ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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CHAPTER 1 - INTRODUCTION

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1 INTRODUCTION

Knockharley Landfill Limited (KLL) wishes to propose further development at its existing landfill facility at Knockharley, Kentstown, Navan, Co Meath.

Fehily Timoney & Company (FT) has prepared this environmental impact assessment report (EIAR) on behalf of Knockharley Landfill Ltd. to accompany an application for permission made directly to An Bord Pleanála for the proposed development.

This chapter of the EIAR introduces the proposed development in the context of the application for permission and documents the procedure that was followed in preparing this EIAR.

1.1 The Applicant – Knockharley Landfill Ltd.

The applicant for the proposed development is Knockharley Landfill Ltd., which is the owner and operator of the Knockharley Landfill facility located in Co. Meath. The facility was developed and previously owned and operated by Greenstar Holdings Ltd. (previously known as Celtic Waste Ltd.). The site was acquired by Knockharley Landfill Ltd. in March 2014.

1.2 Proposed Development

Introduction

Knockharley Landfill is located approximately 1.5 km north of Kentstown village, Co. Meath in the functional area of Meath County Council. The existing landfill operates under an Industrial Emission (IE) licence (Licence No: W0146-02) from the Environmental Protection Agency (EPA) which permits the disposal of up to 200,000 tonnes per annum of waste i.e. 175,000 tonnes of municipal solid waste (MSW) for disposal and 25,000 tonnes of construction and demolition (C&D) waste for recovery. Figure 1.1 presents the site location while Figure 1.2 presents an aerial view of the site. The current facility licence W1046-02 is included in Appendix 1 of Volume 3 of this EIAR.

Condition 3 of the permission granted by An Bord Pleanála in March 2007 (Ref: PL17.220331) restricted disposal at the facility to 132,000 tonnes per annum until December 2010, thereafter reducing to 88,000 tonnes per annum for disposal.

The proposed development comprises:

- The acceptance of up to 435,000 tonnes per annum of non-hazardous wastes, which will comprise up to 150,000 tonnes of incinerator bottom ash (IBA), as well as household, commercial and industrial wastes including residual fines, non-hazardous contaminated soils, construction and demolition (C&D) wastes and baled recyclables. In addition, the acceptance of up to 5,000 tonnes per annum of stable non-reactive hazardous waste is proposed.
- The acceptance and placement within the existing permitted landfill footprint of incoming wastes for recovery or disposal as appropriate; the increase in height of the landfill body from the current permitted post settlement final contour height of 74 mOD to a post settlement contour height of 85 mOD – the proposed height increase will apply from the active landfill phase at the time of permission grant. Permission is sought for the acceptance of waste until the cells are full.
- The construction and operation of a dedicated IBA facility. Permission is sought to store IBA until recovery outlets are identified. Permission is sought for trials to prepare IBA for recovery and removal off site. The IBA facility will consist of 5 no. cells which will be constructed in accordance with the requirements of the Landfill Directive 99/31/EC for non-hazardous wastes. A final post settlement contour height of 85 mOD is proposed. Permission is sought for operation of the IBA facility until the cells are full and subsequent aftercare activities as may be required are complete. The development includes additional perimeter (haul) roads and screening berms.

The IBA facility will comprise 1 no. portal frame building 76 m x76 m x 15.5 m to facilitate:

- o weathering
- o metals recovery trials
- o crushing and washing to facilitate recovery trials and processing

The construction and operation of a building for:

- The extraction and biological treatment of the organic fraction of MSW (otherwise known as MSW 'fines' material) and;
- contingency storage of baled recyclables
- contingency storage of baled MSW

This facility shall comprise:

- o a processing building of 108 m in length, 50 m in width and up to 17 m in height, of portal frame construction with 13 no. vehicle roller shutter doors and 7 or more pedestrian access doors (subject to fire certification requirements)
- o internal storage bays as required
- o 12 no. concrete composting tunnels located within the processing building of c. 6 m in width, 25m in length and 5 m in height
- o a covered bio-filtration unit within the overall processing building footprint, with a stack of height of 20 m
- o access from the internal site road with a marshalling yard area with egress from the existing site road to the landfill gas compound

- o all other ancillary and associated works, including leachate storage in a below ground tank, bio-treatment system for sanitary wastewater drainage and fencing.

Permission is sought for the continued use of this building post filling of the landfill cells onsite.

- The construction and operation of a leachate management facility comprising:
  - o 3 no. additional floating cover leachate storage lagoons (L2, L3 and L4) of c. 5,000 m^2 each
  - o 2 no. bunded above ground tanks for raw leachate from IBA cells (S1 and S2) approximately 25 m diameter 6.0 m high.
  - o 3 no. bunded above ground tanks:
    - 1 no. tank (S3) for treated leachate from landfill leachate approximately 22m diameter 6.0m high.
    - 1 no, tank for treated leachate from IBA approximately 25 m diameter 6.0 m high (S4).
    - 1 no. tank for leachate concentrate 16 m diameter by 6.0 m high (S5).
  - o Modular - typically containerised plant units (C1 through C6), on concrete slab of c. 1,000 m^2 and 1 no. elevated tank 5 m diameter 10 m high (T1) with provision for 2 no. additional low level (<5.0 m high) bunded storage tanks for dosing and other compounds (T2 and T3).
  - o Loading area for 2 no. 25 tonne articulated tankers.

  Permission is sought for the continued operation of this plant post filling of the landfill cells to facilitate continued leachate management.

- Construction of screening berms along the western planning boundary to a maximum of 10 m in height, on the eastern boundary to a maximum height of 10 m and on the northern boundary, to a maximum height of 6 m, with a total berm footprint of c. 11.3 ha. Haul roads for construction will be in or immediately adjacent to berm footprint.

- Construction of surface management infrastructure, with discharge to the adjacent Knockharley Stream to the northern end of the landfilling footprint and the proposed IBA cell development.

- Key elements will comprise:
    - holding pond for surface water runoff
    - storm water attenuation lagoon to maintain green field surface water discharges to Knockharley stream and to facilitate suspended solids management
    - wetland
    - flood compensation culvert to provide equivalent 1:1000-year flood plain storage
    - permitted stream diversion around permitted development

- Felling of c. 12.5 ha of the existing commercial broadleaf/conifer mix plantations to facilitate:
    - construction of the screening berms along the western boundary and to the north of the proposed IBA area, and
    - development of Phase 7 Cells 27 and 26 and the new northern surface water attenuation pond.

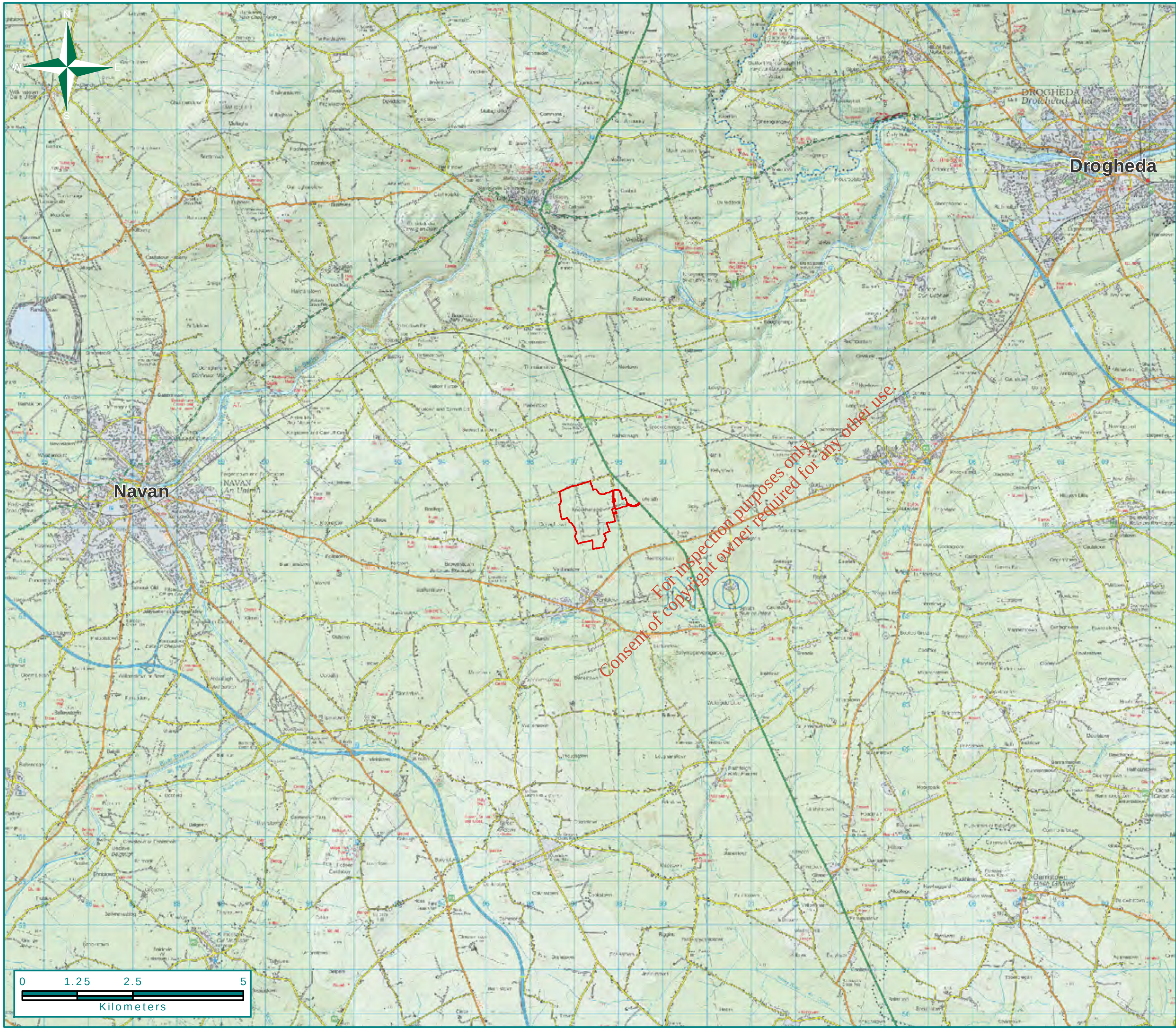
  Replanting and new planting totalling (c.16.8 ha) will off-set loss of commercial forestry in the proposed development footprint at the following locations:

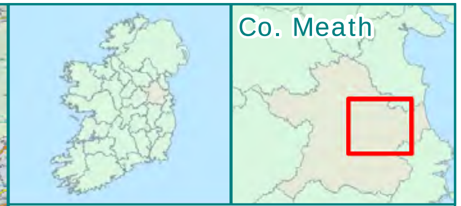
    - replanting over screening berms
    - new planting on the cap over cells 25, 26, 27 and 28 in what is currently the permitted development

- Relocation of an existing 20 kVa overhead ESB powerline that provides power to the existing landfill facility administration buildings, that will be impacted by the development of the screening berm to the east of the proposed IBA cell area.
- Construction of an additional ESB sub-station and new overhead ESB supply to the north-western corner of the currently permitted landfill footprint to facilitate power provision for pumps and other infrastructure.
- Construction of a new ESB sub-station adjacent to the proposed building for biological waste treatment and storage with ESB connection to adjacent 20 kVA power lines.
- Extension of existing below ground infrastructure (permitted development) and provision of additional below ground infrastructure. (Power, water, telemetry, leachate rising mains, drainage). Extension of the existing car park for the administration area.

More detailed descriptions of the elements of the proposed development are provided in Chapter 2 of this Volume 2 of the EIAR ‘Description of the Development’.

An application will also be made to the EPA to facilitate the licensing of the proposed development as outlined herein. The existing facility is licensed to operate by the EPA by IE W0146-02. Consultation with the EPA has commenced in relation to this review with further detail provided in Chapter 5 – EIAR, Consultation & Key Issues.





Legend

Site Boundary

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Site Location
Figure No.	1.1
Rev.	A
Scale	1:120,000 @ A4

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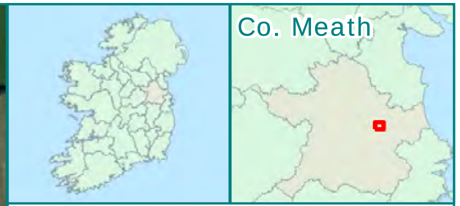

Legend

Site Boundary

Date	18/05/2018	
Client Name	Knockharley Landfill Ltd.	
Project Title	Proposed Development at Knockharley Landfill	
Figure Title	Aerial View of Site	
Figure No.	1.2	Rev. A
Scale	1:15,000	@ A4

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1.3 Planning History

The following outlines the planning history relevant to the Knockharley Landfill site to date.

1.3.1 Meath County Council Planning Reference: 01/5006

Permission was granted to Celtic Waste Ltd. for the development and operation of an engineered landfill and ancillary facilities at the Knockharley site on August 26th, 2002. The permission was subject to a condition that restricted the acceptance of waste for disposal at the facility to waste arising from the North-East waste management region as defined by counties Meath, Louth, Cavan and Monaghan (Condition 2 (a)).

The quantities of waste accepted at the facility were restricted to 132,000 tonnes per annum until December 2007 and thereafter to a maximum of 88,000 tonnes per annum (Condition 2 (b)).

1.3.2 An Bord Pleanála Reference: PL17.125891

Upon appeal of 01/5006, An Bord Pleanála granted permission on appeal for a landfill with conditions specifying that only waste arising in the North East waste management region would be accepted and that the maximum rate of waste acceptance would be 132,000 tonnes per annum until December 2007 and 88,000 tpa thereafter.

1.3.3 Meath County Council Planning Reference: NA50453

In April 2006, Meath County Council refused permission to Greenstar Holdings Ltd. for a material change of use of maintenance building to offices, including a proposed new first floor within the existing building and for permission to omit condition no. 2(a) of 01/5006 which limits the waste to be accepted for disposal at the residual landfill facility to waste arising from the North East Region as defined by the counties Meath, Louth, Cavan & Monaghan.

1.3.4 Meath County Council Planning Reference: NA60336

Meath County Council, in November 2006, granted permission to Greenstar Ltd. for the removal of the regional restriction on the origin of the waste accepted at the Knockharley Landfill facility by modifying condition no. 2(a) of permission ref. no: 01/5006 and An Bord Pleanála decision PL17.125891 so the facility can accept waste from adjoining waste regions.

1.3.5 An Bord Pleanála Reference: PL17.220331

Upon appeal by the applicant Greenstar, the Board granted permission on 21st March 2007 for an extension of the landfill footprint (c. 2 ha), for the removal of the regional restriction on the origin of the waste accepted at the facility and for the continuation of the annual intake volume of 132,000 tonnes per annum until the end of 2010, reverting to 88,000 tonnes per annum thereafter. Permission was refused for an increase in the waste intake to 200,000 tonnes per annum.

1.3.6 Meath County Council Planning Reference: NA70015

Permission was granted to Greenstar Ltd. in April 2007 for the installation and operation of a gas utilisation plant on a 0.3 hectare site which will be phased and generate up to 4.2 MW of electricity for export to the national grid.

1.3.7 An Bord Pleanála Reference: PL17.PA0009

The Board refused permission to Greenstar Holdings Ltd. on the 14th May 2009 to increase the rate of waste acceptance at the permitted facility to 400,000 tonnes per annum for disposal, to alter the landfill phasing sequence, with no extension to the permitted landfill void, and all ancillary works including the installation of a second wheelwash.

The reason for refusal stated that the increase would compromise the viability of more sustainable waste infrastructure and the designation of Knockharley as the long-term residual landfill for the North East region and so would conflict with the waste management plan for that region.

1.3.8 An Bord Pleanála Reference: PL17.PA0019

In September 2011, Greenstar North East Ltd. withdrew an application to the Board for an increase in the rate of waste acceptance, an extension of the operational footprint and new waste treatment infrastructure i.e. an anaerobic digestion facility at Knockharley Landfill.

1.3.9 Meath County Council Planning Reference: AA161431

In December 2016, Knockharley Landfill Ltd. applied for an extension of the duration of planning permission 01/5006. Permission was granted by Meath County Council in January 2017.

1.3.10 Meath County Council Planning Reference: AA180145

In February 2018, Starrus LFG Ltd. applied for permission for the development of a solar farm over reclaimed landfill with an export capacity of approximately 3MW comprising photovoltaic panels on ground mounted frames, connection to existing single-storey ESB sub-station, installation of three no. transformers, ducting and underground electrical cabling and all associated ancillary works and services. Permission was granted by Meath County Council in June 2018.

1.4 EPA Licensing History

Under Waste Licence Ref. No. 103-1 (now W0103-01), Meath County Council applied to the Environmental Protection Agency [EPA] and was granted a licence authorising the acceptance of a total of 76,000 tonnes per annum [62,500 tonnes for disposal and 13,500 tonnes for recovery]. It is understood that waste licence W0103-01 was never commenced and has now ceased.

Waste licence W0146-01 was granted to Celtic Waste Limited in March 2003, and was amended in October 2005, to include conditions relating to resource use and energy efficiency, accident prevention and emergency response and restoration and aftercare.

W0146-01 was also reviewed by the EPA as part of a national review of landfill licences to ensure that the landfills were operating in compliance with all relevant requirements of the Landfill Directive, with the result that W0146-02 was granted to Greenstar Holdings Ltd. in March 2010.

W0146-02 was amended by Technical Amendment A in January 2013 for a conditional amendment relating to groundwater risk screening. The licence was subsequently amended by Technical Amendment B, regarding a trial for incinerator bottom ash metals recovery. A third amendment was effected by Technical Amendment C, in November 2016, in relation to the acceptance of further quantities of waste material for a limited period of time i.e. to 31 December 2016. Finally, in this content, Technical Amendment D was issued in March 2018 authorising the acceptance of waste from an unauthorised landfill remediation.

Furthermore, W0146-02 was changed in classification from a waste licence to an industrial emission (IE) licence in December 2013 by the EPA, while the licence was also transferred from Greenstar Holdings Ltd. to Knockharley Landfill Ltd. in March 2014.

A copy of W0146-02 (including technical amendments A, B, C and D) is provided in Appendix 1.1 to 1.5 of Volume 3 of this EIAR.

1.5 Application and EIA Process

1.5.1 Strategic Infrastructure Development Planning Process

The Planning and Development Act 2000 was amended in 2006 to require certain applications for permission for major infrastructure projects to be made directly to An Bord Pleanála, rather than to the local planning authority, as would have previously been the case.

In July 2016, Knockharley Landfill Ltd. wrote to An Bord Pleanála to formally request a pre-application consultation meeting under Section 37B of the Planning and Development Act 2000, as amended ("the 2000 Act"), in respect of their existing development at Knockharley Landfill.

In order to commence the pre-application consultation required under section 37B, a proposed development must fall within of a class specified in the Seventh Schedule to the 2000 Act.

Part 3 of the Seventh Schedule, as amended, specifies, *inter alia*, the following classes of development:

- *"An installation for the disposal, treatment or recovery of waste with a capacity for an annual intake greater than 100,000 tonnes."*

Thereafter, the Board must satisfy itself that the proposed development meets one or more of the conditions set out in subsection 37A(2) of the 2000 Act, *namely*—

(a) the development would be of strategic economic or social importance to the State or the region in which it would be situate,

(b) the development would contribute substantially to the fulfilment of any of the objectives in the National Spatial Strategy or in any regional spatial and economic strategy in force in respect of the area or areas in which it would be situate,

(c) the development would have a significant effect on the area of more than one planning authority."

Following pre-application consultations held on 4th August 2016, 25th October 2016 and the 14th September 2017. An Bord Pleanála issued a notice to Knockharley Landfill Ltd. on 14th November 2017 (under Ref. No. 17.PC0223) indicating its determination that the proposed development is SID in accordance with the provisions of section 37A of the 2000 Act and, accordingly, an application for permission should be made directly to An Bord Pleanála. Consequently, this EIAR is submitted with an application for permission made directly to An Bord Pleanála, in accordance with the requirements of Section 37E of the Planning and Development Act 2000, as amended.

Correspondence and detail relating to the pre-application consultation process undertaken are included in Appendix 1.6 of Volume 3 of this EIAR.

1.5.2 Requirement for Competent Authority to Conduct an EIA

The European Union Directive 2014/52/EU (amending Directive 2011/92/EU) on the assessment of the effects of certain public and private projects on the environment, requires Member States to ensure that a competent authority carries out an appraisal of the environmental impacts of certain types of project, as listed in the Directive, prior to development consent being given for the project. Throughout this EIAR, Directive 2014/52/EU (amending Directive 2011/92/EU) on the assessment of the effects of certain public and private projects on the environment, shall be referred to collectively as "the 2014 EIA Directive".

With respect to waste-related projects, the 2014 EIA Directive requires that an EIA is required in relation to applications for development consent in relation to:

- "*Installations for the disposal of waste (not included in Annex I)"*

Article 4(2) of the 2014 EIA Directive stipulates that Member States are responsible for setting applicable thresholds in respect of EIA.

The requirement for EIA of certain types of proposed development is transposed into Irish legislation under the Planning and Development Acts, 2000 to 2018 and the Planning and Development Regulations 2001 to 2018, as amended (the "2001 Regulations"). Part 1 of Schedule 5 to the 2001 Regulations includes a list of projects which are subject to mandatory EIA based on, inter alia, their scale, nature, location and context. Part 2 of the same Schedule 5 includes a list of projects where, if specified thresholds are exceeded, or where it is determined that there is potential for significant environmental impact, an EIA is also required. Waste handling facilities that handle in excess of 25,000 tonne of waste per annum fall into Part 2 of Schedule 5 and therefore, pursuant to section 176 of the 2000 Act and article 94 of the 2001 Regulations, an EIA of the proposed development at Knockharley Landfill is required to be carried out by the competent authority prior to the decision to grant development consent.

In any event, separately, under section 37E of the 2000 Act all applications for permission made directly to the Board under that provision must be accompanied by an EIAR (formerly termed an environmental impact statement (EIS).

Accordingly, the environmental impact assessment of the proposed development at Knockharley Landfill will be undertaken by An Bord Pleanála, in accordance with the requirements of the 2014 EIA Directive, Part X of the 2000 Act and the relevant provisions of the 2001 Regulations.

1.5.3 Appropriate Assessment

In compliance with the provisions of Article 6 of the Habitats Directive, as implemented by Part XAB of the 2000 Act, in circumstances where a proposed plan or project is likely to have a significant effect on a European (or Natura 2000) site, either individually or in combination with other plans or projects, an Appropriate Assessment (AA) must be undertaken by the competent authority of the implications for the site in view of the site's conservation objectives.

European sites comprise both Special Protection Areas (SPAs) for birds and candidate Special Areas of Conservation (cSACs) for habitats and species. The Habitats Directive (Council Directive 92/43/EEC) formed a basis for the designation of SACs while SPAs are designated for under the Birds Directive (Council Directive 79/409/EEC on the Conservation of Wild Birds, now Directive 2009/147/EC).

Article 6 of the Habitats Directive envisages a two-stage process, which is implemented in some detail by the provisions of sections 177U and 177V of the Planning and Development Acts. Screening for appropriate assessment in accordance with section 177U is the first stage of the AA process (Stage One), in which the possibility of there being a significant effect on a European site is considered. Plans or projects that can have no appreciable effect on a European site are excluded, or screened out, at this stage of the process. Where screening concludes that the possibility of significant effects on a European site cannot be excluded, then it is necessary for the competent authority to carry out an AA (Stage Two) for the purposes of Article 6(3) and a Natura Impact Statement (NIS) is produced for the purposes of the Stage Two AA. The NIS considers the potential impact of a project or plan on the integrity of a European site and on its conservation objectives, and where necessary, draws up mitigation measures to avoid/minimise negative impacts.

In carrying out an Appropriate Assessment, the competent authority (in this case An Bord Pleanála) is required to make an examination, analysis, evaluation, findings, conclusions and a final determination as to whether or not the proposed development would adversely affect the integrity of the relevant European site in view of its conservation objectives.

In the context of the proposed development at Knockharley Landfill, an Appropriate Assessment Screening Report and Natura Impact Statement has been prepared, as required by Article 6 of the Habitats Directive. The Appropriate Assessment Screening Report and Natura Impact Statement are separate documents appended to Chapter 10 – Biodiversity and have been submitted to An Bord Pleanála with the application for permission. Both these will document will also be submitted to the EPA for the Industrial Emissions Licence

1.6 EIAR Methodology and Structure

An EIAR presents relevant information such that an environmental impact assessment (EIA) can be undertaken to assess the potential effects of certain development projects on the environment. The EIA process is undertaken by the relevant regulatory authorities.

The primary objective of an EIA is to ensure that projects which are likely to have significant effects on the environment are assessed and impacts avoided, where possible. This assessment process aims to achieve the most sustainable and environmentally friendly integration of a development with the local environment.

Firstly, the planning context, the background to the project including the need for the development, the alternatives assessed, and the existing and proposed development is described. This sets the reader in context as to the practical and dynamic process undertaken, to arrive at the layout and design of the proposed development that will cause least impact on the environment.

Subsequent sections deal with specific environmental topics, for example, population, human health, air, water, noise, etc. These sections may involve specialist studies and evaluations. The methodology applied during these specific environmental assessments is a systematic analysis of the proposed development in relation to the existing environment. The broad methodology framework for these assessments is outlined below and is designed to be clear and concise and allow the reader to logically follow the assessment process through each environmental topic. In some instances, more specific topic related methodologies are outlined in the relevant sections of the EIAR.

The broad methodology framework used in all sections includes:

- Introduction
- Assessment Methodology
- Receiving Environment
- Potential Effects
- Mitigation Measures
- Residual Effects
- References

The advantage of using this framework is that it is easy to investigate each environmental topic and it facilitates easy cross-reference to specialist studies undertaken in the preparation of the EIAR.

The EIAR has been prepared in accordance with guidelines listed hereunder expect where specific sectoral guidance was used e.g. traffic.

- European Commission "Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)" (2017)
- Environmental Protection Agency (Draft - August 2017) "Revised Guidelines on the Information to be contained in Environmental Impact Assessment Reports";
- *Guidelines on the Information to be contained in Environmental Impact Statements*, (EPA, 2002)
- *Advice notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA, 2003)

Where specific sectoral guidance was used e.g. traffic, this guidance will be listed in the relevant sections of the EIAR.:

The EPA's guidance published in 2002 and 2003 as outlined above was used only in so far as they comply with the requirements of the 2014 EIA Directive.

1.6.1 EIAR Methodology

Introduction

The main aim of this EIAR is to provide information on the project to the public, public concerned, prescribed bodies and the competent authority. To this end, Article 3(1) of the EIA Directive requires that significant effects are identified, assessed and described in an 'appropriate manner'. Article 5(1) sets the form – the information should be presented in an EIA Report that enables stakeholders and authorities to form opinions and to take decisions regarding the project. While there are no formal requirements concerning the format and the presentation of the report, this EIAR clearly sets out the methodological considerations and the reasoning behind the identification and assessment of significant effects.

Article 5(1) sets out what must be includes as a minimum in the EIA Report. Annex IV to the Directive, expands on these requirements. In short, this includes the following:

- a description of the project: this is an introduction to the project, and includes a description of the location of the project, the characteristics of the construction, and the operational phases of the project, as well as estimates of the expected residues, emissions, and waste produced during the construction and operation phases;
- baseline scenario: a description of the current state of the environment, and the likely evolution thereof without the implementation of the project;
- environmental factors affected: a description of the environmental factors impacted by the project, with specific emphasis being placed on climate change, biodiversity, natural resources, and accidents and disasters;
- effects on the environment: this section addresses the concept of 'significant effects' and the importance of cumulative effects;
- assessment of alternatives: alternatives to the proposed development are described and compared, with an indication of the main reasons for the selection of the option chosen provided;
- mitigation measures, i.e. features or measures to avoid, prevent or reduce, and offset adverse effects should also be considered;
- monitoring: monitoring measures proposed are included in the EIAR, where potentially significant adverse effects have been identified. This monitoring will be carried out during the construction and operation of a project;
- Non-Technical Summary, i.e. an easily accessible summary of the content of the EIA Report presented without technical jargon, hence understandable to anybody without a background in the environment or the project;
- quality of the EIAR: the experts responsible for preparing the EIA Report are competent.

The EIAR has been prepared in accordance with the contents of Directive 2014/52/EU of the European Parliament which has amended Directive 2011/92/EU. Schedule 6 of the Planning and Development Regulations 2001, as amended, and Annex IV of the 2014 Directive sets out the contents of an EIAR. In addition, in the preparation of this EIAR a scoping of possible impacts of the proposed development was carried out to identify impacts thought to be potentially significant, not significant or uncertain. Consultation with the relevant private and public agencies ensured that the most significant impacts and the areas of greatest concern were addressed during the EIA process. Details of the consultation carried out for the proposed development are outlined in Chapter 5 EIA Scoping, Consultation and Key Issues of this EIAR.

As set out in Schedule 6 of S.I. No. 296 of 2018 "European Union (Environmental Impact Assessment) Regulations 2018"., the purpose of this EIAR is to contain:

1.

a) A description of the proposed development comprising information on the site, design, size and other relevant features of the proposed development;

b) A description of the likely significant effects on the environment of the proposed development;

c) A description of the features, if any, of the proposed development and the measures, if any, envisaged to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment of the development;

d) A description of the reasonable alternatives studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed development on the environment.

2. Additional information, relevant to the specific characteristics of the development or type of development concerned and to the environmental features likely to be affected, on the following matters, by way of explanation or amplification of the information referred to in paragraph 1:

a) A description of the proposed development, including in particular –

i. A description of the location of the proposed development;

ii. A description of the physical characteristics of the whole proposed development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases;

iii. A description of the main characteristics of the operational phase of the proposed development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; and;

iv. An estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during construction and operation phases.

b) A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;

c) A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge;

d) A description of the factors specified in paragraph (b)(i) (I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act likely to be significantly affected by the proposed development: population, human health, biodiversity (for example flora and fauna), land (for example land-take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape;

e) (i) a description of the likely significant effects on the environment of the proposed development resulting from, among other things:

(I) the construction and existence of the proposed development, including, where relevant, demolition works,

(II) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources,

(III) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste,

(IV) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters),

(V) the cumulation of effects with other existing or approved developments, or both, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources,

(VI) the impact of the proposed development on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the proposed development to climate change, and

(VII) the technologies and the substances used, and;

(VIII) the description of the likely significant effects of the factors specified in paragraph (b)(i) (I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the proposed development, taking into account the environmental protection objectives established at European Union level or by a Member State of the European Union which are relevant to the proposed development;

f) A description of the forecasting methods or evidence used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information, and the main uncertainties involved;

g) A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of an analysis after completion of the development), explaining the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset during both the construction and operational phases of the development;

h) A description of the expected significant adverse effects on the environment of the proposed development deriving from its vulnerability to risks of major accidents and/or disasters which are relevant to it. Relevant information available and obtained through risk assessments pursuant to European Union legislation such as the Seveso III Directive or the Nuclear Safety Directive or relevant assessments carried out pursuant to national legislation may be used for this purpose, provided that the requirements of the Environmental Impact Assessment Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for, and proposed response to, emergencies arising from such events.

Assessment Methodology

Specific topic related methodologies are outlined in each Chapter. This includes the methodology used in describing the existing environment and assessing effects.

Mitigation Measures

An Index of Mitigation Measures is included as Chapter 16 in Volume 2 of this EIAR. It includes all the mitigation measures in this EIAR.

References

Reports and data sources referred in the preparation of this EIAR are listed in each chapter.

1.6.2 EIAR Structure

The EIAR has been structured in accordance with the European Commission's Guidance "Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)" (2017). Accordingly, the EIAR comprises:

- is presented with a clear structure with a logical sequence that describes, inter alia, existing Baseline conditions, predicted impacts (nature, extent and magnitude), scope for mitigation, proposed mitigation measures, significance of unavoidable/residual impacts for each environmental factor;
- contains a table of contents at the beginning of the document;
- comprises a description of the development consent procedure and how EIA fits within it;

- reads as a single document with appropriate cross-referencing and is concise, comprehensive and objective;
- is written in an impartial manner without bias;
- includes a full description and comparison of the alternatives studied;
- makes effective use of diagrams, illustrations, photographs and other graphics to support the text;
- uses consistent terminology with a glossary;
- references all information sources used
- has a clear explanation of complex issues;
- contains a good description of the methods used for the studies of each environmental factor;
- covers each environmental factor in a way which is proportionate to its importance;
- provides evidence of effective consultations;
- provides a basis for effective consultations to come;
- makes a commitment to mitigation (with a programme) and to monitoring;
- contains a Non-Technical Summary which does not contain technical jargon;
- contains, where relevant, a reference list detailing the sources used for the description and assessments included in the EIAR.

Each section of the EIAR is generally be presented under the following headings:

- Introduction
- Assessment Methodology
- Receiving Environment
- Potential Effects
  - Do nothing Effect
  - Construction Phase
  - Operational Phase
  - Decommissioning Phase
  - Cumulative Effects
- Mitigation Measures
  - Construction Phase
  - Operational Phase
  - Decommissioning Phase
  - Cumulative
  - Monitoring
- Residual Effects
- References

The advantages of using this type of format are that it is easy to examine each environmental topic and it facilitates easy cross-reference to specialist studies undertaken as part of the assessment.

The EIAR comprises of four volumes:

Volume 1: Non-Technical Summary

Volume 2: Main Report

Volume 3: Appendices

Volume 4: Drawings

1.7 Cumulative Assessment

Cumulative assessment assesses the changes to the environment that are caused by activities/projects in combination with other activities/projects. Thus, the potential impact of the proposed development is assessed in conjunction with other existing or proposed development located nearby or in the vicinity of the development in question, such that the potential combined environmental impacts can be accurately assessed in the event of the proposed development proceeding.

Cumulative effects are changes to the environment that are caused by an action in combination with other actions and can arise from:

- the interaction between all of the different Projects in the same area;
- the interaction between the various impacts within a single Project.

The coexistence of impacts may increase or decrease their combined impact. Impacts that are considered to be insignificant, when assessed individually, may become significant when combined with other impacts.

The requirement for cumulative assessment derives from the 2014 EIA Directive, where Annex IV requires that the EIAR should describe "*the likely significant effects of the project on the environment resulting from… the cumulation of effects with other existing and/or approved projects taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*".

In the context of an EIAR, cumulative effects can relate to two different aspects of a development.

Firstly, the various impacts of a particular project can interact in a manner which causes additional effects, which when taken together are greater than they appear when documented under separate topic headings.

Secondly, a project may magnify impacts already associated with other built development. This may mean that, when a development is proposed at a greenfield location which is devoid of other significant built development, its impact is acceptable; by contrast, where it is proposed in conjunction with other development, the cumulative effect may be much greater. In some cases, the impacts of these multiple developments collectively may exceed that which is tolerable.

In relation to the issue of cumulative effects between this proposed development and other projects, the most obvious is the effect of a combination of the proposed development and the existing landfill development. An analysis of the relevant cumulative effects is set out in Chapter 16 'Inter-relationships & Interactions' of this EIAR.

Other than the existing Knockharley Landfill, there are a number of facilities within the surrounding hinterlands that operate under licences issued by the EPA.

Facilities within a 10km radius of the Knockharley Landfill site have been identified as follows:

- Kentstown Sow Unit (transferred to Marry Pig Farms Limited) is located approximately 4 km south of the Knockharley Landfill facility in Danestown. It is operated under an IE licence P0456-01 from the EPA. It is a piggery with approximately 4,000 pigs and employs 3 people. Planning permission was granted in January 2015 for the demolition and reconstruction of facility buildings
- There is a poultry farm in Gerrardstown, Garlow Cross, located approximately 3.5 km south west of the facility. The poultry farm produces eggs and currently has capacity for 40,000 layers and is licensed for 117,500 layer spaces. The facility is licensed by the EPA through IE licence P0917-01. The 2015 AER lists one employee.
- A poultry farm in Garballagh, Duleek rears c. 3,000 broilers per annum. It is operated under IE licence P0887-01. It is approximately 4 km west of the facility and employs one person.
- Dunbia operates a meat processing facility in Beauparc under IE licence P0811-02 the operation of slaughterhouses with a carcass production capacity greater than 50 tonnes per day. It has over 70 employees and is 3.5 km north of the facility.

- Cooksgrove Ltd., trading as Euro Farm Foods, operates as cattle slaughterhouse in Cooksgrove, Duleek. It has an IE licence P0822-01 with a throughput of 300 cattle a day. It has over 100 employees. The facility is approximately 8 km west of the Knockharley Landfill facility.
- Nurendale Ltd. trading as Panda Waste Services Ltd. owns and operates a large Materials Recovery Facility at Rathdrinagh Cross Roads, approximately 4 km north east of the facility on the N2 to Slane. It is operated under a licence from the EPA, W0140-04 and is licenced to accept up to 250,000 tonnes per annum of household, commercial and industrial waste, biowaste and biodegradable waste, and construction and demolition waste and the facility employs approximately 160 people. A licence review application for, *inter alia*, the acceptance and processing of incinerator bottom ash is at time of writing under consideration by the Agency.
- Advanced Environmental Solutions (AES) Ltd. owns and operates a waste transfer facility in Navan under IE licence no. W0131-02, approximately 10 km west of Knockharley Landfill. The licensed capacity of the facility is 95,000 tonnes per annum. The facility has approximately 15 employees.
- Perma Pigs Limited, is an operational pig farm located at Littlegrange, Drogheda, County Louth, is operated under licence P0431-02.
- Irish Cement Limited, located at Platin Works, Platin, Drogheda, County Meath, is operated under licence register number P0030-04.
- A poultry farm, located at Dowth, Slane, County Meath is operated under licence P0951-01.
- Indaver Ireland Limited, operating at Carranstown, Duleek, Co. Meath, is licensed under register number: W0167-03.

Given the operation of a number of EPA licensed facilities within 10 km of the Knockharley Landfill facility, potential cumulative impacts with the proposed development to which this application relates, could be realised in relation to:

- Traffic movements along the N2 national primary route
- Air quality resulting from vehicles movements, potential odour emissions and emissions from boilers and engines and piggery operation

To this end, consideration is given to the potential cumulative impacts relating to both developments in the relevant sections of the EIAR i.e. Chapter 7 – 'Air & Climate', Chapter 8 – 'Roads, Traffic & Transportation' and Chapter 10 'Biodiversity'.

There are no other major or large-scale developments in existence in the vicinity of the development location, nor have there been in the past.

In terms of "*reasonably foreseeable actions",* taken to be potential future development of scale, a number of data sources were consulted:

- Meath County Development Plan 2013 – 2019 (and variations)
- Meath County Council Online Planning Portal (http://www.meath.ie/CountyCouncil/Planning/SearchPlanningPermissionApplications/)

No future development of scale has been identified in the vicinity of the development location based on an assessment of these information sources and thus no further consideration in this regard is undertaken. However, planning applications made to Meath County Council have been considered, where relevant. A list of applications and permissions are in Appendix 1.9

1.8 Contributors to the EIAR

Fehily Timoney and Company (FT) is a consultancy based in Cork & Dublin, specialising in civil and environmental engineering, and environmental science. FT is well established as a leading consultancy in waste management in Ireland. The company has established a professional team specialising in waste management infrastructure development, particularly landfill. This team has the support of many in-house engineers and scientists.

FT was retained by the applicant to undertake the detailed environmental appraisals and prepare the EIAR for the proposed development, as well as preparing a planning application to accompany this EIAR for submission to the relevant planning authority, An Bord Pleanála. Furthermore, FT has been retained to prepare the review application to the EPA for the existing industrial emissions (IE) licence for the facility.

Specialist contributors involved in the preparation of the EIAR are outlined in Table 1.1 and a CV for each contributor is included in Appendix 1.8 in Volume 3 of this EIAR.

Table 1.1: Contributors to the EIAR

EIS Topic	Company	Name and Qualifications
Chapter 1 – Introduction	FT	Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM Bernie Guinan, B.Sc., M.Sc., Dip, IMI, MCIWM
Chapter 2 – Description of the Proposed Development	FT	Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM Tanya Ruddy, B.Sc., M.Sc., MCIWM, MCIWEM, C.Sci Chris Cronin, B.Sc. (Hons) M.Sc., C.Eng, C. Env, MCIWM, MIEI, MIAgEng Alice Riordan, B.Eng, C.Eng, MIEI, MIAH Bernie Guinan, B.Sc., M.Sc., Dip, IMI, MCIWM
Chapter 3 – Policy	FT	Bernie Guinan, B.Sc., M.Sc., Dip, IMI, MCIWM Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM
Chapter 4 – Need for the Development and Alternatives Considered	FT	Bernie Guinan, B.Sc., M.Sc., Dip, IMI, MCIWM Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM
Chapter 5 – EIA Scoping & Consultation and Key Issue	FT	Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM Bernie Guinan, B.Sc., M.Sc., Dip, IMI, MCIWM Tanya Ruddy, B.Sc.,M.Sc., MCIWM, MCIWEM, C.Sci
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	Odournet	Nick Jones, B.Sc., MIWA, MIoD Adam Dawson, B.Sc. Dr Andrew Meacham, BSc and PhD in chemistry Paul Ottley, B,Sc

EIS Topic	Company	Name and Qualifications
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Chapter 9 – Noise and Vibration	FT	Dr. John Mahon, Ph.D. in Acoustics & Vibration
Chapter 10 – Biodiversity	FT	Jon Kearney, M.Sc., B. Sc., MCIEEM Dr. Elaine Bennett, B.Sc., Ph.D Donna O'Halloran, Dip Hort., BSc (Agr.), MSc (Agr) ERM., MSc Ecology
Chapter 11 – Lands, Soils and Geology	FT	Tanya Ruddy, B.Sc., M.Sc., MCIWM, MCIWEM, C.Sci Tom Clayton, M.Eng, CEng James Dunn, M.Sc.
Chapter 12 – Hydrology and Surface Water Quality	FT	Mary Creedon, BE, CEng, MIEI, MIHT Alice Riordan, B.Eng, C.Eng, MIEI, MIAH Chris Cronin, M.Sc., C.Eng, C. Env, MCIWM, MIEI
Chapter 13 - Landscape and Visual Impact Assessment	FT	Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM Siún McCarthy, BA, MPlan, MIPI
Chapter 14 – Archaeology and Architecture and Cultural Heritage	Dermot Nelis Archaeology	Dermot Nelis, BA, ArchOxon, MIAI.
Chapter 15 – Material Assets	FT	Derek Milton, B.Sc., M.Sc., Pg. Dip, B.Sc., MCIWM Tanya Ruddy, B.Sc., M.Sc., MCIWM, MCIWEM, C.Sci
Chapter 16 – Schedule of Commitments	FT	Tanya Ruddy, M.Sc., MCIWM, MCIWEM, C.Sci

1.9 Difficulties Encountered

There were no technical difficulties encountered during the preparation of this environmental impact assessment.

1.10 Viewing and Purchasing of the EIAR

This EIAR is available for download at www.knockharleylandfill.ie.

Copies of this EIAR including the Non-Technical Summary and the Appendices may be inspected free of charge or purchased by any member of the public during normal office hours at the following locations:

- The offices of An Bord Pleanála, 64 Marlborough Street, Dublin 1.
- Meath County Council Planning Department, Buvinda House, Dublin Road, Navan, County Meath.

Submissions or observations may be made to An Bord Pleanála (the Board), 64 Marlborough Street, Dublin 1 within 7 weeks of the date of documentation being made available for inspection. Submissions/observations must be accompanied by a fee of €50.

1.11 References

1. **Meath County Council.** *Meath County Development Plan 2013-2019.*

2. **County Council.** *Online Planning Portal* (http://www.meath.ie/CountyCouncil/Planning/SearchPlanningPermissionApplications/)

3. **European Commission.** *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 1999.* Available from: http://ec.europa.eu/environment/archives/eia/eia-studies-and-reports/pdf/guidel.pdf

4. **Environmental Protection Agency.** *Guidelines on the Information to be contained in Environmental Impact Statements.* 2002.

5. **Environmental Protection Agency.** *Advice notes on Current Practice (in the preparation of Environmental Impact Statements*. 2003.

6. **Environmental Protection Agency.** *Draft publication Guidelines to be contained in Environmental Impact Assessment Reports (August 2017) produced by the EPA to address the transposition of the requirements of Directive 2014/52/EU.* 2017.

7. **European Commission** "Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)" (2017)

8. **Environmental Protection Agency** (Draft - August 2017) "Revised Guidelines on the Information to be contained in Environmental Impact Assessment Reports";

9. **European Parliament, Council.** *Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment*. 2014.

10. **European Parliament, Council.** *Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of public and private projects on the environment*. 2011.

NVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 2 – DESCRIPTION OF THE PROPOSED DEVELOPMENT

NOVEMBER 2018

Knockharley Landfill Ltd.

Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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2 DESCRIPTION OF THE DEVELOPMENT

2.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) details the proposed development at Knockharley Landfill. It includes a description of the existing facility and the proposed development elements comprising the intensification of waste acceptance, storage of incinerator bottom ash (IBA), biological processing of residual municipal solid waste 'fines' and the storage and treatment of leachate. The principal facility elements and processes are identified. Construction and operational phase management of the facility is described, as are waste types to be accepted and processed. The provision for decommissioning and aftercare management of the proposed development is also discussed. There is a glossary of terms in Appendix 2.1 of Volume 3 of this EIAR.

2.2 Existing Development

The existing facility comprises a landfill facility where waste disposal and recovery activities are undertaken. The landfill opened for waste acceptance in December 2004. The landfill accepts the residual fraction of, household, commercial and industrial wastes together with construction/demolition wastes and incinerator bottom ash (IBA) and is licensed by the EPA with an Industrial Emissions (IE) Licence W0146-02. The site is licensed to operate from 07:30 to 18:30 Monday to Saturday inclusive and is licensed to accept waste between 08:00 and 18:00 (excluding public holidays). The proposed planning boundary of the facility is shown in red on Drawing No. LW14-821-01-P-0002 Existing Site Layout in Volume 4 of this EIAR and the ownership boundary (of Knockharley Landfill Ltd.) is shown in blue. This figure identifies the existing planning boundary, ownership boundary, landfill footprint, both built and permitted, screening berms, and infrastructure.

The existing facility infrastructure is shown in Volume 4 of this EIAR on drawing LW14-821-01-P-050-0004 which comprises:

1. Administration building
2. Machinery/maintenance garage
3. Four portable cabins for storage
4. Weighbridge building
5. Two weighbridges
6. Inspection slab
7. Quarantine slab
8. Car parking
9. Landfill gas treatment compound
10. Leachate lagoon
11. Surface water attenuation lagoon and wetland

The facility is located on a 135.2 hectare (333-acre site). The existing landfill footprint is positioned near the centre of the landholding and the current planning permission permits the development of approximately 25 hectares of landfill cells. The landfill is being developed in seven phases. To date, Phases 1-4 (Cell 1 to Cell 16 inclusive) of the seven planned cell phases have been fully constructed. As of November 2018, Cells 13, 14, 15 and 16 are operational.

A permanent cap has been placed on all cells in Phase 1 and Phase 2 (Cells 1-8 inclusive). In relation to Phase 3, Cells 9 and 10 and half of Cells 11 and 12 are fully capped. The permanent lining of the final cap on Cells 11 and 12 is complete, the soil placement will take place in 2019. There is an intermediate cap on the remainder on Cells 13 and 14. The landfill development and waste placement is in a northerly direction. The leachate storage lagoon is located to the south of the administrative buildings and the surface water attenuation pond and wetland is situated to the south of the landfill.

The ownership boundary is shown on Drawing No. LW14-821-01-P0000-BDY in Volume 4 of this EIAR. There is a public road, CR384 to the east of the facility with several residential properties. The access road to the facility from the N2 passes under this public road. The applicant, Knockharley Landfill Ltd. owns land on either side of the public road and residential properties along the public road. The planning boundary excludes the public road and one residential property adjoining the public road as shown on Drawing No. LW14-821-01-P0000-003 Proposed Site Layout in Volume 4 of this EIAR – see red hatched areas.

Knockharley Landfill Facility comprises development, outlined below, that are described in the following sections of this chapter:

- Access road and internal road network
- Buildings, fencing and security
- Environmental monitoring infrastructure
- Existing Utilities
- An engineered lined landfill
- Groundwater management infrastructure
- Leachate management system (comprising collection and storage)
- Surface water management system (comprising collection, attenuation and wetland)
- Landfill gas management system (comprising collection pipework, wells and a landfill gas compound)
- Landfill capping system
- Landfill void
- Existing waste types
- Existing waste activities

2.2.1 Existing Road Network

The landfill is accessed via the N2 national primary route (see Drawing No, LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR) which provides direct vehicular access to the national roads network, with access facilitated at a ghost island priority junction on the N2 at the facility entrance (see aerial overview of entrance in Plate 2-1). The ghost island provides sheltered access for right turning vehicles travelling from the north.

This is complimented with an auxiliary left turn deceleration lane to facilitate access for vehicles coming from the south. Both turning facilities aid in preserving the flow, speed and therefore the capacity of through traffic on the N2. The junction has been designed and constructed in accordance with the NRA: Design Manual for Roads and Bridges (DMRB) and has been the subject of Roads Safety Auditing (Stages 1, 2 and 3) in accordance with procedures set out in the relevant NRA guidelines.

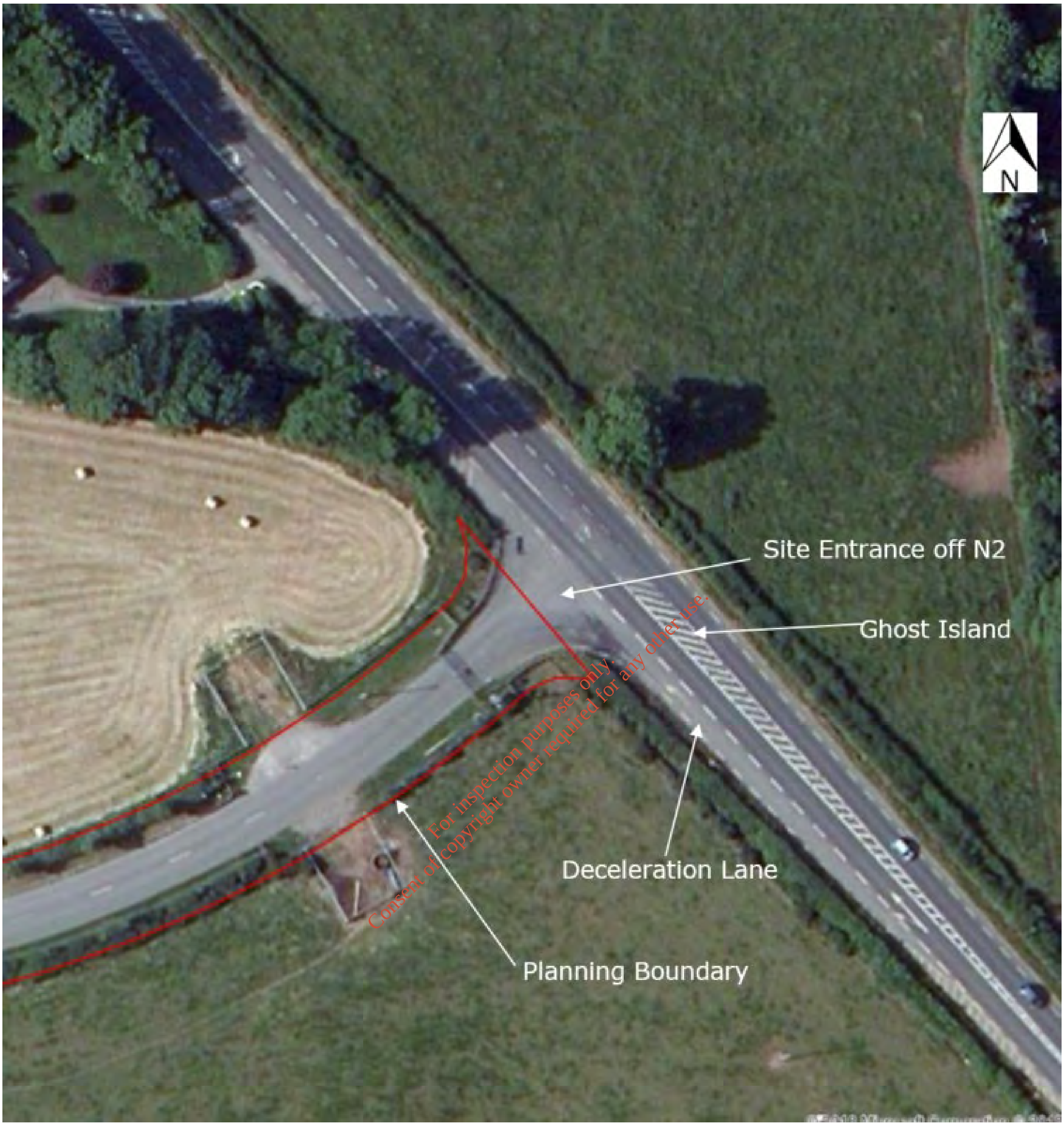


Plate 2-1: Knockharley Landfill Facility Access

The access road to the site runs due west through arable lands, thereafter running under the CR384 County Road. The entrance proper to the site is located approximately 80 to 100 metres west of the underpass of the CR384. The distance from the N2 to the onsite weighbridges is approximately 900 m. The dedicated access road is single carriage way and is the only road access to and from the site.

2.2.2 Existing Buildings, Fencing and Security

Plate 2-2 presents an aerial view of the existing administration building, car parking, weighbridges and weighbridge building, waste inspection and quarantine areas which includes the machinery/maintenance garage, portable storage cabins and bunded fuel storage.

Plate 2-2: Knockharley Landfill Administration Area

The facility is accessed off the national route N2 via a private gated entrance road. A security gate with closed circuit television is located on the access road. This aids site security staff in preventing unauthorised traffic from entering the site. This is the only road access to and from the facility. The perimeter of the site is fenced.

2.2.3 Existing Environmental Monitoring Infrastructure

The conditions and schedules of the current IE Licence (W0146-02) detail the requirements for environmental compliance. This includes monitoring requirements, trigger levels and emission limit values.

The current environmental infrastructure comprises:

- landfill gas perimeter monitoring wells
- in-waste landfill gas monitoring wells
- groundwater wells to monitor groundwater level and quality
- leachate side risers (to monitor leachate quality) and level sensors in cells and in the leachate lagoon
- continuous monitoring of pH, TOC and electrical conductivity at the outlet of the surface water pond
- meteorological monitoring station

Monitoring of the following is carried out on site at pre-defined locations but not requiring permanent monitoring infrastructure:

- surface water
- noise
- dust and PM10
- odour
- surface emissions (VOCs)
- stack emissions (flares and engines)

Existing monitoring locations are shown on Drawing No. LW14-821-01-P-050-001 in Volume 4 of this EIAR.

2.2.4 Existing Utilities

Existing overhead power lines (see Drawing No, LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR), are present at the following locations:

- 220 KV running north south and adjacent to the western boundary of the landfill footprint
- 20 KV running north south on the eastern boundary parallel to the existing local road with spurs to:
  - An ESB substation exporting power from the landfill gas compound to a 20KV line
  - An ESB substation importing power to the administration building

An existing below ground high pressure natural gas main is located south of and off-set from the permitted landfill footprint traversing the site in an east west direction. There is no connection from the facility to this gas main.

The facility is connected to the water mains and has phone and broadband. All foul effluent generated from administration welfare facilities is collected on site and passed through a 'biocycle' treatment unit and is discharged thereafter to the leachate lagoon.

2.2.5 Existing Engineered Landfill

The facility was designed, constructed and is being operated in accordance with the EU Landfill Directive 1999/31/EC, the original Licence, licence review, the IE Amendment and Technical Amendment A, B, C and D, relevant EPA guidance manuals on landfill selection, design, operation and monitoring and the relevant planning permissions that pertain to the site. Of the 7 no. approved landfill phases, the first 4 phases (Cells 1-16) have been constructed. Waste is being placed in Cells 15 and 16 during 2018.

The landfill liner system is a 1 m thick composite barrier comprising HDPE membrane and clay basal layer with a permeability of $1X10^{-9}$ m/s or similar approved, complying with both EU regulation and the licence conditions. Plate 2-3 shows an empty cell as constructed at Knockharley.

Plate 2-3: Lined cells at Knockharley Landfill

The clay component of the basal lining system was won from material excavated during the construction of the cells. The clay was screened by mechanical means to eliminate stone sizes greater than 50 mm. The clay was placed and compacted in layers, to achieve the required degree of permeability, in compliance with the licence. The cells were then lined with a 2 mm thick high-density polyethylene (HDPE) geomembrane. The liner is textured on the side-slopes and smooth on the cell floors. The cell floor falls to low points equipped with leachate pumps. The composite barrier layer is protected against mechanical damage using a protective geotextile overlain by drainage stone on the floor and using a protective geotextile on the side slopes. The construction of the landfill liner system was subject to independent quality assurance testing and controls approved by the EPA.

Cell numbering is shown on Drawing No, LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR.

2.2.6 Existing Groundwater Management Infrastructure

Groundwater drains are constructed below the engineered clay lining system, to maintain groundwater below cell formation. Groundwater flows observed during construction of cells 14 and 15 was approximately 3 m^3 per day. These flows are typically encountered during phased cell developments (plan area approximately 250 m x 70 m). The groundwater pipe drains consist of trenches of 1000 mm deep and 1000 mm wide below the bottom of the cells. 150 mm diameter open jointed concrete and/or slotted drainage pipes are surrounded by a stone filter and wrapped in geotextile, as shown in Figure 2.1. Gravity flows collected in this pipe terminate in sumps and electricity powered pumps discharge groundwater via a rising main to the surface water attenuation pond on site.

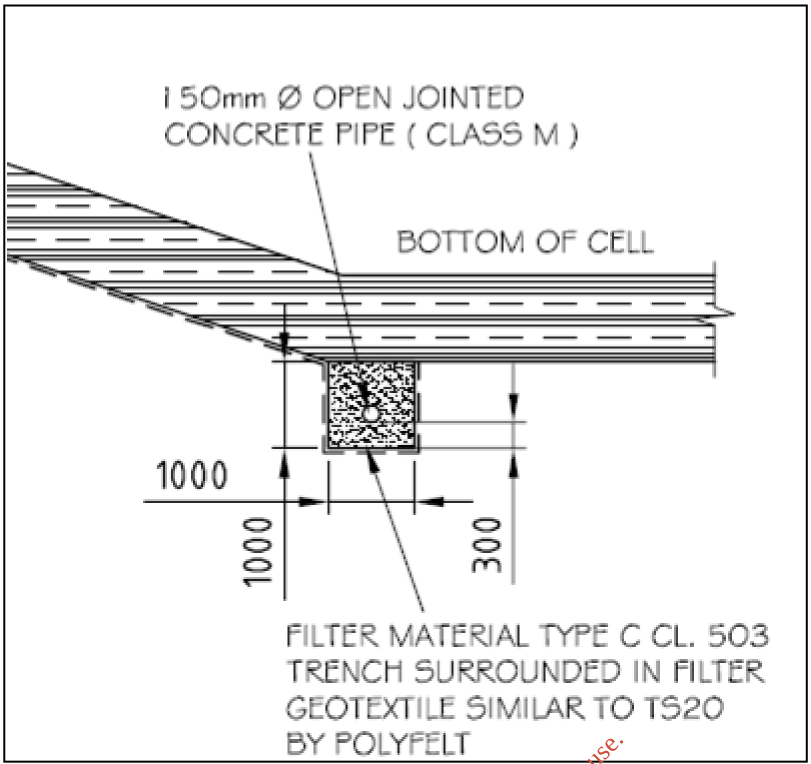


Figure 2-1: Typical Detail of Groundwater Drain

2.2.7 Existing Leachate Management Infrastructure

Leachate that gathers in the base of cells is collected in a leachate collection system comprising slotted drainage pipework, laid in a 'herringbone' fashion within a 500 mm thick leachate drainage layer of granular material laid on the cell floors. Electricity - powered leachate pumps are located in the low points of the cells, and leachate is pumped from side riser sumps to the perimeter leachate collection rising main. The leachate collection rising main, which will ultimately be laid around the entire perimeter of the landfill, discharges to the leachate lagoon.

The leachate lagoon (see Plate 2-4) has a floating cover to prevent rainfall ingress and to minimise odour nuisance. The lagoon is lined with 2 mm HDPE membrane on a 1 m clay layer. The capacity of the leachate lagoon is approximately 2,500 m^3, with an allowance for a 0.75 m freeboard. Leachate is tankered off-site for treatment at a wastewater treatment plant.

There is no foul sewer service near the site. Accordingly, all foul effluent generated from the onsite administration welfare facilities is collected on site and through a 'biocycle' treatment unit, the treated effluent is discharged thereafter to the leachate lagoon.

Plate 2-4: Covered Leachate Lagoon

2.2.8 Existing Surface Water Drainage Infrastructure

Surface water runoff from roads and hard standing areas discharge to a surface water trunk main collection pipe. This surface water trunk is located on the eastern side of the perimeter access road and runs between the administration building to the southern surface water attenuation lagoon. Refer to Drawing LW14-821-01-P-0000-002 in Volume 4 of this EIAR. This below ground pipe main varies from 225 mm diameter up to 750 mm diameter. There is also a 450 mm diameter spur from this pipe main to the north of the proposed building for the biological treatment of the organic fraction of Municipal Solid Waste (also referred to as MSW fines) which runs from east to west and turns north to receive runoff from the main site access road.

The pipe discharges to an existing attenuation pond and wetland serving the overall site, via a Class 1 bypass proprietary oil/water separator. This petrol interceptor prevents petroleum products from entering the storm water attenuation pond and wetland.

Surface water from the landfill footprint is drained via the main landfill perimeter swale to a purpose-built storm water attenuation pond and constructed wetland. Swales are vegetated channels over which flows are conveyed at low non-erosive velocities. The existing swales drain the surface water from the landfill footprint and embankments surrounding the landfill cells. These swales are of approximate depth 600 mm with a bottom width of 1000 mm and side slopes of 1 in 3. The swales were constructed in accordance with CIRIA C698, Site Handbook for the Construction of SUDS. As the landfill cells develop further, the surface water swales will continue to be constructed around the landfill footprint and embankments.

The attenuation pond and wetland (located on the southern boundary of the landfill footprint) were designed to manage the runoff from the development for up to a 1 in 100-year design return period storm event. The outflow from the constructed wetland discharges into the local drainage network at the south-eastern corner of the site.

The discharge from the surface water pond is controlled by a slam shut valve that prevents surface water discharging if continuous monitoring of TOC indicates potential contamination of the surface water. The live storage volume of the pond is 4,253 m^3, (theoretical requirement 3,758 m^3). The 1:20 discharge capacity from the existing attenuation pond to the receiving watercourse (via the wetland) is 0.188 m^3/s. The storm water attenuation pond also has a 1:100 emergency spill capacity of 0.28 m^3/s.

The storm water attenuation pond (see Plate 2-5 foreground) is lined with a composite barrier, comprising a HDPE membrane and a 1.0 m clay basal layer with a permeability of 1 x 10^{-9} m/s, which is the same specification as the landfill cell clay barrier. The constructed wetland comprises a shallow clay-lined pond both naturally colonised and planted with appropriate species.

Plate 2-5: Surface Water Attenuation Pond and Wetland

2.2.9 Existing Landfill Gas Management Infrastructure

Landfill gas (LFG) is extracted from all active and filled cells via vertical and horizontal gas wells. Gas wells are constructed from the cell floor upwards as waste is placed in each cell. Additional bored gas wells are constructed in each cell to aid gas extraction upon reaching a predetermined filling height. Gas extraction commences from each cell once sufficient waste has been placed above the leachate stone drainage layer to prevent air infiltration into the gas extraction system. In addition, short-term use of driven extraction pipes ('pin wells') are used as a temporary gas collection measure, close to the working face. A slotted horizontal gas collection pipe also is installed at the top of the cell side-slopes to intercept any gas travelling up the cell embankments.

