and 5km west of the M9.

With respect to EIAR Scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIAR, which may affect the national road network. The developer should have regard, *inter alia*, to the following;

1. As set down in the DoECLG Spatial Planning and National Roads Guidelines (2012) it is in the public interest that, in so far as is reasonably practicable, that the national road network continues to serve its intended

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3 OCT 2019

strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing in proximity to the national road network in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network.

2. Consultations should be had with the relevant local authority/National Roads Design Office with regard to locations of existing and future national road schemes.
3. Clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed.
4. Where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's TTA Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TII TTA Guidelines which addresses requirements for sub-threshold TTA.
5. TII Standards should be consulted to determine the requirement for Road Safety Audit (RSA) and Road Safety Impact Assessment (RSIA).
6. Assessments and design and construction and maintenance standards and guidance are available at [TII Publications](#) that replaced the NRA Design Manual for Roads and Bridges (DMRB) and the NRA Manual of Contract Documents for Road Works (MCDRW).
7. The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences. In particular evidenced assessment of the protection of the strategic function of the national road in relation to the following matters is required;
 - a. TII's Environmental Assessment and Construction Guidelines, including the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2006),
 - b. The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (1st Rev., National Roads Authority, 2004)).
8. The Environmental Assessment should have regard to previous Environmental Assessment Statements/Reports and conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area.

The developer is advised that any additional works/structures required as a result of the Assessment should be funded by the developer.

Notwithstanding, any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practice.

I hope that the above comments are of use in your EIA preparation.

Yours sincerely,



Natasha Crudden
Regulatory & Administration Unit



Appendix 3.1 Site Suitability Assessment



Site Characterisation Report

By

Dr. Eugene Bolton



Applicant: Kilsaran Concrete

SITE CHARACTERISATION FORM

File Reference:

Kildare County Council
Planning Department

3 OCT 2019

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1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Surname:

Address:

Site Location and Townland:

Telephone No: Fax No:

E-Mail:

Maximum no. of Residents: No. of Double Bedrooms: No. of Single Bedrooms:

Proposed Water Supply: Mains ☒ Private Well/Borehole ☐ Group Well/Borehole ☐

2.0 GENERAL DETAILS (From planning application)

Soil Type. (Specify Type):

Aquifer Category: Regionally Important ☐ Locally Important Poor ☐

Vulnerability: Extreme ☐ High ☐ Moderate ☒ Low ☐ High to Low ☐ Unknown ☐

Bedrock Type:

Name of Public/Group Scheme Water Supply within 1 km:

Groundwater Protection Scheme (Y/N): Source Protection Area: SI ☐ SO ☐

Groundwater Protection Response:

Presence of Significant Sites
(Archaeological, Natural & Historical):

Past experience in the area:

Comments:

(Integrate the information above in order to comment on the potential suitability of the site, potential targets at risk, and on any potential site restrictions.)

Development is a Quarry with 3 workers and up to 5 drivers calling to site. Allow 40 litres /worker and 25 grams BOD and 5 litres/driver and 10 grams BOD. This equates to 145 litres and 175 grams BOD or a total PE of 3

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position: Undulating Landscape

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☐ Relatively Flat (<1:20) ☒

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses: House to Northwest and one to Northeast - both on th opposite side of road and both within 200m

Existing Land Use: Agricultural

Vegetation Indicators: Nothing to indicate poor soakage

Groundwater Flow Direction: To South

Ground Condition: Firm - no surface water

Site Boundaries: Hedge Roads: Road to North

Outcrops (Bedrock And/Or Subsoil): Nothing exposed

Surface Water Ponding: None Lakes: None

Beaches/Shellfish: None Areas/Wetlands: None

Karst Features: None Watercourse/Stream: Stream to South at 500m

Drainage Ditches: None near site Springs / Wells: Area on Mains

Comments:

Integrate the information above in order to comment on the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site.

Ground conditions are dry. Nothing to suggest poor soakage.

*Note and record

Kildare County Council
Planning Department

. 3 OCT 2019

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3.2 Trial Hole (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

Depth of trial hole (m):

Depth from ground surface
to bedrock (m) if present:

Depth from ground surface
to water table (m) if present:

Depth of water ingress:

Rock type if present:

Date and time of excavation:

Date and time of examination:



Depth of P/T Test*	Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m	P	CLAY	Not Dilatant Trds= 10, 9, 9 Rib - 120, 130, 120	Blocky	Firm	Redish brown Rootlets
0.2 m	P					
0.3 m	P					
0.4 m	P					
0.5 m	T1-3	Sandy SILT Few cobbles very low gravel	Slowly Dilatant Trds= 2,3,3 Rib - 70,80,80	Massive	Firm to stiff	Brown
0.6 m	T1-3					
0.7 m	T1-3	Gravelly SILT/CLAY Gravel content increases with depth	Trds= 5,5,6 Ribs=80,90,90	Massive	Firm to stiff	Light brown None
0.8 m	T1-3					
0.9 m						
1.0 m						
1.1 m						
1.2 m						
1.3 m						
1.4 m						
1.5 m						
1.6 m						
1.7 m						
1.8 m						
1.9 m						
2.0 m						
2.1 m						
2.2 m						
2.3 m						
2.4 m						
2.5 m						
2.6 m						
2.7 m						
2.8 m						
2.9 m						
3.0 m						

Evaluation:

Soil is compacted and subsoil has nassive structure - expect slow soakage

Likely T value:

Note: *Depth of percolation test holes should be indicated on log above. Enter P or T all depths as appropriate.

** See Appendix E for BS 5930 classification.

*** All samples to be tested for each horizon and results should be entered above for each horizon.

**** All signs of mottling should be recorded.

3.3(a) Percolation ("T") Test for Deep Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole

	1	2	3
Depth from ground surface to top of hole (mm) (A)	600	600	600
Depth from ground surface to base of hole (mm) (B)	1,000	1,000	1,000
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time

pre-soaking started

25/06/2019

25/06/2019

25/06/2019

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring T

Percolation Test Hole No.

	1	2	3
Date of test	26/06/2019	26/06/2019	26/06/2019
Time filled to 400 mm	08:29	08:36	08:37
Time water level at 300 mm	12:09	12:22	12:21
Time to drop 100 mm (T)	220 00	226 00	224 00
Average T			223 33

If T > 300 minutes then T-value >90 – site unsuitable for discharge to ground

If T < 210 minutes then go to Step 4

If T > 210 minutes then go to Step 5:



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Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1			0.00			0.00			0.00
2			0.00			0.00			0.00
3			0.00			0.00			0.00
Average Δt Value			0.00			0.00			0.00

Average $\Delta t/4 =$ [Hole No.1] 0.00 (ft) | Average $\Delta t/4 =$ [Hole No.2] 0.00 (ft) | Average $\Delta t/4 =$ [Hole No.3] 0.00 (ft)

Result of Test: $T =$ 0.00 (min/25 mm)

Comments:

Step 5: Modified Method (where $T > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor $= T_1$	Time of fall (min) $= T_2$	K $= T_1/T_2$	T-Value $= 4.45/K$	Time Factor $= T_1$	Time of fall (min) $= T_2$	K $= T_1/T_2$	T-Value $= 4.45/K$	Time Factor $= T_1$	Time of fall (min) $= T_2$	K $= T_1/T_2$	T-Value $= 4.45/K$
300 - 250	8.1	118	0.07	64.83	8.1	124	0.07	68.12	8.1	126	0.06	69.22
250 - 200	9.7	150	0.06	68.81	9.7	156	0.06	71.57	9.7	158	0.06	72.48
200 - 150	11.9	188	0.06	70.30	11.9	187	0.06	69.93	11.9	195	0.06	72.92
150 - 100	14.1	221	0.06	69.75	14.1	232	0.06	73.22	14.1	230	0.06	72.59
Average T-Value	T-Value Hole 1= (ft)			68.42	T-Value Hole 1= (ft)			70.71	T-Value Hole 1= (ft)			71.80

Result of Test: $T =$ 70.31 (min/25 mm)

Comments:

Soakage is slow

3.3(b) Percolation ("P") Test for Shallow Soil / Subsoils and/or Water Table

Step 1: Test Hole Preparation

Percolation Test Hole

	1	2	3
Depth from ground surface to top of hole (mm)	0	0	0
Depth from ground surface to base of hole (mm)	400	400.00	400
Depth of hole (mm)	400	400	400
Dimensions of hole (length x breadth (mm))	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Date and Time

pre-soaking started

25/06/2019

25/06/2019

25/06/2019

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3: Measuring P

Percolation Test Hole No.

	1	2	3
Date of test	26/06/2019	26/06/2019	26/06/2019
Time filled to 400 mm	08:39	08:41	08:43
Time water level at 300 mm	09:50	09:54	10:03
Time to drop 100 mm (P)	71.00	73.00	80.00
Average P			74.67

If P > 300 minutes then T-value > 90 – site unsuitable for discharge to ground

If P < 210 minutes then go to Step 4:

If P > 210 minutes then go to Step 5:

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Step 4: Standard Method (where $P \leq 210$ minutes)

Percolation Test Hole	1			2			3			
Fill no.	Start Time at 300 mm	Finish Time at 200 mm	Δp (min)	Start Time at 300 mm	Finish Time at 200 mm	Δp (min)	Start Time at 300 mm	Finish Time at 200 mm	Δp (min)	
1	09:50	11:15	85.00	09:54	11:19	85.00	10:03	11:37	94.00	
2	11:15	13:18	123.00	11:19	13:24	125.00	11:37	14:09	152.00	
3	13:18	15:49	151.00	13:24	15:57	153.00	14:09	16:57	168.00	
Average Δp Value	119.67			121.00			138.00			
Average $\Delta p/4 =$ [Hole No.1]			29.92 (p)	Average $\Delta p/4 =$ [Hole No.2]			30.25 (p)	Average $\Delta p/4 =$ [Hole No.3]		34.50 (p)

Result of Test: $P = 31.56$ (min/25 mm)

Comments:

The P-value is within the acceptable range

Step 5: Modified Method (where $P > 210$ minutes)

Percolation Test Hole No.	1				2				3			
Fall of water in hole (mm)	Time Factor $= \frac{1}{T_1}$	Time of fall (min) $= T_1$	$K = \frac{1}{T_1^2}$	P-Value $= \frac{4.45}{K}$	Time Factor $= \frac{1}{T_1}$	Time of fall (min) $= T_1$	$K = \frac{1}{T_1^2}$	P-Value $= \frac{4.45}{K}$	Time Factor $= \frac{1}{T_1}$	Time of fall (min) $= T_1$	$K = \frac{1}{T_1^2}$	P-Value $= \frac{4.45}{K}$
300 - 250	8.1				8.1				8.1			
250 - 200	9.7				9.7				9.7			
200 - 150	11.9				11.9				11.9			
150 - 100	14.1				14.1				14.1			
Average P-Value	P-Value Hole 1 = (p) 0.00				P-Value Hole 1 = (p) 0.00				P-Value Hole 1 = (p) 0.00			

Result of Test: $P = 0.00$ (min/25 mm)

Comments:

4.0 CONCLUSION of SITE CHARACTERISATION

Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Not Suitable for Development

Suitable for

1. Septic tank system (septic tank and percolation area)

No

2. Secondary Treatment System

a. septic tank and filter system constructed on-site and polishing filter: or

Yes

b. packaged wastewater treatment system and polishing filter

Yes

Discharge Route

Discharge to Ground Water

5.0 RECOMMENDATION

Propose to install:

Packaged wastewater treatment system and polishing filter

and discharge to:

Ground Water

Trench Invert level (m):

Site Specific Conditions (e.g. special works, site improvement works testing etc.)

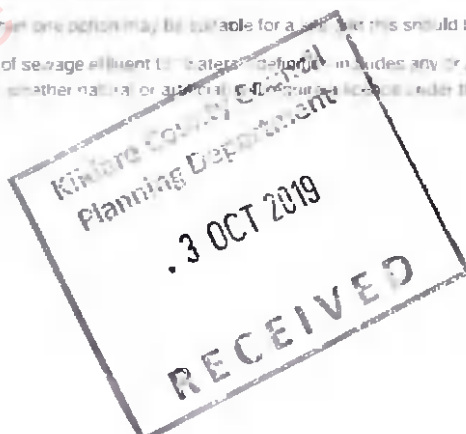
It is recommended to install a Package aeration system and to polish the effluent through a soil polishing filter using a pressurised effluent distribution system. The watertable is in excess of 2m bgl. So the base of the distribution gravel can be at 500mm bgl. A layer of 200mm washed gravel is placed on the surface of the prepared area. Distribution system (32mm diameter) is placed on this and covered with 100mm gravel. This is covered with geotextile and finished with 200mm soil. Effluent from the Treatment unit is pumped to the distribution pipework.

Size of Filter

PE is 3 and hydraulic load is 400 litres. The T-value is in excess of 50 so maximum loading rate is 3 litres/m². There is therefore a requirement for 150m² soil polishing filter.

Note: more than one option may be suitable for a site and this should be recorded.

A discharge of sewage effluent to a watercourse includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial and requires a licence under the Water Pollution Acts 1977/93. Refer to Section 2.6.2.



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6.0 TREATMENT SYSTEM DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m ³)		Percolation Area		Percolation Area	
No. of Trenches		No. of Trenches		No. of Trenches	
Length of Trenches (m)		Length of Trenches (m)		Length of Trenches (m)	
Invert Level (m)		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System

Filter Systems				Package Treatment Systems	
Media Type	Area (m ²)*	Depth of Filter	Invert Level	Type	
Sand/Soil				Oakstown BAF P6	
Soil				Capacity PE	6.00
Constructed Wetland				Sizing of Primary Compartment	
Other					3.00 m ³

SYSTEM TYPE: Tertiary Treatment System

Polishing Filter: Surface Area (m ²)*	150.00	Package Treatment System: Capacity (pe)	
or Gravity Fed:		Constructed Wetland: Surface Area (m ²)	
No. of Trenches			
Length of Trenches (m)			
Invert Level (m)			

DISCHARGE ROUTE:

Groundwater ☒	Hydraulic Loading Rate * (l/m ² .d)	3.00
Surface Water ** ☐	Discharge Rate (m ³ /hr)	

TREATMENT STANDARDS:

Treatment System Performance Standard (mg/l)	BOD	SS	NH	Total N	Total P
	20.00	30.00	20.00		10.00

QUALITY ASSURANCE:

Installation & Commissioning

Installation supervised and Certified by qualified assessor or a suitably qualified person familiar with the EPA Code of Practice 2009.

On-going Maintenance

Annual maintenance contract - including desludging

* Hydraulic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

7.6 SITE ASSESSOR DETAILS

Company:

Prefix:

First Name:

Surname:

Address:

Qualifications/Experience:

Date of Report:

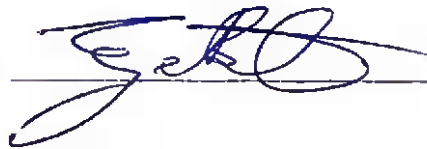
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Fax:

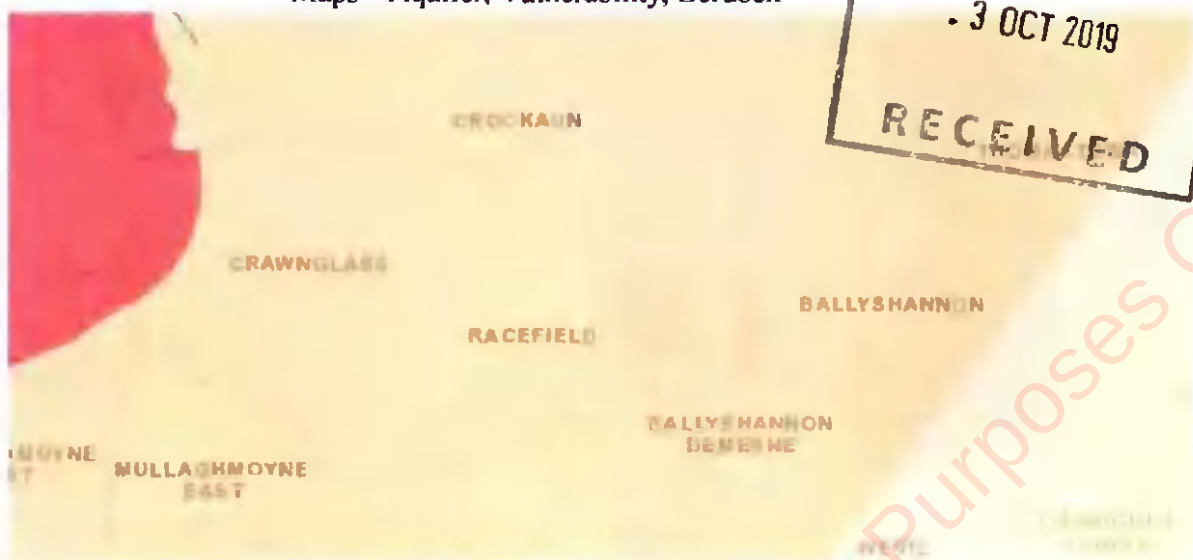
e-mail:

Indemnity Insurance Number:

Signature: _____



Maps – Aquifer, Vulnerability, Berdock



Aquifer is LI



Vulnerability is Moderate



Bedrock is Dinantian Lower Impure Limestones

Photos

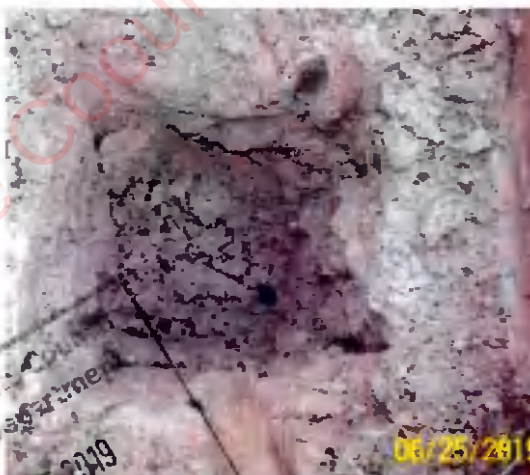
Row 1 - P1, P2



Row 2 - P3, T1



Row 3 - T2, T3



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Trial Pit



Site overview



Appendix 3.2 Oakstown BAF 6 PE wastewater treatment system





**Kilsaran Concrete
Ballyshannon
Racefield
Co. Kildare**

O'Reilly Oakstown Environmental



Oakstown, Trim
Co. Meath
Tel: 046 - 943 - 1389
Fax: 046 - 943 - 7054

E: info@oreillyoakstown.com
W: www.oreillyoakstown.com
V.A.T Reg. No.: IE 8401624D
Company Reg. No.: 381624



Date: 10th July 2019

Applicant Name: Kilsaran Concrete

Site Address: Ballyshannon, Racefield, Co. Kildare

The following is the design specification for the Oakstown BAF 6 PE wastewater treatment system.

1. Waste Water Treatment System Design Details:

- Maximum Daily Design Loadings as per client & EPA - Commercial Loading Rates:

	Max No. of users	Flow Litres/day/ person	Total Hydraulic Load	BOD5 (grams/day /person)	Total Organic Loading (grams/day)
Workers	3	40	120 litres	25	75
Drivers	5	5	25 litres	10	50
Total			145 Litres ~1 PE		125 grams ~ 2PE

- Oakstown BAF 6 PE Maximum Capacity Design Loadings:

Total Organic Loading	0.36kg BOD/day
Total Hydraulic loading	0.9m ³ /day

- Average treated effluent standard

BOD	20mg/litre
TSS	30mg/litre

- Proposed system details:

► Oakstown BAF 6 P.E.

Volume of Total Plant	6.7m ³
Volume of Primary Sedimentation Chambers	2.86m ³
Volume of Secondary Aeration Chamber	1.2m ³
Volume of Biomedia	0.8m ³



2. Wastewater Treatment system description:

The Oakstown BAF 6 PE is designed to provide proven, cost effective primary and secondary wastewater treatment in robust steel reinforced concrete tanks.

The primary sedimentation chamber has a 2.2m³ capacity to allow anaerobic digestion to occur naturally while letting sludge settle on the tank floor.

Once primary treatment has taken place the effluent is further degraded in the aeration chamber where oxygen enriched wastewater provides ideal conditions for aerobic bacteria to thrive.

Before pumping to the percolation area the clear water is left to further settle in the clarifier chamber to eliminate any remaining settle able solids.

3. Guarantee and warranties:

O'Reilly Oakstown provide a 12 month maintenance service contract on all systems from date of first occupation. We provide a 24 month warranty on all parts.

4. Percolation:

The percolation area designed must conform to the requirements of Chapter 10 or Table 8.1 of EPA Code of Practice 2009 Wastewater Treatment and Disposal System serving single houses.

The percolation area requirements are as follows:

Groundwater Protection Response: R1.

T-value: (M) 70.31 as per Site Characterisation Form.

P-value: 31.56 as per Site Characterisation Form.

Depth from ground surface to water table: None Encountered BGL.

Depth from ground surface to bed rock: None Encountered BGL.

Depth from ground surface to mottling: None Encountered BGL.

Area of Soil Polishing Filter required: 150m².

Soil Polishing Filter must be covered in 25-40mm drainage stone.

Soil Polishing Filter must be covered in geo-textile cover then in topsoil.

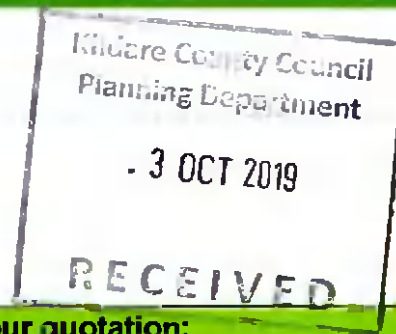
► See Site Characterisation report for percolation area details.



O'Reilly Oakstown Environmental

Oakstown, Trim
Co. Meath
Tel: 046 - 943 - 1389
Fax: 046 - 943 - 7054

E: info@oreillyoakstown.com
W: www.oreillyoakstown.com
V.A.T Reg. No.: IE 6401624D
Company Reg. No.: 381624



5. Client Responsibilities unless included in our quotation:

- Excavation and backfill.
- Construction of the percolation / polishing filter as recommended by the site engineer on the Site Characterisation report and/or drawing.
- Provision of access for delivery by hi-ab truck to within 3 metres of the excavation.
- Provision of a power ducting from the tanks to the Plant Room.
- Mounting and connection of control panel to mains power in the Plant Room.

6. Operation and Maintenance:

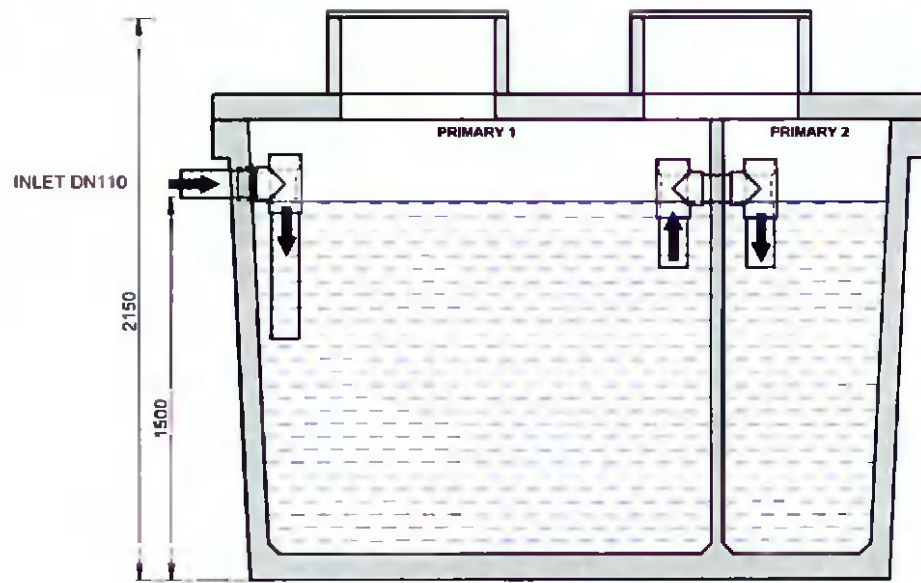
The client is responsible for the operation and maintenance of the wastewater treatment system in accordance with the owner's manual supplied by O'Reilly Oakstown.

Please do not hesitate to contact us if there are any further queries.

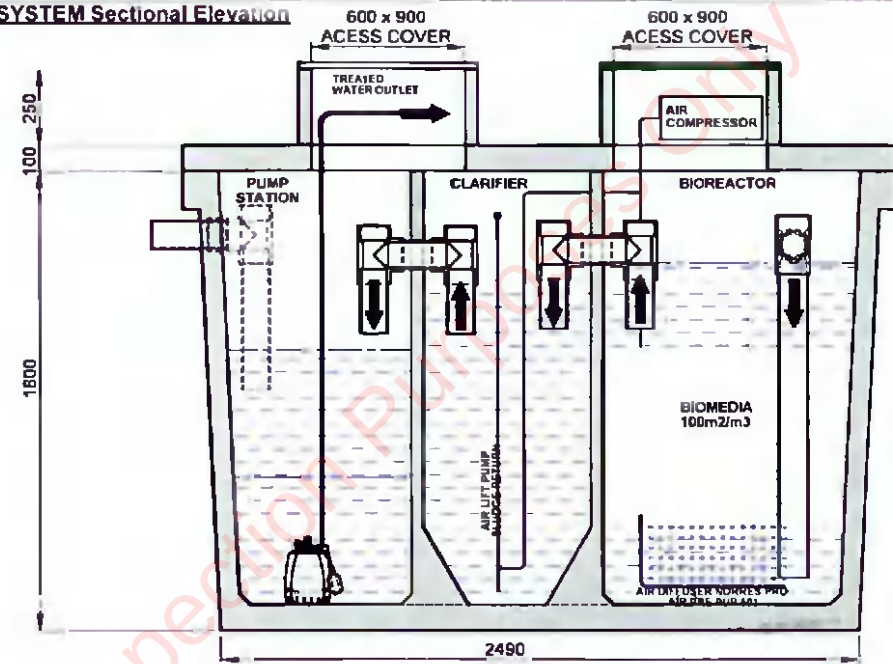
Yours sincerely,

Paula Murphy

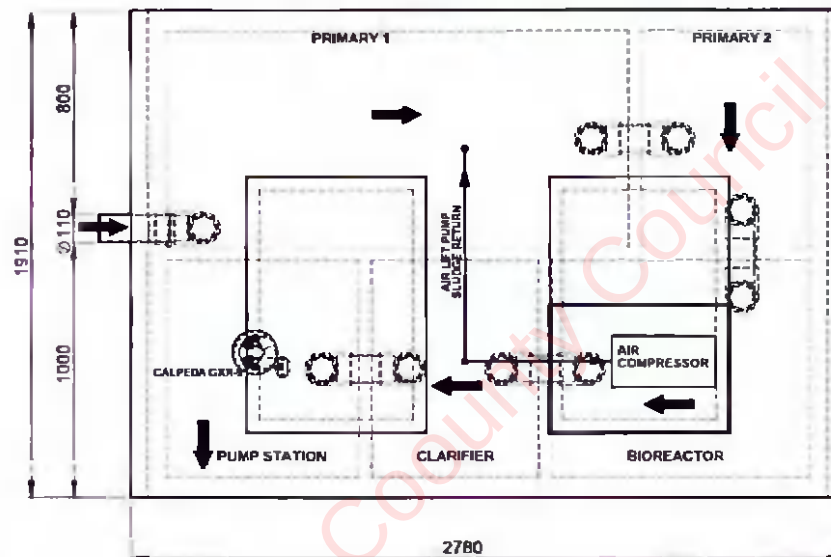
Oakstown 6PE BAF SYSTEM Sectional Elevation



SECTION B-B



SECTION A-A



VOLUME
LITRES 6730
WEIGHT TANK 6500kg
LID 1010kg

PROJECT: SR-66 O'Reilly Oakstown
TITLE: 6 PE BAF SYSTEM

DRAWN
T.Nicinski

CHECKED
D.O'Reilly



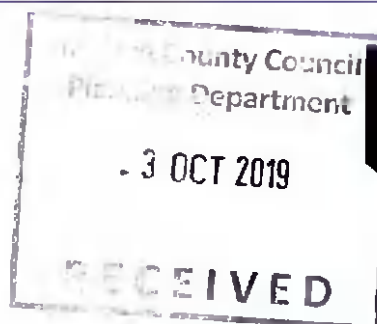
O'REILLY OAKSTOWN LTD.
BAF - WASTEWATER TREATMENT SYSTEM



O'REILLY OAKSTOWN

114M Co Mt A111
Email: info@oreillyoakstown.com
Tel: (046)94411911 Fax: (046)9441054

SCALE	DWG NO	REV	DATE
N.T.S.	02AKS 2017/01	N400	03/2017



Prufinstitut für
Abwassertechnik
GmbH

TREATMENT PERFORMANCE RESULTS

O'Reilly Oakstown Environmental Ltd.
Oakstown, Trim, Co. Meath, Ireland

EN 12566-3

Results corresponding to EN 12566-3 and S.R. 66

PIA-SR66-1603-1036

Oakstown BAF System
Submerged aerated fixed film bioreactor

Nominal organic daily load	0.38 kg/d		
Nominal hydraulic daily load	1.20 m ³ /d		
Material	Concrete		
Watertightness	Pass		
Structural behaviour (Calculation)	Pass (also wet conditions)		
Durability	Pass		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	CDD	93.0 %	46 mg/l
	BOD ₅	97.5 %	8 mg/l
	NH ₄ -N	61.0 %	13 mg/l
	SS	96.7 %	12 mg/l
Number of desludging	Not more than once		
Electrical consumption	2.0 kWh/d		

Performance tested by

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration
of performance nor the CE marking.