Landfill gas is fed via both temporary over-ground and permanent below-ground HDPE pipes to a 355 mm HDPE gas ring main located outside the perimeter of the waste cells. The ring main transfers landfill gas from the cells to the landfill gas compound via two condensate knock-out pots located 'upstream' of the compound.

At present, Cells 1 to 10 and approximately half of Cells 11 & 12 are fully capped. As part of these works, there is a permanent gas collection system connected to the ring main.

Capping works for the other landfill phases will involve the installation of more condensate knock-out pots, permanent well heads and below ground pipes to enable management of the landfill gas field.

The landfill-gas compound is located east of the landfill footprint and north of the surface water lagoon.

The landfill gas treatment infrastructure consisting of enclosed flares and landfill gas utilisation engines are in the landfill gas compound. Currently, there are four engines on site. Two engines are run continuously as lead engines, these have a capacity of 1,000 m^3/hr.

Two back up engines of 800 m^3/hr capacity each are installed on site. There are 3 no. enclosed flares in the landfill gas compound, two duty and one back up. The two duty flares provide flaring capacity of 2,500 m^3/hr and 1,500 m^3/hr. The back-up flare is 1,500 m^3/hr.

The largest flare, is directly connected to the booster station that provides the primary back up to the two duty engines. A fourth open flare of 500 m^3/hr capacity is located within the compound. It is not currently operational and is only used for odour control measures if required.

There is an ESB substation in the compound to facilitate the transfer of energy generated by the plant to the national grid via an overhead 20 KV power line. The landfill gas plant was commissioned in 2010 and has been exporting power to the grid since then. The current energy generation from landfill gas generated on site is 2.1 MW.

Plate 2-6: Landfill Gas Compound

2.2.10 Existing Landfill Capping System

As part of ongoing operations at the site, the active area of the landfill is covered with daily cover. Near-horizontal areas of the working face are covered with soil and woodchip, the slope of the working face is covered with daily cover at the end of each working day.

Temporary low-permeability covers are installed as areas of the landfill reach full height. At the time of writing, a temporary cap has been installed on parts of Cells 13 and 14.

A fully engineered cap is in place over a Cells 1-10 and half of Cells 11 and 12. This cap comprises: a gas collection layer, 1 mm fully welded LLDPE liner, sub-surface drainage layer, subsoil layer and a topsoil layer. The overall thickness of the soil layers is 1 m in accordance with the requirements of the facility licence. Approximately 96,000 m^2 has been capped to date. The final capping of Cells 11 and 12 is underway, the welded LLDPE liner is in place and the soil layers will be placed in 2019.

Future permanent capping will continue on a phased basis.

2.2.11 Existing Landfill Void Capacity

The total quantity of waste and recovery materials landfilled at the site up to the end of 2017 within cells 1 through 16 is approximately 2,170,954 tonnes.

The existing design capacity of Knockharley landfill is approximately 3.137 x10^6 m^3. The estimated remaining void in the current permitted development based on void assessments of Phases 4b, 5, 6 and 7 is 1,627,431 m^3.

The current planning permission permits the acceptance of waste at Knockharley until the 26 August 2021. Condition 3 of the permission granted by An Bord Pleanála in March 2007 (Ref: PL17.220331) restricted disposal at the facility to 132,000 tonnes per annum until December 2010, thereafter reducing to 88,000 tonnes per annum for disposal. Assuming a density of 1.0 t/m^3 It will not be possible to fill the remaining void by the 26 August 2021.

2.2.12 Existing Waste Types Accepted

The categories of waste accepted are as per Schedule A of the licence W0146-02 which includes for the disposal and recovery of household, commercial and industrial waste and construction and demolition waste is shown in Table 2-1. The current planning permission limits intake to 88,000 tonnes per annum.

Table 2-1: Schedule A – Wastes for Acceptance

Waste Type	Maximum Tonnes per Annum
Household	100,000
Commercial	45,000
Industrial	30,000
Sub Total for Disposal	175,000
Construction & Demolition for Recovery	25,000
Total	**200,000**

2.2.13 Existing Waste Activities

Waste Management Act 1996, as amended

The relevant classes of the Third Schedule (Disposal Activities) & Fourth Schedule (Recovery Activities) of the Waste Management Act 1996, on which the original facility licence was granted are shown in Tables 2.2 & 2.3. Note that since the grant of the facility licence, the Waste Management Act 1996 was amended in 2011 such that disposal and recovery activities identified in the Third and Fourth Schedules respectively were revised. The tables indicate in italics the respective revised activities that correspond to those originally licensed, while providing a description of the operational activities to which the classes relate.

Table 2-2: Third Schedule Waste Disposal Activities

Third Schedule Waste Disposal Activities	
Class 1	Deposit on, in or under land (including landfill)
Class D1	*Deposit into or on to land (e.g. landfill, etc.)*
Description of Activity	Deposit of non-hazardous wastes in lined cells that are on, in and under land
Class 4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons
Class D4	*Surface impoundment (e.g. placement of liquid or sludgy discard into pits, pond or lagoons, etc.)*
Description of Activity	Storage of leachate in a lagoon prior to disposal off-site at a suitable wastewater treatment plant and the use of a surface water pond to control the quality and quantity of the surface water run-off from the site
Class 5	Specially engineered landfill, including placement into discrete cells which are capped and isolated from one another and the environment
Class D5	*Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)*
Description of Activity	The deposition of non-hazardous waste into lined landfill cells
Class 6	Biological treatment not referred to elsewhere in this Schedule; which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs to 10 of this Schedule
Class D8	*Biological treatment not specified elsewhere in this Schedule which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12.*
Description of Activity	The possible future biological pre-treatment of leachate subject to the agreement of the Agency.
Class 13	Storage prior to submission to any activity referred to in a preceding paragraph of this schedule other than temporary storage pending collection on the premises where the waste concerned is produced.
Class D15	*Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage (being preliminary storage according to the definition of 'collection' in section 5(1)), pending collection, on the site where the waste is produced).*
Description of Activity	The temporary storage on-site of unacceptable waste in the waste quarantine area prior to transport to another site.

Table 2-3: Fourth Schedule Waste Recovery Activities

Fourth Schedule Waste Recovery Activities	
Class 4	Recycling or reclamation of other inorganic materials
Class R5	*Recycling/reclamation of other inorganic materials, which includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials*
Description of Activity	The use of recycled construction and demolition waste as cover and/or construction material at the site.
Class 9	Use of any waste principally as a fuel or other means to generate energy
Class R1	*Use principally as a fuel or other means to generate energy: This includes incineration facilities dedicated to the processing of municipal solid waste only where their energy efficiency is equal to or above –* *- 0.65 for installations permitted after 31 December 2008,* *using the following formula, applied in accordance with the reference document on Best Available Techniques for Waste Incineration:* *Energy efficiency = (Ep - (Ef + Ei)/ (0.97x(Ew+Ef)* *where -* *'Ep' means annual energy produced as heat or electricity calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1(GJ/year),* *'Ef' means annual energy input to the system from fuels contributing to the production of steam (GJ/year),* *'Ew' means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year),* *'Ei' means annual energy imported excluding Ew and Ef(GJ/year),* *'0.97' is a factor accounting for energy losses due to bottom ash and radiation*
Description of Activity	The utilisation of landfill gas
Class 11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule
Class R11	*Use of waste obtained from any of the operations numbered R 1 to R 10*
Description of Activity	The use of construction and demolition waste on site
Class 13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced
Class R13	*Storage pending any of the operations numbered D 1 to D 12 (excluding temporary storage (being preliminary storage according to the definition of 'collection' in section 5(1)), pending collection, on the site where the waste is produced)*
Description of Activity	The storage of construction and demolition waste on site prior to recovery.

Industrial Emissions Directive

The facility Waste Licence W0146-02 was amended by the EPA in December 2013 in compliance with the Industrial Emissions Directive (2010/75/EU), as implemented by the European Union (Industrial Emissions) Regulations (S.I. 138 of 2013), thus changing the licence from a Waste Licence to an Industrial Emissions (IE) Licence.

In accordance with the revised First Schedule of the EPA Act 1992 to 2013, the 'Schedule of Licensed Activities' of the facility licence at the site are:

11.1 The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required. (is an industrial emissions directive activity, in so far as the process development or operation specified in 11.1 is carried on in an installation connected or associated with another activity that is an industrial emission directive activity)

11.5 Landfills, within the meaning of section 5 (amended by Regulation 11(1) of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)) of the Act of 1996, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25,000 tonnes, other than landfills of inert waste.

Note that this revised Schedule identifies that the relevant activities in accordance with the Waste Management Act 1996 as amended, continue to apply at the facility, where the revised Schedule states:

> *"Notwithstanding the foregoing, any limitation on waste recovery and disposal activities in this Part in accordance with the Third Schedule and Fourth Schedule of the Waste Management Act 1996 as amended including, where applicable, any refused waste disposal and recovery activities form the Third Schedule and Fourth Schedule of the Waste Management Act as amended shall continue to apply."*

2.3 Proposed Development

2.3.1 Introduction

The proposed development comprises:

- The acceptance of up to 435,000 tonnes per annum of non-hazardous wastes, which will comprise up to 150,000 tonnes of incinerator bottom ash (IBA), as well as household, commercial and industrial wastes including residual fines, non-hazardous contaminated soils, construction and demolition (C&D) wastes and baled recyclables. In addition, the acceptance of up to 5,000 tonnes per annum of stable non-reactive hazardous waste is proposed. Permission is sought for the acceptance of waste until the landfill cells are full.
- The acceptance and placement within the existing permitted landfill footprint of incoming wastes for recovery or disposal as appropriate; the increase in height of the landfill body from the current permitted post settlement final contour height of 74 mOD to a post settlement contour height of 85 mOD – the proposed height increase will apply from the active landfill phase at the time of permission grant. Permission is sought for the acceptance of waste until the cells are full.
- The construction and operation of a dedicated IBA facility. Permission is sought to store IBA until recovery outlets are identified. Permission is sought for trials to prepare IBA for recovery and removal off site. The IBA facility will consist of 5 no. cells which will be constructed in accordance with the requirements of the Landfill Directive 99/31/EC for non-hazardous wastes. A final post settlement contour height of 85 mOD is proposed. Permission is sought for operation of the IBA facility until the cells are full and subsequent aftercare activities as may be required are complete. The development includes additional perimeter (haul) roads and screening berms.

  The IBA facility will comprise 1 no. portal frame building 76 m x76 m x 15.5 m to facilitate:
  - weathering
  - metals recovery trials
  - crushing and washing to facilitate recovery trials and processing

- The construction and operation of a building for:
  - The biological treatment of the organic fraction of MSW (otherwise known as MSW 'fines' material) and;
  - contingency storage of baled recyclables
  - contingency storage of baled MSW

  This facility shall comprise:
    - a processing building of 108 m in length, 50 m in width and up to 17 m in height, of portal frame construction with 13 no. vehicle roller shutter doors and 7 or more pedestrian access doors (subject to fire certification requirements)
    - internal storage bays as required
    - 12 no. concrete composting tunnels located within the processing building of c. 6 m in width, 25m in length and 5 m in height
    - a covered bio-filtration unit within the overall processing building footprint, with a stack of height of 20 m
    - access from the internal site road with a marshalling yard area with egress from the existing site road to the landfill gas compound
- all other ancillary and associated works, including leachate storage in a below ground tank, bio-treatment system for sanitary wastewater drainage and fencing.
  Permission is sought for the continued use of this building post filling of the landfill cells onsite.

- The construction and operation of a leachate management facility comprising:
    - 3 no. additional floating cover leachate storage lagoons (L2, L3 and L4) of c. 3,000 m^2 each
    - 2 no. bunded above ground tanks for raw leachate from IBA cells (S1 and S2) approximately 25 m diameter 6.0 m high.
    - 3 no. bunded above ground tanks:
      - 1 no. tank (S3) for treated leachate from landfill leachate approximately 22m diameter 6.0m high.
      - 1 no, tank for treated leachate from IBA approximately 25 m diameter 6.0 m high (S4).
      - 1 no. tank for leachate concentrate 16 m diameter by 6.0 m high (S5).
    - Modular - typically containerised plant units (C1 through C6), on concrete slab of c. 1,000 m^2 and 1 no. elevated tank 5 m diameter 10 m high (T1) with provision for 2 no. additional low level (<5.0 m high) bunded storage tanks for dosing and other compounds (T2 and T3).
    - Extension of existing loading area for 2 no. 25 tonne articulated tankers and a new loading area for 2 no. 25 tonne articulated tankers.

  Permission is sought for the continued operation of this plant post filling of the landfill cells to facilitate continued leachate management.

- Construction of screening berms along the western boundary to a maximum of 10 m in height, on the eastern boundary to a maximum height of 10 m and on the northern boundary, to a maximum height of 6 m, with a total berm footprint of c. 11.3 ha. Haul roads for construction will be in or immediately adjacent to berm footprint.
- Construction of surface management infrastructure, with discharge to the adjacent Knockharley Stream to the northern end of the landfilling footprint and the proposed IBA cell development. Key elements will comprise:
    - holding pond for surface water runoff
    - storm water attenuation lagoon to maintain green field surface water discharges to Knockharley stream and to facilitate suspended solids management
    - wetland
    - flood compensation culvert to provide equivalent 1:1000-year flood plain storage
    - permitted stream diversion around permitted development

- Felling of c. 12.5 ha of the existing commercial broadleaf/conifer mix plantations to facilitate:
    - construction of the screening berms along the western boundary and to the north of the proposed IBA area, and
    - development of Phase 7 Cells 27 and 26 and the new northern surface water attenuation pond.

  Replanting and new planting totalling (c.16.8 ha) will off-set loss of commercial forestry in the proposed development footprint at the following locations:
    - replanting over screening berms
    - new planting on the cap over cells 25, 26, 27 and 28 in what is currently the permitted development
- Relocation of an existing 20 KV overhead ESB powerline that provides power to the existing landfill facility administration buildings, that will be impacted by the development of the screening berm to the east of the proposed IBA cell area.
- Construction of an additional ESB sub-station and new overhead ESB supply to the north-western corner of the currently permitted landfill footprint to facilitate power provision for pumps and other infrastructure.
- Construction of a new ESB sub-station adjacent to the proposed building for biological waste treatment and storage with ESB connection to adjacent 20 kV power lines.
- Extension of existing below ground infrastructure (permitted development) and provision of additional below ground infrastructure. (Power, water, telemetry, leachate rising mains, drainage). Extension of the existing car park for the administration area (760 m^2) to provide additional no. 40 parking spaces.

The proposed site layout is shown in Drawing No.'s LW14-821-01-P-0000-003 through 011 Proposed Site Layout Plan in Volume 4 of this EIAR[1]. To support the written description of the proposed works in this chapter, Drawing LW14-821-01-P-0050-0005 Proposed Site Layout Plan with Infrastructure Locations, in Volume 4 of this EIAR includes a numbering notation as below:

1. Proposed waste acceptance types, activities & quantities (see Section 2.3)
    a. Non-stabilised residual including biodegradable
    b. IBA
    c. Non-hazardous and non-biodegradable stabilised and inert
2. Proposed changes to current permitted cell development (see Section 2.4)
    a. Increased profile
    b. Revised cell layout and additional working faces
3. Proposed dedicated IBA facility (see Section 2.5)
    a. Cell layout
    b. IBA road access
    c. IBA wheel wash
    d. Suspended solids management at side risers
    e. Side risers and rising mains
    f. Suspended solids management
    g. Weathering area including weathering building
4. Proposed biological treatment facility (see Section 2.6)

[1] A separate drawing, No. LW14-821-01-P0000-013 contains the same details as the Proposed Site Layout series 1-8, but includes the proposed surface water management infrastructure, IBA facility, leachate management facility and biological treatment facility on one drawing for ease of reference.

5. Proposed leachate storage and treatment (see Section 2.7)
    a. Bunded storage
    b. Floating cover lagoons
    c. Tanker loading areas
    d. Leachate treatment / conditioning area
6. Proposed surface water/drainage infrastructure (see Section 2.8)
    a. Additional surface water attenuation lagoon
    b. Surface water outfall
    c. Flood compensation lands
    d. Surface water holding pond
7. Earth balance and proposed berms (see Section 2.9)
    a. Cell development
    b. Berm phasing
8. Proposed tree felling & replanting (see Section 2.10)
9. Relocation of ESB powerline (see Section 2.11)
10. Ancillary infrastructure (see Section 2.12)
    a. Additional ESB substation
    b. Additional ESB substation
    c. Additional drainage
    d. New overhead ESB line

An application will also be made to the EPA to facilitate the licensing of the proposed development as outlined herein. The existing facility is licensed to operate by the EPA by IE W0146-02.

2.3.2 Proposed Waste Types, Activities & Quantities

It is proposed to accept up to 440,000 tonnes per annum of waste at Knockharley in total. This waste shall be managed through disposal or recovery activities, dependent on the nature of the waste material.

It is necessary to consider the processes that will be applied to each waste type to be accepted in terms of the process being either a recovery or a disposal activity, as defined by the relevant activities outlined in Schedules 3 & 4 of the Waste Management Acts 1996 to 2011, as amended. The classification of the activities being applied to each waste type is discussed further in this section.

While the current permission pertaining to the facility limits the acceptance of waste for disposal to 88,000 tonnes per annum, for reasons discussed in Chapter 4 'Need for the Development & Alternatives Considered', it is considered that an increased acceptance rate at Knockharley Landfill would be appropriate, and sustainable to provide required national landfilling capacity including contingency capacity.

The proposed development will see the acceptance of a total of 440,000 tonnes 'through the gate' on an annual basis, that will either be recovered or disposed of, dependent on the nature and quantity of the material. The types of waste to be accepted at the proposed development and proposed quantities and related disposal or recovery activities are outlined in more detail in the following sections.

2.3.3 Waste Types to be Accepted

Broadly, the waste types to be accepted as part of the proposed development are the same as those currently accepted at the facility, with the addition of two new waste types; stable non-reactive hazardous waste (maximum 5,000 tonnes per annum) and baled recyclable waste.

The waste types to be accepted are:

- Non-hazardous residual municipal solid wastes of household, commercial and industrial origin, which will have undergone various degree of pre-treatment from separate 'black bin' collection to biological treatment in the form of stabilised residual fines, as well as residual MSW from other sources such as unauthorised landfill remediation and/or repatriated wastes; the issue of unauthorised landfill remediation and waste repatriation is discussed in more detail in Chapter 4 'Need for the Development & Alternatives Considered'.
- Non-hazardous incinerator bottom ash (which is currently accepted at the facility).
- Non-recyclable bulky wastes, where bulky wastes are broadly considered as larger wastes which do not fit in household/commercial bins e.g. mattresses, furniture etc.
- Non–hazardous soils and stones and other C&D wastes.
- Street sweepings and similar cleansing wastes.
- 'Individual' volumes of non-hazardous industrial wastes from various industries such as food preparation, chemical processes, thermal processes, metal treatments, health care (non-hazardous) and water/wastewater treatment industries, all of which are currently accepted at the facility.
- Stable non-reactive hazardous waste
- Baled recyclable waste (contingency storage)
- Baled MSW (contingency storage)

2.3.4 Proposed Waste Activities

The proposed activities to be undertaken at the facility are classified in accordance with relevant legislation and can broadly be described as:

- placement of waste within lined cells
- biological treatment of residual MSW fines
- management of leachate
- storage of surface water for attenuation prior to discharge
- storage of unsuitable waste in quarantine area prior to removal off-site
- contingency storage of baled recyclables
- contingency storage of baled MSW
- IBA recovery trials (screening and washing and recovery of metals)

Waste Activities under the Industrial Emissions Directive

The facility Licence W0146-02 was amended by the EPA in December 2013 in compliance with the Industrial Emissions Directive (2010/75/EU), as implemented by the European Union (Industrial Emissions) Regulations (S.I. 138 of 2013), thus changing the licence from a Licence to an Industrial Emissions (IE) Licence.

An application shall be made to the EPA in respect of the IE Licence following submission of the SID planning application which shall include for the proposed waste activities under the Industrial Emissions Directive. Table 2-4 over shows a list of the proposed activities that may apply to the proposed development.

Table 2-4: Proposed Activities in accordance with the Industrial Emissions Directive 2010/75/EU as per Revised First Schedule of EPA Act 1992 to 2013

Proposed Activity 11.1	The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required. (is an industrial emissions directive activity, in so far as the process development or operation specified in 11.1 is carried on in an installation connected or associated with another activity that is an industrial emission directive activity).
Description of Activity	All waste related site activities as described in 11.4 (a), 11.4 (b) & 11.5 following
Proposed Activity 11.4 (a)	Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities (other than activities to which the Urban Waste Water Treatment Regulations 2001 (S.I. 254 of 2001) apply): (ii) physico-chemical treatment;
Description of Activity	Leachate management
Proposed Activity 11.4 (a)	Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving one or more of the following activities (other than activities to which the Urban Waste Water Treatment Regulations 2001 (S.I. 254 of 2001) apply): (iv) Treatment of slags and ashes
Description of Activity	IBA recovery trials
Proposed Activity 11.4 (b)	Recovery, or a mix of recovery and disposal, of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one or more of the following activities, (other than activities to which the Urban Waste Water Treatment Regulations 2001 (S.I. No. 254 of 2001) apply): (iii) treatment of slags and ashes
Description of Activity	IBA recovery trials
Proposed Activity 11.4 (b)	Recovery, or a mix of recovery and disposal, of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one or more of the following activities, (other than activities to which the Urban Waste Water Treatment Regulations 2001 (S.I. No. 254 of 2001) apply): (i) biological treatment;
Description of Activity	Leachate management Biological treatment of MSW fines
Proposed Activity 11.5	Landfills, within the meaning of section 5 (amended by Regulation 11(1) of the Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)) of the Act of 1996, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25,000 tonnes, other than landfills of inert waste.
Description of Activity	The acceptance of waste at a landfill facility where the proposed rate of acceptance exceeds the identified threshold.

Waste Activities under the Waste Management Act

The classification of an activity as recovery or disposal is an important consideration from a legislative viewpoint, in terms of correctly classifying an activity, such that it has appropriate authorisation to be undertaken.

As per the Waste Framework Directive 2008/98/EC, 'recovery' is defined as:

> *"any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy"*

Annex II to the Waste Framework Directive contains a non-exhaustive list of recovery activities, which are replicated in the Fourth Schedule of the Waste Management Act, 1996 as amended. In a landfilling context, wastes are generally recovered through their use as daily and temporary cover materials, where they replace other non-waste materials that could also be used as cover, as well as construction materials in, for example, internal haul roads.

'Disposal' is defined in 2008/98/EC as:

> *"any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy"*

Annex II to the Directive contains a non-exhaustive list of disposal activities, which are those replicated in the Third Schedule of the Waste Management Act, 1996 as amended. Again, in a landfilling context, wastes placed within the landfill cell void that serve no recovery use are considered as being disposed.

In terms of the waste activities proposed as part of this development, wastes to be accepted have the potential, to varying degrees, to be either 'recovered' or 'disposed of' in keeping with the definitions of 2008/98/EC and the Third and Fourth Schedules of the Waste Management Act 1996, as amended.

Table 2-5 over outlines different situations in which incoming waste types could be identified as undergoing recovery or disposal activities. Further background to the likely origin of these wastes is provided in Chapter 4 'Need for the Proposed Development & Alternatives Considered'.

The acceptance of IBA in dedicated cells is described in more detail in Section 2.5.2 following - the placement of this material could potentially be classified as a recovery or disposal activity, depending on a number of factors.

Table 2-5: Waste Types, Quantities & Recovery and/or Disposal Application

Waste Types	Total Quantities Envisaged	Recovery Activity	Disposal Activity
Incinerator Bottom Ash	Up to 150,000 tonnes per annum	In the event of the acceptance and placement of IBA in dedicated cells, prior to a subsequent offsite recovery application, being considered as an 'R13' storage activity [2]	In the event of the acceptance and placement of IBA in dedicated cells with no subsequent recovery
Soils & Stones & Other C&D wastes	Up to 290,000 tonnes per annum	Where used as cover and/or construction materials during landfilling operations	When not used as cover and/or construction materials and deposited within the landfill void
Residual Municipal Solid Waste (including municipal bulky waste)		Where residual MSW fines are processed, either onsite in the proposed biological treatment plant or offsite, and utilised as cover material during landfilling operations	Where residual MSW is deposited directly within the landfill void
Non-municipal Bulky Waste		Unlikely to be utilised in a recovery application	Where non-municipal bulky waste is deposited directly within the landfill void
Street Sweepings & Cleansing Wastes		Unlikely to be utilised in a recovery application	Where street sweepings and cleansing wastes are deposited directly within the landfill void
Non-hazardous Industrial Wastes		Unlikely to be utilised in a recovery application	Where non-hazardous industrial wastes are deposited directly within the landfill void
Stable Non-Reactive Hazardous Waste (SNRH)	Up to 5,000 tonnes annum[3]	Will not be utilised in a recovery application	SNRH to be deposited directly within landfill void.

To this end, the likelihood of the further use of this material in a recovery application (most likely the R5 recovery activity[4] as per the Fourth Schedule of the Waste Management Act 1996, as amended) is an important factor in the designation of placement of this material in dedicated cells as a recovery or disposal activity.

C&D soil and stones type material, as well as stabilised residual fines materials may also be recovered, when used in daily and temporary cover applications at landfill sites. The use of this material as cover, and hence classification as recovery, is governed by the facility licence and will be undertaken in accordance with the EPA Guidance Note "Guidance Note on Daily and Intermediate Cover at Landfills"[5]

[2] Where Class R13 of the Third Schedule of the Waste Management Acts 1996 to 2011, is "Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage (being preliminary storage according to the definition of 'collection' in section 5(1)), pending collection, on the site where the waste is produced)" where it could be followed by a Class R5 recovery operation

[3] Not to exceed 49,999 tonnes over the lifetime of the facility.

[4] Where R5 is "Recycling/reclamation of other inorganic materials, which includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials"

[5] Guidance Note on Landfill Daily and Intermediate Cover, EPA 2014

Residual MSW accepted at landfill is, on the whole, disposed of within the landfill void – one situation where material of residual MSW origin can be recovered is when residual MSW fines which have undergone biological stabilisation, such that it falls within applicable stabilisation limits[6], are used as daily or temporary cover materials within the landfill.

The activities outlined in Tables 2.9 and 2.7 identify the recovery and disposal activities, in accordance with the Third & Fourth Schedules of the Waste Management Act 1996, as amended, that may apply to the proposed development, and reflect the different situations as outlined in Table 2.4 and above, where materials may be classified as being recovered or disposed.

[6] Respiration activity after four days (AT4) is <7 mg O_2/g DM

Table 2-6: Relevant Disposal Activities as per Third Schedule of the Waste Management Act 1996, as amended

Third Schedule Waste Disposal Activities	
Class D1	Deposit into or on to land (e.g. landfill, etc.)
Class D5	Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
Description of Activity	Classes D1 & D5 relate to the deposition of non-hazardous wastes in lined cells that are on, in and under land
Class D4	Surface impoundment (e.g. placement of liquid or sludgy discard into pits, pond or lagoons, etc.)
Description of Activity	Class D4 relates to the storage of leachate in lagoons prior to disposal off-site at a suitable wastewater treatment plant and the use of surface water ponds to control the quality and quantity of the surface water run-off from the site
Class D8	Biological treatment not specified elsewhere in this Schedule which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12
Description of Activity	Biological treatment of residual waste. Treatment of leachate.
Class D9	Physico-chemical treatment not specified elsewhere in this Schedule which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.)
Description of Activity	Treatment of leachate
Class D13	Blending or mixing prior to submission to any of the operations numbered D 1 to D 12 (if there is no other D code appropriate, this can include preliminary operations prior to disposal including pre-processing such as, amongst others, sorting, crushing, compacting, pelletising, drying, shredding, conditioning or separating prior to submission to any of the operations numbered D1 to D12)
Description of Activity	IBA handling Mixing of different leachate streams prior to treatment and/or disposal off-site.
Class D15	Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage (being preliminary storage according to the definition of 'collection' in section 5(1)), pending collection, on the site where the waste is produced).
Description of Activity	Class D15 relates to the temporary storage on-site of unacceptable waste in the waste quarantine area prior to transport to another site. Class D15 relates to the temporary storage of baled MSW in the biological treatment facility building prior to transport off-site.

Table 2-7: Relevant Recovery Activities as per Fourth Schedule of the Waste Management Act 1996, as amended

Fourth Schedule Waste Recovery Activities	
Class R3	Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes), which includes gasification and pyrolysis using the components as chemicals
Description of Activity	Class R3 refers to the onsite biological treatment of residual fines
Class R5	Recycling/reclamation of other inorganic materials, which includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials
Description of Activity	Class R5 refers to the use of soils, C&D materials, IBA and other inorganic materials as cover materials and/or in construction related activities
Class R11	Use of waste obtained from any of the operations numbered R 1 to R 10
Description of Activity	Class R11 refers to the use of stabilised residual fines from the biological stabilisation of the organic fraction of municipal solid waste as cover material
Class R12	Exchange of waste for submission to any of the operations numbered R 1 to R 11 (if there is no other R code appropriate, this can include preliminary operations prior to recovery including pre-processing such as, amongst others, dismantling, sorting, crushing, compacting, pelletising, drying, shredding, conditioning, repackaging, separating, blending or mixing prior to submission to any of the operations numbered R1 to R11)
Description of Activity	Where R12 refers to the washing and screening of IBA (trials) Class R12 refers to the recovery of metals from IBA (trials)
Class R13	Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where the waste is produced).
Description of Activity	Class R13 may refer to the placement of IBA material within dedicated cells prior to its subsequent recovery in off-site applications, dependent on the duration of its storage and other factors. Class R13 refers to the storage of baled recyclable waste in the biological treatment facility building. Class R13 refers to the storage of baled MSW in the biological treatment facility building.

Waste Quantities

Waste quantities defined in Table 2-8 are indicative and will be subject to availability of national landfill capacity and to prevailing market conditions. Accordingly, it is not proposed to limit waste disposal or recovery for respective waste inputs.

Chapter 4 'of Volume 2 of this EIAR considers that there is a significant capacity requirement for the overall waste tonnages proposed as part of this application totalling 440,000 tonnes per annum. In the event of any of the proposed capacities not being utilised in a given year, which is considered an unlikely situation, the presence of such capacity will provide contingency capacity, the requirement for which is identified in Chapters 3 and 4 of Volume 2 of this EIAR.

To inform the modelling of potential impacts related to noise and air quality addressed in subsequent chapters of this EIAR, as well as to inform the future cell phasing of the development, Table 2-8 presents a likely breakdown of waste types to be accepted at the facility in the coming years and the rate at which they may be accepted, based on the intended operational development of Knockharley Landfill Facility as informed by the market knowledge of the applicant and their consultants.

Table 2-8: Possible Future Breakdown of Incoming Materials to Facility

Incoming material type	Annual intake	Description
Residual MSW	65,000	Biological fraction (unstabilised)
Fines materials - MSW		
Soil & stone and other C&D materials	225,000	Stabilised and inert
Non-recoverable bulky waste individual industrial waste streams & SNRHW		
Fines materials –C&D, C&I, MSW		
Street Sweepings & Cleansing Wastes		
IBA	150,000	No biological fraction
Total	**440,000**	

Drawing No. LW14-821-01-P-0050-005 Proposed Site Layout Plan with Infrastructure and Waste Locations in Volume 4 of this EIAR shows the proposed cell footprints for respective waste types. Cell layout and filling sequence have been designed to accommodate changes in waste streams (volume and input rate) and final cell footprints may change to reflect incoming waste streams.

The material types as presented in Table 2-8 are discussed as follows:

Residual Non-Stabilised Waste

Residual non-stabilised waste is residual MSW material with a biodegradable fraction, originating from household, commercial and industrial waste collections, where thermal treatment and/or export capacity for the management of this material may not either be available at certain times, e.g. thermal plant routine shut down or where suitable treatment is not available.

Included within this waste stream are quantities of waste originating from repatriation activities or historic legacy sites undergoing remediation, which can only be managed at landfill.

It is assumed that a portion of fines accepted at the facility from time to time will have a gas generation potential and therefore has been included in the non-stabilised portion of waste.

These residual non-stabilised wastes will be placed in cells developed within the existing permitted landfill footprint where it will, under anaerobic conditions, result in landfill gas production, which will be either utilised to generate electricity or flared in accordance with facility licence conditions. Leachate from these wastes will be collected from the cell drainage layer and discharged via existing pipework for leachate treatment, as described in Section 2.7.1.

Stabilised and Inert Wastes

Stabilisation' means the reduction of the decomposition properties of the biodegradable fraction of waste to such an extent that offensive odours are minimised and that the Respiration Activity after four days (AT4) is <7 mg O_2 /g DM thereafter[i].

The term stabilised is used to reflect the relatively 'non-reactive' nature, in terms of leachate and landfill gas generation of this waste. It includes stabilised fines, bulky waste, street sweepings, stable non-reactive hazardous waste and inert wastes.

Stabilised and inert waste will be landfilled in separate specific cells and isolated from the non-stabilised waste, by use of using a 1.0 mm LLDPE membrane, (use of an impermeable LLDPE membrane prevents oxygen ingress into anaerobic cells)

It is proposed to provide landfill capacity at Knockharley for non-hazardous soil and stone and C&D waste as there is significant under capacity in the Country for these materials at present. This is discussed in further detail on Chapter 4 'of Volume 2 of this EIAR. Final capping material will be additional to the above.

It is estimated that non-recyclable bulky wastes and individual industrial origin waste streams that are not suitable for thermal treatment will be landfilled at Knockharley. Stabilised fines material may comprise non-biodegradable C&D/C&I type fines, as well as residual MSW fines stabilised on site in the biological waste treatment facility or at other locations prior to acceptance on site. Street sweepings and other cleansing wastes may be accepted. Stable non-reactive hazardous waste shall be accepted on site up to 5,000 tonnes per annum but not exceeding 49,999 tonnes over the lifetime of the facility. Stable non-reactive hazardous waste will be landfilled within dedicated sub cell areas within cells 27 and or 28.

Waste will be contained within plastic sheeting and covered with stable inert waste. Landfill locations of respective consignments will be recorded. Best practice will be carried out in accordance with EPA Technical Guidance.

Once deposited, waste will be covered immediately to a depth of at least 250 mm and by the end of the working day at least one metre of cover will be placed on all flanks and surfaces. Prior to final capping at least two metres of suitable material will be placed below the liner. The waste will be placed in areas removed from gas extraction.

These stabilised and inert wastes will not produce landfill gas and so a system of passive venting to atmosphere via carbon filters, shall be employed for the specific cells in which this material is placed. Leachate collected from these cells will be handled separately to other leachates generated on site. This is, described in Section 2.7. It is likely that a proportion of the stabilised and inert waste accepted at the facility will be utilised for daily cover in the residual non- stabilised waste cells, as a recovery activity.

Incinerator Bottom Ash (IBA)

It is proposed to accept up to 150,000 tonnes per annum of IBA in a dedicated IBA facility. The design is such that the IBA area will ultimately "piggy back" onto the adjacent landfill cells. Only inert waste will be placed under the "piggy back" area to provide future stability for the IBA material. This is described in more detail in Section 2.5. A passive gas venting system shall be employed within these cells, while leachate generated shall be managed in accordance with the manner described in Section 2.7.

It is the intention of the operator to store IBA in lined cells for future recovery off-site and permission is sought to carry out trials to facilitate recovery.

2.3.5 Future Cell Construction

Future cell construction within the currently permitted development will continue to be constructed in the same manner as cells currently constructed i.e. using a 1.0 m composite barrier system comprising an underliner drainage system to control groundwater, 1.0 m clay (permeability of $1*10^{-9}$ m/s) or equivalent, overlain with a 2.0 mm thick HDPE drainage liner.

A 500 mm drainage stone layer will be placed above the HDPE barrier within which collection pipework will facilitate leachate removal. Side slopes will be overlain with a protection geocomposite or similar, to protect the liner during waste placement.

Cell depth below existing ground level will continue as per the existing planning permission and IED Licence. Overburden will continue to be used for the engineered clay barrier and for screening bunds, as discussed in more detail in Section 2.14.3.2, Section 2.14.3.6, and in Chapter 11 Soils, Geology and Hydrogeology of Volume 2 of this EIAR.

During waste placement, horizontal and vertical gas collection pipework will be installed to facilitate extraction, under negative pressure, of landfill gas, as may be required in cells designated for the placement of non-stabilised residual waste. During cell construction, the perimeter gas collection pipework will be extended from the in-situ above ground system on-site.

Leachate from cells is currently pumped from the base of cells via a rising main to a below ground floating cover leachate lagoon onsite, prior to tankering off-site to a wastewater treatment plant. Future leachate treatment is described in more detail in Section 2.7. Future cell construction will include similar leachate extraction infrastructure.

At time of writing Cells 1 through 16 (See Drawing LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR) have been constructed, Cells 17 and 18 are under construction and Cells 19 through 28 have yet to be constructed.

2.4 Proposed Changes to Current Permitted Cell Development

The proposed changes to the operation of the landfill under this application include:

- intensification of landfilling
- increase in final contour height
- operation of 2 no. active faces in the permitted landfill development

These are discussed in the following sections.

There will be no changes to the existing landfill gas management system, leachate management system, surface water management system – albeit a new attenuation pond is required to manage flows in the northern portion of the site. There will be no changes to existing practices associated with nuisance control or other operational practices in place for the existing landfill facility.

2.4.1 Proposed Intensification of Landfilling in Existing Permitted Footprint

The existing permitted development is as described in Section 2.1. It is proposed to intensify the filling of the existing permitted landfill by increasing rate of waste acceptance to 440,000 tonnes per annum and to continue landfilling until the void in the remaining permitted cells is utilised. No change is proposed to the existing permitted footprint of the landfill Phases 1-7. Permission is sought to operate the landfill until the void is filled.

2.4.2 Increase Final Contours

In is proposed to increase the void capacity of the existing permitted footprint by raising the profile of the landfill from 74 m AOD to 85 m AOD. The existing final contour of previously capped cells will remain as is. The increased profile will apply to operational cells post grant of permission. The increased void associated with reprofiling will be approximately 217,000 m^3.

2.4.3 Proposed Future Cell Phasing & Filling

The proposed cell phasing and filling for the existing permitted landfill cells will require 2 no. working faces and the proposed IBA Cells will require a working face.

This is illustrated in Figure 2-2, please note that the size of the working face will be a condition of the licence, e.g. face 2 shall be no more than 25 m long and 25 m wide (i.e. <625 m^2 surface area), no more than 2.5 metres in height after compaction, and have a slope no greater than 1 in 3. The larger faces in Figure 2-3 are only to illustrate the concept. The proposed IBA cell development is discussed in Section 2.5.

The primary objectives of separate working faces are to:

- Separate the different leachates by composition to facilitate targeted and appropriate treatments.
- Facilitate management of different settlement characteristics associated with respective wastes.
- Facilitate more effective management of odour emissions from, and oxygen ingress into, the anaerobic waste body.
- Facilitates alternate engineering design solutions to manage landfill gas e.g. vertical wells under negative extraction in anaerobic cells and passive venting from horizontal wells in the “stabilised aerobic waste body.
- Mitigates the risk of collision from vehicle movements.

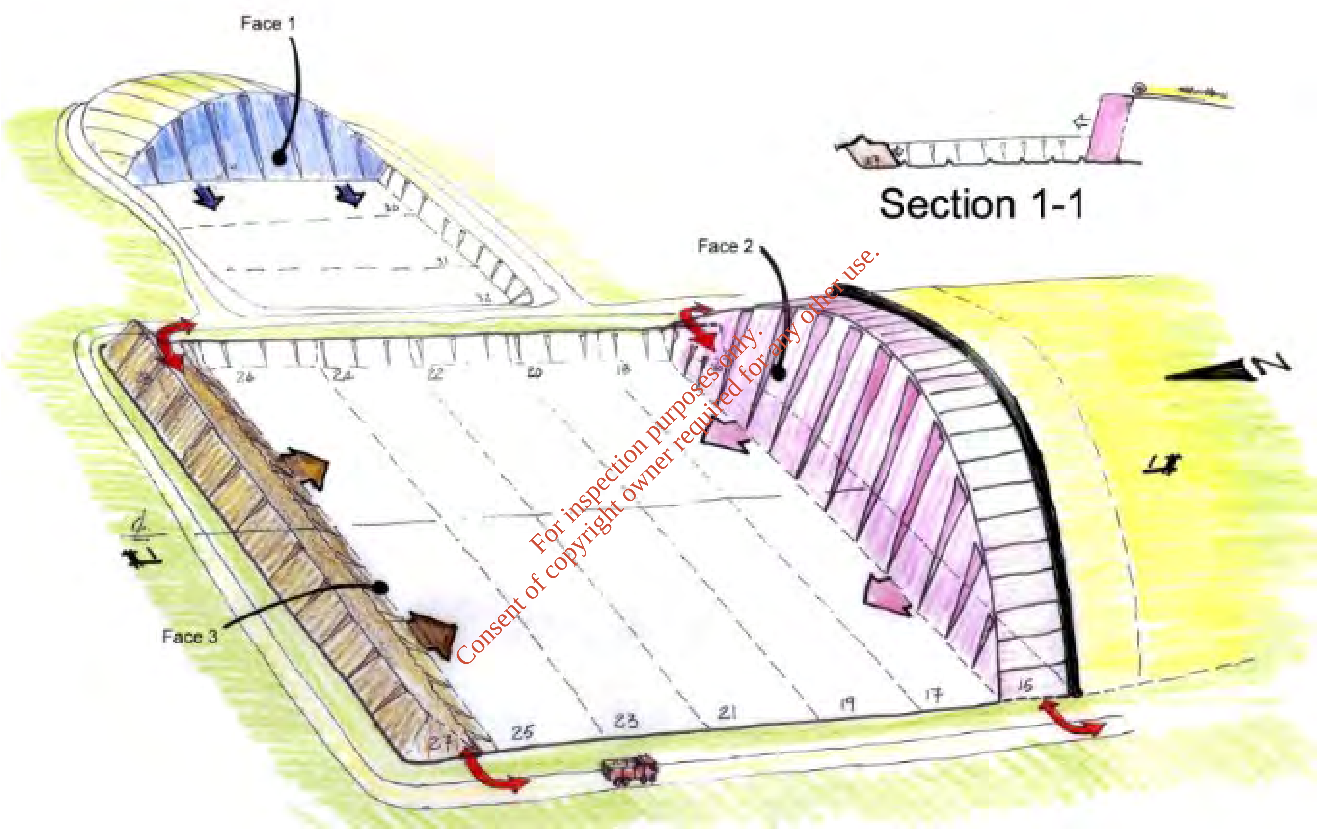


Figure 2-2: Artist Impression of Operational Waste Faces

Drawing LW14-821-01-P-0050-010 Proposed Filling Sequence Volume 4 of this EIAR and Figure 2-2 illustrate the proposed cell layout with cell numbers as defined in the permitted cell development and the proposed operational waste faces which are:

- Face 1 (Blue) is the IBA working face. The blue arrow reflects the fill direction (westerly) of the proposed IBA cell 29 to Cell 33.
- Face 2 (Pink) is the residual non-stabilised waste face and the pink arrow illustrates the direction of filling (northerly).
- Face 3 (Brown) is the stabilised and inert waste face. The brown arrow indicates the direction of filling (southerly direction).

2.4.3.1 Face 1 IBA

Face 1 for IBA in proposed cells 29 through 33 discussed in Section 2.5.5.

2.4.3.2 Face 2 Non-Stabilised Residual

Face 2 which is the current operational face will accept residual non-stabilised waste with the face developing progressively in a northerly direction. This broad waste stream typically has a significant organic fraction, is readily compressible and produces landfill gas under anaerobic conditions. Landfill gas will be collected under negative pressure via horizontal and vertical pipe systems and treated in engines (to produce electricity) or flares. During operations, proactive use of daily and intermediate covers will contain odours, facilitate development of anaerobic conditions within the waste body and isolate the waste from rainfall inputs.

2.4.3.3 Face 3 Stabilised and Inert Waste

Face 3 will accommodate deposition of stabilised and inert wastes. During operations, proactive use of daily and intermediate covers will isolate the waste from rainfall inputs. This broad waste stream will typically be less compressible than residual non-stabilised wastes, contain minimal/no organic matter and as such will not produce odours or landfill gas. Such emissions as may be produced will be vented passively via an appropriate filter to atmosphere via, typically, horizontal piping system and the waste will be landfilled under aerobic conditions.

Placement of stabilised and inert waste in cells 27 and 28 and moving in a southerly direction is designed to maximise the distance between residential receptors on the northern boundary and Face 2. Inert waste will be placed in cells 20 and 22 to create a stable foundation for the future piggy back of the IBA facility.

2.4.3.4 Filling Sequence

Subject to waste intake rates and operational considerations, placement location/filling sequence may change and waste types within the permitted cells may overlap at the interfaces between respective waste faces.

Figure 2-3 over illustrates the proposed filling sequence at respective faces.

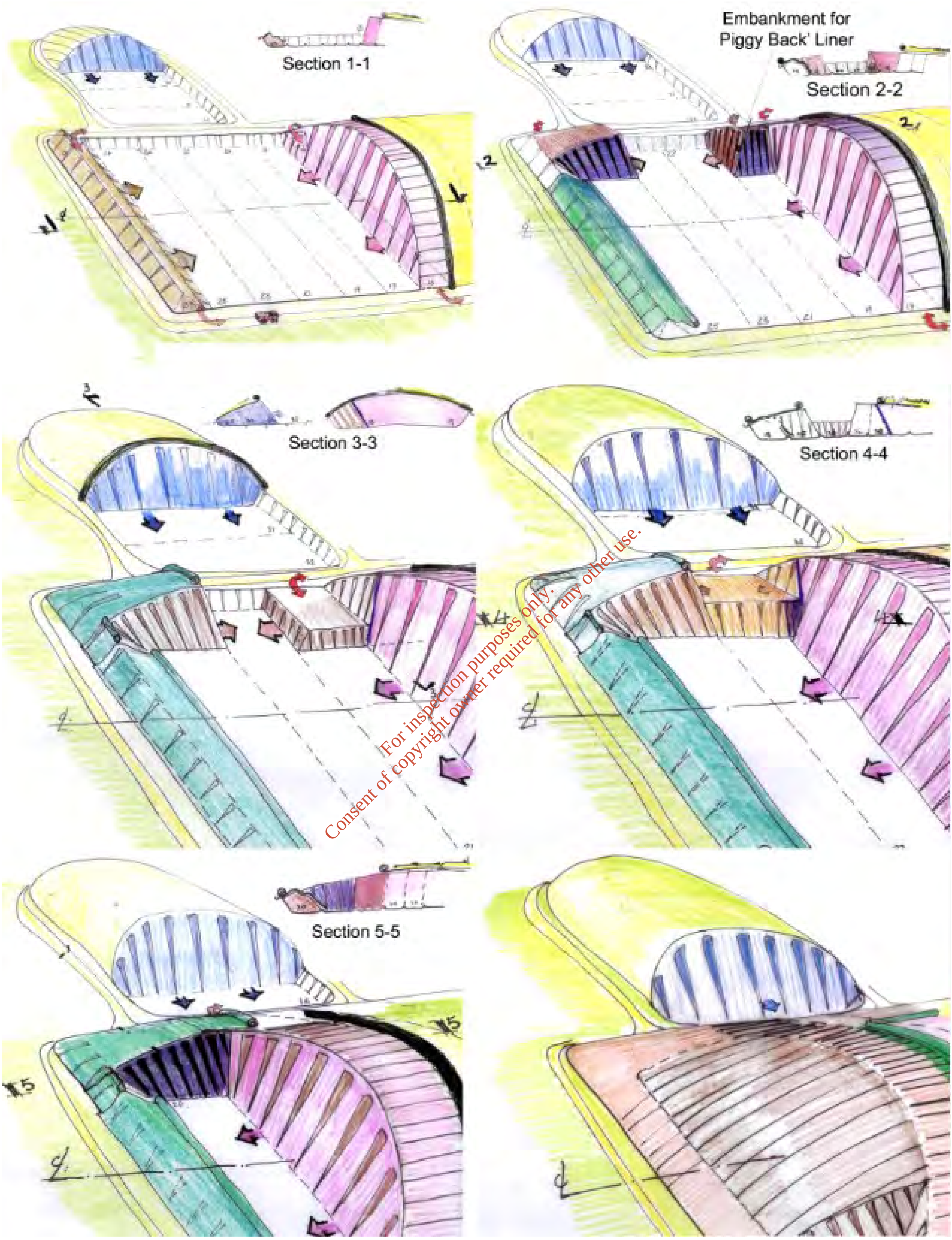


Figure 2-3: Cell Filling Direction Permitted and Proposed Development Footprint

Filling sequence for residual non-stabilised waste

Drawing LW14-821-01-P-0050-010 Proposed Filling Sequence Volume 4 of this EIAR and Figure 2-3 show the filling sequence for the (pink) residual non-stabilised waste. Residual non-stabilised waste will be placed in a south to north direction commencing in cells 17 and 18, reflecting current practice.

Permanent capping will also progress in a south to north direction. There will be one working face within each cell and individual cells or sub cells, will typically be filled in east-west / west-east directions. Filling will typically commence in the low point of cells which will always be adjacent to the perimeter access roads. Whilst the location of the active face on any working day will change it will typically be limited to a width approximately equal to 25 m and the plan and vertical locations will change as filling progresses such that working areas may be placed over one or more cells.

Cells will be subdivided into units approximately 50 m wide by 50 m long to facilitate management of leachate and landfill gas.

To reduce leachate volumes every effort will be made to minimise the working face. Initially rainfall runoff from empty cells (clean) will be directed to the storm water collection system. Once waste is placed in a cell/sub cell rainfall percolation inputs within the cell will be directed to the leachate collection system.

Once the cell floor is covered with waste, operations will be structured to minimise the working face and to place temporary covers on adjacent waste to facilitate management of odour and to isolate the waste body from rainfall inputs to reduce leachate production.

Filling sequence for stabilised and inert waste

The filling sequence for stabilised and inert waste is designed to:

- Reduce leachate volumes – Cell formations will be divided into sub-cells by leachate collection pipework in all cells, approximately 30 m wide by 50 m long, to facilitate isolation of rain falling on empty cells (clean) from rain falling on active cells (leachate). Pipework will be designed to collect, segregate and discharge respective streams to designated outlets (rain to surface water and contaminated rain / leachate to leachate management facility) as required.
- Maximise distance between Face 2 non-stabilised residual waste with gas generation potential and the northern receptors.
- Provide screening for northern receptors by placing stabilised and inert waste in the northern most cells 27 and 28 such that waste placement operations in cells 17 onwards will be screened as waste height in cells 27 and 28 and subsequent cell increases.
- Hermetically isolate the residual non-stabilised (anaerobically landfilled) waste from the aerobic stabilised and inert waste and IBA waste bodies using a LLDPE 'piggy back' liner or similar within cells during waste placement.
- Facilitate future 'piggy back' placement of IBA prior to final capping by placing (inert) material in cells 20, 22, and 24 that will not be subject to the settlement typically associated with MSW.

The filling sequence for stabilised and inert waste, will commence in cells 27 and 28 and fill direction will initially be in a southerly direction. Placement and fill direction of stabilised and inert waste will be subject to material availability and the active face may alternate to a south to north direction subject to finished contours in the adjacent (residual non-stabilised) cells. However only one active face will be open to accept stabilised and inert waste at any one time.

To facilitate a hermetic seal at the interface between the aerobic face and adjacent anaerobic bodies, the stabilised and inert waste needs to form an embankment below and ahead of the advancing active Face 2 (non-stabilised waste). The embankment, see Figure 2-3 Sections 2-2, 3-3 and 4-4 will facilitate installation of an impermeable "piggy back" liner (see green cover, see Figure 2-3, Section 5-5 in advance of non-stabilised waste placement. The "piggy back" liner will be placed within cells 18, 20, 22, 24 and 26.

2.4.3.5 Leachate Balance Permitted Development

The planned intensification will impact leachate production, and this is summarised in Table 2-9. Residual non-stabilised wastes will produce similar flow rates to that being produced at present. The intensified inputs will however reduce the cumulative generation of waste as the cells will be open for shorter periods.

Inert and stabilised waste may produce higher flow rates and higher volumes than residual non-stabilised waste as they will have a lower absorptive capacity and require an additional working face. However, it will be easier to install temporary covers to reduce overall volumes.

The inert and stabilised waste cell will have a lower absorptive capacity that traditional non-stabilised residual wastes and will therefore produce more leachate.

Table 2-9: Predicted Annual Landfill Leachate Generation

Year	Annual Leachate Generation m^3
2017	15,830
2018	10,552
2019	21,811
2020	19,188
2021	26,827
2022	27,531
2023	20,995
2024	28,031
2025	10,838
2026	5,419
2027	2,710
2028	1,355
2029	677
2030	339
2031	169
2032	85
2033	42

2.4.4 Proposed Capping and Restoration Programme

Residual non-stabilised waste temporary capping

As part of ongoing current operations at the site, the active area of the landfill is covered with daily cover. The near-horizontal working platform is being covered with soil and woodchip and the slope of the working face will be covered with synthetic cover sheets at the end of each working day.

Daily soil/woodchip covers will be installed as areas of the landfill reach respective lift heights. These cover systems are used to minimise odour nuisance, facilitate gas extraction, contain litter, discourage scavenging birds and to provide a working platform for vehicles.

Temporary synthetic low-permeability covers (intermediate capping) are installed as areas of the landfill reach full height.

Temporary synthetic covers are designed to facilitate odour control, to minimise leachate generation and to allow differential settlement to occur prior to installing the final landfill cap. These practices will continue for future residual non-stabilised waste inputs.

Stabilised and inert waste temporary capping

Capping systems over in stabilised and inert wastes will adopt similar approaches albeit that odour and landfill gas will not be generated.

Permanent engineered cap

There are no significant proposed changes to the permanent engineered cap makeup that has been and will be placed on the permitted development.

The proposed changes to the capping will comprise:

- an increase in post settlement final cap height from 74 m AOD to 85 m AOD, and
- an increase in cap area to accommodate the proposed IBA development

The final cap makeup will be similar in the permitted and proposed development and subject to EPA approval.

A fully engineered cap will be placed over all wastes within 12 months of wastes reaching the pre-settlement final contours. This cap will comprise an under liner geocomposite for management of gas and/or leachate, a 1 mm fully welded LLDPE liner, sub-surface drainage layer, subsoil layer and topsoil layer. The overall thickness of the soil layers will be 1 m in accordance with the requirements of the licence. Approximately 96,000 m^2 of the existing permitted footprint has been permanently capped at the time of writing and an area of approximately 250,000 m^2 will be capped in the future (anchor trench footprint excluding swales).

The IBA cell footprint discussed in Section 2.5, (excluding wedge infill), will be approximately 58,000 m^2. The final cap footprint for the permitted and proposed development to the anchor trench will be approximately 390,000 m^2.

Surface drainage swale outfalls will convey storm runoff from the permanent cap to either the existing storm water attenuation pond on the southern boundary or to the proposed surface water attenuation outfall on the north-eastern boundary of the site (refer to Section 2.8).

Future permanent capping will continue on a phased basis as described above. Landscaping on the cap will comprise an amenity grassland mix. Following completion of the cap, the landfill will enter the aftercare phase, which will be undertaken in accordance with the conditions of the licence.

2.5 Proposed IBA Facility Development

2.5.1 Introduction

It is proposed to develop five dedicated cells (no. 29 through no. 33) for the acceptance and placement of IBA material only, directly to the east of the permitted facility footprint and directly north of the site accommodation and weighbridge. Cell 33 is termed the ‘wedge’ as it sits at the interface between the existing landfill and the proposed IBA area. The location of the IBA facility is shown in Drawing No. LW14-821-01-P-0000-003 Proposed Site Layout. The “wedge” cell 33 is not shown on the proposed layout drawing as it will be created post filling of cells, 20, 22, 24 and 32. The proposed IBA facility design will facilitate its future recovery.

IBA will be delivered to site over the existing facility weighbridge and directed to these cells where it will be placed.

The dedicated IBA cells will tie into adjacent filled cells 20, 22 & 24 of the current permitted footprint and the final capping profile will cover all wastes within both types of cells with no evident visual delineation when viewed externally. The cap makeup will be identical.

IBA leachate will be collected from the IBA storage cells, passed through temporary localised suspended solids lagoons to mitigate the risk of solids blocking pipes and managed as described in Section 2.7.

This section includes the following:

- Overview of IBA Landfilling
- Cell design, Construction and Phasing
- IBA Acceptance
- Overview of IBA Landfill Operations
    - IBA Cell layout
    - IBA Filling Sequence
    - Weathering
    - Placement, Working Face, Covers
    - Management of Surface water runoff
    - Management of Leachate
    - Management of Hydrogen
    - Management of Temperature
    - Management of Dust
    - Management of Noise
    - Future 'Winning' of IBA

2.5.2 Overview of IBA Placement

The landfilling of IBA in its own dedicated cells as a 'monofill' introduces specific issues that are not realised in the landfilling of other materials, such as non-stabilised residual (MSW) waste. To inform the design and operational considerations of the proposed IBA cells, a review of available literature sources related to the landfilling of MSW IBA residues was carried out to identify issues to be considered and addressed.

2.5.3 Cell Design, Void & Construction

2.5.3.1 Cell Design

The proposed IBA cells will be constructed using a 1.0 m composite barrier system comprising an under-liner drainage system to control groundwater, 1.0 m clay (permeability of 1 $x10^{-9}$ m/s) or equivalent (bentonite enhanced geocomposites or similar), overlain with a 2.0 mm thick HDPE drainage liner. A 500 mm drainage stone layer will be placed above the HDPE barrier within which will be collection pipework to facilitate leachate removal. Side slopes will also be overlain with a protection geo-composite and/or drainage stone to protect the liner during waste placement and to facilitate collection and controlled passive venting of hydrogen gas (described below).

The proposed IBA cell HDPE liner formation, whilst being connected to the existing waste cell development at the anchor trench interface, will be isolated hermetically from those adjacent landfill cells.

Isolation will occur within the adjacent landfill development in:

- cells 20, 22 and 24 as shown in Figure 2.4 Section 5 illustrating the 'piggy back' liner isolating inert soils from the adjacent anaerobic waste; and
- within the IBA 'wedge' infill (cell 33) isolating IBA leachate from the underlying inert soils.

Leachate and hydrogen gas produced within the IBA cell will be managed by independent collection systems.

IBA waste undergoes an exothermic weathering process during which time significant heat is generated and hydrogen and carbon dioxide gases are emitted. Weathering will typically be accommodated under cover within a dedicated weathering area within the IBA cells (described in more detail in sections following).

Figure 2-5 illustrates the proposed IBA cell footprint and provides an indicative section through the IBA cells.

The blue lines in the IBA cell show locations of recessed drainage pipework within the drainage layer at the base of the cell.

2.5.3.2 Cell Construction

Cells 29 and 32 will be constructed as a single entity to facilitate weathering, landfilling and future recovery/winning of IBA, as may be required. As the cells approach capacity, Cell 33 will be the last IBA cell to be constructed prior to filling in the remaining void to raise the landfill to its final finished planning contour height of 85 m AOD and will tie into the final cap on the adjacent cells. Cell 33 is termed the 'wedge' and is the lined 'cell' connection between the IBA cells and the MSW cells.

Cells 29 through 32 within the IBA footprint will be approximately 225 m long and 48 m wide and will be further subdivided in the base by leachate collection pipework such that each sub cell will be approximately 24 m wide (see Drawing No. LW14-821-01-050-006 IBA Cell Layout and Leachate Pipework in Volume 3 of this EIAR).

The 2D plan footprint of the IBA landfill including wedge infill (cells 29 through 33) will be approximately 81,000 m^2.

The 2D plan footprint of the IBA landfill excluding wedge infill (cells 29 through 32) will be approximately 57,829 m^2.

2.5.3.3 IBA Void Capacity

Void capacity will be subject to the need or otherwise to 'win' material as discussed in 2.3.3. If winning is implemented the 'wedge' infill may not be capped, or capping may be deferred. Accordingly, indicative voids are presented below for two scenarios:

- Cells 29 through 32 (excluding wedge infill); and
- Cells 29 through 33 (including wedge infill)

The void capacity of cells 29 through 32 (excluding 'wedge' infill) to be 645,331 m^3. Assuming a density of 1.6 t/m^3 this equates to 1,032,530 tonnes.

The void capacity of the "wedge" infill will be will be 245,112 m^3. Assuming a density of 1.6 t/m^3 this equates to 392,179 tonnes.

Total estimated capacity for IBA is 1,424,709 tonnes.

2.5.3.4 Engineered Cap

A fully engineered cap will be placed over waste once final contours have been reached in accordance with the licence. This cap will comprise an under liner geocomposite for management of gas and or leachate, a 1 mm fully welded LLDPE liner, sub-surface drainage layer, subsoil layer and topsoil layer. The overall thickness of the soil layers will be 1 m in accordance with the requirements of the licence. Surface drainage swale outfalls will convey storm runoff either to the storm water attenuation pond on the southern boundary or to the proposed surface water attenuation outfall on the north-eastern boundary.

As with cells 17 to 28, future permanent capping will continue on a phased basis and landscaping on the cap will comprise an amenity grassland mix. Following completion of the 1.0 m cap, the landfill will enter the aftercare phase.

2.5.3.5 Screening Berms

Screening berms on the eastern and northern boundaries of the IBA cells (see Drawing Nos. LW14-821-01-P-000-003 Proposed Site Layout and Cut Fill Phasing Plan LW14-821-01-P-0050-011 in Volume 4 of this EIAR), will be constructed using overburden from the cell excavation. The berms will mitigate visual and noise impacts associated with landfill related operations on sensitive receptors on these boundaries.

2.5.4 Access and Traffic Control

2.5.4.1 Access & Traffic Control

Access to the IBA cells will be via a new access road to the north of the existing site accommodation, with traffic being directed there from the existing site weighbridge. Vehicles delivering IBA will utilise the existing private entrance road to Knockharley Landfill and existing weighbridge, prior to travelling to the dedicated cells. All waste vehicles entering and exiting the facility must pass over the weighbridge. Appropriate signage will direct waste vehicles to delivery locations.

2.5.4.2 Acceptance

Incoming incinerator bottom ash (IBA) will be transported to the site in articulated covered trailers and following acceptance at the existing facility weighbridge, will be directed to the IBA facility. Upon arrival at the IBA facility, the delivery truck will be directed either to the weathering storage area or to the IBA working face, as appropriate.

2.5.4.3 Site Access

Access to the weathering area and to the IBA working face will be via surfaced perimeter roads. In addition to the perimeter road surrounding the IBA cells, there will be a concrete road in the middle of the weathering area to facilitate unloading of articulated delivery trucks and loading of weathered IBA onto site vehicles. Within the IBA (Areas 1 through 4) the IBA material formation will always be compacted prior to vehicular trafficking to facilitate safe vehicle movements and vehicle tipping.

2.5.4.4 Inspections

Incoming materials following acceptance at the weighbridge, be they deposited in the weathering area or at the working face will be tipped, levelled and visually inspected for the presence of non-conforming materials i.e. non-IBA materials, unburnt organic fractions, large size materials which, if identified, will be removed and temporarily stored in the dedicated quarantine area and then consigned off site for appropriate management, or for landfilling within cells 23 to 28 of the existing landfill, assuming that it conforms with relevant landfill acceptance criteria.

2.5.4.5 One-way system

Vehicles will travel using a one-way system albeit that flow directions will change subject to stockpile movements in the weathering area and placement methodologies.

Incoming articulated vehicles after exiting the weighbridge will turn left into the IBA facility, tip their loads and exit the site in an anticlockwise direction via a dedicated wheel wash before exiting the site via the weighbridge (see Figure 2-4).

Site vehicles will take weathered IBA from respective stockpiles and access the cells in a clockwise direction.

Vehicles will drive over previously tipped and compacted materials and tip the load on a compacted formation. Thereafter vehicles will drive out in a clockwise direction and return to the weathering area for re-loading.

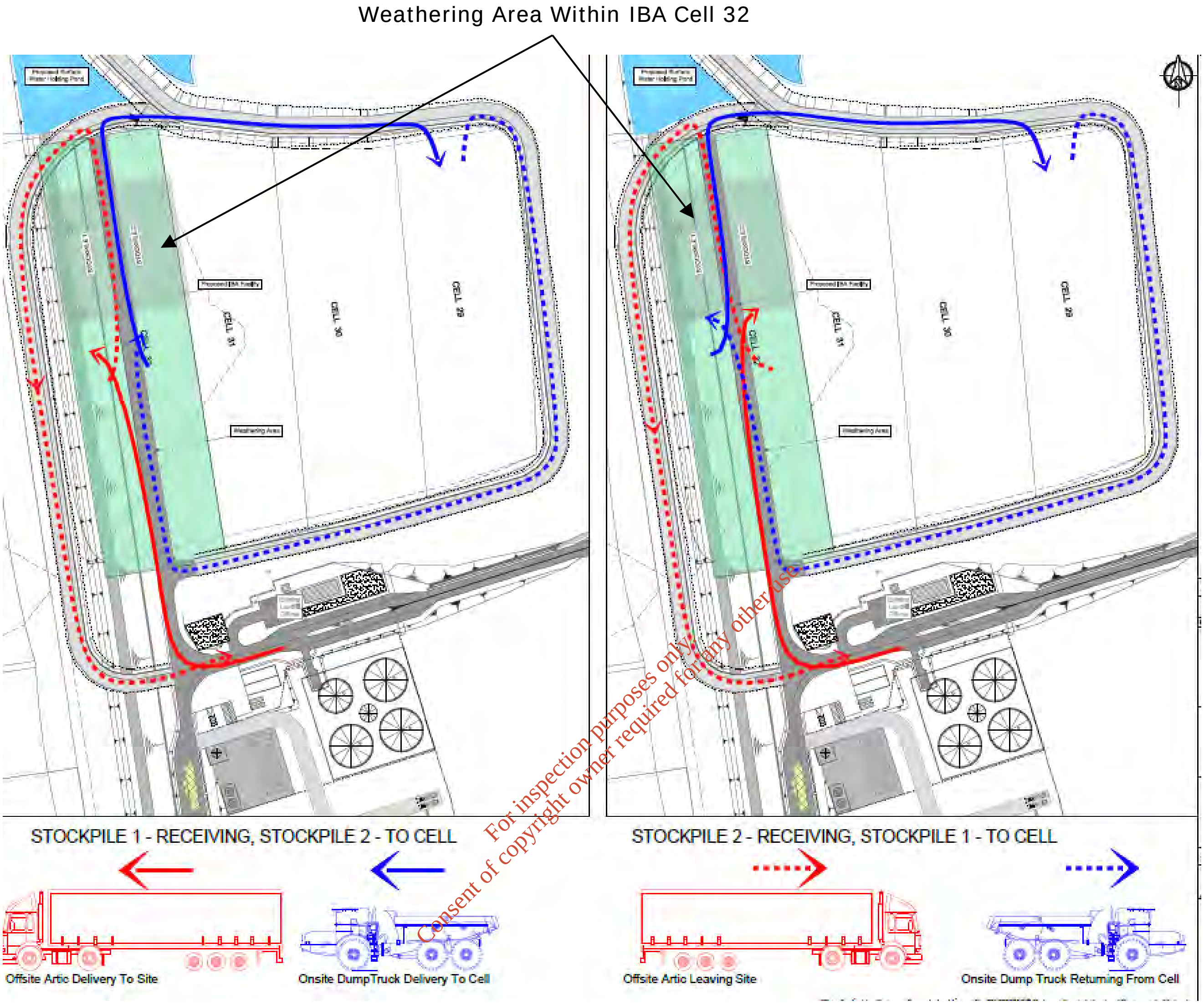


Figure 2-4: Traffic Movements

2.5.5 IBA Area Operations

2.5.5.1 IBA Cell Layout

Figure 2-5 presents an aerial overview of the proposed IBA cell footprint encompassing cells 29 through 32. The cell footprint will be divided into four distinct areas during the operational period, which will vary in size and shape depending on the rate at which the cells are filled and if recovery operations are to be implemented in the future.

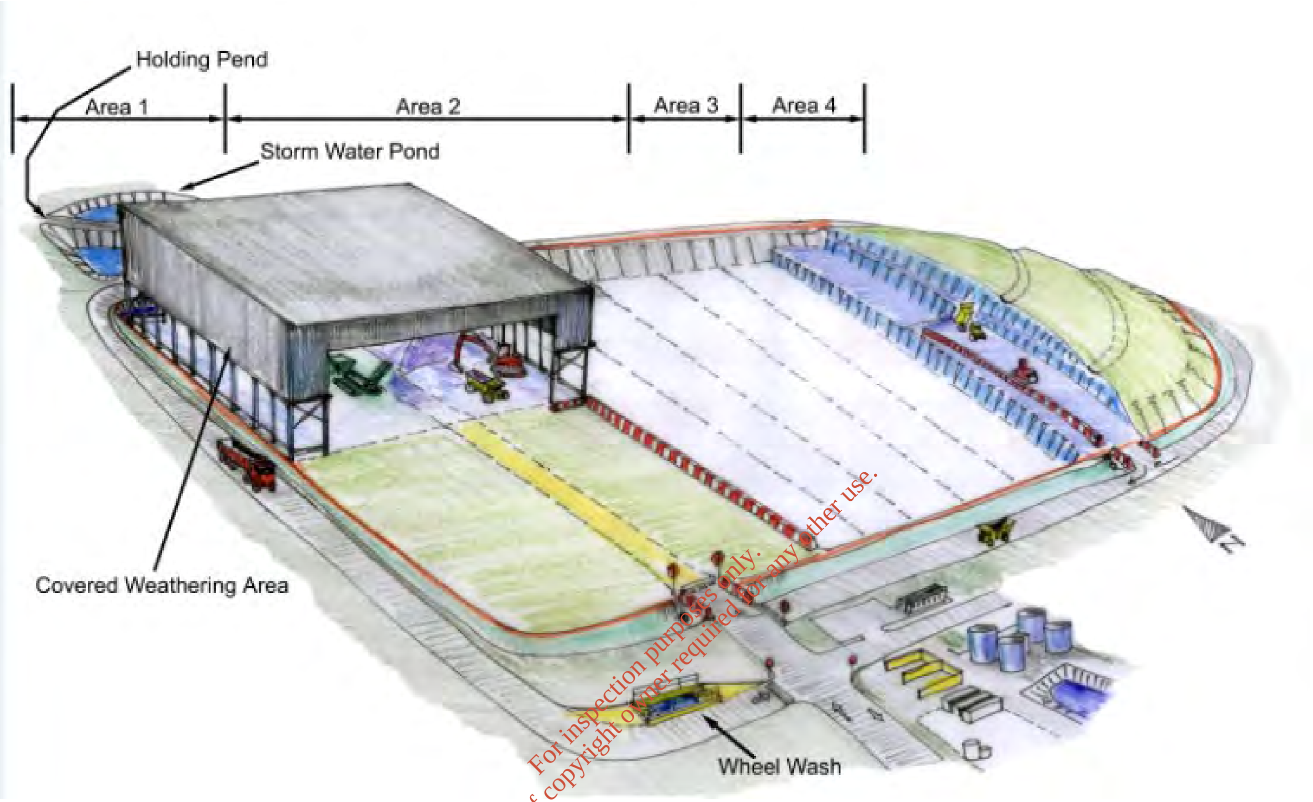


Figure 2-5: IBA Operational Layout (View from Southwest)

Area 1

Area 1 (overlying cell 32) will be assigned to weathering of IBA prior to placement and will provide a covered weathering footprint of approximately 5,776 m^2 (76 m x 76 m). It will comprise a central access reinforced concrete formation route to facilitate access to 2 no. stockpiles. Both stockpiles within Area 1 will each have sufficient capacity to accommodate up to 3 months of IBA acceptance (c. 37,500 tonnes) and temporary storage so that an appropriate weathering period is provided for. Incoming IBA material will be tipped at the relevant stockpile location and placed in the stockpile using a front-end loading shovel. The stockpiling process will facilitate turning of the IBA material during the weathering period, as required.

The building will be a single span structure with roof and side wall ventilation. Its primary objective will be to minimise leachate production and reduce dust and noise impact on adjacent receptors.

The building may also facilitate recovery trials which may include metal recovery, crushing, screening, and washing of IBA.

If an additional weathering footprint is required, the footprint Area 1 will be extended.

In the northern end of Area 1, (see Figure 2.9) the temporary settlement ponds will attenuate IBA leachate and facilitate settlement of suspended solids to mitigate the risk of solids blocking leachate pipework.

A pump sider riser sump in this temporary settlement pond location will pump leachate generated in Area 1 to a holding tank/lagoon in the Leachate Management Facility for treatment and/or tankering offsite to a wastewater treatment facility, as described in Section 2.7.

To mitigate the risk of high pH liquids causing injury to humans, mammals or other the leachate from the weathering area collected from below the weathering building will be directed to the side riser adjacent to the settlement pond and will be pumped via a sealed settlement unit as with all other IBA cell side risers to the leachate management facility and the open water surfaces of the pond will be covered with netting and / or floating covers.

Area 2

Area 2 illustrates the empty cells that initially will have no IBA in place but will accept IBA as the working face develops from the east. Until waste is placed in Area 2, runoff from this area will be considered as clean surface water and directed for discharge via surface water swales (refer to Section 2.8).

Area 2 will be developed progressively subject to IBA inputs.

Area 3

Area 3 illustrates the active area where IBA will be progressively placed. Placement of IBA will occur in 'lifts' of c. 500 mm, in a north-south direction in the respective cells. The filled IBA footprint will progress incrementally from the east to west as respective lifts are developed.

Area 4

Area 4 illustrates IBA with temporary or permanent capping in place. As the area is filled progressively from east to west, temporary sealing/covers and permanent covers will be installed to prevent rainfall ingress to mitigate leachate generation.

Cell formation for the proposed IBA cells will be recessed below original ground level to facilitate below ground containment of leachate. Drainage within the cells will further sub-divide cells to facilitate segregation of clean rainfall runoff and leachates of differing quality. Cell design will be carried out in accordance with guidelines defined in the EU Landfill Directive for non-hazardous cells and the Environmental Protection Agency Landfill Site Design Manual.

2.5.5.2 IBA Filling Sequence

Cell filling will start in cell 29 and progress in a westerly direction through cells 29, 30, 31, 32 and 33.

Figure 2-6 illustrates a section east to west through the IBA footprint above cells 29 and 30 illustrating the filling sequence of respective lifts. Lifts 1 through 4 will be in Cell 29 and will be filled in the first year of IBA acceptance.

Placement of IBA materials will be such that cell 29 will provide supplemental screening to existing perimeter screening berms for works in Cell 30. Similarly, Cell 30 works will provide screening to Cell 31 and Cell 31 works will provide screening for Cells 32 and 33.

The interface between the permitted development will be Cell 33 in the proposed IBA cell development i.e. the 'wedge'.

This is shown in Figure 2.7. To the west in the permitted landfill to facilitate this interface stabilised inert materials will be landfilled under aerobic conditions. Cells 29 through 33 will be landfilled under aerobic conditions where the hydrogen gas will be allowed to vent passively to atmosphere.

Respective waste faces will be typically 24 m wide and will extend approximately 250 m in length (north to south).

Lifts illustrated in Figure 2-6 are approximately 4.0 m high albeit that during operations actual placement lift height will be limited to 2.0 m at any one time. IBA will be installed to grade within each lift in 'mini' lifts 500 mm thickness and compacted thereafter.

Figure 2-6 illustrates how respective operational lifts will be placed. Each lift shown below will be typically 4.0 m deep, 24 m wide and approximately 225 m long and the respective lifts will accommodate approximately 35,000 t of IBA and take approximately 3 months to place assuming an intake of 150,000 t annually.

Figure 2-6 shows that lifts through 16 once placed, will be permanently capped such that these will act as a supplemental screening and noise berm for subsequent works in adjacent areas.

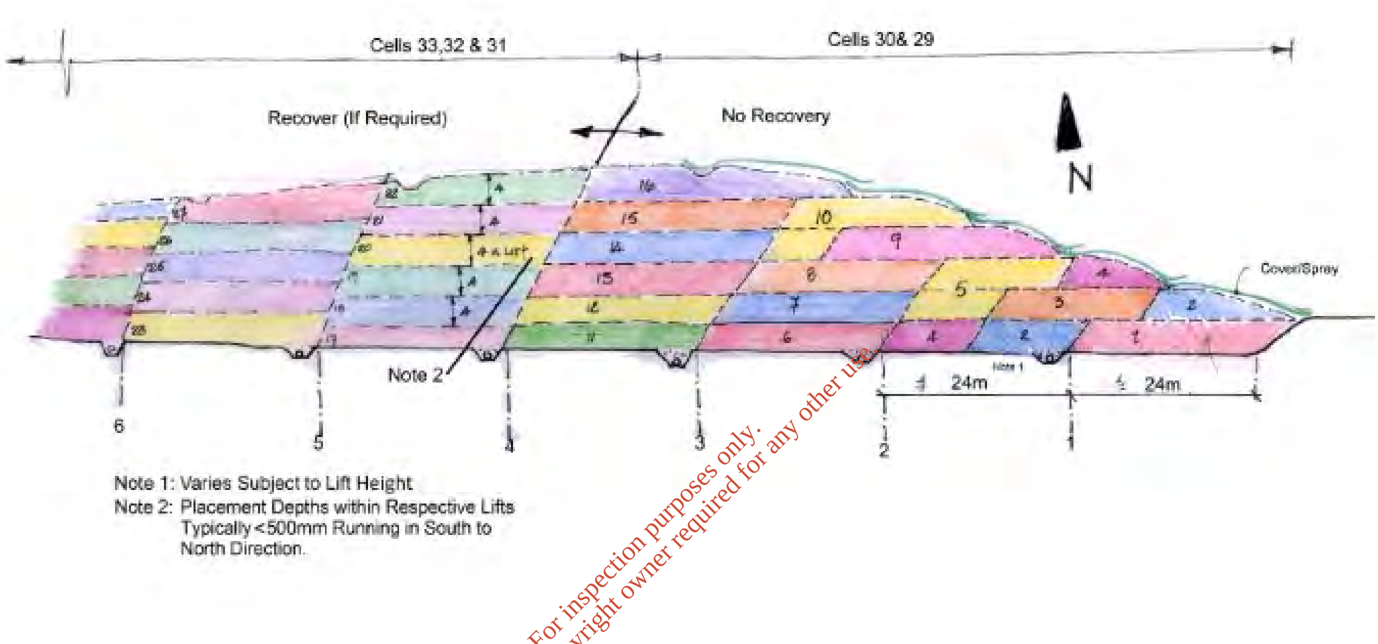


Figure 2-6: IBA Sectional Filling Sequences

Cell 33 "Wedge" infill will be the last cell to be filled See Figure 2.7 below:

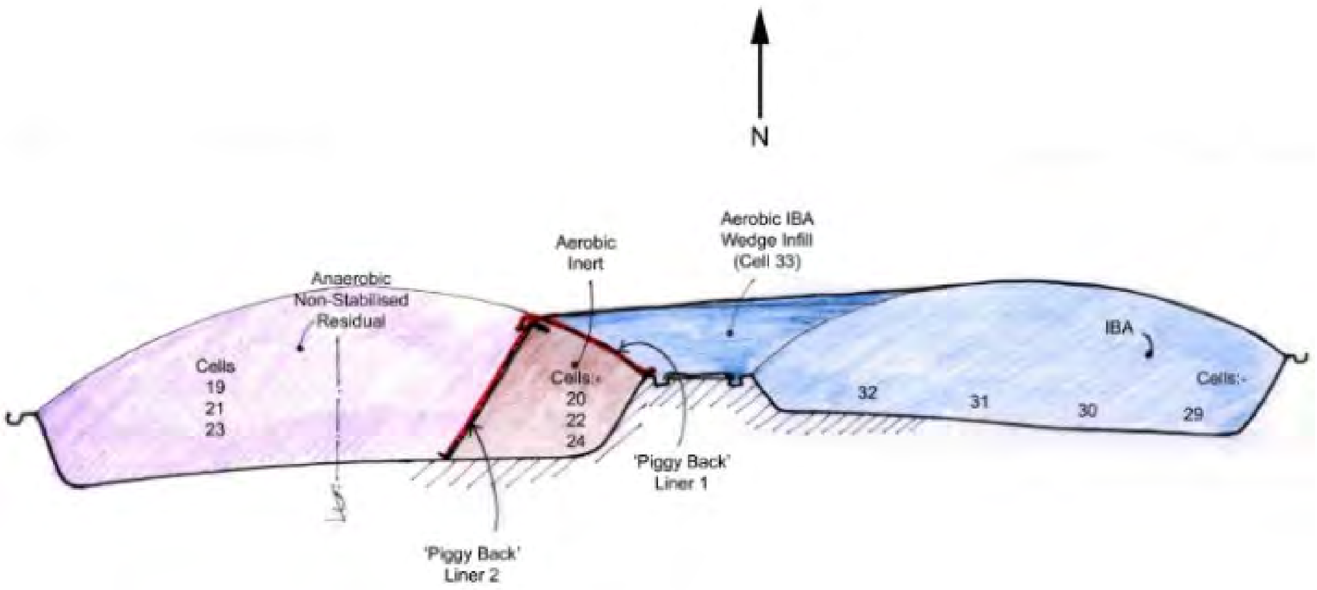


Figure 2-7: Section through Cell 33 "Wedge"

2.5.5.3 Weathering

Section 2.5.2 referenced weathering as being a process whereby silica, calcium, aluminium and sulphate minerals along with heavy metals in the presence of carbon dioxide and water undergo complex physio chemical carbonation (and other) processes.

To understand the operational impacts associated with placement of IBA, this section describes weathering with respect to the pH characteristics of leachate. There are three major stages in weathering that can be identified by the pH characteristics of the IBA and / or leachate. Stage 1 weathering will occur at the incinerator. Operations at Knockharley will accommodate weathering Stages 2 and 3 within the IBA landfill footprint.

Stage 1 will occur when un-weathered IBA leaves the combustion chamber prior to quenching. Typically, IBA will have a pH > 12 in this uncarbonated phase. It will be quenched at the incinerator and thereafter it will be transported to a processing plant for the removal of metals or to processing equipment at the landfill for a similar metals removal process. IBA received at the facility will be in covered trailers.

Stage 2 weathering will occur following placement of IBA in the IBA cells within the dedicated weathering area 1 as shown in Figure 2.6 (or within cells subject to location) over a period of 3 months or more during which time the IBA will become carbonated following exposure to water and carbon dioxide. During this stage of the weathering process, hydrogen gas will be produced, and exothermic reactions may cause elevated temperatures. Hydrogen is potentially explosive between 4% and 75% by volume of air in the presence of an ignition source. The building will have no gables, perforated side sheeting will terminate 6.0 m above ground level and the roof will have ventilation provision to facilitate a well-ventilated space to mitigate the risk of explosive conditions developing.

Specific design and operational practices will be put in place to manage safe venting of hydrogen to atmosphere and to mitigate the risk of high temperatures damaging the HDPE liner of the cell. During this weathering process the pH of leachate will reduce and will be typically < 10.5. During placement, dust will be managed to mitigate potential impacts.

The IBA will be moist when tipped but wind will dry out the surface and therefore dust mitigation measures will be required on an ongoing basis/as part of standard operation procedures in the IBA area.

Stage 3 the final stage of weathering, will occur following placement in cells over many years during which time the pH of leachate from carbonated IBA will typically stabilise between 8 and 8.5. Nominal volumes of hydrogen may also be produced and design provision in the engineered cap and within the IBA body will facilitate safe venting of hydrogen to atmosphere.

Placement operations will therefore be designed to:

- prevent liner damaged from elevated temperatures
- mitigate the uncontrolled release of hydrogen
- Isolate high pH leachate in the weathering area and in dedicated tanks within the leachate management facility
- facilitate weathering

2.5.5.4 Placement Criteria

Operational procedures will be developed to mitigate the risk of elevated temperatures damaging the basal liner system. Typically, Area 1 within the IBA cells will provide for a c. 3-month weathering process prior to placement of IBA within the designated cells.

For subsequent placement of IBA within cells in the lifts illustrated in Figure 2-6, for heights exceeding 2.0 m, Stage 2 weathering of IBA material will need to have occurred within the dedicated weathering Area 1.

Whilst the majority of IBA will undergo Stage 2 weathering in within Area 1 under cover as previously described, weathering may also be facilitated through direct placement with the cells subject to location and prescribed operational criteria. These criteria will require (but not be limited to) presence of a weathered formation layer above the liner (acting as an insulator) with evidence of falling temperatures and sufficient time to allow weathering to occur (> 3 months) prior to subsequent lifts or liners being placed.

2.5.5.5 Placement of IBA in Cells

The first lift in contact with the cell formation will vary between 1.0 m and 2.0 m depth above the liner. This initial lift will be placed to protect the liner, as it will provide both a 'thermal blanket' and a physical barrier. This first layer will also form a tipping platform for subsequent landfill operations.

The lift height of 4.0 m presented in Figure 2-6 was selected to illustrate the lift thickness required to accommodate 3 months of waste inputs. It is not a prescriptive requirement and during operations, lifts are unlikely to exceed 2.0 m and will be subject to operational considerations. The placement of materials will start on the eastern boundary in Cell 29 and respective placement lifts will result in the development of the landfill body.

IBA materials will be placed over large plan areas in vertical lifts within the active placement area.

IBA within respective lifts will be placed in layers not exceeding 500 mm in height, graded to form a smooth finish with falls to facilitate surface water management and compacted to 90 % proctor maximum dry density to facilitate safe tipping of trailers.

Articulated trailers or dump trucks (Volvo A40 or similar) will drive onto the working face, tip in a controlled manner and exit in a one-way system.

The tipped materials will be graded using proprietary equipment (e.g. 20 tonne 360 excavator or grader Cat 120k or paver Barber Green BG-260D or similar), inspected for signs of contamination and compacted using a vibrating roller (Bomag single drum or similar).

2.5.5.6 Management of Surface Water Runoff

Once IBA materials are placed, surface water management procedures will facilitate surface water runoff to minimise rain water infiltration and subsequent leachate generation.

The surface water management procedures include a combination of temporary covers, dust suppression sprays and permanent capping will be progressively installed. These practices will also mitigate potential dust impacts.

Following placement of IBA, temporary impermeable covers or sprays[7] will shed runoff into horizontal contoured swales (see Figure 2-8) which will be formed within the final capping profile.

Leachate (light green area in Figure 2-8), will be directed to the active face. Clean surface water (from dark green areas in Figure 2.10) will be directed to a new surface water holding pond immediately upstream of the new northern storm water attenuation lagoon.

Water from the new surface water holding pond outfall will, subject to quality, be:

- used for dust suppression
- discharged to receiving waters via the new storm water attenuation lagoon
- directed to the on-site floating cover storage prior to transfer off-site to a wastewater treatment facility.

Further detail on proposed surface water management is outlined in Section 2.8.

Figure 2-8 illustrates two swales on a cap that has reached its final height. The lower swales have sandbags or similar placed at outfall to prevent runoff entering the cell. The upper swale illustrates with no sand bags shows how swale runoff can be directed into the cell.

[7] Numerous products are available e.g. Posi-Clear Dust Control http://www.lscenv.com/dust-control-pg.html, or similar

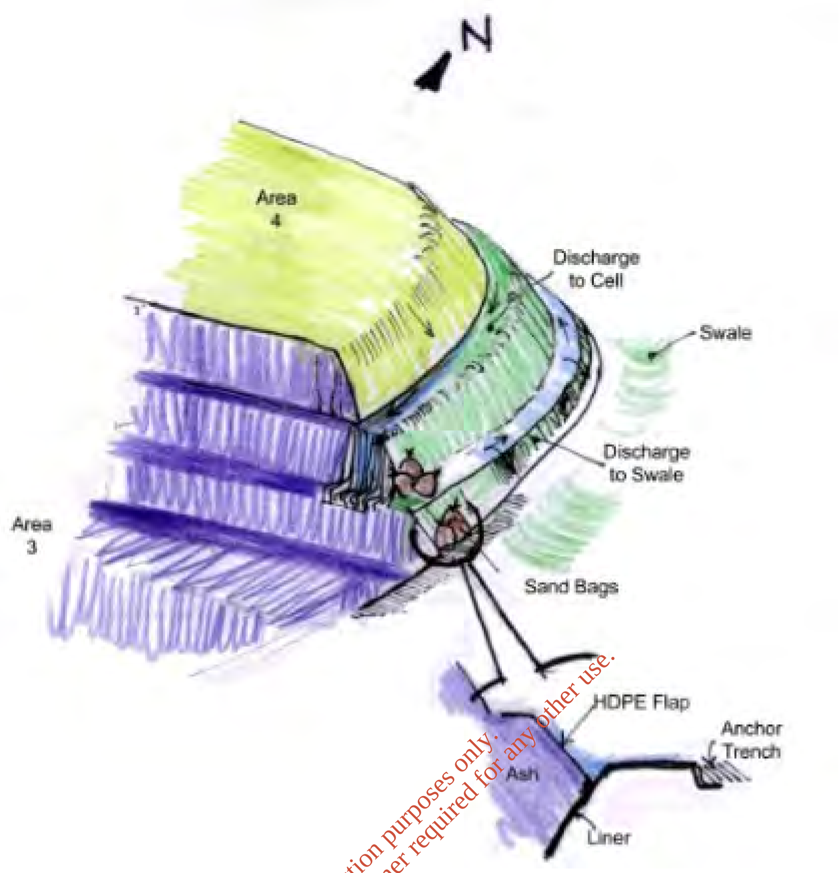


Figure 2-8: Surface Water Management (Intermediate Cap)

Note: Leachate – from light green area. Clean surface water – dark green from capped/sealed area. Purple illustrates – IBA.

2.5.5.7 Management of Leachate During and Post IBA Placement

With reference to Figure 2-5, leachate from the IBA landfilling operations will develop from the following sources:

- weathering stockpiles in 'Area 1'
- IBA placed within cells ('Areas 2, 3 and 4') i.e. from active face

Leachates with differing pH will be produced within the IBA cell footprint. pH will vary according to source location and extent of weathering. A pH of up to 12 can be expected from the weathering Area 1. Over the weathering process the pH of leachate in Areas 2, 3 and 4 will reduce to approximately 8. When the IBA is placed in layers in Areas 1 through 4, the 'strength 'of leachate generated (in terms of contaminants such as salts and heavy metals) will also vary, with a more concentrated leachate expected from Area 1 and a minimally contaminated leachate generated during placement expected in Areas 2, 3 and 4.

To facilitate targeted and cost-effective treatment, leachate streams from respective sources will be collected and managed separately, prior to treatment on site and/or tankering off-site to a wastewater treatment facility.

The leachate treatment methodology is described in detail in Section 2.7. The following sections describe the handling philosophy required within respective areas.

Area 1

All leachate from the IBA weathering Area 1 will be collected from the basal stone drainage and from surface runoff in perimeter edge drains which will direct leachate to a temporary settlement pond located on the northern boundary of Cell 32.

Figure 2-9 over shows the layout of the settlement pond and weir. Solid materials within runoff from Area 1 will settle by gravity within the pond and will be retained behind a weir. Leachate will pass over the weir into an adjacent side riser pump sump (not shown in Figure) and from there to onsite storage tanks via a pumped rising main.

The settlement pond will be de-sludged as required during operations. De-sludged material will be placed within the Area 2, 3 or 4.

Netting and/or floating covers to prevent mammals drinking contaminated storm water have been omitted for clarity.

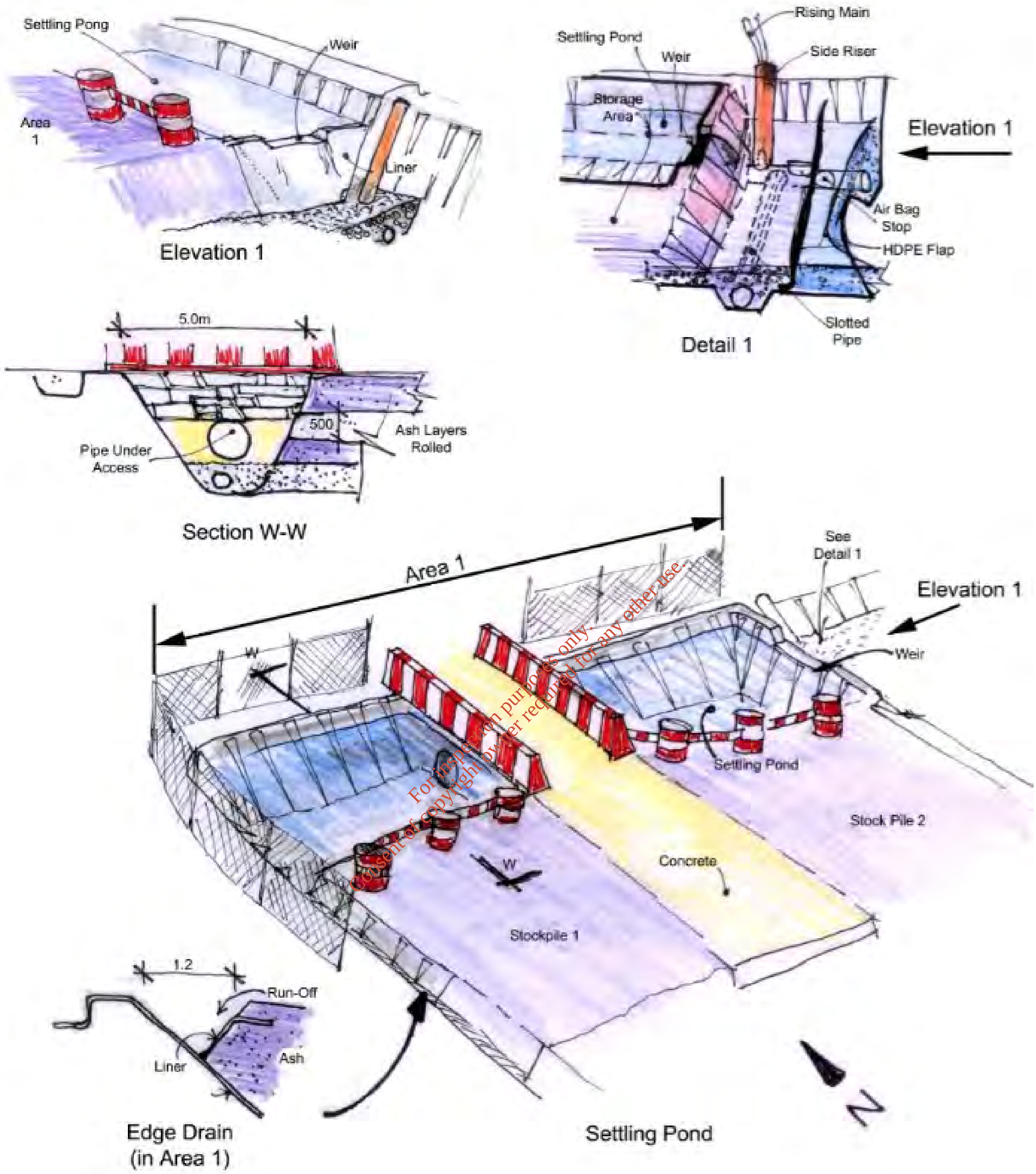


Figure 2-9: Weathering Area Leachate Management

Areas 2, 3 and 4

Leachate generated within active areas 2, 3 and 4, and will be collected within the cell drainage layer and pumped via a rising main to a small sedimentation tank (see settling pond in Drawing No. LW14-821-01-P-0050-006 in Volume 4 of this EIAR) to remove suspended solids before being pumped to covered attenuation leachate storage tanks. On-site attenuation storage will be sufficient to manage at least 1-month of leachate production.

2.5.5.8 Management of Storm Water Runoff

The proposed storm water outfall system on the northern boundary will comprise two storm water lagoons, a holding pond and an attenuation lagoon.

All surface water from the IBA cells will be directed to a holding pond immediately upstream of the northern attenuation lagoon. Continuous monitoring of TOC and Electrical Conductivity will be carried out. If runoff is clean it will be directed to the northern attenuation storm water lagoon. If runoff is contaminated an automated motorised valve will isolate the holding pond from northern attenuation stormwater lagoon and contaminated runoff will be pumped to covered leachate lagoons within the leachate management facility (see Section 2.7). Holding pond and covered attenuation storage within the leachate management facility will be sufficient to manage at least 1-month of surface runoff. Water as may be present in the storm water attenuation or holding ponds may also be used for dust suppression or wetting of IBA as may be required to facilitate weathering.

2.5.5.9 Water Balance IBA Development

Leachate generation from IBA cells will be impacted significantly by the weathering area, and active, open area of which will typically be similar year on year.

In addition, as IBA waste reaches a finished level temporary covers or final cap will be installed to isolate rainfall inputs from the IBA waste body.

Table 2-10 is an estimate of the annual water balance for the IBA area.

Table 2-10: Annual Water Balance for IBA Development

Location	Annual Volumes (m^3)	pH	Comments
IBA Weathering	4,156	12	Assume 5% rainfall (roofed area)
Clean runoff	38,447	7	Storm water
IBA active face	10,067	8 to 10	Assume 250 m x 350 m
Temporary capping	15,901	7	Storm water
Permanent capping	15,901	7	Storm water
Recovery	38,447	8	Not applicable
WWTP	**14,223**		**Estimated WWTP capacity required**

2.5.5.10 Management of Hydrogen Gas

As previously identified, hydrogen gas production is a by-product of IBA weathering, with peak gas production expected to occur within 3 to 4 months following receipt of IBA on-site. Thereafter, research shows that hydrogen gas production declines rapidly over 12 or more months.

Hydrogen is not detrimental to the environment and is not considered a greenhouse gas.

The following design and operational procedures will facilitate safe venting of hydrogen to the atmosphere during weathering, waste placement and post capping and will mitigate the risk explosion.

- All pumps and control equipment in confined spaces will be EX rated.
- Pipes within the leachate stone drainage layer will have vented rodding eyes and operations will maintain free draining conditions within the stone drainage layer to facilitate passive venting from same.
- Leachate drainage pipework will at high points terminate in a collector pipe linked to a vertical riser that will facilitate egress of hydrogen at a fenced point source 5.0 m above the surrounding ground level (during operations and post final capping).
- Horizontal slotted gas pipe will be placed at horizontal spacings no greater than 40 m and at staggered vertical lifts no greater than 12.0 m spacing. This will facilitate egress of gas produced at depth within the IBA material.
- Hydrogen gas produced during weathering, be it in the dedicated weathering Area 1 or in Area 3 cells, will naturally vent to atmosphere via surface emissions, during turning and placement and from dedicated piped point sources within placed material.
- Hydrogen gas produced from capped material in Area 4 will be vented to atmosphere from dedicated outlets at the top of the landfill
- Temporary covers and or spray products will be used with passive venting systems to mitigate leachate production and facilitate passive venting of hydrogen.
- Potential future extraction of IBA, if carried out, (refer to Section 2.5.6 following) will require appropriate method statements to facilitate working practices where hydrogen may be present.

2.5.5.11 Management of Potential Temperature Impacts During IBA Placement

Peak temperatures will develop during the initial weathering in Area 1 or within active areas if weathered in situ and appropriate measures will be employed to prevent any potential damage to the HDPE liner.

The following operational procedures will be implemented to mitigate the risk of elevated temperatures compromising the full life cell liner integrity during the IBA weathering period of approximately 3 months:

- Initial IBA placement in the weathering Area 1 will be used to form a level and stable platform atop a thermal blanket prior to stockpiling activities. Placement will be limited to less than 2.0 m above the stone drainage layer to facilitate weathering for a period not less than 3 months. During this initial weathering process the heat will be encouraged to dissipate via surface emissions to atmosphere. Such heat and hydrogen as may develop within the stone drainage layer will be removed either passively in the case of air or pumped in the case of leachate being present. Following weathering this layer will also provide a thermal barrier between liner and subsequent IBA lifts.
- IBA stockpiles above the previously described platform will be limited to 6.0 m if placed on a dedicated weathering location in Area 1.
- IBA lifts of weathered materials in adjacent areas will be placed in mini lifts of 500 mm to facilitate trafficking and a maximum lift 2.0m in one operational pass to mitigate the risk of vehicles overturning over steep embankments. This will also facilitate dissipation of heat.
- Subject to Agency approval, the basal HDPE liner under the weathering slab will be protected against elevated temperatures below the leachate stone drainage layer by:
    - A thermal protection barrier in contact with the HDPE liner, and/or
    - a permeable stone drainage layer below the weathering formation to remove heat and/or hydrogen via passive or pumped venting, and/or
    - a saturated drainage layer and pumping system designed to facilitate heat exchange.
- If weathering is being carried out in cells, respective 2.0 m lifts shall be left in place for a minimum period of 3 months.
- All weathering and landfill placement works will be subject to site specific method statements.

2.5.5.12 Management of Potential Dust Generation During IBA Placement

There is potential for dust impact in the absence of mitigation measures. Dust will be managed using a combination of the following:

- dust suppression using water
- dust suppression spray (will also make surface impermeable to shed surface runoff)
- temporary covers to shed surface runoff

Weathering Area 1

IBA tipped in within the weathering area (building) will be in stockpiles < 6.0 m high and materials will be subject to subsequent moving operations using front end loaders, 360º excavators or similar. IBA in these areas will be kept moist using overhead sprinkler systems or similar.

Active cell Areas 2, 3 and 4

Dust production during placement of IBA in cells will be negligible as the IBA will require wetting to facilitate compaction.

The primary potential source of dust in the active cell areas will come from vehicle movements, post compaction and following evaporation within cells in the absence of mitigation measures

Potential dust generation in these areas will be mitigated by compaction of placed IBA using smooth rollers and thereafter by a combination of the following:

- sprinklers
- vehicle mounted dribble bars
- dust suppression sprays

Once IBA has reached its final profile, temporary covers or a permanent LLDPE liner will mitigate the risk of dust generation.

Air quality is also discussed in Chapter 7 ‘of Volume 2 of this EIAR.

2.5.5.13 Management of Noise During and Post IBA Placement

Screening berms on the eastern boundary of the IBA cells have been designed to mitigate potential noise impacts from IBA related operations.

Thereafter IBA in cells 29 and 30 will facilitate supplemental visual screening for subsequent and adjacent landfill operations.

Noise is discussed in Chapter 9 of Volume 2 of this EIAR.

2.5.6 Future Winning of IBA Material

As identified in Section 2.3.3, potential exists for the future winning of the IBA placed within these cells i.e. the extraction of IBA material for recovery.

A significant factor in the decision to propose the development of IBA cells as part of this proposed development is to enable the future recovery of this material, for use in offsite applications such as road construction (embankments, sub-bases), concrete block or cement production.

It is acknowledged that there are several steps and processes to be undertaken before this could happen, but the availability of the IBA material within its own dedicated location means that there is potential for its future winning should a recovery use be identified. This will be subject to future regulatory approval.

2.5.6.1 Recovery of IBA

Recovery of IBA is well developed in the UK and continental Europe, where the use of incinerator bottom ash aggregate (IBAA) is quite commonplace and is approved for use by the Environment Agency.

IBAA refers to the IBA material that has been produced to a specification for an identified end use. 7 million tonnes of IBAA has been produced from IBA and utilised in the UK to date[8] according to anecdotal references IBAA displays properties that are similar to other 'virgin' aggregates and displays good pozzolanic (cementitious) properties, making it a suitable foundation aggregate.

In the Netherlands, where annual IBA generation runs at approximately 1.8 million tonnes per annum, the historical approach to IBAA use has been to adopt an 'isolate, constrain and monitor' approach when IBAA is used in application such as embankment construction – this effectively required the encapsulation of IBAA within a HDPE liner within an embankment, which among other things, placed continual aftercare requirements on the embankment. This approach has now been discarded by the Dutch authorities such that targets have been set for other recovery applications, subject to IBA being further processed through washing and/or separation.

2.5.6.2 IBA Transfer Off-Site for IBA Recovery Trials

IBAA may be developed in Ireland if appropriate standards are developed. Commercial trials will be required for the development of these standards.

For the purpose off facilitating future recovery trials off site, there may be a requirement to transfer weathered IBA materials off site. Material from the weathered stockpiles in areas 1 and 2 will be used for the trials. Crushing of the IBA may be required to loosen the material for haulage.

The annual material transferred off-site will not exceed the maximum annual intake level and will be backhauled in IBA delivery vehicles.

Operational procedures will be developed for the loading of weathered IBA from the Area 1 stockpiles.

2.5.6.3 IBA Processes within Weathering Area

As described previously in 2.5.5.3 Covered articulated trailers will tip IBA within the weathering area (building) it will be stockpiled, and eventually loaded using front end loaders of tracked excavators into site dump trucks for transfer to the IBA cells.

It may also be necessary to turn stockpiles periodically. To stream line the weathering process it is proposed to carry out site-based trials within the covered weathering area to examine the impacts of metals recovery, screening and washing on the weathering process and to implement same as may be appropriate.

Typically, the trials will require mobile screening plant to facilitate separation of metals and washing. The screening equipment will be loaded using the same loading shovels and tracked excavators required to manage stockpiles. The screening equipment will be similar to that used to screen the engineered clay barrier during cell construction.

[8] http://www.smithsbletchington.co.uk/assets/files/Ibaa-brochure.pdf

2.6 Proposed Biological Treatment Facility

2.6.1 Overview

It is proposed to develop an aerobic biological treatment (composting) facility as part of the overall development. This facility will process residual MSW fines accepted at the landfill, to stabilise this material, prior to landfilling. The facility will compost 25,000 tonnes per annum of MSW fines material. A sketch of the proposed facility is shown in Figure 2.10.

This facility is termed a 'Type 8' facility and it will require approval by the Department of Agriculture, Food and the Marine (DAFM) to operate. The design and operation will be in accordance with the "Conditions for Approval and Operation of a 'Type 8' Composting/Biogas plant transforming Category 3 catering waste", DAFM 2014 (herein after referred to as the 'Conditions Document').

In the future, the facility maybe reconfigured to process the source segregated organic fraction of municipal solid waste i.e. brown bin" material, through a relatively minor internal reconfiguration of the processing building. Such a reconfiguration would be driven by market demand for composting capacity and would subject to regulatory approval. This EIAR examines the potential impacts of biological treatment of 25,000 tpa of MSW fines. The facility, in whatever configuration, will continue to operate post void utilisation.

The stabilisation process which residual MSW fines will undergo within the treatment facility is defined by the EPA to a respiration activity limit is <7 mgO_2/g DM.

Graph 2.1 shows the impact of biological treatment on the reactivity of MSW against time. As can be seen the reactivity decreases as the time within the managed biological treatment system is extended. The proposed treatment facility at Knockharley Landfill is expected to have a retention time of approximately 10 weeks to achieve the EPA stability standard of <7 mg O_2/kg DM, as shown in Graph 2.1.

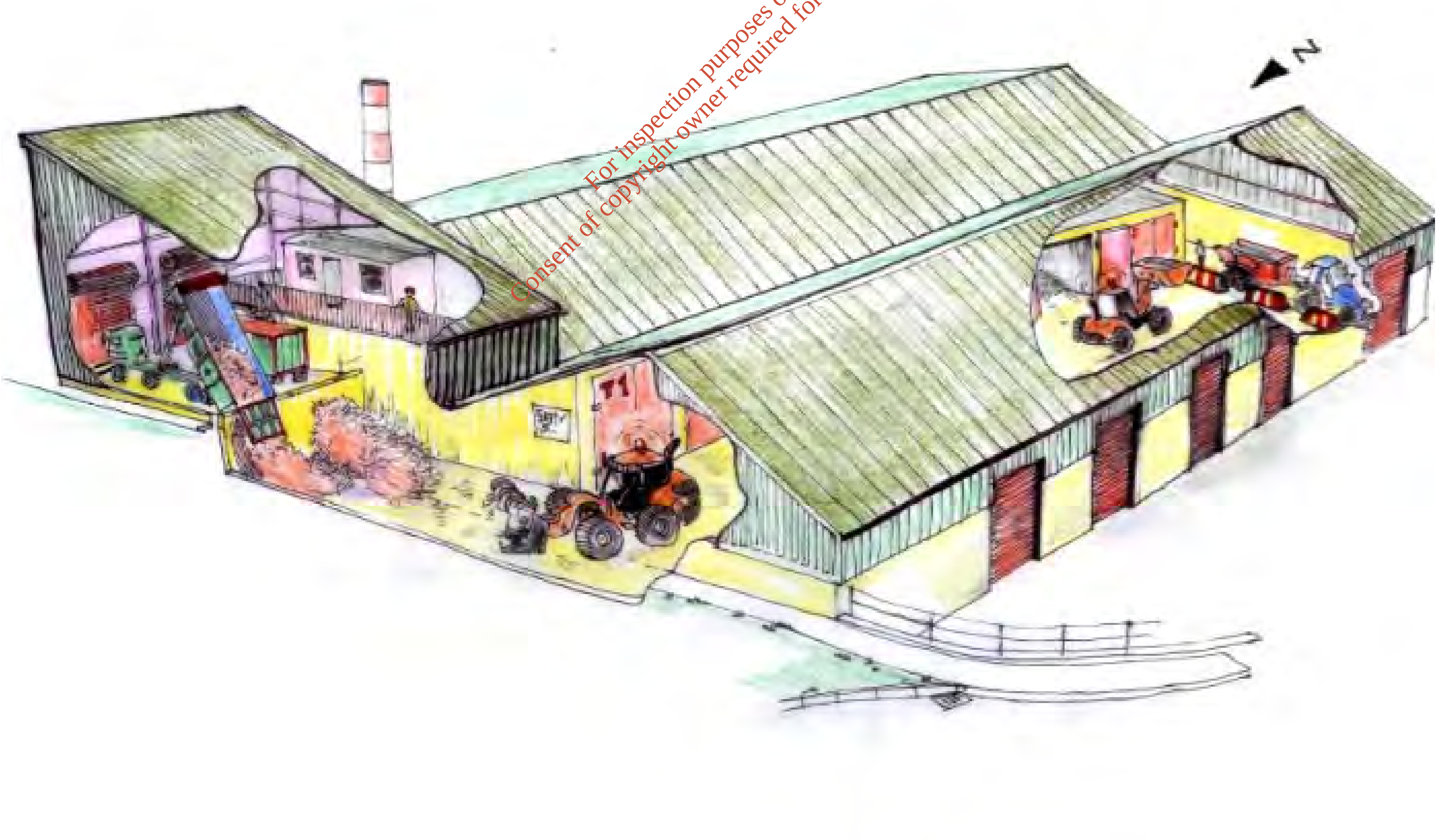
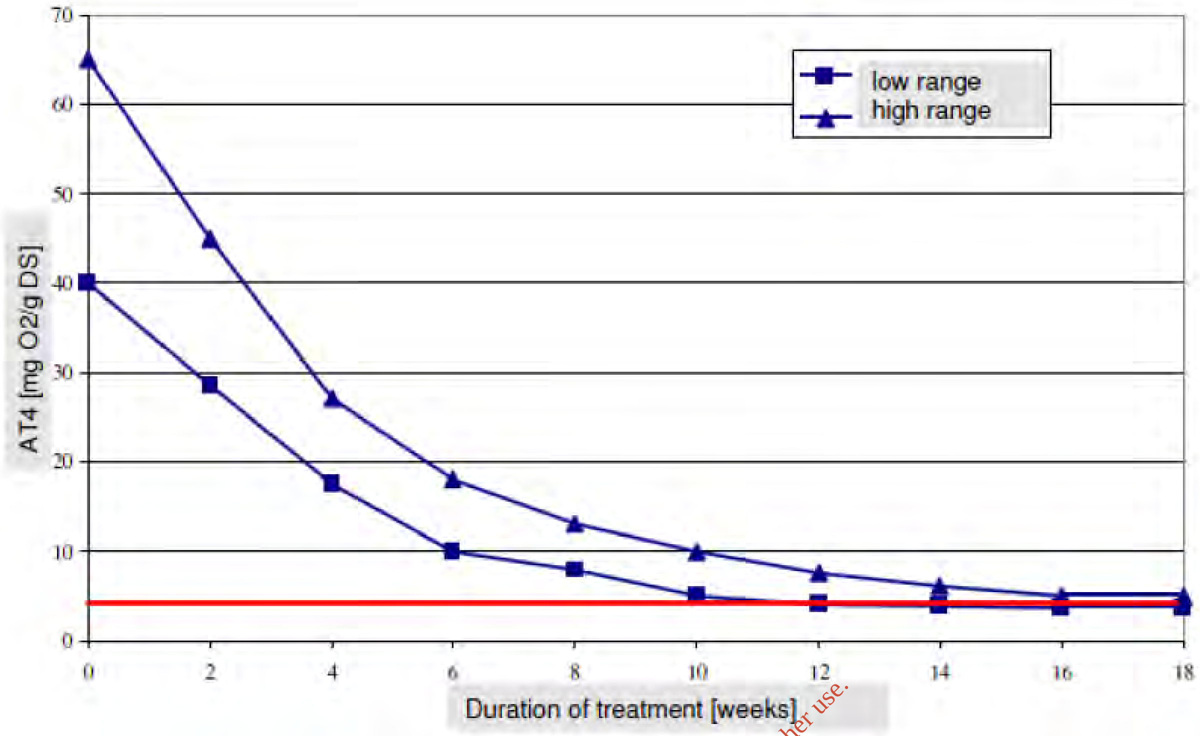


Figure 2-10: Proposed Biological Waste Treatment Facility



Source: Ingenieurgesellshaft Witzenhausen Technical Consultants

Graph 2-1: Typical Reduction in the Biodegradability of MSW as a function of time (based on high and low levels of biological reactivity in the source material)

Therefore, the purpose of the proposed biological treatment facility is to:

- Reduce both the quantity and biodegradability of waste going to landfill in accordance with the facility licence, the Landfill Directive 1999/31/EC and the EPA Pre-Treatment & Residuals Management Guidance (2009).
- Reduce the potential for environmental nuisance in the absence of mitigation caused by the landfilling of biodegradable waste such as odours, landfill gas generation, leachate generation, attractiveness to vermin, flies and birds, etc.

The biological treatment proposed will use composting as its core technology. Composting harnesses a natural process whereby organic matter is broken down by bacteria in the presence of oxygen, producing carbon dioxide and water vapour. Over time, the organic components within the waste (carbohydrates, proteins etc.) are metabolised by these bacteria, resulting in the reduction in mass/volume of the input material and the production of a stabilised humus type material of low respirability/biological activity, to meet the relevant standard previously identified.

In addition, the facility is designed to accommodate storage of baled recyclables and or baled MSW on the ground floor and above the compost tunnels.

2.6.2 Access and Traffic Control

The proposed biological treatment facility will be located within the south-eastern corner of the facility, directly north of the existing landfill gas compound. It will occupy an area of c. 5,400 m^2. Ground levels in this location are in the region c. 56 mOD and as such the facility will be at a lower level than the haul road around the landfill.

Access to the facility will be via the existing facility entrance road and weighbridge, followed by a left turn in a southerly direction along the existing internal road. A new entrance and access road to the biological treatment facility will be constructed off the internal road.

The facility operations will make use of an existing road off the perimeter haul road to the landfill gas compound, see Figure 2.11 and Drawing No. LW14-821-01-P-050-0008 Traffic Management Biological Treatment Facility in Volume 4 of this EIAR.

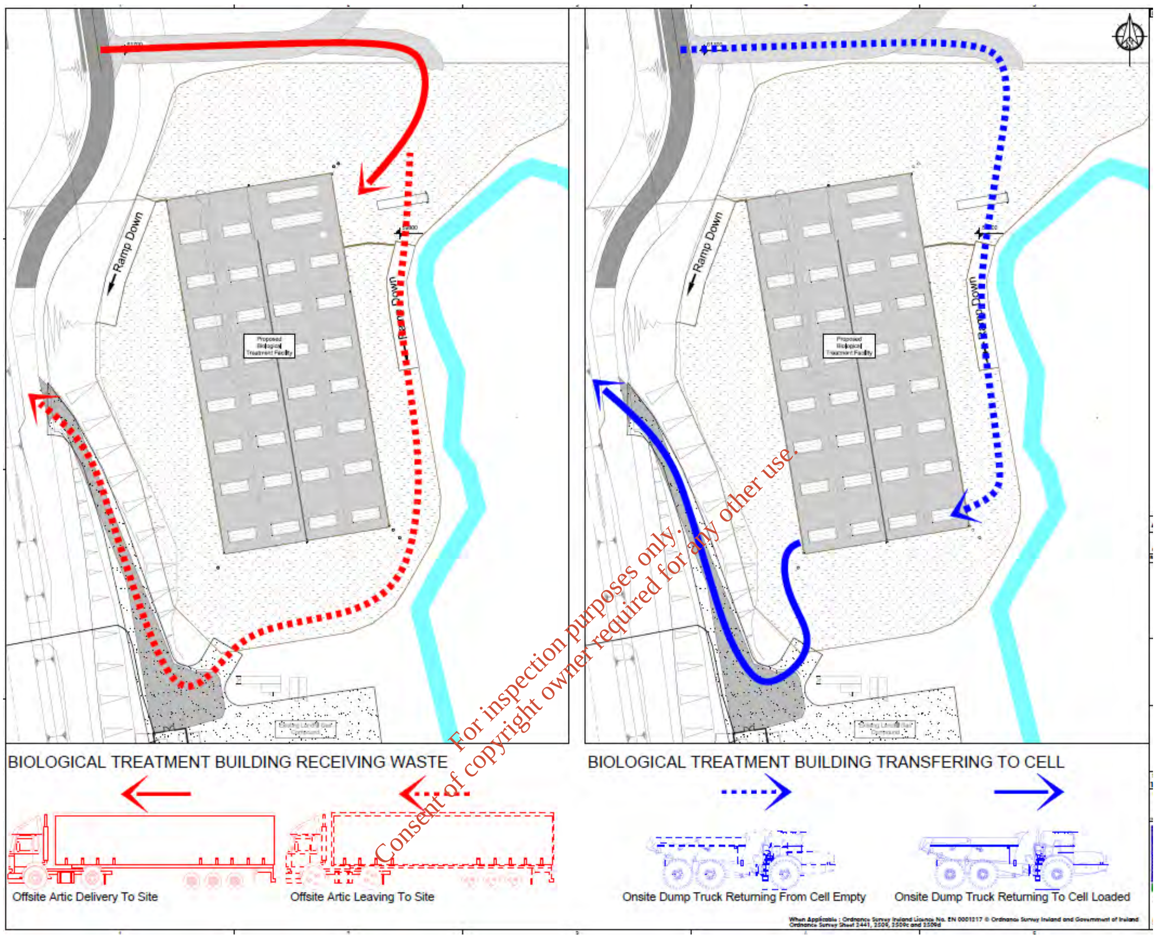


Figure 2-11: Traffic Movements to and from the Biological Treatment Facility

2.6.3 Principal Building Dimensions & Layout

Figure 2-10 is an artist impression of the proposed facility building and Drawing No. LW14-821-01-P-1700-005 in Volume 4 of this EIAR shows the sections and elevations of the facility. The following is a list of the major structural components of the proposed biological waste treatment facility:

- Facility processing building of 108 m in length, 50 m in width and varying between 12 m and 17 m in height, of portal frame construction, with 9 no. roller shutter doors containing:
    - Incoming material stockpile area
    - 12 no. aerobic composting tunnels (25 m x 6 m x 5 m) with single doors
    - Outgoing material stockpile area
    - 1 no. biofilter and a stack with 3 no access hatches to facilitate placement and removal of biofilter material.
    - Storage space for baled recyclables
- Marshalling yard and adjacent hardstanding with an approximate footprint of 1.31ha.

The ground elevation at this location varies between 56 and 59 mOD and the finished floor level of this building is at 57.0 mOD with the southern end of the building at 59 mOD. The general building height is 12 m to ridge height. There is a local increase in building height to accommodate tipping vehicles where the height above the tipping bay varies approximately between 14.0 m and 17.0 m. The biofilter stack height is approximately 20 m above ground level. Overall, the processing building at its highest at the southern end (excluding the stack will be approximately 74.0 m AOD). The building will be constructed in a portal frame configuration of reinforced concrete and cladded steel. The colour of the steel cladding will be RAL 1006020 or similar.

The aerobic composting tunnels will be typically 25 m long, 6 m wide and 5 m in height. The tunnels will be constructed from reinforced concrete designed to withstand strong chemical attack and high abrasion. They will be sealed by insulated stainless steel lined sliding doors. The tunnels will be equipped with an aerated floor system with a computer-controlled blower system that will be mounted in a gallery on the roof of the tunnels overlooking the tunnel loading area.

2.6.4 Composting Process

2.6.4.1 Waste Acceptance

Waste will enter the facility via the newly constructed road and marshalling area and will enter the processing building via fast acting roller shutter doors on the north-eastern side of the building. Both incoming vehicles and out-going vehicles will be in “clean areas” (shown below in Figure 2-12 as salmon colour), replicated from Drawing No. LW14-821-01-P-1700-0002 Proposed Biological Treatment Facility Ground Floor Plan in Volume 4 of this EIAR where dimensions and text descriptions are legible.

Input materials (residual fines) will be delivered by walking floor or tipper transfer trailers in a pre-screened form, directly suitable for composting. Record keeping and acceptance procedures in accordance with the requirements of the DAFM Conditions Document and the EPA licence shall be implemented.

Given the sequencing and logistics of compost tunnel filling and unloading, sufficient space on the floor will be provided to accommodate daily operations. As a minimum, the bio-waste will be stockpiled until the volume of feedstock is sufficient to half - fill a composting tunnel (c. 260 m^3).

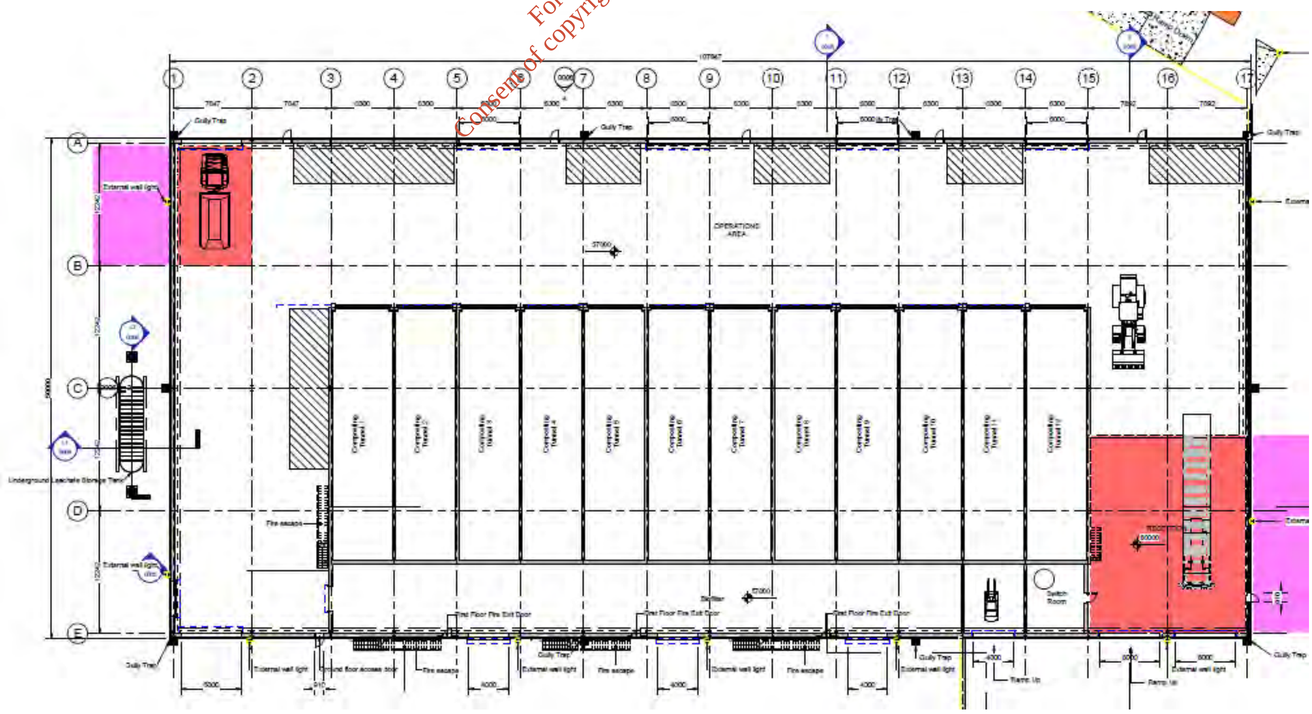


Figure 2-12: Layout of Biological Treatment Facility

The building will operate under negative pressure to mitigate potential dust and odour emissions. The incoming material will be inspected during unloading. Residual fines material will be mixed and blended with a portion of retained post-stabilised material and/or woodchip (or similar) amendment material in the reception hall floor before being loaded into a composting tunnel. The added stabilised material inoculates the incoming material with micro-organisms before composting and provides stability to facilitate aeration.

2.6.4.2 Tunnel Filling and Operation

Material will be loaded into the composting tunnels using a front-end loader where it will remain for an appropriate period of aerobic maturation. Each full tunnel of material shall be considered as a 'batch' in terms of the logistics of the process. The material readily de-waters (through evaporation and free drainage) and the aerobic microbial population rapidly increases.

The composting process for the tunnels will be controlled by a PLC/PC interface which records time and temperature and controls airflow within the waste from individual tunnel blowers/fans located in a gallery on the roofs of the composting tunnels, with air delivered through a network of piping located within the tunnel floors. As a result, temperature will be maintained for the appropriate time period to ensure pasteurisation.

Typically, the compost will be turned mechanically a number of times (2-3 times) within its overall composting duration to break up compaction. Depending on facility logistics, composting material may be unloaded from one tunnel into another, several times during the composting process, resulting in a fully stabilised material, with a final moisture content of 30-40%.

2.6.4.3 Testing and Storage

Upon completion of the composting process, the composted 'batch' of material will be unloaded from the tunnel in a dedicated 'clean' vehicle and placed in the outgoing stockpile area which will be separated from the tunnel area by moveable barriers to prevent vehicle entry and facilitate tipping of clean material over the barrier. (see Figure 2.10)

While located within the outgoing stockpile area, the material will be sampled and analysed, for compliance with AT4. Where more than one batch is located within the outgoing stockpile area, these batches will be kept separated by moveable concrete walls, of Alfabloc variety or similar. Sufficient capacity for storage of 1 – 1.5 weeks stabilised output will be provided in the outgoing stockpile area.

2.6.4.4 Dispatch

When results are obtained indicating that a batch meets the appropriate AT4 standard, the composted fines material will be loaded into a tipper trailer that enters the facility building via a fast-acting roller shutter door on the south-eastern side of the building and exits the building through the fast-acting roller shutter door on the south-western side of the building. Record of dispatch in accordance with the requirements of the DAFM Conditions Document will be maintained.

Vehicles exiting the facility through the roller shutter door on the western flank will be subjected to cleaning procedures in accordance with the DAFM Conditions Document in a designated cleaning area located outside of this door.

2.6.5 Air Handling

2.6.5.1 Ventilation System

The ventilation system will extract:

(1) 'Moderate-strength' aerobic exhaust from the composting tunnels, which will be subjected to bio-filtration and or/ scrubbing, prior to venting via blowers to atmosphere via stack;

(2) 'Low-strength' building ventilation air that will be mixed with the treated exhaust from the scrubber and treated via the biofilter prior to venting to atmosphere via stack

The ventilation system within the main building void will be designed for 3-6 air changes per hour. This ventilation rate allied with a good building skin integrity, will ensure that all odorous air produced within the facility will be contained and directed to the odour abatement system.

The processing building will be designed to be operated under slight negative pressure. Ventilation pipe work installed in the head space of the building and within tunnels will be connected to a high-volume medium-pressure blower that will draw off the warm, buoyant building air that will be generated by a combination of emissions in the processing building from the input materials in the intake area and from fugitive emissions from the movement of the material between composting tunnels.