Notified Body
No. 1739

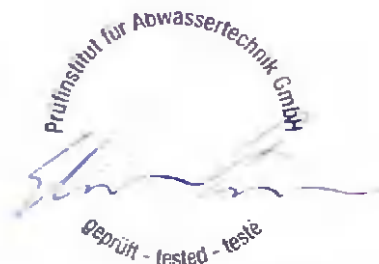


Certified according to
ISO 9001:2008



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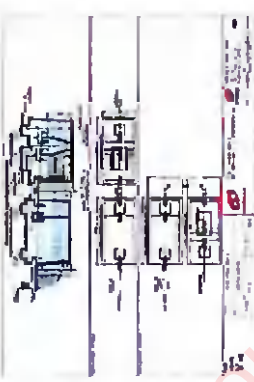
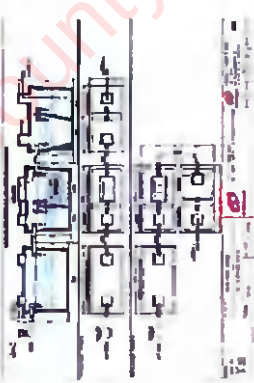
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Akkreditierungsstelle
D-PL-17712-01-00



Elmar Lance

January 2017

Oakstown BAF range and its referring test reports:

Population equivalent (PE)	Drawing of model of the range	Watertightness (EN 12566-3 Annex A)	Treatment Efficiency (EN 12566-3 Annex B)	Structural Behaviour (EN 12566-3 Annex C)	Durability
6 PE 3 OCT 2019 RECEIVED		Pass PIA2016-WD-1603-1036.02	Pass Range conformity according to S.R. 66:2015	Pass For wet ground conditions also, installation depth 1.50 m from inlet invert	Pass PIA2017-DH-1603-1036.01
Initial Type Test (ITT) 8 PE		Pass PIA2012-WD/NC-1209-1059	Pass PIA2008-094B04	Pass PIA2009-ST-AT0809-1071 For wet ground conditions also, installation depth 1.50 m from inlet invert	Pass PIA2017-DH-1603-1036.01
12		Pass PIA2016-WD-1603-1036.01	Pass Range conformity according to S.R. 66:2015	Pass For wet ground conditions also, installation depth 1.50 m from inlet invert	Pass PIA2017-DH-1603-1036.01

Population equivalent (PE)	Drawing of model of the range	Watertightness (EN 12566-3 Annex A)	Treatment Efficiency (EN 12566-3 Annex B)	Structural Behaviour (EN 12566-3 Annex C)	Durability
16		Pass PIA2016-WD-1603-1036.01	Pass Range conformity according to S.R. 66:2015	Pass For wet ground conditions also, installation depth 1.50 m from inlet invert	Pass PIA2017-DH-1603-1036.01
20		Pass PIA2016-WD-1603-1036.01	Pass Range conformity according to S.R. 66:2015	Pass For wet ground conditions also, installation depth 1.50 m from inlet invert	Pass PIA2017-DH-1603-1036.01

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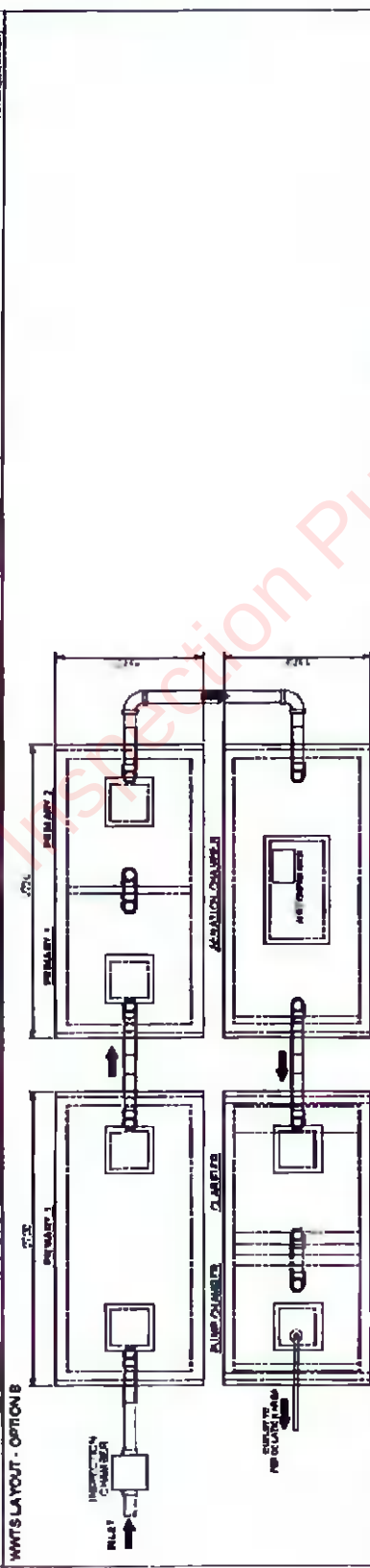
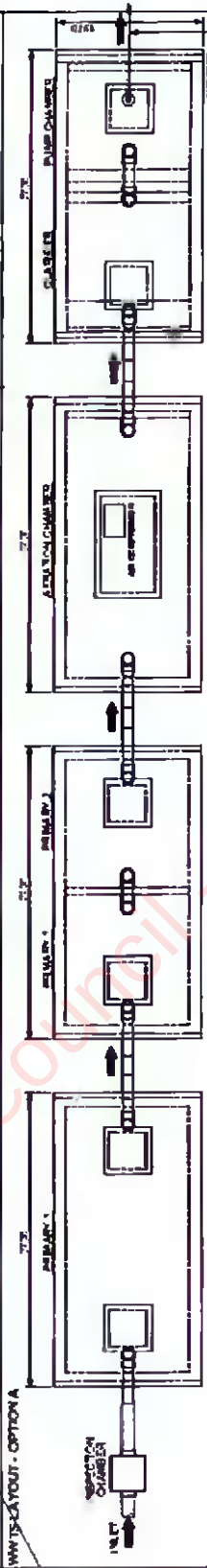
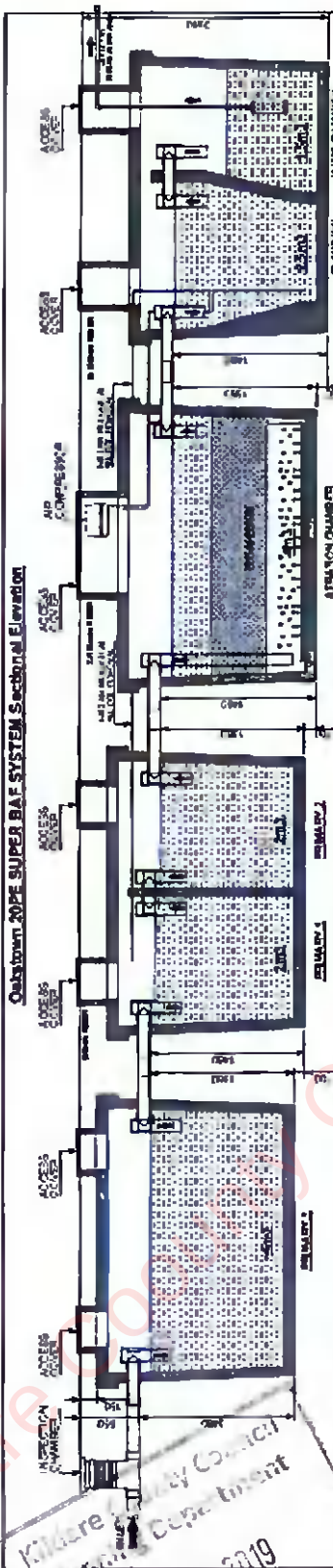
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Q. No.	Q. Text	Ans.
1	What is the difference between a <i>function</i> and a <i>method</i> ?	A function is a block of organized, reusable code that is used in your program. A method is a function that is associated with an object.
2	What is the difference between a <i>function</i> and a <i>method</i> ?	A function is a block of organized, reusable code that is used in your program. A method is a function that is associated with an object.
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PROJECT SEWAGE TREATMENT PLANT TITLE SUPER BAF SYSTEM DATE 10/10/18		CLIENT KILDARE COUNTY COUNCIL DESIGNER O'REILLY SCALE 1:100	
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Appendix 5.1 Aquatic Survey Report



SAND AND GRAVEL EXTRACTION AT RACEFIELD

Aquatic Survey Report



MH18057Rp0004
Sand and Gravel Extraction
at Racefield
F01
23 August 2019

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1 INTRODUCTION

The purpose of this aquatic survey is to gather baseline information and inform the Appropriate Assessment and the Environmental Impact Assessment Report for the proposed extraction development and associated works at Racefield, Ballyshannon, Co. Kildare (hereafter referred to as the 'proposed development').

The proposed development is located approximately 3km west of Calverstown, Co. Kildare. The site is mainly bordered by agricultural fields with coniferous forestry to the south. A small stream/drainage ditch is located approximately 250m south of the proposed development running parallel to the forestry border. EPA online mapping has identified this stream as the Eagle Hill 14 (also known locally as the Asgulusian).

This report was prepared to investigate the macroinvertebrate community and habitat quality for the Eaglehill 14 stream with regard to the following protected aquatic species; salmon (*Salmo salar*, Annex II, V), lamprey (*Lampetra fluviatilis* Annex II, V, *Lampetra planeri* Annex II) and white clawed crayfish (*Austropotamobius pallipes* Annex II,V). If present, visual signs and/or presence of otter (*Lutra lutra*), an Annex II and IV species, were noted during the aquatic survey but results are discussed elsewhere in project documentation. In addition, habitat was assessed to include a further salmonid species, e.g., brown trout (*Salmo trutta*) and is referred to as salmonid habitat.

1.1 Existing Environment

1.1.1 Water Bodies

The proposed development area gently slopes toward the forestry and the stream to the southern boundary. The Eaglehill 14 flows along the southern edge of the forestry boundary. It is first order stream at this point and rises 400m to the east of this location. It joins with the Ballysax little, 2km downstream. The Ballysax little flows for a short distance (1.8km) then joins the Kildoon stream. The Kildoon then joins the Tully Stream and finally joins the River Barrow north of Athy. The Kildoon (also referred to as the Boherbaun or Finnelly stream) forms part of the River Barrow and River Nore SAC 5km downstream of the proposed development.

The Eaglehill 14, Ballysax Little and Kildoon form the Kildoon_010 water body while the Tully Stream forms the Tully_Stream_040 water body. All these water bodies are part of the River Barrow Catchment (Hydrometric Area 14).

The main land use along these water bodies is agricultural grassland with some scattered coniferous forestry. The Tully flows north of Kilberry Bog before confluenting with the Barrow.

The proposed development overlies the New Ross groundwater body which is poorly productive. Flow is probably confined to fractures, fissures, joints, bedding planes and the uppermost part of the bedrock. Groundwater flow is to the south toward the River Barrow (GSI 2004). EPA codes for these water bodies are shown below in Table 1.1.

Table 1.1: EPA water body codes

EPA water body name	Water body type	EPA Code	EPA water body code
Kildoon_010 (Eaglehill 14)	River	14E04	IE_SE_14K270950
Kildoon_010 (Ballysax_Little)	River	14B39	IE_SE_14K270950
Kildoon_010 (Kildoon)	River	14K27	IE_SE_14K270950
Tully_040 (Tully Stream)	River	14T02	IE_SE_14T0200600
New Ross	Groundwater	n/a	IE_SE_G_152

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1.1.2 Surface Water Quality and Risk Characterisation

No EPA sampling data is available for the Eaglehill 14, Ballysax little or Kildoon streams. Macroinvertebrate sampling for Q-value determination was conducted within the Tully stream as part of EPA's Water Framework Directive monitoring. This sampling point is located 16km downstream from Site 1 in this survey report, where the Kildoon becomes the Tully stream. Table 1.2 displays the results from the last three monitoring cycles. In summary, for 2017 the Tully stream had a moderate macroinvertebrate condition (Q3-4) a drop from the Good macroinvertebrate condition (Q4) seen in 2011 and 2014.

Table 1.2: Summary of EPA Q-values within Tully stream from 2011-2017

River	Station Code	Station Name	Easting	Northing	2011	2014	2017
Tully Stream	RS14T020600	Cloney Br	265517	201249	4	4	3-4

The overall WFD status for the Kildoon_010 stream for 2010-2015 was unassigned and 'Good' for the Tully_040 in the same time period. A summary of the WFD status is shown below in Table 1.3. A status summarising the risk of a water body failing WFD objective has not been assigned to the Kildoon_010 or Tully_040 and both are currently "Under Review".

Table 1.3: Summary of WFD status for Kildoon and Tully and water bodies

EPA Waterbody Name	Code	Risk	WFD Status ¹ 2007-2009	WFD Status ¹ 2010-2012	WFD Status ¹ 2010-2015
Kildoon_010	IE_SE_14K270950	Review	Unassigned	Unassigned	Unassigned
Tully Stream_040	IE_SE_14T020600	Review	Moderate	Moderate	Good

1.2 Review of Records for Annex II Aquatic Species

1.2.1 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

The River Barrow and River Nore SAC (002162) is designated for two freshwater pearl mussel species, *Margaritifera margaritifera* and *Margaritifera durrovensis*. The latter appears now to be restricted to a short section within the River Nore (NPWS 2011). Records of *Margaritifera margaritifera* within the main channel of the Barrow were not identified during the desktop review however there are a number of tributaries which are designated under the Freshwater Pearl Mussel Regulations (S.I. No. 355/2018 as amended). These tributaries are not hydrologically connected to the proposed development nor the Eaglehill 14, Ballysax little, Kildoon or Tully streams. There are no records of freshwater pearl mussel (*Margaritifera margaritifera* or *Margaritifera durrovensis*) within the Kildoon_10 or Tully_40 water bodies. A freshwater pearl mussel survey was not conducted as part of this aquatic survey.

1.2.2 Salmon (*Salmo salar*), Brown trout (*Salmo trutta*) and Lamprey (*Lampetra* spp. & *Petromyzon marinus*)

The Kildoon_010 is not a designated salmonid river under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988. The Kildoon_010 becomes part of the River Barrow and River Nore SAC 5km downstream which salmon is a Qualifying Interest (QI). The National Research Survey Programme Rivers undertaken by Inland Fisheries Ireland (IFI) within the Barrow Catchment found Atlantic salmon and brown trout within the Kildoon stream (referred to as the Finney stream) approximately 7km downstream of the proposed development. Lamprey spp. were found 8km downstream of the proposed

¹ <https://gis.epa.ie/EPAMaps/>

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development (Delanty *et al* 2015). Other fish species located within the Kildoon included dace (*Leuciscus leuciscus*), perch (*Perca fluviatilis*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*). The upper two sites 97 and 8km downstream of the proposed development) within the Kildoon were assigned Good fish status while further downstream this was degraded to Moderate Fish status before the stream meets the Tully.

The Site-Specific Conservation Objectives for the River Barrow and River Nore SAC 002162 (Version 1.0 19th July 2011) indicates that all three lamprey species are designated within the River Barrow and River Nore SAC, which begins approximately 5km downstream from the site (NPWS 2011). A survey was conducted by NPWS summarising the status of lamprey within the SAC. No lamprey were found within the Kildoon_010 (referred to as the Boherbaun stream in this report) (King 2006) however as noted above lamprey species were found in a later survey conducted by IFI. Sea lamprey appear confined to the lower reaches of the Barrow with spawning observed below the weir at Graignamanagh (Kurtz and Costello 1999)

1.2.3 White-clawed crayfish (*Austropotomobius pallipes*)

A review of the National Biodiversity Data Centre maps indicates that there are no records of white-clawed crayfish within the Eaglehill 14 stream. The nearest record is from the Tully stream just before the Barrow confluence approximately 14km downstream of the proposed development (N655012, EPA 1997, 2000, 2006, 2009 & 2014). (www.biodiversityireland.ie).

The crayfish plague in the River Barrow in 2017 has been well publicised and as recently as May 2019 has migrated as far upstream as Monasterevin. A freshwater crayfish survey was not conducted as part of this aquatic survey, owing to the lack of suitable habitat



2 METHODOLOGY

On the 19th June 2019, RPS ecologists carried out a survey at four sites. The suitability of habitat for the following Annex II protected species was also assessed; salmon, crayfish and lamprey species. In addition, habitat was assessed to include a further salmonid species, brown trout (*Salmo trutta*) and is referred to as salmonid habitat. Q-value surveys (macroinvertebrates) were conducted at all four sites. See Figure 2.1 for a map of the sampling locations.

2.1 Macroinvertebrate Survey

Macroinvertebrates were collected using a two-minute kick sampling method with a standard hand net (0.5 mm mesh). The survey technique adhered to the ISO Standard (10870:2012) for kick sampling and utilised the Environmental Protection Agency (EPA) standard protocol and RPS recording sheets. Stone washing was also undertaken to ensure collection of species which cling to rock surfaces.

Q-values and water quality classes are assigned using a combination of habitat characteristics and the structure of the macroinvertebrate community within the waterbody. Individual macroinvertebrate taxa are ranked for their sensitivity to organic pollution and the Q-value is determined based on their relative abundance within a sample.

The macroinvertebrate survey was conducted in June. The Q-value is usually applied in summer/autumn when anthropogenic pressures are greatest on macroinvertebrates due to lower flows and higher temperature.

Q-values and water quality classes are assigned using a combination of habitat characteristics and the structure of the macroinvertebrate community within the waterbody. Individual macroinvertebrate taxa are ranked for their sensitivity to organic pollution and the Q-value is determined based on their relative abundance within a sample and reflects the average water quality at a location.

The Environmental Quality Ratio (EQR) represents the relationship between the values of the biological parameters observed for a body of surface water and the values for these parameters in the reference conditions applicable to that body. The ratio is expressed as a value between zero and one, with high ecological status represented by values close to one and bad ecological status by values close to zero. In Ireland it is calculated as Observed Q-value/Reference Q-value (i.e., Q5). The EQR allows comparison of water quality status across the European Union as each Member State has an EQR value for 'High'; 'Good' etc., based on an intercalibration of boundaries between water quality categories e.g., 'High-Good'; 'Good-Moderate'.

The Q-value is assigned on a scale of 1 to 5 with a Q5 representing high quality pristine conditions and a Q1 representing bad seriously polluted conditions. The intermediate values (Q1-2, 2-3, 3-4 etc.) denote transitional conditions. The scheme mainly reflects the effects of organic pollution (i.e. deoxygenation and eutrophication) but where a toxic effect is apparent or suspected the suffix '0' is added to the biotic index (e.g. Q1/0, 2/0 or 3/0). An asterisk after the Q value (e.g. Q3*) indicates heavy siltation of the substratum.

EPA indices, EPA water quality status and Water Framework Directive (WFD) status are interpreted in Table 2-1.



Table 2-1: EPA biotic index (Q-value) and equivalent WFD water quality status classes

Biotic Index	EQR ²	EPA Quality Status	WFD ³ Status
Q5	1.0	Unpolluted	High
Q4.5	0.9	Unpolluted	High
Q4	0.8	Unpolluted	Good
Q3-4	0.7	Slightly Polluted	Moderate
Q3	0.6	Moderately Polluted	Poor
Q2-3	0.5	Moderately Polluted	Poor
Q2	0.4	Seriously Polluted	Bad
Q1-2	0.3	Seriously Polluted	Bad
Q1	0.2	Seriously Polluted	Bad

(colour coding as employed under the WFD as specified in Schedule 3 of S.I. No 272 of 2009: High – blue, Good – green, Moderate – yellow, Poor – orange, and Bad – red)

2.2 Limitations

The Eaglehill 14 stream is a small, modified drainage ditch which rises 400m to the east of the proposed development site. The Ballysax stream is a second order stream. Q-values are not developed for first and second order streams and therefore it is inappropriate to assign a value to these water bodies. A summary of the macroinvertebrate found is given.

2.3 Habitat Assessments

The habitat assessment included surveys for a general river habitat survey, lamprey/salmonid habitat potential and invasive aquatic species. The general physical characteristics and hydromorphological features of each site were recorded including substrate, flow types and aquatic vegetation during surveys. All sites were assessed in terms of:

- Stream width and depth;
- Substrate type, listing substrate fractions in order of dominance;
- Flow type, listing prevalence of flow types in the area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampled area;
- Dominant bankside vegetation, listing the main species overhanging the watercourse;
- Estimated cover by bankside vegetation, and estimated shading of the sampling site, and

² EQR = Environmental Quality Ratio (Observed/Reference)

³ WFD = Water Framework Directive (EPA, 2006)

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- The degree of siltation was recorded on a scale of clean, slight, moderate and heavy, prior to kick sampling.

The rating of habitat for salmonids, crayfish and lamprey is on a scale of *None/Poor/Fair/Good/Very Good/Excellent*. This rating assesses the physical suitability of the habitat; the presence/absence/density of the species in question will also depend on present and historical water quality and accessibility of the section to these species.

A rating of;

'None' indicates that the ecologist carrying out the assessment regards it as impossible that the watercourse could support the species in question in the relevant life stage.

'None – Poor' indicates that it is regarded as possible but extremely unlikely that the stream could support the species in the relevant life stage.

'Fair' indicates that it is possible that the stream section could support the species in question.

'Good' indicates that the ecologist considers it possible and likely that the stream could support the species in question.

'Very Good' indicates that the stream certainly could support the species.

'Excellent' indicates that the ecologist regards the stream as the ideal habitat for the species in question.

2.3.1 Criteria used for Assessment of White-clawed Crayfish Habitat Quality

Assessment of the quality of crayfish habitat is based on published information on the habitat criteria for crayfish (Holdich 2003, Peay 2002 and Peay 2003) as well as the surveyor's personal experience in aquatic sampling and research. The white-clawed crayfish occurs in areas with relatively hard, mineral-rich waters on calcareous and rapidly weathering rocks. Crayfish are found in a wide variety of environments, including canals, streams, rivers, lakes, reservoirs and water-filled quarries and are typically found in watercourses 0.75 m to 1.25 m deep, but the species may occur in very shallow streams (about 5 cm of water) and in deeper, slow-flowing rivers (2.5 m). They occupy cryptic habitats under rocks and submerged logs, among tree roots, algae and macrophytes, although they usually emerge to forage. Juveniles, in particular may also be found among cobbles and detritus such as leaf litter. Adults may burrow into suitable substrates, particularly in the winter months. The presence of juveniles and a varied size range of adults are indicative of a breeding population.

White-clawed crayfish may be found associated with:

- Undermined, overhanging banks;
- Sections exhibiting heterogeneous flow patterns with refuges;
- Under cobbles (juveniles) and rocks in riffles, and under larger rocks in pools;
- Among roots of woody vegetation, accumulations of fallen leaves and boulder weirs;
- Under water-saturated logs;
- Slow-flowing glides and pools (provided there are refuges), localised velocity of 0.1 m/s or less;
- Loose boulders (>25cm) or other similarly sized material;
- Boulders or large cobbles in groups with crevices between them;
- Deep crevices in bedrock;

- 3 Underlying substrate of fine gravel/sand with some pebbles;

- Submerged refuges in stable banks (e.g. natural crevices, stone block reinforcement or stable slightly undercut banks with overhanging vegetation, large tree roots, etc);

- Unmortared stone revetting, which protects banks from erosion; and

- Stands of submerged and emergent aquatic plants.

2.3.2 Criteria used for assessment of lamprey habitat quality

Each surveyed location was rated for its quality to support lamprey. Assessment of the quality of lamprey habitat is based on published information on the habitat criteria for lamprey (Maitland, 2003) as well as the surveyor's personal experience in lamprey sampling. General habitat requirements are discussed for the three lamprey species that occur in Ireland (river, brook and sea lamprey). Lamprey habitat preferences change with the stages of their life cycle. They show a preference for gravel-dominated substratum for spawning similar to salmonids. After hatching, lamprey larvae (ammocoetes) swim or are washed downstream by the current to areas of sandy silt in still or slow flowing water where they burrow and spend the next few years in tunnels. Lampreys therefore require mainly silt and sand-dominated substratum for nursery habitat. Other important environmental characteristics for optimal ammocoete habitat are shallow waters with low velocity, and the presence of organic detritus.

Suboptimal habitat supporting only a few individuals may consist of a few square centimetres of suitable silt in an open, comparatively high-velocity, boulder-strewn streambed.

- The following summarises the ecological requirements of lamprey:
- Spawning habitat is broadly similar to that favoured by salmonids. Usually occurs at the tails of pools where the gravels have been deposited from upstream and the scouring of pools but the current is still reasonably fast with some water flow through the substrate;
- Larval nursery beds are at the edges of streams and rivers, well away from the main current, and that the current over them is often not only very slow, but is actually a backwater in reverse of the main current;
- Water depth in nursery areas is typically 0.1 to 0.5 m with silty/sandy substrate;
- Channelization can be damaging to lampreys, mainly through destruction of their habitat. The removal of areas of riffle and associated spawning gravels, and the dredging of essential nursery silt beds, may entirely eliminate lampreys from a river; and
- Dams/weirs can be obstacles to upstream migration of sea lamprey.

2.3.3 Criteria used for assessment of salmonid habitat quality

Assessment of the quality of salmonid (salmon and trout) spawning, nursery and adult habitat is based on published information on the habitat criteria of salmonids (Bjorn & Reiser 1991, Hendry & Cragg-Hine 2003), water quality criteria listed in the Salmonid Regulations and the surveyor's personal experience in fish sampling and research. Habitat features important to the lifecycle of salmonids include, stream width, depth, flow type, substrate type, vegetation cover, gradient and altitude. These habitat requirements can vary during the life stages of salmonids and the proximity of juvenile habitat to spawning gravels may be significant to their utilisation. The more diverse the stream habitat in terms of substrate, flow rate, depth, riparian vegetation, light conditions etc., the richer the biological community is likely to be, and the more suitable it is likely to be for salmonids.

The presence of overturned gravels lighter in colour compared to the rest of surrounding substrate is used to indicate the presence of salmonid redds. Excessive fine sediment can be detrimental to the survival of eggs

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by limiting the amount of dissolved oxygen to diffuse across the egg membrane. The presence of 10% fine sediment can reduce egg survival to hatching to 43% (Cocchiglia *et al.*, 2012) Fine sediment content of substrate is assessed visually and high levels present indicate reduce spawning habitat quality.

Permanent stream structures such as culverts, dams, bridge abutments, perched aprons and weirs can present an obstacle to upstream migration to spawning sites. Salmon can surmount obstacles 2–3 m high, providing there is an adequate pool in front of the obstruction. The presence of obstacles is also considered during a habitat survey as well as cumulative impact of many small obstacles.

The habitat rating assigned applies to the salmonid species *Salmo salar* which is considered to be more sensitive and less tolerant of pollution than *Salmo trutta*. Optimal habitat for brown trout is noted.

The following summarises ecological requirement of salmonids;

- Salmon spawning is likely to occur where the gradient of a river is 3% or less;
- Typical spawning sites are the transitional areas between pool and riffle where flow is accelerating and depth decreasing, where gravel of suitable coarseness is present and interstices are kept clean by upwelling flow;
- Salmon fry and parr occupy shallow, fast-flowing water with a moderately coarse substrate with cover;
- Deep or slow-moving water, particularly when associated with a sand or silt substrate, does not support resident juvenile salmonids;
- Suitable cover for juveniles includes areas of deep water, surface turbulence, loose substrate, large rocks and other submerged obstructions, undercut banks, overhanging vegetation, woody debris lodged in the channel, and aquatic vegetation;
- Adults require holding pools immediately downstream of spawning gravels in which they can congregate prior to spawning;
- Cover for adult salmon waiting to migrate or spawn can be provided by overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water and surface turbulence; and
- EPA Q-value of Q4 or higher.

Water Quality Criteria within the Salmonid Regulations S.I. 293/1988

- pH $\geq 6 \leq 9$;
- Dissolved Oxygen ≥ 9 mg/l (50% off the time);
- Temperature downstream of point thermal discharge not exceed (a) 21.5°C or (b) 10°C from 1st Nov to 30th Apr during reproductive season; and
- Sediment ≤ 25 mg/l (annual average).

2.3.4 Compliance with the Water Framework Directive (2000/60/EC)

The potential for the proposed development to impact upon water quality is assessed in the context of the EU WFD (Directive 2000/60/EC). The WFD established a framework for the management of water resources throughout the EU. The WFD overarching goal is to achieve at least good ecological status and good chemical status for all surface waters by 2015, or by 2021/2027 via extended deadlines. The WFD aims are specified in Article 1:

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- Prevent further deterioration and protect and enhance the status of aquatic ecosystems and associated wetlands;
- Promote the sustainable consumption of water;
- Reduce pollution of waters from priority substances and phasing out of priority hazardous substances;
- Prevent the deterioration in the status and to progressively reduce pollution of groundwater; and
- Contribute to mitigating the effects of floods and droughts

The WFD established four core environmental objectives to be achieved for surface waters which include rivers, lakes, transitional and coastal waters (out to 1 nautical mile):

- Prevent deterioration;
- Protect, enhance and restore good status by 2015;
- Protect and enhance artificial and heavily modified water bodies (aim to achieve Good Ecological Potential and good surface water chemical status), and
- Progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances.

Environmental objectives are set for each water body in the River Basin Management Plan for Ireland 2018 – 2021 and are based on scientific evidence, extensive surface water quality monitoring, and risk characterisation undertaken by the EPA. The target in most cases is for a river to be of at least good status (Q4).





Figure 2.1: Location of aquatic survey Sites 1-4

3 FIELD SURVEY RESULTS

3.1 Site 1 Eagle Hill 14 Stream upstream of proposed development

EPA online mapping has marked this stream as rising approximately 400m upstream. On investigation the Eaglehill 14 has been modified near the source into a drainage ditch and deepened below the level of the surrounding field. There is little water here and flow is blocked by a field with some water seeping through. This section appears to be mainly fed by another unmapped drainage ditch entering at a 90 degree angle approximately 100m upstream Site 1.

At Site 1, the stream is 1.5m wide and approximately 20cm in depth. The channel has been heavily modified into a drainage ditch which has been straightened and dredged. Siltation was heavy here with silt forming 100% of the substrate and a large plume when disturbed. The stream was very slow flowing to stagnant and entirely covered with macrophytes. It is bordered by a conifer plantation directly north and improved agricultural land to its immediate south.

There is little to no riparian zone on the left bank as it leads directly into the stream for the most part. The ditch has been deepened forming a 2m high bank with a conifer plantation. Riparian vegetation on the right bank consisted of thistle (*Cirsium* spp.), gorse (*Ulex europaeus*), willow (*Salix* spp.), brambles (*Rubus fruticosus*) and coniferous forestry and some Scots pine (*Pinus sylvestris*). Gorse and willow were present on the left bank in patches.

Instream habitat was solely a pool due to the stagnant condition of the water. Aquatic vegetation consisted of foals water cress (*Apium nodiflorum*) (95%), starwort (*Callitriche* sp.) (4%), lesser water parsnip (*Berula erecta*) (<1%) and duckweed (*Lema minor*) (<1 %). The substrate was entirely silt.

No Class A taxa were present in the macroinvertebrate sample. It was dominated by the gastropod *Lymnea peregra* and the waterlouse, *Asellus aquaticus* was common, both taxa are Class D. One Class B taxon was present in low numbers (Phryganeidae) few. richness was low with 10 taxa recorded. Group C taxa made up the majority of the sample with the abundances of each being few. No Q-Value was assigned to this site as it is a first order stream. This stream historically has not received a Q-Value.

Salmonid and lamprey spawning habitat, juvenile salmonid and lamprey habitat, crayfish habitat was rated as None. The Eaglehill 14 is a modified drainage ditch at this point with little flow and consisting entirely of silt. High density of macrophyte growth was also observed.

Groundwater seepage on the right bank was observed at Site 1 with some tufa formation.

3.2 Site 2 Eaglehill Stream at proposed development

Site 2 is located approximately 120m downstream of Site 1. The stream is 1.5m wide and very shallow (10cm) deep. Here the Eaglehill 14 was tunnelled with heavy bramble growth and access any further downstream was not possible. The channel has been heavily modified into a drainage ditch which has been straightened and dredged. Siltation was heavy here with silt forming 100% of the substrate and a large plume when disturbed. Flow has started to return to the stream at this point but was slow. It is bordered by a conifer plantation directly north and improved agricultural land to the south.

There is a 1m scrub buffer on the left and right bank. Riparian vegetation consists of Ivy (*Hedera helix*), Gorse (*Ulex europaeus*), willow (*Salix* spp.), brambles (*Rubus fruticosus*) and coniferous trees (Scots pine).

Dense macrophyte growth was also observed as above at Site 1. Aquatic vegetation consisted of *Apium nodiflorum* (70%), *Phalaris arundinacea* (10%), *Callitriche* spp (5%), and *Lema minor* (<1 %). Instream habitat was mostly pool (99%) with a small glide present (1%).

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The macroinvertebrate sample consisted of one Class A taxon (Nemouridae) as being few with four Class B taxa (*Leuctra* sp., Limnephilidae, Phryganeidae and Polycentropodidae) also with few numbers. *Gammarus*, *Asellus aquaticus* and *Baetis rhodani* were also common. Species richness was higher than the upstream Site 1 with 16 taxa recorded. Group C taxa formed the majority of the sample and abundances of each being few. As previously stated, no Q-Value was placed on this stream as it is not suited to the Q-Value system as it is a first order stream.

Salmonid and lamprey spawning habitat, juvenile salmonid and lamprey habitat, crayfish habitat was rated as None. The Eaglehill 14 is a modified drainage ditch at this point with little flow and consisting entirely of silt. High density of macrophyte growth was also observed.

3.3 Site 3 Eaglehill 14 stream downstream proposed development

The Eaglehill 14 stream is 1 m wide and 10cm deep here. This site is just upstream of the confluence with the Ballysax stream. The channel has been heavily modified and straightened here. Upstream of Site 3 an undersized piped culvert has blocked flow and severe cattle poaching was observed.

The riparian vegetation on the left bank consists of a trimmed hedgerow with no riparian vegetation on the right bank and improved pasture up to the stream. Riparian vegetation consisted of Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Willow (*Salix* spp.) and brambles (*Rubus fruticosus*). Instream habitat was entirely glide. Aquatic vegetation consisted of *Apium nodiflorum* (1%) and the filamentous algae *Cledophora* spp (5%), which was brown and dying.

The macroinvertebrate sample had no Class A or Class B specimens. Hydracarina, Chironomidae, Planorbidae and *Asellus aquaticus* were all common. Species richness was low with 10 taxa recorded with Group C taxa forming the majority of the sample and abundances of each being low. No single taxon was dominant. As previously stated, no Q-Value was placed on this stream as it is not suited to the Q-Value system as it is a first order stream.