2.6.5.2 Scrubber

Exhaust air from the composting tunnels, generated by the active aeration of the compost, will be extracted and passed through an acid scrubber if required subject to technology. The acid scrubber will be designed to remove odorants that are poorly degraded in biofilters. This particularly includes ammonia and amines. The removal of ammonia is particularly important as its oxidation in biofilters can give rise to elevated emissions of nitrous oxide, a strong greenhouse gas. An appropriately scaled acid scrubber will be installed to treat air from the proposed facility design if required to mitigate potential emissions by design.

The following minimum design performance and specification in Table 2-11 will influence the design of the scrubbing plant if required.

Table 2-11: Acid Scrubber Process Characteristics for the Development

Parameter	Values
Inlet NH_3 Concentration	100-250 mg/Nm³
Liquid Recirculation Rate	30 m³/h
Liquid Temperature	55 °C
pH in Sump	2.0
Packing Vol	10 m³
Safety Factor	1.25
Outlet NH_3 Concentration	<0.50 mg/m³
NH_3 Removal Efficiency	99%

With the removal of ammonia and amines, the airstream will be mixed with the low strength building ventilation air and directed to the biofilter.

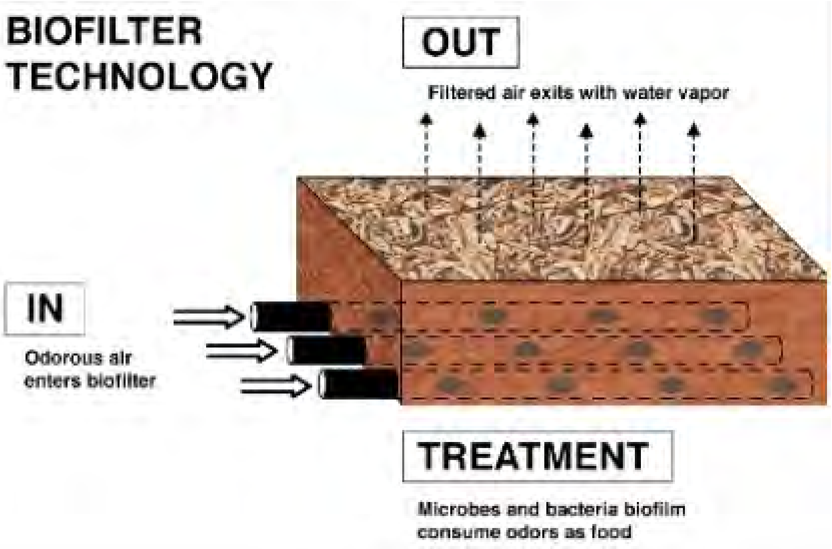
2.6.5.3 Biofilter

The combined scrubber exhaust and the building ventilation air will be mixed and directed to the biofilter located at the western side of the building (mitigation by design). The biofilter bed will comprise either a proprietary high surface-area inorganic media such as clay or activated carbon or an organic media such as woodchip, peat, bark or combinations of same. The biofilter will be designed to allow an empty bed retention time (EBRT) of between 40 and 60 seconds.

The design will consider contingency for media change-out and preventative maintenance to ensure optimal performance. The inlet air distribution floor within the biofilter will provide homogenous airflow throughout the biofilter bed medium thereby eliminating short-circuiting and poor treatment.

The operation of the biofilter with a continuous moving liquid film will minimise the build-up of contaminants within the media and will allow for the continuous control and addition of nutrients, minerals, pH and biofilm development. A schematic of a typical biofilter is illustrated in Figure 2-13.

As part of the overall odour treatment system, an integrated SCADA monitoring system will be incorporated into to allow for continuous monitoring of performance of the ventilation and odour control equipment.



Source: www.environmental-systems.co.uk/services/odour-control/

Figure 2-13: Typical Schematic of a Biofilter Bed

The biofilter will be on the western side of the building, as shown in Figure 2-12. The containment of the biofilter will be within concrete walling with an airtight fabric roof. All air will be directed to a single emission stack to ensure good dispersion of the residual odour plume to mitigate odour nuisance.

The biofilter design will ensure compliance with EPA emission standards for odour, ammonia, hydrogen sulphide and mercaptan concentrations. The overall incorporation of robust preventative maintenance procedures, containment measures, focused extraction, zoned and cascade ventilation, SCADA control, monitoring, trending and data-logging and multiple stages of treatment will ensure that odours will not cause impact on the surrounding area and that the odour control system will operate at optimal capacity.

Further detail in relation to the assessment of impacts on air quality and climate is provided in Chapter 7 of Volume 2 of this EIAR.

2.6.6 Effluent Management

The proposed biological treatment facility will generate a few effluents for management. The facility will be designed to maximise the reuse of effluents within the process, such that it operates on a balanced process water requirement, with a slight 'water demand' possible i.e. all effluent generated within the facility will be re-circulated within the process, with a potential requirement for fresh input water.

As the facility will be completely enclosed, the generation of contaminated storm water will be avoided. The facility will generate a few effluents that will require management including:

1. Internal floor wash-down
2. Vehicle wash-down (internal and external)
3. Composting tunnel leachate
4. Odour abatement effluents
5. Sanitary wastewater from welfare facilities
6. Leachate storage tank adjacent to Biological Facility

2.6.6.1 Vehicle Wash-Down

There will be internal vehicle wash-down facilities shown in Figure 2-12 (salmon colour) within the building at both the northern and southern ends and a wash down facility area located external to the roller shutter door on the northern external flank of the building (purple colour), which will be a concrete area of c. 200 m^2 graded to fall to a dedicated collection tank. Given the expected incoming traffic, truck wash down is expected to generate approximately 30 - 50 m^3/month, including for rainfall which will be captured in the external wash-down area. This wash down will drain to the leachate storage tanks.

2.6.6.2 Internal Floor Wash-Down

The internal floor area of the facility will all be subject to wash-down. Wash down of these floors will be reuse in the composting process and excess wash-down is expected to generate approximately 10 - 12 m^3 of effluent per month. This wash down will drain to the leachate storage tanks.

2.6.6.3 Composting Tunnel Leachate Management

It is not proposed to add moisture to the input residual fines material when being placed within the first composting tunnel due to the expected moisture content of the incoming material but, during the composting process, the composting material will lose moisture due to the process heat generated plus seepage/drainage from the material itself.

The in-floor aeration system will also act as a leachate collection system from the material when it is in the composting tunnels, such that leachate generated within the composting tunnel will be collected and directed towards a leachate holding tank(s). The aeration system will be configured using a series of controlled valves such that valves will be open during periods when air is not being delivered to the tunnels to allow leachate to freely drain, but which will be closed when air is being blown into the composting tunnel so that no air is lost from the system.

The leachate initially generated by the composting process will then be added to the composting material that is being transferred from one tunnel to another, in order that optimum moisture content is maintained within the composting material – this will either be done manually using a hose pipe as material is being placed within the tunnel or through in-tunnel roof sprinklers when material has been placed within the tunnels.

2.6.6.4 Odour Abatement Effluents

The odour abatement system will consist of a wet scrubber in tandem with a biofilter. The biofilter is designed to operate in a bio-trickling mode with the recirculation of the effluent generated back through the bio-filter.

At full capacity, the scrubbers will generate up to 20 m^3/month of excess wastewater with the biofilter generating a net 25 m^3/month. The leachate from the scrubber will be directed to the leachate holding tank.

2.6.6.5 Sanitary Wastewater from Welfare Facilities

Effluent from welfare facilities will generate up to 200 litres per day and will discharge to a 2,000 litre proprietary biocycle unit. Treated effluent will be discharged thereafter by pumped rising main to the leachate treatment and storage area) and tankered off site.

2.6.6.6 Leachate Storage Tank

Up to 120 m^3 per month of leachate may be generated at the proposed facility from the sources outlined. This leachate will be collected through a series of sumps that will drain to underground leachate storage tanks of 120 m^3 total capacity, located adjacent to the composting tunnel footprint. All leachate collected within the process will be captured together for re-use within the composting process, where a significant water demand will exist when composting material is being moved from one tunnel to another.

The leachate tank will be equipped with level indicators and high-level alarms to ensure visibility on the liquid levels within the tanks.

While the facility will be designed such that a sufficient quantity of leachate for addition to composting material is available always, a pipeline shall be provided from the leachate tanks to the wider landfill site leachate collection lagoons to allow for pumping to these lagoons in the unlikely event of the tanks capacity being reached or exceeded.

Likewise, a pumped water supply pipe shall be provided from the existing surface water attenuation lagoon at such that surface water in the lagoon can be supplement the leachate tanks for use for the composting process, should there be a deficit of compost 'make-up' water.

The leachate storage tank will have secondary containment provided by a 1.0m thick clay barrier k $1*10^{-9}$ m/s or similar.

2.6.7 Surface Water Management

Runoff from clean areas of the facility, such as the roof, marshalling yard and roadways external to the building will be collected and conveyed to the southern and existing surface water attenuation pond.

2.6.8 Ancillary Infrastructure

Key ancillary proposed developments are discussed as follows:

- Removal of a small area of trees adjacent to the south-east corner of the building.
- Relocation of site installed drains and minor services within the building footprint.
- Access roads and hardstands to facilitate access and egress and working areas around the building on all sides. These will drain into to the adjacent site surface water system.
- Water supplies to the building including internal wash down systems at vehicle egress points.
- External below ground tanks for leachate storage.
- External biotreatment unit with pumped discharge of treated effluent to the leachate management facility.
- Retaining walls to facilitate incoming vehicle access to the building and to facilitate a 'level' working platform surrounding the building on what is currently sloping ground with natural falls exceeding 3.0 m.
- Additional below ground pumped leachate rising mains.
- Additional below ground ducting for water, telemetry and power.

2.6.9 Operational Aspects

2.6.9.1 Traffic Control & Marshalling Area

The biological treatment plant shall be surrounded by a hard-surfaced marshalling area with appropriate drainage to allow for vehicle circulation and movement throughout the site. Vehicles shall enter the facility from the northern proposed access road off the internal perimeter road, through an entrance gate and all vehicles delivering waste material, shall enter the facility processing building through the northern eastern roller shutter door and shall exit the facility through the north-eastern roller shutter door. Upon exiting the facility, all vehicles shall be subjected to a wash-down procedure in accordance with the requirements of the DAFM Conditions Document.

All vehicles collecting stabilised waste from the facility shall enter the building through the south-western roller shutter door and exit the building through the south-eastern roller shutter door. All vehicles shall be subjected to a wash-down procedure in accordance with the requirements of the DAFM Conditions Document and wash facilities will be provided at both exit and entry doors to facilitate reverse movements if required.

2.6.9.2 Security

A paladin fence of c.2.4 m in height will be installed along all sides of the marshalling area and access to the site outside of operational hours will be restricted.

2.6.9.3 Staff Resources

It is expected that the proposed facility will be operated by 4 primary staff at full capacity. These will comprise one facility manager, one supervisor and 2 machine operatives working in one shift.

2.6.9.4 Staff Welfare

Within the building an office and welfare facilities (WC, sink, shower, changing room) will be provided.

2.6.10 Health and Safety

2.6.10.1 Vehicle Safety

There are risks and hazards associated with operating any type of biological treatment facility and operators will be trained to operate the equipment. Drivers and operators of all vehicles and plant shall hold all appropriate training credentials. Dedicated pedestrian areas will be identified within the building to avoid accidental contact with reversing loaders and delivery lorries.

2.6.10.2 Infectious risks

Training for all staff will include:

- precautions such as regular washing of hands before eating
- procedures on protective clothing washing before re-use
- protecting wounds and open sores
- appropriate respiratory protection
- vaccinations in line with HSE recommendations.

2.6.10.3 Air quality

The primary gases generated in the process will be water vapour and carbon dioxide. In addition, other gases will be present in trace amounts, including ammonia, organic acids, alcohols, sulphides and other odorants.

These gases will be subject to double containment within the composting tunnels and the gases will be retained within the odour abatement and biofiltration systems prior to discharge to atmosphere after treatment.

Within the building dust, gases and bioaerosols will be managed and treated by the ventilation system. The level of ventilation will be typically increased during compost transfer periods, i.e. when the material in the tunnels is being turned. At these times, there is potential for increased levels of emissions and therefore, these operations will be undertaken by operators within air-conditioned loader cabs and offices. High rates of air exchange in the tunnels and transfer corridors will be maintained at these times to maximise visibility, to maintain high oxygen concentrations and to extract waste air.

2.6.10.4 Risk of Fire

Fire can occur from the overheating of any machinery and potentially from self-heating of the material within the incoming and outgoing storage piles and within the composting tunnels.

However, the moisture content of the compost piles will be continuously monitored to optimise biological activity and this process also acts as a fire prevention measure. Therefore, the risk of spontaneous combustion is very low with these mitigation measures.

No naked flames or smoking will be allowed at the facility, in keeping with the no smoking policy for the wider site and machinery will be serviced regularly in accordance with manufacturers recommendations.

The Fire Prevention Management Plan and Emergency Response Procedure for the site will be updated to reflect the proposed development and shall be submitted to the EPA for approval.

2.6.10.5 Fire Safety Certificate

Meath County Council Fire Officer will be informed of the development prior to commencement of operations as part of the preparation of emergency procedures for the site in line with the requirements of the facility licence. An application for a Fire Safety Certificate will be made prior to the construction phase of the proposed development to ensure full compliance with Part B of the current Building Regulations.

The number and location of pedestrian access and egress points may change be subject to fire safety assessments.

2.7 Proposed Leachate Storage and Treatment

Refer to Drawing No. LW14-821-01-P-0600-01 Layout Leachate Management Facility in Volume 4 of this EIAR.

- The construction and operation of a leachate management facility comprising:
  - 3 no. additional floating cover leachate storage lagoons (L2. L3 and L4) of c. 3,000 m^2 each
  - 2 no. bunded above ground tanks for raw leachate from IBA cells (S1 and S2) approximately 25 m diameter 6.0 m high.
  - 3 no. bunded above ground tanks:
    - 1 no. tank (S3) for treated leachate from landfill leachate approximately 20m diameter 6.0m high.
    - 1 no, tank for treated leachate from IBA approximately 25 m diameter 6.0 m high (S4).
    - 1 no. tank for leachate concentrate 10 m diameter by 6.0 m high (S5).
  - Modular - typically containerised plant units (C 1 through C6), on concrete slab of c. 1,600 m^2 and 1 no. elevated tank 5 m diameter 10 m high (T1) with provision for 2 no. additional low level (<5.0 m high) bunded storage tanks for dosing and other compounds (T2 and T3).
  - Extension of the existing loading area to accommodate 2 no. 25 tonne articulated tankers
  - 1 new tanker loading area to accommodate 2 no. 25 tonne articulated tankers.

Permission is sought for the continued operation of this plant post filling of the landfill cells onsite to facilitate continued leachate management.

The leachate plant will be designed to facilitate treatment of respective leachate streams as may be required prior to transfer to off-site wastewater treatment plants. The different leachate streams will be generated from the following sources:

- residual non-stabilised waste in landfill
- stabilised and inert waste in landfill
- IBA cells (weathering, placement cells and contaminated stormwater runoff)
- biological treatment facility

The leachate management facility will:

- Provide at least 1 month's on-site attenuation storage for all leachate streams using both elevated above ground bunded tanks and below ground floating cover lagoons.
- Facilitate on-site treatment and or conditioning of respective leachate streams.
- Provide tankering loading facilities for transport of treated and un-treated leachate to wastewater treatment plants.

2.7.1 Location and Layout

The facility will be located south of the administration building and adjacent to the existing covered leachate lagoon.

2.7.2 Leachate Storage

Raw leachates will be stored in lagoons, underground tank and or above ground bunded tanks.

Lagoons will be constructed using a composite containment system comprising 2.0 mm HDPE overlying 1.0 m clay barrier with a permeability < $1*10^{-9}$ m/s. Surface runoff from rainfall will be directed from floating covers to the site surface water system.

Above ground bunded tanks will have proprietary systems to accommodate drainage of clean surface water runoff to surface water site drainage system under normal operations. In the event of a spill or tank damage, bund contents will be discharged to a wastewater treatment plant or similar approved. Bunds will facilitate containment of 110% of the largest tank or 25% of total storage capacity whichever is greater. In addition, rainfall storage over and above bunded capacity will be provided in excess of 50 l/m^2.

Leachate from respective sources will be stored separately to facilitate site specific pre-treatment as required.

On-site raw leachate capacity will accommodate no less than 1 month's storage. Pumping to these storage lagoons will be automated and controlled by proprietary SCADA control systems or similar.

If leachate is treated on-site, treated effluent will be stored in adjacent bunded above ground tanks. On-site capacity for treated effluents will accommodate no less than 7 days treatment throughput.

Tables 2-12 and 2-13 over summarise the capacities of the proposed storage tanks and lagoons.

Table 2-12: Raw Leachate Storage

Notation	Leachate source	Tank description	Width/diameter/Volume	Height /Depth
L1	Residual non-stabilised waste	Existing floating cover lagoon	50 m x 50 m	< 1.0 m high <5.m deep
L2	Stabilised and inert waste	Proposed floating cover lagoon	<60 m x 60 m	<1.0 m high <5.0 m deep
L3	IBA recovery	Proposed floating cover lagoon	<60 m * 60 m	< 1.0m high < 5m deep
L4	IBA contaminated storm runoff	Proposed Floating Cover Lagoon	<60 m * 60 m	< 1.0m high < 5m deep
S1	IBA weathering	Proposed Bunded tank	25 m Ø	< 6.0 m high
S2	IBA cells	Proposed Bunded tank	25 m Ø	< 6.0m high
None	Biological facility	Below ground storage	120 m^3	0 m

Table 2-13: Treatment Units and Treated Leachate Storage

Notation	Contents	Tank Description	Diameter / Size	Height / Depth
S3	Treated stabilised and inert	Proposed Bunded tank	20 m Ø	< 6 m
S4	Treated IBA leachate	Proposed bunded tank	25 m Ø	< 6 m
S5	Concentrate from leachate treatment process	Proposed bunded tank	6 Ø	<10 m
T1	Modular containerised vertical tank	Covered bunded storage	10 m * 5 m	< 6 m
T2 & T3	Chemicals for Dosing	Bunded storage tanks	5 m Ø	< 5 m
C1–C6	Various leachates for treatment	Containerised proprietary treatment units	12 m * 3 m	< 3 m unit (container only)
None	Proprietary Bio Treatment plant adjacent to and servicing biological facility	Below ground tank	< 5 m * 5 m * 3 m	< 4 m deep

Refer to Drawing No. LW14-821-P-0600-001 Layout Leachate Management Facility in Volume 4 of this EIAR.

2.7.2.1 Treatment

The need or otherwise for on-site treatment as advised previously may be subject to factors such as local waste water treatment facilities, IE licence conditions, commercial considerations or other which may change over the lifetime of the facility.

Accordingly, a dedicated plan area 40 m*40 m will be provided to accommodate proprietary containerised modular leachate treatment units. Any treatment carried out on site will be subject to EPA approval.

Storage of materials if required to support treatment, e.g. caustic for pH balancing, will be in modular bunded units located on the dedicated concrete pavement plant area.

Drainage from the concrete pavement area, roads, floating covers and tank roof systems will discharge into the existing on-site surface water drainage system discharging to the existing southern storm water attenuation pond.

2.7.2.2 Tanker Loading

It is proposed to upgrade the current tanker loading facility to facilitate collection of treated or untreated leachate from the lagoons and tanks on-site within the leachate treatment facility. This will allow filling of two tankers concurrently.

Each tank / lagoon will have a valved discharge pipe that will terminate in the tanker loading area at a manifold.

The vacuum tanker or similar will drive into the tanker loading area and a flexible pipe will connect the tanker to the manifold. Typically, a vacuum in the tanker facilitates removal of effluent from respective tanks.

The tanker loading area will retain and connect to the in-situ below ground drainage system to accommodate, as required, spills and runoff from this area which will be discharged to the in-situ leachate lagoon for subsequent treatment and or transfer off site to a waste water treatment facility.

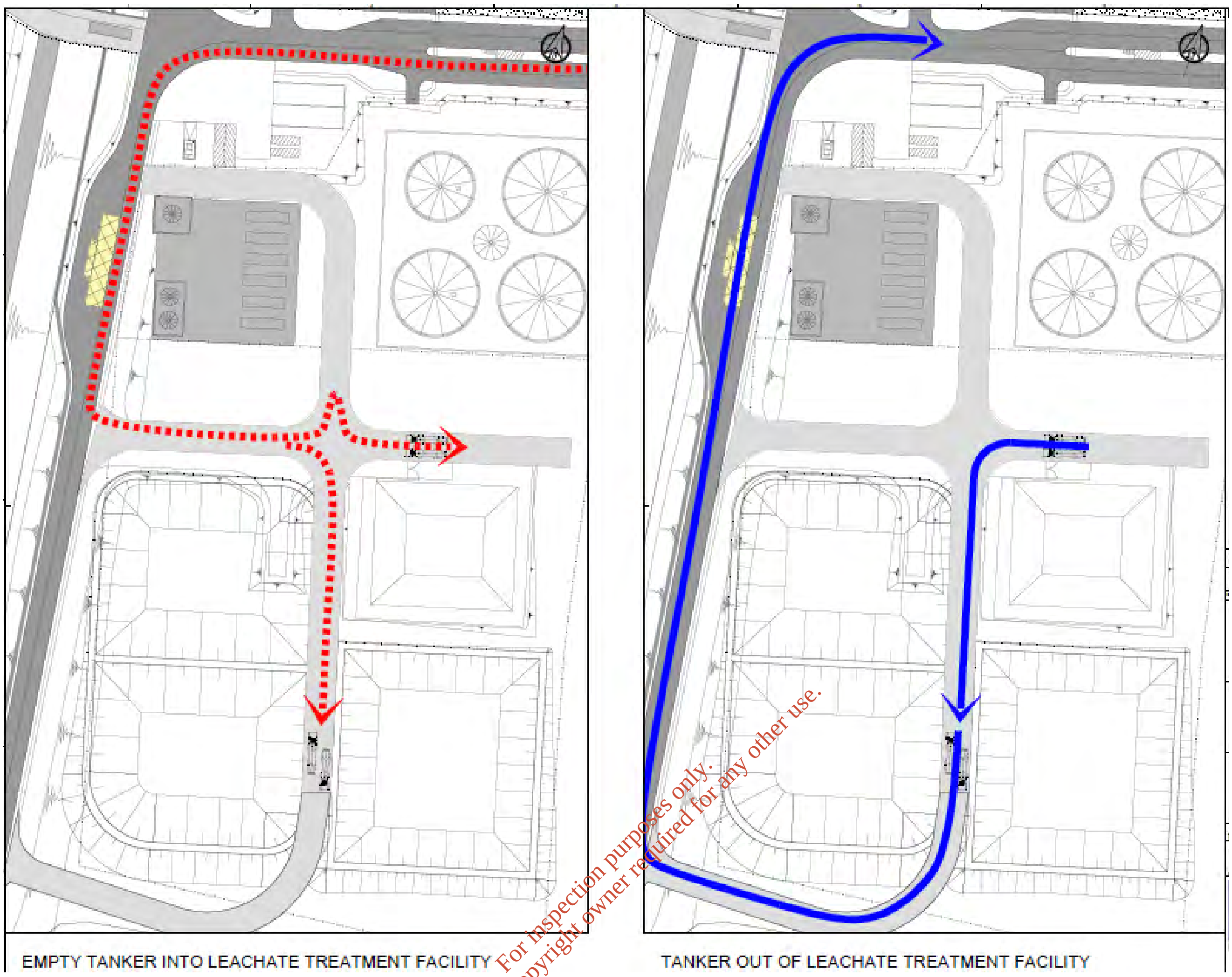


Figure 2-14: Traffic Movements to and from the Leachate Management Facility

2.7.2.3 Operative Wash Area

There will be operational procedures for:

- tanker loading
- leachate storage
- leachate treatment

Operatives will be trained in accordance with these procedures and in accident and emergency procedures. In the event of an accident, an external shower wash down and medical station will be located adjacent to the bunded storage.

2.7.2.4 Odour Control

All tanks and exhaust from vacuum tankers will have dedicated venting with carbon filters to facilitate passive or pumped venting of gases which may be dissolved in leachate.

2.7.2.5 Traffic Management

Traffic associated with leachate management will use the existing site road infrastructure and the tankers will exit the facility over the weighbridge as per existing procedures to record the transfer of leachate (volume and destination) off-site.

Up to 14 no. daily vehicle traffic movements will be associated with the following:

- Transfer of leachate off-site to WWTPS (articulated 25 tonne and 15 tonne rigid tankers)

In addition, occasional deliveries to support leachate treatment may require product deliveries using articulated 25 tonne and 15 tonne rigid delivery vehicles.

The proposed traffic movements are shown in Figure 2-14 and in Drawing No. LW14-821-01-P-0500-0009 Traffic Management Leachate Management Facility in Volume 4 of this EIAR.

2.7.2.6 Security & Staff Resources

The existing security and facility staff will operate the leachate storage and treatment facility. Training will be provided as appropriate.

2.7.2.7 Surface Water & Foul Water Infrastructure

Surface water runoff from hard standings, bunds, roof systems and roads will be directed into the existing on-site surface water drainage network and will pass via the existing petrol interceptor to the southern storm water attenuation lagoon.

Leachate spills, contaminated arisings from the tanker loading area, or other spills from bunded containers will be tankered off site.

2.7.2.8 Fire Control

The Fire Prevention Management Plan and Emergency Response Procedure for the site will be updated to reflect the proposed development and will be submitted to the EPA for approval.

Meath County Council Fire Officer will be informed of the development prior to commencement of operations as part of the preparation of emergency procedures for the site in line with the requirements of the facility licence. An application for a Fire Safety Certificate will be made prior to the construction phase of the proposed development to ensure appropriate measures are in place.

2.7.2.9 Other Services and Ancillary Infrastructure

The leachate management facility will have provision for the following services:

- Water
- Telemetry
- Power
- Lighting
- Laboratory
- Operative wash area (as described previously)
- Leachate recirculation (subject to Agency approval)

2.8 Proposed Surface Water Drainage Infrastructure Northern Catchment Area

The site has a watershed running approximately east to west through the permitted Phase 4 cell development area of the landfill, see Figure 12.2 Chapter 12 Surface Water of Volume 2 of this EIAR.

Historically surface runoff from the landfill and adjacent lands south of the watershed has discharged surface waters by overland flows, piped drainage and surface water drainage networks to the surface water attenuation pond and wetland south of the landfill.

It is proposed to develop a northern surface water attenuation pond to facilitate surface water generated in the northern catchment. This is shown in Drawing No. LW14-821-01-P-0500-0001 Proposed Layout Plan of Surface Water Management Infrastructure in Volume 4 of this EIAR.

An artist's impression of the northern surface water management pond system is included as Figure 2.15.

To provide access to the northern part of the site, it will be necessary to replace an existing culvert across the existing stream. This new culvert will also facilitate flooding described below. A Section 50 application in accordance with the Office of Public Works (OPW) document 'A Guide to Applying for Consent under Section 50 of the EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010 and Section 50 of The Arterial Drainage Act, 1945' will be submitted to the OPW to seek permission for this crossing.

Refer to Drawing No's LW14-821-01-P-0500-0001 through 0004 in Volume 4 of this EIAR. The proposed surface water management infrastructure consists of:

- A surface water holding pond with a 1,000 m^2 top water footprint and live capacity >2,000 m^3 upstream of the new surface water attenuation lagoon to facilitate containment, if required, of contaminated storm water. The pond will have a composite lining system comprising a 2.0 mm HDPE liner overlying a 1.0m clay ($1*10^{-9}$ m/s) barrier. Flows into the pond will be via baffled chute inlet structures. An automated "slam shut" control valve will be installed within an inlet weir to facilitate isolation, if required of incoming (contaminated) surface water flows. The weir structure will also have provision for a pump to discharge contaminated storm water into the leachate collection pipework system. Flows will discharge via the sluice valves/overflow weir, through a culvert (or in emergency conditions via a ford overlying the culvert) normal conditions via a baffled chute to the surface water attenuation lagoon.
- A surface water attenuation lagoon, with a 3,880 m^2 water footprint, live capacity > 4,698 m^3 to:
  - Attenuate surface water runoff from the permitted and proposed developments.
  - Facilitate settlement of suspended solids.

  The lagoon will have dead storage to accommodate solids, an overflow weir discharging via a baffled chute structure to accommodate extreme storm events into the adjacent stream, and a constant discharge outflow structure (floating inlet or similar) discharging to a wetland.
- A wetland, footprint 250 m^2 at the outlet of the surface water attenuation lagoon to the north of the currently permitted footprint. This structure is designed to polish surface water flows and reduce further suspended solids suspensions below statutory guidelines. The wetland will also have an overflow weir to accommodate failure of the outflow structure which will be the primary discharge outlet to the receiving drain/watercourse via a circular riser weir discharging via a piped outflow to the existing watercourse.
- The existing storm water drain/watercourse is typically 800 to 1000 m deep with a top width of approximately 2.0 m. It will require a permitted minor realignment at the north-eastern corner of the permitted development over an approximate length of 171 m requiring an increase in stream length approximately equal to 8 m. A section 50 application will be made to the OPW to seek consent for this realignment.
- IBA french drain perimeter pipework taking surface runoff from the IBA perimeter road and discharging runoff into:
  - IBA cells during operations, and;
  - Holding pond via petrol interceptor post operations.

- A culvert 1500 mm diameter with an 825 mm orifice or similar approved at the entrance, c. 45 m long in the existing drain/watercourse is proposed to off-set loss of flood storage by constructing the permitted cell footprint and the proposed storm water attenuation pond within an existing flood plain. The culvert will restrict upstream extreme runoff flows and cause water level upstream of the culvert to backup resulting in flooding of lands immediately upstream of the culvert and contained within the confines of the waste licence (and planning) boundaries of the proposed development. A 1:30 year storm events will pass through the culvert with no impacts on upstream levels.
- Ancillary infrastructure includes:
  - 2 no. culverts (60 m) connecting the attenuation lagoon to the holding pond and the baffled chute outfall to the surface water attenuation lagoon.
  - 2 no baffled chute inlet structures discharging swale drainage flows into the holding pond.
  - 1 no baffle chute energy dissipation structure discharging holding pond outflows into the storm water attenuation lagoon.
  - 1 no baffled chute conveying emergency spills from the storm water attenuation lagoon to the Knockharley Stream.
  - 1 no emergency spill each on holding pond and attenuation lagoon.
  - Surface water quality monitoring stations at interface between Holding pond and Attenuation pond and at outfall from wetland into receiving drain/watercourse.
  - Infrastructure to support management of surface water monitoring and contaminated water arisings should they occur, (monitoring, pump sump, control valves).

Surface water management is described in Chapter 12 of Volume 2 of this EIAR.

2.8.1 Surface Water Attenuation

The permitted and proposed developments will be constructed on an existing 1000-year flood plain. Accordingly, replacement storage measures detailed in Chapter 12 of Volume 2 of this EIAR are proposed to offset volume lost from the permitted development.

Surface water runoff from all roads, hard standings and development north of the watershed divide will be diverted to the proposed northern surface water drainage attenuation outfall via a surface water trunk pipe. This pipe will vary from a 225 mm diameter up to a 750 mm diameter. The pipe will discharge into a holding pond and thereafter into the new northern attenuation pond and wetland, via a Class 1 bypass proprietary oil/water separator.

The attenuation system will be designed to manage the runoff from the development for up to a 1 in 100-year design return period storm event.

Surface water arising south of the watershed divide will discharge to the existing "Southern" storm water management system details of which are presented in Appendix 12.1 of Volume 3 of this EIAR proposed IBA cell area will drain via the main perimeter swale into a holding pond and thereafter enter the storm water attenuation pond via a culvert and baffled chute inlet. This pond has sufficient capacity to the accommodate increased

Surface water runoff from the "Northern" catchment will first pass through a proposed holding pond. The function of the holding pond will be to provide a containment facility in case contaminated surface water enters the storm water system. Flow will then pass to the proposed "Northern" surface water attenuation lagoon.

The function of the surface water attenuation lagoon will be attenuation and suspended solids management. Sizing details for the Proposed "Northern" attenuation is presented Appendix 12.4 of Volume 3 of this EIAR. The attenuation pond will have 4,969 m^3 dead storage, 4,698 m^3 live storage and 750 mm freeboard. The catchment area north of the watershed is c 62 ha and the greenfield 20-year outflow rate will be designed to throttle flows to 255 l/s.

Outflows from the storm water pond will enter wetland via a floating weir or similar and will be discharged thereafter into the receiving Knockharley stream/storm drain via a piped outfall with rip rap or similar lining protection. The attenuation pond will also have an emergency spill capable of passing a 1:100-year discharge of 3,240 l/s into the receiving watercourse via a baffled chute.

The lagoon will be designed to accommodate a suspended solid loading of 2,500 mg/l and deliver an outflow containing less than 35 mg/l in accordance with current licence emission limit values.

The receiving wetlands will provide additional polishing to reduce suspended solids loading to typically less than 5 mg/l once wetland vegetation has been established.

This attenuation design approach is appropriate according to The CIRIA SUDS Manual C753 ISBN: 978-0-86017-759-3 (published December 2015) as pre-treatment devices for SUDS components receiving point source inflows.

The perimeter swales will have an approximate depth 600 mm with a bottom width of 1,000 mm and side slopes of 1 in 3.

The swales will be constructed in accordance with The CIRIA SUDS Manual C753 version 6. Surface water swales will initially commence at the storm water attenuation lagoon outfall and be constructed around the landfill footprint and embankments as the facility develops.

The storm water attenuation pond will be lined with a composite barrier, comprising a HDPE membrane and a 1.0 m clay basal layer with a permeability of $1x10^{-9}$ m/s, which is the same specification as the landfill cell clay barrier. The constructed wetland will comprise a shallow clay-lined pond both naturally colonised and planted with appropriate species. The outflow from the constructed wetland will flow into the local water course/drainage network at the north-eastern corner of the site. The 1:20 year outflow discharge rate will be 255 l/s.

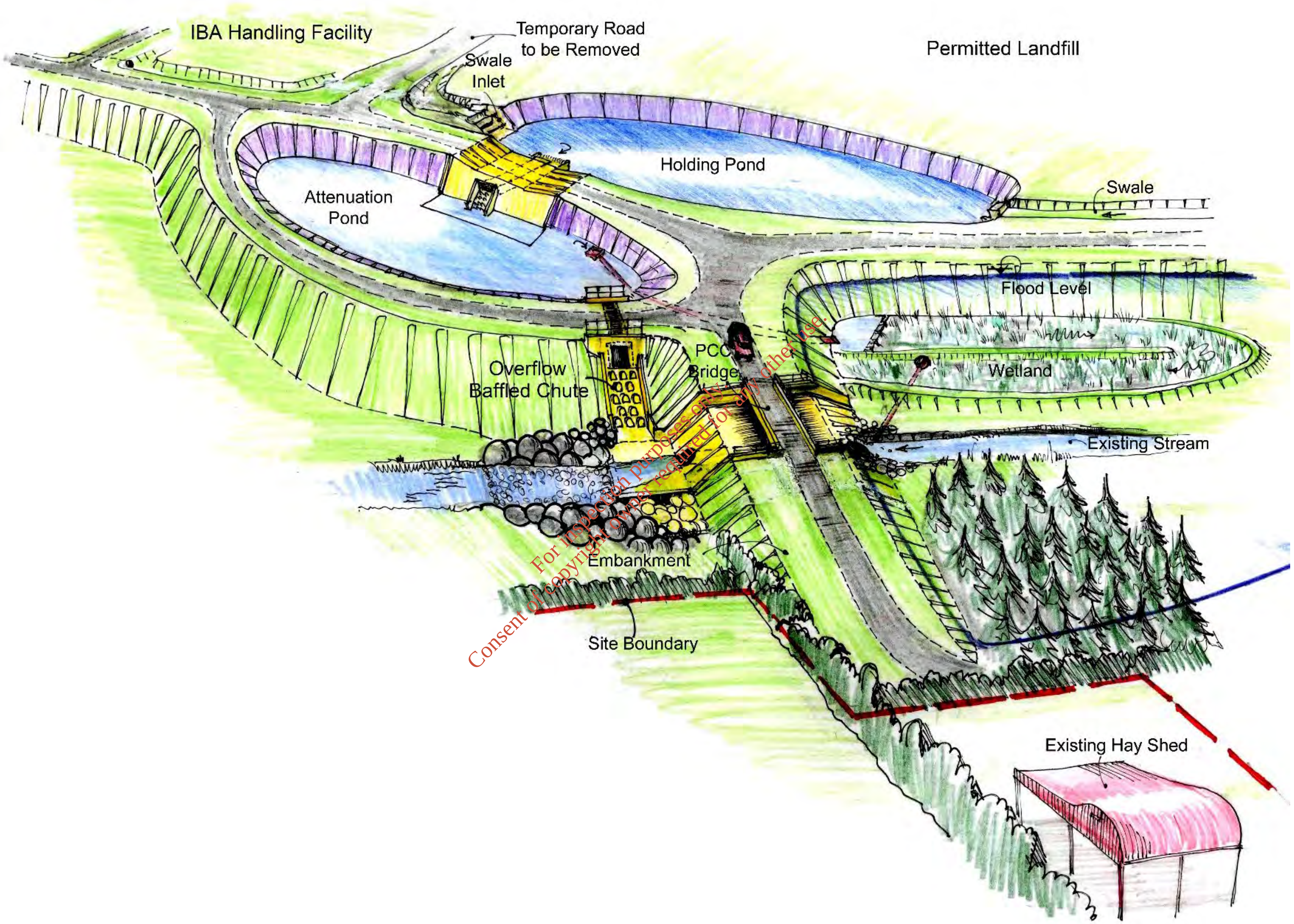


Figure 2-15: Artist Impression Northern Stormwater Attenuation Pond and New Flood Area

2.9 Earth Balance & Proposed Berms

Perimeter screening berms will be constructed using excavated materials from the cell development. The proposed berms are shown on Drawing No. LW14-821-01-P-050-0011 Cut Fill Phasing in Volume 4 of this EIAR. It is proposed to construct screening berms along the western boundary to a maximum of 10 m in height, on the eastern boundary to a maximum height of 10 m and on the northern boundary, to a maximum height of 6 m, with a total berm footprint of c. 11.3 ha. Haul roads for construction of the berms will be in or immediately adjacent to berm footprint.

2.10 Proposed Tree Felling & Replanting

The development of the proposed IBA cells, as well as the installation of the proposed screening berms, will necessitate the felling of approximately 12.5 ha. of commercial forestry currently in place within the boundary of the existing facility. A total of 37.7 ha of forestry is in place. Post restoration the forestry will comprise more than 40 ha. The replanted areas will require restoration of forestry over proposed screening berms (8.8 ha) and new planting within the site of 7.1 ha. Felling and Replanting locations are presented in Drawing No. LW14-821-050-003 Existing Forestation, Proposed Felling and New Planting in Volume 4 of this EIAR. In the context of this development reforestation means restoring forestry in areas that were felled to facilitate development, i.e. replanting. New planting/forestation means planting forestry in areas that were not previously forested to maintain the same level of forestry on the site.

The existing and forestry and proposed felling and replanting is discussed in more detail in Chapter 10 of Volume 2 of this EIAR.

Typically, woodland to be felled is immature woodland comprising mixed broadleaved/coniferous woodland (WD2). The trees are largely less than 4-5 m in height in the still immature sections and comprise a mixture of Alder, Silver Birch, Beech, Willow species, Sitka Spruce and Lodgepole Pine (among others). The more mature compartments now comprise trees up to 10m in height though wet conditions underfoot have restricted growth in some locations. These are largely in the northwest of the site.

It is expected that the clear felling will occur in sequential phases prior to clearance of the areas required for IBA cell development and the areas required for berm development and will correspond with one of the phases of construction of landfill cells.

It is assumed that the clear felling over respective areas will occur over periods between 4 and 8 weeks.

It is also proposed that replanting of the felled forestry will take place within the site and this replacement planting will occur on the berms to be developed. The replant lands will be properly certified as suitable for forestry by a certified forester. Replanting will be influenced by the following criteria:

- not occurring within an environmentally designated area
- not within high ecological value habitat
- replanting to be in accordance with Forest Service Guidelines e.g. 'no-plant' buffers from aquatic zones to be implemented.
- no fertilization to take place when replanting

All felling and replanting will be undertaken in accordance with the Felling Act 2014.

The felling will be the subject of a Felling Licence from the Forest Service and will be in accordance with the conditions of such a licence. Subject to receipt of planning, Knockharley Landfill Ltd. will apply to the Forest Service for the necessary Limited Felling licence(s) for clear felling works at the Knockharley site, in line with the requirements of the Forestry Acts 1988 to 2014.

Clear felling has the potential to impact adversely upon the environment if undertaken in an uncontrolled manner; however, the adoption of felling procedures, operating techniques and control measures will mitigate any potential adverse environmental effects.

The impacts associated with clear felling in respect of other aspects, such as hydrology and water quality, ecology, soils and geology, traffic, etc. are appraised in detail in the relevant chapters of the EIAR.

No felling will be required for the proposed development during the decommissioning phase and as such the operational and decommissioning phases of development are not discussed in this chapter, other than in respect of turbulence felling.

2.10.1 Proposed Felling Methodology

A harvester or processor is used for harvesting operations, which incorporates the felling of trees, de-branching, and cutting them into required lengths. Processing is the term used to describe de-branching and cross-cutting. The harvesting machine operates the harvesting head which is located on the front arm of the machine. The head contains the saw, wheels for moving and de-branching the tree, measuring devices for measuring the length and diameter along the tree, and a urea applicator. A typical harvester/processor is shown in Plate 2-7.

(source: www.teagasc.ie)

Plate 2-7: Typical Harvester Unit

The harvester will fell four rows of trees at each side of the machine, so from a standing position 8 rows of trees, within the reach of the machine, are cut. The rows of trees are typically planted 2m apart, so a harvester can cut a c. 16m wide strip. Therefore, the harvesting racks, laid down as the harvester moves along will be c. 16m apart.

The harvesting or extraction rack is the path used by timber harvesting and extraction machinery. It is normally formed by the harvesting machine during the cutting of the timber using the branches and crown of the tree. The covering of branches on the extraction rack is also called a brash mat or lop and top.

A number of racks at c. 16 m centres will be required to clear the respective cell and berm development areas which can link together along a central extraction corridor, as required.

Each tree will be cut at its butt as close to the ground as possible. Each tree will then be de-branched and processed into several lengths of log which are dependent on the tree diameter and its length. The minimum useable diameter is generally 7 cm. The harvesting machine is calibrated to make maximum use of each tree to avoid unnecessary wastage.

The processed logs will be dropped in piles beside the extraction racks with the different categories of logs grouped together to facilitate forwarder extraction.

A forwarder is a mechanically propelled machine which uses a hydraulic arm to gather timber logs and stacks them on the body of the machine.

It then transports the logs to the required location and stacks them in heaps. A forwarder has a rotating operating area which allows it to be operated efficiently going forward or backward. A typical forwarder is shown in Plate 2-8.

A forwarder will be used to transport the timber logs from the forested areas to intermediate storage areas within the Knockharley site before collection and transport off-site.

The proposed storage areas are shown in Drawing No. LW14-821-050-0003 Existing Forestation, Proposed Felling and New Planting in Volume 4 of this EIAR are located adjacent to the proposed internal road network within the facility, for ease of loading/storage of the timber. The timber logs will be transported along the racks laid down by the harvester to join into the existing landfill site roads. The extraction or haul distances will vary throughout the site depending on the distance to the existing site roads but has been laid out to minimise the length of travel. Temporary adjoining roads, from the harvesting area/racks to the existing landfill roads, will be developed utilising suitable virgin material available within the Knockharley Landfill. As the proposed felling will be undertaken in conjunction with a phase of landfill cell development at the Knockharley landfill site, the development of these temporary adjoining roads will be included within the specification associated with this construction phases.

(source: www.teagasc.ie)

Plate 2-8: Typical Forwarder Unit

Smaller forwarders which can transport up to 12m^3 of timber will be used throughout the site.

The forwarder transports each different category of logs separately and stacks them at the forest road in separate piles in a stable and safe condition.

Dense, fresh brash mats are the most important part of a felling site as they serve to avoid soil damage, erosion and sedimentation. These will be designed and installed to protect the underlying soil from damage, while avoiding aquatic zones and will be maintained throughout the felling operation. Their purpose is to prevent breaking of the ground surface thus preventing silt or nutrient run-off.

Brash mats will be installed along the extraction racks to protect the underlying soil from damage and will be well maintained and functional throughout the harvesting operation. The minimum amount of brash necessary to support the machinery will be used throughout the site. The bulk of the brash will be bundled and recovered from the site in a process known as forest residue recovery.

Double- wheeled machinery and close poling (laying timber or logs side by side perpendicular to the direction of travel to spread the load across a low bearing surface) will be used as necessary to maximise the recovery of brash and where the bearing capacity of the ground may be poor.

Before any harvesting works commence on site all personnel, particularly machine operators, will be made aware of the following and have copies of relevant documentation:

- the felling plan, surface water management, construction management, emergency plans and any contingency plans
- environmental issues relating to the site
- the outer perimeter of all/any buffer and exclusion zones
- all health & safety issues relating to the site

The harvested timber will be transferred off site. The proposed traffic movements associated with the removal of timber off site is discussed in Chapter 8 Roads, Traffic and Transportation of Volume 2 of this EIAR.

2.11 Relocation of ESB Powerline & Substation Construction

2.11.1 Relocation of Existing 20KV line

An existing 20 KV overhead ESB powerline, which runs roughly north-south through the eastern portion of the Knockharley Landfill site, provides power to the landfill facility administration buildings via a 'spur' that runs overhead to the buildings.

The proposed route of the relocated powerline is shown in Drawing No. LW14-821-01-P-0000-003 Proposed Site Layout.

This spur runs over an area that will be impacted by the development of the proposed IBA cells area and the screening berm to the east of the cells, and thus will require relocation.

A new connection will be made approximately 100 m south of the existing connection point on the 20 KV line, such that an overhead line will run from this new point, roughly parallel with the existing entrance road, to the administration building.

All works in relation to the relocation of the powerline will be undertaken by ESB Networks or an approved contractor and will likely involve, *inter alia*:

- the erection of powerline poles by approved contractors
- the pulling of the electrical cable along the poles
- the disconnection of power and the temporary interruption of power supply associated with the 20 KV line
- the reconnection of the new cable as part of the powerline
- the powering up and checking of the new line

2.11.2 New ESB Substations

It is proposed to construct 2 no. new ESB substations located within the existing Knockharley Landfill site boundary. Station 1 will be at the north-eastern corner of the currently permitted landfill footprint. Station 2 will be adjacent to the proposed Biological Management facility. The location of the substations is shown in Drawing No. LW14-821-01-P-0000-003 Proposed Site Layout in Volume 4 of this EIAR and details of the substations are provided in Drawing LW14-821-P-1700-010 in Volume 4 of this EIAR.

Overhead lines will be constructed to connect into ESB substation subject to ESB approval and shall connect into overhead lines running east west parallel to and offset from the Kentstown Road on the northern boundary of the facility.

2.12 Proposed Ancillary Developments

To facilitate intensification of the permitted cells and the proposed IBA cell development, ancillary infrastructure will be required for the management of surface water, leachate, air and for traffic movement. These have been discussed in the relevant sections above.

2.12.1 Ancillary Services

The permitted development has provision for:

- Above ground gas collection ring mains, site lighting and overhead power lines, site access.

The proposed development will require extension of the following in-situ services:

- Below ground services associated with power, water supply and telemetry to leachate, groundwater side risers and associated proposed development areas.
- Additional leachate side riser pump installations to remove IBA leachate from the cells.
- Above ground temporary site lighting in cells and permanent site lighting on:
  - The proposed IBA cell perimeter road.
  - The proposed leachate management facility.
  - The proposed biological facility.

2.13 Environmental Controls

The facility was designed and is being operated in accordance with the EU Landfill Directive 1999/31/EC (hereinafter referred to as the Landfill Directive), IE Licence W00146-02 and Technical Amendments A, B, C and D and the EPA Manuals on landfill selection, design, operation and monitoring.

It is not proposed, nor is it deemed necessary, to implement changes to the comprehensive environmental controls and monitoring that are presently in operation for the permitted development.

Environmental Controls are currently implemented via monitoring and reporting undertaken in accordance with Schedule D of the existing facility licence.

As identified previously, the proposed development will require an updated licence to reflect the proposed operations as outlined herein. An application is being prepared for the Environmental Protection Agency (EPA) to follow the planning application to which this EIAR relates.

Pre-application consultation has been undertaken with the EPA and further detail on this is provided in Chapter 5 of Volume 2 of this EIAR.

Subsequent sections hereinunder will therefore refer to, current licence conditions or future variants as may be required to identify how controls will be implemented.

2.13.1 Groundwater Protection

Leachate has the potential to impact on groundwater quality in the absence of mitigation.

The existing landfill facility was designed and is being operated in accordance with the EU Landfill Directive 1999/31/EC (hereinafter referred to as the Landfill Directive), IE Licence W00146-02 and Technical Amendments A, B, C and D and the EPA Manuals on landfill selection, design, operation and monitoring. The remainder of the permitted landfill development and the proposed IBA cell area will be designed in accordance with the EU Landfill Directive.

Prior to any construction on site, EPA approval is required for all specified engineering works. Following construction an independent Construction Quality Assurance (CQA) report will be prepared for submission to the EPA for approval.

All containment structures such as lagoons and tanks shall be designed to mitigate any potential impacts on groundwater. Please refer to section 2.6.3 and 2.7. All bunds, tanks, lagoons, containment structures and pipework are, and will be subject to integrity assessment every 3 years in accordance with the licence.

A leachate management system will control leachate generated in the landfill, the IBA cells and the biological treatment facility. Leachate management is discussed in Sections 2.2.6, 2.5.5, 2.6.3 and 2.7.

Groundwater monitoring is carried out quarterly with biannual reports submitted to the Agency which are available on the EPA web site. Monitoring will continue in accordance with the licence. As part of the preparation of this application, 3 new boreholes were installed in 2016 to facilitate baseline sampling at locations downgradient of proposed infrastructure.

Leachate lagoons and tanks will be designed, constructed and operated as discussed in Section 2.7. All lagoons and bunds will be tested for integrity at 3-year intervals in accordance with the licence.

Groundwater control

Historically groundwater has required drainage systems below the cell liner systems to intercept such groundwater as may be present.

Typically, groundwater from site has been present in sand lenses within the boulder clay and flow rates are historically very low. Such groundwater as may be pumped will be directed to the existing storm water lagoons as is presently the case or to the proposed northern storm water lagoon. This was discussed in Section 2.2.5. This method of groundwater control will be employed for all future cell development on site.

Historic evidence shows that groundwater pumping has little if any influence on surrounding groundwater elevations.

Once cells are full, subject to Agency approval, groundwater may be allowed to rise above leachate levels within cells, to mitigate further the risk to groundwater. Under these circumstances and in the unlikely event of a leak in a liner, groundwater elevation would be higher than the 1.0 m leachate depth conditioned in the waste licence and groundwater would enter the cell as opposed to leachate egressing from the cell.

The potential impacts to groundwater and mitigation measures are discussed in Chapter 11 of Volume 2 of this EIAR.

2.13.2 Protection of Air Quality

The following have the potential to impact on air quality in the environment in the absence of mitigation measures:

- Landfill gas generated by the landfilling of waste
- Malodourous waste materials accepted and managed at the facility (including leachate)
- Dust, particulate matter and traffic emissions generated at the facility

There is an existing landfill gas collection and management system at the facility which will be extended (collection network) to include the permitted development. There is sufficient treatment capacity on site to treat landfill gas produced by the proposed development. This is discussed in Section 2.2.9.

An air handling system will be installed in the proposed biological waste treatment facility to manage air quality in the building and emissions from it. A new monitoring point will be located at the stack emissions point from this facility. This is discussed in Section 2.6.

Operational practices in accordance with the licence are and will be employed to manage nuisance from dust and odour.

Air quality is discussed in further detail in Chapter 7 of Volume 2 of this EIAR.

2.13.3 Surface Water Protection

The facility was designed and is being operated in accordance with the EU Landfill Directive 1999/31/EC (hereinafter referred to as the Landfill Directive), IE Licence W00146-02 and Technical Amendments A, B, C and D and the EPA Manuals on landfill selection, design, operation and monitoring.

A second surface water attenuation lagoon and wetland with an associated surface water holding pond and a new flood plain is proposed for the facility to facilitate management of surface water in the northern portion of the site. It is proposed to create a new surface water sampling point at the outlet from the northern wetland. There are existing monitoring points upstream and downstream of the proposed discharge location.

Surface water at the facility is managed in accordance with the surface water management plan. Surface water during construction will be managed in accordance with the Outline Construction Environmental Management Plan (CEMP) in Appendix 2.0 of Volume 3 of this EIAR.

The potential impacts on surface water are addressed in Chapter 12 of Volume 2 of this EIAR.

Surface water monitoring and reporting of results is and will continue to be carried out in accordance with the licence.

2.13.4 Noise Control

Noise monitoring is and will be carried out in compliance the licence and the licence specified noise emission limits. The potential impacts of noise on the environment are discussed in detail in Chapter 9 of Volume 2 of this EIAR. Two new noise monitoring points are proposed on the local road to the east of the facility, located to monitor potential noise emissions from the proposed IBA facility and the proposed biological treatment facility.

2.13.5 Nuisance Controls

2.13.5.1 Vermin Control

Strict management and mitigation measures are in place and have been successful in the control of populations of vermin in the vicinity of the landfill. These measures include the following:

- Daily cover material comprising soil-like material is placed on the active area of the landfill to deny access for scavenging birds and vermin to the waste
- The surface area of exposed waste is minimised during operations and good housekeeping practices are employed to minimise the potential for scavenging
- Professional vermin control experts are employed to control vermin levels using standard humane methods. Measures used as part of this programme include internal and external bait boxes, rodenticides and insect control measures. Vermin control commenced before the onset of landfilling
- Baiting is undertaken monthly, or more frequently as required
- Precautions are taken to avoid non-target species from coming in contact with vermin bait e.g. rodenticides. This includes the following: laying bait in areas not accessible to non-target species and strict control of vermin population levels. The success of the programme is manifest by the diversity of fauna that has colonised the site since farming has ceased and landfilling has commenced.

These measures will be extended to provide vermin control for the proposed biological treatment facility.

2.13.5.2 Litter Control

Measures used to control litter at the site include the following:

- The active tipping area is kept to the minimum area required to efficiently operate the site
- The active tipping area is covered daily with soil-like material
- All waste in non-active areas of the landfill is always covered with soil or an alternative mineral layer
- Netting systems are employed around active areas of the site
- Mobile litter cages are used as necessary close to unloading vehicles
- A minimum buffer of approximately 100 m exists between the landfill footprint and the site boundary. This ensures that in the event of a failure in the netting system the primary receptor of any litter will be on land owned by the site operator and a clean-up can be instigated immediately
- All waste is delivered to the site in covered vehicles. Any vehicle delivering uncovered waste is deemed to be in breach of waste acceptance contract conditions and appropriate action is taken by Knockharley Landfill Ltd. This action is designed to ensure that this practice does not recur
- Future deliveries of biodegradable waste will also be in fully-covered vehicles that will be unloaded indoors with no potential for littering
- Waste contractors are prohibited from using minor roads on their approach to and departure from the site and all access is directly from the N2
- Staff at the site patrol the nearby roads regularly to ensure that there is no litter emanating from vehicles using the facility. The nature of the waste to be deposited on the north face will be less prone to litter nuisance
- The site is closed in the event of severe wind conditions.

These measures will continue to be employed at the facility and shall be reviewed annually.

2.13.5.3 Bird Control

The number of scavenging birds such as gulls and crows attracted to the landfill site are minimised by the following measures:

- Daily cover material comprising soil-like material is placed on the active area of the landfill to deny access for scavenging birds to the waste
- The surface area of exposed waste is minimised during operations
- The number of birds at the surface water attenuation pond is monitored regularly by site personnel confirming the success of the bird control measures.

In over ten years of operation, there has been no significant increase in the number of birds at the site. Current procedures will be maintained as part of controls associated with the proposed increase in waste acceptance. The pre-treatment of MSW such that the biodegradable fraction of waste is reduced in accordance with specific conditions of W01465-02 reduces the attractiveness of the waste to birds and vermin.

2.13.6 Other Environmental Controls

The controls in place to mitigate potential impacts on the human environment are discussed in Chapter 6 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on roads, traffic and transportation are discussed in Chapter 8 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on biodiversity are discussed in Chapter 10 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on soil are discussed in Chapter 11 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on landscape are discussed in Chapter 13 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on material assets are discussed in Chapter 14 of Volume 2 of this EIAR.

The controls in place to mitigate potential impacts on archaeology are discussed in Chapter 15 of Volume 2 of this EIAR.

2.14 Construction Phase Methodology

2.14.1 Construction Programme

The proposed cell layout and phasing for the permitted and proposed developments are presented in Table 2-14. Drawing LW14-821-01-P-0050-011 Cut and Fill Phasing in Volume 4 of this EIAR shows the proposed construction cut locations and phasing of screening berms associated with key mile stone developments. This drawing should also be read in conjunction with Drawing no. LW14-821-01-P-0050-003 Existing Forestation Proposed Felling and New Planting in Volume 4 of this EIAR as programming was designed to facilitate replanting / new planting within 2 years following felling as may be required.

It is preferable, from a construction viewpoint, that construction of the facility take place during the summer months to take advantage of longer daylight hours and drier weather. However, this is dependent on a number of factors including the implementation of appropriate mitigation measures in relation to the ecology of the development locations (refer to Section 11).

Upon appointment of a contractor for the works, a programme will be developed taking account required mitigation factors.

Table 2-14: Proposed Construction Phasing

Infrastructure	Cell Construction Programme (years post grant of permission)	Screening Berm
Cells 19, 20, 21, 22, 28, 29 and cell weathering area 32	0 through 2	Berms A and B
Advance works, security, felling, suspended solids management, site clearance, haul roads, services	0 through 1	Berm A
Surface water management infrastructure	0 through 1	Berm A
Screening Berms	1 through 8	Berms A through D
Leachate infrastructure	1 through 5	Berms A through D
Miscellaneous infrastructure	1 through 5	Berms A through D
Cells 24, 26 and 27	3 through 4	Berm C
Cells 23. 25 and 30	5 though 6	Berm D
Cells 31 and remainder 32	7 through 8	Berm E
Capping	1 through 8	

Infrastructure provision (access roads, power, telemetry, gas, leachate, surface water) will be developed concurrent with cell construction.

2.14.2 Construction elements

The key construction elements are as follows:

- advance works
- general earthworks and associated concrete works
- internal roads
- deforestation
- screening berms
- access Roads
- IBA storage facility
- additional above ground and below ground floating cover lagoons to store incoming and treated leachates
- leachate management facility
- a weathering / future reprocessing area within the IBA cells
- an additional wheel wash to clean vehicles leaving the IBA cell development
- additional leachate rising mains and associated suspended solids management systems tanks
- additional below ground ducting for water, telemetry and power
- biological treatment facility
- upgrading of leachate management facility
- new underground ESB power supplies and remove existing overhead power supplies

2.14.3 Construction Methods and Materials

2.14.3.1 Advance works

The following section outlies the key construction related deliverables required prior to development of Cells and associated Infrastructure:

- Establishment of site security, fences and Works compound (s) with appropriate welfare provision.
- Establishment of temporary surface water management measures requiring construction of silt fences and or localised settlement ponds to contain suspended solids associated with dig and deposition areas.
- Site clearance for screening berms.
- Installation of site access roads requiring stripping and stockpiling of topsoil and installation of granular formations atop separation membranes.
- Felling in accordance in accordance with the Felling Act 2014.
- Relocation / exposing of existing services to facilitate connection to proposed works.

2.14.3.2 Overview of Earthworks and Associated Concrete Works

Construction element broadly fall under two categories for earthworks related operations; earthworks and structures.

Bulk dig and construction of stockpiles and screening berms

An earth balance will define excavation locations and fill (typically screening berm) locations subject to construction program considerations and detailed design.

Prior to earthworks taking places advances works described above will require construction of haul roads, silt ponds and installation silt fences to mitigate impact of suspended solids on adjacent watercourses.

Thereafter overburden material will be excavated using tracked 360º excavators and transported in off road dump trucks to screening berm locations where material will be placed, compacted in layers, profiled, top soiled planted with trees and grass seed. If boulder clay (at depth) is encountered it will be stockpiled for reuse as engineered clay in lining systems, see below.

Where ground water is present gravity and or pumped drainage will be provided with outlets via suspended solids pond into receiving surface waters.

In all lagoons engineered clay will be installed in layers and compacted using a sheep's foot roller or similar in layers to ensure compliance with permeability specifications after which 2.00 mm welded HDPE lining materials will be installed.

Production of engineered clay

Following removal of overburden to screening berms or stockpiles, in-situ boulder clay will be excavated, passed through trommels to remove boulders exceeding 50 mm diameter and stockpiled or placed within excavations to form a 1.0 m engineered clay barrier.

Boulders will be used on site as granular fill in haul roads.

Engineered clay (with boulders removed) will be placed and compacted in layers not exceeding 250 mm typically to a proctor maximum dry density of 98% or more subject to permeability testing.

Concrete works

Concrete works will typically require local excavations, drainage and suspended solids management for dig and concrete pours and into which structures will be built requiring placement of blinding, shutters, reinforcement and final concrete pour. Near watercourses, where possible precast concrete (e.g. culvert) to mitigate any potential impacts on surface water will be used.

Swales and inlet structures will be excavated, profiled and seeded asap to mitigate development of suspended solids

2.14.3.3 Internal Roads

Internal roads will comprise:

- Haul roads during construction. These will typically comprise stone aggregate compacted using vibrating rollers on separation membranes.
- Paved roads in the IBA cells constructed using reinforced concrete over IBA formations.
- Perimeter roads using conventional barber greens, vibrating and dead rollers for:
  - IBA cells
  - Permitted development.

2.14.3.4 Screening Berms

Screening berms will be constructed on a phased basis concurrent with overburden from cell excavation works. Prior to berm installation, top soil will be stripped back formation compacted and soils as may become available placed and compacted in layers.

Layers will be overfilled and once berms are at the final height is reached will have side slopes profiled receive and allow subsequent placement of topsoil, seeding and tress as required.

To minimise erosion, storm drainage will be installed prior to bulk earth moves and silt fences will be placed around screening berms until a grass cover has become established.

Prior to earthworks taking place temporary haul roads will also be installed.

2.14.3.5 Surface Water Management

Prior to any earthworks or forestry works taking place, measures to mitigate potential impact on surface water from suspended solids will be implemented. Where permanent measures are not in place temporary settlement ponds and or silt fences will be established to mitigate the risk of suspended solids entering water courses.

Settlement ponds will typically have below ground excavation facilitating gravity flows where possible lined with a synthetic material and a discharge pipe system with appropriate downstream protection in the receiving water using concrete or rip rap to dissipate energy and prevent downstream erosion.

Prior to cell development works taking place, the northern catchment storm water infrastructure will be constructed.

Excavated materials will be removed to screening berms. Clay barrier material won from underlying boulder clays to produce engineered clay will be placed in layers and compacted to 98% maximum dry density.

Thereafter a 2mm textured HPPE liner will installed with welding being monitored by independent CQA.

Inlet and outlet structures and associated protection works will constructed using reinforced concrete.

2.14.3.6 IBA Cells

Overburden will be removed and placed in screening berms. In-situ boulder clays will be engineered via screening to remove boulders. A ground water drainage system will be installed to accommodate prevailing site conditions upon which the engineered clay barrier will be installed and compacted to 95% maximum dry density.

Thereafter a 2 mm textured HPPE liner will installed with welding being monitored by independent CQA upon which a protection geotextile will be placed prior to installation of a 500 mm drainage stone blanket within which will be a HDPE drain pipe network will terminate in HDPE sider risers.