Salmonid and lamprey spawning habitat, juvenile salmonid and crayfish habitat was rated as None. The Eaglehill 14 is a modified drainage ditch at this point with little flow and consisting entirely of silt.

Although slow silty margins are present here with some rooted macrophyte vegetation nursery lamprey habitat was also rated as None. Once hatched, the lamprey larvae (ammocoetes) can be found as far upstream in a reach as the adults and mainly drift downstream before burrowing into suitable substrate. As no adult lamprey spawning habitat is available at Site 3 and an undersized pipe forming a migration barrier to the remaining reach it is considered unlikely for lamprey larvae to be present here.

3.4 Site 4 Ballysax Little stream downstream of proposed development

Site 4 is located 40m downstream of Site 3 after the Eaglehill 14 stream has joined the Ballysax Little stream. The Ballysax Little stream is 5 m wide and 20cm deep. The channel has been historically widened and straightened.

The right bank consists of a garden with amenity grass and the left bank has a narrow tree line and runs parallel with a minor road. Riparian vegetation consisted of Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), brambles (*Rubus fruticosus*), Sycamore (*Acer pseudoplatanus*), Nettles (*Urtica dioica*) and grass. Instream habitat was riffle (30%), glide (70%) and pool (10%). Aquatic vegetation consisted of *Apium nodiflorum* and *Leptodictyum riparium* on boulders.

Substrate consisted of boulder, cobble and coarse gravel but siltation was also evident with 10% covering of silt and heavy plume when kicked. Clods of sediment were also found on the substrate. Calcareous deposits were evident on cobbles and boulders and substrate had become compacted.

The macroinvertebrate sample had three Class B specimens (*Alainites muticus*, Lepistomatidae and *Sericostoma personatum*) with only *Alainites muticus* common. *Baetis rhodani* was numerous. Species richness was low with 16 taxa recorded with Group C taxa forming the majority of the sample. No Class A and only one Class E specimen was present. A Q3 was assigned (Poor) however it must be noted that this is a second order stream.

Although there was some coarse gravel present, these were not free from siltation. A heavy covering of silt was present and substrate had become compacted. River habitat consisted mainly of glide with small infrequent sections of riffle. Water levels were shallow throughout the reach with limited pools for resting adults, **Poor-None** salmonid and lamprey spawning habitat was assigned.

Poor-None juvenile salmonid habitat was assigned to this stream. A Q3 (Poor) was assigned to this stream indicating polluted conditions unsuitable for salmon. Some cover was available with boulder and rock substrate present, overhanging vegetation was limited and overall the depth was shallow and uniform (20cm). The habitat was unsuitable for salmon but there is potential for brown trout to be present.

Near the bridge there was a slow flowing area with silty margins providing suitable juvenile lamprey habitat. Although this habitat was not common in the reach surveyed, Juvenile lamprey habitat was rated as **Poor to None**.

Fair crayfish habitat was assigned to this reach. There is leaf litter present in stream and there is boulder/rock habitat although compaction of the substrate was evident. No crayfish were present within the kick sample.

The results of the aquatic survey are summarised in Tables 3.1 to 3.4.



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Table 3.1: Site 1 Eaglehill 14 stream upstream of proposed development

Site name	ITM	Q-value	Invasive sp.	Land use
Site 1 Eaglehill 14 stream upstream of proposed development	677613, 704547	n/a	None	Improved pasture, Rough pasture, Coniferous forestry



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Clockwise from top left: Eagle Hill 14 facing upstream. Eagle Hill 14 facing downstream and Seepage on right bank

Taxa	Group	Abundance
<i>Lymnea peregra</i>	Group D	Dominant
<i>Asellus aquaticus</i>	Group D	Common
<i>Phryganeidae</i>	Group B	Few
<i>Hydracarina</i>	Group C	Few
<i>Gammarus sp.</i>	Group C	Few
<i>Veliidae</i>	Group C	Few
<i>Dipteran larvae</i>	Group C	Few
<i>Platyhelminthes</i>	Group C	Few
<i>Esolus</i>	Group C	Few
<i>Halplidae</i>	Group C	Few
Salmonids	Spawning: None Juveniles: None	
Lamprey	Spawning: None Nursery Habitat: None	
Crayfish	Habitat: None No crayfish found in kick sample.	
Comment	Q-Value was not assigned Tadpoles present Groundwater seepage from the forestry on the right bank was observed with some tufa formation	

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Site name	ITM	Q-value
Site 1 Eaglehill 14 stream upstream proposed development	677613, 704547	n/a
Instream parameters	Dissolved Oxygen	87.6%
		10.3 mg/l
	Temp	9.5°C
	Conductivity	795 µs
	Total Dissolved Solids	397 ppm
	pH	n/a Probe malfunction



Table 3.2: Site 2 Eaglehill 14 stream at proposed development

Site name	ITM	Q-value	Invasive sp.	Land use
Site 2 Eaglehill 14 stream at proposed development	677493, 704543	n/a	None (Potential for Giant Hogweed – old hollow stem)	Coniferous Forestry, Improved Pasture



Left: Eagle Hill stream facing upstream. Right: Eagle Hill stream facing downstream

Taxa	Group	Abundance
<i>Gammarus</i>	Group C	Common
<i>Baetis rhodani</i>	Group C	Common
<i>Asellus aquaticus</i>	Group D	Common
<i>Nemouridae</i>	Group A	Few
<i>Limnephilidae</i>	Group B	Few
<i>Leuctra</i> sp.	Group B	Few
<i>Phryganeidae</i>	Group B	Few
<i>Polycentropodidae</i>	Group B	Few
<i>Hydracarina</i> sp.	Group C	Few
<i>Dytiscidae</i>	Group C	Few
<i>Platyhelminthes</i>	Group C	Few
<i>Simuliidae</i>	Group C	Few
<i>Diptera</i>	Group C	Few
<i>Chironomidae</i> sp.	Group C	Few
<i>Esolus</i>	Group C	Few
<i>Lymnea peregra</i>	Group D	Few

Salmonids Spawning: None
Juveniles: None

Lamprey Spawning: None
Nursery Habitat: None

Crayfish Habitat: None
No crayfish found in kick sample.

Comment Q-Value assigned
Tunnelled with bramble
Very low flow (10cm)

Instream parameters	Dissolved Oxygen	94.5%
	Temp	10.8 mg/l
	Conductivity	9.2°C
	Total Dissolved Solids	790 µs
	pH	395 ppm
		n/a Probe malfunction

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Table 3.3: Site 3 Eaglehill 14 stream downstream of proposed development

Site name	ITM	Q-value	Invasive sp.	Land use
Site 3 Eaglehill 14 stream downstream proposed development	675913, 705209	n/a	None	Improved & rough pasture.



Left: Eagle Hill stream facing upstream. Right: Eagle Hill stream facing downstream

Taxa	Group	Abundance
<i>Hydracarina</i> sp.	Group C	Common
<i>Chironomidae</i> sp.	Group C	Common
<i>Planorbidae</i>	Group C	Common
<i>Asellus aquaticus</i>	Group D	Common
<i>Baetis rhodani</i>	Group C	Few
<i>Pisicola geometra</i>	Group C	Few
<i>Halplidae</i>	Group C	Few
<i>Glossiphoniidae</i>	Group D	Few
<i>Erpobdellidae</i>	Group D	Few
<i>Oligochaeta</i>	Group E	Few
Salmonids	Spawning: None Juveniles: None	
Lamprey	Spawning: None Nursery Habitat: None	
Crayfish	Habitat: None No crayfish found in kick sample.	
Comment	Q-Value not assigned due to it being a first order stream Undersized culvert forming a fish barrier Heavy cattle poaching	
Instream parameters	Dissolved Oxygen	108.8% 12.4 mg/l
	Temp	9.2°C
	Conductivity	746 µs
	Total Dissolved Solids	372 ppm
	pH	n/a Probe malfunction



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Table 3.4: Site 4 Ballysax Little stream downstream of proposed development

Site name	ITM	Q-value	Invasive sp.	Land use
Site 4 Ballysax Little stream downstream of proposed development	675890, 705225	n/a	None	Improved pasture. Suburban (Garden)



Left: Ballysax Little stream facing upstream. Right: Ballysax Little stream facing downstream

Taxa	Group	Abundance
<i>Baetis rhodani</i>	Group C	Dominant
<i>Alainites muticus</i>	Group B	Common
Gammarus	Group C	Common
<i>Elmis aenea</i>	Group C	Common
<i>Asellus aquaticus</i>	Group D	Common
<i>Lepistomatidae</i>	Group B	Few
<i>Sericostoma personatum</i>	Group B	Few
Chironomidae sp.	Group C	Few
<i>Serretella ignita</i>	Group C	Few
Dytiscidae	Group C	Few
Muscidae	Group C	Few
Simuliidae	Group C	Few
Halplidae	Group C	Few
Ceratopogonidae	Group C	Few
Esolus	Group C	Few
Oligochaeta	Group E	Few

Salmonids

Spawning: Poor-None

Juveniles: Poor-None

Lamprey

Spawning: Poor-None

Nursery Habitat: Poor-None

Crayfish

Habitat: Fair

No crayfish found in kick sample.

Comment

This stream was assigned a Q3 however it must be noted that this is a second order stream.

Compacted substrate with sediment clods

Instream parameters

Dissolved Oxygen	112.5% 12.5 mg/l
Temp	10.7°C
Conductivity	705 µs
Total Dissolved Solids	355 ppm
pH	n/a Probe malfunction



4 CONCLUSIONS

The Eaglehill 14 stream is a heavily modified drainage ditch along its entire length from source to where it confluences with the Ballysax little (circa 2km in total). Upstream near the source there is little flow and heavy growth of macrophytes was observed. Groundwater seepage was observed on the right bank and a small section of tufa formation on this bank.

Low flows were evident within the Eaglehill 14 stream and the reach appears to be suffering from drainage activities, siltation and cattle poaching.

Water quality results (Q-values) could only be assigned at one survey site (Site 4) as all other sites were in a first order stream/drainage ditch. Although a Q-value was assigned at Site 4 this is indicative and to be used as guideline only as the Ballysax Little is a second order stream. The Q-value was not developed for headwaters. Poor water quality (Q3) was assigned.

At Site 1-3 within the Eaglehill 14 stream, no spawning or juvenile salmonid/lamprey habitat was observed. Habitat conditions are not supportive for crayfish either. An undersized pipe near the Ballysax little confluence forms a barrier to any upstream migration of salmonids and lamprey.

Conditions improved only slightly in the Ballysax little which is a larger stream. Poor to None salmonid/lamprey spawning and juvenile habitat were observed at Site 4, conditions are more likely to support juvenile brown trout here with shallow water and limited pools present to support larger adult trout. Fair crayfish habitat was also observed. The Ballysax little stream also appears to be suffering from sedimentation issues.



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Appendix 5.2 Invasive Alien Species Management Plan



MEMO

Date: 22 August 2019
To: Kilsaran Concrete
From: RPS
Pages: 6 inc. this page
Regarding: Invasive Species Management Plan



1.1 Introduction

Invasive Alien Species (IAS) are animals and plants that are introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences for their new environment. They represent a major threat to native plants and animals on a global scale and considered as one of the most significant drivers of ecological change.

Invasive alien plant species (IAPS) were not encountered during the field surveys undertaken at the Racefield site or environs. Notwithstanding this fact, the potential for any unwanted alien invasive plant is possible through the movement of material to and from the site during both construction and operation. As such, this outline Invasive Species Management Plan has been prepared for adoption and implementation through these phases of the proposed development.

1.2 Legislative Framework

The control of IAPS in Ireland is regulated by the Wildlife Acts, 1976 to 2012, the European Communities (Birds and Natural Habitats) Regulations 2011-2015 and the EU Regulation (1143/2014) on the Prevention and Management of the Introduction and Spread of Invasive Alien Species. A summary of the relevant regulations are provided below.

Wildlife Acts, 1976 to 2012

Section 52(7)(c) of the Wildlife Act, 1976, as amended by Section 56 of the Wildlife (Amendment) Act, 2000, provides that 'Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, [...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.' Section 52(8) of the Wildlife Act, 1976, as amended, states the following 'For the purposes of subsection (7), any reference to [...] plants, flowers, roots, seeds or spores refers only to exotic species thereof.'

European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011)

Regulation 49 of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011) as amended specifically relate to the control of IAS listed in the Third Schedule (lists 59 species (including plants and animals)) which are regulated under Regulation 49 provide as follows;

49 (2) Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such

MEMO

Date: 22 August 2019
Regarding: Invasive Species Management Plan

plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence.

The Third Schedule Part 3 also deals with vector material which applies to knotweed species as follows:

"Soil or spoil taken from places infested with Japanese knotweed, Giant knotweed or their hybrid Bohemian knotweed".

EU Regulation (1143/2014)

EU Regulation (1143/2014) on the Prevention and Management of the Introduction and Spread of Invasive Alien Species was adopted by the European Council on 29 September 2014. The first "Union list" of 37 species consisting of 23 animals and 14 plants came into force, following the publication of the Commission Implementing Regulation (2016/1141), in the Official Journal of the Union on the 14 July, 2016. Of the 37 species on the 'Union list', 12 are already found on in Ireland including Grey squirrel, Muntjac deer, Chinese mitten crab, Red-eared terrapin/slider, Ruddy duck, Curly waterweed, American skunk cabbage, Parrot's feather, Coypu, Raccoon, Siberian Chipmunk and Uruguayan Hampshire-purslane.

NPWS Circular

In their Circular Letter of 2/08, the National Parks and Wildlife Service bring to attention the specific requirements of Section 40 of the Wildlife Act 1976, as amended by Section 46 of the Wildlife (Amendment) Act 2000, which places restrictions on the destruction of vegetation on uncultivated land during the period from 1st March to 31st August in any year. The Circular was prompted by extensive poorly-targeted spraying of herbicide on road verges by local authorities in an effort to control noxious weeds. The Circular highlights that while control of noxious weeds (and invasive species) is permitted under legislation, it does not authorise the destruction of adjacent vegetation and extensive, untargeted spraying of road verges with herbicide is, *prima facie*, an offence under Section 40 of the Wildlife Acts.

1.3 Guidance

This plan applies the most relevant and current guidance in relation to the treatment and management of non-native invasive plant species. The following literature was referred to in preparation of this plan.

- Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010);
- Guidelines for the Management of Waste from National Road Construction Project (NRA, 2014 (Revision 1));
- The Knotweed Code of Practice. Managing Japanese Knotweed on Development sites. UK Environment Agency Environment Agency (2013). Inland Fisheries Ireland guidance regarding aquatic invasive species control (<http://www.fisheriesireland.ie/Research/invasive-species>); and
- Invasive Species Ireland guidance (<http://invasivespeciesireland.com>).

1.4 Threats to the Proposed Development

The spread of IAPS has the potential to lead to an offence under the Wildlife Acts 1976 -2012 and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. It is an offence to plant or encourage the spread of IAPS listed under the Third Schedule, by moving contaminated materials from one place to another, or incorrectly handling and transporting contaminated material or plant cuttings. Persons must therefore take all reasonable steps and exercise due diligence to avoid committing an offence under the regulations.

The main potential threats to the PROPOSED sand and gravel pit at Racefield relate to the following:

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- Export of potentially contaminated material from the site to other Kilsaran sites around the country or through dispersal from road haulage vehicles; and
- Import of potentially contaminated residues on road haulage vehicles.

Good management practices and biosecurity measures will ensure that such threats are not realised at the site and the site will remain free from IAPS.

1.5 Control and management of IAS

As part of this outline invasive species management plan, appropriate mitigation measures including the management and control measures will be implemented at the site where invasive species are encountered for the prevention of spread of these species and any IAPS recorded in the pre-construction survey.

The control and management measures presented below will inform the options for the treatment, control and management IAPS within the site for the proposed development. The Herbicide Advisors and Users undertaking the control and management measures will be appropriately trained and registered with the Department of Agriculture, Food and the Marine (DAFM). A suite of management and control options are presented below as outlined in the guidance documents. However, it will be at the discretion of the project ecologist to decide which method is most appropriate.

1.6 Methods of Eradication

The principle options available to manage and control the invasive species recorded in the environs of the site are detailed below. All control measures require adequate follow up procedures to ensure that the plant is effectively killed. For species such as Japanese knotweed, the smallest fragment of the plants, such as the plants rhizomatous materials, are capable of regenerating so follow up treatment will be required in subsequent years to ensure that no new shoots appear. The management options are as follows:

- Option 1: Avoidance;
- Option 2: Treatment with Herbicide;
- Option 3: Combined Treatment;
- Option 4: Soil Screening and Sieving;
- Option 5: Root Barrier Membrane;
- Option 6: Bund Method;
- Option 7: Burial Method;
- Option 8: Root Barrier Membrane Cell Method; and
- Option 9: Off-site Disposal.

This list is not exhaustive; however, there are a number of recommended options available for the management of IAPS on the site should any IAPS be discovered on site.

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Table 1: Treatment Options

Option	Suitability	Recommendation
Option 1: Avoidance	Currently no IAPS present on site. Subject to preconstruction survey IAPS can be effectively avoided	Recommended
Option 2: Treatment with Herbicide	It is likely that the use of herbicide will be required. If required the most effective time for herbicide treatment is from July – September (or before cold weather causes leaves to discolour and fall). Spring treatment is based on NPWS acceptable, but less effective. The treatment plan should aim to: - Ensure eradication - Adopt high levels of biosecurity to ensure there is no spread off the site - Compliance with relevant legislation Actions must be implemented to prevent spread from the site to neighbouring properties and spread onto the site from outside. Appropriate actions include: - Cordon off infested areas, - Signage to alert operatives and the public, - Thorough monitoring of adjacent land, and - Liaison with adjacent landowners to eradicate infestations near to the site	Not Recommended Circular
Option 3: Combined Treatment	This involves treatment with herbicide in conjunction with excavation. The aim of the treatment is to break up the rhizome which stimulates leaf production and therefore make the plant more vulnerable to herbicide based treatment. Digging can be conducted during the winter, if care is taken to compact wet soil. Fresh regrowth can be treated during the spring and summer. This method reduces the amount of time required to chemically treat IAPS but must be carried out for greater than 18 months to be effective	Recommended Circular
Option 4: Soil Screening and Sieving	It may be possible to use mobile plant to sieve and screen excavated material within an infested area. This allows the majority of the rhizome to be extracted and destroyed by incineration or disposal to landfill. If removed IAPS be identified off site, the remaining soil material must be disposed of to a licensed waste on site facility. Alternatively, the screened soil can be reused on site and monitored for regrowth. This approach could minimise the amount of infested material to be removed from the site.	Recommended
Option 5: Root Barrier Membrane	Root Barrier membrane may be required if the extent of IAPS extends beyond the development site boundary. In this case, root barriers specific locations as membrane will be placed along the boundary to prevent horizontal spread inside the site boundary.	Recommended at Racefield
Option 6: Bund Method	Where deep site burial is not an option, it may be possible to create a shallow treatment bund. A bund is a shallow area of knotweed-contaminated soil, typically 1m deep. The bund can either be raised, on top of the ground, or placed within an excavation to make the surface flush with the surrounding area. The bund is to be constructed on a root barrier membrane, installed in accordance with the manufactures recommendations including a 100mm thick sand layer both above and below the root barrier to prevent puncturing. The bund area is to be cleared of any stones prior to placing the sand. The bund is to be constructed to a maximum height of 1m with 2:1 side slopes; the barrier membrane is to extend 2m beyond the toe of the bund. A permanent fence is to be erected around the completed bund and offset 2m from the toe of the bund. The purpose of the bund is to move the contaminated material to an area of the site that is not in use where it can be treated over an extended period of time, 18 months - 2 years. The bund should be located away from watercourses and vegetation.	Not recommended
Option 7: Burial Method	This option involves the deep burial of contaminated soil on-site to a depth of five metres or greater. It is advisable to apply non-persistent herbicide to the growing plants, at least once, to prevent the potential regrowth of infested material prior to burial. The treated material should be left a	Not recommended

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sufficient amount of time to allow the herbicide to take effect on the plant prior to excavation and burial. The period time when the herbicide is active is described on the product label. It is important the containment cell is recorded to avoid future damage

Option 8: Root Barrier Membrane Cell Method This option involves the construction of an underground containment cell to store infested soil permanently and securely by wrapping it in root barrier membrane and burying at a depth of over 2 metres. This is designed for sites where burial to a depth of five metres is not possible. It is important the containment cell is recorded to avoid future damage

Option 9: Off-site Disposal All excavated material is to be disposed of to a licenced waste facility. **Recommended where required**

1.7 Biosecurity Measures

Regardless of the preferred method of treatment good site organisation and hygiene shall be maintained at all time on a site, particularly during construction activities. The following best practice avoidance measures will help to contain and/or prevent the introduction of an IAPS infestation on a site as follows;

- Clearly demarcated the infested areas accounting for potential underground rhizome spread;
- Clearly identify and mark out areas where contaminated material is to be stockpiled / treated on site. This should not be within 50m of any watercourse or within a flood zone;
- Create dedicated exclusion zone entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of IAPS should be established through the site to minimise the spread of IAPS by permitted vehicles accessing the site;
- Dedicated footwear & vehicular clean down facility should be installed in the exclusion zone
- Vehicles leaving the site should be inspected for any plant material and cleaned down in a secure and contained area;
- Vehicles used in the transport of contaminated material will need to be visually checked and cleaned down into a contained area before being used for any other work, either on the same site or at a different site;
- Material gathered in dedicated clean down contained areas will need to be appropriately treated along with other contaminated soil on site;
- For any material entering the site (unlikely to be required at Racefield), the supplier must provide an assurance that it is certified free of IAPS;
- Ensure all site operators are aware of the measures detailed in the outline invasive species management plan and treatment methodologies; and
- Adequate site hygiene signage should be erected in relation to the management of IAPS material

1.8 Monitoring

Monitoring of treated IAPS stands will be undertaken in the spring following initial treatment for a minimum of two years to check for re-growth. Any subsequent re-growth will be treated by foliar spray application using a cowed knapsack sprayer or using a weed wiper (subject to location specific environmental sensitivities) which will prevent the rhizome from re-charging over the season's growth. The stems on young material are too small and fragile to use stem injection.

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Where regrowth has occurred, this will be treated and further monitoring to check for new growth will be undertaken again approximately 2 months later. No disturbance of the ground within the site will take place prior to complete eradication. Certification of successful eradication will require a period of 2 years with no evidence of regrowth.

Invasive species surveys of the site and its immediate environs will be completed in years 1, 3, 5 and 10 of the project's operational phase. These surveys will determine the occurrence (if any) of IAPS. All subsequent maintenance measures and operations, particularly tree, shrub and grassland maintenance, will be informed by and take cognisance of the findings and recommendations of these surveys.



Appendix 6.1 Site Investigation 2019

Kildare County Council
Planning Department

3 OCT 2019

RECEIVED

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (James Fitzgerald)

DATE	PROGRESS		SAMPLE		HOLE		2	STRATA		
	Depth (m)		Depth (m)		STRATA			W/T	Depth (m)	Legend
	From	To	From	To	Strata Record					
07/03/2019	0.00	0.60	0.00	0.50	Topsoil					
	0.60	3.70	0.50	1.00	Light brown slightly silty sandy gravelly clay					
	3.70	6.00	1.00	2.00	Rounded gravel and sand with big cobbles					
08/03/2019	6.00	7.20	2.00	3.00	Rounded gravel and sand					
	7.20	10.20	3.00	4.00	Brown silty clay					
	10.20	10.20	4.00	5.00	Chiselling for 1 hour on a boulder					
			5.00	6.00	10.2m end of BH					
			6.00	7.00						
			7.00	8.00						
			8.00	9.00						
			9.00	10.00						
Kildare County Council Planning Department 3 OCT 2019 RECEIVED										
Summary of HOLE No. --					General remarks					
O/B	S/G	Other	W/T	B/Rock	50mm slotted pipe fitted with raised cover & bentonite seal to -1m bgl					
3.70	3.50	3.00								
					Diameters (mm) 200mm					

Eastng =	677,633 196	Ground Level (mAOD)	94 125	Start date =	07/03/2019
Northng =	705,385 283	Final DepthTop of Collar Level (mAOD)	94 521	End date =	08/03/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis)

DATE	PROGRESS		SAMPLE		HOLE		3	STRATA		
	Depth (m)		Depth (m)		STRATA			W/T	Depth (m)	Legend
	From	To	From	To	Strata Record					
18/02/2019	0.00	0.60	0 00	0 50	Topsoil					
	0.60	2.70	0 50	1 00	Light brown slightly silty gravelly clay with					
			1 00	2 00	some small cobbles					
	2.70	6.50	2 00	3 00	Rounded gravel & sand with big cobbles					
			3 00	4 00	(80mm to 150mm) in diameter, very slow drilling					
19/02/2019	6.50	13.50	4 00	5 00	Rounded gravel & sand with big cobbles,					
			5 00	6 00	very slow drilling					
20/02/2019	13.50	16.50	6 00	7 00	Rounded gravel & sand with big cobbles,					
			7 00	8 00	very slow drilling					
	16.50	21.00	8 00	9 00	Stiff brown gravelly clay					
	21.00	21.00	9 00	10 00	Chiselling 1 hour end of BH					
			10 00	11 00						
			11 00	12 00						
			12 00	13 00						
			13 00	14 00						
			14 00	15 00						
			15 00	16 00						
			16 00	17 00						
			17 00	18 00						
			18 00	19 00						
			19 00	20 00						
			20 00	21 00						
Summary of HOLE No. -					General remarks -					
O/B	S/G	Other	W/T	B/Rock	50mm slotted pipe fitted with raised cover & bentonite seal to -1m bgl					
2.70	13.80	4.50								
					Diameters (mm) - 200mm					

Easting =	677944 938	Ground Level (mAOD)	99 74	Start date =	18/02/2019
Northing =	705135 863	Final Depth Top of Collar Level (mAOD)	100 249	End date =	20/02/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis)

DATE	PROGRESS		SAMPLE		HOLE	4	STRATA			
	Depth (m)		Depth (m)				Strata Record	W/T	Depth (m)	Legend
	From	To	From	To						
12/02/2019	0.00	0.40	0.00	0.50	Topsoil					
	0.40	1.60	0.50	1.00	Brown slightly gravelly clay					
	1.60	5.00	1.00	2.00	Rounded gravel with some sand and big cobbles,					
			2.00	3.00	100mm-160mm in size, very slow progress					
13/02/2019	5.00	5.30	3.00	4.00	Chiselling 35 minutes on a boulder					
13/02/2019	5.00	5.30	4.00	5.00	Rounded gravel and sand with big cobbles					
	5.30	7.40	5.00	6.00	100mm in size					
	7.40	7.50	6.00	7.00	Chiselling 40 minutes on a cobble					
	7.50	8.20	7.00	8.00	Rounded gravel and sand with big cobbles					
	8.20	9.40	8.00	9.00	Fine gravel and sand					
	9.40	10.50	9.00	10.00	Rounded gravel and sand					
14/02/2019	10.50	14.00	10.00	11.00	Rounded gravel and sand, slow drilling					
	14.00	16.00	11.00	12.00	Firm brown gravelly clay					
15/02/2019	16.00	20.00	12.00	13.00	Brown gravelly clay, firm					
			13.00	14.00	20.00m end of BH					
			14.00	15.00						
			15.00	16.00						
			16.00	17.00						
			17.00	18.00						
			18.00	19.00						
			19.00	20.00						
100mm County Council Planning Department 3 OCT 2019 RECEIVED										
Summary of HOLE No :-					General remarks -					
O/B	S/G	Other	W/T	B/Rock	50mm slotted pipe fitted with raised cover & bentonite seal to -1m bgl					
1.60	12.40	4.00								
					Diameters (mm) - 200mm					

Easting =	677.819 983	Ground Level (mAOD)	97 005	Start date =	12/02/2019
Northing =	704 926 420	Final Depth/Top of Collar Level (mAOD)	97 454	End date =	15/02/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis)

DATE	PROGRESS		SAMPLE		HOLE	5A	STRATA	
	Depth (m)		Depth (m)		Strata Record	W/T	Depth (m)	Legend
	From	To	From	To				
25/02/2019	0.00	0.40	0.00	0.50	Topsoil			
	0.40	2.50	0.50	1.00	Light brown slightly clay			
	2.50	3.40	1.00	2.00	Rounded gravel and sand with big cobbles			
	3.40	3.70	2.00	3.00	Chiselling 30 minutes on boulder			
	3.70	6.10	3.00	4.00	Rounded gravel and sand with big cobbles			
26/02/2019	6.10	12.50	4.00	5.00	Light brown sandy gravelly clay			
27/02/2019	12.50	13.00	5.00	6.00	Light brown sandy gravelly clay			
	13.00	13.20	6.00	7.00	Chiselling 50 minutes on boulders			
	13.20	14.00	7.00	8.00	Light brown sandy gravelly clay			
			8.00	9.00				
			9.00	10.00				
			10.00	11.00				
			11.00	12.00				
			12.00	13.00				
			13.00	14.00				
					Kildare County Council Planning Department . 3 OCT 2019 RECEIVED			
Summary of HOLE No -					General remarks -			
O/B	S/G	Other	W/T	B/Rock	50mm slotted pipe fitted with raised cover & bentonite seal to -1m bgl			
2.50	3.60	7.90						
					Diameters (mm) = 200mm			

Easting =	677.593 702	Ground Level (mAOD)	92 193	Start date =	25/02/2019
Northing =	704.863 112	Final Depth/Top of Collar Level (mAOD)	92 592	End date =	27/02/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis)

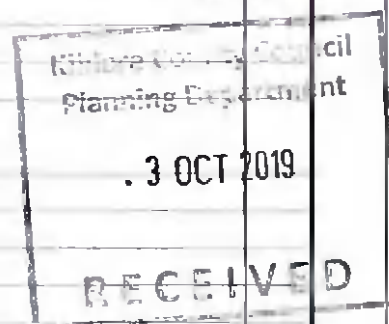
DATE	PROGRESS		SAMPLE		HOLE	6	STRATA			
	Depth (m)		Depth (m)				STRATA	W/T	Depth (m)	Legend
	From	To	From	To						
28/02/2019	0.00	0.40	0.00	0.50	Topsoil					
	0.40	2.50	0.50	1.00	Brown silty gravelly clay					
	2.50	4.00	1.00	2.00	Rounded gravel and sand					
01/03/2019			2.00	3.00	*Problem with winch drum on rig					
	4.00	6.00	3.00	4.00	Rounded gravel and sand with big cobbles					
	6.00	9.10	4.00	5.00	Light brown sandy gravelly clay					
	9.10	9.10	5.00	6.00	Chiselling for 1 hour on boulder					
			6.00	7.00	9.1m end of BH					
			7.00	8.00						
			8.00	9.00						
			9.00	10.00						
			10.00	11.00						
			11.00	12.00						
			12.00	13.00						
			13.00	14.00						
			14.00	15.00						
			15.00	16.00						
			16.00	17.00						
			17.00	18.00						
			18.00	19.00						
			19.00	20.00						
			20.00	21.00						
Summary of HOLE No. 6					General remarks -					
O/B	S/G	Other	W/T	B/Rock	50mm slotted pipe fitted with raised cover & bentonite seal to -1m bgl					
2.50	3.50	3.10								
					Diameters (mm) 200mm					

Easting =	677 435 382	Ground Level (mAOD)	93 09	Start date =	28/02/2019
Northing =	705,059 975	Final Depth Top of Collar Level (mAOD)	93 417	End date =	01/03/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis/James Fitzgerald)