Headwalls and valve chambers associated with leachate pumping will be constructed using reinforced concrete and pipework and telemetry ducts will be constructed using HDPE welded pipework.

2.14.3.7 IBA Weathering Facility

The construction of the IBA Weathering Facility is described as follows.

The storage area will be constructed within the IBA footprint in cell 32. Following completion of the cells a level formation will be established using IBA materials to facilitate acceptance of IBA materials. A single span portal frame building (76 m x 76 m) will be constructed on concrete pad foundations within the in the IBA weathering footprint.

Initially IBA material will be placed in thin layer above a thermal protection barrier to mitigate elevated temperatures damaging the liner.

To facilitate weathering. Once a level platform of weathered IBA is in place, a central access road will be constructed using reinforced concrete.

Clay barrier material will be won from underlying boulder clays excavated to form cells. Boulders within the excavated clay will be removed via screening and engineered clay will be placed in layers and compacted to 96% maximum dry density.

Thereafter a 2mm textured HPPE liner will installed with welding being monitored by independent CQA.

Inlet and outlet structures and associated protection works will constructed using reinforced concrete.

2.14.3.8 Leachate Management Facility

The primary elements associated with the leachate management facility will comprise:

- Floating cover lagoons excavated below ground and lined with 1.0 m clay barrier. Clay barrier material will be won from underlying boulder clays excavated to form cells. Boulders within the excavated clay will be removed via screening and engineered clay will be placed in layers and compacted to 96% maximum dry density. The floating cover will be constructed using LLDPE.
- Overground tank constructed using glass lined prefabricated steel tanks founded on a reinforced concrete foundation with reinforced concrete bund walls to facilitate emergency containment.
- Leachate tanker loading facility constructed with reinforced concrete bays and associated HDPE pipe drainage to adjacent tanks to accommodate spills. Pipework from tanks and lagoons will be below ground welded HDPE.
- Reinforced concrete area on granular fill to accommodate containerised treatment modules as may be required for future treatment and or conditioning of leachate road.
- Surfaced dressed access road on granular formation facilitating access to the facility.

2.14.3.9 Biological Treatment Facility

The biological treatment facility will be a portal frame building surrounded by a concrete working area to facilitate access and egress of vehicles.

Prior to building construction, the topsoil will be stripped back under the footprint of the buildings. Additional excavation will be carried out to the formation level of foundations and underground tanks, where required. The foundations will be ground bearing reinforced concrete pads/strips on a suitable stratum. Once the foundations are poured, rising walls will be constructed. These will be comprised of a mixture concrete blockwork walls and reinforced concrete retaining “push walls” in material handling areas and in tunnels. Push walls will be designed to retain the weight of stockpiled material and pushing forces from loading vehicles. Due to site topography, import of fill material to raise the levels to the underside of floor will be required. Imported fill shall be a granular engineered fill, compacted to provide a suitable subgrade for the building floors. Floors will be steel, or fibre reinforced concrete industrial floors on a suitable depth of compacted granular fill.

The steel frame will be erected on the reinforced concrete substructure. The frame will consist of rolled steel columns and rafters at 5-7m typical spacing. Cold rolled light gauge steel purlins and cladding rails will be fixed to the main columns and rafters. The frame will be cladded with corrugated coated steel cladding, to match the existing building. Access to the building will be by fast acting industrial roller shutter doors, with personnel access/fire escape doors as required to comply with Fire Regulations.

The walls and roof of the composting tunnels will be entirely of reinforced concrete construction.

External cladding will be affixed to the steel frame when completed.

Roof drainage will consist of gutters and downpipes draining the pitched roofs, the roof of the composting tunnels will be “flat” with a nominal fall. The concrete surface of the tunnel roof will be made waterproofed by means of a bonded membrane system. All roof water will be collected for harvesting.

Below ground tanks leachate tanks will use proprietary fibre glass or similar encased in concreted and surrounded by a 1.0m engineered clay barrier.

The external marshalling yard areas will be topsoil stripped. Imported fill will be required on the lower portion of the site to raise the subgrade to the final levels. The yard will be paved with steel or fibre reinforced concrete slabs and ramps similar to the internal floors of the building. The slab will be jointed to control cracking. The slab will bear on a layer of compacted granular fill. Services and drainage in the yard area will run underneath the slab.

The concrete slabs will be laid to falls, surface water drainage will be by means of gullies or drainage channels. Reinforced concrete retaining walls and gabion structures will be constructed along the western boundary of the facility footprint to retain the raised ground levels.

Drainage runoff will pass through petrol interceptors by gravity into the existing stormwater system. Manhole chambers will be constructed using reinforced concrete.

2.14.3.10 Wastes generated during construction

The wastes/spoils likely to be generated during the construction phase are presented in Table 2-15 below.

Table 2-15: Potential Wastes Generated during Construction Phase

Waste	Source
Hardcore, stone, gravel, concrete and plaster	Materials used during construction
Timber	Temporary supports, concrete shuttering and product deliveries
Miscellaneous building materials	Chemical toilets
Waste from chemical toilets	Packaging materials
Plastics	Unused quantities at end of construction period
Lubricating oils, diesel	

All wastes will be collected at the end of the construction phase, taken off site, and reused, recycled, recovered or disposed of according to best practice in an authorised facility. Lubricating oils and diesel will be removed from the site and disposed of by an approved waste contractor in accordance with the European Communities (Waste Oil) Regulations, 1992, as amended.

An Outline Construction Environmental Management Plan has been prepared and included in Appendix 2.0 of Volume 3 of this EIAR which includes a draft waste management plan to be implemented during the construction phase.

2.14.4 Hours of work

Construction work will generally be carried out during daylight hours. Construction work will generally be confined to the following times:

07:30 to 18:30 Monday to Saturday

2.14.5 Construction Traffic & Access

The facility's construction will lead to construction-related traffic on the roads in the proximity of the development.

It will include:

- Site personnel driving to the work site and site compounds (by car, van and 4x4)
- Delivery of liner materials, tanks, steel, cladding and other construction materials by van and HGV
- Movement of construction equipment and refuelling trucks to and around the site
- Import of fill material and concrete
- Export of felled timber

A detailed Traffic Management Plan will be prepared prior to the commencement of the construction work. This will be drawn up in consultation with Meath County Council. Written procedures will also be put in place to deal with refuelling machinery in line with best practice. The Outline Construction Environmental Management Plan is prepared and included in Appendix 2.0 of Volume 3 of this EIAR which includes a Draft traffic management plan to be finalised to take account of relevant conditions attached to any permission or IE review granted and implemented during the construction phase.

Potential impacts from construction traffic are further dealt with in Chapter 8 Roads, Traffic & Transportation of Volume 2 of this EIAR.

2.14.6 Construction Compound

A temporary Contractors Compound will be required for the duration of the construction cycles. It will consist of a hardcore area surrounded by secure fencing, comprising site office, canteen, toilet facilities, storeroom and staff parking areas. Fuel/oil storage areas will be bunded in accordance with best practice. The compound will move around site to accommodate the cycles of construction.

Temporary toilet facilities will be required for construction workers. These will consist of temporary 'portaloo' type chemical toilets located within the construction site compound.

2.14.7 Environmental Management

The Outline CEMP is included as Appendix 2.0 in Volume 3 of this EIAR. It sets out the key construction and environmental management issues associated with the proposed development. This plan will be finalised to take account of relevant conditions attached to any permission or IE review granted.

2.15 Management of the Facility

2.15.1 Operational Hours

The IE Licence currently permits the following operational and waste acceptance hours:

Hours of Operation:

- 07.30 to 18.30 Monday to Saturday

Hours of Waste Acceptance:

- 08.00 to 18.00 Monday to Saturday

No changes to the hours of operation or waste acceptance are proposed.

2.15.2 Management & Staffing

Knockharley Landfill currently operates with 6 no. permanent personnel:

- Landfill Manager
- Assistant Landfill Manager
- Site Foreman
- Weighbridge Operator
- 2 no. general operatives

When operational, it is envisaged that further operational personnel will be required in addition to those currently employed, for the operation of the various elements of development as follows:

IBA Cells:

- 1 no. overseer
- 3 no. general operatives/plant drivers

Landfill - 2nd Working Face:

- 1 no. overseer
- 2 no. general operatives/plant drivers

Biological Treatment Plant:

- 1 no. overseer
- 3 no. general operatives/plant drivers

Therefore, it is envisaged that 17 no. personnel shall be employed on a full-time basis when the proposed development is operational.

2.15.3 Management of wastes generated onsite

All non-process related wastes generated onsite (from administration building, weighbridge office etc.) will continue to be managed by a suitable waste management contracting company and will be taken offsite for treatment at relevant approved waste management facilities.

2.16 Environmental Monitoring & Reporting

Environmental monitoring and reporting is undertaken in accordance with Schedule D of the existing facility licence W0146-02. Additional monitoring locations will be proposed as part of the required licence review of W0146-02 and are shown on Drawing No. LW14-821-01-P0050-002 in Volume 4 of this EIAR

There are also a number of engineering/design monitoring requirements under the existing licence, which will be maintained within any revised licence, as summarised below.

2.16.1 Stability and Settlement

A survey of the landfill body site is carried out once per year and submitted to the EPA in accordance with Condition 8 of the existing licence. If settlement is found to be interfering with the integrity of the cap or interfering with run-off from the landform, measures will be taken to reinforce the cap or reshape the landform as required. No issues have arisen to date. The most recent survey was carried out in May 2018.

The height difference between the permitted and proposed development will be realised with slopes not steeper than 1:20 such that impacts of differences in differential settlement will be minimal.

Where non-stabilised residual waste abuts inert and stabilised waste differential settlement rates and extents will differ significantly and reprofiling may be required over several years subject to annual survey findings.

Preliminary design studies also informed selection of the proposed side slopes to ensure that translational cap and rotational stabilities within the waste body will not present long-term problems.

2.16.2 Contingency Arrangements

Contingency arrangements for the current landfill operation as conditioned in the licence i.e. emergency response procedures, will apply to the proposed development.

2.16.3 Closure and Restoration

On closure, the landfill body will be capped, and the area returned to vegetation in compliance with Closure, Restoration and Aftercare plans agreed with the Agency. As part of the facility licence review, the existing Closure, Restoration and Aftercare plan will be revised to account for the new elements of development i.e. increased waste acceptance, IBA cell development, biological treatment plan development etc.

2.16.4 Reporting

Quarterly, bi-annual and annual environmental reports are submitted to the Agency in compliance with Schedule E of the existing licence for the facility. All records of monitoring are also kept in the information room. The general public can request sight of all monitoring data associated with the landfill and this practice will continue after review of the existing facility licence. Since 2016, all monitoring compliance reports are available online on the EPA website www.epa.ie.

2.17 Description of Natural Resources Used

Natural resources will be consumed during both the construction and operational phases related to the proposed development.

2.17.1 Construction Phase – Natural Resource Consumption

Natural resources consumed during the construction phase will include:

- diesel fuel for construction machinery
- steel in the building construction
- granular material for use as in-fill material for site development works and in concrete

While exact quantities are difficult to quantify at this juncture, it is expected that the following maximum quantities of resources will be consumed during construction:

- 9,975 m^3 of concrete
- 1,547 tonnes of steel
- 212,000 litres of diesel
- 52,495 m^3 of granular fill material

2.17.2 Operational Phase – Natural Resource Consumption

Natural resources consumed during the operational phase will include:

- Diesel fuel for site machinery (loading shovels, compactors, tracked machines etc.)
- Woodchip/peat/bark (if used for biofilter bed media)
- Water

Machinery

Biological Facility:

- Front end loader 2
- Tractor trailer 1

IBA Landfill:

- 30 t off road vehicles 2
- Roller 1
- Grader 1
- 360 excavator 2

Permitted development:

- Compactors 2

Fuel consumption per year assuming the average plant consumes on average 50 l/day average 275 days will be 151,250 l annually.

Biofilter

With a biofilter bed depth of approximately 3 metres, and a biofilter length of 70 m and width of 7m, approximately 1,450 m^3 of woodchip/peat/bark (if used as bed media) would require replacing very 3 – 4 years. This 'spent' woodchip could then be consumed within the composting process as a structural amendment material or as a daily cover within the landfill cells.

Water

Potable water loading on site will be less than 40,000 l annually.

Water loading for dust suppression will be significant and is estimated at 3,650,000 l annually but will typically use surface water runoff or contaminated runoff from cells.

Electricity Use within the Biological Treatment Facility

The estimated electricity usage at the proposed biological treatment facility is estimated at 750 – 1,000 MWhrs per annum.

2.18 Regulatory Control

As identified previously, the proposed development will require an update of the licence to reflect the proposed operations as outlined herein. An application is being prepared to the Environmental Protection Agency (EPA) which will be submitted concurrently to the planning application to which this EIAR relates.

Pre-application consultation has been undertaken with the EPA and further detail on this is provided in Chapter 5 of Volume 2 of this EIAR.

Works associated with the development of the surface water attenuation lagoon to the north of the proposed IBA facility and the realignment of the stream on the north-eastern corner of the permitted landfill development will each require a Section 50 consent from the Office of Public Works (OPW).

Felling associated with the removal of existing forestry at the location of the proposed screening berms will require a Felling Licence from the Forestry Service.

The acceptance and processing of residual municipal solid fines at the proposed biological treatment facility will require a 'Type 8' facility approval by the Department of Agriculture, Food and the Marine (DAFM).

2.19 Decommissioning

As an existing licensed landfill facility, closure, a restoration and aftercare plan has been agreed with the EPA which relates the period aftercare cessation of waste acceptance at the site. This plan centres on the creation of nature trails and a wetland at the site.

As part of the update of the facility licence, a revised closure, restoration and aftercare plan will be agreed to address the aftercare period when:

- waste acceptance within the landfill body ceases
- waste acceptance at the IBA cells ceases
- waste acceptance at the biological treatment facility ceases

Upon cessation of waste acceptance and processing proposed as part of this application, it is anticipated that the following closure and restoration measures will be undertaken at a minimum:

- The plant used within the individual development elements will be removed from the site.
- Portable structures will be removed from the site, where applicable.
- Road sweeper vehicles will be employed to clean the site.
- Tanks will be decommissioned and emptied, backfilled filled and or removed by a licensed contractor with ground reprofiled.

The restoration and aftercare plan covering decommissioning will be subject to Agency approval.

Knockharley Landfill Ltd. has put in place the financial provision to cover any liabilities associated with the operation of the facility including closure and aftercare of the facility. This financial provision is reviewed and revised annually.

In the event of receiving permission and an IE licence in respect of the proposed development, the financial aspects of the closure, restoration and aftercare management plan will be revised to include the biological treatment waste facility and IBA cells development. This will ensure that the financial provision is available to fully decommission the facility when appropriate.

2.20 Health & Safety

The proposed facilities will be designed, constructed and operated in accordance with the:

- Safety, Health & Welfare at Work (Construction) Regulations 2013
- Safety, Health & Welfare at Work Act 2005
- Safety, Health & Welfare at Work (General Application) Regulations 2007
- Safety, Health and Welfare at Work (Biological Agents) Regulations 2013
- Best practice guidelines
- Relevant BREF/BAT guidance
- The facility IE licence
- DAFM Type 8 facility approval

2.20.1 Health & Safety During Design

Design stage risks can be described as risks which can easily be identified at the design stage, and detailed design will eliminate or minimise risks where possible.

FT is appointed as Project Supervisor for the Design Process (PSDP) for the preliminary design phase of the development. This role is carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013.

The PSDP ensures that the appropriate Design Stage Risk Assessments are prepared and that a safety file is developed and maintained for the works. These are required to demonstrate that the designers have taken account of the General Principles of Prevention as required by the Safety, Health and Welfare at Work (Construction) Regulations 2013.

Where possible, the facility design stage will eliminate and minimise many of the potential risks at construction stage. However, health and safety risks at construction stage will need to be properly managed.

2.20.2 Health & Safety During Construction

The construction contractor will be appointed as Project Supervisor for the Construction Stage (PSCS) in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013. The suitability and competence of the contractor to fulfil this role will be carefully assessed by Knockharley Landfill Ltd. prior to the appointment.

A site-specific Health and Safety Plan for the construction phase of this project will be prepared in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013. This will address all safety aspects of the construction project including, but not limited to:

- site access and general induction training
- general site safety
- chains, ropes and lifting gear
- special provisions for hoists
- protective clothing and footwear required
- lockout/tag-out procedures for safe electrical
- method statements for work procedures
- miscellaneous items

2.20.3 Operational Health & Safety

Access to the site is currently restricted to employees, waste trucks and occasional visitors and this will continue to be the case. Procedures are in place at the facility to ensure the health and safety of all persons entering the site, including the signing in/out of all visitors.

All new staff working at the site will be made familiar with the contents of the site-specific Health and Safety Plan. Health and safety practices are reviewed on an annual basis to ensure that they are in line with best practice in this sector and will continue to be so.

Regular safety audits are carried out on-site to ensure the safety of all personnel working there. Furthermore, suitable operation and maintenance procedures are currently in place to facilitate the safe operation of the whole site and these will be amended to reflect the proposed new facilities.

Vehicular traffic movements within the site are restricted and monitored and all traffic movements are subject to strict procedures, in full accordance with health and safety requirements.

Other operational health and safety aspects, such as noise and air quality are discussed in other Chapters of this EIAR. Measures have been taken in the design of the proposed infrastructure to minimise the potential impact of these aspects on health and safety.

Existing IE licence W0146-02 currently require the following procedures/systems to be in place at the facility:

- Full training for all employees
- Accident Prevention Policy – procedures to identify hazards onsite
- Emergency response procedures - setting out all procedures that, in the event of an emergency, will be undertaken by personnel at the facility

As identified, a review of W1046-02 will be undertaken – this review process will require the review of the existing procedures to reflect the proposed development.

Given the nature of the material to be accepted at the proposed biological treatment facility, all operational recommendations outlined in and legally required by the 2013 Code of Practice for the Safety, Health and Welfare at Work (Biological Agents) Regulations 2013 shall be adhered to.

[i] Municipal Solid Waste –Pre-treatment & Residuals Management, An EPA Technical Guidance Document, EPA 2009 amended 2011

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 3 – POLICY

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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3. POLICY

3.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) examines the general waste management, planning and regional policy and legislative context at European, national and regional levels with relevance to the proposed development at Knockharley Landfill.

3.2 European & National Legislation & Policy Context

3.2.1 European & National Legislation

Council Directive 1999/31/EC on the Landfilling of Waste

The overall objective of this Directive is to tightly define and unify the nature of acceptable landfill usage, by reducing and minimising the potential environmental impacts which may otherwise occur at any point in the life-cycle of a landfill.

As well as technical standards, the Directive also contains binding obligations for an EU-wide reduction of the use of landfill as an option for the disposal of biodegradable municipal waste (BMW). It contains specific reduction targets for biodegradable waste which must be applied nationally. These targets are to be viewed against baseline BMW landfilled in each member state for the year 1995. Ireland applied for derogations for each target years due to an over reliance on landfill. The target years in Ireland are shown in Table 3.1.

Table 3-1: Ireland's current performance versus Landfill Directive obligations

Target Year	Maximum Quantity allowed to be landfilled, tonnes	Corresponding MSW tonnage[1]
2010	916,000	1,696,296
2013	610,000	1,129,629
2020	427,000	790,740
Current Position	**Quantity biodegradable municipal waste landfilled, tonnes**	**Corresponding MSW tonnage**
2010	860,000 (Target achieved)	1,592,592
2011	771,550	1,428,796
2012	589,000	1,090,740
2013	380,800	705,185
2016	390,000	722,222

Note 1: Based on an average BMW content of MSW (municipal solid waste) of 54%, as per Table 9 of NWR 2012

In its 'National Statistics - Progress towards EU waste recycling, recovery and diversion targets'[1], published in November 2017, the EPA reports that Ireland has met its 2010 and 2013 targets and is on track to meet its 2020 obligations.

[1] http://www.epa.ie/pubs/reports/waste/stats/EPA_Progress%20towards%20EU%20targets_Nov17.pdf

Relevance to the Proposed Development

Based on the requirements of the Landfill Directive, the EPA applies limit values to the amount of BMW material that can be accepted at landfill facilities to ensure achievement of the targets identified. However, considering the closure of a significant number of landfill facilities in recent years, the combined capacities of landfills currently operating, and that will continue to operate, will be less than the target values applicable as per Table 3-1, thus ensuring that compliance with the 2020 target is likely to be achieved nationally and maintained (reference Table 4-4 in Chapter 4 – 'Need for the Development & Alternatives Considered').

Continued acceptance of BMW material at Knockharley Landfill, as one of the few remaining operating landfill facilities in 2017 and beyond, will therefore contribute to achievement of our national obligations as per 1999/31/EC. In addition, the proposed treatment of the organic fraction of MSW at the proposed biological treatment facility will contribute to the overall diversion of BMW material from landfill in accordance with the objectives of this Directive.

Council Directive 2008/98/EC on waste (and repealing certain Directives)

A revised Waste Framework Directive (2008/98/EC) (the "New" Waste Framework Directive) was adopted in 2008 which introduces a number of new targets for member states. These revisions include setting new recycling targets to be achieved by EU member states by 2020 i.e. a recycling rate of 50% for household derived paper, metal, plastic and glass, which is on track at 45% in 2014and 70% for construction and demolition waste, which has been achieved (91% based on 2012 data). It also places a binding obligation on member states to develop national waste prevention programs and report on prevention and waste prevention objectives. Ireland established a National Waste Prevention Programme in 2013.

The Waste Framework Directive also clearly defines many important definitions, such as recycling, recovery and waste to resolve previous interpretation problems. It also alters the impression of waste as an unwanted burden to become a valued resource in Europe, for example, incineration is considered a recovery operation provided it meets certain energy efficiency standards. The five-stage waste hierarchy has also been more clearly defined and lays down waste operations in prevention, re-use, recycling, recovery and safe disposal in order of preference.

The Waste Framework Directive introduces the concepts of "self-sufficiency and proximity" which requires Member States *"to take appropriate measures, in cooperation with other Member States where this is necessary or advisable, to establish an integrated and adequate network of waste disposal installations and of installations for the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers, taking into account best available techniques."*

It is envisaged that this network will "*enable waste to be disposed of or waste referred to in paragraph 1 (*i.e. mixed municipal waste collected from private households, including where such collection also covers such waste from other producers*) to be recovered in one of the nearest appropriate installations, by means of the most appropriate methods and technologies, in order to ensure a high level of protection for the environment and public health*."

While the Waste Framework Directive does not require each Member States to "*possess the full range of final recovery facilities within that Member State*", its intention is that Member States should, on the whole and excepting for "*certain types of waste*", be in a position to appropriately manage waste generated within their own country.

European Communities (Waste Directive) Regulations 2011

Directive 2008/98/EC has been implemented in Ireland through the European Communities (Waste Directive) Regulations 2011 (S.I. 126 of 2011), as amended. Therefore, the waste hierarchy and the concepts of self-sufficiency and proximity, as previously described, are legislative requirements in Ireland.

> ***Relevance to the Proposed Development***
>
> The proposed development will contribute to the implementation of the principles of the Directive through the provision of waste disposal and recovery infrastructure which will facilitate the management of wastes generated within the region and nationally, in an EPA approved facility incorporating the best available techniques to ensure environmental protection, thus supporting the self-sufficiency and proximity tenets of the Directive.
>
> In addition, the proposed development will support other national waste infrastructure that operates on 'higher' tiers in the waste hierarchy, through the provision of management capacity for the outputs produced from these processes e.g., management of IBA from thermal treatment & stabilised residual fines management from recovered fuel production.

Circular Economy Package

In December 2015, the EU adopted the Circular Economy Package. This package included legislative proposals on waste, with long term targets to reduce landfilling and increase recycling and reuse. In order to 'close the loop' of product lifecycles, it also included an Action Plan to support the circular economy in each step of the value chain – from production to consumption, repair and manufacturing, waste management and secondary raw materials that are fed back into the economy. The Circular Economy Action Plan identifies how waste management plays a central role in the circular economy – through determining how the EU waste hierarchy is put into practice. A number of legislative proposals have been made, and adopted, under the Action Plan, including, *inter alia,* a Directive to amend Directive 1999/31/EC.

The new Landfill Directive (EU) 2018/850 [2] outlines several proposals including the implementation of measure by Member States to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10% of the total amount of municipal waste generated (by weight).

> ***Relevance to the Proposed Development***
>
> The measures outlined in the Directive on Landfill (EU 2018/850 are likely to be of relevance to the proposed development, to some extent in future years, when their implementation on a national basis is clearer. It is noted that the proposals centre on municipal waste landfilling by 2035 – as identified in Chapter 2 – 'Description of the Development', the expected lifespan on the proposed landfill development is up to 2025/6, dependent on rates of filling. In addition, the limitations apply only to municipal wastes, and not IBA, C&D materials, non-hazardous contaminated soils and stabilised residual fines, all of which would not be considered as municipal waste. Furthermore, the application of the 10% limitation would likely to be applied on a national basis, such that this quantity would be 'allocated' across whatever facilities are operational at that time. Further consideration of this point is given in Chapter 4 – 'Need for the Development and Alternatives Considered'.

[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015PC0594&from=EN

3.2.2 National Planning Policy

Project Ireland 2040: The National Planning Framework

Project Ireland 2040: The National Planning Framework (NPF) published in February 2018, sets out the preliminary high-level, strategic planning and development for the country over the next 20+ years, to ensure that growth is economically, socially and environmentally sustainable in line with population growth.

Section 9.2: Resource Efficiency and Transition to a Low Carbon Economy: Sustainable Land Management and Resource Efficiency, provides details regarding the plan's objective to move towards a circular, bio economy:

> *"Ireland is advancing its development as a circular economy and bio economy where the value of all products, materials and resources is maintained for as long as possible and waste is significantly reduced or even eliminated. Further developing the circular economy will require greater efficiency with raw materials, energy, water, space and food by constantly reusing natural resources wherever possible and where smartly-designed products based on alternative plastic feedstock and recyclable materials will form the basis of smart material cycles, in order to create less waste and reduce resource consumption. A recycling rate of 65% has been proposed by the European Commission for 2030 for the Circular Economy Package."*

In managing our waste needs, the NPF supports circular economy principles that minimise waste going to landfill and maximise waste as a resource. This means that prevention, preparation for reuse, recycling and recovery are prioritised in that order, over the disposal of waste.

National Policy Objective 56 of the NPF provides to:

> *"Sustainably manage waste generation, invest in different types of waste treatment and support circular economy principles, prioritising prevention, reuse, recycling and recovery, to support a healthy environment, economy and society."*

Furthermore, the NPF reaffirms the role of waste management and capacity under Section 9.1: Environmental and Sustainability Goals:

> *"Adequate capacity and systems to manage waste, including municipal and construction and demolition waste in an environmentally safe and sustainable manner and remediation of waste sites to mitigate appropriately the risk to environmental and human health."*

Relevance to the Proposed Development

The NPF is the relevant national planning framework policy document for Ireland. The NPF provides a context for which national waste management policy should be considered, highlighting the need to develop sustainable means of managing waste. The development proposed at Knockharley can be considered supportive of and consistent with the aims of the NPF through the provision of the necessary waste management infrastructure to support industry and enterprise and the overall balanced development nationally.

Project Ireland 2040: National Development Plan 2018-2027

The National Development Plan 2018-2027 (NDP) published in February 2018, in tandem with the National Planning Framework (NPF), seeks to drive Ireland's long term economic, environmental and social progress over the next decade, in accordance with the spatial planning context of the NPF.

The NDP recognises the role of waste management and resource efficiency under Chapter 5 National Strategic Outcomes and Public Investment Priorities: National Strategic Outcome 9. Sustainable Management of Water and other Environmental Resources:

> *"Investment in waste management infrastructure is critical to our environmental and economic well-being for a growing population and to achieving circular economy and climate objectives."*

Furthermore, under National Strategic Outcome 9, the NDP addresses concerns regarding capacity:

> *"Capacity will continue to be built in waste facilities, including anaerobic digestion, hazardous waste treatment, plastics processing, recycling, waste to energy, and landfill and landfill remediation, to meet future waste objectives. The infrastructure to deliver waste management policy has been, to date, largely delivered through private investment with some public-sector investment. Significant infrastructure capacity development will be required to separate and process various waste streams at municipal and national levels to achieve new EU legally-binding targets and the additional investment may include a potential role for public investment."*

Relevance to the Proposed Development

Knockharley Landfill, as a fully engineered landfill facility licensed by the EPA, for which full provision is made in relation to future remediation and aftercare, can be considered as a facility that operates in keeping with the requirements of the NDP.

3.2.3 National Waste Management Policy

National waste management policy over the years has been outlined in a number of documents which are described sequentially in the following.

Waste Management: Changing Our Ways 1998

Government policy in relation to waste management was set out in the policy statement entitled *Waste Management: Changing Our Ways* published by the Department of the Environment and Local Government (DoELG) in September 1998. The policy statement incorporated the EU Waste Management hierarchy of waste prevention/minimisation/reuse/recycling/recovery/disposal, as well as earlier policy statements including Government strategy documents such as *Recycling for Ireland* (July 1994) and *Sustainable Development: A Strategy for Ireland* (April 1997).

It outlined a clear commitment to reduce dependency on landfill as a primary waste disposal route. It encouraged the development of a smaller number of well-designed and managed landfills for the receipt of *residual* waste - residual waste being waste which has undergone some form of treatment to remove recyclable material or to further process the waste in order to achieve a volumetric reduction.

Essentially, that is the situation that has developed over the past number of years to the current situation – with the closure of a significant number of landfill facilities since 2010 with only Knockharley, Drehid, East Galway and Ballynagran Landfills remaining operational at the time of writing.

Waste Management: Changing Our Ways outlined ambitious targets for waste management as follows:

- a diversion of 50% of overall household waste away from landfill
- a minimum 65% reduction in biodegradable wastes consigned to landfill
- the development of waste recovery facilities employing environmentally beneficial technologies as an alternative to landfill, including the development of composting and other feasible biological treatment facilities capable of treating up to 300,000 tonnes of biodegradable waste per annum nationally
- recycling of 35% of municipal waste

- recycling at least 50% of construction and demolition (C & D) waste within a five-year period, with a progressive increase to at least 85% over fifteen years
- rationalisation of municipal waste landfills, with progressive and sustained reductions in numbers, leading to an integrated network of some 20 state-of-the-art facilities incorporating energy recovery and high standards of environmental protection
- an 80% reduction in methane emissions from landfill, which will make a useful contribution to meeting Ireland's international obligations.

Preventing and Recycling Waste – Delivering Change – a Policy Statement - 2002

A second policy statement was issued by the Minister for the Environment and Local Government in 2002. In this policy statement entitled 'Preventing and Recycling Waste - Delivering Change', the Government set out objectives for developing recycling and recovery facilities.

This policy statement incorporated the EU waste management hierarchy of waste prevention, minimisation, reuse, recycling, recovery and disposal as outlined in '*Waste Management: Changing our Ways'* as well as earlier policy statements. This policy document:

- highlighted the necessary disciplines that must be imposed within waste management systems to secure real progress on waste prevention, reuse and recovery
- outlined a range of measures that would be undertaken in the interests of minimising waste generation and ensuring a sustained expansion in reuse and recycling performance and
- set out a number of clear objectives which the Government proposed to implement to meet the targets identified in *Changing Our Ways*.

The National Strategy on Biodegradable Waste - 2006

The National Strategy on Biodegradable Waste was launched in April 2006 by the Department of Environment, Heritage and Local Government (DoEHLG), and highlighted the urgent need for waste management facilities with infrastructure to deal with biodegradable waste. It focused on biodegradable waste from municipal sources, such as from domestic dwellings and commerce and sets target in relation to minimisation of same to landfill.

Ireland's performance in terms of these targets is presented in Section 3.2.1 previously.

The means by which the relevant BMW targets are be achieved was augmented in the past number of years by a number of actions taken by the Environmental Protection Agency (EPA) in terms of limitation being placed on landfill with respect to the amount of BMW that can be accepted at these facilities. In addition, clear guidance on the means of calculating and reporting BMW content has also been developed.

A Resource Opportunity – Waste Management Policy in Ireland - 2012

The most recent national waste management policy document was produced in July 2012 and outlines the measures through which Ireland will make "*the further progress necessary to become a recycling society, with a clear focus on resource efficiency and the virtual elimination of landfilling of municipal waste"*.

A range of policy measures are outlined in relation to the elements of the waste hierarchy i.e. prevention, reuse, recycling, recovery and disposal that concentrate on the supporting legislative and market environment in relation to the waste industry. It is acknowledged that "*Ireland requires an adequate network of quality waste treatment facilities*" and that a review of waste infrastructure in Ireland is being undertaken by the EPA that will examine the "*capacity for managing municipal waste in conformity with the principles of proximity and self-sufficiency*".

It is further identified that progress in achieving the various remaining targets in relation to the diversion of biodegradable waste from landfill, in particular, "*is crucially dependent on the development of a network of recycling and recovery infrastructure across a range of technologies to ensure competitive and effective provision."*

Regarding disposal, policy direction is "*towards the virtual elimination of landfilling of municipal waste"* and *"the elimination of landfill within the next decade*" while the intention to consider the banning of certain materials to landfill is mooted within the policy document.

This option is addressed in more detail in a consultation document produced in November 2015 entitled 'Exporting a Resource Opportunity'[3], where response to a discussion point in relation to banning of certain material to landfill, is identified, with feedback requested.

Relevance to the Proposed Development

While acknowledging the policy objectives in relation to "*landfill elimination*", it is important to consider these objectives in relation to the type or nature of material to which it refers – the provision of landfill capacity for inert, stabilised or non MSW wastes, as well as for contingency landfill supply, as proposed as part of the proposed development, will continue to be required and be supported, as exemplified by the non-applicability of the landfill levy to inert wastes and stabilised MSW.

The provision of biological treatment capacity will contribute to addressing the diversion of biodegradable waste from landfill.

In general terms, the policy objectives in relation to '*landfill elimination'* are broadly mirrored by those currently proposed at EU level, i.e. the Proposed Directive on Landfill, as described previously, which proposes limitations on municipal waste to landfill at 10% by 2030. This proposed Directive also proposes the examination of the suitability of applying restrictions on landfilling of other waste types, with this to be considered by the end of 2024.

It is acknowledged that future policy and legislative measures will be applied and implemented which will restrict the type and/or quantity of waste materials to be accepted at landfill facilities – further consideration of these potential measures in relation to timelines, waste types accepted and facility capacity, at the proposed development location and others, on a national scale, is provided in Chapter 4 – 'Need for the Development and Alternatives Considered'.

3.3.1 Regional Planning Policy

Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022

Meath County Council, being part of the Eastern & Midlands Regional Assembly, which was created on the 1st January 2015, contributed to the development of the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022, which were made in June 2010.

There are number of specific statements and strategic recommendations in relation to waste management outlined in these Guidelines that are directly relevant to the proposed development.

Section 6.7 of the Guidelines identify that "*the RPGs support the waste management hierarchy and increased and coordinated effort should be made in the areas of source reduction and re-use of waste across the industrial, commercial and residential sectors of the GDA*".

Local Authorities should also "*seek to anticipate burgeoning waste streams, identify opportunities to integrate facilities where appropriate and identify current or future opportunities for re-use of waste, for example, the re-use of secondary aggregates as physical infrastructure construction bases or the potential re-use of suitable soil material in amenity projects or landfill restoration. In terms of construction waste, market factors will invariably dictate the extent of the viability of re-use of this waste*".

[3] http://www.housing.gov.ie/sites/default/files/migratedfiles/en/Publications/Environment/Waste/FileDownLoad,43713,en.pdf

Specific strategic recommendations of relevance with the Guidelines include:

PIR36 *The new waste management strategy across the regions of the GDA should seek to facilitate a balanced use of resources and greater adaptability and robustness of services. Integrated waste management should be considered from the perspective of the GDA as one singular functioning economic and spatial unit and to increase economies of scale.*

PIR37 *Encourage the expansion of increased levels of diversion of biodegradable waste from landfill through provision of or support for biological treatment facilities and home composting.*

PIR39 *The reuse of waste should be encouraged and reinforced through encouragement of business clustering across the GDA. Opportunities to facilitate source reduction, the reuse of wastes, by-products and associated energy throughout the GDA should be examined as part of economic policies. Development of these opportunities shall not compromise the integrity of ecologically sensitive areas, in particular infilling with inert materials which can result in loss and fragmentation of wetlands.*

PIR 40 *Waste management facilities should be appropriately managed and monitored according to best practice to maximise efficiencies and to protect human health and the natural environment.*

Relevance to the Proposed Development

Recommendation PIR36 identifies integrated waste management as a single functioning unit, and landfill, while being the lower tier of the waste hierarchy, is nonetheless an important factor in the functioning of a fully integrated waste management system.

PIR37 recognises the need to divert biodegradable waste from landfill – the proposed biological treatment facility will specifically enable this.

PIR 39 encourages the re-use of waste – the proposed development will re-use excavated soil and stone material for construction of berms surrounding the site.

The continued regulation of the facility under the IE licence and in keeping with the measures outlined in this EIAR will satisfy the requirements of recommendation PIR 40.

Draft Eastern Midland Regional Assembly: Regional Spatial and Economic Strategy, November 2018

Arising from the Local Government Reform Act 2014, the Eastern and Midland Regional Assembly has assumed a number of new functions. Chief among these responsibilities is the preparation of a Regional Spatial and Economic Strategy (RSES) for the Eastern and Midlands Region. The RSES, once adopted, will replace the function of the Regional Planning Guidelines at this tier in the hierarchy of planning policy. A Draft Regional Spatial and Economic Strategy has been published as of November 2018 for public consultation.

The region covers nine counties containing twelve local authorities namely – Longford, Westmeath, Offaly, Laois, Louth, Meath, Kildare, Wicklow, Fingal, South Dublin and Dún Laoghaire-Rathdown County Councils along with Dublin City Council. The region includes 3 sub regions or Strategic Planning Areas (SPAs), namely the Midland, Eastern and Dublin.

The principal statutory purpose of the RSES is to support the implementation of the National Planning Framework (NPF) - Ireland 2040 Our Plan, and the economic policies and objectives of the Government by providing a long-term strategic planning and economic framework for the development of the regions. The Draft RSES echoes the sentiments of the NPF in its objectives, highlighting the need for a consolidated waste management plan for the region.

Of particular relevance in considering the proposed development, is Section 10.4 Waste Management of the Draft Regional Spatial and Economic Strategy. This section sets out the provisioning of waste management for the region and the overall vision towards rethinking the approach taken towards managing waste.

Regional Policy Objective RPO 10.20 highlights that: *"development Plans shall identify how waste will be reduced, in line with the principles of the circular economy and how remaining quantums of waste will be managed and shall promote the inclusion in developments of adequate and easily accessible storage space that supports the separate collection of dry recyclables and food."*

Relevance to the Proposed Development

The recognition of the need for an integrated, sustainable means of waste management is promoted in the Draft Regional Spatial and Economic Strategy for the Eastern and Midlands area. The Draft RSES recognises the role of the Regional Waste Management Policy document.

3.3.2 Regional Waste Management Policy

The policy document, A Resource Opportunity, recommended that the number of waste management planning regions be reduced from ten to three. Consequently, three Waste Management Plans were made. These are

1. Eastern Midlands Regional Waste Management (EMWR) Plan 2015 – 2021
2. Southern Region Waste Management (SRMWR) Plan 2015 – 2021
3. Connacht - Ulster Region Waste Management (SRMWR) Plan 2015 – 2021

These Plans set out the strategic vision for waste management nationally and the policy objectives outlined in each Plan are complementary. The relevant policy objectives in the Eastern Midlands Regional Waste Management (EMWR) Plan 2015-2021 are set out below.

Eastern Midlands Regional Waste Management (EMWR) Plan 2015 – 2021

A regional waste management plan, for the period 2015 – 2021, was made in April 2015 for the Eastern Midlands Region, which comprises twelve local authorities (Dublin City Council, Dun Laoghaire Rathdown County Council, Fingal County Council, South Dublin County Council, Kildare County Council, Laois County Council, Longford County Council, Louth County Council, Meath County Council, Offaly County Council, Westmeath County Council and Wicklow County Council).

This plan supersedes the 2010 Waste Management Plan for the North East Region, which has been the plan 'of relevance' to the proposed development site location in the past. Two other regional waste management plans, the Southern Region Waste Management Plan and the Connacht-Ulster Waste Management Plan were also made for the same 2015 – 2021 period.

The Plan addresses many topics, with varying degrees of direct relevance to the proposed development, with Section 4.3 'Residual and Biowaste Exports', Section 5.4 'Targets over the Plan Period', Section 11.2 'Construction & Demolition Wastes', Section 13 'Disposal Infrastructure', Section 16 'Market Analysis and Infrastructure Planning' and Section 17.2.8 Roles and Responsibilities – Waste Industry being considered the most relevant in terms of the development proposed at Knockharley Landfill. Section 15 addresses Waste Growth Projections and these are considered in more detail in Chapter 4 – 'Need for the Development and Alternatives Considered''.

A significant degree of comment and a number of policies are outlined in these sections and the following tables outline those comment and policies considered relevant to the proposed development, with discussion on their relevance following:

Section 4.3 Residual and Biowaste Exports

Policy A4.

Aim to improve regional and national self-sufficiency of waste management infrastructure for the re-processing and recovery of particular waste streams, such as mixed municipal waste, in accordance with the proximity principle. The future application of any national economic or policy instrument to achieve this policy shall be supported.

Relevance to the Proposed Development

The Plan identifies that over 300,000 tonnes of residual municipal waste was exported in 2013, with indications being that over 500,000 tonnes of residual waste being exported in 2014[4] (waste data being historically reported), with industry sources suggesting even greater quantities being exported in 2015. Residual waste is being exported to central and northern Europe and utilising excess thermal treatment capacity available in these countries.

The growth in exports is identified within the Plan as being due to a number of factors, mainly the increase in landfill levy to €75 tonne in 2013.

While identifying the future of export of residual waste as being uncertain in terms of the length of time this capacity will be available, as well as the loss to the Irish exchequer of the resource potential (energy) of this material, the benefits of residual waste export are identified as contributing to the achievement of mandatory landfill diversion targets, while also keeping waste management costs to consumers down.

The preferred policy of the region is identified as being to "*support the development of competitive, environmentally and energy efficient thermal recovery facilities in Ireland, including the replacement of fossil fuels by co-combustion in industrial furnaces or cement kilns and ultimately to minimise the exporting of municipal waste resources over the plan period*" and supporting "*self-sufficiency and the development of indigenous infrastructure for the thermal recovery of residual municipal wastes.*"

The Plan identifies the uncertainty of the consistent or long-term availability of the existing thermal capacity in Europe through referencing the anticipated increase in residual waste generation across Europe in coming years, as well as the expected closure of older, less efficient plants that currently provide capacity, with the resultant decrease in capacity. This is identified as a risk to Irish exporters in securing long term and cost-effective outlets for residual waste.

Since the making of the Plan, this risk has manifested itself through the inability of the private waste management operators to secure consistent outlets for exported residual waste on the continent in 2016, which, combined with annual waste acceptance limitations applied at operational waste management facilities, resulted in the application of 'emergency' measures in accordance with Section 56 of the Waste Management Act 1996, as amended, in 2016, 2017 & 2018. This resulted in the acceptance of identified quantities of waste at Drehid, Knockharley and Ballynagran Landfills for defined periods, as initially outlined in the first annual implementation report (2015/2016) for the Eastern Midlands Waste Management Plan 2015 -2021[5].

This annual implementation report 2016/2016 also identifies that "*a National Capacity Oversight Committee, will continue to monitor the situation on an ongoing basis to ensure sufficient capacity for 2016 and beyond*". Further discussion on this issue is presented in Chapter 4 – 'Need for the Development and Alternatives Considered'.

[4]Appendix 1 of 'Exporting & Resource Opportunity – Consultation Document' http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Waste/FileDownLoad%2C43707%2Cen.pdf
[5] http://emwr.ie/wp-content/uploads/2016/12/19115_DCCo_EastMidlandsWaste_V5%E2%80%A2.pdf

While the preferred policy of the Plan, as per Section 4.3 and A.4, is to support management of residual waste by thermal treatment, the proposed development supports this policy objective through:

- Provision of an outlet for the management of IBA material produced through thermal treatment
- Provision of contingency capacity during the periods of EfW facility planned or unplanned shutdown.
- Potential to provide emergency contingency in consultation with and approval of relevant stakeholders
- Provision of disposal and recovery capacity for residual non-hazardous waste and non-hazardous soils which are not suitable for thermal treatment, e.g. bulky waste, street sweepings, stabilised fines from recovery activities and non-hazardous soils.
- Provision of disposal capacity for repatriated waste which is not suitable for thermal treatment.

Further discussion on the means by which the proposed development supports this, and other policy objectives, is provided in Chapter 4 – 'Need for the Development and Alternatives Considered''.

Section 5.4 Targets over the Plan Period

Plan Targets

- 1% reduction per annum in the quantity of household waste generated per capita over the period of the Plan
- Achieve a recycling rate of 50% of managed municipal waste by 2020
- Reducing to 0% the direct disposal of unprocessed[6] residual municipal waste to landfill (from 2016 onwards) in favour of high value pre-treatment processes and indigenous recovery practices.

Relevance to the Proposed Development

Of the 3 headline Plan targets identified, the reduction in the direct disposal of unprocessed residual municipal waste to landfill from 2016 onwards, is of most direct relevance to the proposed development. In fact, a similar requirement is placed on landfill sites by the EPA, through conditional application of the requirements of the guidance document "Municipal Solid Waste – Pre-treatment and Residuals Management", which requires from January 2016, the mechanical pre-treatment of residual wastes prior to landfilling.

The existing EPA licence that applies to Knockharley Landfill, W0146-02, requires compliance with these requirements through Condition 1.6, and therefore, Knockharley Landfill can be considered to operate in accordance with the requirements of the Plan policy objective identified.

[6] Where unprocessed residual waste means residual municipal waste collected at kerbside or deposited at landfills/CA sites/transfer stations that has not undergone appropriate treatment through physical, biological, chemical or thermal processes, including sorting.

Section 11.2 Construction & Demolition Wastes

The Plan identifies historic trends in C&D waste generation, going from a peak in 2007, reflective of national economic activity, to a trough in 2011-2012. Since 2012, C&D waste generation has increased, and continued to increase in the intervening years, as identified in the "Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity"[7] report, recently published by the combined regional authorities, which identifies a 75% increase in C&D generation between 2013 and 2015, identified as being due to "*the strong construction growth in the residential and commercial sectors particularly in the Greater Dublin Area*". This report also identifies Knockharley Landfill as an existing licenced facility that accepts relevant C&D materials.

The Plan identifies that "*the sharp decrease in the number of operational landfill nationally*" which were significant outlets for C&D waste in the past, requires the consideration of the other recovery options to be developed. It also identifies that C&D fines, produced from C&D screening or trommelling, may be suitable for landfill cover, subject to EPA agreement, with ongoing testing and verification of same, being required.

The 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity' report outlines a very significant anticipated shortfall in capacity for soil and stones in the Greater Dublin Area, in excess of 2.6 million tonnes of capacity per annum, from 2019 onwards. In terms of options in relation to capacity provision for this shortfall, it is identified in the report that "*existing licenced facilities with capacity to expand, or with a readiness to increase their annual limit, could choose to apply for an extension to their existing licenced capacity*".

The provision of C&D waste capacity in relation to the proposed development is addressed in further detail in Chapter 4 – 'Need for the Development and Alternatives Considered''.

Section 13 Disposal Infrastructure

Section 13 of the Plan identifies the remaining disposal capacity at landfills accepting MSW in the EMR in 2014, in Table 13-1.

Further discussion in respect of landfill capacity is provided in Chapter 4 – 'Need for the Development and Alternatives Considered'.

The Plan also identifies the increasing quantities of bio-stabilised residual fines accepted at landfills between 2012 and 2014 and identifies that the "*decreasing availability of landfill as an option for this stabilised waste requires the region to research alternative options for bio-stabilised residual waste".* It is considered that the proposed development can provide a realistic and appropriate outlet for residual fines management and this is discussed in more detail in Chapter 4.

The issue of repatriated waste from Northern Ireland is identified in Section 13 of the Plan, whereby the Irish government is obligated to accept illegally disposed of waste in Northern Ireland.

The framework for landfills to accept this waste (as it is only acceptable for landfilling, given its nature), which the Knockharley Landfill is a part of, is referenced and in reality, any landfill which is operational and has the ability to accept such waste will likely be considered to accept this material in the coming years. Knockharley Landfill, being located in Co. Meath, is the closest of the landfills located with the Eastern Midlands region to the source of waste coming from Northern Ireland. It is identified in the Plan that there is an estimated 120,000 tonnes of mixed municipal waste to be repatriated in the coming years.

The Brexit decision in the UK has the potential to impact on the timeline under which this waste must be repatriated, given that, post Brexit (be that March 2019 or a 2 year transition period thereafter), the UK may be operating under a different regulatory framework and regime that would make the cross border repatriation much more difficult – this fact is noted in the Northern Ireland Assembly Briefing paper (November 2016)[8] *Background Paper on Waste Management in Northern Ireland* where it is stated:

"…. the co-ordinated approach to waste management both sides of the border is essential in controlling the movement and disposal of legal and illegal waste.

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[7] http://southernwasteregion.ie/sites/default/files/National-C-D-Capacity-Report.pdf
[8] http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2016-2021/2017/aera/1017.pdf

Given that post- Brexit the RoI will continue to work to EU requirements and regulation, it may be of interest to find out what discussion there has been in relation to the impact, either side of the border, given that NI could potentially work to a different framework with fundamental differences in levies, controls and levels of regulation."

The repatriation of waste from Northern Ireland is considered in more detail the following sections and in Chapter 4 – 'Need for the Development and Alternatives Considered'.

A specific policy measure in relation to the need to address legacy, historic and closed licenced landfills in the region in presented in Section 13 of the Plan, as follows:

Policy G.2.

Roll - out the plan for remediating historic closed landfills prioritising actions to those sites which are the highest risk to the environment and human health.

Relevance to the Proposed Development

The Plan addresses the road map outlined in Circular WP15/12, which outlined deliverables relating to the remediation of historic legacy landfill facilities, which were difficult to achieve within the timeline initially envisaged. The policy objective outlined in the Plan is to prioritise those sites considered the highest risk to the environment and human health such that these sites are appropriately remediated.

Appendix 4 of the Plan identifies a number of high risk (Class A) historic and legacy sites are identified in the Eastern and Midlands region, with the above policy supporting the remediation of these sites. It is likely that for a significant proportion of these sites, the removal of waste material will be the only preferable remediation option, with appropriate landfill capacity then being required for this material, as landfilling will be the only viable option for its management. The following table presents the Class A sites in the Eastern Midlands region.

Kildare Co. Co	Carrigeen	South Dublin Co. Co.	Friarstown
Kildare Co. Co	Knocknagarm	South Dublin Co. Co.	Waterstown
Kildare Co. Co.	Greenhills	South Dublin Co. Co.	Cruagh
Kildare Co. Co	Prusselstown	South Dublin Co. Co.	Lucan Demense
Kildare Co. Co.	Pollardstown	South Dublin Co. Co.	Corbally Sagart
Kildare Co. Co.	Wolfestown	South Dublin Co. Co.	Clondalkin Paper Mill
Longford Co. Co.	Ballymaurice	South Dublin Co. Co.	Woodtown
Longford Co. Co.	Cartron Big	Westmeath Co. Co.	Moate
Longford Co. Co.	Longford Town No. 1	Westmeath Co. Co	Marlinstown
Louth Co. Co.	Carlingford	Westmeath Co. Co.	Lickbla
Meath Co. Co.	Fletcherstown Bog	Wicklow Co. Co.	Fassaroe No. 3A
		Wicklow Co. Co.	Fassaroe No. 3C

The Plan identifies that a roadmap will be prepared for the remediation of the high-risk sites over the lifetime of the Plan.

In addition to these, landfill capacity will be required to manage other sources of inappropriately disposed waste material, with 2 no. unauthorised landfills alone having identified in 2016 in Co. Meath and Co. Donegal and Whitestown unauthorised landfill having been identified as requiring significant remediation activity in Co. Wicklow in 2017.

The proposed development at Knockharley will be in a position to provide capacity for the appropriate management of this material and other future sources of similar material.

Section 16 Market Analysis and Infrastructure Planning

Section 16.4.3 of the Plan identifies that "*the local authorities anticipate that there will be an ongoing need for landfill capacity during the plan period for processed residual wastes. There is also a need to maintain a contingency supply, in response to potential situations which pose a risk to the health and well-being of citizens, livestock and the environment".*

This section of the Plan also addressed the issue of repatriation of waste from Northern Ireland in the context of disposal and identifies that "*all waste repatriated must go for disposal*" and that this Plan "*supports the repatriation of this waste to landfills in the region*."

In terms of the proposed development, which seeks to intensify the existing landfill operation within the existing permitted footprint and to develop an IBA acceptance capacity, with ancillary infrastructure, the following policy objectives of the plan are relevant:

Policy E8 The waste plan supports the development of disposal capacity for the treatment of hazardous and non-hazardous wastes at existing landfill facilities in the region subject to the appropriate statutory approvals being granted in line with the appropriate environmental protection criteria.
Relevance to the Proposed Development The proposed development will provide additional disposal capacity for the treatment of non-hazardous household, commercial and industrial waste, C&D wastes, non-hazardous contaminated soils and IBA at an existing landfill. The application seeks to increase the rate of acceptance at the facility capacity, with IBA being managed within dedicated cells and the other wastes being managed within the existing permitted footprint. This EIAR relates to applications for approval in accordance with the appropriate statutory processes i.e. planning approval through the strategic infrastructure development (SID) process to An Bord Pleanála (ABP) and industrial emission (IE) licence application to the EPA, with both bodies subjecting the application to environmental impact assessment (EIA).

Policy E9a The on-going availability of disposal facilities for non-hazardous municipal residual wastes in the region will be required during the plan period. The local authorities consider there is no need to provide additional disposal facilities for residual wastes over and above the existing authorised (i.e. operational, inactive or uncommenced) facilities in place.
Relevance to the Proposed Development The Plan identifies the requirement for landfill capacity to be available for the duration of the Plan period for municipal waste disposal. As an existing facility, the Knockharley Landfill will continue to provide disposal capacity as required. It is identified that there is no need for additional provision of disposal facilities over and above the existing authorised facilities in place. This is taken to refer to there being no requirement to develop any new landfill facility i.e. a new landfill on a new site requiring planning and EPA licence approvals that have not been in place before. The proposed development, while proposing an amendment to existing waste acceptance rates, and development of dedicated IBA cells, does not contravene Policy E9a in that it is not considered a new or an additional facility, as the development is proposed at an existing, authorised facility.

Policy E10 The waste plan recognises the need for on-going disposal capacity to be available in response to events which pose a risk to the environment and/or and health of humans & livestock. The local authorities of each region shall monitor available contingency capacity annually.
Relevance to the Proposed Development The proposed development will support this policy objective through the provision of usable disposal void as contingency landfill in the event of such an occurrence. The acceptance of waste materials in such an event would only be carried out in consultation with and approval of relevant stakeholders and is exemplified by the application of the Section 56 measures in 2016 -2018, with such capacity being provided by Knockharley Landfill and others, in order to prevent a situation of uncollected waste. The provision of such capacity is discussed in more detail in Chapter 4 – 'Need for the Development and Alternatives Considered''.

Policy E12 The waste plan supports the repatriation of residual waste illegally disposed in Northern Ireland to licensed disposal facilities appointed to a framework set up on behalf of the State by the National Trans Frontier Shipment Office.
Relevance to the Proposed Development Knockharley Landfill is appointed to the framework of disposal facilities to provide disposal capacity in relation to repatriated waste from Northern Ireland. As the landfill located in closest proximity to the source of the material repatriated from Northern Ireland, the Knockharley Landfill is ideally situated to provide disposal capacity for this material, through its management in a fully engineered landfill, where landfilling is the only technical option for managing this material. As previously identified, there may be potential for the repatriation programme to be accelerated in light of Brexit, given the potential significant complications arising from both jurisdictions operating under different legislative frameworks past March 2019.

Policy E15a The waste plan supports the development of up to 300,000 tonnes of additional thermal recovery capacity for the treatment of non-hazardous wastes nationally to ensure there is adequate and competitive treatment in the market and the State's self-sufficiency requirements for the recovery of municipal waste are met. This capacity is a national treatment need and is not specific to the region. The extent of capacity determined reflects the predicted need of the residual waste market to 2030 at the time of preparing the waste plan. Authorisations above this threshold will only be granted if the applicant justifies and verifies the need for the capacity and the authorities are satisfied it complies with national and regional waste policies and does not pose a risk to future recycling rates. All proposed sites for thermal recovery must comply with the environmental protection criteria set out in the plan.

Relevance to the Proposed Development
While related directly to the provision of a further 300,000 tonnes of thermal treatment capacity on a national basis, this policy measure is relevant to the proposed development in the event of this capacity being provided, given that capacity of this scale could generate up to approximately 75,000 tonnes of IBA that will require management. Potential future IBA management capacity is discussed in more detail in Chapter 4 – 'Need for the Development and Alternatives Considered'

Section 16.5 of the Waste Plan outlines environmental protection criteria for facilities requiring consent and identifies several specific policy objectives relating to same. A number of these criteria relate specifically to the siting of new waste infrastructure, which is not applicable in the case of the existing Knockharley site.

The Plan recommends that consultation be undertaken with the regional waste offices, as well as relevant planning and regulatory authorities, prior to submitting development applications. The applicant has undertaken such consultations, as described in Chapter 5 – 'EIAR Scoping, Consultation & Key Issues'.

The Plan also references the intention to develop facility specific siting guidelines and such guidelines were provided for public consultation in November 2016. The draft guidelines specifically stated that landfill siting was outside of their scope, as it was considered that landfill siting is adequately addressed in the EPA 2006 publication on the matter[9].

Policy G3. Ensure there is a consistent approach to the protection of the environment and communities through the authorisation of locations for the treatment of wastes. **Policy G5.** Ensure that the implementation of the regional waste management plan does not prevent achievement of the conservation objectives of sites afforded protection under the EU Habitats and Birds Directives.
In respect of Policies G3 and G5, these objectives are related to the consent processes to be undertaken by relevant authorities, in consideration of the environmental criteria outlined in the Plan. The environmental criteria set out was considered in the development of the EIAR/EIS.

Section 17 – Roles and Responsibilities and Other Relevant Plan Sections

Section 17.2.8 of the Plan outlines the role of the waste industry in the achievement of the objectives, policies, actions and targets contained in the plan.

Those which are applicable to the applicant are included below, with indication of their applicability/relevance to the proposed development presented.

Cooperate with the designated lead authorities and local authorities to implement the objectives, policies, actions and targets contained in the plan.	As discussed previously, the proposed development supports, is relevant to and/or is in adherence with the following policy objectives: Policy A4, Policy E8, Policy E9a, Policy E10, Policy E12, Policy E15a, Policy G2, Policy G3 and Policy G5.

[9] EPA Landfill Manual on Site Selection, Draft for Consultation, December 2006

Provide sustainable waste management infrastructure /technology in keeping with the waste hierarchy and the principle of self-sufficiency.	The preferred policy of the Plan supports self-sufficiency and the development of indigenous infrastructure for the thermal recovery of residual municipal waste. Its preference is to minimise the exporting of residual municipal waste resources. The proposed development will provide support to this policy objective, through: • Provision of an outlet for the management of IBA material produced through thermal treatment • Provision of contingency capacity during the periods of EfW facility planned or unplanned shutdown. • Potential to provide emergency contingency in consultation with and approval of relevant stakeholders. • Provision of disposal and recovery capacity for other non-hazardous wastes and non-hazardous soils which are not suitable for thermal treatment. • Provision of disposal capacity for repatriated waste which is not suitable for thermal treatment.
Comply with licence conditions as prescribed by the EPA.	The existing facility is licensed by the EPA and is operated in accordance with the conditions of that licence. A new licence application will be sought for the proposed development, and it will be operated in accordance with the conditions set out.
Promote high standards of health and safety in the industry.	The existing facility has an excellent record in health and safety and the applicant will continue to promote high standards of health and safety during the construction and operation of the proposed development.

3.4 Local Policy Context

3.4.1 Local Planning Policy

Meath County Development Plan 2013 - 2019

The Meath County Development Plan 2013 – 2019 contains a number of specific policies across a number of topic areas considered applicable to the proposed development, outlined as follows:

WS SO 3 *To secure the provision of water, wastewater treatment and **waste management initiatives** to accommodate the future sustainable economic and residential growth of the County in accordance with the Core Strategy and Settlement Strategy and in consultation with statutory agencies and adjoining Local Authorities.*

WM POL 1 *To adopt the **provisions of the waste management hierarchy** and implement policy in relation to the county's requirements under the current or any subsequent waste management plan**.** All prospective developments in the county will be expected to take account of the provisions of the regional waste management plan and adhere to the requirements of the Plan. Account shall also be taken of the **proximity principle** and the inter-regional movement of waste as provided for under appropriate Minister Directives from time to time.*

WM POL 3 *To seek the provision of **quality cost effective waste infrastructure** and services, which reflect and meet the needs of the community.*

WM POL 4 *To seek in the Council's dealings with private companies that all waste shall be undertaken **in compliance with the requirement of the EPA and relevant waste management** legislation and policy.*

WM POL 6 *To encourage the **development of waste infrastructure** and associated developments **in appropriate locations**, as deemed necessary in accordance with the requirements of the Regional Waste Management Plan.*

WM POL 7 *To encourage the recycling of construction and demolition waste and the **reuse of aggregate and other materials** in future construction projects.*

Relevant objectives outlined include:

WM OBJ 1 ***To facilitate the provision of appropriate waste recovery and disposal facilities** in accordance with the principles set out in the appropriate Waste Management Plan applicable from time to time made in accordance with the Waste Management Act 1996.*

WM OBJ 8 *To facilitate **the implementation of national legislation and national and regional waste management policy**.*

WM OBJ 18 *To seek to ensure in cooperation with relevant authorities that **waste management facilities are appropriately managed** and monitored according to best practice to maximise efficiencies and to protect human health and the natural environment.*

EC POL 3 *To encourage the production of **energy from renewable sources**, such as from biomass, **waste material**, solar, wave, hydro, geothermal and wind energy, subject to normal proper planning considerations, including in particular the potential impact on areas of environmental or landscape sensitivity and Natura 2000 sites.*

Relevance to the Proposed Development

The proposed development is considered as strongly adhering to the policies and objectives of the Meath County Development Plan 2013 to 2019, which defers to the requirements of national legislation, policy and the regional waste management plan in most instances. The potential recycling / recovery of IBA as part of the proposed development as described in Chapter 2 'Description of the Proposed Development' specifically relates to WM POL7, while the utilisation of landfill gas in renewable electricity generation which will continue as the development site, is supported by EC POL3.

Kentstown Written Statement

The Kentstown Written Statement, developed under Variation No. 2 of the Meath County Development Plan 2013 – 2019, has, as its goal, the protection of "*the scale, character and the built and natural heritage of the village by encouraging development which will improve the character and structure of the village core and the social and physical infrastructure in the village*". Cognisance is given to this document given the proximity of the proposed development.

While the Written Statement focuses on the extent of the village boundary only, relevant policies referenced include:

FR POL 1 *To manage flood risk and development in Kentstown in line with policies WS29 – WS36 inclusive in Volume 1 of this County Development Plan*

HER POL 2 *To conserve and enhance the amenity of the River Nanny in Kentstown including the landscape, water environment and wildlife habitats and, where consistent with this, to encourage increased public access and provision of walkways.*

Relevance to the Proposed Development

Based on the issues identified in the Kentstown Written Statement, this EIAR / EIS gives consideration to the water quality and ecological value of the River Nanny and flood risk potential, through assessment of potential impacts resulting from the proposed development in the following sections of this EIAR / EIS.