DATE	PROGRESS		SAMPLE		STRATA	HOLE	7	STRATA			
	Depth (m)		Depth (m)					Strata Record	W/T	Depth (m)	Legend
	From	To	From	To							
09/03/2019	0.00	0.30	0.00	0.50	Topsoil						
	0.30	2.70	0.50	1.00	Light brown slightly silty gravelly clay						
	2.70	4.80	1.00	2.00	Rounded gravel and sand with big cobbles						
	4.80	5.00	2.00	3.00	Chiselling for 45 minutes on a boulder						
	5.00	7.50	3.00	4.00	Rounded gravel and sand with big cobbles						
11/03/2019			4.00	5.00	BH to be continued						
	7.50	10.40	5.00	6.00	Small - medium gravel and coarse sand,						
			6.00	7.00	adding water						
12/03/2019	10.40	12.30	7.00	8.00	Fine sand and small gravel						
	12.30	13.50	8.00	9.00	Light brown silty clay						
	13.50	13.60	9.00	10.00	Chiselling on boulder for 1.5 hours						
			10.00	11.00	Requested by client end of BH						
			11.00	12.00							
			12.00	13.00							
Summary of HOLE No. -					General remarks -						
O/B	S/G	Other	W/T	B/Rock	No standpipe fitted						
2.70	9.60	1.30									
					Diameters (mm) = 200mm						



Easting =	677,611 854	Ground Level (mAOD)	97.43	Start date =	09/03/2019
Northing =	705,043 108	Final Depth/Top of Collar Level (mAOD)	XXX	End date =	12/03/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (Brendan Ellis)

DATE	PROGRESS		SAMPLE		STRATA	HOLE	8	STRATA			
	Depth (m)		Depth (m)					Strata Record	W/T	Depth (m)	Legend
	From	To	From	To							
04/03/2019	0.00	0.40	0.00	0.50	Topsoil						
	0.40	2.70	0.50	1.00	Light brown slightly silty gravelly clay						
	2.70	3.40	1.00	2.00	Rounded gravel and sand, slow drilling						
	3.40	3.70	2.00	3.00	Chiselling for 40 minutes on boulder						
	3.70	4.60	3.00	4.00	Rounded gravel and sand with some boulders						
	4.60	4.70	4.00	5.00	Chiselling for 25 minutes on boulder						
	4.70	5.00	5.00	6.00	Rounded sand and gravel						
05/03/2019	5.00	6.80	6.00	7.00	Rounded gravel and sand with big cobbles						
	6.80	7.00	7.00	8.00	Chiselling for 20 minutes on boulder						
	7.00	9.50	8.00	9.00	Rounded gravel and sand with big cobbles, slow drilling						
06/03/2019	9.50	10.00			Light brown sandy gravelly clay						
	10.00	10.90			Light brown sandy gravelly clay						
	10.90	10.90			Chiselling for 1 hour						
					10.90m end of BH						
Summary of HOLE No -					General remarks		General remarks				
O/B	S/G	Other	W/T	B/Rock	No Standpipe Installed						
2.70	6.80	4.10									
					Diameters (mm)		200mm				

Easting = 677,547.515

Ground Level (mAOD)

95.31

Start date = 04/03/2019

Northing = 705,241.013

Final Depth/Top of Collar Level (mAOD)

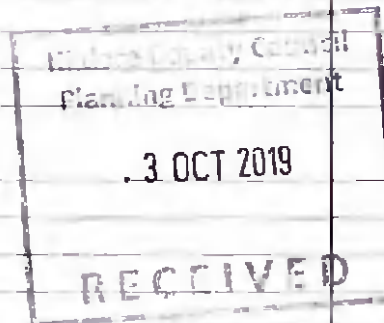
XXX

End date = 06/03/2019

Site Racefield, Co. Kildare

Drilled By Ground Investigation Ireland (James Fitzgerald/Charlie Rowland)

DATE	PROGRESS		SAMPLE		HOLE	9	STRATA			
	Depth (m)		Depth (m)				Strata Record	W/T	Depth (m)	Legend
	From	To	From	To						
12/03/2019	0.00	0.80	0.00	0.50	Topsoil					
	0.80	1.50	0.50	1.00	Soft grey gravelly clay					
	1.50	2.60	1.00	2.00	Small medium and large gravel with coarse sand					
	2.60	4.50	3.00	4.00	Small and medium gravel with coarse sand and some conglomerate gravel					
			4.00	5.00						
13/03/2019	4.50	7.50	5.00	6.00	Small medium gravel with coarse sand with many big cobbles					
			6.00	7.00						
			7.00	8.00	4.60 - 4.80 chiselling on boulder for 40 minutes					
			8.00	9.00	6.50 - 6.60 chiselling on boulder for 45 minutes					
	7.50	9.50	9.00	10.00	Small gravel and coarse sand with medium and large cobbles					
			10.00	11.00						
			11.00	12.00	8.10 - 8.20 chiselling on boulder for 30 minutes					
	9.50	15.00	12.00	13.00	Small and medium gravel with coarse sand					
			13.00	14.00	large cobbles and conglomerate gravel					
			14.00	15.00	10.20 - 10.40 chiselling on boulder for 30 minutes					
					13.80 - 14.00 chiselling on boulder for 30 minutes					
					14.60 - 14.70 chiselling on boulder for 30 minutes					
15/03/2019	15.00	15.50			Small medium gravel with coarse sand and large cobbles					
					Chiselling for 1.5 hours on obstruction					
					End of BH					
					Indraghata Council Planning Department 3 OCT 2019 RECEIVED					
Summary of HOLE No					General remarks					
O/B	S/G	Other	W/T	B/Rock	No Standpipe Installed					
1.50	14.0+									
					Diameters (mm) 200mm					



Easting =	677.773 863	Ground Level (mAOD)	100 14	Start date =	12/03/2019
Northing =	705.147 662	Final Depth/Top of Collar Level (mAOD)	XXX	End date =	15/03/2019

Appendix 6.2 Geophysical Investigation 2019



AGP19013_01

**REPORT
ON THE
GEOPHYSICAL INVESTIGATION
AT
RACEFIELD,
CO. KILDARE.
FOR
KILSARAN**



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28TH FEBRUARY 2019

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.



PROJECT NUMBER	AGP19013		
AUTHOR	CHECKED	REPORT STATUS	DATE
TONY LOMBARD M.Sc (GEOPHYSICS).	EURGEOL PETER O'CONNOR P. GEO., M.Sc (GEOPHYSICS), DIP. EIA MGT	V.01	28 TH FEBRUARY 2019

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1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Kilsaran to carry out a geophysical investigation at a site in Racefield, County Kildare. The purpose of the investigation is to provide information on potential sand and gravel deposits underlying the site.

The objectives of the survey were to; provide information on the thickness of the overburden; estimate the extent & thickness of the sand & gravel; calculate the potential aggregate resource; make recommendations for direct investigation.

The area to be surveyed is c. 34 ha in extents and consists of open agricultural land with topography across the site ranging from 91 mOD to 101 mOD.

The Geological Survey of Ireland (GSI) 1:100,000 Bedrock Geology map indicates that the survey area is underlain by limestone of the Ballysteen Formation. The GSI subsoils map shows the survey area is within limestone till with lacustrine sediments to the south and north and limestone gravels further north.

The investigation was carried out in February 2019 and consisted of reconnaissance EM Ground Conductivity mapping with follow-up 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling.

The geophysical results have outlined one area (Area A – c. 17.6 ha) in the east of the site with **OVERBURDEN over mainly silty SAND/GRAVEL** with pockets of 'clean' SAND/GRAVEL.

The results indicate that the average **OVERBURDEN** thickness in Area A is 3.1m and the average combined **silty SAND/GRAVEL** and 'clean' SAND/GRAVEL thickness is 8.0m. The silty SAND/GRAVEL material may have economic potential but the fines content, which, based on previous experience, is likely to be between 5% and 15% may be a limiting factor.

The main sand/gravel layer is underlain by 2.5 to 7.0m of clayey SAND/GRAVEL and between 11 and 35m of interpreted very stiff sandy gravelly CLAY.

A potential combined **Silty SAND/GRAVEL** and 'clean' SAND/GRAVEL gross resource of 2,534,400 tonnes has been calculated for Area A.

To confirm the findings of the geophysical report trial pits are recommended. Samples should be taken from the trial pits for Particle Size Distribution (PSD) analysis and for physical, mechanical and laboratory tests. (If the pits show good quality material down to 4m then two pits should be continued as macro pits with the sides battered back to a safe angle to allow digging in of the excavator.)

The geophysical report should be reviewed after the completion of any direct investigation.

2. INTRODUCTION

APEX Geophysics Limited was requested by Kilsaran to carry out a geophysical investigation at a site in Racefield, County Kildare. The purpose of the investigation is to provide information on potential sand and gravel deposits underlying the site.

2.1 Survey Objectives

The objectives of the survey were to provide information on the following:

- Overburden thickness.
- Extent of sand and gravel
- Assess the quality of the sand and gravel
- Estimate the sand and gravel resource volume



2.2 Site Background

Racefield, Co. Kildare is located close to the R418 approximately 8km south-west of Kilcullen and approximately 9km south-east of Kildare town. The survey area is outlined in Figure 2.1 below and is c. 34 ha in extents. The site consists of open agricultural land and topography across the site ranges from 91 mOD to 101 mOD.



Fig.2.1. Site location.

2.3 Bedrock and soils

The Geological Survey of Ireland (GSI) 1:100,000 Bedrock Geology map indicates that the survey area is underlain by limestone of the Ballysteen Formation (see Fig. 2.2 below).

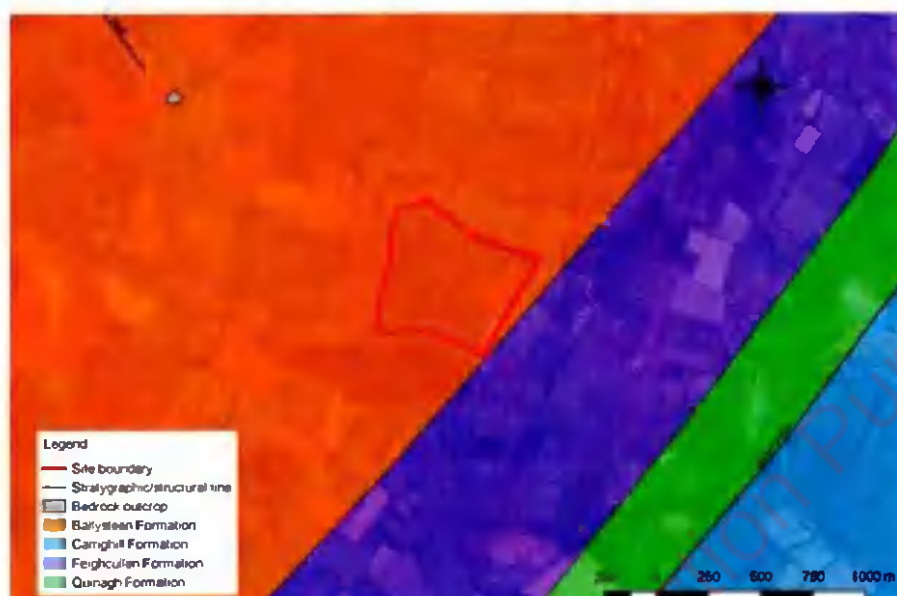


Fig.2.2. Bedrock geology of the survey area.

The GSI subsoils map shows the survey area is within limestone till with lacustrine sediments to the south and north and limestone gravels further north (see Fig. 2.3 below).



Fig.2.3. Subsoils of the survey area.

2.4 Groundwater

The GSI database describes bedrock across the site as a "Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones"(Fig. 2.4). The gravels are not shown as an aquifer.



Fig.2.4. Aquifer classification of the survey area.

2.5 Historical Sheet

The 6" Geological Sheet (Fig. 2.5) indicates limestone gravel 750m to the east of the site.



Fig.2.5. GSI 6" Sheet of the survey area.

2.6 Survey Rationale

The investigation consisted of reconnaissance EM Ground Conductivity mapping with follow-up 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling.

EM ground conductivity mapping operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). This technique will provide information on the shallow (0-6m below ground level) soils and outline shallow bedrock. Sand/gravel will have a low conductivity while silt/clay will have a high conductivity.

ERT soundings image the resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity to depths dependent on the length of the profile. Each cross-section is interpreted to determine the material type along the profile based on the typical resistivities returned for Irish ground materials. Sand/gravel will have a high resistivity whilst silt/clay will have a low resistivity.

Seismic Refraction Profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities. This method profiles the depth to subsurface layers and provides a cross check on the ERT interpretation.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY**.



3. RESULTS

The survey was carried out over a number of sessions between the 04th and 11th of February 2019. The geophysical investigation locations are indicated on Drawing AGP19013_01 (Appendix C).

3.1 EM Ground Conductivity Mapping

The conductivity results (Drawing AGP19013_02) are indicative of the bulk conductivity of the ground materials from 0-6.0m bgl. The values range from 3.0 – 16.0 mS/m and have been generally interpreted in conjunction with the ERT and Seismic data as follows:

Conductivity (mS/m)	Interpretation
3 – 6	Clayey GRAVEL over Silty SAND / GRAVEL and 'clean' SAND / GRAVEL
6 – 8	Clayey GRAVEL and minor Sandy Gravelly CLAY
8 – 12	Thick Sandy Gravelly CLAY
12-16	Interference from boundary fences

3.2 ERT

Seven ERT Profiles (R1 – R7) were acquired across the site. The resistivity values have been interpreted on the following basis:

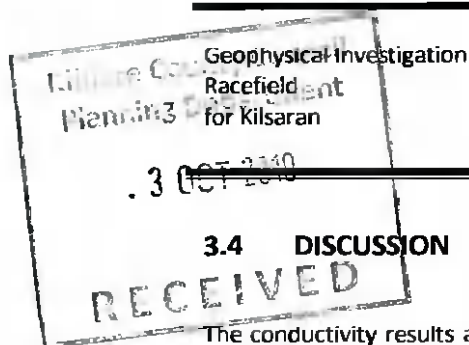
Resistivity (Ohm-m)	Interpretation
50 - 250	Sandy gravelly CLAY
250 - 500	Clayey SAND/GRAVEL
500 - 1000	Silty SAND/GRAVEL
1000 - 2000	SAND/GRAVEL
250 - 2500	Dark LIMESTONE

3.3 Seismic Refraction Profiling

Five seismic refraction spreads were recorded (Drawing AGP19013_01). The seismic refraction data has been interpreted on the following basis:

Layer	Seismic Velocity (m/s)	Interpretation
1	361 - 400	Soft / Loose Soil
2	958 - 1308	Firm – Stiff / Medium Dense – Dense Soil
3	2156 - 2407	Very Stiff / Very Dense Soil
4	3405	Moderately – Slightly Weathered LIMESTONE





3.4 DISCUSSION

The conductivity results are plotted on Drawing AGP19013_02, with the summary interpretation shown on Drawing AGP19013_03. The interpreted ERT profiles R1-R7 and seismic refraction profiles S1-S5 are shown in Drawings AGP19013_R1-R7.

3.4.1 Soil

From previous experience electrical resistivity values for Irish sand and gravel deposits are usually within the following ranges:

Material	*Fines Content %	Electrical Resistivity (Ohm-m)	Economic Potential
'Clean' SAND/GRAVEL	< 5	> 1000	Yes
Silty SAND/GRAVEL	5 - 15	500-1000	may have, subject to screening/washing.
Clayey SAND/GRAVEL	> 15%	250-500	unlikely, due to fines content

**(Fines refer to the clay and silt content of the sand/gravel material. The higher the fines content the poorer the material and use is restricted and screening/or washing required. The estimates given below should be confirmed by subsequent sampling and testing).*

The geophysical results have outlined thick OVERBURDEN (sandy gravelly CLAY and clayey SAND/GRAVEL) in the west and south of the site over an area of c. 16.6 ha.

The data outlined one area (Area A – c. 17.6 ha) in the east of the site where thin OVERBURDEN (clayey SAND/GRAVEL) overlies mainly silty SAND/GRAVEL with pockets of 'clean' SAND/GRAVEL (Drawing AGP19013_03).

The results indicate that the average OVERBURDEN thickness in Area A is 3.1m and the average combined silty SAND/GRAVEL and 'clean' SAND/GRAVEL thickness is 8.0m. The silty SAND/GRAVEL material may have economic potential but the fines content, which, based on previous experience, is likely to be between 5% and 15% may be a limiting factor.

The main sand/gravel layer is underlain by 2.5 to 7.0m of clayey SAND/GRAVEL and between 11 and 35 m of interpreted very stiff sandy gravelly CLAY.

3.4.2 Bedrock

Material with a resistivity of 250 - 2500 Ohm-m is present across the site and has been interpreted as Ballysteen Formation Limestone.

3.4.3 Potential Resource

A potential gravel resource for Area A has been calculated below. The silty SAND/GRAVEL material may be viable to produce after screening and washing and should be examined by trial pits, sampling and testing.

	Area		Volume	Tonnage
		Average thickness		(at 1.8t/cu.m)
	(ha)	(m)	(cu. m.)	(tonnes)
Overburden (Clayey Sandy GRAVEL)	17.6	3.1	545,600	982,080
Silty SAND/GRAVEL & 'Clean' SAND/GRAVEL pockets	17.6	6.0	1,408,000	2,534,400

Notes:

1. The estimated thicknesses on the ERT profiles have been multiplied by a calibration factor of 0.7, (this is due to the overestimation of the thickness of high resistivity materials, which is an artefact of resistivity data processing software).
2. (This is a gross estimate based on interpreted geophysical data, average heights from the topographic data acquired as part of the geophysical investigation and should be refined after direct investigation and detailed design).
3. No allowance has been made for waste or standoffs from boundaries. This is likely to reduce the net resource amount by 10-20%.



4. RECOMENDATIONS

To confirm the findings of the geophysical report the following trial pits are recommended:

No.	ITM Easting	ITM Northing	Comment
PTP01	677495	705338	to assess soil / overburden
PTP02	677647	705290	to assess sand / gravel
PTP03	677714	705159	to assess sand / gravel
PTP04	677890	705105	to assess sand / gravel
PTP05	677658	705073	to assess sand / gravel
PTP06	677829	705018	to assess sand / gravel
PTP07	677544	704992	to assess sand / gravel
PTP08	677794	704915	to assess sand / gravel
PTP09	677447	704908	to assess soil / overburden

Samples should be taken from the trial pits for Particle Size Distribution (PSD) analysis and for physical, mechanical and laboratory tests. (If the pits show good quality material down to 4m then two pits (PTP03 & PTP05) should be continued as macro pits with the sides battered back to a safe angle to allow digging in of the excavator.) Based on the geophysical interpretation PTP03 & PTP05 have the potential to encounter thicker 'clean' sand / gravel beneath clayey sand / gravel and silty sand / gravel.

The geophysical report should be reviewed after the completion of any direct investigation.



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APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY

A combination of geophysical techniques was used to provide a high quality interpretation and reduce any ambiguities, which may otherwise exist.

EM Ground Conductivity Mapping

Principles

This is an electromagnetic technique used to investigate lateral variations in overburden material and to assist with the indication of the depth to bedrock. This method operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). Readings over material such as organic waste and peat give high conductivity values while readings over dry materials with low clay mineral content such as gravels, limestone or quartzite give low readings. The EM31 survey technique determines the apparent conductivity of the ground material from 0-6m bgl depending on the dipole mode used. Depending on the dipole mode used, the measured conductivity is a function of the different overburden layers and/or rock from 0 to 6m below ground level.

Data collection

The EM31 equipment used was a GF CMD-4 conductivity meter equipped with data logger. This instrument features a real time graphic display of the previous 20 measurement points to monitor data quality and results. Conductivity and in-phase values were recorded across the site. Local conditions and variations were recorded.

Data processing

The conductivity and in-phase field readings were downloaded, contoured and plotted using the SURFER 9 program (Golden Software, 2009). Data which was affected by metallic objects was removed. Assignment of material types and possible anomaly sources was carried out, with cross-reference to other data.

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

Profiles were recorded using a ABEM LS4 resistivity meter, imaging software, four 20 takeout multicore cables and up to 80 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.



Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic refraction profiling

Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (V_p) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher V_p velocities while soft, loose or fractured materials have lower V_p velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (3m spacing). Equipment was carried and operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile. (eg. 69m profile ~23m depth, 33m profile ~ 11m depth)

Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors. All profiles were surveyed to Irish National Grid using a ProXR dGPS system.

Data Processing

First break picking in digital format was carried out using the FIRSTPIX software program to construct p-wave (V_p) traveltime plots for each spread. Velocity phases were selected from these plots using the GREMIX software program and were used to calculate the thickness of individual velocity units. Topographic data were input. Material types were assigned and estimation made of material properties.

First break picking in digital format was carried out using the FIRSTPIX software program to construct traveltime plots for each spread. The recorded data was processed and interpreted using the GREMIX software program. GREMIX interprets seismic refraction data as a laterally varying layered earth structure. It incorporates the slope-intercept method, parts of the Plus-Minus Method of Hagedoorn (1959), Time-Delay Method, and features the Generalized Reciprocal Method (GRM) of Palmer (1980). Up to four layers can be mapped; one deduced from direct arrivals and three deduced from refractions. Phantomming of all possible travel time pairs

can be carried out by adjusting reciprocal times of off shots. Material types were assigned and estimation made of material properties, cross-referenced to borehole data.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

Spatial Relocation

All the geophysical investigation locations were acquired using Trimble Geo 7X high-accuracy GNSS handheld GPS system using the settings listed below. This system allows collecting GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Meters
Altitude units:	Meters
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland



APPENDIX B: SEISMIC DATA

The tomographic inversions for seismic refraction spreads S1 – S5 are shown below.

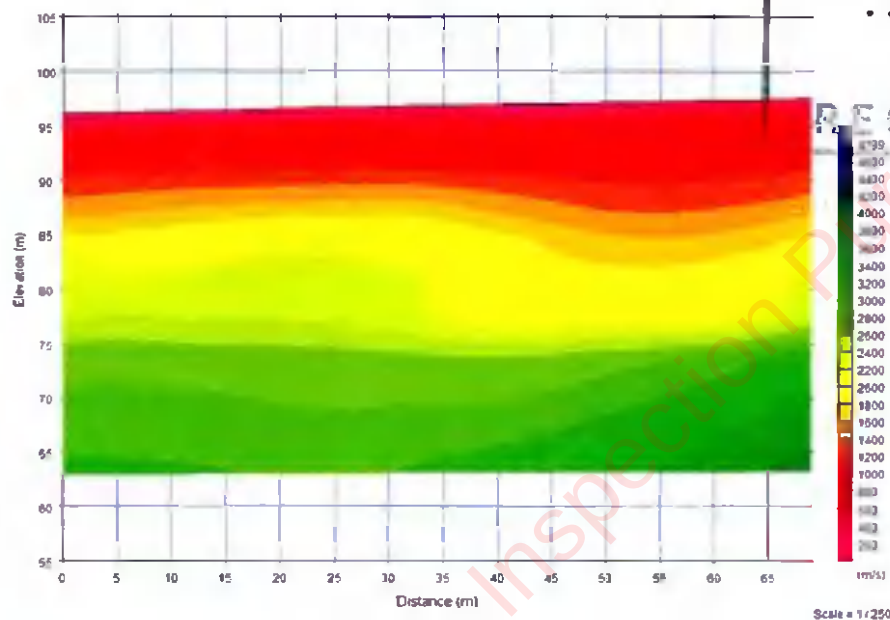


Fig.B.1.Seismic refraction spread S1 Tomographic Inversion.

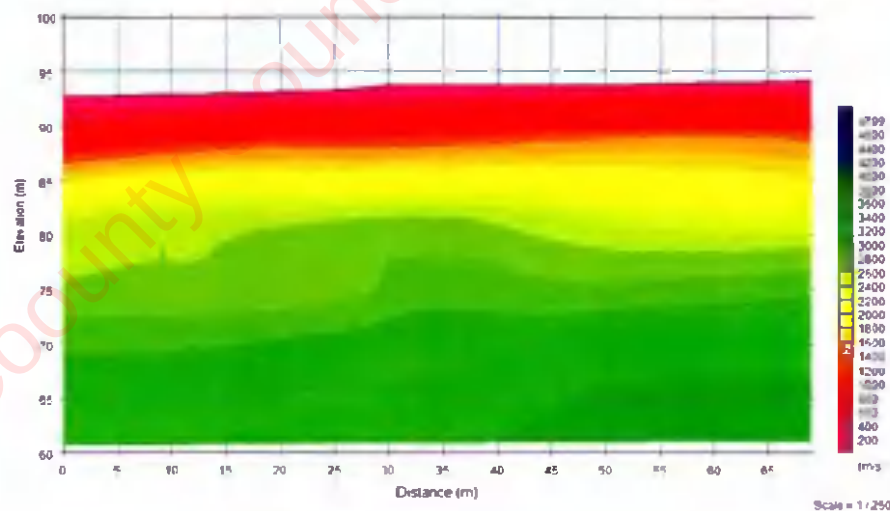


Fig.B.2.Seismic refraction spread S2 Tomographic Inversion.

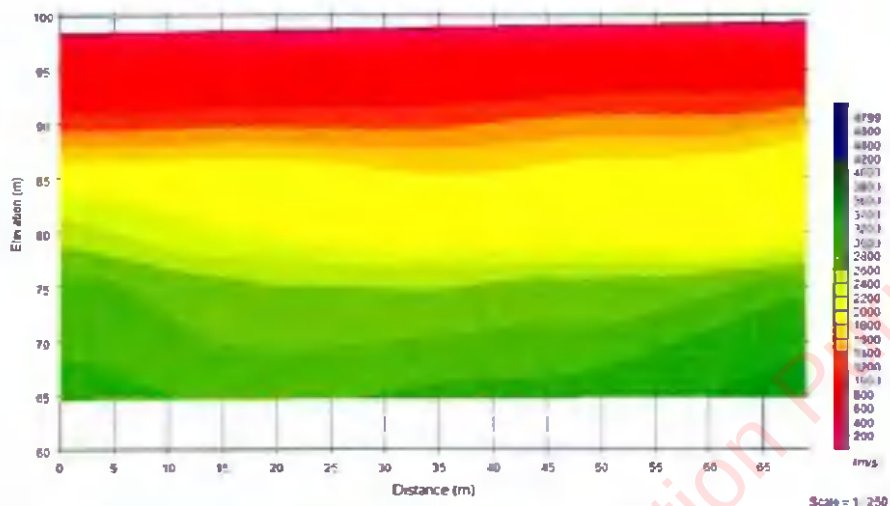


Fig.B.3.Seismic refraction spread S3 Tomographic Inversion.

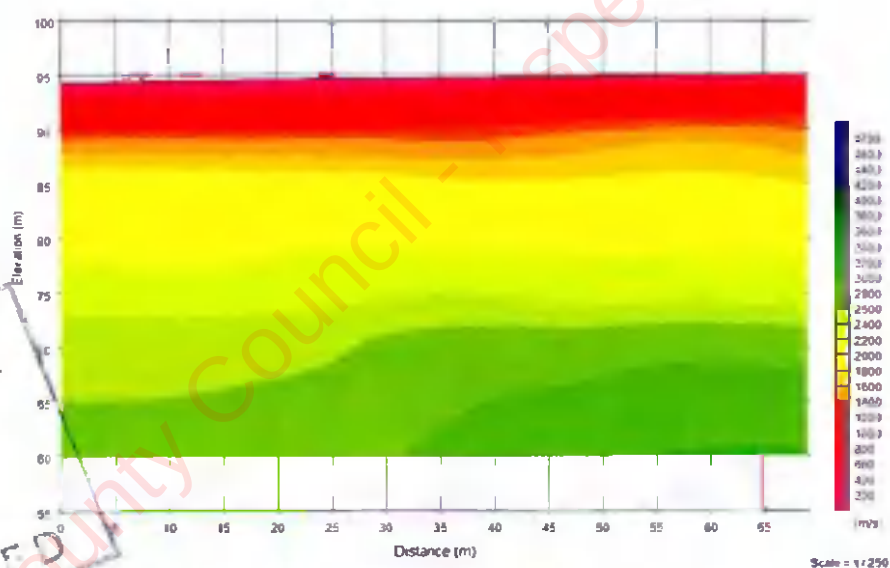


Fig.B.4.Seismic refraction spread S4 Tomographic Inversion.

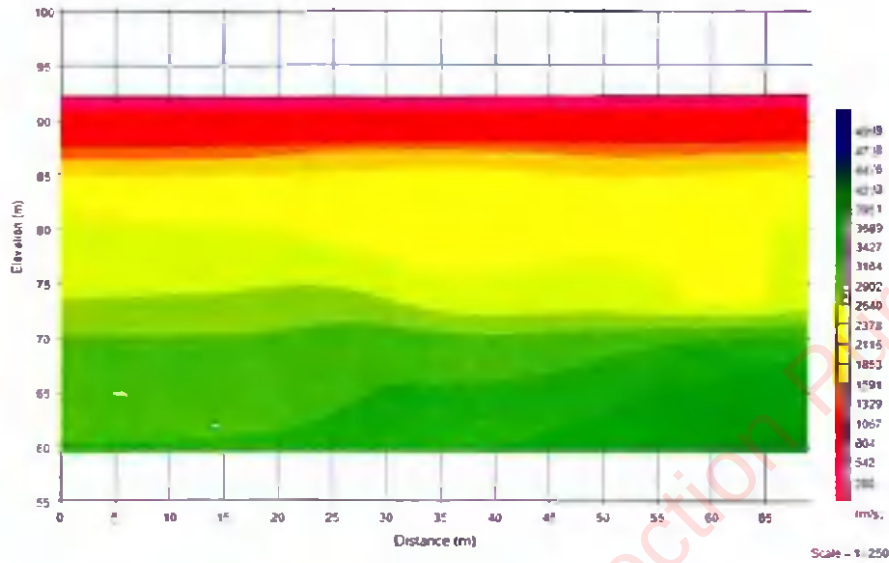


Fig.B.5.Seismic refraction spread S5 Tomographic Inversion.