3.5 The Development & its Compliance with Policy

It is considered that the proposed development at Knockharley is in compliance with the policy objectives listed previously, as indicated in the "relevance boxes". In terms of European and national legislation, the proposed facility will ensure adherence to the principles of self-sufficiency and proximity by providing disposal and recovery infrastructure for the management of waste generated both within the region and nationally.

The provision of continued landfill capacity is likely to arise in a context of national landfill capacity being lower than the 2020 Landfill Directive targets and as such will be in compliance with the Directive targets.

National planning policy, outlined in the National Planning Framework and the National Development Plan, is supported by the proposed development through the provision of effective and efficient waste management facilities, which are identified as essential in the promotion of balanced regional development

Current national waste policy, outlined in A Resource Opportunity, is supported in a number of ways by the proposed development as contributing to the achievement of the self-sufficiency and proximity principles. While the policy of the elimination of landfilling of municipal waste is identified, consideration must be given to the type of material to which this refers, with an ongoing need for disposal capacity for, as well as contingency and repatriation capacity.

The proposed development also displays adherence with the Draft Eastern and Midland Regional Assembly regional planning guidelines and the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022 through, *inter alia*, its contribution as an important factor in the functioning of a fully integrated waste management system.

The Eastern Midlands Regional Waste Management Plan 2015 – 2021 acknowledges the need for the ongoing provision of landfill capacity in the region, as well as for contingency and repatriation needs. While the preferred policy of the plan for residual waste management refer to thermal treatment, the implementation of policies in this regard, will result in the production of IBA material capacity for which can be provided by the proposed development. The environmental protection criteria specified within the plan are assessed individually in sections of this EIAR where they are relevant. In addition, the Plan highlights the increasing quantities of C&D wastes being generated, in light of decreasing capacity for the management of same. The Plan also outlines policies in relation to the management of repatriated wastes and historic closed landfills. The preceding sections have outlined the means by which the propose development is in a position to strongly contribute to these identified policies.

A range of policies and objectives outlined in the Meath County Development Plan 2013 – 2019 are supported by the proposed development, including the requirement for compliance with EPA authorisations the future potential for re-use of aggregates and the overall adherence with regional and national waste policy.

Furthermore, specific policies identified in relation to Kentstown are considered in the preparation of this EIAR.

3.6 References

Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity; http://southernwasteregion.ie/sites/default/files/National-C-D-Capacity-Report.pdf

DoELG; Waste Management: Changing Our Ways – 1998; https://www.epa.ie/pubs/reports/waste/plans/EPA_changing_our_ways_1998.pdf

DOELG; Preventing and Recycling Waste – Delivering Change – a Policy Statement – 2002 http://www.epa.ie/pubs/reports/waste/plans/epadeliveringchange2002pdf.html ;

DoECLG; A Resource Opportunity – Waste Management Policy in Ireland – 2012; http://www.housing.gov.ie/environment/waste/policy-and-legislation/resource-opportunity-waste-management-policy-ireland

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EMWR; Eastern Midlands Regional Waste Management Plan 2015 – 2021' http://emwr.ie/download-the-eastern-midlands-regional-waste-management-plan

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ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 4 – NEED FOR THE DEVELOPMENT & ALTERNATIVES CONSIDERED

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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4 THE NEED FOR THE DEVELOPMENT & ALTERNATIVES CONSIDERED

4.1 Introduction

This chapter assesses the need for the proposed development in the context of the existing and future waste management environment in Ireland.

The need for the proposed development is determined through consideration of a number of factors:

- examination of the current levels of generation of particular waste streams and likely future rates of generation
- assessment of the adequacy of the existing means of management of these waste streams
- consideration for the need for contingency/emergency waste management capacity with the State in the event of an emergency arising, and
- consideration the relevant policy environment that pertains to the relevant waste stream

Chapter 3 of this Main Volume of the EIAR has examined relevant policy in detail and where applicable, these policies will be referenced in this section in the context of the need for the development as appropriate.

The relevant waste streams for which the proposed development can provide capacity over its lifetime will include:

- incinerator bottom ash (IBA)
- non-hazardous wastes of municipal (household and commercial) and industrial origin, including wastes of this origin arising from, for example, stabilised waste, repatriation, historic legacy sites, illegal landfills and emergency/contingency events and SHRHW
- non-hazardous soil and other C&D wastes

These waste streams are examined in further detail in the following sections in order to identify the reasons why the proposed development is required for their management. As a first step, however, an overview of the developments that have occurred in the landfill and wider waste management sectors in the past number of years, and that are likely to recur in the coming years, is presented, in order to set the context in which the proposed development should be considered, in terms of the provision of landfill capacity on a regional and national basis.

4.2 Context of Proposed Development

The context in which the application for permission in respect of the proposed development is made reflects a waste management sector which has undergone significant changes in the past number of years and which continues to undergo change. The waste management sector is transitioning from being heavily 'landfill supported', to one in which the role of landfill is diminishing. This reflects the requirements and objectives of European, national, regional and local policy, where waste management activities are focused on the higher tiers of the waste hierarchy.

However, what has occurred in Ireland in recent years is that this transition has occurred in a relatively uncontrolled manner, with national landfill capacity being significantly reduced over a short period of time, leading to significant pressures in the management of certain waste types, where suitable and sustainable outlets for landfillable waste have been lacking. Indeed, from time to time in recent years, emergency situations have arisen, in which waste acceptance was permitted under Section 56 of WMA. In addition, the treatment of certain wastes in higher tiers of the waste hierarchy, is resulting in different waste streams requiring further management, for which landfill is an acceptable and sustainable outlet.

In addition, there is an increasingly visible requirement for the availability of landfill capacity for the management of wastes illegally deposited at unauthorised sites, both within the Republic of Ireland and in Northern Ireland, where landfill is the only appropriate means of management of this material.

Accordingly, there will remain a requirement for landfill capacity as part of a fully integrated waste management system, which incorporates high rates of recovery and recycling, to provide management capacity for non-recoverable/non-recyclable wastes, as well as to provide back-up contingency and emergency capacity, as and when required.

It is in this context that this development is proposed.

4.2.1 Decreasing Landfill Capacity

Table 4-1 presents the number of landfills accepting MSW between 2008 and 2018 (November), sourced from EPA produced national waste reports for the years 2008 to 2012 and from respective facility annual environmental returns (AERs) and industry knowledge for subsequent years – in Table 4-1, 'O' represents a respective facility being operational in that year.

Table 4-1: Operational MSW landfills between 2008 and 2018

Facility	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ballynacarrick	O	O	O	O	O	-	-	-	-	-	
Derrinumera	O	-	O	O	O	-	-	-	-	-	
Rathroeen	O	O	O	O	O	O	O	O			
Scotch Corner **	O	O	O	O	O	O	O	O	O	-	
Ballyeally	O	O	O	O	O	-	-	-	-	-	
Kyletalesha ***	O	O	O	O	O	-	-	-	-	-	
Whiteriver	O	O	O	O	O	O	-	-	-	-	
Arthurstown	O	O	O	-	-	-	-	-	-	-	
Rampere	O	O	O	O	O	-	-	-	-	-	
Powerstown	O	O	O	O	O	O	O	O	O	-	
Youghal	O	O	O	O	O	-	-	-	-	-	
North Kerry	O	O	O	O	O	O	O	-	-	-	
Gortadroma	O	O	O	O	O	O	O	-	-	-	
Donohill	O	O	O	-	O	O	O	-	-	-	
Holmestown	O	O	O	O	O	-	-	-	-	-	
East Galway	O	O	O	O	O	O	O*	O*	O	O	O
Drehid	O	O	O	O	O	O	O	O	O	O	O
Knockharley	O	O	O	O	O	O	O*	O*	O	O	O
Ballynagran	O	O	O	O	O	O	O	O	O	O	O
Corranure	O	O	O	-	-	-	-	-	-	-	
Inagh	O	O	O	O	-	-	-	-	-	-	
Kinsale Road	O	O	-	-	-	-	-	-	-	-	

Facility	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Derryconnell	O	O	O	-	-	-	-	-	-	-	
Ballynacarrick	O	O	O	O	-	-	-	-	-	-	
Balleally	O	O	O	O	-	-	-	-	-	-	
Dunmore	O	O	O	-	-	-	-	-	-	-	
Ballaghveny	O	O	O	O	-	-	-	-	-	-	
Derryclure	O	O	O	O	-	-	-	-	-	-	
Ballaghdereen	O	O	O	-	-	-	-	-	-	-	
Ballydonagh	O	O	O	-	-	-	-	-	-	-	
Killurin	O	-	-	-	-	-	-	-	-	-	
KTK	O	O	O	O	-	-	-	-	-	-	
Kerdiffstown	O	-	O	-	-	-	-	-	-	-	
No. of Operational facilities	**33**	**30**	**31**	**23**	**18**	**11**	**10**	**7**	**6**	**4**	**4**
** East Galway Landfill and Knockharley Landfill did not accept significant quantities of waste in 2014 & 2015*											
*** Scotch Corner ceased waste acceptance in Q2 2017*											
**** Kyletlaesha Landfill facility re-opened in Q3 2017 for the acceptance of C&D soil and stones*											

The purpose of Table 4-1 is to highlight the dramatic decrease in the number of operational landfills accepting MSW in the country between 2008 and 2018 – from 33 operational facilities in 2008 to just 4 in 2018. Approximately 3.2 million tonnes of household, commercial, industrial and C&D waste materials were accepted at the facilities in 2008, while the combined disposal capacity of the 4 remaining facilities, as per time of writing in 2018 is 698,000 tonnes. From 2012 onwards, the most dramatic drop off is observed.

Table 4-1 presents a visualisation of the dramatic reduction in landfill capacity within the country in the identified years – while a number of factors contributed to this reduction, not least economic factors associated with the economic downturn between 2008 and 2012, the waste management capacity removed by this reduction has not been replaced with sustainable solutions, leading to sectoral pressures discussed in more detail in the following sections.

Further discussion on current and future landfill capacity is presented in Section 4.4.1.

4.2.2 Capacity considerations

Landfill planning consent applications have historically presented arguments for the need for landfill development based on projections of future waste generation, assumptions around relevant recycling/recovery rates and identification of competing or alternative means of managements of wastes.

While a not dissimilar approach is taken in the following sections of this chapter in discussing the need for the proposed development, historically, the arguments around the need for landfill capacity have always centred on the objective (of the consenting authorities) of ensuring that 'over-capacity' of landfill did not result from granted consents. This is exemplified by the reduction in waste acceptance waste for disposal applied to the Knockharley Landfill from 2010, applied in the context of the applicable waste management plan at the time of application.

While the logic behind this objective appeared sensible at that time i.e. that providing overcapacity of landfill may have stymied efforts to improve recycling & recovery performance and develop a more integrated waste management system within the country, it is not appropriate to apply a similar logic to an application for landfill development consent in 2018.

This is due to the fact there now exists a range of other instruments, supported by national and regional policy measures, that control and influence waste to landfill including:

- the application of the landfill levy at a rate of €75 per tonne, which has applied since 2013.
- active enforcement of the requirement for landfill operators to demonstrate compliance with Section 53A of the Waste Management Act, 1996 as amended, such that appropriate charges are imposed for the disposal of waste at landfill facilities
- the requirement for pre-treatment being conditioned into landfill licences, in accordance with EPA guidance on the matter
- availability of other more cost-effective options for residual waste treatment in particular i.e. thermal treatment (incineration), mechanical treatment incorporating recovered fuel production, export of waste – the current applicability of these options in discussed in more detail in the following.

While not proposing a capacity-focussed approach to considering the overall need for the proposed development, there is a significant under capacity for the management of municipal solid wastes (and non-municipal wastes) nationally due to the lack of appropriate waste management infrastructure, as identified in each of the annual implementation regions by the three waste management regions, where each states that ..."*during 2016 there was a national waste infrastructure deficit due to the lack of suitable outlets for municipal residual wastes".* This shortfall has resulted in the Section 56 authorisations (in relation to measures to prevent or limit environmental pollution caused by waste) being granted over the recent years, including in relation to depositing waste at the Knockharley landfill.

The Eastern Midlands Region Annual Report 2015/2016 also identifies that *"it is clear that an immediate requirement for significant additional active licensed capacity is required".* Further assessment of landfill capacity is provided in Section 4.4.1.

In a fully functioning, integrated waste management system, landfill provides the last option for wastes that cannot be managed alternatively, while providing an appropriate means of management for wastes for which there are no alternatives.

To this end, and specifically in light of the dramatic reduction in national landfill capacity, the application of a "capacity focussed" logic as a means of influencing/controlling volume of wastes to landfill is not appropriate in the current climate, given the other instruments that now influence waste movement towards landfill.

Future landfill capacity within the country will be provided at a small number of facilities, including at the Knockharley Landfill facility – it therefore is logical that these facilities operate at appropriate capacities, in order that:

1. sufficient capacity is provided for, at least, the quantities of MSW and non MSW residuals wastes that may be directed towards to landfill in future years
2. appropriate contingency capacity is provided to account for emergency, unplanned and unexpected events, as and when required.

In summary, future consideration of individual landfill capacities should focus on ensuring appropriate capacities are provided to account for likely and potential inputs including making provision for contingency / emergency events, rather than attempting to limit input quantities, as this is sufficiently influenced by the measures identified.

4.2.3 Capacity on a National Basis

Landfill capacity was historically considered in the context of the applicable waste management plans at the time of licence application, such that landfill capacity was primarily determined as providing capacity for the particular region in which a facility was located.

Subsequent to that, the concept of 'inter-regional movement of waste' was recognised by relevant authorities, as landfill facilities began to reduce in number with the consequent requirement to utilise capacity within other regions.[1]

With the rationalisation of waste management regions in Ireland from 10 down to 3, as required by the national policy document 'A Resource Opportunity', as identified in Chapter 3, the majority of existing landfill capacity is now located within the Eastern & Midlands waste management region: Knockharley Landfill, Ballynagran Landfill and Drehid Landfill. The East Galway Residual Landfill is located in the Connacht-Ulster Waste Management Region and is currently operational but planning for this site will expire in December 2018.

Therefore, in the coming years, with landfill capacity concentrated particularly within the Eastern Midlands waste management region, this capacity by default will be considered as national capacity, given the absence of landfilling capacity within the Southern and Connacht-Ulster regions.

4.2.4 Policy Environment

As identified in Chapter 3, national policy, as presented in 'A Resource Opportunity' identifies policy objectives relating to '*landfill elimination'.*

Thus, consideration of the policy environment in which the current situation, in terms of landfill capacity, exists, must always acknowledge and be tempered by the actual situation that is occurring within the waste sector, when determining any proposed development's consonance with policy.

4.2.5 Infrastructural Developments

The commencement of operations at the Dublin Waste to Energy facility in Q2 of 2017 is a significant factor in the future management of residual municipal solid waste, within the country. A significant quantity of residual waste materials that are currently exported are likely to migrate to this facility, and combined with the Carranstown Waste to Energy facility, and with thermal capacity provided at cement kilns within the country, indigenous thermal recovery of energy from waste will be the primary means of management of residual municipal waste nationally from this point onwards, in line with policy objectives of the regional waste management plans (where the national need for 300,000 tonnes of further thermal treatment capacity is identified).

This further 300,000 tonnes of thermal capacity may be provided through the development of another dedicated waste to energy facility, with a number of such facilities currently in various stages of the planning process at present, or through increased recovered fuel utilisation at cement kilns, where a number of planning applications relating to increased recovered fuel utilisation are being considered, or a combination of both. However, at the time of writing there is no certainty in relation to any timeline associated with the provision of this infrastructure.

However, increased thermal treatment of wastes means increased generation of outputs from this process which will require management. With a combined 820,000 tonnes of thermal capacity (from 2018) from Carranstown and Dublin Waste to Energy facilities alone, this will result in the generation of c. 160,000 tonnes of incinerator bottom ash (IBA) that requires management – with potential alternative outlets for bottom ash (e.g. road construction aggregate) not yet developed within the country, IBA storage remains the most appropriate means of management of this material. Even in the event of alternative outlets for this material being developed, storage capacity will be required to be maintained, given the variability in demand that would likely be associated with such alternative outlets.

Increased recovered fuel utilisation is also likely to result in the increased production of residual municipal solid waste 'fines' material to be appropriately stabilised.

[1] National Waste Report (NWR) 2012, which states that declining numbers of landfills "*will lead to significant inter-regional movement of waste as the remaining capacity is not distributed evenly across the State*".

4.2.6 Removal of Previously Deposited Wastes

In addition to residual MSW and IBA material that requires management nationally, there is a significant quantity of waste material that requires management arising from obligations to deal with illegally deposited waste, where this material will effectively require removal as part of the remediation of these sites e.g. Whitestown landfill, Co. Wicklow.

As previously identified in Chapter 3, there is a requirement for the disposal of repatriated MSW from Northern Ireland as part of the intergovernmental agreement on the repatriation of waste[2]. As per the Eastern Midlands Region Waste Management Plan 2015-2021, an estimated 120,000 tonnes of waste that remains to be repatriated. Since the publication of the regional plans, a number of further sites have been discovered in Tyrone and Armagh in 2015 and 2016, such that it is now estimated that at least 170,000 tonnes of waste that remains to be repatriated[3].

It was originally envisaged in the July 2014 'Comptroller and Auditor General Special Report – Transhipment of Waste' that, on the basis of repatriation of the 7 remaining sites (at that time) at a rate of 2 sites per year, the repatriation programme would be completed by the end of 2018. Such progress has not been realised to date. A framework of approved landfills, identified as being appropriate to accept repatriated waste from Northern Ireland, which Knockharley Landfill is on, and is the closest landfills to Northern Ireland in terms of distances from the sites from which waste will be repatriated.

With an increased number of sites having been discovered, as well as progress not having been made at the rate expected in the Comptroller and Auditor General Special Report of 2014, it is evident that the requirement for repatriation capacity will extend until such time as all of the remaining sites are fully completed.

Chapter 3 also identifies the requirement for the remediation of a number of 'Class A' historic legacy sites, not only within the Eastern Midlands region, but nationally, where remediation by removal may likely to be required in some instances. There are 23 Class A sites identified with the Eastern Midlands Region, 16 in the Connacht Ulster Region and 34 in the Southern Region, with each regional plan referencing the development of a roadmap to identify the remediation of these sites over the lifetime of the plans i.e. 2015 to 2021. While it is not possible to quantify the exact amount of waste that may require removal from these sites, as in situ management may form part of individual remediation plans, with 73 sites requiring management nationally over the lifetime of the plans, there remains potential for the generation of significant waste volumes for management.

In addition, there are a number of other illegal landfills facilities identified for which the requirement for the removal of waste is highly likely - 2 no. illegals landfills alone having been identified in 2016 in Co. Meath[4] and Co. Donegal[5] and one significant illegal landfill having been identified as requiring significant remediation activity in Co. Wicklow in 2017[6].

These materials, if removed from the illegal and Class A sites, can only be managed by landfilling in an appropriate designed and managed facility, as it is unsuitable for thermal treatment.

Furthermore, it is also identified that it is intention of Wexford County Council to remove all waste accepted to date at the Holmestown Landfill facility, such that the site will no longer be designated a waste management facility and to allow it to be potentially utilised for other non-waste related activities. Holmestown Landfill commenced waste accepted in 2008 and ceased in 2012, over which time c. 120,000 tonnes of waste material was accepted including cover material. Should this material be removed, it too shall require management by landfilling at an alternative site.

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[2] Comptroller & Auditor General Special Report – Transhipment of Waste, July 2014: http://www.audgen.gov.ie/documents/vfmreports/84_Transhipment_Waste.pdf

[3] http://www.irishexaminer.com/ireland/euro7m-spent-removing-illegal-waste-dumped-in-north-307653.html http://www.independent.ie/irish-news/news/20000-tonnes-of-republics-waste-found-dumped-in-the-north-34523843.html

[4] http://www.irishexaminer.com/ireland/council-claims-land-used-for-illegal-dump-426632.html

[5] http://www.independent.ie/irish-news/exclusive-investigators-discover-massive-illegal-dump-after-threeyearlong-investigation-into-suspicious-activity-35224466.html

[6] https://www.irishtimes.com/news/crime-and-law/courts/high-court/wicklow-council-ordered-to-remove-up-to-1-4m-tonnes-from-dump-1.3146953

Therefore, there are significant quantities of waste that the State is or will be obliged to appropriately manage in the coming years, for which landfill will be the primary means of management of this material, given that it is unsuitable for acceptance at waste to energy or other facilities. Capacity for the management of this material must therefore be available.

4.2.7 C&D waste & soils and stone

The recently published report, prepared on behalf of the three waste management regions, entitled 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity', referenced in Chapter 3, identifies a potential shortfall in capacity for C&D soil and stone in the range of c. 1.5 million tonnes in 2018 to just under 4 million tonnes in 2023. In the context of this proposed development, where potential to increase the acceptance of this type of material at the Knockharley Landfill facility exists, as described in Chapter 2, this identified lack of capacity is a significant contextual issue.

4.2.8 Summary of Context

This section is intended to provide an overview of the context in which the proposed development application is made. Issues touched upon in this section are expanded in the following sections where relevant. The following summarises the context of the proposed development application:

- The dramatic decrease in landfill capacity that has not been replaced by appropriate and sustainable alternative management options
- An identified immediate requirement for further infrastructural capacity for the management of MSW
- The development of a number of measures, primarily financial, that influence the acceptance of waste at landfill, that provide alternatives to the imposition of capacity restrictions, as historically applied in the granting of permissions for landfill development
- The consideration of landfill capacity as national rather than regional capacity
- The requirement to reflect the actual situation occurring within the waste management sector when assessing compliance with relevant policies
- The potential for further thermal treatment infrastructural development albeit with lack of certainty around associated timelines
- The continued requirement for landfill capacity for management of non-municipal wastes e.g. IBA and C&D material and soils, as well as the requirement for significant landfill capacity to appropriately manage waste from repatriated and unauthorised sites.
- This continued need for contingency landfill void in the event of an emergency arising.

4.3 Quantification of Wastes Requiring Management

This section presents analysis to quantify the likely future amounts of the waste materials proposed for acceptance, as part of this development, and as described in Chapter 2 'Description of the Proposed Development'. Subsequent sections of this chapter assess the means by which these wastes may be managed, such that the need for the capacity proposed as part of this development can be identified.

Waste types are examined in the following groupings:

- Household, commercial and industrial wastes, including stabilised residual fines
- Incinerator bottom ash (IBA)
- C&D, non-hazardous soil
- Other wastes – grit & screening, street sweepings, contaminated dry recyclables

In addition, contingency provision in terms of unforeseen events occurring is also discussed.

4.3.1 Household, commercial and industrial wastes, including stabilised residual fines

Schedule A of the existing IE licence W0146-02 for the Knockharley Landfill authorises the acceptance of 175,000 tonnes of “household, commercial and industrial waste” for disposal in the following proportions:

- Household – 100,000 tonnes
- Commercial – 45,000 tonnes
- Industrial – 30,000 tonnes

Schedule A also allows for the recovery of 25,000 tonnes of construction and demolition (C&D) waste.

While not identified as MSW in Schedule A, the three ‘origins’ of the waste authorised for disposal amount to the definition of municipal solid waste (MSW) where MSW is defined as “household waste as well as commercial and other waste that, because of its nature or composition, is similar to household waste[7].

For the purposes of this analysis, the description of “household, commercial and industrial waste” is taken as MSW.

As per the requirements of W0146-02, MSW must be accepted at the facility in a pre-treated form. Pre-treatment includes a variety of process including source segregation, separate collection, manual sorting, mechanical treatment etc. When mechanical treatment, in the form of tromelling or screening is applied to the residual (”black bin”) fraction of MSW, ‘fines’ material is produced, which typically has a high organic fraction.

This material is typically biologically treated to produce a stabilised material with a reduced landfill gas and leachate generation potential, such that it can be landfilled. Thus, this ‘stabilised fines’ material is a material of municipal origin and is appropriate to be considered within this section. However, the quantification of this material is related to the extent of mechanical treatment that may be applied to residual MSW, and so the quantification of same, and hence the need for the proposed biological treatment facility, is addressed in the following sections that consider management options for this material.

Current & Future MSW generation

Current and future MSW generation is assessed on a national basis in the following section, given that consideration of future landfill capacity as being on a national basis, as previously discussed.

Current MSW Generation

The National Waste Report (NWR) 2012 remains the most recent, detailed published source of waste generation nationally. A national waste report was produced annually by the EPA for each year up to 2012 but due to a change in the way in which the EPA reports data to the European Union, annual reports are no longer published.

Table 4-2 over presents the following data in relation to national MSW generation, management and treatment in 2012 i.e. the most recent verified data available.

[7] As per National Waste Report 2012 - it excludes municipal sludges and effluents. In the context of the NWR, municipal waste consists of three main elements - household, commercial (including non-process industrial waste), and street cleansing waste (street sweepings, street bins and municipal parks and cemeteries maintenance waste, litter campaign material).

Table 4-2: MSW generated, managed and treated in 2012

Municipal Solid Waste:	Quantity (tonnes)
Generated	2,692,537
Managed	2,478,337
Landfilled	1,027,577
Incinerated	427,142
Recycled (ex. composting/digestion)	828,492
Composted/digested	156,212

Ireland is on target to achieve its targets under the Waste Framework by 2020 as follows[8]:

- reuse or recycle 50% of household derived paper, metal, plastic & glass
- reuse, recycling and other material of 70% by weight of C&D non-hazardous waste
- Establishment of a National Waste Prevention Programme

1,027,577 tonnes of residual MSW was landfilled i.e. the fraction of MSW remaining after a treatment or diversion step, across 18 landfills that were operating in 2012, which corresponds to a 41% disposal rate of MSW managed.

The remaining 59% recovery rate applies to material that was recycled, composted/digested or recovered in incineration and other facilities.

The c. 430,000 tonnes of residual MSW incinerated in 2012 was comprised of:

- c. 200,000 tonnes incinerated at the Carranstown EfW facility i.e.
  - c. 170,000 tonnes of mixed residual waste and
  - c. 30,000 tonnes of recovered fuel derived from residual MSW
- c. 66,000 tonnes of recovered fuel accepted at Irish Cement
- c. 70,000 tonnes of recovered fuel accepted at Lagan Cement
- c. 94,000 tonnes of recovered fuel and mixed MSW exported to the continent

In total, there was c. 1,455,000 tonnes of residual MSW that was managed in Ireland and abroad by recovery through incineration and other thermal treatment (i.e. cement kilns) and disposal in landfill.

Future MSW Generation

Each of the three regional waste management plans published in 2015 provides projections of regional waste generation which, when combined, present future national waste generation projections. Given that these projections form the basis on which the policy objectives within the regional plans are made, it is considered appropriate to utilise the projections made within these plans in this need assessment.

Table 4-3 summarises the future MSW projections provided with the three regional plans, which are presented in detail up until 2021.

Figures presented within the regional plans are presented for every two years (2013, 2015, 2017 etc.) and so Table 4-3 reflects the intervening years as being the midpoints between the tonnages identified. These projections within the plans reflect a year on year growth of 2-3% for both household and commercial wastes.

[8] http://www.epa.ie/pubs/reports/waste/stats/EPA_Progress%20towards%20EU%20targets_Nov17.pdf

The regional waste plans also envisage an MSW generation total of approximately 3.9 million tonnes by 2030, which was determined by applying a 2.5% growth factor for the period for 2020 to 2030. While the tonnages for the intervening period between 2021 and 2030 are not presented within the plans, Table 4-3 applies the growth factors identified to the MSW generated to reach the figures presented for 2030.

Note that the regional plans allow for total MSW generated, rather than managed, the difference being 'uncollected waste', for which an assumption is annually included in national waste reporting (reference Table 4-2 where the difference between MSW generated and managed equated to 214,200 tonnes of 'uncollected waste'[9] i.e. approximately 8% of MSW generation in 2012). The regional plan projections have maintained a figure of 214,200 tonnes difference between MSW generated and managed to 2021, and Table 4-3 continues this inclusion to 2030 – as waste volumes increase, the % proportion of uncollected waste declines, which is considered likely to reflect improvements in waste collection coverage in future years.

Note also that projections within the regional plans do not include for street cleaning or cleansing wastes, which are typically included in municipal projections. This waste type is not included in Table 4-3 and instead is addressed in further detail in Section 4.3.4 following.

[9] Methodology for calculation of same provided in Appendix M of NWR 2012

Table 4-3: Regional Waste Management Plans projections

	Year	2013,t	2014,t	2015,t	2016,t	2017,t	2018,t	2019,t	2020,t	2021,t	2022,t	2023,t	2024,t	2025,t	2026,t	2027,t	2028,t	2029,t	2030,t
Connacht / Ulster Region	*High Range*	428,177	439,119	450,061	462,537	475,012	489,044	503,076	516,525	529,973	543,222	556,803	570,723	584,991	599,616	614,606	629,971	645,721	661,864
	Low Range	432,333	443,399	454,465	461,993	469,521	477,244	484,967	492,498	500,029	512,530	525,343	538,477	551,938	565,737	579,880	594,377	609,237	624,468
Eastern / Midlands Region	*High Range*	1,229,965	1,306,313	1,382,661	1,426,717	1,470,772	1,519,317	1,567,862	1,612,747	1,657,632	1,699,073	1,741,550	1,785,088	1,829,716	1,875,458	1,922,345	1,970,404	2,019,664	2,070,155
	Low Range	1,332,303	1,373,816	1,415,328	1,445,384	1,475,440	1,506,250	1,537,059	1,565,549	1,594,038	1,633,889	1,674,736	1,716,605	1,759,520	1,803,508	1,848,595	1,894,810	1,942,181	1,990,735
Southern Region	*High Range*	884,171	908,179	932,187	958,238	984,289	1,013,284	1,042,278	1,070,181	1,098,083	1,125,535	1,153,673	1,182,515	1,212,078	1,242,380	1,273,440	1,305,276	1,337,908	1,371,355
	Low Range	892,643	917,366	942,089	958,957	975,824	992,875	1,009,926	1,026,803	1,043,680	1,069,772	1,096,516	1,123,929	1,152,027	1,180,828	1,210,349	1,240,608	1,271,623	1,303,413
Total Generated	*High Range*	2,542,313	2,653,611	2,764,909	2,847,491	2,930,073	3,021,645	3,113,216	3,199,452	3,285,688	3,367,830	3,452,026	3,538,327	3,626,785	3,717,454	3,810,391	3,905,651	4,003,292	4,103,374
	Low Range	2,657,279	2,734,581	2,811,882	2,866,334	2,920,785	2,976,369	3,031,952	3,084,850	3,137,747	3,216,191	3,296,595	3,379,010	3,463,486	3,550,073	3,638,825	3,729,795	3,823,040	3,918,616
	Midpoint	2,599,796	2,694,096	2,788,396	2,856,913	2,925,429	2,999,007	3,072,584	3,142,151	3,211,718	3,292,011	3,374,311	3,458,669	3,545,136	3,633,764	3,724,608	3,817,723	3,913,167	4,010,996
Total Managed	High Range	2,328,113	2,439,411	2,550,709	2,633,291	2,715,873	2,807,445	2,899,016	2,985,252	3,071,488	3,153,630	3,237,826	3,324,127	3,412,585	3,503,254	3,596,191	3,691,451	3,789,092	3,889,174
	Low Range	2,443,079	2,520,381	2,597,682	2,652,134	2,706,585	2,762,169	2,817,752	2,870,650	2,923,547	3,001,991	3,082,395	3,164,810	3,249,286	3,335,873	3,424,625	3,515,595	3,608,840	3,704,416
	Midpoint	**2,385,596**	**2,479,896**	**2,574,196**	**2,642,713**	**2,711,229**	**2,784,807**	**2,858,384**	**2,927,951**	**2,997,518**	**3,154,756**	**3,160,111**	**3,244,468**	**3,330,935**	**3,419,564**	**3,510,408**	**3,603,523**	**3,698,966**	**3,796,795**

As identified, the regional plans estimated an MSW generation of approximately 3.9 million tonnes in 2030, which equates to the approximate midpoint between the 'total managed' low range and 'total generated' high range, as shown in Table 4-3.

Therefore, it is considered that taking the 'total managed' midpoint forecast range provides a reasonable projection of future MSW generation nationally, based on the regional plan data.

Future Residual MSW Projections

While future 'overall' MSW generations are presented in Table 4-3, it is only the residual fraction of MSW that may potentially be landfilled, after the application of pre-treatment or other treatment steps. In terms of projecting future residual MSW quantities, the residual fraction can be considered as that which remains after the application of recycling activities – therefore, the future recycling rate will influence the amount of residual MSW that is managed through non- recycling means, which will essentially be recovery through thermal treatment or disposal post treatment (which includes pre-treatment).

Table 4-4 below presents the future MSW projections identified in Table 4-3 and applies appropriate recycling rates to these figures, in accordance with targets laid out in the three regional plans, which assume the achievement of a 50% MSW recycling rate by 2020, with incremental growth in the years thereafter, such that recycling rates in excess of 60% are ultimately achieved by 2030 and beyond.

The starting point for the projected recycling rate presented is the 2012 position of 984,704 tonnes recycled, as per NWR 2012 i.e. material recycled (828,492 tonnes) plus material composted/digested (156,212 tonnes), as composting/digestion are considered recycling activities. Of MSW managed, this corresponded to a total of 39.7%, taken as 40%, which is close to the EU recycling average of 42%. Incremental linear increases of 1.25% per annum are applied from 2012 onwards, to reach 50% by 2020, and the same rate of increase is applied post 2020, as applied within the regional plans, resulting a recycling rate of 62.5% is observed by 2030.

It should be noted that the recycling rate projected to 2030 can be considered very challenging and reflects the efforts that will be required to further develop an extensive national biological treatment capacity to provide the higher composting/digestion rates that contribute to the high overall recycling rates, observed in countries such as Germany (65% recycling) and Austria (62% recycling), for example.

Table 4-4: MSW projections from 2013 to 2030

Year	MSW Projections	Recycling Rate	Projected Recycling Volume	Residual MSW remaining
2013	2,385,596	41.25%	984,058	1,401,538
2014	2,479,896	42.50%	1,053,956	1,425,940
2015	2,574,196	43.75%	1,126,211	1,447,985
2016	2,642,713	45.00%	1,189,221	1,453,492
2017	2,711,229	46.25%	1,253,943	1,457,286
2018	2,784,807	47.50%	1,322,783	1,462,023
2019	2,858,384	48.75%	1,393,462	1,464,922
2020	2,927,951	50.00%	1,463,976	1,463,976
2021	2,997,518	51.25%	1,536,228	1,461,290
2022	3,154,756	52.50%	1,656,247	1,498,509
2023	3,160,111	53.75%	1,698,560	1,461,551
2024	3,244,468	55.00%	1,784,458	1,460,011

Year	MSW Projections	Recycling Rate	Projected Recycling Volume	Residual MSW remaining
2025	3,330,935	56.25%	1,873,651	1,457,284
2026	3,419,564	57.50%	1,966,249	1,453,315
2027	3,510,408	58.75%	2,062,364	1,448,043
2028	3,603,523	60.00%	2,162,114	1,441,409
2029	3,698,966	61.25%	2,265,617	1,433,349
2030	3,796,795	62.50%	2,372,997	1,423,798

While acknowledged that projecting waste volumes is an inexact science, by applying the assumptions to the data presented within the regional waste management plans, it can be seen that it is likely that there will be between **1.40 and 1.49 million tonnes of residual MSW** requiring management each year over the next 15 years or so.

4.3.2 Incinerator Bottom Ash (IBA)

IBA is currently accepted at the Knockharley Landfill facility from the Indaver EfW facility in Carranstown, Co. Meath, with 15,198 tonnes accepted in 2016 and 13,200 tonnes in 2017. A portion of the IBA material is currently disposed of in the landfill void with the remainder used in the construction of temporary haul roads etc. within the landfill.

Current IBA Generation

At the time of writing, the Indaver Energy from Waste (EfW) facility at Carranstown is the only facility to have produced IBA over a number of years, given that Dublin Waste to Energy commenced operations only in Q2 of 2017 when it produced 33,982 tonnes of IBA[10] during this start up period. A review of the Carranstown annual environmental returns (AERs) for the past number of years confirms the following:

Table 4-5: IBA produced at Carranstown

Year	Tonnage
2012	40,507
2013	40,579
2014	33,451
2015	33,921
2016	35,565

The apparent reduction in quantities observed from 2014 onwards can be attributed to the increased direct recovery of ferrous and non-ferrous metals at the Carranstown facility.

Future IBA Projections

Future projections of IBA generation are based on the Carranstown and Dublin Waste to Energy facilities but also make an allowance for the future generation of IBA, in the event of a third energy from waste facility being developed nationally.

[10] http://www.epa.ie/licences/lic_eDMS/090151b280680b37.pdf

IBA projections presented in Table 4-6 following relate to the two known facilities that will produce IBA for management over the next 20 to 25 years i.e. the lifetime of the Carranstown Waste to Energy and Dublin Waste to Energy facilities, and allows for IBA produced from the proposed EfW in Ringaskiddy, Co Cork of c. 300,000 tonnes capacity (in line with identified requirement in regional waste management plans), assumes to be onstream from 2022/3.

Table 4-6: IBA quantities in future years (approximate)

Facility	2017	2018	2019	2020	2021	2022	2023 - 2030
Carranstown [11]	39,800	39,800	39,800	37,300	37,300	37,300	37,300
Dublin Waste to Energy [12]	60,000	120,000	120,000	120,000	120,000	120,000	120,000
3rd EfW facility (Ringaskiddy) [13]	-	-	-	-	-	*52,600*	*52,600*
Total, tonnes	**99,800**	**159,800**	**159,800**	**157,300**	**157,300**	**209,900***	**209,900***
*in event of a 3rd dedicated waste to energy facility being developed							

It should be noted that the management of IBA from the Dublin Waste to Energy facility is currently authorised through the facility planning permission as being through the export of this material - the 2006 EIS for the facility (Section 10.5.2 of the Main EIS) states that "*until the framework for re-use of bottom ash develops in Ireland, the bottom ash will be exported by ship for reuse in the UK or Continental Europe*". This point is expanded upon in Section 4.4.2 following.

4.3.3 C&D waste including non- hazardous soil.

Construction and demolition (C&D) waste is identified in the regional plans as typically comprising 68% soils and stone and 32% of other C&D wastes (timbers, metals, packaging etc.) and, from a management perspective, it is the non-hazardous soils and stone element that requires focus, given the relative ease in recycling other C&D waste components.

C&D generated inert classified soil and stone are typically managed through soils recovery activities, either in dedicated licensed, permitted or registered soils recovery facilities or within landfill facilities, where this material is used for cover and temporary capping activities.

Current & Future C&D soil and stone generation

The most up to date data source regarding C&D waste is the 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity' report, produced by the three regional authorities, previously referenced in Chapter 3.

This report highlights a significant increase in total C&D waste collected between 2013 and 2015, as shown in Table 4-7, which belies a decreasing trend for this waste type that was presented in the three regional plans, which were based on 2012 data at the time of writing.

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[11] Carranstown has permission to increase waste acceptance to 235,000 tonnes until end of 2019, reverting to 220,000 tonnes thereafter - figure calculated from pro-rata increase on 2015 IBA tonnage

[12] as per Section 1.11.3 of the 2006 Dublin Waste to Energy EIS (http://www.epa.ie/terminalfour/ippc/ippc-view-filter.jsp?regno=W0232-01&filter=b&docfilter=go), assume commencement beginning Q1 2018 (in terms of IBA being managed nationally)

[13] 6,583 kg/hr over 8,000 hrs, Planning Application, Section 4 of EIS; http://www.ringaskiddyrrc.ie/pdfs/Environmental_Impact_Statement/EIS_Vol_2_Main_Text/EIS_Ch_4_Project_Description_Issue_1.pdf

Table 4-7: Total C&D waste collected in 2013 -2015

Million tonnes	2013	2014	2015
Total C&D waste	2.926	3.787	5.1
Soil & Stones	2.02	2.86	3.5

It is identified that the c.1.5 million tonnes increase observed between 2013 and 2015 reflects increased construction growth, particularly in the Greater Dublin Area.

Table 4-8 below summarises the data from the report by applying the identified forecast growth rates from 2016 onwards, while also outlining the projected shortfall in capacity for the management of these materials in future years.

Table 4-8: Forecasted C&D soil and stones quantities, with shortfall identified

Soil & Stones	2016	2017	2018	2019	2020	2021	2022	2023
Forecast Quantity, t	4,004,000	4,644,640	4,988,343	5,237,761	5,499,649	5,774,631	5,947,870	6,126,306
Identified Shortfall	1,279,600	1,200,000	1,533,000	2,621,000	2,958,000	3,283,000	3,456,000	3,979,000

4.3.4 Quantification of Other Wastes

There are a number of miscellaneous waste streams that will require management in future years, that are not captured within the waste categories described previously – in addition, there are a number of waste types, produced in the categories previously identified, that do not follow a 'direct' route, in terms of their management, whereby they become 're-introduced' into the overall waste management system, such that they are seen to consume available waste management capacity on more than one occasion in their treatment.

Street Sweepings, Grit and Screenings

As identified in Section 4.3.1, sweet sweepings would historically have typically been included within MSW calculations and projections, given their generation by the population of a 'municipality'. The projections presented in Table 4-3, based on the regional waste management plan data, do not include for street sweepings. In terms of quantifying this material, the 3 regional waste management plans indicate that, in 2012, a combined c. 59,000 tonnes of litter and street sweepings waste was collected across the regions.

Grit and screenings are typically produced from water treatment processes and is a material that is typically landfilled. On the basis that Ringsend wastewater treatment plant (the largest nationally) produced c. 1,300 tonnes of grit and screenings in 2016 (as per facility AER), it is considered that 8,000 – 10,000 tonnes of this material is produced nationally annually.

A review of the 2016 AERs for Scotch Corner, Drehid, Knockharley and Ballynagran landfills indicate that a combined total of c. 67,000 tonnes of material, labelled as street sweeping, local authority clean-up waste and grit & screenings was landfilled.

Contaminated Dry Recyclables

Dry recyclables are part of the overall MSW stream and are 'captured' as part of the recycling rates assumed in Table 4-4 i.e. dry recyclable material collected separately is directed to a recycling activity and are not materials that are typically directed for recovery or disposal activities and hence are not considered in the residual waste quantities in Table 4-3.

However, given high contamination rates being observed in dry recyclable collections, reported by some waste operators as being in range of 30%, a significant proportion of material is being produced that is not suitable for recycling but is instead being directed to cement kiln facilities as a recovered fuel product.

While difficult to specifically quantify the amount of material being directed to kilns, it is considered that 50,000 tonnes per annum is an appropriate and conservative estimate, given the extent of contamination levels observed – note that, based on the 2012 National Waste Report (which is the most recent data source presenting accessible information on municipal recycling rates), c.830,000 tonnes of municipal materials were recycled (excluding biological treatment) in 2012, which is likely to be higher in 2018 – an allocation of 50,000 tonnes as contaminated material sent for recovery at cement kilns as a proportion of the overall quantity recycled is therefore considered a conservative figure.

Should performance in terms of reducing contamination rates with dry recyclable waste streams been seen to improve, this would likely be balanced out by overall increasing waste generation rates, and so it is appropriate to consider this value as remaining consistent in future years.

The effect of this material being accepted at cements kilns results in the situation described earlier – this material consumes cement kiln capacity that would otherwise be available for the utilisation of recovered fuels produced from residual MSW and as such it consumes 'recycling' treatment capacity as well as 'recovery' treatment capacity. This then results in a lesser capacity being available for residual MSW treatment through recovered fuel utilisation at kilns.

A further factor to bear in mind in relation to the potential for contaminated dry recyclables to consume cement kiln capacity is the as yet unknown impact on the stated Chinese intention to crack down on waste shipments with a contamination rate higher than 1.5%, at the end of 2017. This development has the potential to increase the quantity of dry recyclable material sent to kilns where this contamination limit cannot be met - where it may previously have been acceptable to export this material, outlets may now be limited. While not possible to quantify the impact of the Chinese ban, it certainly has the potential to increase the allocation of 50,000 tonnes identified above.

Incinerator Bottom Ash

Similar to the situation described above, the generation of incinerator bottom ash results in a situation where a portion of residual MSW sent for thermal treatment remains for management after thermal treatment – should this material be landfilled, it also then consumes landfill capacity that could be utilised for a range of other waste streams, if required. Therefore, any assessment of landfill capacity must take this into account.

4.3.5 Contingency Capacity

While the previous identifies future quantities of waste material that can definitively be identified as requiring management in the years to come, it is also considered that there will be a requirement to provide capacity to address materials and/or events that will arise in coming years, that cannot yet be readily quantified, in what can be termed 'contingency capacity'.

As identified in Chapter 3, the regional waste management plans all acknowledge this contingency requirement, for example, as stated in Section 16.4.3 of the Eastern and Midlands Waste Management Plan 2015 – 2021, where "*the local authorities anticipate that there will be an ongoing need for landfill capacity during the plan period for processed residual wastes. There is also a need to maintain a contingency supply, in response to potential situations which pose a risk to the health and well-being of citizens, livestock and the environment*".

The requirement for contingency supply can be considered in two ways – in terms of foreseen events and unforeseen events.

Foreseen contingency relates to a number of the situations described previously – there are situations where a known contingency capacity is required. For example, Chapter 3 makes reference to the implementation of emergency measures, in accordance with Section 56 of the Waste Management Act 1996, as amended, since 2016, which resulted from the lack of available outlets for residual MSW for waste management operators. This resulted from an inability to secure outlets on the continent for exported residual waste, in combination with limitations of acceptance at operational landfills, including Knockharley Landfill.

As part of these Section 56 measures, Knockharley Landfill accepted c. 105,000 tonnes of waste above its normal authorised capacity in 2016 and c.40,000 tonnes in 2017/8 from the remediation of Timoole Landfill. Contingency capacity was effectively provided through the Section 56 measures in response to lack of available outlet and this remains a situation which is kept under constant review by each of the regional waste authorities.

Similarly, it is known that capacity is required for the management for repatriated waste, waste from Class A historic legacy landfills and waste from other illegal landfills, which is contingent on the availability of landfill capacity and the rate at which this material becomes available. As discussed in previous sections, it is estimated that at least 170,000 tonnes of waste that requires repatriation from Northern Ireland, with 300,000 tonnes of material considered as a reasonable estimate of waste deposited in illegal landfills. In terms of Class A historic legacy landfills, with 73 such sites identified nationally, 400,000 tonnes of excavated waste to be managed could be considered a legitimate estimate.

In this regard, a significant 'foreseen' contingency capacity is required nationally at present.

On the other hand, unforeseen contingency events will effectively be emergency events that cannot be predicted and therefore difficult to quantify in terms of capacities that may be required in response to them.

Therefore, it is clear that contingency capacity will need to be available to address either 'foreseen' or 'unforeseen' situations as and when such capacity is required – in terms of quantifying 'unforeseen' contingency capacity, it may be prudent to apply a nominal headspace figure over and above what might be considered the required capacity for 'foreseen' contingency event.

4.4 Management Options for Identified Wastes

While the previous section has attempted to quantify the amount of the differing waste streams which are proposed for acceptance as part of this development, as well as instances that could result in an increased demand for capacity, this section examines the differing means of managing these waste streams, such that the need for or role of the proposed development is identified within this assessment of management capacity.

Management capacity for the range of materials previously identified is provided by different options as follows:

- Capacity provided by Landfill
- Capacity provided by indigenous thermal treatment – waste to energy and cement kilns
- Capacity provided by Export
- Capacity provided by permitted facilities
- Capacity provided for biological treatment

4.4.1 Capacity provided by Landfill

Table 4-9 presents the existing and future projected disposal capacity at the remaining operational landfills, based on the extent of existing authorisations in terms of Drehid, Knockharley and Ballynagran Landfill and based on stated intentions in terms of East Galway landfill. Note figures presented here are based on what the facilities are approved to take under their relevant authorisations, rather than built capacity – it has been assumed that the required cells/void capacity will be in existence to provide the capacity identified.

Drehid Landfill has permission, in accordance with An Bord Pleanála authorisation reference PL09.PM0008, for the acceptance of 360,000 tonnes per annum for disposal until December 2017, reverting to 120,000 tonnes per annum for disposal. As per the 2016 AER for the Drehid Landfill facility, the projected closure date for the facility is 2028.

Knockharley Landfill, in accordance with Meath County Council Reference: AA161431, has permission for the continued disposal of 88,000 tonnes per annum of materials until December 2021, while Ballynagran Landfill has planning permission for the acceptance of 150,000 tonnes per annum for disposal until 2020.

Planning Permission expires on East Galway landfill facility in December in 2018.

Table 4-9: Current and Future Projected Landfill disposal capacity

Facility	2017	2018	2019	2020	2021	2022	2023	2024	2026	2028
East Galway	100,000	100,000	-	-	-	-	-	-	-	-
Drehid	360,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
Knockharley	88,000	88,000	88,000	88,000	88,000	-	-	-	-	-
Ballynagran	150,000	150,000	150,000	150,000	-	-	-	-	-	-
Capacity	**698,000**	**458,000**	**358,000**	**358,000**	**208,000**	**120,000**	**120,000**	**120,000**	**120,000**	**120,000**

The above capacity provides for the acceptance of the following materials in accordance with the respective facility Industrial Emissions (IE) licences:

Knockharley Landfill (W0146-02):
- Household, Commercial, Industrial for Disposal & Construction & Demolition Waste for recovery

Ballynagran Landfill (W0165-02):
- Household, Commercial, Industrial for Disposal & Construction & Demolition Waste for recovery

East Galway Landfill (W0178-02):
- Household. Commercial & Industrial non-hazardous for Disposal and Inert waste for recovery

Drehid Landfill (W0201-03):
- Non-hazardous municipal, commercial and industrial wastes for landfill and inert waste for landfill engineering

Therefore, the capacity provided at the above facilities is approved for the management of all of the waste streams identified in Section 4.3 preceding i.e. residual municipal solid waste (including rMSW from repatriated waste, Class A historic legacy landfills, illegals facilities and other sources), incinerator bottom ash and C&D non-hazardous soil and stones.

Other existing constructed landfill capacity

While Table 4-9 outlines the future projected landfill disposal capacity, it is worth pointing out that there does remain other constructed landfill capacity nationally in existence at facilities that are not currently operational.

However, this capacity is not considered available in this assessment due to specific circumstances in relation to each of the specific facilities. The following identifies existing constructed capacity at closed landfill sites and provides background in relation to same.

- Bottlehill Landfill Facility, Co. Cork- licenced under W0161-02, this facility has never operated as an operational landfill facility. 5 no. landfill cells were constructed in 2005, of c. 65,000 m^2 in area but no waste has been placed in these cells to date.
- The planning permission pertaining to the facility requires the cessation of landfilling at the site by end of 2025, while an annual acceptance of 217,000 tonnes of waste is permitted under W0161-02[14]. In 2015, Cork County Council invited proposals from interested parties in relation to potential waste or non-waste related uses for the Bottlehill site.

[14] In 4th year of operation and subsequent years; 189,000 tonne in Year 1.

- Corranure Landfill, Co. Cavan (W0077-04) – some capacity remains within Cell 4 (total footprint of 17,800 m^2) of the Corranure facility, but this capacity is being consumed in 2017 by non-hazardous soils and alum sludges as part of the agreed remediation plan for the facility, as per AER 2016 for the facility.
- Kyletalesha Landfill Facility, Co. Laois (W0026-03) – capacity remains in Cell 15b of the Kyletlaesha Landfill facility and, as identified in Table 4-1, the facility re-opened in Q3 of 2017 to accept C&D soil and stones, in order to fill Cell15b as part of the remediation plan for the facility.
- Holmestown Landfill Facility, Co. Wexford (W0191-02) – AER 2016 for this facility identifies overall remaining capacity of c 1.1 million tonnes, and constructed cell capacity is c. 16,000 m^2. As previously identified, Wexford County Council have signalled their intention to remove existing waste material from this site, such that it may be utilised in a non- waste related application.
- Ballaghveny Landfill Facility, Co. Tipperary (W0078-03) – as per AER 2014, there remains capacity for c. 300,000 tonnes of waste within the existing constructed cells at this closed site, according to facility AERs. However, TCC are undertaking feasibility studies to determine if the site should be reopened.

4.4.2 Capacity provided by Indigenous Thermal Treatment

Indigenous thermal treatment capacity is provided through both waste to energy facility capacity as well as at cement kilns throughout the country. These thermal treatment capacities are considered as 'recovery' activities, in accordance with the 3rd Schedule of the Waste Management Act 1996, as amended. Existing and planned thermal capacity is outlined in the following.

Recovery at Indigenous Waste to Energy Facilities

Waste to energy capacity in Ireland is provided by:

- 200,000 tonnes of treatment capacity at the Indaver Carranstown facility, Co. Meath, for which an increased capacity of 235,000 tonnes to the end of 2019, reverting to 220,000 tonnes thereafter has been authorised
- 600,000 tonnes of treatment capacity at the Dublin Waste to Energy facility[15] at Poolbeg, Dublin, which commenced operations in Q2 of 2017.

A third energy from waste facility at Derryclure, Co. Offaly, is licenced under W0282-01 to provide 65,000 tonnes of MSW treatment capacity. At the time of writing, some preliminary construction works have begun at the facility location, but it is unclear as to if or when this development shall be completed.

In addition to the capacity provided by the above facilities, as outlined in Chapter 3 national policy (through the 3 no. regional waste management plans) supports the provision of a further 300,000 tonnes per annum of national thermal treatment capacity for residual MSW management – this capacity could be provided by a dedicated waste to energy facility or facilities and/or through increased recovery at cement kilns.

Waste to energy projects that are currently in the public domain include:

- The proposed 240,000 tonnes per annum Indaver waste to energy facility at Ringaskiddy, Co. Cork which was granted planning permission by An Bord Pleanála under reference PA0045.
- A 48MW gasification facility of c. 300,000 tonnes per annum at Gortadroma, Co. Limerick which is currently at Strategic Infrastructure Development pre-application consultation stage with An Bord Pleanála (PC0244).

[15] 600,000 tonnes represents the maximum capacity that can be accepted at the Dublin Waste to Energy facility, which can be impacted by the calorific value of the material – it is prudent to assume that facility will operate to its full capacity in an assessment of future management capacity

While no development that could provide the identified 300,000 tonnes of further thermal treatment capacity identified in the regional policy documents is yet commence, the provision of such capacity should be considered as being provided in future years when determining required capacities. For the purposes of this assessment, it is assumed that a capacity equivalent to that proposed by the Indaver facility at Ringaskiddy, Co. Cork is available from 2022 onwards, to allow for construction timelines etc. on foot of grant of permission.

Waste types permitted for acceptance at the Carranstown facility are relatively broad and are categorised as non-hazardous residual municipal waste, commercial and industrial hazardous wastes, sewage and industrial sludges, non-hazardous wastes, construction and demolition (C&D) waste (primarily combustible C&D) and small quantities of hazardous wastes. For the purposes of this assessment, it can be considered that the capacity at Carranstown will be mainly consumed by residual MSW type material in future, given that over 90% of the wastes accepted to the facility in 2017, was of municipal classification (20 codes) or its treatment (19 codes), as per the facility 2017 AER.

Similarly, waste types permitted for acceptance at the Dublin Waste to Energy facility comprise non-hazardous residual waste (19 and 20 codes) as well as a range of other commercial and industrial wastes – as with Carranstown, it is prudent to consider the maximum capacity at the facility will be consumed by municipal wastes identified in Section 4.3.

Waste to Energy Facility Downtime

While thermal treatment facilities will provide the primary means of management of residual MSW in the country in coming years, it should be borne in mind that it is the case that these facilities typically undergo scheduled maintenance downtime on a regular basis (either annually or every 18 months) over which duration they cannot thermally treat waste.

The EIS that accompanied the licence application for the Carranstown Waste to Energy facility[16] identifies that:

> "*…The capacity of the waste bunker will allow the acceptance of waste during shut downs up to 1 week. From experience of operating similar plants in Belgium, non-scheduled events typically require a maximum shutdown of one-week. A scheduled shutdown for maintenance takes place once a year. Such a shutdown is typically longer than 1 week, but less than 3 weeks. As these shutdowns are scheduled it is possible to organise an alternative outlet for the waste to be accepted. Alternatives would be another waste incinerator or a landfill facility, depending on their availability at the time.*"

Thus, with 1-week input capacity provided within the bunker and a potential period of up to 3 weeks for annual shutdown, the Carranstown Waste to Energy facility may not be a position to accept waste for 2 weeks per annum, requiring the provision of alternative capacity of c. 8,500 tonnes of input waste during that period.

Similarly, the EIS accompanying the Dublin Waste to Energy facility[17] identifies that:

> "*the bunker will have sufficient capacity to store one week's normal throughput of waste. In the event of a shut down, waste deliveries will be controlled so that no wastes for incineration will be delivered to the plant if it cannot be placed in the bunker. This will be managed by communicating with waste suppliers, etc to control deliveries…….. The maintenance intervals are intended to be 18 months…. Typically, for maintenance one line at a time will be shut down while the other line continues to operate. Due to the buffer capacity of the waste bunker, normal waste deliveries will continue while one line is shut down.*"

Therefore, every 18 months, the Dublin Waste to Energy facility requires maintenance, which will see the facility operating at 50% capacity (through 1 line). Assuming a 3-week maintenance period, and 1 weeks input capacity within the bunker, suggest that aa minimum of 23,000 tonnes will require alternative management or the period, twice every 3 years.

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[16] http://www.epa.ie/licences/lic_eDMS/090151b2802893f3.pdf

[17] http://www.epa.ie/licences/lic_eDMS/090151b2800f9ce8.pdf

While difficult to exactly quantify, it is considered that on an annual basis, the scheduled maintenance periods at the Carranstown and Dublin Waste to Energy facilities, will result in at least 20,000 – 25,000 tonnes of residual MSW material that cannot be accepted at these facilities during their downtime periods.

In addition, the above does not consider the potential for unscheduled or emergency events at these facilities, which also has the potential to require the acceptance of waste at alternative facilities, depending on extent of same.

In considering the fact that these facilities incorporate a downtime period on an annual or biannual event, it is assumed that their annual intake allowance incorporates these periods i.e. their 'run rate' reflects their licenced input tonnage over, for example, 50 weeks per annum in the case of Carranstown as described above.

IBA Generation

As identified in Section 4.3.2 previously, the planning permission that currently applies to the Dublin Waste to Energy facility permits the management of bottom ash generated at this facility through export to continental Europe or the UK, given the absence of a framework for recovery of bottom ash in Ireland at present, where it could be used in a number of construction related application, as is common in other European countries.

The proposed IBA acceptance at the Knockharley Landfill facility can be considered the 'first phase' in the development of IBA recovery in Ireland and it is intended that the materials from this facility will ultimately all be used off site as a "secondary aggregate" in a variety of end-uses such as road construction, thus maximising the recovery, recycling and re-use potential of this material in keeping with national and regional policies and legislative objectives of the waste hierarchy.

However, it is likely that a period of time will be required for:

- the development of appropriate specifications/standards for IBA use in road/construction applications in conjunction with the EPA, National Roads Authority (NRA) and others
- the carrying out of trials and the acceptance of this material by the construction sector as a viable alternative to virgin aggregates

Therefore, until such time as these end-use markets may be developed, this material can be stored within the dedicated IBA cells proposed for development at Knockharley, such that it can be accessed in future should a demand as a replacement to virgin aggregate can be identified.

Recovery at Indigenous Cement Kilns

Cement kilns accept a refined, treated element of residual MSW that has been produced to a required specification through the mechanical treatment of residual MSW, which is generally recovered fuel or variation thereof e.g. solid recovered fuel (SRF) or refuse derived fuel (RDF) depending on the level of treatment applied. The mechanical treatment separates the larger plastics, card and papers from the waste stream which is then further refined (shredded and/or dried) to produce the recovered fuel.

During this treatment process, typically undertaken at a materials recycling facility (MRF), the elements not used for recovered fuel production (which contains a high percentage of biodegradable material) are also separated and typically undergo stabilisation at an off-site biological treatment facility, prior to landfilling. Treatment in this manner can be considered 'loose' mechanical biological treatment (MBT) arrangement, as opposed to a more conventional MBT process whereby mechanical and biological treatment may occur on the same site.

Table 4.10 lists the cement kiln facilities in Ireland that are currently EPA licenced to accept recovered fuels and identifies licenced capacity. The Lagan Cement facility, Kinnegad, Co. Westmeath, the Irish Cement facility in Platin, Co. Louth and the Quinn Cement facility, Ballyconnell, Co. Cavan have all accepted solid recovered fuel in recent years. The Irish Cement facility in Castlemungret, Co. Limerick is currently undertaking an EPA licence review and has had planning granted by ABP to accept recovered fuel.

Table 4-10: Consented Kiln Capacity

Facility	Licenced Capacity
Lagan Cement (P0487-06)	95,000
Irish Cement – Platin (P0030-04)	120,000
Quinn Cement (P0378-02)	127,875
Total	**342,875**

At the time of writing, a number of these facilities indicated their intention to apply for approvals to further increase the acceptance of alternative fuel (that can comprise SRF) at their facilities, as follows:

- Irish Cement (Platin)– increased acceptance of alternative fuels up to 600,000 tpa through EPA licence review (P0030-06), which, at time of writing has been confirmed as Strategic Infrastructure Development (SID) through pre-application Ref: PC0221 – it is understood that it is proposed that up to an extra 100,000 tonnes of the 600,000 tonnes will comprise SRF material, in addition to the potential 120,000 tonnes currently permitted, totalling 220,000 tonnes[18]
- Quinn Cement (P0378-04) - increased acceptance of alternative fuels up to 300,000 tpa which is currently in SID pre-application ref: PC0241
- Irish Cement (Castlemungret)– acceptance of alternative fuels up to 90,000 tpa through EPA licence review (P0029-05), with planning permission granted by Limerick County Council (Ref:16345) and upheld on appeal by An Bord Pleanála

Waste types accepted at kiln facilities span a relatively broad range and can include SRF (produced from household and commercial residual wastes), meat and bone meal (MBM), waste wood, waste tyres, solvents and other liquid wastes. Therefore, to quantify the proportion of SRF material that may be accepted is difficult – a review of SRF production nationally, as shown in Table 4-11, suggest c. 230,000 tonnes of SRF being produced in 2015 & 2016.

Table 4-11: Recovered Fuel production since 2012

Facility	2012	2013	2014	2015	2016
Panda Waste Services, Navan (W0140-04)	17,616	38,319	69,537	82,941	93,144
Greenstar, Millennium Business Park (W0183-01)	10,498	11,135	11,084	5,862	4,041
Pacon Waste & Recycling, Balbriggan (P1014-01)[1]	-	-	22,250	50,000	50,000
Thorntons Recycling, Killeen Road (W0044-02)	67,864	80,349	72,303	88,190	85,962
Total[2]	**95,978**	**129,803**	**175,174**	**226,993**	**233,147**

[18] Reference ABP pre-application meeting PC0221 with Eastern Midlands waste management region; http://www.pleanala.ie/documents/records/PC0/PPC0221E.pdf

When considering available thermal treatment capacity at cement kiln facilities, cognisance should be given to the potential for capacity to be consumed by contaminated dry recyclables, as identified previously, thus reducing the potential to process residual MSW derived recovered fuels.

Furthermore, available thermal treatment capacity in cement kilns is also reduced through the importation of solid recovered fuel material from Northern Ireland for consumption in cement kilns south of the border. A review of the national transfrontier shipment (TFS) waste transportation register for 2016[19] indicated that c 23,000 tonnes of solid recovered fuel (LoW Code 19 12 10) was brought into the country in that year, with cement kilns being its destination.

However, as with the issue of repatriation of waste discussed previously, the impact of Brexit has the potential to close off this option for Northern Irish recovered fuel producers.

4.4.3 Capacity provided by Export

As discussed in Section 3.3.2 in Chapter 3 'Policy', significant quantities of residual municipal waste have been exported to central and northern Europe since 2013 as a result of a number of factors identified by the regional plans, not least the increases in the landfill levy. The reduction in number of operating landfills, as shown in Table 4-1, from 11 in 2013 to 4 in 2017, must also be considered a factor in the increased quantity of waste exported.