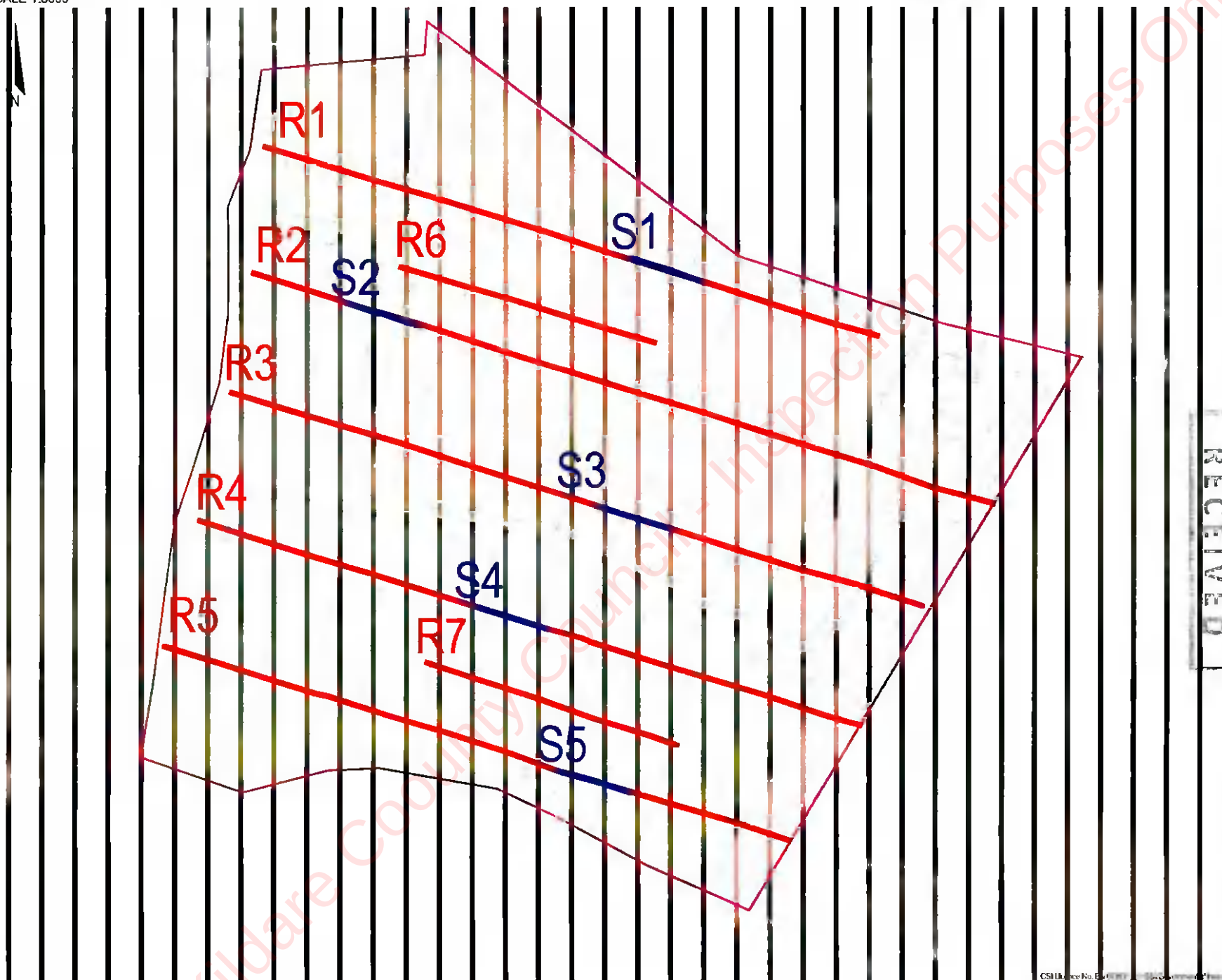
APPENDIX C: DRAWINGS

The information derived from the geophysical investigation as well as correlation with the available direct investigation is presented in the following drawings:

AGP19013_01	Geophysical Survey Locations	1:3000	@ A3
AGP19013_02	EM Conductivity Contour Map (mS/m)	1:3000	@ A3
AGP19013_03	Summary Interpretation Map	1:3000	@ A3
AGP19013_R1	ERT R1 & seismic refraction S1, Results & Interpretation	1: 2000	@ A3
AGP19013_R2	ERT R2 & seismic refraction S2, Results & Interpretation	1: 2000	@ A3
AGP19013_R3	ERT R3 & seismic refraction S3, Results & Interpretation	1: 2000	@ A3
AGP19013_R4	ERT R4 & seismic refraction S4, Results & Interpretation	1: 2000	@ A3
AGP19013_R5	ERT R5 & seismic refraction S5, Results & Interpretation	1: 2000	@ A3
AGP19013_R6	ERT R6 & Results & Interpretation	1: 2000	@ A3
AGP19013_R7	ERT R7 & Results & Interpretation	1: 2000	@ A3



SCALE 1:3000



- Site
- EM conductivity reading
- 2D resistivity profile
- Seismic refraction profile

Shareholder, Council
Planning Department

3 OCT 2019

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in conjunction with Report RSP79013 of
Report on the Geophysical Investigation at
Racefield, Kidder for Kissanan
APEX Geophysics Ltd 28th February 2019

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RACEFIELD
GEOPHYSICAL SURVEY
KILSARAN

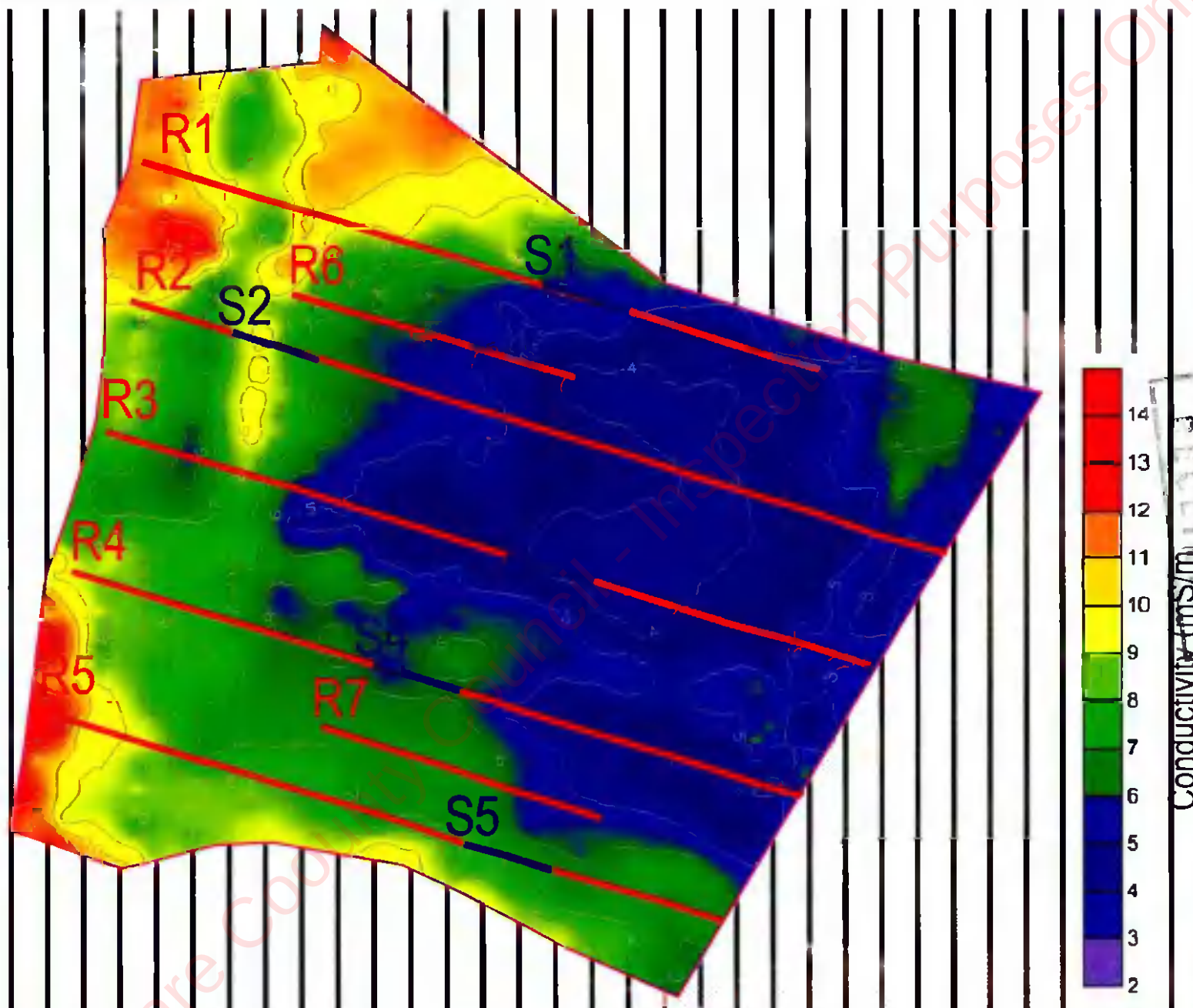
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AS INDICATED @ A3
28-02-2013

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01	28-32-20'9	11	YOC

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FIGURE 1: EM CONDUCTIVITY CONTOUR MAP (ms/m)

SCALE 1:3000

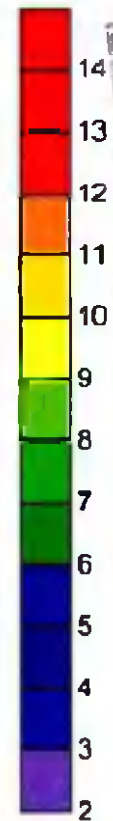


INDEX MAP

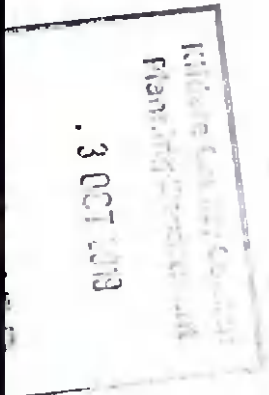


LEGEND:

- Site
- EM conductivity reading
- 2D resistivity profile
- Seismic refraction profile



Conductivity (ms/m)

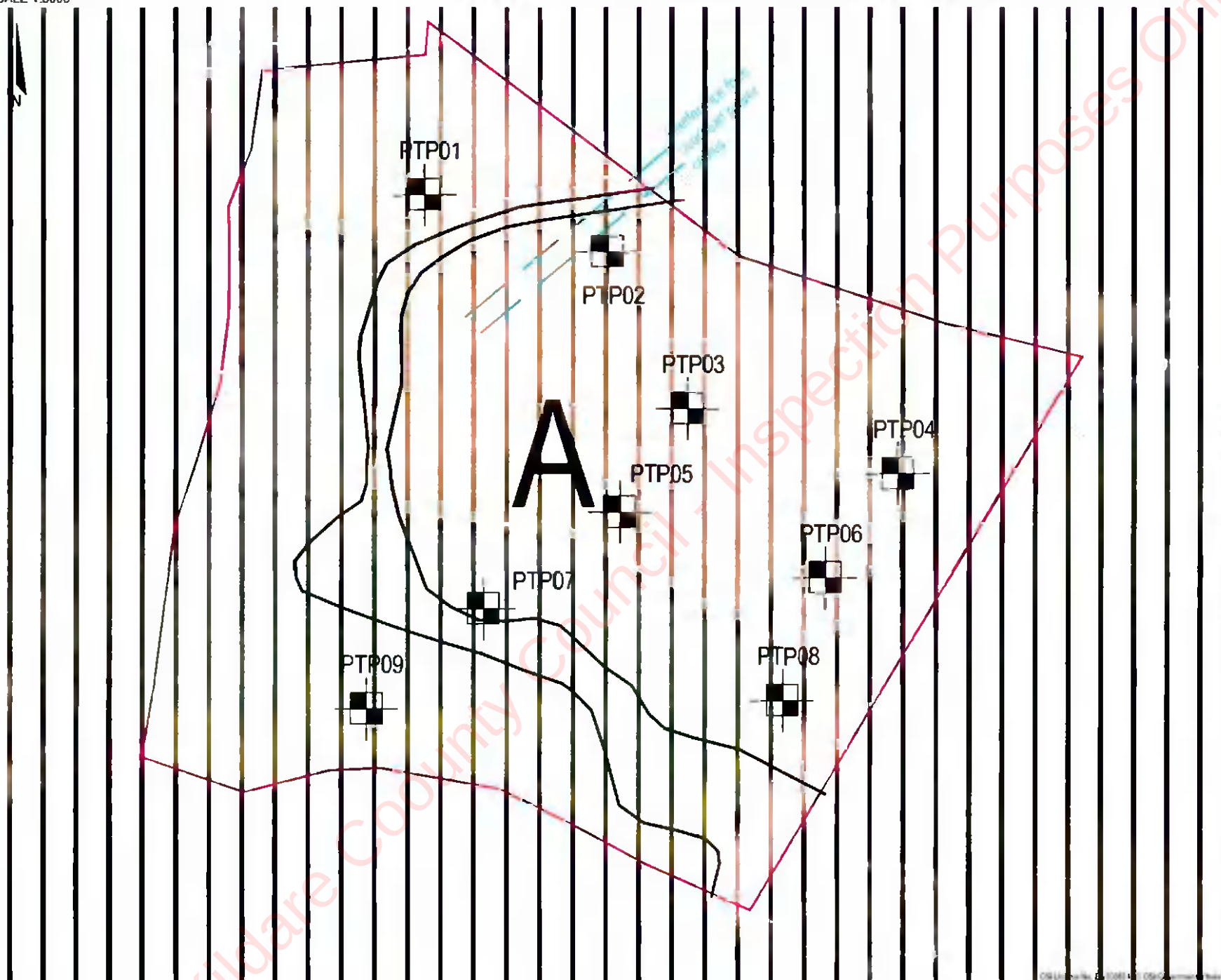


The information displayed here is to be used in conjunction with Report AGP19013.01 Report on the Geophysical Investigation at Ractfield, Kerteh for Kalsar APEX Geophysics Ltd. 28th February 2019



PROJECT: RACTFIELD
 CLIENT: GEOPHYSICAL SURVEY
 NAME: RLSARAW
 PROJECT: AGP19013.01
 AS INDICATED @ 43
 DATE: 28-02-2019
 BY: 26-02-2019
 YOC

FIGURE 1: SUMMARY MAP
SCALE 1:3000



INDEX MAP



LEGEND:

- Thin OVERBURDEN (Sandy Gravelly CLAY)
- OVERBURDEN (Clayey SAND/GRAVEL)
- Area A: Thin Overburden over Silty SAND/GRAVEL & SAND/GRAVEL
- Proposed Trial Pit Location

RECEIVED

3 OCT 2019

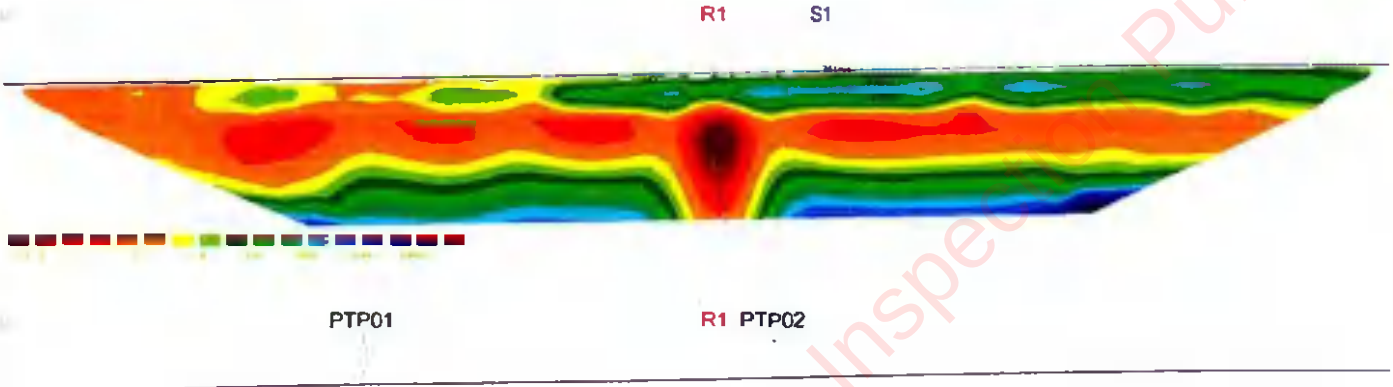
Kildare County Council
Planning Department

The information displayed here is to be used in conjunction with Report AGP18013_01 Report on the Geophysical Investigation at Heccleshill, Kildare for Kildare APEX Geophysics Ltd 20th February 2019



Project Name: AGP18013_01
Client: Kildare APEX Geophysics Ltd
Project Location: Heccleshill, Kildare
Project Start Date: 20th February 2019
Project End Date: 28th February 2019
Project Manager: [Name]
Project Engineer: [Name]
Project Surveyor: [Name]
Project Technician: [Name]
Project Assistant: [Name]
Project Date: 28-02-2019
Project Time: 11:00
Project Location: Heccleshill, Kildare

FIGURE 1: ERT R1, S1 RESULTS & INTERPRETATION
SCALE 1:2000



- LEGEND:
- Sandy Gravelly CLAY
 - Clayey SAND/GRAVEL
 - Silty SAND/GRAVEL
 - SAND/GRAVEL
 - DARK LIMESTONE
 - 351 Seismic Velocity (m/s)



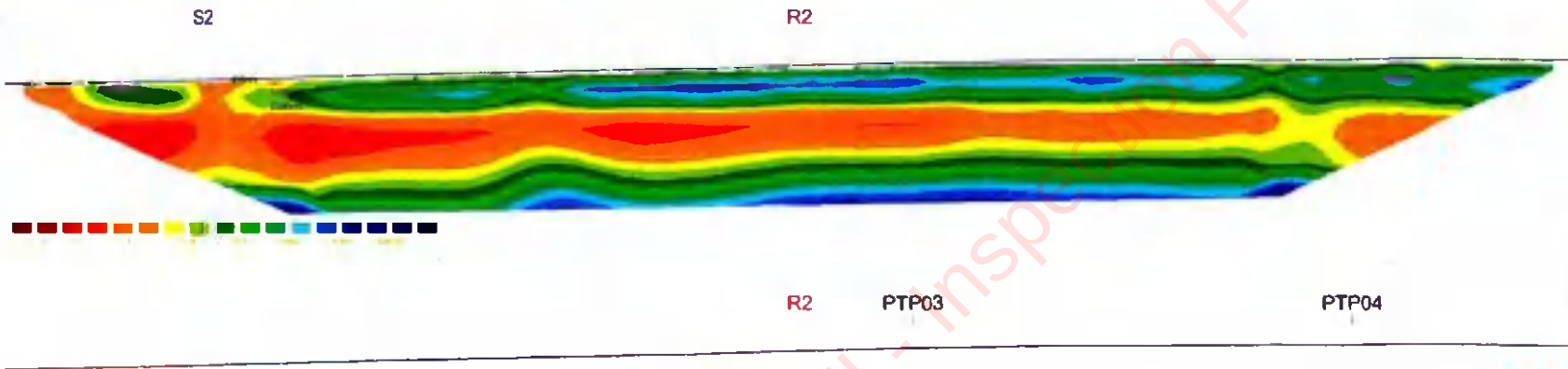
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Report on the Geophysical Investigation at
Racahold, Kildare for Kilsaran APEX
Geophysics Ltd 29th February 2019



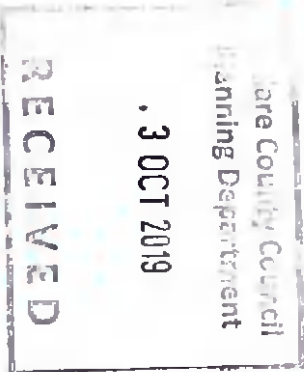
1:5

Project Name	RACEFIELD
Project Number	GEOPHYSICAL SURVEY
Client	KILSARAN
Report Title	AGP19013_R1
Author	AS INDICATED @ A3
Date	27-02-2019
Drawn By	YOC

FIGURE 1: ERT R2, S2 RESULTS & INTERPRETATION
SCALE 1:2000



- LEGEND:
- Sandy Gravelly CLAY
 - Clayey SAND/GRAVEL
 - Silty SAND/GRAVEL
 - SAND/GRAVEL
 - DARK LIMESTONE
 - 351 Seismic Velocity (m/s)



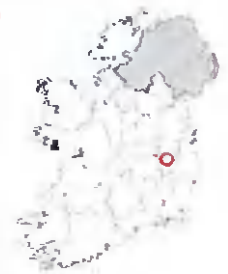
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in conjunction with Report AGP19013_01
Report on the Geophysical Investigation at
Racefield, Kildare for Kilsaran APEX
Geophysics Ltd 28th February 2019



RACEFIELD GEOPHYSICAL SURVEY			
Client	KILSARAN		
Project No	AGP19013_01		
Scale	AS INDICATED @ A3		
Date	27-02-2019		
Drawn By	IL	Check By	VOC
Date	27-02-2019	Date	IL

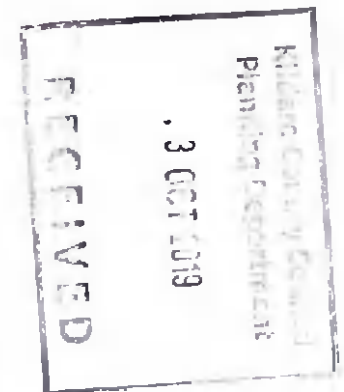
FIGURE 1: ERT R3, S3 RESULTS & INTERPRETATION
SCALE 1:2000

INDEX MAP:



LEGEND:

- Sandy Gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- SAND/GRAVEL
- DARK LIMESTONE
- 351 Seismic Velocity (m/s)



The information displayed here is to be used
in conjunction with Report AGP18013_01
Report on the Geophysical Investigation at
Racefield, Kildare for Kilsaran APEX
Geophysics Ltd 28th February 2019



PROJECT: RACEFIELD
GEOPHYSICAL SURVEY
CLIENT: KILSARAN
PROJECT NO: AGP18013_R3
DATE: 27-02-2019
BY: YDC

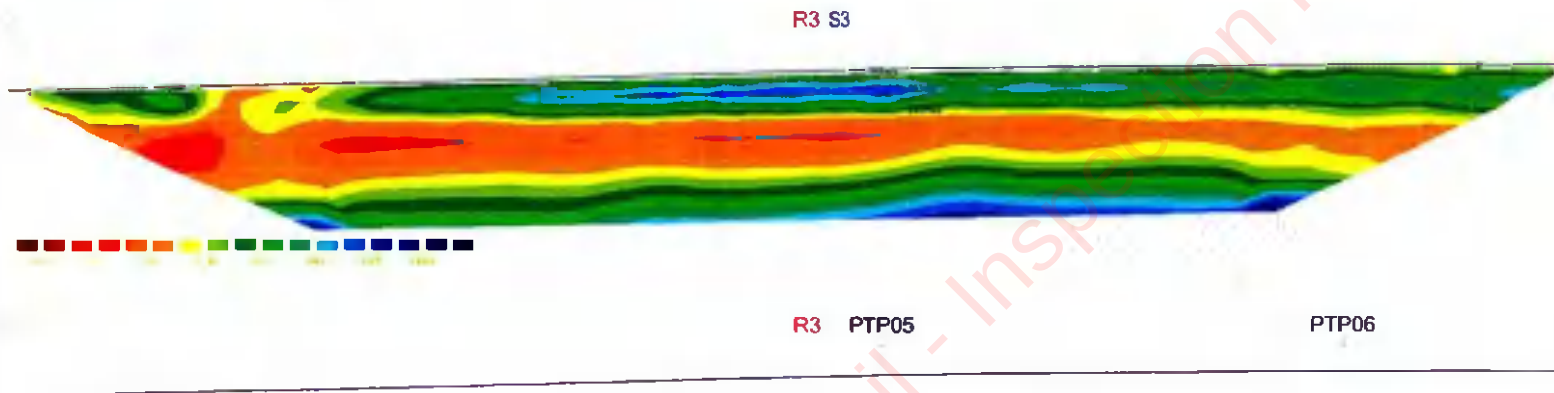
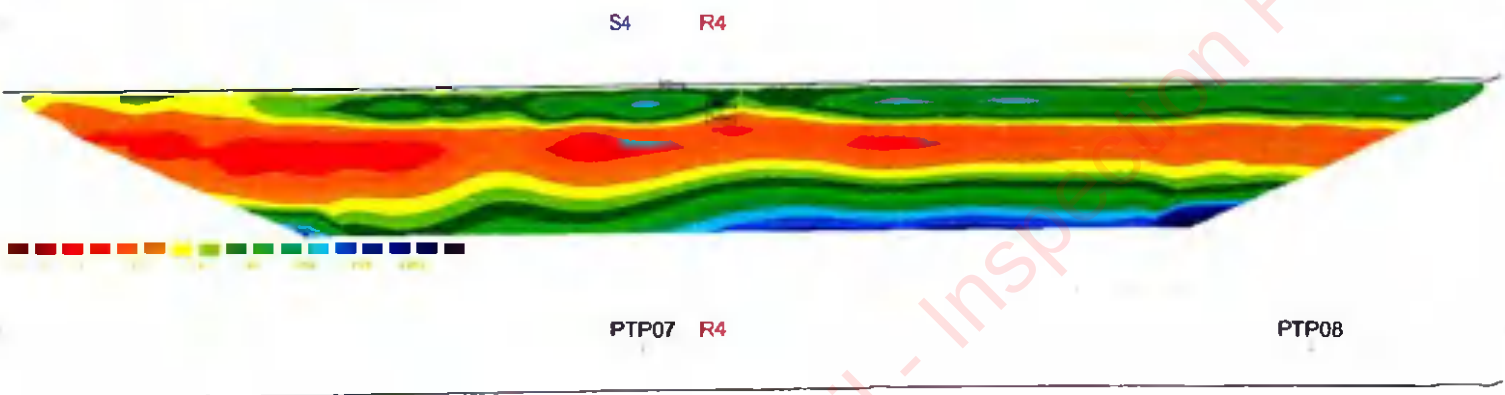


FIGURE 1: ERT R4, S4 RESULTS & INTERPRETATION
SCALE 1:2000



- LEGEND.
- Sandy Gravelly CLAY
 - Clayey SAND/GRAVEL
 - Silty SAND/GRAVEL
 - SAND/GRAVEL
 - DARK LIMESTONE
 - 351 Seismic Velocity [m/s]



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3 OCT 2019

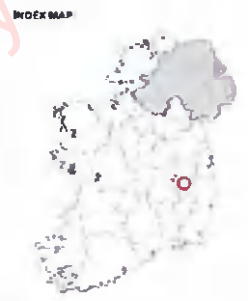
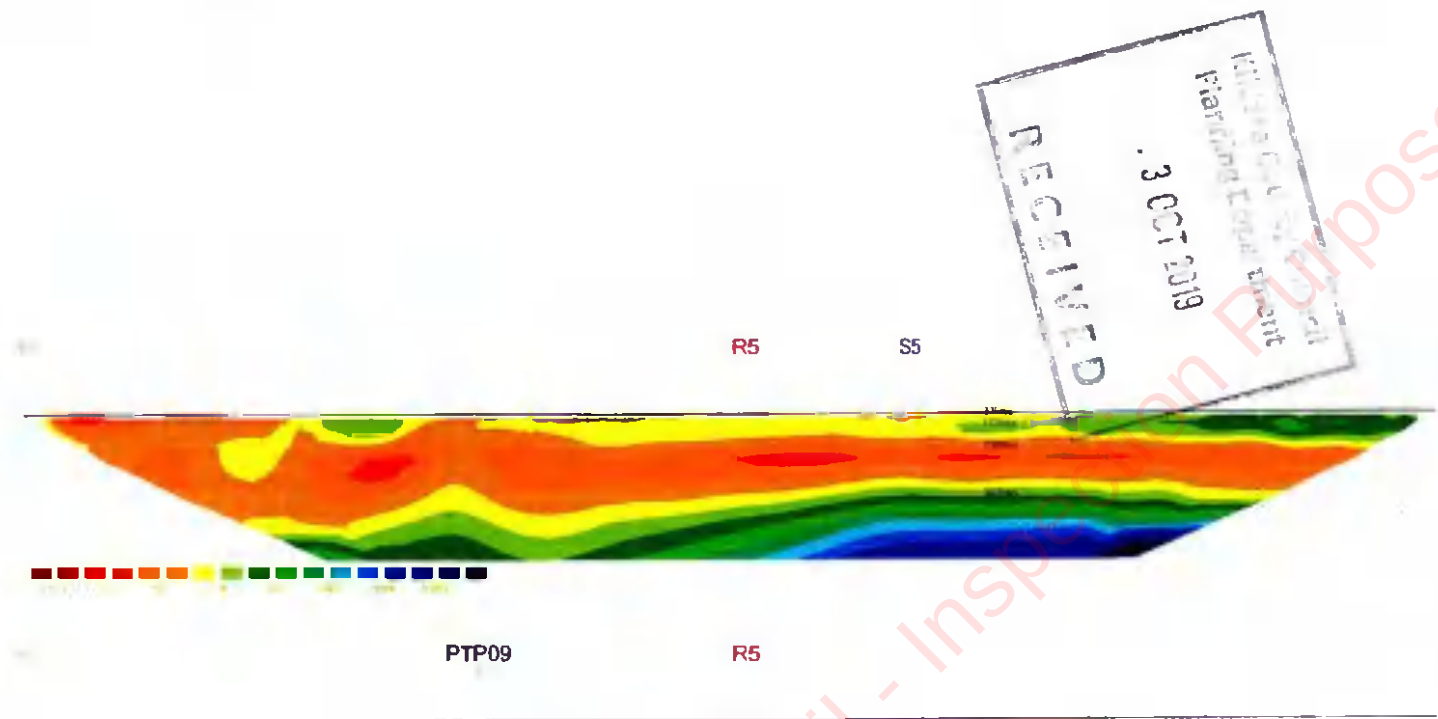
Kildare County Council
Planning Department

The information displayed here is for use in conjunction with Report AGP19073_01
Prepared by: Geophysics Ltd. for Kilsaran APEX
Racelfield, Kildare for Kilsaran APEX
Geophysics Ltd. 28th February 2019



Client	RACEFIELD
Project	GEOPHYSICAL SURVEY
Location	KILSARAN
Report	AGP 19073 R4
AS INDICATED @ A3	
Date	27-02-2019
By	TL
Checked	YUC

FIGURE 1: ERT R5, S5 RESULTS & INTERPRETATION
SCALE 1:2000



- LEGEND:
- Sandy Gravelly CLAY
 - Clayey SAND/GRAVEL
 - Silty SAND/GRAVEL
 - SAND/GRAVEL
 - DARK LIMESTONE
 - 351 Seismic Velocity (m/s)

The information displayed here is to be used in conjunction with Report AGP15013_01 Report on the Geophysical Investigation at Racefield, Kildare for Kilsaran APEX Geophysics Ltd 28th February 2019

**RACEFIELD
GEOPHYSICAL SURVEY**

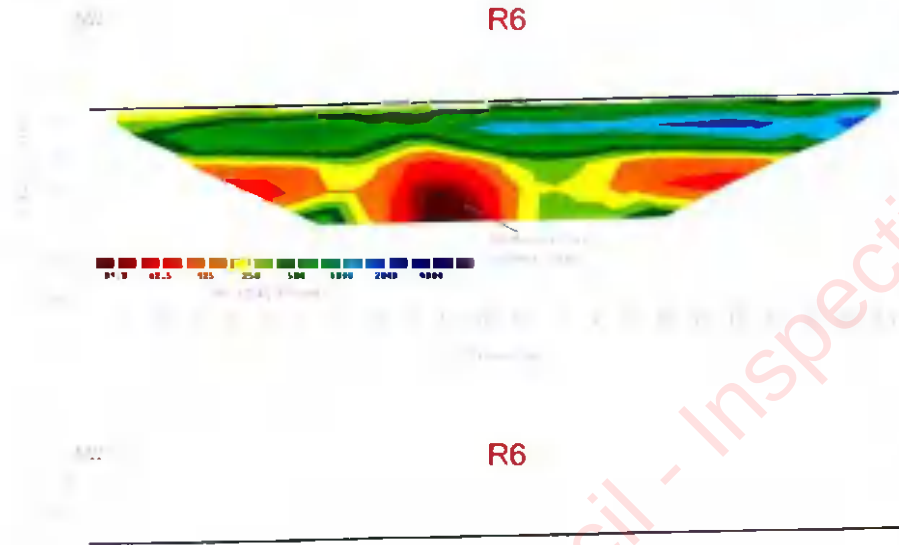
KILSARAN

AGP15013 R5
AS INDICATED @ A3

21/02/2019

Drawn	Scale	Date	Rev	By
D1	1:2000	27-02-2019	01	YOC

FIGURE 1: ERT R6 RESULTS & INTERPRETATION
SCALE 1:2000

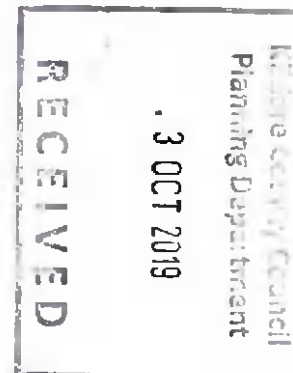


INDEX MAP:



LEGEND:

- Sandy Gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- SAND/GRAVEL
- DARK LIMESTONE
- 351 Seismic Velocity (m/s)

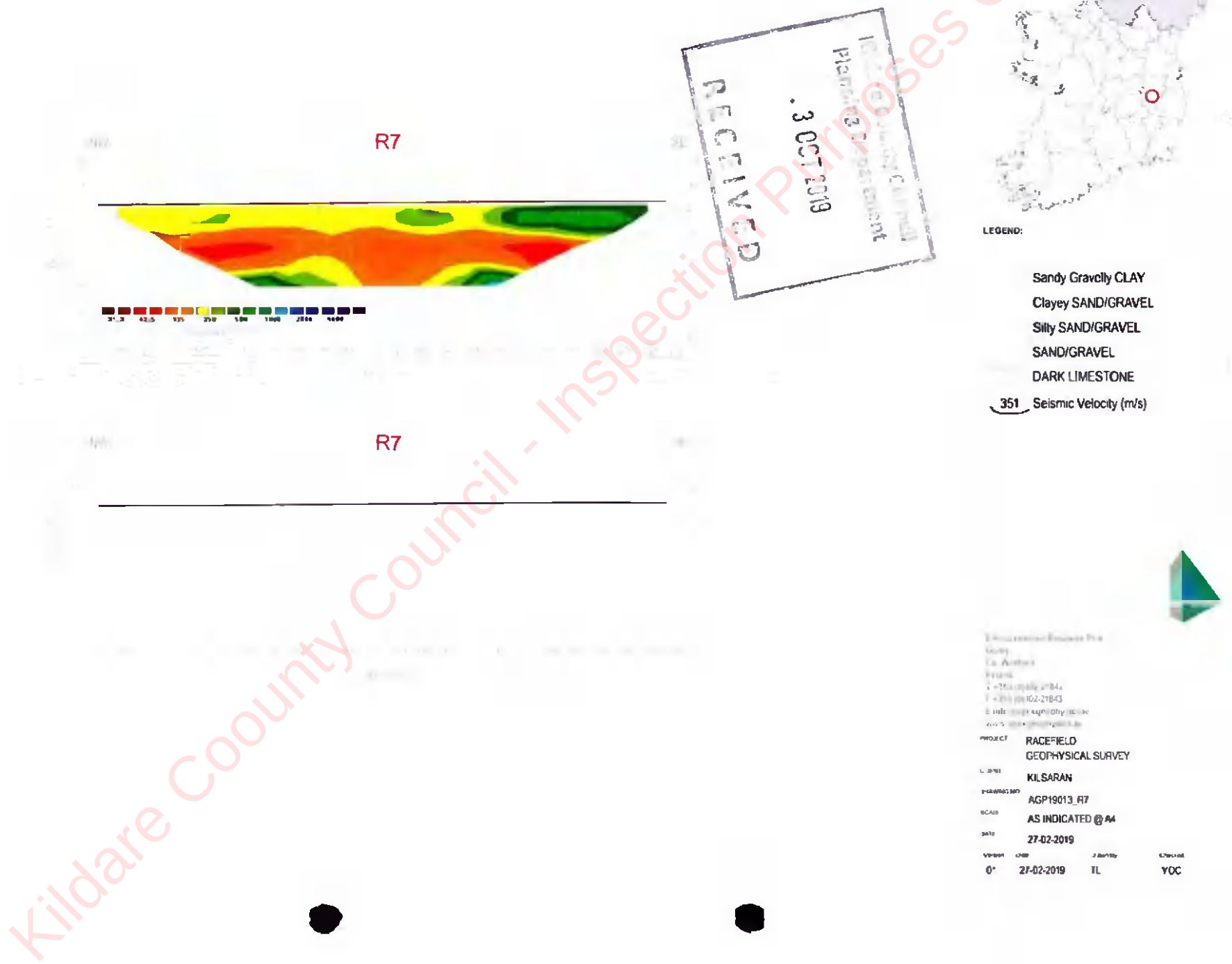


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GEOPHYSICAL SURVEY
SHEET: KILSARAN
DRAWING NO: AGP19013_R6
SCALE: AS INDICATED @ A4
DATE: 27-02-2019

Version: 0*
Date: 27-02-2019
Author: TL
Checked: YOC

FIGURE 1: ERT R7 RESULTS & INTERPRETATION
SCALE 1:2000



Appendix 10.1 Traffic Surveys 2019



Ireland

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Lower Bridge Street,
Dublin 8

Tel: 01 633 4725
Fax: 01 633 4562

**RPS
RACEFIELD
TRAFFIC SURVEY**

**SURVEY REPORT
MAY 2019**



PROJECT NO.	10101
CHECKED	P. MURRAY
DATE	28/06/2019
CONTACT	A.CHAMBERS
REVISION	

CONTENTS

Introduction

Junction Turning Count

Automatic Traffic Counts

Diagram 10101-01

Appendix A – Vehicle Categories



INTRODUCTION

Nationwide Data Collection (NDC) was instructed by RPS to undertake the following surveys in Racefield, Co. Kildare.

A general location plan is given in Diagram 10101-01.

JUNCTION TURNING COUNT

A junction turning count was undertaken at the following site:

Site No.	Location	Day / Date
1	R418(N) / Carrighill Lower(W) / R418(S) / Carrighill Lower(E)	Tuesday 28 th May 2019

The site was surveyed using a telescopically mounted video cameras from which the information was subsequently extracted. Details of the observed movements are given in Diagram 10101-01.

The survey was carried out with survey hours of 07:00 to 19:00. All information was collected in 15 minute intervals and has been tabulated with both hourly and period totals.

Vehicles were classified into the following categories:

- Cars and Taxis (**CAR**)
- Light Goods Vehicles (**LGV**),
- Other Goods Vehicles - type 1 (**OGV1**),
- Other Goods Vehicles - type 2 (**OGV2**),
- Buses (**PSV**),
- Motorcycles (**M/C**) and
- Pedal Cycles (**P/C**).

A detailed description of the vehicles included in each category is provided in Appendix A.



AUTOMATIC TRAFFIC COUNTS

Automatic traffic counts were undertaken at the following sites:

Site No.	Location	Days / Dates
1	Carrighill Lower, west of JTC Site 1	Tuesday 28 th May to Wednesday 12 th June 2019*
2	R418, north of JTC Site 1	Tuesday 28 th May to Monday 3 rd June 2019

* Extended survey period due to damage to counter/tubing.

METROCOUNT 5600 series automatic traffic counters, attached to pneumatic tubes, were used at all the sites. Data was collected in both directions at all locations, with one counter being used for single carriageway sites (1 lane per direction).

The survey was carried out with survey hours of 00:00 to 00(24):00.

The results have been provided in excel, in hourly totals and includes the following information:

- Total Vehicles
- Class Bin Totals (12 Class)
- Number of Vehicles over Speed Limit
- Percentage of Vehicles over Speed Limit
- Number of Vehicles over Speed Limit 1 (Speed Limit + 5kph)
- Percentage of Vehicles over Speed Limit 1
- Number of Vehicles over Speed Limit 2 – (Speed Limit + 10kph)
- Percentage of Vehicles over Speed Limit 2
- Mean Speed
- 85th Percentile Speed
- Speed Bin Totals (Range 0 to 140kph)



12hr (07:00 to 19:00), 16hr (06:00 to 22:00), 18hr (06:00 to 00:00) and 24hr (00:00 to 00:00) totals are also included along with a virtual day, week and grand total. The peak time period for both the a.m (00:00 to 12:00) and p.m (12:00 to 24:00) are also highlighted.

A detailed description of the vehicles included in each category is provided in Appendix A.

SITE REPORT

Weather Clear with sunny spells.

Accidents None.

Roadworks None.

Queues Not required.

Pedestrians Not required.

General Site Notes. No additional site notes.





APPENDIX A

VEHICLE CATEGORIES



	Sites / Location:	JTC Site 1 and ATC Sites 1 & 2 / Racefield	Project No:	10101	Diagram No:	10101-01	Drawn By:	AC
	Survey Date:	JTC: Tuesday 28th May 2019 ATC: Tuesday 28th May to Wednesday 12th June 2019	Project Name:	RACEFIELD				
	Survey Times:	JTC: 07:00 to 19:00 ATC: 00:00 to 00:24:00	Diagram Title:	General Location Plan				

Kildare County Council
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COBA VEHICLE CATEGORIES

CAR	 SALOON  ESTATE  PEOPLE CARRIER  CAR TOWING CARAVAN / TRAILER
LIGHT GOODS VEHICLE (LGV)	 VAN  <3.5 TONNES – single rear tyres  PICK-UP
OTHER GOODS VEHICLE (OGV1)	 > 3.5 TONNES – twin rear tyres  2-AXLES RIGID  2-AXLES RIGID  3 AXLES-RIGID
OTHER GOODS VEHICLE (OGV2)	 4 OR MORE AXLES RIGID  3-AXLES ARTIC  4 OR MORE AXLES ARTIC  OTHER GOODS VEHICLE WITH TRAILER
BUSES & COACHES (PSV)	 DOUBLE DECK BUS  SINGLE DECK BUS OR COACH

COBA VEHICLE CATEGORIES**Definition of Categories**

The various components of traffic have different characteristics in terms of operating costs, growth and occupancy. The most common categories into which the traffic is split in COBA; these are defined as:

Cars (CARS)

Including taxis, estate cars, 'people carriers' and other passenger vehicles (for example, minibuses and camper vans) with a gross vehicle weight of less than 3.5 tonnes, normally ones which can accommodate not more than 15 seats. Three-wheeled cars, motor invalid carriages, Land Rovers, Range Rovers and Jeeps and smaller ambulances are included. Cars towing caravans or trailers are counted as one vehicle unless included as a separate class.

Light Goods Vehicles (LGV)

Includes all goods vehicles up to 3.5 tonnes gross vehicle weight (goods vehicles over 3.5 tonnes have sideguards fitted between axles), including those towing a trailer or caravan. This includes all car delivery vans and those of the next larger carrying capacity such as transit vans. Included here are small pickup vans, three-wheeled goods vehicles, milk floats and pedestrian controlled motor vehicles. Most of this group is delivery vans of one type or another.

Other Goods Vehicles (OGV 1)

Includes all rigid vehicles over 3.5 tonnes gross vehicle weight with two or three axles. Includes larger ambulances, tractors (without trailers), road rollers for tarmac pressing, box vans and similar large vans. A two or three axle motor tractive unit without a trailer is also included.

Other Goods Vehicles (OGV 2)

This category includes all rigid vehicles with four or more axles and all articulated vehicles. Also included in this class are OGV1 goods vehicles towing a caravan or trailer.

Buses and Coaches (PSV)

Includes all public service vehicles and works buses with a gross vehicle weight of 3.5 tonnes or more, usually vehicles with more than 16 seats.





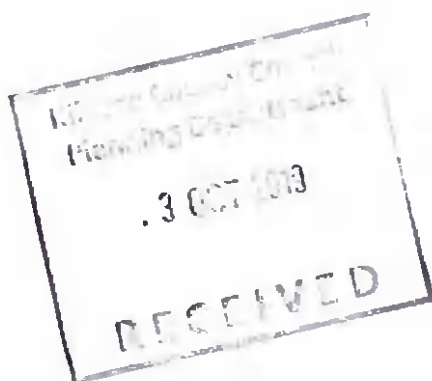
3 OCT 2019

ATC VEHICLE CATEGORIES

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Axes	Groups	Description	Class		Parameters	Dominant Vehicle	Aggregate
2	1 or 2	Very Short - Bicycle or Motorcycle	MC	1	$d(1) < 1.7m$ & axles=2		
2	1 or 2	Short - Sedan, Wagon, 4WD, Utility, Light Van	SV	2	$d(1) \geq 1.7m$, $d(1) \leq 3.2m$ & axles=2		
3, 4 or 5	3	Short Towing - Trailer, Caravan, Boat, etc.	SVT	3	groups=3, $d(1) \geq 2.1m$, $d(1) \leq 3.2m$, $d(2) \geq 2.1m$ & axles=3,4,5		1 (Light)
2	2	Two axle truck or Bus	TB2	4	$d(1) > 3.2m$ & axles=2		
3	2	Three axle truck or Bus	TB3	5	axles=3 & groups=2		
>3	2	Four axle truck	T4	6	axles>3 & groups=2		2 (Medium)
3	3	Three axle articulated vehicle or Rigid vehicle and trailer	ART3	7	$d(1) > 3.2m$, axles=3 & groups=3		
4	>2	Four axle articulated vehicle or Rigid vehicle and trailer	ART4	8	$d(2) < 2.1m$ or $d(1) < 2.1m$ or $d(1) > 3.2m$ axles = 4 & groups>2		
5	>2	Five axle articulated vehicle or Rigid vehicle and trailer	ART5	9	$d(2) < 2.1m$ or $d(1) < 2.1m$ or $d(1) > 3.2m$ axles=5 & groups>2		
>=6	>2	Six (or more) axle articulated vehicle or Rigid vehicle and trailer	ART6	10	axles=6 & groups>2 or axles>6 & groups=3		
>6	4	B-Double or Heavy truck and trailer	BD	11	groups=4 & axles>6		
>6	>=5	Double or triple road train or Heavy truck and two (or more) trailers	DRT	12	groups>=5 & axles>6		3 (Heavy)

Appendix 10.2 Pavement Condition Survey





Falling Weight Deflectometer Survey

L8007 Racefield to Ballyshannon Cross

Client: Kilsaran

Address: Piercetown, Dunboyne, Co. Meath.

Site: L8007 Racefield to Ballyshannon Cross

Date: 05-September-2019

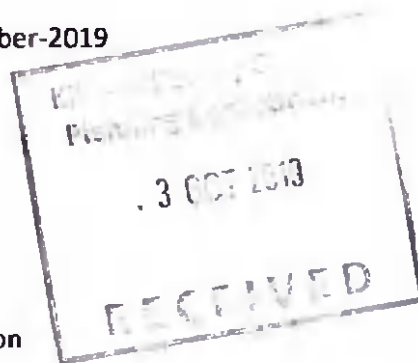
Contents:

1. Introduction
2. Description of testing
 - 2.1. FWD Details
 - 2.2. Coring
3. Survey Details
 - 3.1 Date of Survey
 - 3.2 Site Details
 - 3.3 Pavement Construction
 - 3.4 Traffic Loading
 - 3.5 Tabulated Deflections
 - 3.6 Deflection Graphs
4. Back-analysis
5. Strengthening Proposals

Appendix A: Tabulated Deflections

Appendix B: Deflection Graphs

Appendix C: Core Results



1. Introduction:

Falling Weight Deflectometer (FWD) surveys are carried out to assess the condition and load bearing capacity of pavement structures, to identify weaknesses, and in some cases to recommend strengthening requirements.

A FWD survey was requested by Kilsaran to assess the condition of a section of the L8007 between Racefield and Ballyshannon Cross in Co. Kildare. Pavement condition was considered based on the measured deflection results.

2. Description of testing

2.1. FWD Testing

A load pulse is produced by dropping a known mass, and is transmitted to the pavement through the loading plate. The load cell measures the load imparted to the pavement surface. Geophones mounted radially from the centre of the load plate measure the pavement deflection in response to the load.

Testing was carried out using the Primax 1500 FWD manufactured by Sweco. Readings were taken from 9 geophones mounted radially from the centre of the load plate and positioned as follows:

Geophone Number	D1	D2	D3	D4	D5	D6	D7	D8	D9
Distance from centre of load(mm)	0	300	450	600	900	1200	1500	1800	2100

In this case the load level was set at 40Kn and the load pulse applied through a 300mm diameter plate. Deflections at each geophone were measured at a resolution of 1 micron.

Deflections were measured at 50 metre intervals in each lane, staggered by 25 metres between lanes. At each test point at least 3 drops were made, after an initial drop to settle the loading plate.



3. Survey Details

3.1. Date of Survey

The FWD survey took place in September 2nd, 2019.

3.2. Site Details

The survey took place on a section of the L8007 off the R418 Kilcullen to Athy Road as shown in Figure 1. Testing commenced at the junction with the R418 (Chainage 0) and proceeded west for a distance of 1550 metres.

Figure 1: Site Map for L8007 Racefield to Ballyshannon Cross



3.3. Tabulated Deflections

The deflection bowl created by the FWD load pulse is influenced by the stiffness of the different pavement layers. Deflection values are tabulated in Appendix A as follows:

D1: Indication of overall pavement performance

D1-D2: Indicates condition of upper pavement layers

D9: Indication of sub-grade condition



Guidance on the interpretation of deflection values is given in NRA-HD31/15 for national roads, and DTTAS publication '*Guidelines on Depth of Overlay to be used on Rural Regional and Local Roads*'. The DTTAS interpretation is used in this case and is reproduced in Table 2 and Table 3.

Table 1: Upper Pavement Level Condition based on deflection values

Central Deflection (D1)	SCI (D1-D2)	Comment
<300	<150	Good load spreading ability
300-500	150-250	Good to poor load spreading ability
501-800	251-400	Poor to bad load spreading ability
		Bad load spreading ability

Table 2: Subgrade Condition based on deflection values

Outer Deflection (D9)	Comment
<15	Stiff subgrade
15-30	Stiff to moderate subgrade
31-45	Moderate to weak subgrade
	Weak subgrade

Deflection values measured indicate some variation in pavement condition along the test section. Table 3 contains average values for sub-sections with deflections of similar magnitude.

Table 3: Average Deflection Values

Chainage	Westbound			Eastbound		
	D1	D1-D2	D9	D1	D1-D2	D9
0-25	130	47	8	173	60	9
25-300	302	122	11	406	170	10
300-550	204	111	6	306	140	9
550-700	330	157	9	252	137	6
700-1050	200	97	7	252	120	8
1050-1300	266	126	7	310	147	7
1300-1475	403	207	4	449	237	6
1475-1550	229	124	4	249	143	5

The pavement condition based on deflection values could be described as follows:

- (D1) and (D1-D2) values generally indicate a reasonably strong structure for a local/regional road with good load spreading ability in the upper layers. Weaker sub-sections are highlighted from Chainage 25 to 300, Chainage 550 to 700 and Chainage 1300 to 1475.
- The sub-grade is stiff based on (D9) deflections.

3.4. Deflection Graphs

The selected deflection parameters plotted against distance are contained in Appendix B. Deflection and deflection difference graphs are useful for showing relative differences in the condition of the layers.

3.5. Pavement Construction

Knowledge of the pavement structure is required to analyse FWD data, and estimate layer stiffness. Three cores were taken along the section to investigate the depth of each layer. A summary of the results are shown in Table 4. Pictures of the bound layers are contained in Appendix B.

Table 4: Pavement Layers for L8007

Chainage	250	750	1300
Layer 1 (Top)	90mm Bound Material	80mm Bound Material	40mm Bound Material
Layer 2	60mm Granular Sub-base	60mm Granular Sub-base	40mm Granular Sub-base
Layer 3	Gravelly Clay	Gravelly Sand	Gravelly Sand

3.6. Traffic Loading

For the purpose of calculating the overlay requirements of the pavement an estimate of the number of heavy goods vehicles (HGV's), or standard axles (8.16 tonnes) is required. Based on information provided by Kilsaran the projected traffic volumes, including traffic from the proposed development, will be an AADT of 1127 with a HGV content of 8.8% from Chainage 0 to 1300, and an AADT of 666 with a HGV of 13% from Chainage 1300 to 1550.

Based on a 20 year design life at a growth rate of 3% the pavement section could be expected to carry up to 1.4 million standard axles from Chainage 0 to 1300, and 1.2 million standard axles from Chainage 1300 to 1550.

4. Back-analysis

Pavement layer moduli values were estimated from the FWD deflections by the RoSy Design program using the back calculation method. The calculation of road surface deflection is based on the theory of elasticity and the method of equivalent thickness as framed by J.M. Kirk and N. Odemark on the basis of Boussinesq's equations. The main inputs include surface deflection, structural layer thickness, Poissons ratio and initial moduli estimates.



5. Strengthening Proposals

Once the back-analysis is complete, and the stresses and strains in the pavement are estimated, the number of axles to failure can be calculated. Where this is less than the predicted traffic loading for the design period, strengthening is required. Overlay design is based on 'Guidelines on the Depth of Overlay to be used on Rural Regional and Local Roads (March 2014)' as issued by the Department of Transport, Tourism and Sport. The requirements for a 20 year design life are shown in Table 5.

Table 5: Overlay Proposals for L8007 Racefield

Chainage	Asphalt Concrete Overlay
0-250	No Overlay Required
250-350	40mm
350-575	No Overlay Required
575-700	40mm
700-1000	No Overlay Required
1000-1150	40mm
1150-1225	No Overlay Required
1225-1550	40mm

Estimated stiffness values are based on inputs such as layer thickness and temperature, therefore inaccurate input information will lead to inaccurate output data. The values are also based on the non-destructive FWD test and should be considered in the context of any additional detailed information regarding the pavement structure.





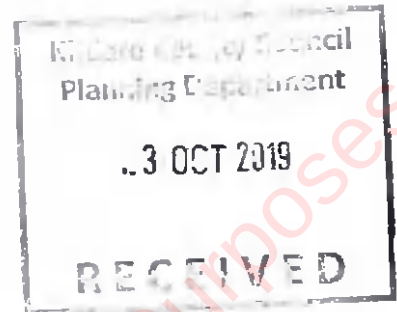
Appendix A:
Tabulated Deflections

Table A1: L8007 Westbound Deflection Values

Chainage	D1	D1-D2	D9
0	130	47	8
50	296	109	6
100	360	141	11
150	172	90	8
200	167	62	20
250	266	115	9
300	553	214	10
350	187	96	4
400	223	127	9
450	209	122	4
500	148	89	6
550	255	123	7
600	336	179	6
650	287	140	7
700	368	153	12
750	259	100	11
800	187	93	6
850	201	99	8
900	169	89	4
950	166	89	5
1000	210	106	5
1050	206	105	6
1100	332	150	6
1150	297	129	7
1200	184	95	6
1250	248	109	8
1300	266	146	4
1350	562	279	4
1400	280	149	4
1450	368	194	4
1500	198	113	4
1550	260	136	4

Table A2: L8007 Eastbound Deflection Values

Chainage	D1	D1-D2	D9
0	173	60	9
25	307	130	11
75	539	216	11
125	291	129	10
175	330	149	12
225	270	118	8
275	698	279	8
325	424	136	12
375	272	170	5
425	249	141	10
475	294	120	13
525	291	136	7
575	196	109	3
625	239	140	5
675	320	161	8
725	288	110	12
775	233	108	9
825	346	141	11
875	197	108	6
925	215	126	4
975	173	95	3
1025	314	155	9
1075	363	153	8
1125	368	173	6
1175	264	136	7
1225	242	116	7
1275	311	156	8
1325	555	299	8
1375	190	108	3
1425	486	248	4
1475	566	294	6
1525	324	195	5
1550	174	92	4

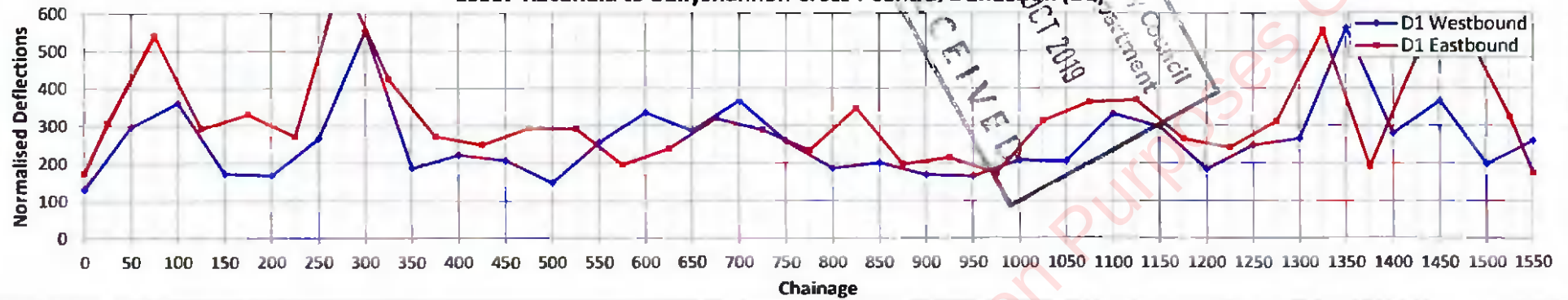


Appendix B
Deflection Graphs

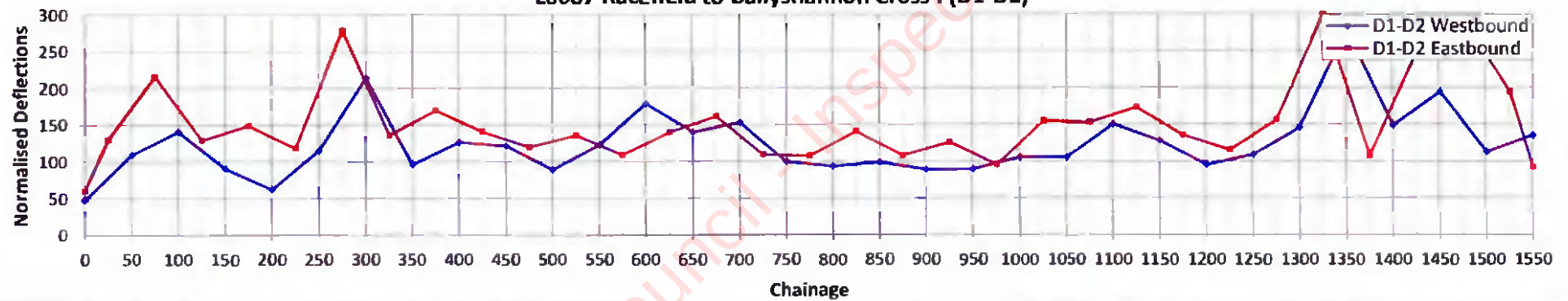
Appendix B: Deflection Graphs

L8007 Racefield to Ballyshannon Cross

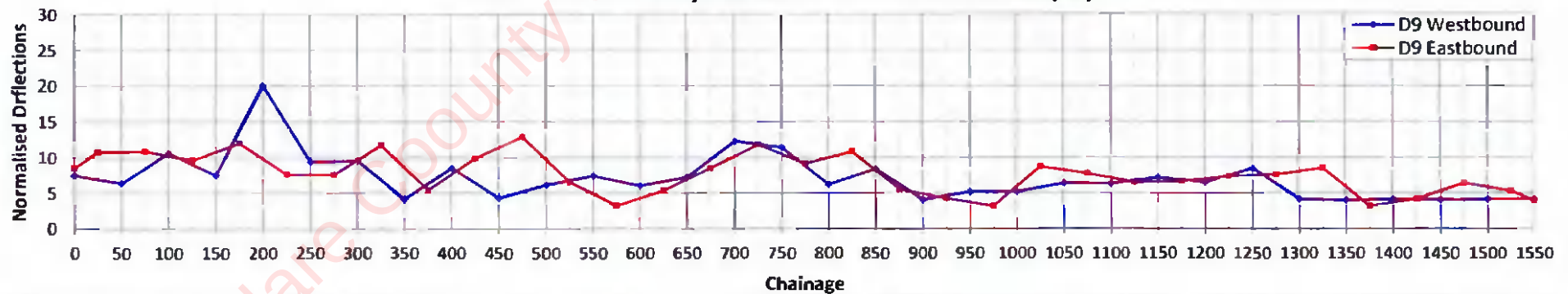
L8007 Racefield to Ballyshannon Cross : Central Deflection (D1)



L8007 Racefield to Ballyshannon Cross : (D1-D2)



L8007 Racefield to Ballyshannon Cross : Outer Deflection (D9)

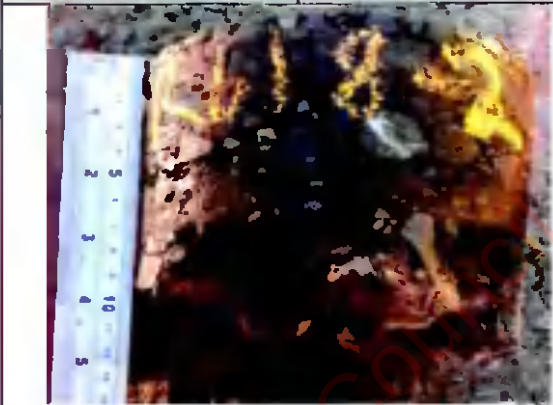


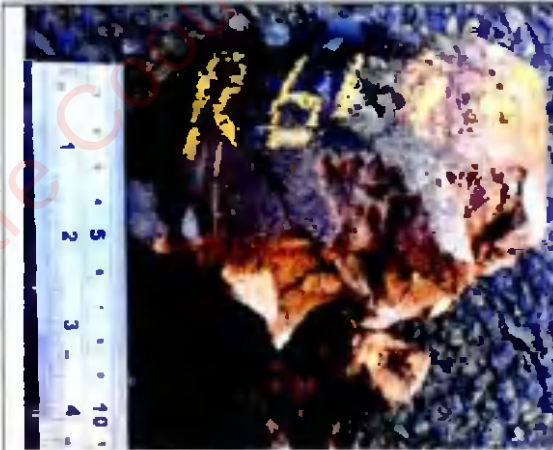


Appendix C

Core Results

Core No.: L8007/1	Chainage: 250	Depth (mm)	Description
		5	Surface Dressing
		80	Asphalt Concrete
		5	Surface Dressing
		60	Crushed Rock

Core No.: L8007/2	Chainage: 750	Depth (mm)	Description
		5	Surface Dressing
		45	Asphalt Concrete
		30	Asphalt Concrete
		60	Crushed Rock

Core No.: L8007/3	Chainage: 1300	Depth (mm)	Description
		10	Surface Dressing
		30	Asphalt Concrete
		50	Crushed Rock

Appendix 10.3 Road Safety Audit



Title: STAGE 1 ROAD SAFETY AUDIT
For;
L8007, Kilsaran Racefield.

Client: RPS/Kilsaran.

Date: August 2019

Report reference: 0630R01

VERSION: FINAL

3 OCT 2019

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Prepared By:

Bruton Consulting Engineers Ltd

Glaspistol

Clogherhead

Drogheda

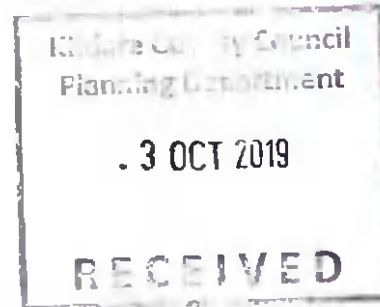
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1.0 Introduction

This report was prepared in response to a request from Mr. David Garvey, RPS, for a Stage 1 Road Safety Audit of the proposed sand and gravel pit at Racefield, Ballyshannon, Kilcullen, Co. Kildare.

The Road Safety Audit Team comprised of;

Team Leader: Norman Bruton, BE CEng FIEI, Cert Comp RSA.

TII approval number: NB 168446

Team Member: Owen O'Reilly, B.SC. Eng Dip Struct. Eng NCEA Civil Dip Civil. Eng CEng MIEI

TII approval number: OO 1291756

The Road Safety Audit comprised an examination of the information provided and a site visit by the Audit Team, together, on the 8th August 2019.

The weather at the time of the site visit was dry and the road surface was dry.

This Stage 1 Road Safety Audit has been carried out in accordance with the requirements of TII Publication Number GE-STY-01024, dated December 2017.

The scheme has been examined and this report compiled in respect of the consideration of those matters that have an adverse effect on road safety. It has not been examined or verified for compliance with any other standards or criteria.

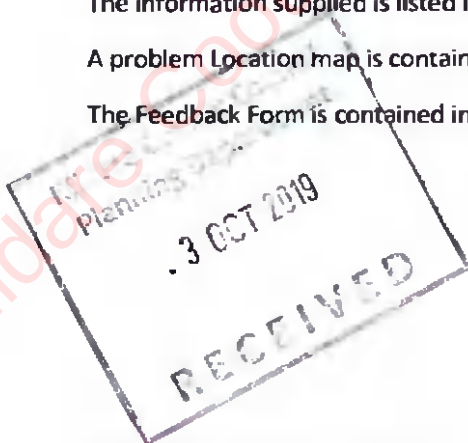
The problems identified in this report are considered to require action in order to improve the safety of the scheme for road users.

If any of the recommendations within this safety audit report are not accepted, a written response is required, stating reasons for non-acceptance. Comments made within the report under the heading of Observation are intended to be for information only. Written responses to Observations are not required.

The information supplied is listed in **Appendix A**.

A problem Location map is contained in **Appendix B**

The Feedback Form is contained in **Appendix C**





2.0 Background

It is proposed to develop a sand and gravel pit at Racefield, Ballyshannon, Kilcullem, Co. Kildare.

The site is expected to facilitate 3-4 full time employees. It is estimated that there will be approximately 36 trips made by 28 tonne trucks per day (72 movements in total).

The development will be accessed by a new access off the L8007. (This may be the L8006, see location map below)

The Audit Team have been informed through the Audit Brief that all outgoing vehicles will be instructed to turn right towards the Ballyshannon crossroads where the R418 intersects with the L8007. There they will turn left and travel due north towards junction 2 of the M9. Likewise, all incoming vehicles will use this route, never travelling on the section of the L8007 which lies to the west of the site entrance.