Waste exported is accepted at facilities in continental Europe with available excess treatment capacity – however, the long-term sustainability and cost effectiveness of these outlets has been questioned by the regional Plans.

The policy objectives identified in each of the regional plan, represented as Policy A4 in the Eastern and Midlands Region Waste Management Plan 2015 – 2021, is to "*aim to improve regional and national self-sufficiency of waste management infrastructure for the re-processing and recovery of particular waste streams, such as mixed municipal waste, in accordance with the proximity principle*". Each Plan aim(s) to "*minimise the exporting of municipal waste resources over the plan period*".

To this end and considering the commencement of the Dublin Waste to Energy Facility, which will bring up to 600,000 tonnes of treatment capacity on the market, and assuming the future provision of the 300,000 tonnes of thermal capacity identified as being required in national capacity, it is considered that export of residual municipal waste to the continent will effectively cease over a period of time.

Based on industry knowledge, it is considered that c. 350,000 tonnes of residual waste was be exported in 2017, with an expectation of c. 300,000 tonnes in 2018, approximately reflecting the identified further thermal capacity required. As per Section 4.4.2 previously, where the identified 300,000 tonnes is assumed to come online by 2022, it is considered likely that export will continue at the rate of c. 300,000 tonnes until such time as this thermal capacity becomes available. Thereafter, it is not unreasonable to consider that some low level of residual waste export will continue at a rate of c. 50,000 tonnes per annum, given that the 'export channels' have been developed over the past number of years.

4.4.4 Capacity provided by permitted/registered facilities

Capacity provided by permitted facilities is assessed herein in relation primarily to the management of C&D soil and stones – there are no facilities operating under the permitting/registration regimes that provide management capacity (in terms of ultimate end treatment) for municipal wastes or incinerator bottom ash.

The 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity' report identified the following permitted and register capacities in the 3 waste regions:

- Eastern & Midlands region – c. 375,000 tonnes
- Southern region – c. 1.25 million tonnes
- Connacht Ulster region – c. 780,000 tonnes

[19] http://www.dublincity.ie/main-menu-services-water-waste-and-environment-waste-and-recycling-national-tfs-office/ntfso-waste

In total, c. 2.4 million tonnes of C&D soil and stones capacity is provided at registered and permitted facilities across the country – however, in the context of the findings of the 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity' report, which identifies a very significant shortfall in C&D soil and stone management capacity in future years, as shown in Table 4-8 previously, the capacity provided at these facilities is very likely to be fully consumed for the duration of these facilities lifespans.

4.4.5 Capacity provided for biological treatment

In terms of management of residual MSW, biological treatment of residual 'fines' provided management capacity for c. 115,000 tonnes of residual MSW material in 2015, as per the EPA 'Composting and Anaerobic Digestion in Ireland' Bulletin[20], which reflects the acceptance of residual fines material in 5 no. facilities throughout the country[21]. However, biological treatment does not provide 'final' treatment for fines, rather it stabilises the fines material and results in c. 50% mass reduction of the material. It must be supported by landfill capacity as a final disposal outlet.

The anticipated increase in Solid Recovered Fuel (SRF) production nationally is likely to result in increased fines generation from mechanical treatment of residual MSW to produce SRF.

4.4.6 Future Management Options

Based on the assessment of future residual MSW generation rates and existing and planned infrastructure, the following graph and tables present a potential scenario for future management of the waste streams identified herein in Ireland to 2030. A national approach is taken to developing this scenario for the reasons outlined in Section 4.3. It should again be pointed out that the assumptions in relation to future residual waste generation can be considered to be conservative, such that quantities of residual waste projected would reflect a very strong performance in terms of increased recycling nationally.

Naturally, this scenario can only be taken as only one potential future situation – waste does not flow in an orderly manner to different management options and the economics of different management options is a significant factor to be considered. However, in an assessment of quantity of wastes for management versus potential management outlets, the following is informative and is presented in Figure 4.1 and Table 4-12 following.

[20] http://www.epa.ie/pubs/reports/waste/stats/compost/EPA_Compost%20&%20AD_2015_web.pdf

[21] Those being: Drehid Composting, Enrich Environmental, McGill Environmental, Miltown Composting, OD Recycling

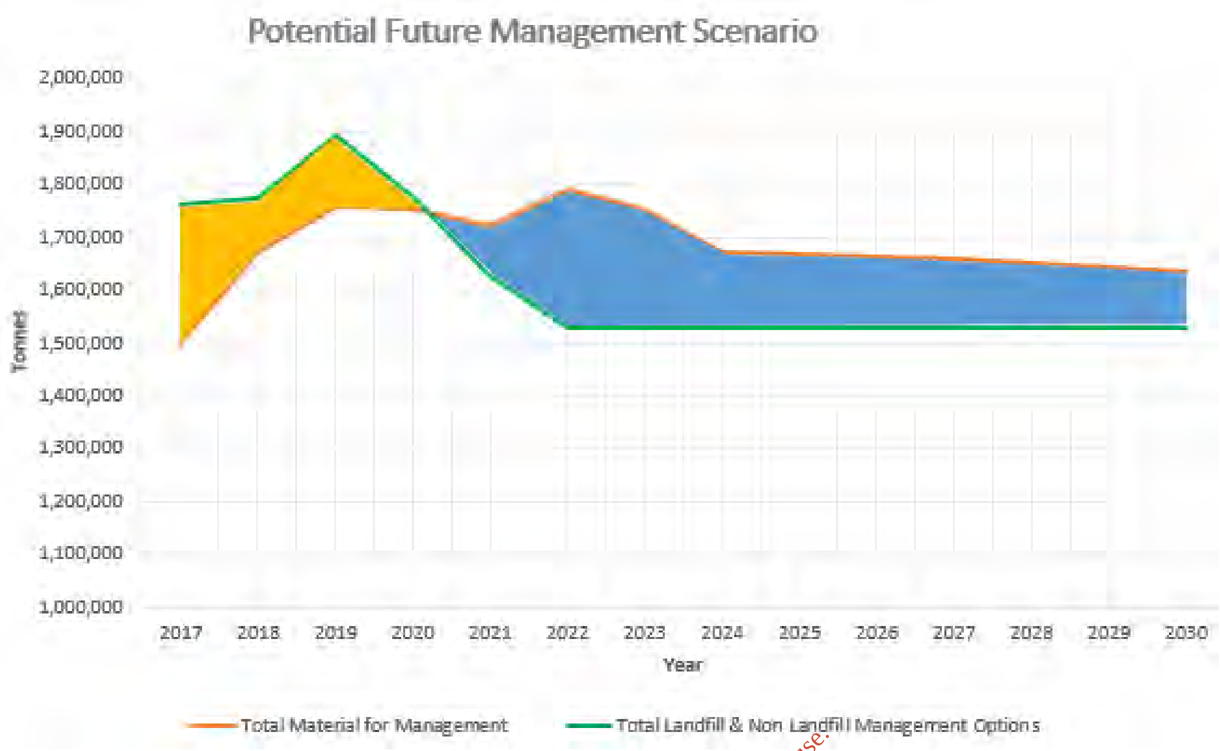


Figure 4-1: Potential Future Management Scenario

Table 4-12: Future Management Scenario

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Projected Municipal Solid Waste (MSW) Generation	2,711,229	2,784,807	2,858,384	2,927,951	2,997,518	3,154,756	3,160,111	3,244,468	3,330,935	3,419,564	3,510,408	3,603,523	3,698,966	3,796,795
2	Projected Recycling Rate	46.25%	47.50%	48.75%	50.00%	51.25%	52.50%	53.75%	55.00%	56.25%	57.50%	58.75%	60.00%	61.25%	62.50%
	Materials for Management														
3	Residual MSW for Management	1,457,286	1,462,023	1,464,922	1,463,976	1,461,290	1,498,509	1,461,551	1,460,011	1,457,284	1,453,315	1,448,043	1,441,409	1,433,349	1,423,798
4	Residual MSW adjusted for Stabilised Fines	1,399,786	1,404,523	1,407,422	1,406,476	1,403,790	1,441,009	1,404,051	1,402,511	1,399,784	1,395,815	1,390,543	1,383,909	1,375,849	1,366,298
5	Projected IBA for Management	39,800	159,800	159,800	157,300	157,300	209,900	209,900	209,900	209,900	209,900	209,900	209,900	209,900	209,900
6	Street Sweepings, Grit & Screenings	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000
8	Waste Repatriation	-	50,000	50,000	50,000	20,000	-	-	-	-	-	-	-	-	-
9	Historic Legacy site dig out	-	-	80,000	80,000	80,000	80,000	80,000	0	0	0	0	0	0	0
10	*Total Materials for Management*	1,498,586	1,673,323	1,756,222	1,752,776	1,720,090	1,789,909	1,752,951	1,671,411	1,668,684	1,664,715	1,659,443	1,652,809	1,644,749	1,635,198
	Non Landfill Management Options														
11	Waste to Energy Capacity	535,000	835,000	835,000	820,000	820,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000	1,060,000
12	SRF production	180,000	180,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
13	Allowance for export	350,000	300,000	300,000	300,000	300,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
14	*Total Non Landfill Management options*	*1,065,000*	*1,315,000*	*1,435,000*	*1,420,000*	*1,420,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*	*1,410,000*
	Existing Projected Landfill Capacity														
15	Knockharley	88,000	88,000	88,000	88,000	88,000	-	-	-	-	-	-	-	-	-
16	Drehid	360,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
17	Ballynagran	150,000	150,000	150,000	150,000	-	-	-	-	-	-	-	-	-	-
18	East Galway Residual Landfill	100,000	100,000		-	-	-	-	-	-	-	-	-	-	-
19	*Total Combined landfill capacity*	*398,000*	*458,000*	*358,000*	*358,000*	*208,000*	*120,000*	*120,000*	*120,000*	*120,000*	*120,000*	*120,000*	*120,000*	*120,000*	*120,000*
20	*Total Landfill & Non Landfill Management Options*	*1,763,000*	*1,773,000*	*1,793,000*	*1,778,000*	*1,628,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*	*1,530,000*
21	**Difference**	264,414	99,677	36,778	25,225	-92,090	-259,909	-222,951	-141,411	-138,684	-134,715	-129,443	-122,809	-114,749	-105,198

Note 1	Projected Municipal Waste Generation as per Table 4-4	***Note 11***	Waste to Energy capacity projected as per Section 4.4.2, does not include for the facility at Derryclure
Note 2	Projected Recycling Rate as per Table 4-4	***Note 12***	Assumed Recovered Fuel (SRF) production rate, adjusted for capacity consumed by contaminated dry recyclables
Note 3	Project Residual MSW management as per Table 4-4	***Note 13***	Assumptions for decrease in export
Note 4	Adjustments for stabilised fines on the basis that c.115,000 tonnes of residual fines continues to be processed as per Section 4.4.5 – if 115,000 tonnes of fines is processed in biological treatment facilities, then 50% of this quantity remains post treatment for landfilling, therefore overall residual MSW quantity reduced by 57,500 tonnes to reflect the 50% mass losses (50% mass losses as per typical fines processing - Kuehle-Weidemeier, M. (2007)[22])	***Note 14***	Combined WtE capacity, recovered fuel production and Export influence
Note 5	Projected IBA quantity for management, assuming a 3rd facility developed (Ringaskiddy)	***Note 15***	As per Section 4.4.1
Note 6	As per 2012 generation rate, considered conservative ongoing	***Note 16***	As per Section 4.4.1
Note 7	Allowance for contaminated dry recyclables re-entering the loop for management as a residual material	***Note 17***	As per Section 4.4.1
Note 8	Assumes 170,000 tonnes of waste to be repatriated by 2021 (extended Brexit window)	***Note 18***	As per Section 4.4.1
Note 9	Allowance for the inclusion of the 'dig out' of legacy landfills at a rate of 40,000 tonnes per annum over a 10-year period	***Note 19***	As per Section 4.4.1
Note 10	Projected materials for management	***Note 20***	Combined Landfill and non-Landfill management options
		Note 21	Surplus (+) / deficit (-) in management capacity

[22] https://www.wasteauthority.wa.gov.au/media/files/documents/MBT_Paper_2014.pdf

Wastes to be Managed

The starting point of this scenario is the identification of materials to be managed. Starting with the potential quantity of residual MSW to be managed in future years, as projected previously which, in themselves, result from an ambitious recycling target performance, this quantity is then augmented by the IBA volumes identified in Section 4.3.2, which assumes the development of a 3rd EfW facility (Ringaskiddy) in accordance with the policy objectives for national thermal recovery capacity as outlined in the regional waste management plans.

Street sweeping, grit & screenings are also then considered, and projected in accordance with the figures identified in each of the regional waste management plans, with the assumption that this material is wholly directed to landfill.

An allowance for the management of repatriated waste from Northern Ireland is also included, given national obligations in this regard, on the assumption that this material will be managed through its acceptance at authorised landfill facilities (being the only facilities suitable for its acceptance), within the suggested 2 year extension period post Brexit i.e. by 2021.

In addition, consideration is also given to the requirement for the remediation of historic legacy landfills identified nationally through their 'dig out' and acceptance at authorised landfill facilities at a rate of 80,000 tonnes per annum over a 5-year period. While this exact volume may or may not materialise in the coming years for the duration modelled, it is considered prudent to allow for the management of this type of material, given the stated intention of the regional plans to address this issue over their lifetime.

An adjustment is made for the impact of biological stabilisation of residual fines on the quantity of residual waste generated, as is shown in Table 4-12, where a portion of the residual MSW fraction for management is reduced to reflect mass losses during this process, but with the outputs from this process remaining for management as a residual waste (where landfilling is the primary outlet). It is assumed that the same quantity of fines treatment capacity provided in 2015 i.e. 115,000 tonnes is available for the purposes of modelling this scenario, resulting in 57,500 tonnes of stabilised fines for landfilling.

The combined totals of these volumes are represented by the green line in Figure 4-1. Note that within this scenario, no consideration is given to the management of C&D soil and stone, other illegal landfills not classified as 'historic legacy' or for the provision of any contingency capacity for unforeseen events.

Means of Management

As identified previously, the primary means for future residual MSW management is considered to be thermal treatment. This scenario assumes that both the Carranstown and Dublin Waste to Energy facilities will operate at full capacity and this can be considered a reasonable assumption given their location within the State and the competitive gate fees they will be able to offer in comparison to other residual treatment options, either within the State or externally i.e. export to the Continent. From 2022/3 onwards, it is also assumed that a 3rd Waste to Energy facility will be operational which, for the sake of this scenario this is assumed to be the proposed Ringaskiddy facility.

The amount of waste material directed to cement kilns in the form of solid recovered fuel (SRF) is likely to be influenced by the rate of SRF production, rather than the capacity available within kilns for SRF acceptance (on the assumption that any SRF that is produced will be consumed by kilns with available 'alternate' fuels capacity). As identified, the kiln facilities typically accept a range of 'alternative fuels', of which SRF may be one, and while in theory the maximum capacity available could be consumed by SRF, the amount of SRF that may be produced is a more relevant figure in this regard. As previously identified, a figure of 350,000 tonnes of SRF production capacity in 2019 is likely – however, with the identified 'impact' of contaminated dry recyclables on the appetite for residual waste derived recovered fuels, this figure is adjusted downwards by 50,000 tonnes, as per Section 4.3.4.

Export of residual municipal solid waste in this scenario is modelled in keeping with the assumption outlined in Section 4.4.3 i.e. that export remains as a viable management until the 3rd waste to energy facility become operational by 2022. Notwithstanding the consideration of export in relation to the principles and proximity and self-sufficiency, it is considered likely that export of residual MSW will continue to some extent after 2022, due to the acceptable economics of export when compared with other management options, existing contracts that may have been entered into etc.

Consideration of landfill capacity, as outlined in Section 4.4.1 previously, allows for the continued operation of currently operating landfills, projected as per their currently permitted operational lifespans and tonnages.

When combined with Waste to Energy, export and SRF production as potential residual waste management capacity, this is represented by the green line in Figure 4-1.

Therefore, when comparing the requirement for management capacity for the projected quantities of future residual waste, IBA, street sweepings, repatriated waste and historic legacy sites 'dig out versus the current likely projected means of management of these materials, a slight excess of capacity is shown in 2018/2019 as indicated by the yellow area in Figure 4-1 followed by a significant dearth in capacity post 2020, as shown by the blue area in Figure 4-1, in the average region of c.150,000 tonnes over the years 2030.

As previously stated, this scenario only reflects one particular situation that may occur, but it does identify that on the basis on the waste generation rates and available capacities identified, that a lack of capacity is likely to occur in future years for the appropriate management of the waste streams identified.

Furthermore, this scenario does include a number of variables that also have the potential to increase the identified potential capacity gap, should they come to pass (or not):

- In the event of the challenging recycling rates outlined in Section 4.3.1 previously not being achieved, a greater quantity of residual waste will require management, thus increasing the capacity gap identified
- Should a 3rd EfW facility (Ringaskiddy) not be developed or not be developed within the timelines suggested herein, then the potential management capacity identified may not be realised or may be delayed, putting pressure on other potential management options
- Should SRF production not increase to the projected level or should the availability/viability of export be impacted, there would be increased quantities of residual MSW for management

Scenarios/Materials not considered

It should be noted that **no** consideration within these totals is given to:

- the acceptance of C&D soil and stone
- the requirement for the management of illegal, 'non-historic legacy' sites
- the provision of any **contingency capacity** to cover unforeseen/emergency events.

<u>C&D Soils Management</u>

As outlined in Section 4.3.3, a significant shortfall in C&D soil and stones capacity is identified in the coming years, with Figure 4-2 visually representing the figures presented in Table 4-8 previously.

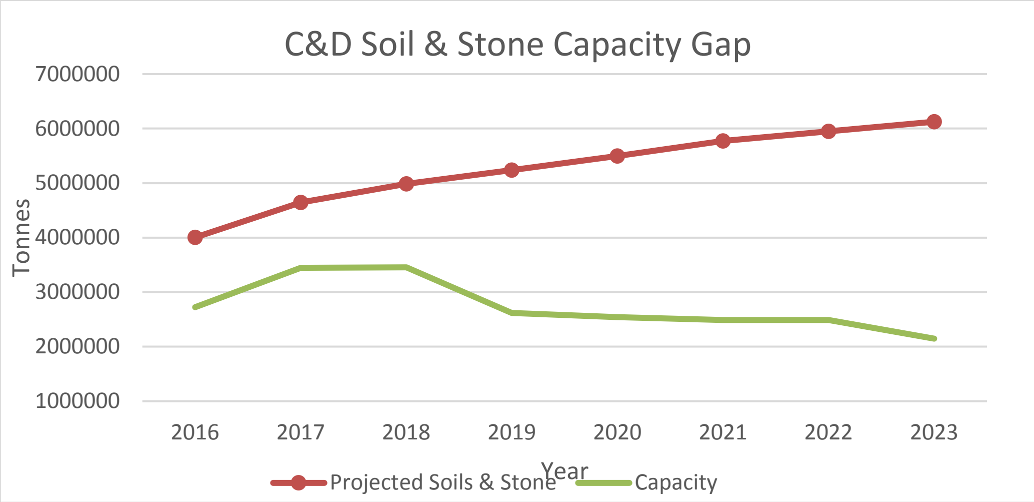


Figure 4-2: C&D Soil & Stones Capacity Gap

The significant need for C&D soil and stones capacity may be contributed to as part of the proposed development at Knockharley – alternative options for management of these materials, outlined in the 'Construction & Demolition Waste – Soil and Stone Recovery/Disposal Capacity' report identified previously, include expanding capacity at existing waste licenced facilities where it is stated that *"An existing waste licenced facilities with capacity to expand, or with a readiness to increase their annual limit, could choose to apply for an extension to their existing licenced capacity".*

Knockharley Landfill accepts C&D soils and stones for recovery activities in keeping with the condition of its waste licence with potential to accept material for both disposal and recovery as part of the proposed development, thus providing some alleviation to the significant under-capacity identified.

Management of illegal landfills and other sources

As identified in Section 4.3.5, it is considered a reasonable estimate that a minimum of 300,000 tonnes of illegally deposited waste will require management in future years, from more recently discovered illegal sites, in addition to the identified Class A historic legacy sites which are being managed under their own management regime.

In addition, the intended extraction of waste material from Holmestown Landfill is identified as another likely significant source of waste material to be managed.

The timing/duration of these works is unclear and is unlikely to be within the shorter term (e.g. to 2022), in which case capacity for management of same will likely be required when there is a demonstrated lack of capacity available.

Provision of Contingency Capacity

The scenario presented previously demonstrates the inability of the national waste management system, not only to provide sufficient capacity in future years for identified waste streams, but to provide any 'headroom' nationally for the unforeseen potential events, in keeping with the policies measures outlined in Chapter 3 'Policy'. As identified, the quantification of an appropriate contingency amount is difficult, but at present, there is no contingency for known waste volumes that will be generated (e.g. illegal facility described above), let alone contingency for unforeseen or emergency situation.

In attempting to quantify the volumes of material that could be associated with these items that have not been modelled, it is considered that:

- a contribution of a further 200,000 tonnes per annum to soils management (disposal and/or recovery) at licenced landfill facilities nationally could be considered a reasonable contribution to the lack of capacity for the management of these materials
- 40,000 tonnes per annum of repatriated waste averaged over 6 years is likely to require management

- The provision of 60,000 tonnes per annum in national landfill contingency is a reasonable and conservative consideration
- The remediation of Whitestown landfill which is anticipated to result in a dig out of between 290,000 and 1,000,000 tonnes.

To this end, a minimum further 600,000 tonnes of landfill capacity alone could be required to be provided to address these instances, in addition to the scenario modelled above.

4.5 The Need for Management Capacity

Table 4-12 presents a potential future scenario for the management of a number of waste sources from 2018 onwards, which assumes that:

- Dublin Waste to Energy and Carranstown EfWs operate at full capacity, with a third facility coming on-stream in 2022/3;
- that SRF production and utilisation increases;
- that Dublin Waste to Energy and Carranstown IBA is managed in Ireland through landfilling;
- that historic legacy landfill sites are managed in the short to medium term
- that export declines as a management option when a 3rd EfW (Ringaskiddy) comes online;
- and that biological stabilisation of residual fines continues to play a part in material management

This scenario, or an amalgam or variation of it, is considered to represent the likely direction of the future management of the identified waste streams in this country, insofar as future scenarios can be predicted.

Whatever future scenario is actually realised is not essential to the demonstration of the need for the proposed development at the Knockharley facility. Any integrated national waste management system needs to be supported by the presence of landfill capacity. What is clear is that there exists an impending lack of capacity across the various infrastructural elements of the national waste management system to manage waste streams that will clearly and evidentially arise. Post 2021, there is likely to be only 120,000 tonnes of landfill capacity in the country and that fact alone, when viewed against the identified capacity requirements, supports the need for further increased landfill capacity.

It cannot be argued that the presence of landfill capacity will negatively impact on the appropriate management of residual MSW through processes “higher up” the waste hierarchy – the presence of a significant landfill levy for material disposed in landfill removes any such effect that the presence of capacity might have and did have in the past. In fact, given the significant requirement for appropriate landfill capacity, the issue of where material is managed on the waste hierarchy is moot, if the material is not actually managed.

The capacity proposed for development at the Knockharley Landfill facility can contribute to the identified need in a number of ways:

- through provision of dedicated IBA management capacity
- through contribution to biological treatment of residual fines, resulting in mass loss and stabilisation of residual fines prior to landfilling
- through direct contribution to residual MSW management through disposal, as required
- through acceptance of C&D soils for disposal and/or recovery
- through acceptance of repatriated waste for disposal
- through acceptance of waste from historic legacy site for disposal
- through acceptance of waste from other unauthorised landfills for disposal
- through the continued operation of the site being available to provide contingency waste management solutions in an emergency

The 'proportion' of contribution to these different requirements is likely to vary on an annual basis (with the exception of IBA management and biological treatment of fines), with there likely to be a greater requirement for, for example, residual MSW disposal one year and soils recovery or repatriated waste disposal another year.

The 'fluid' nature of future capacity requirements does not belie the fact that significant capacity is required – as previously identified, the Eastern Midlands Region Annual Report 2016 identifies a "national waste infrastructure deficit" in 2016 and states that "it is clear that an immediate requirement for significant additional active licensed capacity is required". As evidenced by the scenario presented previously, the national waste infrastructure deficit identified in 2016 will be realised again in the coming years, and the proposed development Knockharley landfill has a significant ability to contribute to mitigating this deficit.

4.6 Alternatives Considered

This section outlines the reasonable alternatives studies for the proposed development together with the reasons for which a particular alternative was chosen.

The revised EIA Directive 2014/52/EU *on the assessment of the effects of certain public and private projects on the environment* requires an EIAR to contain:

'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.'

The draft 2017 EPA *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* state that, in relation to alternatives:

"The objective is for the developer to present a representative range of the practicable alternatives considered. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option'. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."

However, given that this draft guideline has not been finalised and were published before SI296 of 2018, the 2017 EC Guidelines on *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report* are currently the most applicable. In summary, in order to address the assessment of alternatives the Developer must do the following:

- Assess "*reasonable*" alternatives
- The EIAR must include a description of the alternatives
- The approach should be project specific, taking into account over reaching national and local plans
- The consideration of alternatives should take into account consultation
- The guidance suggests the inclusion of "*project design, technology, location, size and scale*" but is clear in saying that these are just suggestions
- The assessment of alternatives should be "*targeted and focused*"

According to the 2017 EC guidance "*'Reasonable Alternatives' must be <u>relevant</u> to the proposed Project and its specific characteristics, and resources should only be spent assessing these Alternatives. In addition, the selection of Alternatives is <u>limited in terms of feasibility</u>.*" It gives the example that if an "*Alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible Alternative*".

Consequently, taking consideration of the available guidance in relation to an assessment of alternatives, this section addresses the topic under the headings of:

- Alternative site development locations
- Alternative layout design

- Alternative technology
- 'Do nothing' alternative

4.6.1 Alternative Site development locations

Two active landfill facilities are currently under the ownership of the AGB Landfill Holdings Ltd., which is the parent company of the applicant, Knockharley Landfill Ltd.:

- Knockharley Landfill, Kentstown, Co. Meath
- Ballynagran Landfill, Ballynagran, Co. Wicklow
- Kilcullen Closed Landfill, Co. Kildare

While the Kilcullen Landfill in Co. Kildare is also under the ownership of AGB Landfill Holdings Ltd., as a closed landfill undergoing restoration and entering its aftercare phase, it is not considered an appropriate location for the proposed development, given its inability to accept waste. Therefore, the proposed development is assessed as being potentially carried out at these two facilities.

While the 2014 EIA Directive and SI296 of 2018 state that the main reasons for selecting a chosen option should be described, which includes environmental considerations, the 2017 EC guidance states that other factors may also be considered such as *technological obstacles, budget, stakeholders and legal or other requirements*.

In this instance, the economic fact that both the Knockharley and Ballynagran landfill facilities are owned and operated by AGB Landfill Holdings Ltd., and considering they have existing planning and waste licence authorisations, is an important factor in that these were considered the only reasonable alternative locations. The consideration of other alternative development locations, either greenfield sites or other licensed waste management facilities <u>not</u> controlled by AGB Landfill Holdings Ltd., is not considered to be a reasonable alternative for AGB Landfill Holdings Ltd., given that such sites are not owned or controlled by them. Therefore, facilities of this type are not considered relevant in the assessment of alternative site locations.

The consideration of alternative locations is undertaken between Knockharley Landfill and Ballynagran Landfill.

In order to compare the two development locations, a number of broad criteria are applied to the sites to facilitate the assessment of the strengths and weaknesses of each. These criteria are:

- Location & Accessibility – Criterion 1
- Available development footprint – Criterion 2
- Suitability for development – Criterion 3
- Environmental Considerations – Criterion 4

Criterion 1 – Location & Accessibility

Location

Both sites are located within the Eastern & Midlands Waste Management Region, which has a population of 2,325,122 persons, as per the 2016 Census. Of this population, the 4 no. Dublin region local authorities i.e. Dublin City Council, Fingal County Council, South Dublin County Council and Dun Laoghaire-Rathdown County Council, comprise 57% of the population (1,345,402 persons). Therefore, Dublin City and County can reasonably be considered the 'centre of waste generation' for the region, with more than half of the waste being generated within these 4-local authority functional areas.

In addition, the Carranstown Energy from Waste (EfW) facility is located in Carranstown, Co. Meath, while the Poolbeg EfW facility is located in the Dublin city docklands.

In a comparison of distances from:

- the Dublin local authorities 'centre of waste'
- sources of incinerator bottom ash at Carranstown and Poolbeg EfWs

the Knockharley site is located closer to these waste sources than Ballynagran Landfill and is therefore the preferable option in terms of this criterion.

Figure 4.3 presents the locations of the Knockharley and Ballynagran Landfills with respect to Carranstown and Poolbeg EfWs.

Accessibility

In terms of accessibility, both sites can be accessed directly from the M50 via the N11/M11 for Ballynagran and via the N2 for Knockharley.

Knockharley Landfill, being located directly off the N2 and accessed by a left hand turning lane when travelling from the south and a dedicated right hand ghost island priority junction when travelling from the north, will ensure that queuing to enter the site when travelling from the north or south will not be an issue. This is addressed in further detail in Chapter 8 'Roads, Traffic & Transportation'. Similarly, when exiting, any potential for queuing to turn right (south) will be contained within the dedicated site access road.

Criterion 2 – Available Development Footprint

Both sites have significant area for development within the wider site footprints, with:

- the Ballynagran site having an overall site area of 129 ha of which 31 ha is permitted for landfill activities and
- the Knockharley site having an overall site are of 135 ha of which 25 ha is permitted for landfilling activities.

However, the Ballynagran site is not under the ownership of AGB Landfill Holdings Ltd., rather it is leased from a private land owner.

Therefore, while the two sites are considered similar in terms of available development footprint to facilitate the elements of the proposed development, the more defined control over the lands at Knockharley make it a more preferable option in terms of further development.

Criterion 3 – Suitability for Development

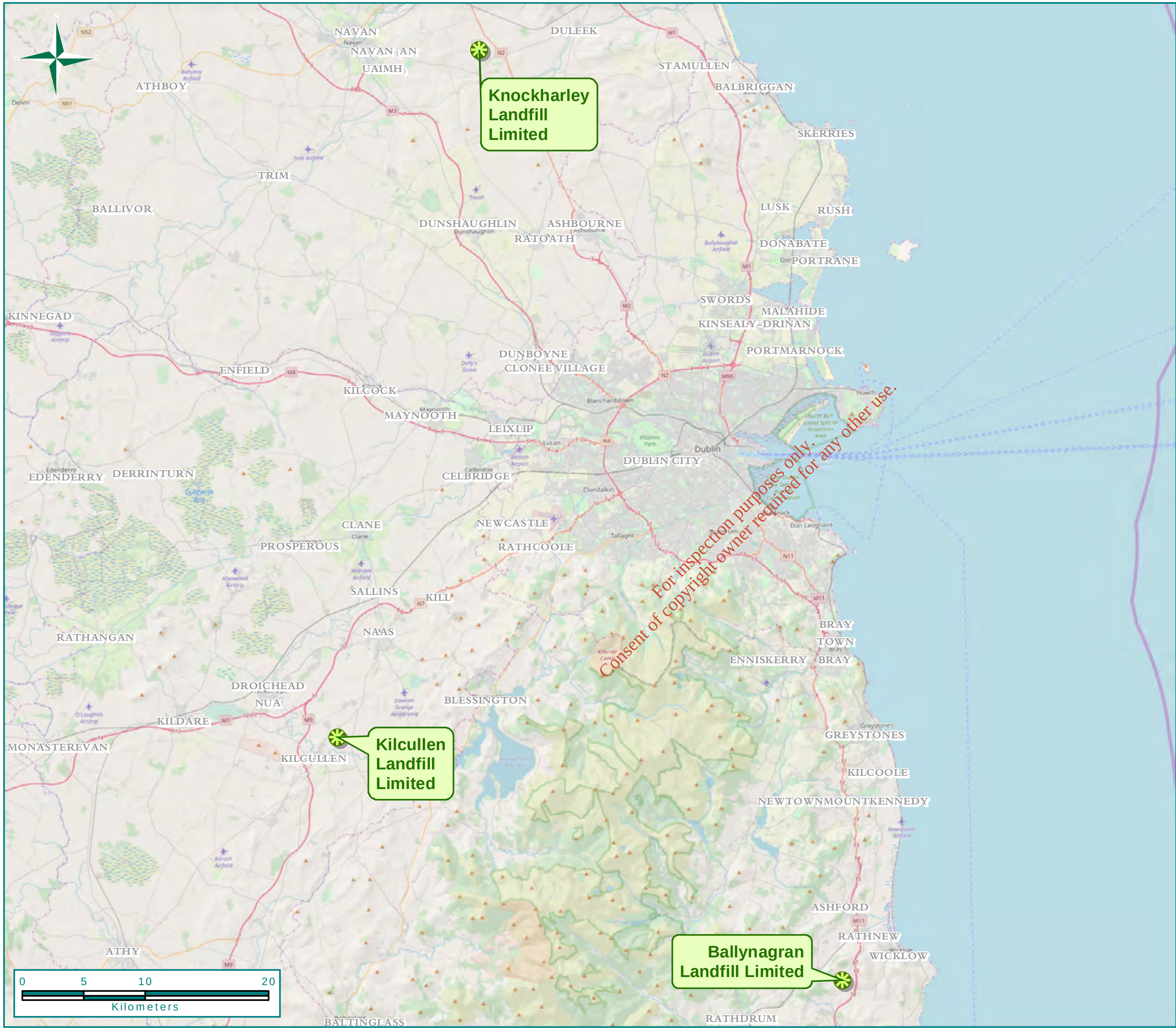
Further development at the Knockharley site is considered more preferable due to the relatively flat topography of the site and hence easier constructability. All materials for the 1m engineered clay barrier layer for cell construction will be won on site.

Ballynagran, by comparison, is developed in an irregular manner with challenging topography, which would require more extensive design input and a potentially more challenging construction.

Criterion 4 – Environmental Considerations

As facilities that both currently operate under licences from the EPA, protection of the environment and assessment of the environmental capacity of each site is overseen by the requirements of these licences – to this end, environmental considerations in terms of site location are considered neutral.

Of the 4 no. criteria assessed as part of the alternative site development locations, the Knockharley site is considered the preferable location across three of the four criteria, with environmental considerations being considered as neutral.



Legend

Location of Landfill Facilities

Date	21/11/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Location of Landfill Facilities
Figure No.	4-3
Rev.	A
Scale	1:430,982 @ A4

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4.6.2 Alternative Site Layout Design

With Knockharley Landfill being considered the preferable development location, there are a number of options in terms of the siting of the various elements of infrastructure proposed, within the overall footprint of the site.

The various elements of the proposed development could potentially be developed in a number of areas within the site. 4 location options are considered:

- Option 1 – IBA storage facility – east of the existing permitted landfill footprint
- Option 2 – IBA storage facility - west of the existing permitted landfill footprint
- Option 3 – Biological treatment facility Location 1
- Option 4 – Biological treatment facility Location 2

Given the current existence of a leachate lagoon, the logical location for leachate treatment infrastructure is adjacent to the lagoon and therefore alternative layouts for these elements were not considered.

The layout location options outlined above are shown Drawing No. LW14-821-01-P-0000-012 in Volume 4 of the EIAR.

IBA Storage Facility

Options for the location of the dedicated IBA cells within the overall site footprint were considered as being directly east (Option 1) and directly west (Option 2) of the existing permitted landfill footprint, due to the availability of the required footprint in these areas.

Upon consideration of:

- Operational issues – ease of access, utilisation of existing weighbridge
- Design issues – integration with existing drainage and electrical infrastructure
- Construction issues – management and re-use of soils

Option 1 was considered as being the preferable location of the location of the IBA cells.

Biological Treatment Facility Locations

The biological treatment facility location options (3 & 4) were considered on the basis of the potential environmental impact associated with emissions from the biofilter stack associated with the facility.

An odour modelling exercise was applied to the emission values, in terms of odour units, modelled as being emitted from stack shown in location options 3 & 4. Based on the finding of this modelling exercise, Option 4 was deemed as being the preferable location.

4.6.3 Alternative Treatment Technologies

Upon identification of the preferred locations for the IBA storage, leachate treatment infrastructure and biological treatment plant, consideration was given to the different technologies and processes that can be applied as part of these processes. Further details on the technologies and processes to be implemented has been given in Chapter 2 'Description of the Proposed Development'.

Processing Options for Biological Waste Treatment

There is a large range of processing options available for the treatment of biodegradable waste. Legal requirements constrain the choice to some type of 'in-vessel' technology, given that biodegradable waste of municipal waste or food waste origin is classified as an 'animal by-product' material. That is because of the requirement to guarantee time-temperature parameters so that destruction of pathogens can be effective.

In-vessel processes can be aerobic (presence of oxygen) or anaerobic (absence of oxygen). Odour management and odour control are common to both as are waste reception facilities and by-product management. The vessels can be manufactured using a range of metals or concrete. The shape and orientation of the individual components is usually technology provider driven.

Based on 'tried and tested' technology, the preferred technology option to be employed as part of the proposed development is aerobic composting using concrete composting vessels (tunnels) with all waste handling occurring indoors, and with full control of process air and liquids (leachates), in terms of environmental controls.

Processing Options for Leachate Treatment

Leachate treatment technologies can combine physical, chemical and/or biological processes to reduce the strength of the leachate. The choice of technology is influenced by the degree of treatment required and/or and the acceptance standards imposed by recipient's wastewater treatment plants.

As part of the proposed development, it is intended to utilise a combination of leachate treatment processes facility to reduce the leachate strength prior to offsite disposal at wastewater treatment plants.

Options for the IBA Storage

The containment design for waste landfills, from inert to hazardous classification, is prescribed by Council Directive 99/31/EC, on the Landfill of Waste, and landfill design must comply with the provisions of Annex I of the Directive. In summary, the design of the cells for the IBA placement comprise, in conjunction with the requirements of the Directive:

- Water control and leachate management
  - Control/prevention of precipitation/surface water from entering the IBA storage cell
  - Leachate collection
  - Leachate pre -treatment
- Protection of soil and water (IBA cell lining)
  - Combination of bottom liner (geomembrane) and appropriate geological barrier (clay or variant) under the IBA
  - Combination of top liner (geomembrane) and appropriate geological barrier (clay or variant) over the IBA
  - Basal soil liner to comprise (for non-hazardous waste) the equivalent of ≥ 1m of soil with a permeability $K < 1.0 \times 10^{-9}$ m/s.
- Gas control
  - In the case of the IBA material, the absence of biodegradable material will negate the potential of landfill gas generation and active gas management; however, as described in Chapter 2, the potential for hydrogen gas generation requires the presence of a passive gas venting system
- Nuisance and Hazards
  - The IBA material will not have potential for odour generation while mitigation measures associated with potential dust generation are an operational consideration
  - The absence of litter in the waste will eliminate the risk of wind-borne material
  - Waste placement has potential for noise which has been considered in terms of noise mitigation measures including screening berm

- Birds, vermin and insects are not attracted to IBA material as it contains no biodegradable material
- There is no aerosol potential from the type of waste proposed for this landfill

There is no option but to comply to the standards set down in the Directive (and summarised above) and in doing so, relevant environmental factors are inherently considered. The shape and size of the IBA cell area has been determined by factors such as accessibility, available space and target volume.

4.6.4 ‘Do nothing’ Alternative

The primary objective of the proposed development is to provide management capacity for a range of non-hazardous waste materials, comprising non-hazardous municipal solid wastes (MSW) from varying origins, incinerator bottom ash, C&D soils & stones and other similar commercial and industrial wastes.

The ‘do-nothing’ alternatives, in terms of the environmental considerations of the management of the different waste streams proposed, are described in the following.

‘Do nothing’ Alternative for residual MSW

In a ‘do-nothing’ scenario for residual MSW, residual MSW will continue to be managed through a combination of existing landfilling capacity, thermal treatment and export, with ‘pressure points’ (similar to the Section 56 emergency events implemented in 2016 and 2017) potentially occurring, until such time as sufficient extra national capacity is provided. Such ‘pressure points’ have the potential to have negative environmental impacts from, for example, longer storage at waste transfer facilities due to lack of available outlets, increasing potential for odour generation at these sites.

In a ‘do nothing’ scenario for the management of repatriated wastes and historic legacy sites, this material will be competing for the limited landfill capacity that will exist in coming years, resulting in instances where waste material will not be removed due to lack of available landfill outlets, with resultant continuance of the negative environmental impacts resulting from the presence of this material at these sites.

‘Do nothing’ Alternative for IBA

In the ‘do-nothing’ IBA management scenario, IBA material produced from the Carranstown EfW will compete with other materials for the limited landfill capacity available in the coming years and the potential resource value of that material will continue to be lost as it is co-landfilled with other materials.

IBA material produced from the Dublin Waste to Energy facility will continue to be managed through export, with the environmental benefits associated with recovery of this material being potentially realised in in the end destination country, rather than in Ireland.

‘Do-nothing’ alternative for C&D soil and stones

A ‘do-nothing’ alternative for C&D soil and stones will see the identified lack of capacity continue, with the proposed development not making any contribution in terms of national capacity provision. Lack of appropriate management capacity could result in negative environmental impacts associated with the inappropriate management of this material as it arises.

4.7 References

Connacht-Ulster Region Waste Management Plan 2015-2021;
http://www.curwmo.ie/publications/

Comptroller and Auditor General Special Report – Transhipment of Waste (July 2014);
http://www.audgen.gov.ie/documents/vfmreports/84_Transhipment_Waste.pdf

Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2017);
http://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf

Guidelines on Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017)
http://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

SI 296 of 2018 EUROPEAN UNION (PLANNING AND DEVELOPMENT) (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2018
http://www.irishstatutebook.ie/eli/2018/si/296/made/en/pdf

Eastern-Midlands Region Waste Management Plan 2015-2021;
http://emwr.ie/about-the-eastern-midlands-regional-waste-management-plan

Eastern Midlands Region Annual Report 2015/2016;
http://emwr.ie/wp-content/uploads/2016/12/19115_DCCo_EastMidlandsWaste_V5%E2%80%A2.pdf

EIA Directive 2014/52/EU;
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Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2003);
http://www.epa.ie/pubs/advice/ea/guidelines/

National Waste Report 2012;
http://www.epa.ie/pubs/reports/waste/stats/nationalwastereport2012.html

Southern Region Waste Management Plan 2015-2021;
http://www.southernwasteregion.ie/content/southern-region-waste-management-plan-2015-2021-associated-reports

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 5 – EIA SCOPING, CONSULTATION AND KEY ISSUES

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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5 EIA SCOPING, CONSULTATION AND KEY ISSUES

5.1 Introduction

This chapter describes the consultation process and EIAR scoping that was undertaken to identify key potential impacts from the proposed development to be included in the EIAR.

It presents the issues that arose through the consultation/scoping process and how these issues were addressed in the EIAR. Records of consultation documentation and responses contained in Appendix 5.1 to 5.5 of Volume 3 of this EIAR.

5.2 Scoping

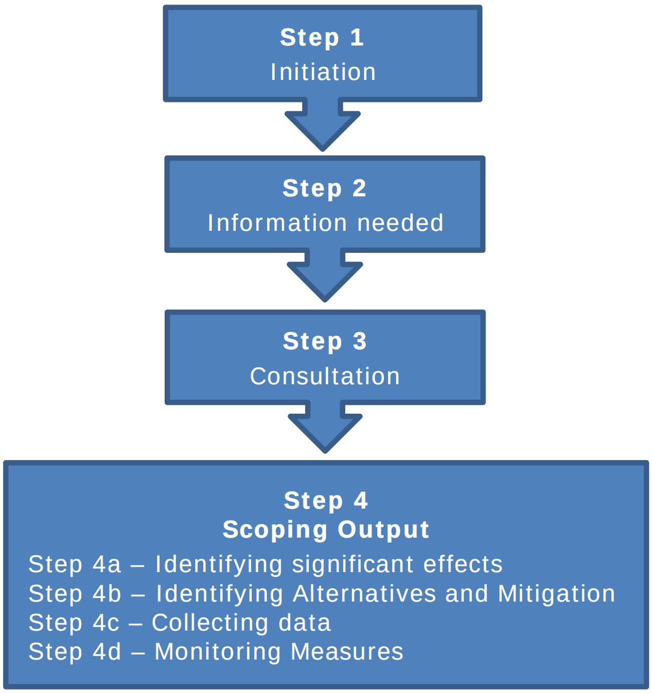
Article 5(2) of the Environmental Impact Directive, as implemented by section 37D of the Planning and Development Act 2000, as amended, provides for a mandatory scoping process, whereby a developer may request the competent authority (i.e. An Bord Pleanála) for an opinion to be supplied by the developer in the EIAR. It should be stated that the developer did not seek a "formal" scoping opinion from the Board.

In addition, it is good practice for a developer to "informally" or voluntarily scope the contents of an EIAR by engaging in consultations with prescribed and other statutory bodies and stakeholders and through public consultation. Informal scoping was undertaken in preparation for this EIAR, in accordance with in the European Commission's (EC) 2017 "Environmental Impact Assessment of Projects Guidance on Scoping".

The purpose of the EIAR scoping process is to identify the issues which are likely to be important during the environmental impact assessment and to eliminate those that are not relevant. The scoping process identifies the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. The primary focus of scoping is to define the most appropriate assessment of significant effects related to the proposed development.

5.3 Scoping Methodology

An informal or voluntary scoping exercise was carried out which established the terms of reference for the EIA and identified the concerns and issues that warranted attention during the assessment phases. This process was carried out taking into account the four-stage process recommended by the European commissions (2017) as follows:



Planning guidance[1] does not set out a methodology for scoping but it draft EPA draft guidance (2017)[2] does that that scoping should be an ongoing and iterative process and assessors "should maintain a flexible view of the scope throughout the entirety of the design and EIA process.

Using the EC (2017) methodology while maintaining a "flexible view" of the scope of the EIAR, the following tasks were undertaken during the scoping exercise:

1. The developer initiated a voluntarily scoping exercise:
2. In 2016, a draft scoping document for circulation to relevant consultees was prepared on the basis of baseline studies and a preliminary design. In 2017, supplementary scoping was undertaken with IFI and OPW and in 2018 a second scoping exercise was conducted.
3. Scoping with relevant statutory and non-statutory stakeholders took place which included:
    - Written requests for scoping input from a range of prescribed and other statutory bodies and stakeholders; and
    - Holding of a public information event in relation to the proposed development
4. The final scoping opinion was incorporated into the preparation of this EIAR and too into account the following:
    - Environmental impact statements for similar developments which were deemed to be of an acceptable standard by the relevant authorities were examined and their scope taken into account
    - The experience of the project team in undertaking environmental impact assessments for waste infrastructure developments, particularly in relation to the Knockharley Landfill site, and
    - Responses received during consultation.

5.4 Consultation Process & Responses Received

A consultation letter was sent out to 29 recipients on the 25th October 2016. The recipients included relevant statutory consultees (as defined in Article 28 of the Planning and Development Regulations, as amended), non-governmental organisations (NGOs) and key stakeholders. A detailed scoping report was included with each consultation letter.

A copy of the consultation letter and the accompanying scoping report are included in Appendix 5.1 of Volume 3 of this EIAR. Stakeholders consulted are identified in Table 5.1.

Table 5.1: Stakeholders Consulted on the 25th of October 2016

Contact	Organisation
Mr. Eoin McDonnell	Planning & Environmental Department, Failte Ireland, 88-95 Amiens Street, Dublin 1
Mr. Noel Culleton	Head of Centre, Teagasc, Environmental Research Centre, Johnstown Castle, Co. Wexford
Ms. Alison Harvey	Planning & Development Officer, The Heritage Council (An Chomhairle Oidhreachta), Áras na hOidhreachta, Church Lane, Kilkenny
The Manager	Development Application Unit, Department of Arts, Heritage & the Gaeltacht, Newtown Road, Wexford
Mr. Padraig Maguire	Senior Executive Planner, Planning Department, Meath County Council, Buvinda House, Dublin Road, Navan Co. Meath

[1] Government of Ireland (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment

[2] EPA (2017) Guidelines on The Information to Be Contained in Environmental Impact Assessment Reports Draft

Contact	Organisation
Ms. Caroline Corrigan	Senior Executive Engineer, Environment, Meath County Council, Buvinda House, Dublin Road, Navan Co. Meath
Mr. Noel Mc Gloin	Senior Fisheries Environmental Officer, Inland Fisheries Ireland – Eastern River Basin District, 3044 Lake Drive, Citywest, Dublin 24
Ms. Joanne Pender	Development Officer, Irish Wildlife Trust, Sigmund Business Centre, 93A Lagan Road, Dublin Industrial Estate, Glasnevin, Dublin 11
Mr. Michael Mc Cormack	Senior Land Use Planner, Transport Infrastructure Ireland, Parkgate Business Centre, Parkgate Street, Dublin 8
Ms. Maite Zabaltza	Irish Geological Heritage Programme, Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4
Ms. Eilish O'Reilly	Principal Environmental Health Officer, Environmental Health Department, HSE Dublin North East, Co Clinic, Navan, Co. Meath
Mr. Malachy Bradley	Planning Section, East & Midland Regional Assembly, 3rd Floor North, Ballymun Civic Centre, Main Street, Ballymun, Dublin 9
Ms. Suzanne Dempsey	Spatial Planning Specialist – Asset Strategy and Sustainability, Irish Water, Colville House, Talbot Street, Dublin 1
Ms. Stephanie O'Callaghan	An Chomhairle Ealaíon (The Arts Council), 70 Merrion Square, Dublin 2
The Manager	Department of Communications, Climate Action & Environment, 29 – 31 Adelaide Road, Dublin 2, D02 X285
Ms. Danielle Coll	Climate Change and Bioenergy Policy Division, Department of Agriculture, Food & Marine, Portlaoise Grattan Business Centre, Portlaoise, Co. Laois
Mr. Gerry Murphy	The Manager, National Transport Authority, Floor 3, Block 6/7, Irish Life Centre, Dublin 1
Mr. Ian Lumely	An Taisce – The National Trust for Ireland, The Tailors Hall, Backlane, Dublin 8
Mr. Jim Holloway	Meath County Development Board, Local Enterprise Board, Enterprise Centre, Trim Road, Navan, Co. Meath
Mr. Hugh Coughlan	Regional Coordinator, Eastern Midlands Regional Waste Office, Environment and Transportation Department, Block 1, Floor 6, Civic Offices, Dublin 8
Ms. Karen Donovan	Office of Public Works (OPW), Jonathan Swift Street, Trim, Co. Meath
Mr. Brian Meaney	Environmental Protection Agency, PO Box 3000, Johnstown Castle Estate, Co. Wexford
Sir/Madam	National Parks & Wildlife Service, 7 Ely Place, Dublin 2, D02 TW98
Ms. Yvonne Dalton	Head of Planning, Dublin Airport Authority PLC, Head Office, Dublin Airport, Ireland
The Minister	The Minister for Housing, Planning, Community & Local Government, Minister's Office, Custom House, Dublin 1

Contact	Organisation
Mr. Ian Hall	Secretary, Knockharley and District Residents Association, The Cottage, Rathdrinagh, Beauparc, Co. Meath
Mr. Paschal Marry	Chairman, Kenstown Village Project, Ballymagarvey, Balrath, Navan, Co. Meath
Mr. Paddy Lawlor	Knockharley Landfill Liaison Committee, Bronstown, Navan, Co. Meath
Mr. Peter Keegan	Environmental Manager, Gas Networks Ireland, NSC, St. Margarets Road, Finglas, Dublin 11

In total there were 11 no. replies received to the consultation letters sent. A summary of all the replies received is provided in Table 5.3 with a copy of all correspondence received included in Appendix 5.1 of Volume 3 of this EIAR. The responses received were fully considered and where appropriate, the topics raised were included within the EIAR.

During the development of the description of the proposed development further consultation was held with Inland Fisheries Ireland (IFI) and the Office of Public Works (OPW). Details of this consultation together with responses received are included in Appendix 5.2. Table 5-3 includes a summary of the responses received from OPW and IFI.

A third phase of consultation was sent out to 29 recipients on the 29th March 2018. The recipients included relevant statutory consultees (as defined in Article 28 of the Planning and Development Regulations, as amended), non-governmental organisations (NGOs) and key stakeholders.

A copy of the consultation letter is included in Appendix 5.3 of Volume 3 of this EIAR. Stakeholders consulted are identified in Table 5.1.

Table 5-2: Stakeholders Consulted on the 29th of March 2018

Contact	Organisation
Mr. Eoin McDonnell	Planning & Environmental Department, Fáilte Ireland, 88-95 Amiens Street, Dublin 1.
Mr. Noel Culleton	Teagasc, Environmental, Research Centre, Johnstown Castle, Co. Wexford
Ms. Alison Harvey	The Heritage Council (An Chomhairle Oidhreachta), Rothe House, Church Lane, Kilkenny
The Manager	Development Applications Unit, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Newtown Road, Wexford
Mr. Michael Griffin	Planning Department, Meath County Council, Buvinda House, Dublin Road, Navan, Co. Meath
Ms. Caroline Corrigan	Environment, Meath County Council, Buvinda House, Dublin Rd, Navan, Co. Meath
Mr. Noel McGloin	Inland Fisheries Ireland – Eastern River Basin District, 3044 Lake Drive, City West, Dublin 24

Contact	Organisation
Ms. Joanne Pender	Irish Wild Life Trust, Sigmund Business Centre, 93A Lagan Road, Dublin Industrial Estate, Glasnevin, Dublin 11
Mr. Michael McCormack	Transport Infrastructure Ireland, Parkgate Business Centre, Parkgate Street, Dublin 8
Ms. Maite Zabaltza	Irish Geological Heritage Programme, Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4
Ms Eilish O'Reilly	Environmental Health Department, HSE Dublin North East, Co Clinic, Navan, Co. Meath
Mr. Malachy Bradley	East & Midland Regional Assembly, 3rd Floor North, Ballymun Civic Centre, Main Street Ballymun, Dublin 9
Ms. Suzanne Dempsey	Spatial Planning Specialist Asset Strategy & Sustainability, Irish Water, Colville House, Talbot Street, Dublin 1
Ms. Stephanie O'Callaghan	An Chomhairle Ealaíon, (The Arts Council), 70, Merrion Square, Dublin 2
The Manager	Department of Communications, Climate Action & Environment, 29 - 31 Adelaide Road, Dublin, D02 X285
Ms. Danielle Coll	Climate & Change & Bioenergy Policy Division Department of Agriculture, Food & Marine Portlaoise Grattan Business Centre, Portlaoise, Co. Laois
Mr. Gerry Murphy	National Transport Authority, Floor 3 Block 6/7, Irish Life Centre, Dublin 1
Mr. Ian Lumley	An Taisce – The National Trust for Ireland, The Tailors' Hall, Backlane, Dublin 8
Mr. Jim Holloway	Meath County Development Board, Local Enterprise Board, Enterprise Centre, Trim Rd., Navan, Co. Meath
Mr. Hugh Coughlan	Eastern-Midlands Regional Waste Office, Environment and Transportation Department, Block 1, Floor 6 Civic Offices, Dublin 8
Ms. Karen Donovan	Office of Public Works (OPW), Jonathan Swift Street, Trim, Co. Meath
Licensing	Environmental Protection Agency, PO Box 3000, Johnstown Castle Estate, Co. Wexford
National Parks & Wildlife Service	7 Ely Place, Dublin 2, D02 TW98
Ms. Yvonne Dalton	Head of Planning, Dublin Airport Authority PLC Head Office, Dublin Airport
The Minister	The Minister for Housing, Planning, Community and Local Government, Minister's Office, Custom House, Dublin 1

Contact	Organisation
Mr. Peter Keegan	Gas Networks Ireland, NSC, St. Margarets Road, Finglas, Dublin 11
ESB Networks	111 Kylemore Way, Inchicore, Dublin
Ms. Noelle Carroll	Department of Communications, Climate Action & Environment, 29 - 31 Adelaide Road Dublin, D02 X285
Ms. Shirley Callaghan	Climate & Change & Bioenergy Policy Division, Department of Agriculture, Food & Marine, Portlaoise Grattan Business Centre, Portlaoise, Co. Laois

In total there were 11 no. replies to the consultation letters sent on the 29th of March. A summary of all the replies received is included in Table 5-3 with a copy of all correspondence received included in Appendix 5.3 of Volume 3 of this EIAR. The responses received were fully considered and where appropriate, the topics raised were included within the EIAR.

Table 5.3: Submissions / Responses Received

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
An Taisce	26/10/2016 (Letter)	Response presented a list of general EIAR issues that should be considered: • Consideration of negative impacts on local residents (odour etc.) and appropriate mitigation measures • Consideration of negative impacts on traffic congestion • Consideration of impacts on nearby designated sites • Consideration of water quality impacts and appropriate mitigation measures • Consideration of impacts on landscape, views, archaeological features and architectural heritage	Issues identified by An Taisce for consideration are addressed in the following chapters of this EIAR: Chapter 6: Population and Human Health, Chapter 7 Air and Climate, Chapter 8 Roads, Traffic & Transportation, Chapter 10 Biodiversity, Chapter 12 Hydrology and Surface Water Quality, Chapter 13 Landscape and Visual Impact Assessment and Chapter 14 Cultural Heritage in Volume 2 of this EIAR.
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs	27/10/2016 (Email)	Consultation letter acknowledged – no comments made in response	Not applicable
Fáilte Ireland	04/11/2016 (Email)	Response did not deal specifically with the proposed development but provided a copy of the Fáilte Ireland's Guidelines for the	Information provided by Fáilte Ireland is considered in Chapter 6 'Population and Human

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
		treatment of tourism in an EIS, which is recommended to be taken into account.	Health' of Volume 2 of this EIAR.
	10/04/2018 (Email)	Consultation letter acknowledged. Fáilte Ireland's Guidelines for the treatment of tourism in an EIS was recommended to be taken into consideration (as noted in response dated 4th April 2016 also).	Chapter 6: Human Environment of Volume 2 of this EIAR has taken into consideration this document.
Irish Water	04/11/2016 (Letter)	Response identified water mains contiguous to the eastern boundary of the site – suggested a full site investigation is carried out prior to construction and proposals put in place for managing potential interference with water services infrastructure. A list of general EIS considerations in relation to water services was also provided by Irish Water: • Consideration of development impact on the capacity and/or upgrade requirement of an existing supply • Consideration of surface water discharges to sewers • Any physical impacts on Irish Water assets • Consideration of assimilative capacity of receiving waters • Impact on contribution catchments of water sources • Mitigation measures relating to any of the above	Information provided by Irish Water is considered in Chapter 11 Soils, Geology and Hydrogeology and Chapter 12 Hydrology and Surface Water Quality in Volume 2 of this EIAR.
	09/04/2018	IW does not have the capacity to advise on scoping of individual projects. Requested further information on the nature, location and volume of any groundwater development for dewatering, location of aquifers, outline of the proposed site and demonstration of how the proposed developments relates to conservation sites, aquifers and groundwater abstractions, geological cross section where a conservation site, groundwater abstraction or a discharge location is located within 2km. Also suggested a site investigation to be carried out prior to construction. General considerations to be considered in the EIAR were also put forward as per previous consultation.	Information provided by Irish Water is considered in Chapter 11 Soils, Geology and Hydrogeology and Chapter 12 Hydrology and Surface Water Quality of Volume 2 of this EIAR.

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
Dublin Airport Authority	07/11/2016 (Letter)	Consultation letter acknowledged – no comments made in response	Not applicable
Inland Fisheries Ireland	07/11/2016 (Email)	Response raised concerns over the following issues and indicated that the EIAR should assess these issues: • The potential generation of suspended solids, hydrocarbons and other related deleterious matter that may flow to waters • The potential blocking of any waters and any proposed new channel diversions. • Potential impacts on brown trout and lamprey stocks within the Nanny River, a tributary of the River Boyne A copy of the Inland Fisheries Ireland guidelines on the protection of fisheries during construction works in and adjacent to water was also provided.	Information provided by Inland Fisheries Ireland is primarily considered in Chapter 12 Hydrology and Surface Water Quality, and also in Chapter 10 Biodiversity in Volume 2 of this EIAR.
	11/10/2017 (Email)	Response repeated concerns from correspondence dated 07/11/2016: 5. Potential generation of suspended soils, hydrocarbons and other related deleterious matter that may flow to waters 6. Potential blocking of waters and any proposed channel diversions 7. Proximity of the application site to the Veldonstown tributary of the Nanny River whose status is poor and must be restored to good status. The correspondence also attached a copy of the Inland Fisheries Guidelines in relation to construction works	
Health Service Executive	08/11/2016 (Letter)	Response presented a list of EIAR considerations that should be made under the following headings: • Description of the project: - Clarification required as to whether or not this is the final proposal for the facility - Further details should be provided in EIS outlining proposed processes	Issues identified by the Health Service Executive for consideration are addressed in the following chapters of Volume 2 of this EIAR: Chapter 2 Description of the Proposed Development, Chapter 5 EIA Scoping, Consultation & Key Issues, Chapter 6 Population and Human

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
		- EIS should describe waste acceptance criteria, identify wastes and waste volumes to be accepted on site and provide clarification if hazardous waste is to be handled on site. - Consideration should be given to assessment of all construction phase impacts and proposed mitigation measures within a construction management plan • Later consents required - EIS should provide information on monitoring requirements • Consideration of alternatives • Public consultation - Should be carried out with all concerns fully addressed and evaluated. EIS should demonstrate how public consultation influenced decision making within the EIA. • Noise: - Baseline noise monitoring and noise assessment modelling to assess the impact of noise from the construction and operational phases should be carried out, with results displayed in the EIS, as well as analysis on their significance and potential cumulative effects. - Mitigation measures should be outlined. • Water: - Drinking water sources, potential impacts on these and proposed mitigation measures should be identified. - Information should be gathered via a site survey rather than desktop studies. - Potential impacts of surface water runoff should be assessed, and proposed mitigation measures identified. Site drainage, rainfall and flooding should be considered.	Health, Chapter 7 Air Quality & Climate, Chapter 9 Noise & Vibration, Chapter 8 Roads, Traffic & Transportation, Chapter 10'Biodiversity and Chapter 12 Hydrology and Surface Water Quality.