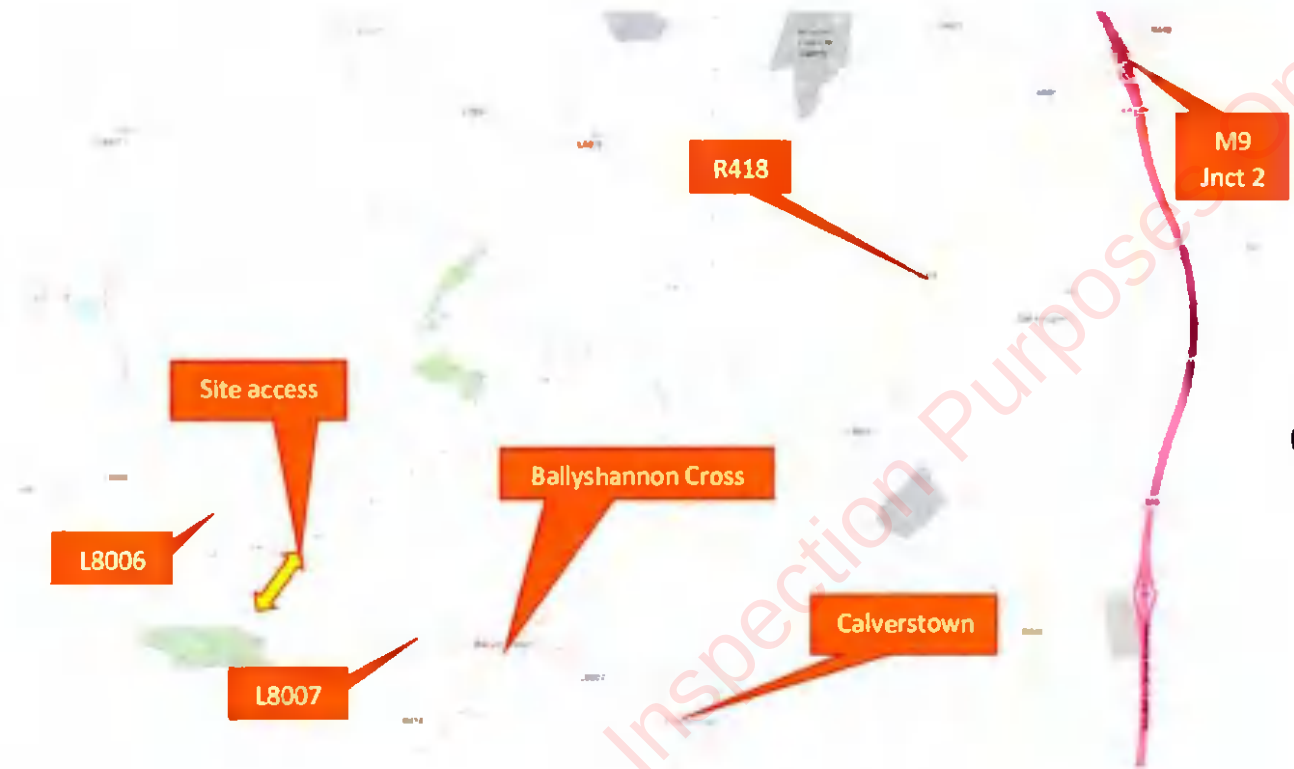
The L8007 is a single carriageway local road of varying cross section. The speed limit is 80km/hr where the development is proposed and reduced to 60km/hr on approach to its junction with the R418 (Ballyshannon Cross).

Ballyshannon National School is located circa 1.5km east of the site along the R418, 150m to the North of Ballyshannon Cross. The Audit Team have been informed through the Audit Brief that HGV arrival and departure times will be scheduled to not coincide with the times of peak activity at the school.

The Audit Team have been informed that the vegetation will be cleared at the proposed access to provide 160m sightlines. The "x" distance of the visibility envelope has not been stipulated.

The scope of the Audit included the Section of the L8007 to Ballyshannon Cross.

The site location map is shown below.



Site Location Map – image courtesy of Google.

The Road Safety Authority's website (<http://www.rsa.ie/RSA/Road-Safety/Our-Research/Collision-Statistics/Ireland-Road-Collisions/>) indicates that there have been six recorded injury collisions on the R418 in the vicinity of the junction between the years 2005 and 2015.

The collision closest to the L8007 /R418 junction was a serious injury collision that occurred in 2009. The primary collision type was head-on.

There were three minor injury collisions where the primary collision type was rear-end straight. One in 2005, one in 2008, and one in 2009.

It is noted that the M9 Motorway opened in December 2009 and no collisions have been recorded at the L8007/R418 junction since that time.



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3.0 Main Report

3.1 Problem

LOCATION

Drawing MH18057-RPS-00-XX-DR-Z-DG0018 – 51 Rev P01 & Site observation.

PROBLEM

There is insufficient space for two HGVs to pass at certain location along the L8007 between Ballyshannon Cross and the development access. This could lead to material damage collisions as vehicles pass.



Narrow carriageway along site frontage



Example of narrow carriageway where 2 HGVs cannot pass.



Examples of bends on the carriageway too narrow for HGV's passing.



RECOMMENDATION

It is recommended that the L8007 be widened locally at certain areas and/or that passing bays be provided at suitable locations.

If passing bays are to be provided, they should be such that there is inter-visibility from each one to the next. This is of particular importance where there are bends in the road to avoid vehicles meeting on the bend.

Local widening should be provided along the site boundary which would also cater for HGV queuing on the carriageway if they are waiting to enter the site.

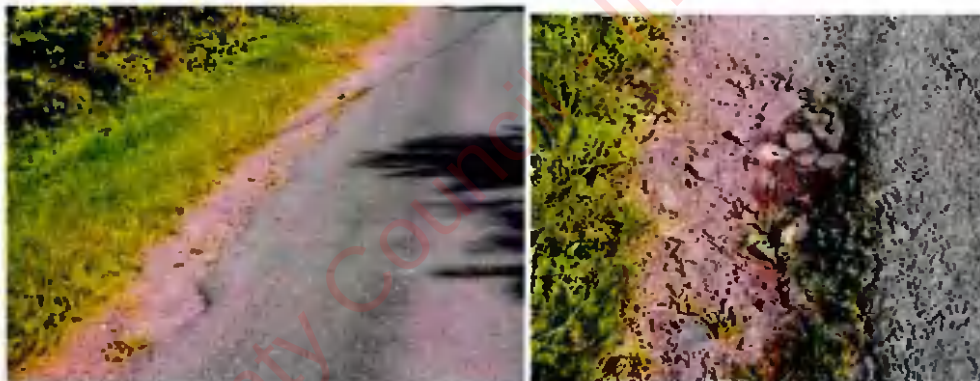
3.2 Problem

LOCATION

Site Observation, L8007.

PROBLEM

It was observed during the site visit that the cross section of the L8007 is narrow at certain locations and that when vehicles pass that drivers place wheels on the grassed verge or in the areas of hard standing outside residences or agricultural accesses to pass. There is a risk that if laden vehicles from the quarry travel over the edge of the carriageway that they will break the edge of the carriageway which will lead to hazards for other road users, especially pedestrians and cyclists.



Examples of carriageway edges without sufficient pavement depth to take HGV loading



Examples of hard standing areas at private property that are not designed to take HGV loading.

RECOMMENDATION

It is recommended that full depth pavement construction is applied to any road widening, hard standing strengthening or passing bay construction to ensure that they will be able to withstand the vehicular loading in the future.

3.3 Problem

LOCATION

Site Observation, L8007.

PROBLEM

It is unclear what depth of pavement construction exists on the L8007. There is a risk that due to the intensification of HGV use that the pavement will fail leading to cracking, subsidence, potholes etc. These can be hazards for other vehicular traffic resulting in material damage to vehicles and can also be hazards to pedestrians and cyclists leading to trips and fall or loss of control of bicycles.

The pavement at the quarry access would have additional turning forces which could accelerate pavement deterioration.

RECOMMENDATION

It is recommended that an analysis of the existing pavement makeup and condition be undertaken and checked to ensure that it will withstand the predicted future loading from the quarry. If the analysis shows that the pavement will fail within a reasonable period, then the pavement should be strengthened.

3.4 Problem

LOCATION

Site observation, foliage

PROBLEM

Summer growth of the foliage at road boundary has reduced forward visibility at certain locations along the L8007. This could lead to head-on collisions if drivers are unable to stop if they meet HGVs travelling to/from the quarry.



RECOMMENDATION

It is recommended that through liaison with the landowners and the local Authority that a maintenance regime be developed and implemented by the quarry operator to avoid excessive growth of the vegetation which can impede forward visibility for drivers.

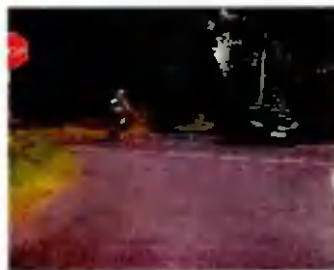
4.0 Observations

8Observation

It is unclear at this preliminary design stage how drivers will be prohibited from travelling West on the L8007/L8006. It is assumed that this will be via site rules, adequate signage and built into a licence agreement from the Local Authority.

4.1 Observation

The 'STOP' road marking text at the L8007 /R418 junction is faded and should be renewed.



4.2 Observation

It is assumed that the screening mound will be of such profile and setback that it will not be a hazard for road users.

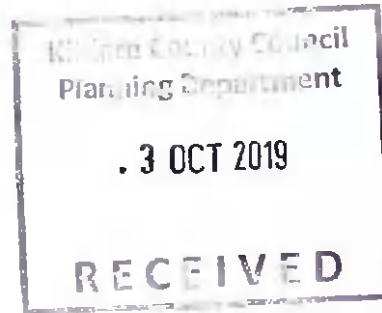
4.3 Observation

It is assumed that the "x" distance for the sightlines at the new access will take into account the slow-moving nature of heavy goods vehicles and time taken to undertake turning manoeuvres.

4.4 Observation

It is assumed that the Management Plan will cover regular road sweeping to remove any loose stones from the L8007.





5.0 Audit Statement

We certify that we have examined the information provided and the site on the 8th August 2019. The examination has been carried out with the sole purpose of identifying any features of the design which could be removed or modified in order to improve the safety of the scheme.

The problems identified have been noted in this report together with associated safety improvement suggestions which we would recommend should be studied for implementation. The audit has been carried out by the persons named below who have not been involved in any design work on this scheme as a member of the Design Team.

Norman Bruton

Signed: Norman Bruton

(Audit Team Leader)

Dated: 26-9-2019

Owen O'Reilly

Signed: Owen O'Reilly

(Audit Team Member)

Dated: 26-9-2019

Appendix A

List of Material Supplied for this Stage 1 Road Safety Audit;

- Drawing MH18057-RP5-00-XX-DR-Z-DG0018 – S1 Rev P01

List of Background Material Supplied for this Stage 1 Road Safety Audit;

- Audit Brief
- Site Location Map



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Appendix C

Feedback Form



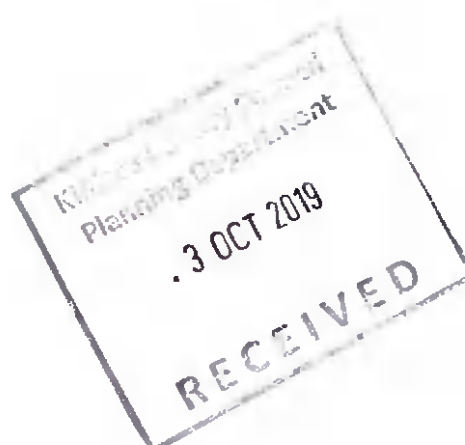
SAFETY AUDIT FORM – FEEDBACK ON AUDIT REPORT

Scheme: L8007, Kilsaran, Racefield.

Stage: 1 Road Safety Audit.

Date Audit (Site visit) Completed: 8th August 2019

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.1	Yes	Yes	As recommended in the RSA and in line with the relevant TII standards, Kilsaran proposes to construct two passing bays along the northern side of the L-8007. The proposed passing bays will comprise extending the paved road width by 1.0m for a 20m distance at locations approximately 500m and 1km from the junction with the R418. The requirement for inter-visibility between the two proposed passing bays is not achievable given the horizontal alignment of the road in this area. It is noted that the TII standard states that the requirement for inter-visibility only applies "where feasible" and in this case a deviation from the recommendation is sought. Local widening along the northern site boundary is not proposed as queuing will be prohibited on the local road and the entrance will be set back to ensure adequate space for HGVs to pull in safely off the local road and all vehicles will be Kilsaran operated with security fobs to allow them easy access to the site. As such, there is no specific requirement for Local widening along the northern site boundary.	Yes
3.2	Yes	Yes	Both of the proposed passing bays and the site entrance will be constructed as full depth pavement construction in line with TII standards and under agreement with Kildare County Council.	Yes



Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)																		
3.3	Yes	Yes	In September 2019, Kilsaran commissioned a Falling Weight Deflectometer Survey which was undertaken by Milestone Pavement Technologies. A copy of the report is appended to this feedback form. This test was carried out on the entirety of the L-8006/L-8007 from the site entrance to Ballyshannon crossroads (i.e. the haul route on the local road) over a length of 1550 metres. In addition, three cores were taken along the route to investigate the depth of each pavement layer. The assessment generally indicates a reasonably strong structure for a local road with good load spreading ability in the upper layers. Weaker sub-sections are highlighted from Chainage 25 to 300, Chainage 550 to 700 and Chainage 1300 to 1475. The report recommends the following pavement interventions on this road for a 20 year design life which will be implemented in full by Kilsaran under agreement with Kildare County Council: <table><tr><th>Chainage</th><th>Asphalt Concrete Overlay</th></tr><tr><td>0-250</td><td>No overlay required</td></tr><tr><td>250-350</td><td>40mm</td></tr><tr><td>350-575</td><td>No overlay required</td></tr><tr><td>575-700</td><td>40mm</td></tr><tr><td>700-1000</td><td>No overlay required</td></tr><tr><td>1000-1150</td><td>40mm</td></tr><tr><td>1150-1225</td><td>No overlay required</td></tr><tr><td>1225-1550</td><td>40mm</td></tr></table>	Chainage	Asphalt Concrete Overlay	0-250	No overlay required	250-350	40mm	350-575	No overlay required	575-700	40mm	700-1000	No overlay required	1000-1150	40mm	1150-1225	No overlay required	1225-1550	40mm	Yes
Chainage	Asphalt Concrete Overlay																					
0-250	No overlay required																					
250-350	40mm																					
350-575	No overlay required																					
575-700	40mm																					
700-1000	No overlay required																					
1000-1150	40mm																					
1150-1225	No overlay required																					
1225-1550	40mm																					
3.4	Yes	No	Section 70 of the Roads Act 1993 places responsibility for the maintenance of roadside hedges on all landowners/occupiers of land. In this regard, Kilsaran is legally responsible for the maintenance of the verges along the northern boundary of the site on the L-8006. Any vegetation maintenance at this boundary will be undertaken by Kilsaran outside of the bird nesting season (1st March to 31st August). Maintenance of hedges and vegetation between the Kilsaran site boundary and the junction with	Yes																		

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
			the R418 will be managed by the relevant landowner	

Signed *Paul Thakur*

Date: ..25-09-2019.....

Design Team Leader

Signed *Alexander Bruton*

Date:25-09-2019.....

Audit Team Leader

Signed

Date:25-09-19.....

Employer



Appendix 12.1 Summary of Relevant Cultural Heritage Legislation



3 OCT 2019

National Monuments (Amendment) Act (1930-2014)

All archaeological sites have the full protection of the national monuments legislation (Principal Act 1930, Amendments 1954, 1987, 1994, 2004 and 2014). In the 1987 Amendment of Section 2 of the Principal Act (1930), the definition of a national monument is specified as:

any artificial or partly artificial building, structure or erection or group of such buildings, structures or erections;

any artificial cave, stone or natural product, whether forming part of the ground, that has been artificially carved, sculptured or worked upon or which (where it does not form part of the place where it is) appears to have been purposely put or arranged in position;

any, or any part of any, prehistoric or ancient tomb, grave or burial deposit, or

(ii) ritual, industrial or habitation site

and

any place comprising the remains or traces of any such building, structure or erection, any cave, stone or natural product or any such tomb, grave, burial deposit or ritual, industrial or habitation site...

Under Section 14 of the Principal Act (1930):

It shall be unlawful...

to demolish or remove wholly or in part or to disfigure, deface, alter, or in any manner injure or interfere with any such national monument without or otherwise than in accordance with the consent hereinafter mentioned (a licence issued by the Office of Public Works National Monuments Branch),

or

to excavate, dig, plough or otherwise disturb the ground within, around, or in the proximity to any such national monument without or otherwise than in accordance...

Under Amendment to Section 23 of the Principal Act (1930),

A person who finds an archaeological object shall, within four days after the finding, make a report of it to a member of the Garda Síochána...or the Director of the National Museum...

The latter is of relevance to any finds made during a watching brief.

In the 1994 Amendment of Section 12 of the Principal Act (1930), all the sites and 'places' recorded by the Sites and Monuments Record of the Office of Public Works are provided with a new status in law. This new status provides a level of protection to the listed sites that is equivalent to that accorded to 'registered' sites [Section 8(1), National Monuments Amendment Act 1954] as follows.

The Commissioners shall establish and maintain a record of monuments and places where they believe there are monuments and the record shall be comprised of a list of monuments and such places and a map or maps showing each monument and such place in respect of each county in the State.

The Commissioners shall cause to be exhibited in a prescribed manner in each county the list and map or maps of the county drawn up and publish in a prescribed manner information about when and where the lists and maps may be consulted.

In addition, when the owner or occupier (not being the Commissioners) of a monument or place which has been recorded, or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.

Under the National Monuments Amendment Act (2004), the Minister of Environment, Heritage and Local Government will issue directions relating to archaeological works and will be advised by the National Monuments Section and the National Museum of Ireland. The Act sets out the circumstances whereby the

REPORT

Minister of Environment, Heritage and Local Government may grant consent (i.e. in respect of a national monument of which the Minister or a local authority are the owners or the guardians or in respect of which a preservation order is in force) or issue directions (i.e. in relation to approved road developments—being road development approved under either or both sections 49 and 51 of the Roads Act 1993)

14A. (1) The consent of the Minister under section 14 of this Act and any further consent or licence under any other provision of the National Monuments Acts 1930 to 2004 shall not be required where the works involved are connected with an approved road development.

14A. (2) Any works of an archaeological nature that are carried out in respect of an approved road development shall be carried out in accordance with the directions of the Minister, which directions shall be issued following consultation by the minister with the Director of the National Museum of Ireland.

14A. (4) Where a national monument has been discovered to which subsection (3) of this section relates, then the road authority carrying out the road development shall report the discovery to the Minister subject to subsection (7) of this section, and pending any directions by the minister under paragraph (d) of this subsection, no works which would interfere with the monument shall be carried out, except works urgently required to secure its preservation carried out in accordance with such measures as may be specified by the Minister

The Minister will consult with the Director of the National Museum of Ireland for a period not longer than 14 days before issuing further directions in relation to the national monument.

The Minister will not be restricted to archaeological considerations alone, but will also consider the wider public interest.

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999

This Act provides for the establishment of a national inventory of architectural heritage and historic monuments.

Section 1 of the act defines "architectural heritage" as:-

- (a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,
- (b) groups of such structures and buildings, and,
- (c) sites

which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest

Section 2 of the Act states that the Minister (for Arts, Heritage, Gaeltacht and the Islands) shall establish the NIAH, determining its form and content, defining the categories of architectural heritage, and specifying to which category each entry belongs. The information contained within the inventory will be made available to planning authorities, having regard to the security and privacy of both property and persons involved.

Section 3 of the Act states that the minister may appoint officers, who may in turn request access to premises listed in the inventory from the occupiers of these buildings. The officer is required to inform the occupier of the building why entry is necessary, and in the event of a refusal, can apply for a warrant to enter the premises.

Section 4 of the Act states that obstruction of an officer or a refusal to comply with requirements of entry will result in the owner or occupier being guilty of an offence.

Section 5 of the Act states that sanitary authorities who carry out works on a monument covered by this Act will as far as possible preserve the monument with the proviso that its condition is not a danger to any person or property, and that the sanitation authority will inform the Minister that the works have been carried out

The provisions in the Act are in addition to and not a substitution for provisions of the National Monument Act (1930–94), and the protection of monuments in the National Monuments Act is extended to the monuments

REPORT



covered by the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act (1999).

Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000

The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act provides for the establishment of a national inventory of architectural heritage and historic monuments.

Section 1 of the act defines "architectural heritage" as:

- (a) all structures and buildings together with their settings and attendant grounds, fixtures and fittings,
- (b) groups of such structures and buildings, and,
- (c) sites, which are of architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest

The Local Government (Planning and Development) Act, 1999, which came into force on 1st January 2000, provides for the inclusion of protected structures into the planning authorities' development plans and sets out statutory regulations regarding works affecting such structures, thereby giving greater statutory protection to buildings. All structures listed in the development plan are now referred to as Protected Structures and enjoy equal statutory protection. Under the 1999 Act the entire structure is protected, including a structures interior, exterior, the land lying within the curtilage of the protected structure and other structures within that curtilage. This Act was subsequently repealed and replaced by the Planning and Development Act, 2000, where the conditions relating to the protection of architectural heritage are set out in Part IV of the Act.

The main features of the 2000 Act are:

- a) planning authorities have a clear obligation to create a record of protected structures (RPS) which includes all structures or parts of structures in their functional areas which, in their opinion, are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. This record forms part of a planning authority's development plan
- b) planning authorities are also obliged to preserve the character of places and townscapes which are of special architectural, historic, archaeological, artistic, cultural, scientific, social or technical interest or that contribute to the appreciation of protected structures, by designating them architectural conservation areas (ACAs) in their development plan.
- c) development plans must include objectives for the protection of such structures and the preservation of the character of such areas to ensure proper and sustainable planning and development
- d) new responsibilities are given to the owners and occupiers of protected structures to maintain them and planning authorities have additional powers to ensure that buildings are not endangered either directly or through neglect.⁵ Financial assistance, in the form of conservation grants, is available from planning authorities to assist in this process.
- e) the owner or occupier of a protected structure may seek a declaration from the relevant planning authority to determine the works to the structure that would materially affect its character and therefore require planning permission, and those works which may be carried out as exempted development
- f) where a structure is protected, the protection includes the structure, its interior and the land within its curtilage and other structures within that curtilage (including their interiors) and all fixtures and features which form part of the interior or exterior of all these structures. All works which would materially affect the character of a protected structure, or a proposed protected structure, will require planning permission.

Appendix 12.2 Code of Practice between the Department of the Environment, Heritage and Local Government and the Irish Concrete Federation



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The Code is guided by the following agreed principles:

1. The Minister has a responsibility to protect the archaeological heritage and to exercise powers of preservation under the National Monuments Acts, 1930-2004, taking account of the European Convention for the Protection of the Archaeological Heritage.
2. The Irish Concrete Federation (ICF) has a responsibility to secure the provision of an efficient quarry, concrete and aggregate industry in Ireland.
3. The Code is without prejudice to the decision-making role of local authorities in respect of applications for planning permission for quarry or related developments. It is fully recognised that, in arriving at such decisions, local authorities must take account of a wide range of issues.
4. The growth in the provision of infrastructure in the State, and new private sector development to meet the National Development Plan, inevitably means that the quarry industry continues to have considerable archaeological implications, which must be addressed, given that aggregate resources can only be worked where they exist. Given that the archaeological heritage is a non-renewable resource the presence of known archaeological sites or the anticipation of potential sites must be a major consideration in the selection of development sites.
5. The ICF and the Minister will co-operate, as far as possible, to ensure that appropriate archaeological investigation is carried out before land acquisition and prior to commencement of development.
6. Appropriate strategies will be developed to minimise direct impacts on archaeology taking account of safety implications, environmental and other impacts and costs.
7. Mitigation planning at the earliest opportunity minimises the impact on the archaeological heritage.
8. The ICF members will finance a balanced and cost effective approach to archaeological investigation, excavation and mitigation as an integral element of development costs on the basis of the developer pays principle and in keeping with the Minister's stated policy in this regard.
9. All ICF members will be treated in a fair and equitable manner.
10. Prospecting for archaeological sites and other such remains other than in exceptional circumstances is limited to the confines of the area under development.
11. Each party reserves the right to appeal decisions.
12. The commitment of both parties to dealing with the archaeological implication of quarry development and extensions in a balanced and cost-effective manner consistent with a level of excavation and recording of archaeological sites, impacted upon by quarry extraction, that is acceptable to the Minister.
13. Both parties agree to establish a team to monitor the operation of the Code of Practice and carry out a formal review within one year of its adoption and at agreed intervals thereafter.

Agreed Actions

The ICF (members) will:

1. Appoint, or ensure the appointment of, a project archaeologist to oversee the smooth running of the archaeological elements of quarry development and extension projects (Appendix I defines the role of the project archaeologist, Appendix II sets out the relationship between the project archaeologist and the consultant archaeologist).
2. Ensure that the project archaeologist will be a member of the project design team. As part of the project design team the project archaeologist will input into the development of the programme and the construction / procurement strategy for the project including the development of contract documentation relating to the management of archaeology. S/he will also input, as appropriate, on implications for archaeology arising from any proposed changes in the programme.

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3. Undertake investigation of the archaeological implications of a development proposal at the initial planning stages with a view to informing selection of areas for development, ensuring that appropriate weight is given to archaeological implications in identifying the preferred location of the development and seeking to minimise the impact on known archaeological sites or areas of established archaeological potential.
4. Require that the process of identifying the potential impact of development proposals on archaeology will be dealt with by an experienced archaeologist.
5. Consult with the Minister throughout the design process.
6. Where it cannot be reasonably avoided, excavate and record all known monuments or archaeological sites or parts of such, that are impacted by the construction works, in accordance with agreed methodologies and allow sufficient time for such recording to be carried out to the satisfaction of the Minister.
7. Provide the necessary finance to fulfil the post-excavation requirements of the Minister including the conservation of archaeological objects, the provision of scientific analyses and dating, as well as the production of reports on all archaeological work to a standard which will meet the approval of the Minister.



Appendix 12.3 Glossary of Impacts



REPORT

Significance Criteria (NRA Guidelines 2006)

The significance criteria can be used to evaluate the significance of an archaeological site, monument or complex. It should not, however, be regarded as definitive, rather it is an indicator which contributes to a wider judgment based on the individual circumstances of a feature. Different archaeological heritage asset types lend themselves more easily to assessment and it should be borne in mind that this can create a bias in the record, for example an upstanding stone monument such as a fortified house is easier to examine with a view to significance than a degraded enclosure site.

Table Error! No text of specified style in document.: 1: Significance Criteria, NRA Guidelines 2006 (Archaeological Heritage)

Criteria	Explanation
Existing Status	The level of protection associated with an archaeological site / monument is an important consideration.
Condition /Preservation	The survival of a monument's archaeological potential both above and below ground is an important consideration and should be assessed in relation to its present condition and surviving features. Well-preserved sites should be highlighted, this assessment can only be based on a field inspection.
Documentation /Historical Significance	The significance of a monument may be enhanced by the existence of records of previous investigations or contemporary documentation supported by written evidence or historic maps. Sites with a definite historical association or an example of a notable event or person should be highlighted.
Group Value	The value of a single monument may be greatly enhanced by its association with related contemporary monuments or with monuments from different periods indicating an extended time presence in any specific area. In some cases it may be preferable to protect the complete group, including associated and adjacent land, rather than to protect isolated monuments within that group.
Rarity	The rarity of some monument types can be a central factor affecting response strategies for development, whatever the condition of the individual feature. It is important to recognise sites that have a limited distribution.
Visibility in the Landscape	Monuments that are highly visible in the landscape have a heightened physical presence. The inter-visibility between monuments may also be explored in this category.
Fragility/ Vulnerability	It is important to assess the level of threat to archaeological monuments from erosion, natural degradation, agricultural activity, land clearance, neglect, careless treatment or development. The nature of the archaeological evidence cannot always be specified precisely but it may still be possible to document reasons to justify the significance of the feature. This category relates to the probability of monuments producing material of archaeological significance as a result of future investigative work.
Amenity Value	Regard should be taken of the existing and potential amenity value of a monument.

Determining Significance of Architectural Heritage Assets

The significance of perceived impact on structures and sites of architectural merit is determined by a combination of the architectural heritage importance of the structure and the degree of impact. In each case the structure is given a rating as to its importance and, if higher than "Record only", the nature of its special interest is given. The rating definitions are in accordance with those given by the National Inventory of Architectural Heritage (NIAH).

- **International:** Structures or sites of sufficient architectural heritage importance to be considered in an international context. Examples include St Fin Barre's Cathedral, Cork. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries.
- **National:** Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context. Examples include Ardnacrusha Power Station, Co. Clare; the Ford Factory, Cork; Carroll's Factory, Dundalk; Lismore Castle, Co. Waterford; Sligo Courthouse, Sligo; and Emo Court, Co. Laois.

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- **Regional:** Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Examples would include many Georgian terraces; Nenagh Courthouse, Co. Tipperary; or the Bailey Lighthouse, Howth. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shop fronts.
- **Local:** These are structures or sites of some vintage that make a contribution to the architectural heritage but may not merit being placed in the RPS separately. Such structures may have lost much of their original fabric.
- **Record only:** These are structures or sites that are not deemed to have sufficient presence or inherent architectural or other importance at the time of recording to warrant a higher rating. It is acknowledged, however, that they might be considered further at a future time.

Where the rating is deemed to be higher than "Record only" the category of special interest is noted. It should be noted that the term "special architectural interest" applies only in the context of this assessment of architectural heritage and does not imply that those buildings and other structures that are not considered to be of special architectural interest are in any way inferior or are of lower value.

The special interest is based on the categories set down in the Planning and Development Act, 2000. While that Act gives no criteria for assigning a special interest to a structure, the National Inventory of Architectural Heritage (NIAH) offers guidelines to its field-workers. This offers guidance by example rather than by definition, and is the system adopted for the present assessment. There are eight categories set down in the Act, viz. archaeological, architectural, historical, technical, cultural, scientific, social and artistic, and the NIAH guidance for each is as follows:

Archaeological

It is to be noted that the NIAH is biased towards post-1700 structures. Structures that have archaeological features may be recorded, providing the archaeological features are incorporated within post-1700 elements. Industrial fabric is considered to have technical significance, and should only be attributed archaeological significance if the structure has pre-1700 features.

Architectural

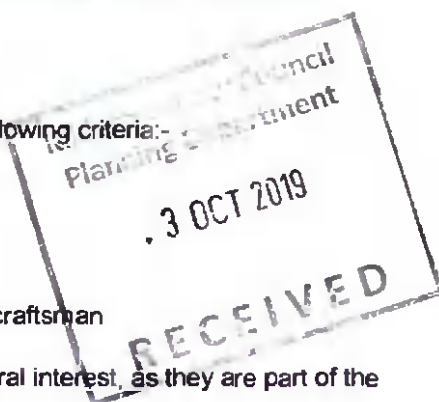
A structure may be considered of special architectural interest under the following criteria:-

- An aspiration of aesthetic appeal to its design.
- Good quality or well executed architectural design
- The work of a known and distinguished architect, engineer, designer, craftsman
- Modest or vernacular structures may be considered to be of architectural interest, as they are part of the history of the built heritage of Ireland
- Well-designed decorative features, externally and/or internally.

Historical

A structure may be considered of special historical interest under the following criteria

- A significant historical event associated with the structure
- An association with a significant historical figure
- Has a known interesting and/or unusual change of use, e.g. a former workhouse now in use as a hotel



REPORT

- A memorial to a historical event.

Technical

A structure may be considered of special technical interest under the following criteria:

- Incorporates building materials of particular interest, i.e. the materials or the technology used for construction
- Incorporates innovative engineering design, e.g. bridges, canals or mill weirs
- A structure which has an architectural interest may also merit a technical interest due to the structural techniques used in its construction, e.g. a curvilinear glasshouse, early use of concrete, cast-iron prefabrication.
- Mechanical fixtures relating to a structure may be considered of technical significance

Cultural

A structure may be considered of special cultural interest where there is an association with a known fictitious character or event, e.g., Sandycove Martello Tower which featured in Ulysses.

Scientific

A structure may be considered of special scientific interest where it is considered to be an extraordinary or pioneering scientific or technical achievement in the Irish context, e.g., Mizen Head Bridge, Birr Telescope.

Social

A structure may be considered of special social interest under the following criteria:

- A focal point of spiritual, political, national or other cultural sentiment to a group of people, e.g. a place of worship, a meeting point, assembly rooms.
- Developed or constructed by a community or organisation, e.g. the construction of the railways or the building of a church through the patronage of the local community
- Illustrates a particular lifestyle, philosophy, or social condition of the past, e.g. the hierarchical accommodation in a country house, philanthropic housing, vernacular structures.

Artistic

A structure may be considered of special artistic interest under the following criteria:

- Work of a skilled craftsman or artist, e.g. plasterwork, wrought-iron work, carved elements or details, stained glass, stations of the cross.
- Well-designed mass produced structures or elements may also be considered of artistic interest
- In the evaluation of the special interest of a structure it is possible for the structure to have a special interest under more than one of the above categories.

Assessment of Material Assets, as Defined by the EPA (2002)

Context Describe the location and extent of the asset. Does it extend beyond the site boundary?

Character Describe the nature and use of the asset. Is it exploited, used or accessible? Is it renewable or non-renewable and if so, over what period?

REPORT

Significance Describe the significance of the asset. Is the material asset unique, scarce or common in the region? Is its use controlled by known plans, priorities or policies? What trends are evident or may reasonably be inferred?

Sensitivity Describe the changes in the existing environment which could limit the access to, or the use of, the material asset.

Glossary of Impacts as defined by the NRA Guidelines 2006, with reference to the EPA (2002 & 2015)

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact. A glossary of impacts as defined by the EPA are as follows: -

- A direct impact occurs when a cultural heritage asset is located within the proposed development area and entails the removal of part, or the entire asset.
- Indirect impacts may be caused due to the close proximity of a development to a cultural heritage asset. Mitigation strategies and knowledge of detail design can often ameliorate any adverse indirect impact. Indirect impacts may include severance of linked features, degradation of setting and amenity or provide a visual intrusion.
- No predicted impact occurs when the proposed development does not adversely or positively affect a cultural heritage asset.

The impacts of the proposed scheme on the cultural heritage environment are first assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect).

Negative Impact A change that will detract from or permanently remove a cultural heritage asset from the landscape.

Neutral Impact A change that does not affect the cultural heritage asset.

Positive Impact A change that improves or enhances the setting of a cultural heritage asset.

Duration of Impacts:

Temporary Impact Impact lasting for one year or less.

Short-term Impacts Impact lasting one to seven years.

Medium-term Impact Impact lasting seven to fifteen years.

Long-term Impact Impact lasting fifteen to sixty years.

Permanent Impact Impact lasting over sixty years.

Types of Impacts:

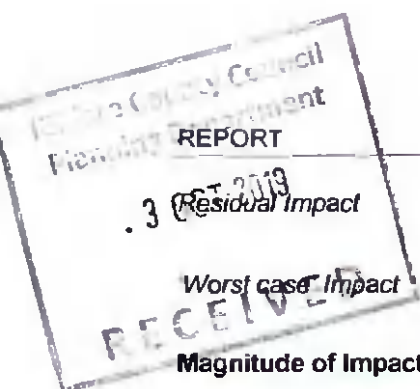
Cumulative Impact The addition of many small impacts to create one larger, more significant, impact.

Do Nothing Impact The environment as it would be in the future should no development of any kind be carried out.

Indeterminable Impact When the full consequences of a change in the environment cannot be described.

Irreversible Impact When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.





The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

The impacts arising from a development in the case where mitigation measures substantially fail.

Magnitude of Impact

Extent – size, scale and spatial distributions of the effect

Duration – period of time over which the effect will occur

Frequency – how often the effect will occur

Context – how will the extent, duration and frequency contrast with the accepted baseline conditions

Table Error! No text of specified style in document .2: Magnitude Criteria

Magnitude of Impact	Criteria
Very High	Applies where mitigation would be unlikely to remove adverse effects. Reserved for adverse, negative effects only. These effects arise where a cultural heritage asset is completely and irreversibly destroyed by a proposed development.
High	An impact which, by its magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where part of a cultural heritage asset would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological / cultural heritage feature/site.
Medium	A moderate direct impact arises where a change to the site is proposed which though noticeable is not such that the archaeological / cultural heritage integrity of the site is compromised and which is reversible. This arises where an archaeological / cultural heritage feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.
Low	An impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological / cultural heritage feature, site or monument.
Negligible	An impact capable of measurement but without noticeable consequences.
No change	No change to the asset or setting

Sensitivity Criteria

An evaluation of the sensitivity / value of sites and features is based on the extent to which assets contribute to the archaeological or built heritage character, through their individual or group qualities, either directly or potentially and guided by legislation, national policies, acknowledged standards, designations and criteria. The table below presents the scale of sensitivity / value together with criteria.

Table Error! No text of specified style in document .3: Sensitivity Criteria

Sensitivity / Value	Criteria
Very High	Sites of international significance. World Heritage Sites National Monuments Protected Structures of international and national importance Designed landscapes and gardens of national importance Assets of acknowledged international importance or that can contribute significantly to international and national research objectives
High	RMP / SMR sites Designated assets that contribute to regional research objectives Protected Structures of regional importance Architectural Conservation Areas

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Sensitivity / Value	Criteria
Medium	Recently / newly identified archaeological sites (not yet included on the SMR / RMP; the importance of the resource has yet to be fully ascertained) Undesignated assets that contribute to regional research objectives NIAH Building Survey and Garden Survey Sites
Low	Undesignated Sites of local importance (e.g. townland / field boundaries) Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value but with the potential to contribute to local research objectives (e.g. potential buried foundations associated with features / structures shown the 1 st edition OS six-inch mapping) Historic townscapes or built up areas of limited historic integrity in their building or their settings
Negligible	Assets with very little or no surviving archaeological interest Buildings of no architectural or historic note
Unknown	The nature of the resource has yet to be fully ascertained, e.g. sites or areas of specific archaeological potential, greenfield areas or riverine / stream / coastal environs with inherent archaeological potential Structures with potential historic significance (possibly hidden or inaccessible)

Criteria for Assessment of Impact Significance

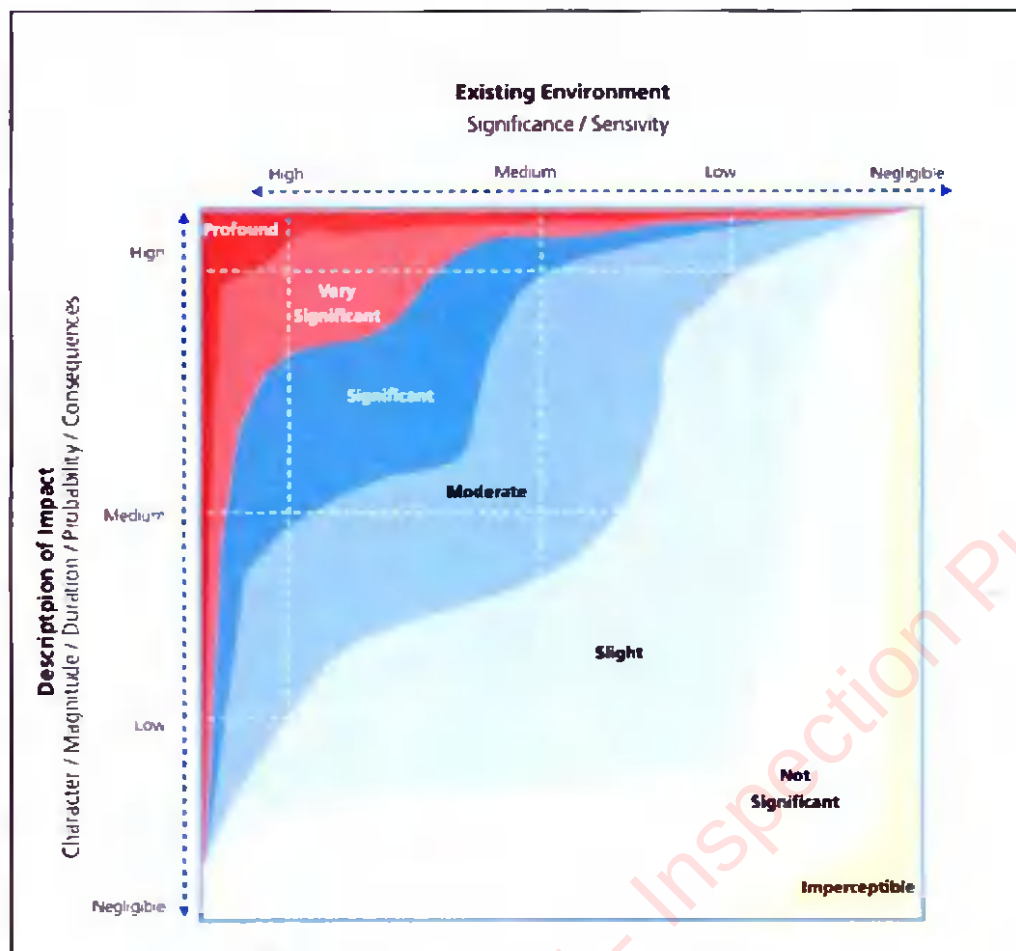
Using both the sensitivity of the heritage asset and the magnitude of impact, the impact significance is established (Table 15.4).

The Draft EPA Revised Guidelines on Information to be contained within an EIS (September 2015) has also added the following levels of significance of effect (as per figure below):

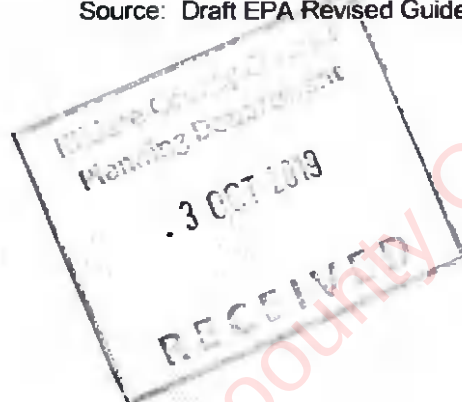
Table Error! No text of specified style in document..4: Significance of Effects (EPA draft 2015)

Significance of Effect	Description
Very Significant	An impact which by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment, for example in this case a monument
Not Significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences





Source: Draft EPA Revised Guidelines on Information to be contained within an EIS (September 2015), p.43



Appendix 12.4 Recorded Archaeological and Architectural sites within 2km of site



REPORT

Table Error! No text of specified style in document. 8. RMP / SMR sites within 2km of site

RMP / SMR no.	Townland	Distance	Description
KD028-044	Marlinstown	1.4km	Ringfort – Rath. In the year 2000 the upstanding monument was described as following, 'Near the top of a long, gentle W-facing pasture slope. A poorly preserved circular area (diam. 46m) defined by a low earthen bank (Wth 3-4.5m; H 0.2-0.4m) SSE-W-NE, with faint traces of an outer fosse, partially recut as a later field drain along the W'. Recent aerial photographs visible on Digital Globe indicate that today there are no surface remains visible of this monument which has been levelled since last site visit in 2000.
KD028-050	Crawnglass	600m	Ringfort – Rath. Described in 1972 as being in low-lying marshy pasture land and comprising a circular area (diam. 26m) enclosed by a low, partially overgrown earthen bank and a shallow, outer fosse (SMR file). Not visible on a 2010 aerial photo (OSi Orthophoto).
KD028-051	Thomastown	1.9km	Moated site. In tillage, at the SE foot of a short, moderately steep slope, with a narrow, dry valley to the SE. Shown on the OS 25-inch map as a rectangular area (c. 60m NW-SE, c. 50m NE-SW) defined by a substantial bank on the SE and SW sides, with a rounded corner at S, and by modern field boundaries along the NW and NE sides. The monument - possibly a moated site - was levelled sometime between 1953 and 1955 (SMR file). No visible surface trace survives.
KD028-052	Moortowncastle	2.2km	Ringfort – Rath. Shown on the 1st ed. (1838) of the OS 6-inch map as a circular area (diam. c. 35m) enclosed by a partially tree-covered bank. Reported as having been destroyed sometime between 1953 and 1955 (SMR file). On a moderately steep SW-facing pasture slope. No visible surface trace survives.
KD028-058001	Ballyshannon Demesne	910m	Castle – motte. At the top of a long gentle, S-facing pasture slope. A possible medieval church site (KD028-058002-) stands in a graveyard (KD028-058004-) c. 50m to the W, and the levelled Ballyshannon Castle (KD032-003002-) stood c. 80m to the SSW. Depicted on an 1853 sketch of an original 'Plan of the Castle of Ballyshannon, with its Outworks, in 1650', as a steep-sided, conical mound, with a possible bank enclosing the summit, on which a large tree is shown, and annotated, 'The high mount fortified which wee stormed' (Fitzgerald 1899-1902, 447). The plan shows an outwork skirting the base of the motte along the N, with a second outwork further N. A low denuded, grass-covered and partially tree-clad, oval, earthen mound (base diams. 30m E-W, 20m N-S; H 2m at S-3.5-4m at E, including natural slope).
KD028-058002	Ballyshannon Demesne	830m	Church. At the centre of a small graveyard (KD028-058004-). Depicted on the 1853 sketch of the 1650 plan, as a roofed rectangular structure, lit by three windows in the N wall and one in the W gable wall, with a doorway near the W end of the N wall, and annotated, 'The Church. On the other side stood our Mortier piece.' The existing church may stand on the site of an earlier, medieval church.
KD028-058004	Ballyshannon Demesne	830m	Graveyard. At the top of a long gentle, S-facing pasture slope. Contains a possible medieval church site (KD028-058002-). The graveyard is not depicted in the 1853 sketch of the 1650 plan. A subrectangular area (c. 50m E-W, c. 30m N-S) is enclosed by a mortared stone wall with an entrance gate on the N side. Legible burial markers date from the 18th to the 20th-century.
KD028-084	Crockaun	800m	Enclosure. In tillage. Visible on Apple Maps as the cropmarks of two fosses forming a bivallate enclosure comprising a large irregular, penannular outer enclosure (estimated maximum diameter

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RMP / SMR no.	Townland	Distance	Description
			c. 130m) with a possible entrance at NW, containing a smaller, more circular enclosure (estimated maximum diameter c. 30m) (pers. comm. C. Chambers, 25-06-2015).
KD031-035	Fearaun	1.9km	Designed landscape feature In a built up farmyard just N of Fearaun House. Shown on the 1st ed. (1839) of the OS 6-inch map as a small circular enclosure (est. dia. c. 18m) encircled by a band of vegetation, but not recorded on subsequent OS mapping. No visible surface trace survives. May have been an ornamental landscape feature associated with Fearaun House.
KD032-001	Borough	970m	Mound In level pasture overlooking a small stream immediately to the N. A low, but steep-sided, circular mound (diam. 8m, H. 1.7m) is heavily poached by livestock.
KD032-002	Tippeenah Lower	1km	Burial ground n a S-facing slope in tillage. An oval area (c. 30m E-W; c. 22m N-S), rising towards the centre (H. c. 1.5m) is enclosed by a modern stone wall. The overgrown interior contains several uninscribed headstones.
KD032-003001	Ballyshannon Demesne	885m	Bastioned fort On a long gentle S-facing, pasture slope. Depicted on an 1853 1650 plan as a bastioned fort - shown under attack during the Confederate War (1641-53) - (Fitzgerald 1899-1902, 447). A rectangular area is shown (est. dims. from OS 25-inch map c. 40m N-S, c. 30m E-W) with triangular bastions on each corner projecting NW, NE, SE and SW. Ballyshannon Castle (KD032-003002-) is shown in the interior. An accompanying, 'A description of the strong fort of Ballisanon, in Leinster (1650)' lists an inner 'moat ... in some places 40 foot [c. 12m] broad ... the graft [ditch] 25 foot [c. 7.6m] in five places and 12 foot [c. 3.6m] deep (with a drawbridge near the NW angle) ... the Rampire and Parapet 30 [c. 9m] foot thick and in some places 25 foot [c. 7.6m] high'. Two outworks are also depicted, and are annotated, 'The workes of the Towne'. The first, L-shaped, encloses all but the E side and portion of the SE angle of the bastioned fort, as well as an earlier motte (KD028-058001-) and a church (KD028-058002-) to the N, and an entrance is shown mid way along its N side. A second outwork, with projecting bastions, runs outside and parallel to the W and N sides of the first. 'The Black Castle' (KD032-003003-) is shown defending a gateway on its W side. No visible surface traces survive.
KD032-003002	Ballyshannon Demesne	885m	Castle - unclassified: Depicted on an 1853 sketch of an original 'Plan of the Castle of Ballyshannon, with its Outworks, in 1650', where it is shown under attack during the Confederate War (1641-53)(Fitzgerald 1899-1902, 447). The plan shows a substantial Fitzgerald castle, consisting of a large double-gabled building, of apparently three stories plus attic, with crenellations on the N facade, and a rectangular tower, also crenellated, projecting from the centre of the N wall, together with a tall circular turret projecting from the SW angle overlooking one of the two entrances. The castle stood in the NE corner of a well-defended square bawn with a crenellated wall and towers at the NW and SE angles. A second entrance, with a drawbridge/causeway, is shown mid-way along the N wall. A bastioned fort (KD032-003001-) encloses the castle and bawn, as well as a motte (KD028-058001-) and church (KD028-058002-) nearby, to the N. No visible surface traces survive.
KD032-004	Carrighill Lower	1.8km	Enclosure At the S end of a pasture ridge which is scarped sharply along the W side to facilitate a modern farm road. A circular area (diam. c. 50m) is defined by an earthen bank (Wth 2m, H 1-1.2m) NE-S-NW. The interior is slightly raised at the W. A low, square platform (L c. 10m; Wth c. 10m) visible inside the bank at W in 1987 (SMR file) is no longer visible. The monument may

REPORT

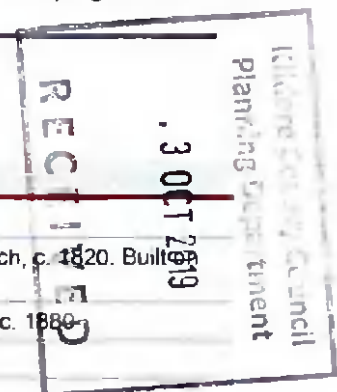
RMP / SMR no.	Townland	Distance	Description
			possibly have been the site of an encampment connected with the siege of Ballyshannon Castle (KD032-003001-) in 1650?
KD032-005	Davidstown	2.8km	Church. In a graveyard (KD032-005001-). In 1837, according to O'Connor (Herity 2002, 96 [30]) who co-compiled the OSL for County Kildare, 'The old walls of a church, which is said to have been never roofed, stand in perfect condition ...'. The grass-covered foundations (int H 0.5m, Wth 3.4m, ext H 0.4m) of the W gable wall (traceable L 7.9m N-S) and the W end of the S wall (traceable L 5.4m) of a medieval church extend W from the W gable wall of a later, 19th-century church (int. 11m E-W, 5.95m N-S). While the later structure may incorporate some earlier fabric, the wall thicknesses (T 0.7m) are less than would be expected of a medieval wall.
KD032-005001	Davidstown	2.8km	Graveyard. At the top of a moderately steep E-facing pasture slope. A large roughly rectangular area (c. 72m NE-SW, c. 50m NW-SE) is enclosed by a stone wall with an entrance gate on the W side. The interior contains the foundations of ruined medieval church (KD032-005---) adjoining a later, 19th-century church. Burials are concentrated to S and W of the church and the earliest legible grave markers date to the 19th-century.
KD032-006	Davidstown	3km	Holy well. In a small clearing in a coniferous plantation on a moderately steep E-facing slope, c. 175m SE of a medieval church (KD032-005---) and graveyard (KD032-005001-). While its existence is mentioned by O'Connor (Herity 2002, 96 [30]) who co-compiled the OSL for County Kildare, nothing else is recorded about the well. A wooden post and plastic trellis fence encloses an oval well (2.4m NW-SE, 2.1m NE-SW, D 0.9m) which is retained by a mortared stone wall (T 0.6m) which doesn't rise above ground level. A circular concrete cistern and feed pipe abuts the well at NE and a modern cross slab (H 0.6m, Wth 0.45m, T 0.05m) is erected on its NE edge. (Jackson 1979-80, 155)
KD032-013001	Castlefarm	2.4km	Graveyard. On a low E-W pasture ridge. A large roughly rectangular area (c. 62m E-W, c. 45m N-S) is enclosed by a mortared stone wall and rises towards the centre where a ruined church (KD032-013---) stands. The site of a castle (KD032-014---) lies just to the E of the graveyard. Legible grave markers date from the 19th-century.
KD032-013002	Castlefarm	2.4km	Font. In a ruined church (KD032-013---). An octagonal granite font (max. L 0.7m; max. Wth 0.7m; H 0.35m) has a straight-sided clay-filled circular basin (diam. 0.5m) and two opposing mortice-holes on its upper edge to accommodate a hinged lid.
KD032-014	Castlefarm	2.4km	Castle – unclassified. A castle in ruins is shown immediately to the E of a church in ruins (KD032-013---) on Taylor's 1783 map of County Kildare, but is not recorded on any OS mapping. The area has been improved and drained in recent times, and no visible surface trace survives.
KD032-015	Bullhill	2.4km	Barrow – Ring barrow. On a hilltop. A circular area (diam. c. 40m) is enclosed by a broad fosse (Wth 4m, D 0.6-0.8m) and an outer earthen bank. No visible entrance.
KD032-047001	Calverstown Demesne	2.9km	Castle – Tower house. Incorporated into the N corner of a later, 17th-century house. A barrel-vaulted rectangular structure (int. 8.7m NNE-SSE, 3.6m ESE-WNW) is built of rubble masonry (wall T. 1.2m) without a base batter. A square-headed doorway at the N end of the ESE sidewall, currently giving access to the later building, may be original, while a wider doorway in the WNW sidewall appears to be a later insertion. There are traces of a blocked loop in the WNW side wall and also in the NNE gable wall.

REPORT

RMP / SMR no.	Townland	Distance	Description
KD032-047002	Calverstown	2.9km	House – 17 th century house. At the SW foot of a low hill upon which the late 18 th -century Calverstown House stands. A poorly preserved roofless, three storied, rectangular structure (c. 21.5m NNE-SSW, c. 14m ESE-WNW) built of rubble masonry (av. wall T 0.9m) has a Jacobean-style chimney projecting from each gable, with a third similar chimney internally, just N of centre. The ESE façade is badly robbed out leaving no trace of the doorway or any windows. An earlier tower house (KD032-047001-) is incorporated in the N corner of the building.
KD032-067	Tippeenán Upper	1.1km	Field system. In tillage. Visible on Bing Maps Aerial view (pers. comm. P. Reid) as the cropmarks of linear and rectilinear back-filled fosses covering a large area (est. L c. 300m, est. Wth c. 300m), possibly the remains of an extensive field system and associated enclosures.
KD032-074	Tippeenán Upper	1.4km	Field system. In tillage. Visible on Google Earth aerial coverage taken 28/06/2018 as the cropmarks of , circular, linear and rectilinear ditches covering a large area (approx. dims. 490m N-S x 230m E-W), possibly the remains of an extensive field system and associated enclosures.
KD032-076	Hillfarm	2.4km	Cropmark of small circular-shaped enclosure or possible ditch-barrow (approx. diam. 15m) bisected by cropmark of a later field boundary visible on Google Earth aerial photograph taken 28/06/2018.
KD032-078	Calverstown	2.6km	Cropmark of three small circular-shaped enclosure or barrows (approx. diam. 16m) aligned E-W visible on Google Earth aerial photograph taken 28/06/2018
KD032-079	Calverstown	2.6km	Cropmark of three small circular-shaped enclosures or barrows (approx. diam. 12m) aligned E-W visible on Google Earth aerial photograph taken 28/08/2018
KD032-080	Calverstown	2.6km	Cropmark of three small circular-shaped enclosures or barrows (approx. diam. 10m) aligned E-W visible on Google Earth aerial photograph taken 28/06/2018

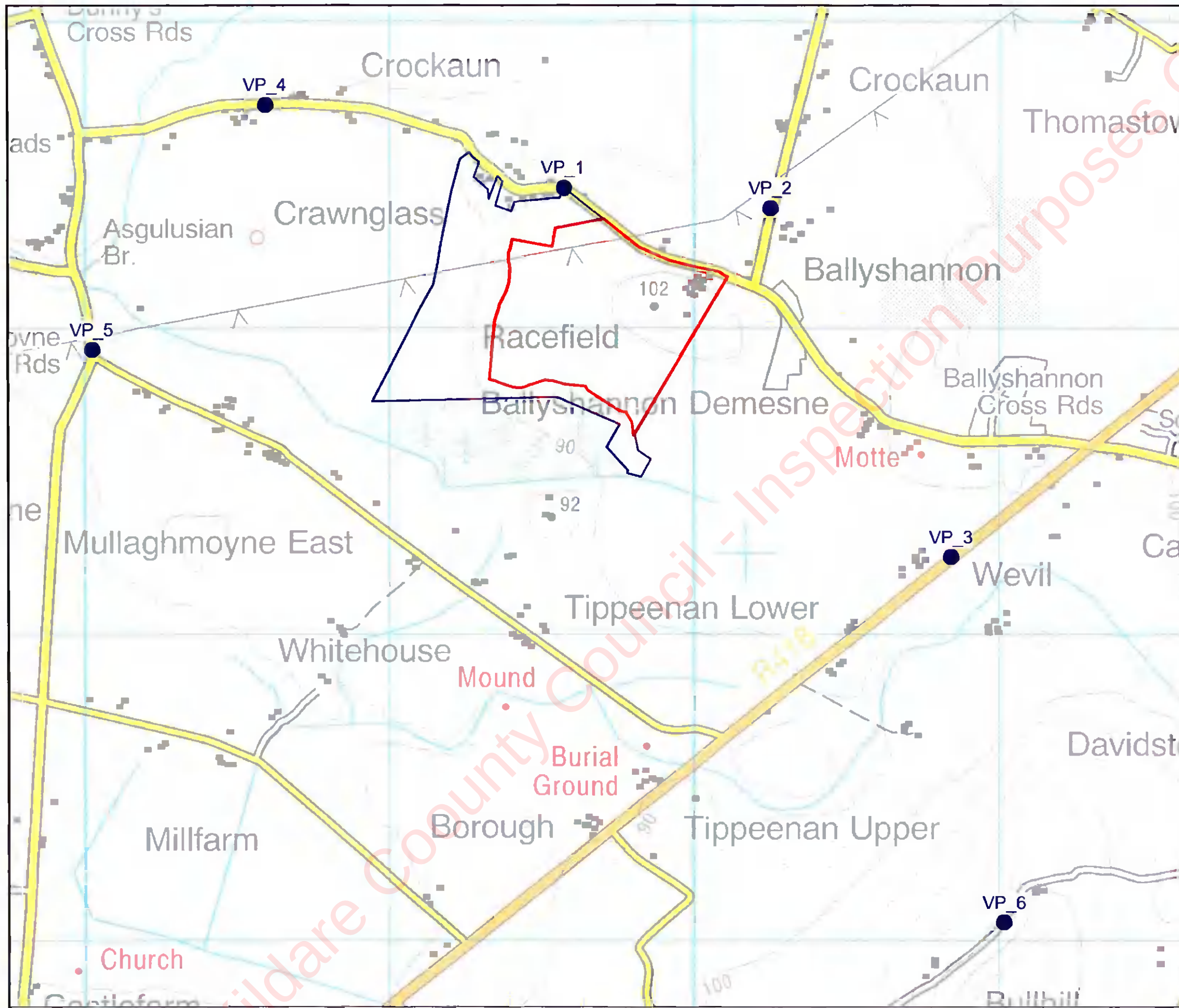
Table Error! No text of specified style in document..6: RPS / NIAH sites within 2km of site

RPS No.	NIAH No.	Townland	Distance	Description
B28-23	11902806	Carr	1.9km	St. Brigid's Catholic Church – Gothic Revival Catholic church, c. 1880.
B28-24	11902811	Ballyshannon Demesne	775m	St. James' Church – Gothic style Board of First Fruits Church of Ireland church, c. 1820. Built on site of earlier medieval church.
-	11902807	Carr	1.9km	Suncroft Parochial House – Presbytery / parochial / curate's house dating to c. 1880.
-	11902809	Martinstown	1.4km	Rectory – Three storey Church of Ireland rectory, extant 1901.
-	11902810	Martinstown	2km	Farm House – Single-storey farmhouse with dormer attic, extant 1837.



Appendix 13.1 Photomontages





10/2019 RPS Group
Note:
1. This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
2. If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing must be read in conjunction with all other relevant drawings and specifications.

Planning Department
OCT 2019

Legend

- Site Boundary
- Land Ownership Boundary
- Viewpoint Locations

VP_1	277571	205456
VP_2	278251	205390
VP_3	278843	204253
VP_4	276594	205726
VP_5	276026	204929
VP_6	279017	203060

Rev	Description	By	On	Rev

Elmwood House, 74 Boucher Road,
BELFAST, BT12 6RZ
T: 028 9066 7914

Client

Project Racefield Sand & Gravel Pit LVIA

Title Viewpoint Location Plan

Figure Number 16.2

Status	Scale @ A3	Date
Planning	NTS	13.08.19

RPS Project Number	Revision
N12132	-

rpsgroup.com



Baseline



Photomontage

Easting 277571 Northing 205456 Direction 165° Field of View 90°	VPT 01 - Crockaun Road Baseline + Photomontage	Insh Grid 1965 Revision: 01 Data Source RPS 2019 Status: Planning	Drawn by PM Checked SA Job Ref NI 2132 Date Sept 2019	Project Racefield Sand & Gravel Pit Title: Photomontages	Client   Elmwood House, 74 Boucher Road BELFAST, BT12 6RZ 028 9066 7914
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Baseline



Red Line

Easting	278251
Northing	205390
Direction	245°
Field of View	90°

VPT 02 - Ballyshannon Road

Baseline + Red Line

Irish Grid 1965	Drawn by:	PM
Revision: 01	Checked:	S A
Data Source: RPS 2019	Job Ref:	NI 2132
Status: Planning	Date:	Sept 2019

Project:	Racefield Sand & Gravel Pit
Title:	Photomontages

Client:	Kilsaran build
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RPS
Elmwood House, 74 Boucher Road BELFAST, BT12 6RZ 028 9066 7914



Baseline



Red Line

Kildare County Council
Planning Department
3 OCT 2019
RECEIVED

Easting	276594
Northing	205726
Direction	165°
Field of View	90 °

VPT 04 - Crawnglass Road

Baseline + Red Line

Irish Grid 1965	Drawn by:	PM	Project
Revision	01	Checked:	SA
Data Source:	RPS 2019	Job Ref:	NI 2132
Status:	Planning	Date:	Sept 2019

Racefield Sand & Gravel Pit

Client:

Kilsaran
build

rps
ELMWOOD HOUSE, 74 BOUCHER ROAD
BELFAST, BT12 6RZ
028 9065 7914

Photomontages



Baseline



Red Line

Kildare County Council
Planning Department
3 OCT 2019
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rpsgroup.com	Easting	276026	VPT 05 - Mollaghmoyn Road	Irish Grid 1965	Drawn by	PM	Project	Racefield Sand & Gravel Pit	Client					
	Northing	204929		Revision	01	S A								
	Direction	83°		Data Source	RPS 2019	NI 2132						Title	Photomontages	
	Field of View	90°		Status	Planning	Date								Sept 2019
			Baseline + Red Line											



Baseline



Red Line

Kildare County Council
Planning Department
3 OCT 2019
RECEIVED

	Easting	279017	VPT 06 - Bull Lane	Irish Grid 1965	Drawn by	PM	Project	Racefield Sand & Gravel Pit	Client	 Elmwood House, 74 Boucher Road BELFAST BT12 6RZ 028 9066 7914	
	Northing	203060		Revision	01	Checked	S A				
	Direction	330°		Data Source:	RPS 2019	Job Ref	NI 2132				Title
	Field of View	90°		Status	Planning	Date	Sept 2019				Photomontages