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
		• Dust: - Potential impacts of air emissions and odour generation should be outlined in EIS - Proposals for the capture, containment and treatment of odours should be outline in EIS - Appropriate odour modelling should be completed with all impacts assessed - Assessment of all previous odour complaints should also be carried out • Pest control: - A description of measures to control rodent activity should be included in the EIS. • Litter: - An assessment of the impact of litter and proposed control measures to prevent problems should be included in the EIS. • Complaints procedure: - Proposals for dealing with odour/nuisance complaints should be outlined in the EIS. • Cumulative impacts: - All cumulative impacts should be assessed in the EIS • Decommissioning: - Proposals for the decommissioning of the facility should be outlined in the EIS along with the assessment of all residual impacts on the environment.	
Health Service Executive	17/04/2018 (Letter and by Email)	Response reiterated the detail of the original HSE EIS Scoping Report	Relevant chapters of Volume 2 of the EIAR have had regard to the response from the HSE.
Meath County Council	08/11/2016 (Letter)	Consultation letter acknowledged – no comments made in response	Not applicable
	09/04/2018 (email)	Consultation letter acknowledged – mentioned the anticipated draft Climate Action Strategy (CAS) document	Document has not yet been published

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
	18/04/2018 (email)	Response provides detail on a number of key areas: • Alternatives: With respect of the alternatives section of the EIAR, the specific reasoning for: site selection, landfill design, increase in height, increase in waste tonnage and need for an incinerator bottom ash storage facility should be included. • Human Environment: The human environment section should consider positive and negative impacts on a range of human factors, visual impact and to assess the odour from the proposal. • Noise & Vibration: A map detailing noise monitoring locations should be included. Impact from additional traffic and potential increased operational noise should be assessed. Additional planting and noise reduction equipment should be assessed and proposed. • Traffic & Transportation: Traffic assessment should include hours of operation, volume and frequency of traffic movements, details of waste origin, haul routes, output materials, staff numbers and other potential increased traffic. • Air Quality & Climate: Air quality to reference source of waste material, dust generated. Air quality to consider Climate Action Strategy. • Ecology: Indirect impacts on designated sites in the vicinity must be considered: e.g. Discharge run-off. To determine if an AA is required, and if an NIS should be submitted. Ecological assessment to be carried out on habitats on site. Mitigation measures to be clearly stated. NPWS should be consulted with. • Soils, Geology & Hydrogeology: Impact on soils/geology relating to excavations to be assessed. Details of current groundwater protection measures and any additional measures should be clearly identified. Groundwater monitoring locations to be shown. • Hydrology & Water Quality: Impact and change in run-off rates to be assessed in	Issues identified by Meath County Council for consideration are addressed in the following chapters in Volume 2 of this EIAR: Chapter 2 Description of the Proposed Development, Chapter 4 Need for the Development and Alternatives Considered Chapter 5 EIA Scoping, Consultation & Key Issues, Chapter 6 Population and Human Health, Chapter 7 Air Quality & Climate, Chapter 9 Noise & Vibration, Chapter 8 'Roads, Traffic & Transportation', Chapter 10 'Biodiversity' and Chapter 12 'Hydrology and Surface Water Quality, Chapter 11 Soils, Geology and Hydrogeology, Chapter 13Landscape and Visual Impact Assessment and Chapter 14 Cultural Heritage.

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
		hydrology section, including impact of proposed additional berms. Felling and replanting also to be assessed. • Landscape & Visual Impact: LCA of the area should be appraised in Landscape assessment as per Development Plan, including views, prospects, features, places as per Development Plan. Photomontages should be submitted with the application (including a number of important archaeological sites). Impact from N2 road and local roads should also be assessed in terms of visual impact. • Archaeology, Architecture and Cultural Heritage: Cultural heritage should assess protected structures, monuments, buildings or places within study area and consider potential impacts. Important archaeological sites should also be considered.	
Transport Infrastructure Ireland	10/11/16 (Letter)	Response does not deal specifically with the proposed development but does provide the following general guidance: • Consult with relevant Local Authority with regard to locations of existing and future national road schemes • Determine impacts on the national road network in proximity to the development; N2 • Assess visual impacts from existing national roads • Have regard to road scheme issues addressed in EIS for nearby developments, with particular regard to cumulative impacts. • Have regard to the NRA DMRB and the NRA Manual of Contract Documents for Road Works • Have regard to the NRA's Environmental Assessment and Construction Guidelines, including the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA, 2006)* • Consideration of the Environmental Noise Regulations 2006 (SI 140 of 2006) for EIS	Information provided by Transport Infrastructure Ireland is considered in Chapter 8 Roads, Traffic and Transportation in Volume 2 of this EIAR.

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
		• Completion of a traffic and transport assessment, if appropriate • Consult with the NRA's DMRB *Road Safety Audit* to determine if a Road Safety Audit is required • Identification in the EIS of the methods used for road works transversing/in proximity to the national road network • Identification of proposed haul routes and full assessment of network to be transversed.	
	18/04/2018 (Letter)	TII advises that it does not directly engage with planning applications, but general guidelines are provided (same as 10th of November 2016 correspondence)	Information has been considered in Chapter 8 Roads, Traffic and Transportation of Volume 2 of the EIAR.
Office of Public Works	17/11/2016 (Letter)	Provided a map showing channels maintained by the Office of Public Works and drainage district channels maintained by the Local Authority. Indicated that these channels require a 10m maintenance strip along their edge to allow for maintenance and outlined that any works on these watercourses will require consent from the Office of Public Works.	Information provided by Transport Infrastructure Ireland is considered in Chapter 12 Hydrology and Surface Water Quality in Volume 2 of this EIAR.
	20/10/2017	In addition to the original comments made by OPW, further correspondence noted that new culverts/bridges on any watercourse or changes to existing structures or watercourse will require Section 50 consent from the Office of Public Works	
Teagasc	18/11/16 (Email)	Consultation letter acknowledged – no comments made in response	Not applicable
	09/04/2018 (Email)	Consultation letter acknowledged – no expertise to comment	Not applicable
Gas Networks Ireland	10/04/2018 (Email)	Consultation response notes information on infrastructure in the vicinity. 14m wide GNI wayleave in the general area. Work in the vicinity of a gas transmission pipeline must be completed in compliance with the Code of Practice 2015. No excavation may take within wayleave without consent.	Not applicable
Department of Communications, Climate Action & Environment	03/04/2018	Consultation letter acknowledged – no comments made in response	Not applicable

Consultee	Date of Response	Summary of Comments Provided	Areas in which comments are addressed in EIAR
Department of Agriculture, Food and the Marine	16/04/2018	Consultation response identifies that if the proposal involves felling or removal of trees, a license must be obtained prior to felling or removal. The consultation response includes further information on the application process.	A license has been obtained for tree felling. Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines (34) and Forest Harvesting and Environmental Guidelines (36).
Department of Housing, Planning and Local Government	03/04/2018	Consultation letter acknowledged – no comments made	Not applicable

5.4.1 Consultation with the EPA

On 29th August 2016, a pre-application consultation meeting in relation to the proposed development was held with Mr. Brian Meaney and Ms. Caroline Murphy of the EPA, in the context of the EIAR preparation and the application for the review of the existing Industrial Emission (IE) licence that applies to the site. Key points and issues discussed were:

- Consideration of potential odour generation as the main issue – discussion in relation to odour mitigation measures to be employed
- Consideration of ash processing to be included in the development proposal
- Consideration of the potential for re-circulation of concentrated leachate
- Consideration of the classification of proposed activities
- Consideration of applicable IE classes in term of ash management (processing & placement)
- Consideration of the requirement for completion of a Stage 2 Appropriate Assessment, as the Nanny catchment potentially discharges to a Natura 2000 site
- Requirement for assessment of existing baseline condition in detail, including the identification of appropriate hazardous substances
- Requirement for a hydrogeological risk assessment to be completed as new cells are proposed
- Requirement for information to be provided in relation to fire controls
- Requirement for the need to reference relevant BREF activities
- Requirement for updated financial provision as well as a revised CRAMP and ELRA to be submitted with the IE review application
- Requirement for EIA to address existing conditions (development and emissions) at the facility

These issues have been considered in the relevant sections of this EIAR, as well as in preparation for the EPA Industrial Emissions licence application.

5.4.2 Pre-Application Consultation with An Bord Pleanála (PC0223)

As identified in Chapter 1, pre-application meetings to assess whether the proposed development was to be considered a strategic infrastructure development (SID) were held with An Bord Pleanála (ABP) on 4th August 2016 ,25th October 2016 and 14th September, with ABP determining on the 14th November 2017 that the project constitutes strategic infrastructure development.

An overview of issues surrounding the proposed development were presented in the first meeting with ABP.

These were as follows:

- Development proposal
- Site location
- Existing development
- Elements of the proposed development
- Need for the proposed development
- Why the proposed development is considered to be strategic
- Intended submission programme

Queries were raised by ABP during this meeting in relation to the capture of leachate arising from Incinerator Bottom Ash (IBA), the levels of contamination in respect of soils accepted for disposal at the facility and the degree of consultation between the applicant and the relevant regional and local authorities.

These queries were addressed in full by the (then) prospective applicant at the meeting and it was agreed that a second meeting would be held following completion of the initial consultation process and the design for the proposed development.

The second meeting began with a presentation from the prospective applicant which provided updates on the design of the proposed development and summarised the outcome of the consultation meetings held with the EPA, Meath County Council and the Eastern-Midlands Waste Regional Office. The prospective applicant also informed ABP of the intention for a public consultation event to be held.

Queries were raised by ABP during this meeting in relation to the degree of policy context discussion that took place during the meeting with the Eastern-Midlands Waste Regional Office, whether a Stage 2 Natura Impact Statement would be required with the application, the proposed recovery and storage of IBA at the facility and the requirement for a Traffic Impact Assessment (TIA) to be completed with the application.

The procedures and sequencing in relation to making a formal planning application were subsequently outlined by ABP to the prospective applicant, before final concluding comments were made.

The third meeting began with a presentation from the prospective applicant which provided an update on the design of the proposed development.

Correspondence and notes in relation to these consultation meetings with ABP are included in Appendix 5.4 of Volume 3 of this EIAR. Feedback received during this consultation process has been considered in the preparation of this EIAR.

5.4.3 Consultation with Meath County Council

Meeting were held with Meath County Council representatives on 7th September 2016 and on 16th April 2018.

Key issues discussed included the nature and scale of the proposed development compared to previous developments on site and the potential for an IBA or bale storage element within the proposed facility building. The main concerns raised by the Council related to visual and odour impacts on the local environment. It was recommended that the visual assessment included viewpoints from the wider locality i.e. elevated areas and that clear odour management proposals were put forward. Queries were also raised by Meath County Council in relation to the extent of Appropriate Assessment and public consultation to be carried out.

The feedback from Meath County Council from the consultation meetings has been taken into consideration in the preparation of the EIAR.

5.4.4 Consultation with Eastern-Midlands Waste Regional Office

Meetings were held with Eastern–Midlands Waste Regional Office (EMWRO) representatives on 12th September 2016, on 14th July 2017and 16th April 2018.

Key issues discussed included the nature and scale of the proposed development compared to previous developments on site, the breakdown of proposed input tonnages, makeup of the 'non IBA' components, 're-integration' of tonnage and further discussions relating to foreseen and unforeseen events amongst other things. The EMWRO also raised the issue of the extent of Appropriate Assessment to be carried out and potential environmental impacts that may arise from the proposed development.

The consultation feedback received from EMWRO has informed the preparation of the EIAR.

5.4.5 Consultation with the Public

A public information event was held on Monday 14th November 2016 at the Knockharley Landfill facility. This event was advertised in the Meath Chronicle on Tuesday 8th November 2016 and a copy of this advertisement is included in Appendix 5.5 of Volume 3 of this EIAR, along with a sign in sheet of attendees. Comment cards were available for attendees to leave written comments should they so wish. Pictures showing the information boards presented at the event are shown in Figure 5.1.

A total of 15 people attended the event at various times and they engaged in discussions with representatives from Knockharley Landfill Ltd. and Fehily Timoney & Company, who outlined the nature of the proposed development to the attendees.

Figure 5-1: Story Boards presented at Public Information Event

The main issues that were raised by attendees during the event were:

- the potential for negative impacts associated with traffic
- the potential for negative impacts associated with odour
- the potential for negative impacts associated with noise
- queries in relation to the contributions relating to the existing Community Fund

The issues have been addressed in the relevant chapters of this EIAR where they arise, such that issues raised will be addressed through the design and mitigation measures assessed and proposed, particularly in relation to odour, noise and traffic, demonstrating how the applicant has addressed the key concerns raised by the public at the public information event.

5.5 Summary

Consultation was sought from a number of stakeholders, including Meath County Council, the EPA, the Eastern Midlands Waste Management Region and others. Their comments and feedback were incorporated into the EIAR as identified.

Pre-application consultation was held with An Bord Pleanála to determine if the proposed development was to be considered as strategic infrastructure development (SID). That process was closed, and the proposed development was deemed to be SID.

A public consultation event was held to inform attendees of the nature of the proposed development, and to provide an opportunity for feedback in relation to the proposed development. The assessment of potential impacts, mitigation by design and the proposed mitigation measures address the issues raised at the public consultation event.

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 6 – POPULATION AND HUMAN HEALTH

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan, Co.Meath

FEHILY TIMONEY & COMPANY

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6 POPULATION AND HUMAN HEALTH

6.1 Introduction

This section of this Environmental Impact Assessment Report (EIAR) assesses the likely significant effects of the proposed development on Population and Human Health, with reference to population, human heath, employment and socio-economics, land use, recreation, amenity and tourism.

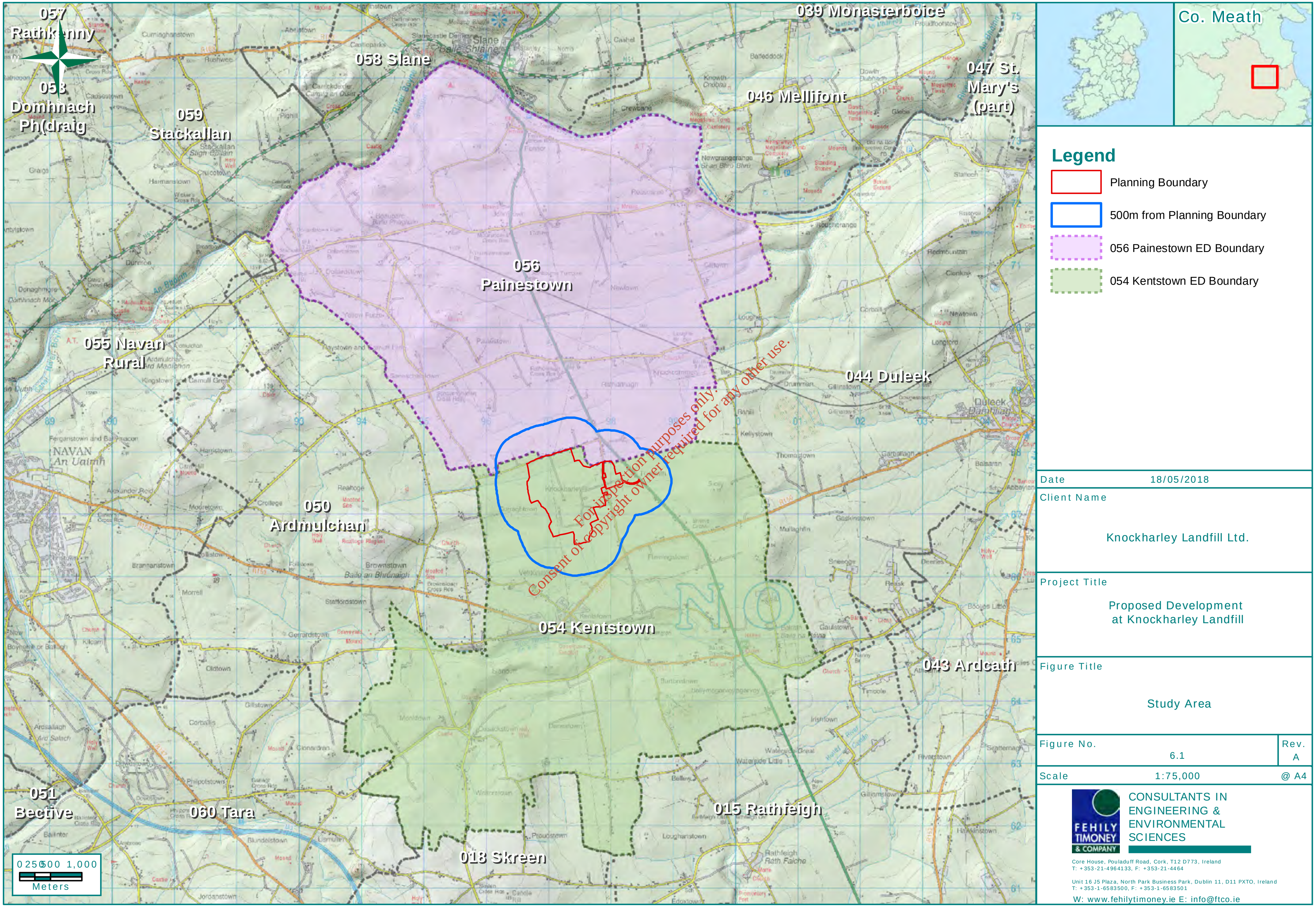
There are additional potential significant effects from the proposed development on population and human health which are covered in separate chapters of this EIAR. These impacts include air and climate, traffic and transportation, noise, groundwater, surface water and landscape and visual impacts. These potential significant effects are considered in detail and are addressed separately in Chapters 7, 8, 9, 11, 12 and 13 respectively of Volume 2 of this EIAR, a summary of these significant effects is also provided in the human health section of this EIAR. Natural disasters such as flooding is assessed in Chapter 12 Hydrology and Surface Water of Volume 2 of this EIAR and land-slides are assessed in Chapter 11 Land, Soils and Geology in Volume 2 of this EIAR. This chapter includes a description of the existing environment and likely significant effects arising from the proposed development and proposed mitigation measures to include:

- Population Trends;
- Employment and Socio-Economics i.e. the interaction of social and economic factors;
- Land-Use;
- Tourism, Recreation and Amenity; and,
- Human Health.

6.2 Study Area

The study area for the population and human health chapter of this EIAR is identified in Figure 6.1 and is defined in terms of the District Electoral Divisions (DEDs) within 500 m of the proposed development site. The site of the proposed development is contained solely within the DED of 054 Kentstown, but also directly abuts the DED of 056 Painestown. For this reason, both DEDs are considered to define the context of this proposed development site and are considered pertinent in the consideration of population and human health. The total study area comprises a total land area of 6,368 hectares while the planning boundary of the proposed development site comprises a total area of 135.2 hectares.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig6-1_StudyArea_A4.mxd



Legend

- Planning Boundary
- 500m from Planning Boundary
- 056 Painestown ED Boundary
- 054 Kentstown ED Boundary

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Study Area
Figure No.	6.1
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6.3 Methodology

This section of the EIAR regarding population and human heath has been prepared following a review of the Greater Dublin Area Regional Planning Guidelines 2010-2020 and the Meath County Development Plan 2013-2019. Population and general socio-economic data was sourced from the Central Statistics Office.

Regarding Tourism, Recreation and Amenity, Fáilte Ireland published a guideline on tourism and environmental impacts in 2011 entitled 'Guidelines on the treatment of tourism in Environmental Impact Statements'.

The methodology used in the assessment of Human Heath in this Chapter was guided by the US Environmental Protection Agency (US EPA) in their Human Health Risk Assessment process. This assessment methodology advised by the US EPA follows a 4-step process:

1. Hazard Identification - Examines whether an agent has the potential to cause harm to humans and if so, under what circumstances - The assessment includes a literature review outlining the findings of relevant medical findings/publications related to the proposed development and its potential effects.
2. Dose-Response Assessment - Examines the relationship between exposure and effects.
3. Exposure Assessment. Examines what is known about the frequency, timing, and levels of contact with an agent.
4. Risk Characterisation - Examines how well the data supports conclusions about the nature and extent of the risk from exposure to environmental agents.

It should be noted that in the preparation of this chapter, has been prepared to comply with the European Commission *Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report*, 2017, regard was had to the EPA *Draft Guidelines for Preparing Environmental Impact Assessment Reports*, 2017 and that the above methodology (items 1-4) is consistent with these guidelines.

This methodology also encompassed a detailed literature review including the following documents:

- Crowley, D.; Staines, A.; Collins, C.; Bracken, J.; Bruen, M.; Fry, J; Hrymak, Victor; Malone, D.; Magette, B.; Ryan, M.; and Thunhurst, C, (2003) *Health and Environmental Effects of Landfilling and Incineration of Waste - A Literature Review.*
- Enviros Consulting and the University of Birmingham (2004) *Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes*
- World Health Organisation (2007) *Population Health and Waste Management – Scientific Data and Policy Options.*
- Porta D1, Milani S, Lazzarino AI, Perucci CA, Forastiere F. (December 2009) *Systematic review of epidemiological studies on health effects associated with management of solid waste.*
- Ozonoff 0. Collen ME, Cupples A. Heeren T. Schatzin A. Mangione T. Dresner M. Colton T. (1987) *Health problems reported by residents of a neighborhood contaminated by a hazardous waste facility*. Am J Ind Med 11:581-597.

Health based standards by their nature are set to protect against human health effects. The level at which the standard is set is chosen to protect the vulnerable, not the robust. These standards are taken into direct consideration in Chapters 7 Air and Climate, Chapter 9 Noise, Chapter 11 Land, Soils and Geology and Chapter 12 Hydrology and Surface Water Quality of Volume 2 of this EIAR. Health standards have an in-built measure of significance in that they are set at levels where there will be no significant health effects. An example is Air Quality Standards set in the CAFÉ Directive 2008/50/EC. This standard based approach is consistent with the recommendations set out in the EPA *Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports,* (2017).

While every human being should be considered a sensitive receptor, clearly the vulnerable are the most sensitive. Older people and particularly younger children, for example constitute a vulnerable group.

Older people in general have greater sensitivity to air pollution and potential effects on the respiratory system and cardiovascular system. There are other vulnerable groups also, for example, the disabled or psychologically ill.

The significance criteria used in the assessment are set out in Table 6.1: Criteria Used in the Assessment of Human Health Effects as per the EPA, 2017 draft guidance.

Table 6-1: Criteria Used in the Assessment of Potential Significant Human Health Effects

Effect Level	Significant Criteria
Imperceptible	No significant human health impacts are apparent. An example is no measurable effect attributable to the proposed development.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	A small impact on individual reported symptoms but no change in health status can be attributed to the proposed development. An example is a temporary increase in symptoms in an individual but no change in the severity of the underlying condition or treatment required.
Moderate	A small impact on health status of individuals but no change in morbidity or mortality can be attributed to the proposed development. An example is an individual increasing their use of a treatment attributable to the development but no change in underlying condition.
Significant	A proposed development has the potential to impact on individual health status. An example is an individual's condition becoming measurably more severe as a result of the proposed development.
Very Significant	A proposed development has the potential to impact on the health status of groups. An example is a group of individuals' conditions becoming measurably more severe as a result of the proposed development.
Profound	A proposed development has the potential to impact on the health status of communities. An example is a measurable increase in the incidence or severity of a condition in a community.

As outlined in Chapter 5 Scoping and Consultation in Volume 2 of this EIAR, prior to preparing this EIAR statutory authorities and other relevant bodies were consulted. Key items raised by these parties have been addressed in this EIAR.

6.4 Existing Environment

6.4.1 Existing Environment - Population

Population Trends

The proposed development is in north-east County Meath within an area predominantly characterised as rural. The village of Slane is located approximately 7 km north of the site, and the centre of the village of Kentstown is located 1.3km to the south of the site. Duleek is located approximately 7 km to the east and Navan is approximately 10 km to the west.

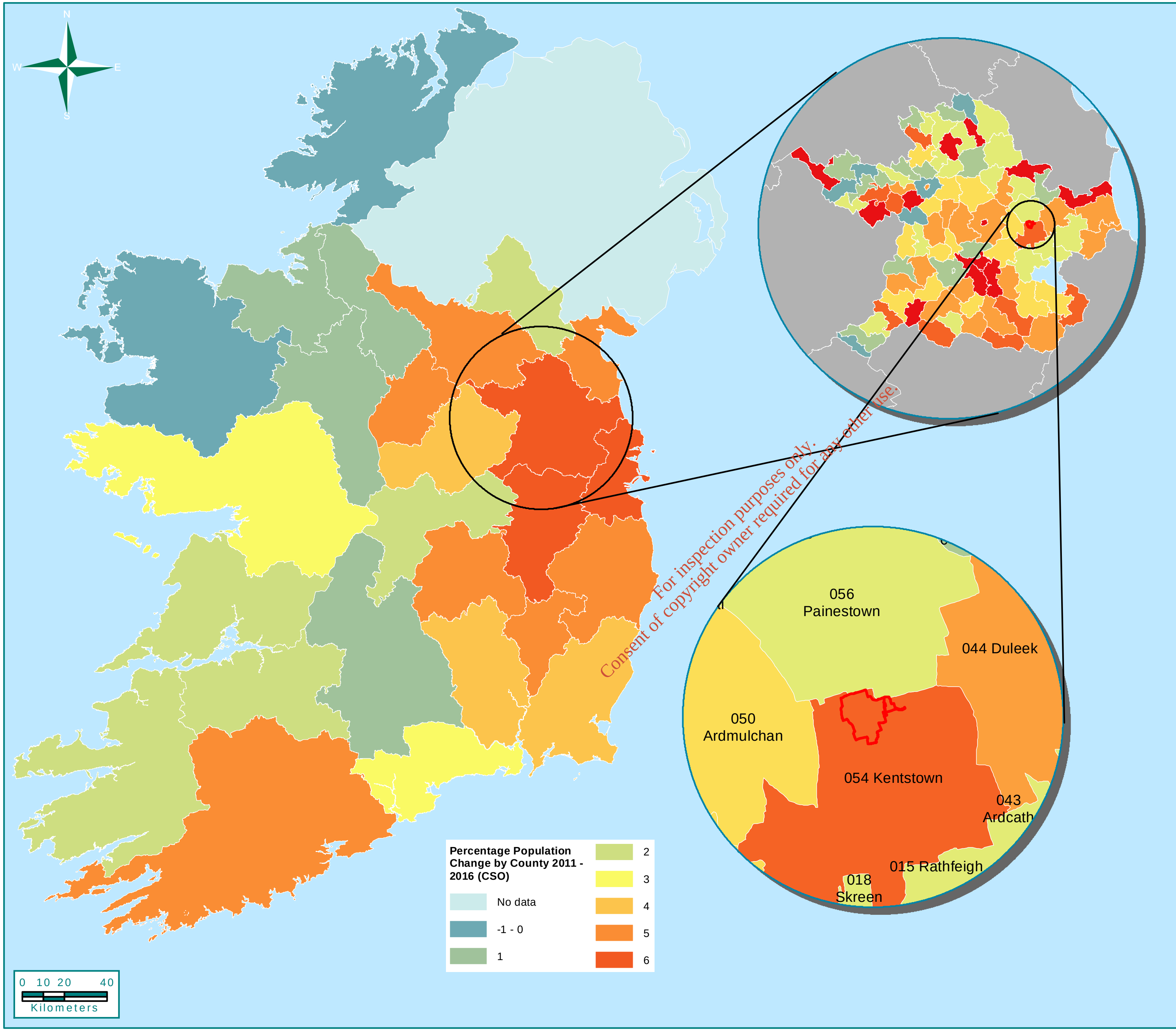
Meath is located within the Eastern and Midland Region of Ireland, and shares boundaries with Dublin, Kildare, Offaly, Westmeath, Cavan, Monaghan and Louth. In the five years between the 2011 and 2016 censes, the population of Ireland increased by 169,724 persons or 3.7%. During this time the population of County Meath grew by 10,909 persons or 5.9%.

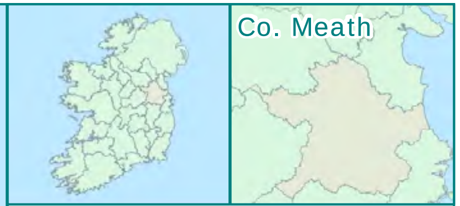
Section 3.5 of the Meath County Development Plan 2013-2019 sets out the Settlement Hierarchy and Future Population Growth for Meath. This settlement hierarchy is consistent with the Regional Planning Guidelines as set out in Chapter 3 of Volume 2 this EIAR. Map 3.1 of the County Development Plan sets out the detailed settlement structure based on a five-tier structure.

The position of each settlement within the hierarchy coupled with the defined role of each tier provides an indication of the potential likely scale of population growth permissible over the period of the Plan. The proposed development is located between the Tier 1 Large Growth Town of Navan and the Tier 5 Village Settlement of Slane.

Population statistics for the State, County and Study Area have been obtained from the Central Statistics Office. These are set out in Figure 6.2.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig6-2_PopulationChange_A4.mxd





Legend

Planning Boundary

Percentage Population Change by Electoral Division 2011 - 2016 (CSO)

- >-10.0
- -10.0 - -5.0
- -5.0 - 0.0
- 0.0 - 2.5
- 2.5 - 5.0
- 5.0 - 7.5
- 7.5 - 10.0
- 10.0 - 15.0

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Population Change
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Table 6-2: Population 2006-2016

	Population			Population Change	
Area	**2006**	**2011**	**2016**	**2006-2011**	**2011-2016**
State	4,239,848	4,588,252	4,761,865	8.2%	3.8%
County Meath	162,831	184,135	195,044	13.1%	5.9%
Study Area	2,845	3,133	3,337	10.1%	6.5%

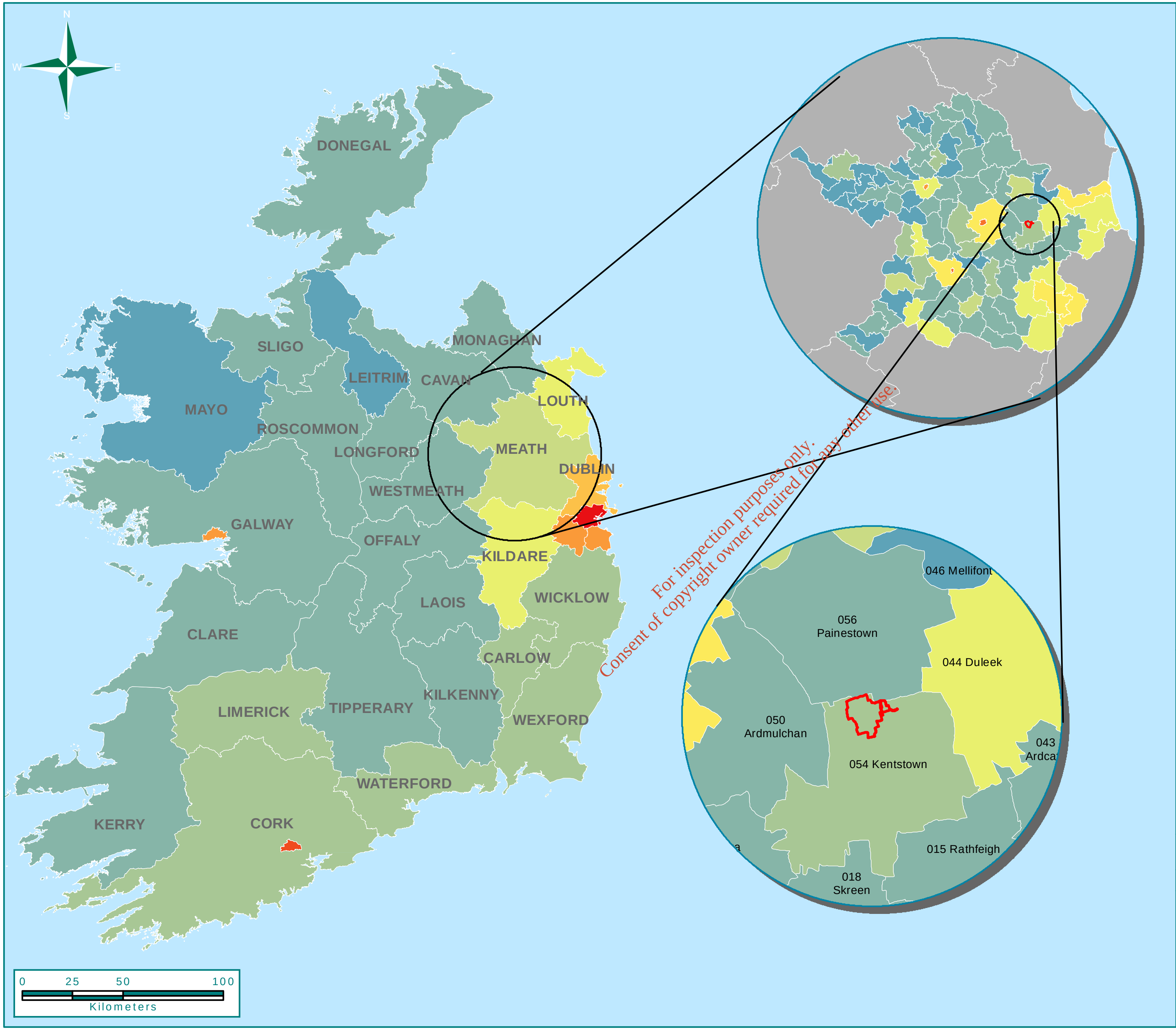
The data presented in Table 6.2 shows that the population of the study area increase between 2006 and 2011 by 10.1% and increased between 2011 and 2016 by 6.5%. This increase is higher than the national and county trends between 2011 and 2016 which were 3.8% and 5.9% respectively. It should be noted that the greatest percentage increase was experienced within the DED of 054 Kentstown.

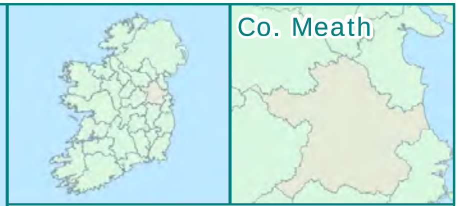
Population Density

The population densities recorded within the State, County Meath and the Study Area in the 2016 Census are set out in Table 6.3, and in Figure 6.3.

Table 6-3: Population Density in 2016

Area	Population Density (Persons per square kilometre)
State	70.0
County Meath	83.2
Study Area	53.6





Legend

Planning Boundary

Population Density By County

- 1 - 10
- 11 - 25
- 26 - 50
- 51 - 75
- 76 - 100
- 101 - 250
- 251 - 500
- 501 - 1000
- 1001 - 2000
- 2001 - 3000
- 3001 - 4000
- 4001 - 4500
- No Data

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Population Density
Figure No.	6.3
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Household Statistics

A housing stock of 705 was identified in the DED of 054 Kentstown during the 2016 Census. The Meath County Development Plan 2013 - 2019 states that "*residential development has largely taken the form of low density residential estates, with houses being set in single plots with front and back gardens. This has caused the village to sprawl outwards from the crossroads at its core*".

The number of households by size recorded within the State, County Meath and the Study Area during the 2011 and 2016 censes is set out in Table 6.4.

Table 6-4: Number of Households and Average Household Size 2011-2016 (Source: CSO)

Area	2011		2016	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,654,208	2.8	1,702,289	2.9
County Meath	62,201	3.0	64,234	3.0
Study Area	1,024	3.1	1,046	3.2

There are currently 721 no. dwellings within 2 km of the site boundary, as identified in Eircode dataset. Most of the residential dwellings are detached residential single-family dwellings and are concentrated in ribbon type developments located along local roads in the vicinity of the site.

Meath County Councils' planning online search utility was used to search for planning permissions granted for developments in the Kentstown area. This search assessed permissions granted from the beginning of 2016 to July 2018. Most of notable grants of permission relate to planning applications for one- off residential dwellings, within 1 km of the site. Planning application references AA151165, AA160390 and AA171308 which sought permission for the development of single rural dwellings noted. Cumulatively however, these are not considered to have a significant effect on the population of the area.

Age Structure

The age category distribution between 2011 and 2016 has remained mostly consistent. The characteristics of the study area within each age category is similar to those recorded at the national and county level for most categories. Within the study area the highest population percentage occurs within the 25-44 age category (28%), which is broadly similar to that of County Meath (29%) and the State (30%). The greatest percentage difference occurs within the 0-14 age category where within the Study Area this comprises 24% of the overall population composition, in contrast to just 21% within the State. The percentage population per age category in 2011 and 2016 is shown in Table 6.5 and Table 6.6.

Table 6-5: Percentage Population per Age Category in 2011

Area	Age Category				
	0-14	15-24	25-44	45-64	65+
State	21%	12%	32%	23%	12%
County Meath	25%	11%	33%	21%	9%
Study Area	25%	11%	32%	23%	9%

Table 6-6: Percentage Population per Age Category in 2016

Area	Age Category				
	0-14	15-24	25-44	45-64	65+
State	21%	12%	30%	24%	13%
County Meath	25%	12%	29%	23%	11%
Study Area	24%	11%	28%	25%	12%

6.4.2 Existing Environment – Land Use

The existing facility comprises a landfill facility where waste disposal and recovery activities are undertaken. The landfill opened for waste acceptance in December 2004. The landfill accepts residual household, commercial and industrial wastes together with construction/demolition wastes and incinerator bottom ash (IBA) and is licensed under EPA Industrial Emissions (IE) Licence W0146-02. The site is licensed to operate from 07:30 to 18:30 Monday to Saturday inclusive and is licensed to accept waste between 08:00 and 18:00 (excluding public holidays). The licensed boundary of the licence facility is shown in red on LW14-821-01-P-Figure 2.1 Existing Site Layout in Volume 4 of this EIAR and the ownership boundary (of Knockharley Landfill Ltd.) is shown in blue. This figure identifies the licensed boundary, ownership boundary, landfill footprint, both built and permitted, screening berms, and infrastructure which comprises:

1. Administration building
2. Machinery/maintenance garage
3. Four portable cabins for storage
4. Weighbridge building
5. Two weighbridges
6. Inspection slab
7. Quarantine slab
8. Car parking
9. Landfill gas treatment compound
10. Leachate lagoon
11. Surface water attenuation lagoon and wetland

The facility is located on a 135.2 hectare (333 acre site). The existing landfill footprint is positioned near the centre of the landholding and the current planning permission permits the development of approximately 25 hectares of landfill cells. The landfill is being developed in seven phases. To date, Phases 1-4 (Cell 1 to Cell 16) of the seven planned cell phases have been fully constructed. At time of writing, Cells 13, 14, 15 and 16 are operational.

A permanent cap has been placed on all cells in Phase 1 and Phase 2 (Cells 1-8 inclusive). In relation to Phase 3, Cells 9 and 10 and half of Cells 11 and 12 are fully capped. The permanent lining of the final cap on Cells 11 and 12 is complete, the soil placement will take place in 2019. There is an intermediate cap on Cells 13 and 14.

The landfill development and waste placement is in a northerly direction. The leachate storage lagoon is located to the south of the administrative buildings and the surface water attenuation pond and wetland is situated to the south of the landfill.

To the north and the west of the existing landfill footprint and within the site boundary is agricultural land which is predominantly managed forestry. The site itself, while relatively flat, rises gradually northwards and westward from approximately 50 mOD at the south-east corner to almost 70 mOD at the western boundary.

Meath County Council permitted application reg ref AA180145 on the 21st of June 2018 for:

> *"The development will consist of a solar farm to be installed over reclaimed landfill with an export capacity of 3MW comprising photovoltaic panels on ground mounted frames, connection to existing single storey ESB Sub Station/ switch room building, installation of 3no. transformers, ducting & underground electrical cabling and all associated ancillary works and services."*

This development is permitted within the boundary of the landfill site.

The predominant land use in the wider area beyond the landfill site boundary is agricultural land, residential development and infrastructural services such as roads, power lines, etc. Individual small tree stands/woodlands are intermittent in the landscape and quarry developments are located near Slane and Duleek.

The existing site is bound immediately to the north by the local road and thereafter to the north, west and south by agricultural land. To the east, agricultural land leads to the local third-class road which has residential dwellings scattered along it.

The agricultural land is a patchwork of medium to large sized fields divided by hedgerows, which are mainly used for tillage and crop production and some animal grazing. Intensive pig farming and other agricultural industries area also present in the wider vicinity of the landfill.

The general topography of the area is low-lying which rises gently from the River Nanny (below 50 m OD) in the south.

Kentstown is located within a landscape area designated as the 'Central Lowlands', The Landscape Character Assessment set out in the Meath County Development Plan 2013-2019 identifies the proposed development location as being located within LCA 6 – Central Lowlands, which is of the "Lowland Areas" LCT.

LCA 6 is described as follows:

> *"The landscape character around settlements tends to be a well-managed patchwork of small pastoral fields, dense hedgerows and small areas of broadleaved woodland particularly in the Kildalkey environs where there are estate landscapes with large mature parkland trees. The landscape is predominantly rolling pastureland, although the landscape surrounding Castlerickard has greater diversity than elsewhere in the lowlands with estate landscape, large conifer plantations, and birch woodland around the Boyne river corridor.*
>
> *In more remote areas, away from settlements, single-track roads wind through less well-managed farmland with rough pasture, overgrown hedgerows and less woodland. Farmland is a variety of scales with square – rectangular fields divided by hedgerows, which are usually clipped to eye-level adjacent to road corridors but are less well managed away from roads. The agricultural landscape comprises a series of small farms rather than few large ones. Views within this area are generally limited by the complex topography and mature vegetation except at the tops of drumlins where panoramic views are available particularly of the Hill of Tara uplands and Skryne Church."*

According to the Corine 2012 landcover dataset, land cover in the vicinity of the proposed development primarily comprises a dump (132), non-irrigated lands (211), pastures (231), broad-leaved forest (311) and discontinuous urban fabric (112). A map of this 2012 CORINE land cover dataset, is identified in Figure 6.4.

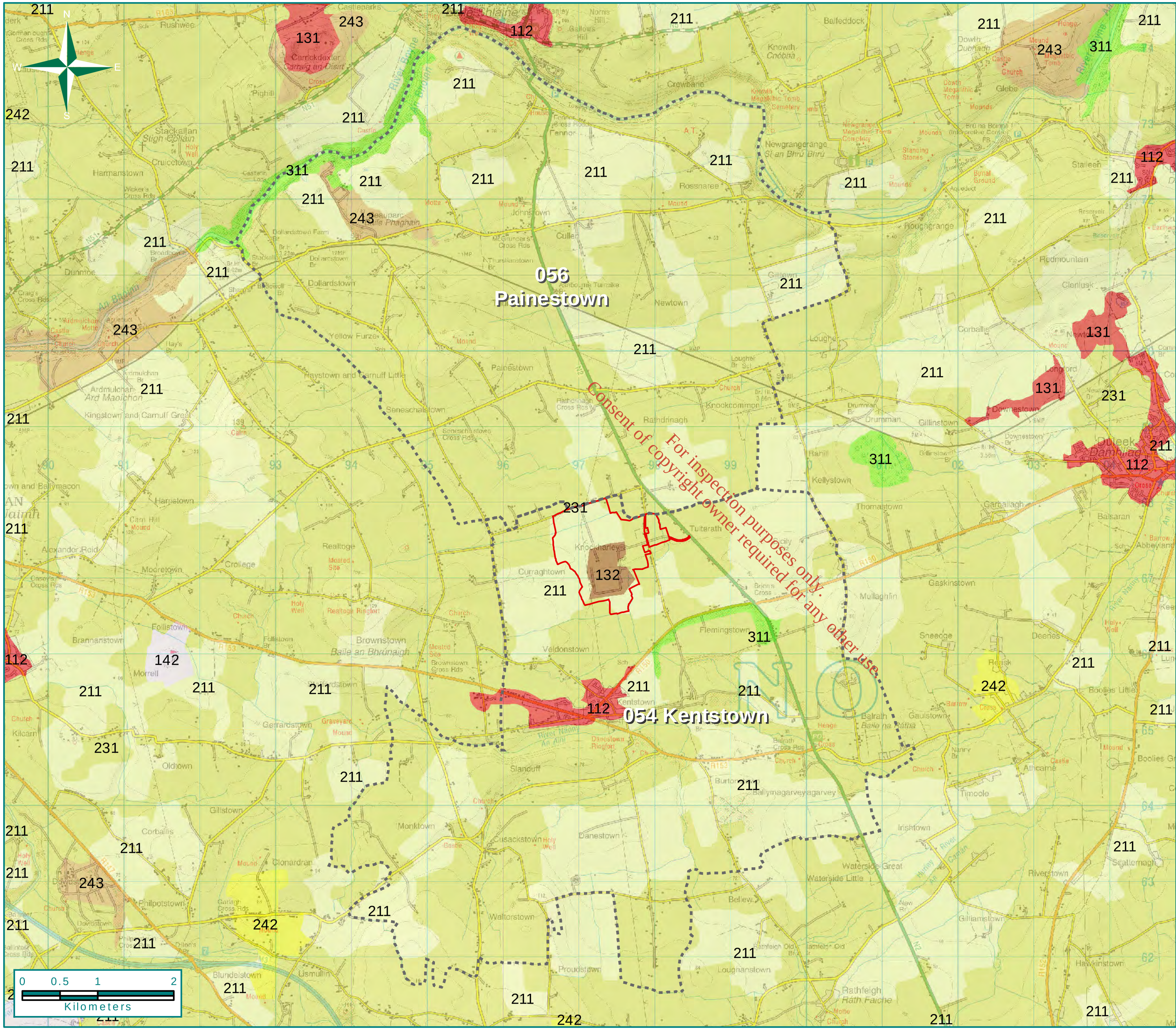
The land use zoning mapping for County Meath as set out in the Meath County Development Plan identifies the lands within the vicinity of the site as unzoned white lands.

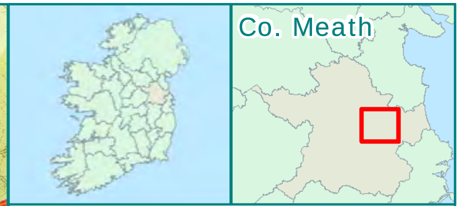
Map 10.1 Rural Area Types of the Meath County Development Plan 2013-2019 illustrates the Rural Area Types of the County based on Development pressure. The proposed development site is identified as being located within an area of *Rural Area under Strong Urban Influence.*

The County Development plan characterises this area as follows:

> *"This area exhibits the characteristics of proximity to the immediate environs of close commuting catchment of Dublin, with a rapidly rising population and evidence of considerable pressure for development of housing due to proximity to such urban areas. This area includes the commuter-belt and peri-urban areas of the county, and the areas that are experiencing the most development pressure for one-off rural housing."*

This growth in population is detailed above in Section 6.4.1. Meath County Council has put in place strategic land use policies to direct urban generated housing to areas zoned for new housing development in towns and villages in the area of the development plan.





Legend

Site Boundary

Study Area

056 Painestown& 054 Kentstown ED Boundaries

Corine Landcover Type

- 112 Discontinuous urban fabric
- 131 Mineral extraction sites
- 132 Dump
- 142 Sport and leisure facilities
- 211 Non-irrigated land
- 231 Pastures
- 242 Complex cultivation patterns
- 243 Land principally occupied by agriculture with areas of natural vegetation
- 311 Broad-leaved forest

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Land Cover withinStudy Area
Figure No. 6.4	Rev. A
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6.4.3 Existing Environment –Socio-Economics, Employment and Economic Activity

Socio-economics refers to the interaction between social and economic factors. Landfill developments by their nature have both economic and social impacts in their respective context.

The percentage of people ages 15 and over who participate in the labour force, as opposed to having another status such as student, retired or homemaker – is known as the labour force participation rate. It is measured as the number in the labour force (at work or unemployed) expressed as a percentage of the total population ages 15 and over.

The 2016 census indicated that the unemployment rate nationally is 7% while in County Meath it is 6.5%. Table 6.7 sets out the total population aged 15+ who were in the labour force during the 2016 census.

Local Employment

Table 6-7: Economic Status of the Total Population Aged 15+ in 2016

	Status	State	County Meath	Study Area
% of Population aged 15+		79%	74.9%	74.5%
% of which area:	At work	53%	57.1%	57.7%
	First time job seeker	0.8%	0.7%	0.7%
	Unemployed	7%	6.5%	5.2%
% of the population 15+ who are not in the labour force		30%	35.8%	36.3%
% of which are	Student	11%	10.9%	10.8%
	Home duties	8%	9.1%	10.9%
	Retired	15%	11.9%	11.3%
	Unable to work	4%	3.5%	3.1%
	Other	0.4%	0.3%	0.3%

Overall the principal economic status of those living in the study area (56.7%) is similar to that recorded at county level, and 4% greater than that recorded at state level. The number of retired people is in contrast, 4% lower than that at state level (15%).

The study area is near Dublin, Navan, Drogheda and other surrounding large urban centres which hold significant industry and commerce developments; therefore, it is likely that a considerable number of the local population commute daily to these centres of work. This is supported by the evidence of the CSO for the 054 Kentstown DED and 056 Painestown DED which shows that Commerce & Trade, Professional Services and Manufacturing Industries accounted for 43.5% of employment in the study area and up to all of which is likely to be provided at larger urban centres.

There are limited local businesses operating in Kentstown. Local businesses include Evan's Coaches, Kilmore Cars, Kentstown Country Store, Hazels Hair Store and Reilly Agri. & Plant Sales. Hillcrest Nurseries and Garden Centre is also located less than 0.5 km west of Kentstown village. The local shop and pub also contribute to the industry and commerce of the area.

Knockharley Landfill facility currently employs 12 no. permanent staff.

Agricultural employment was historically one of the main employers in the East Meath area. However, in recent years, along with national trends, there has been a decrease in the total number of farms as well as a decrease in employment in agriculture in the area, with Agriculture, Forestry and Fishing accounting for c. 6.6% of employment in the study area.

A tonnage-based community levy of €1.89 per tonne of waste per annum disposed of is currently paid into a Community Development Fund. This was initiated as part of the grant of permission for the existing Knockharley Landfill facility in 2002.

In July 2009, Meath County Council and the Knockharley Landfill Community Liaison Committee launched a Small Grants Scheme for the provision of environmental improvements to properties in the general vicinity of Knockharley Landfill. Such improvements include: landscaping, insulation, double glazing windows and doors, waste water treatment systems, biomass boiler and solar panels. The extent and households that can benefit from this scheme has been outlined in defined areas. The quantity of funding available to this scheme is determined by Meath County Council and the Knockharley Landfill Community Liaison Committee each year.

Knockharley Landfill Ltd. has contributed over €2,500,000 into the local Community Development Fund administered by Meath County Council through the Kentstown Village Project and the Small Grants Scheme. Increasing the landfill tonnage capacity will benefit the Community Development Fund.

Economic Activity in the Wider Area

There are several facilities in the surrounding wider area which provide employment including businesses in the surrounding towns of Navan, Duleek and Drogheda such as:

- Navan Sofa Factory
- Lir Chocolate (Navan)
- Irish Country Meats (Navan)
- Irish Cement (Duleek)
- Carranstown Waste to Energy Facility (Duleek)
- Dawn Paper (Drogheda)
- Boyne Valley Group (Drogheda)
- Cisco Engineering Ltd. (Drogheda)

There are 11 no. facilities located within 10 km of the proposed development site which are licensed by the EPA and which provide varying levels of employment.

6.4.4 Existing Environment – Recreation, Amenity and Tourism

The concept of amenity is not defined in Irish planning legislation but a non-legislative definition of amenity states that it is "*the pleasant or normally satisfactory aspects of a location which contribute to its overall character and the enjoyment of residents or visitors*" (Parker, 2012).

Amenity is generally taken to comprise of a number of elements that, in combination, create the attractive aspect of the location in question. These aspects include:

1. Visual appearance/landscape
2. Traffic levels
3. Noise levels
4. Air quality
5. Recreational options
6. Open spaces

Elements 1 – 4 above are addressed in further detail in Chapter 13 Landscape and Visual Impact, Chapter 8 Roads, Traffic and Transportation, Chapter 9 Noise and Vibration and Chapter 7 Air and Climate in Volume 2 of this EIAR. A summary of the elements 1-4 as they relate to this chapter is included hereunder. Elements 5 and 6 are discussed thereafter.

Visual appearance/landscape

The landfill site is generally characterised by the field network pattern of the wider landscape setting into which the landfill cells and associated infrastructure and facilities have been placed. While this has necessitated the removal of part of the hedgerow landscape infrastructure, significant sections of it remain on the site and additional planting has been undertaken since the commencement of landfill operations, particularly along the boundaries to provide screening and a suitable buffer between the site and the local road network.

There are 2 no. protected views within 2 km of the Knockharley Landfill location, classified as per Appendix 12 of the Meath County Development Plan 2013 -2019 and listed in Table 6.8.

Table 6-8: Protected Views within 2 km of the proposed development location *

View No:	Location	Direction	Description	Significance
36	County road to north of Brownstown Cross Roads on R153 I	North West	View to north west across working landscape with visual agricultural structures.	Local
37	County road to north of Brownstown Cross Roads on R153 II	South East	View to south east across working landscape with visual agricultural structures.	Local

* as per Appendix 12 of the CDP 2013 - 2019

These views are those visible from one single location i.e. one of the views being in a north-west direction and the other being the opposite view in the south-east direction from the same place. The proposed development location lies directly east of these view locations and, as such, the development location is not within the visual envelope of either of these views. Further detail is provided in Chapter 13 –Landscape and Visual Impact in Volume 2 of this EIAR.

Fáilte Ireland indicates the number of accommodation units available in County Meath in 2015, as shown in Table 6.9. There is a wedding and events venue located at Ballymagarvey Village at Balrath Cross, 3.5 km south east of the facility and there is a B&B adjacent on the R153 (Burtonstown House B&B), as well as self-catering accommodation at Balrath Courtyard on the eastern side of the N2 at Balrath Cross.

Traffic Levels

The N2 National Primary Road is the main artery to the site and to a lesser extent the R150 (east of O'Brien's Cross Roads) and the R153 (west of Balrath Cross Roads). The predominant weekday traffic flow is southbound in the morning (toward Ashbourne) and northbound in the evening. As is typical for commuter traffic. Peak traffic flows from 2015 and 2016, as the latest data available were studied.

This study identifies receiving road network traffic conditions together with the permitted traffic generation of the development and provides an assessment of the potential impact likely to arise directly from the current proposal. All sources of traffic generation are taken into consideration and include waste related transportation, construction traffic and traffic associated with the day to day operation of the landfill which includes for the removal of leachate off site and felled forestry.

To frame the traffic assessments in the context of previous applications determined for the site, reference is made to previous Traffic Impact Assessment reports and comparison is made with the assessment scenarios and the results of various sensitivity analyses which, from the perspective of traffic and transportation, the determination of the current permission is predicated. Road safety auditing was carried out in accordance with NRA standard HD/19.

Noise levels

Quarterly noise monitoring is ongoing in accordance with the IE licence and it is undertaken at four boundary locations. In the period Q1 2015 to Q3 2018, there have been no exceedances of the daytime noise limit at the facility.

Air Quality

From the perspective of air quality pollutants, the site is located in a Zone D area as defined within AG4 guidance (rural Ireland, including towns with a population of less than 15,000). The nearest EPA air quality monitoring station within a comparably rural location is located at Monaghan (Kilkitt) and this measures a range of air quality parameters. Review of the monitoring data collected at this station over the last 3 years indicates that the measured background concentrations of relevant pollutants are substantially below their applicable limit values and Air Quality Standards.

Under the existing IE licence conditions, there is a requirement to monitor dust deposition, PM_{10}, landfill gas, emissions from the landfill gas flares and utilisation plant, as well as volatile organic compounds (VOC) from the surface of the landfill. A monitoring location map illustrating the location of each of these existing monitoring points is provided in Volume 4 of this EIAR. Figure 7.1 shows the dust and PM_{10} monitoring location points.

There are 8 no. dust monitoring points. Dust deposition results for the facility from 2013- Quarter 3 2018 have been within the EPA limit value of 350 $mg/m^2/day$ throughout 2013-Quarter 3 2018 except for two results in Quarter 2, 2014 and one result in Quarter 4 2015 where algal growth in the dust pots (as opposed to landfill operations) resulted in levels recorded above the licence limit. The elevated levels were not attributable to site activities.

PM_{10} (i.e. particulate matter less than 10 microns) monitoring is undertaken annually at six monitoring locations (PM1- PM6) at the facility. Monitored results are compared with the limit values for the protection of human health in SI No 180 of 2011 which sets a PM_{10} 24-hour limit value of 50 $\mu g/m^3$ for protection of human health. This limit value is not to be exceeded more than 35 times per year. There were no exceedances of the 50 $\mu g/m^3$ at Knockharley in the 5 year 2014-2018, all results were <10 $\mu g/m^3$.

Flare and engine stack monitoring is undertaken annually on site in accordance with Condition 6.3.2 and 6.3.3 and Schedule D of the licence. Stack testing results are available online on the EPA website. The results for the past 5 years (2014-2018) were within the Emission Limit Values (ELVs) set by the licence.

In accordance with the licence and the Odour Management Plan, odour assessments are carried out by the licensee. The landfill staff are trained to carry out odour impact assessment in accordance with AG5[1]. If odour nuisance is detected, or in response to an odour compliant, the potential source of odour is investigated and mitigated.

<u>*Recreational Options*</u>

In relation to recreation options, tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. In 2015 overseas tourist visits to Ireland grew by 13.1% to 8 million.

[1] Odour Impact Assessment Guidance for EPA Licensed Sites (AG5), EPA 2010.

Expenditure by tourists visiting Ireland is estimated to be worth €6 billion in 2015 (Fáilte Ireland, September 2016). In 2011, approximately 134,000 overseas visitors visited County Meath, contributing over €44 million to the economy (Fáilte Ireland, October 2016). The main visitor attractions in County Meath in 2012 were Tayto Park and Brú na Bóinne, Newgrange. There are a number of recreation, amenity and tourism features in the study area which are described below.

In the Meath County Development Plan 2013 -2019, County Meath has been identified as having a rich natural heritage, which includes scenic river valleys, rolling farmland, a network of mature hedgerows and diverse coastal habitats, all of which are influenced by land use and management.

It is a strategic policy of Meath County Council to ensure that features of Meath's natural heritage and green infrastructure that provide ecosystem services are protected, that biodiversity is conserved and where possible enhanced, that the character of landscapes are maintained and enriched, and that tourist and recreational uses are facilitated in a sensitive manner.

The Kentstown Local Area Plan also identifies the potential of Sommerville Demesne, located approximately 1.5 km south east of Knockharley Landfill site, from a tourism perspective in terms of encouraging further tourism related facilities in Kentstown. In addition, potential future expansion of Ballymagarvey Village, located at Balrath Cross, c. 3 km south east of the landfill site, as a tourism destination is supported by the LAP.

Table 6-9: Accommodation Units in Co. Meath

	Premises	Rooms	Beds
Hotels	18	1,117	2,614
Guesthouses	6	69	165
B&Bs	16	59	150
Self-Catering	76		527
Hostels	2		113

Meath's wealth of built heritage makes it exceptional in Ireland. It includes the UNESCO World Heritage Site of Brú na Bóinne, the seat of the High Kings of Ireland at Tara, the passage tombs of Loughcrew, the largest Anglo-Norman castle in Europe at Trim, the historic towns of Navan, Trim and Kells, great country houses, demesne landscapes, and a significant industrial heritage of canals and mills.

The proposed development is located c.5.3km from the Brú na Bóinne information centre. In 2013, 'The Boyne Valley Drive', a driving route encompassing 22 historic sites throughout County Meath and County Louth was launched in conjunction with Fáilte Ireland, Meath County Council and Louth County Council with a promotional programme aimed at the overseas market. The Boyne Valley is considered by Fáilte Ireland to be one of a number of priority destinations in Ireland. The Boyne Valley Drive presents several attractions and amenities to tourists and visitors. The Boyne Valley Drive traverses the Study Area for the purposes of this Chapter of the EIAR. The nearest of these sites to Knockharley Landfill is Brú na Bóinne which is 7 km to the north east. The Brú na Bóinne or Boyne Valley Drive includes the N51 from Navan to Drogheda and the N3 from Navan to Tara. The Boyne Valley Drive provides exceptional value landscape, which at its nearest point is approximately 5 km north east of the site

Plate 6-1 indicates the route of The Boyne Valley Walks. Balrath Woods is located c.2.8km south of the proposed development site. Plate 6-2 displays the Boyne Valley Drive in the context of Co. Meath. Plates 6-1 and 6-2 were sourced from the website www.discoverireland.ie.

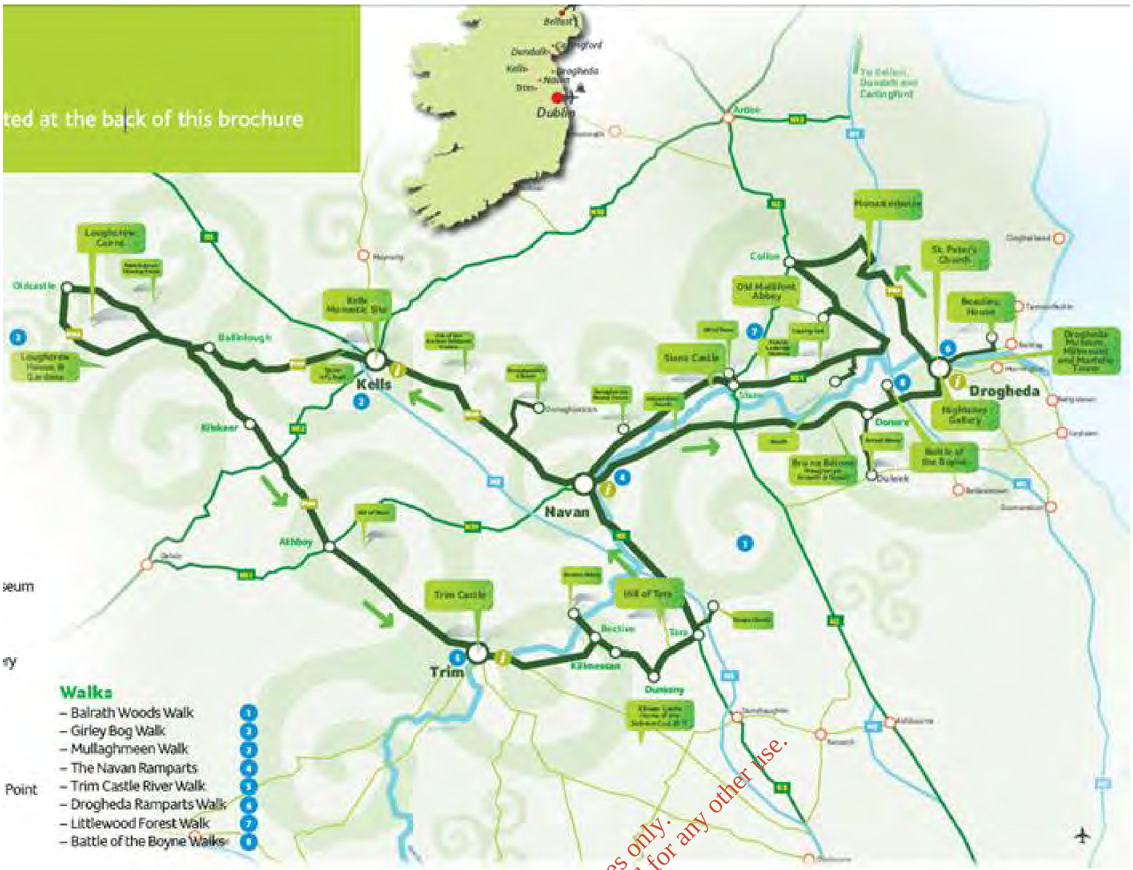


Plate 6-1: Map Extract of Boyne Valley Walks in counties Meath and Louth

Plate 6-2: Map Extract of Boyne Valley Drive in counties Meath and Louth

Moynalty Steam Threshing is a community festival, located c.30 km from the proposed development, in its 40th year, attracting locals as well as tourists from throughout Ireland and overseas. Meath is also synonymous with Slane Castle, located c.6.6 km from the proposed development, which hosts one of the largest outdoor concerts in Ireland and which has attracted tourists from throughout Ireland and from overseas.

There is a long tradition of horse racing in County Meath with fixtures held regularly at Fairyhouse, Navan and Bellewstown Racecourses and along the beach at Laytown. Fairyhouse regularly hosts National Hunt and Flat racing and is home to the Irish Grand National. Tattersalls Ireland, located in Ratoath, is renowned for selling top class National Hunt and Flat horses and also hosts the annual Tattersalls International Horse Trials and Country Fair. Sport-horse enterprises generates considerable employment in the county, through to spin off industries such as tourism. However, none of these are located within 10km of the Site.

Recreational provision within the DEDs identified include walking, cycling, angling and various team sports at dedicated sports fields. This is addressed further in Chapter 13 Landscape and Visual Impact of Volume 2.

Open Spaces

The Kentstown Rovers Football Club pitch is located directly adjacent to the north-western boundary of the Knockharley Landfill facility. Other sports facilities in the area include the Knockharley Cricket Club which is located c.1.2 km south west of the facility in the townland of Veldonstown and Seneschalstown. A GAA Club is located approximately 5 km north west of the facility in Beauparc/Yellow Furze. Balrath Football Club pitch is located to the east of the facility off the local road. Moore Park Golf club also serves the local area and is located on the R153 to the west of the village. Planning permission was granted in June 2016 by An Bord Pleanála (reg ref: Pl17.246165) for development of community sports facilities, comprising playing pitches, tennis courts and children's playground within the centre of Kentstown village c. 1.5km to the south of the proposed development.

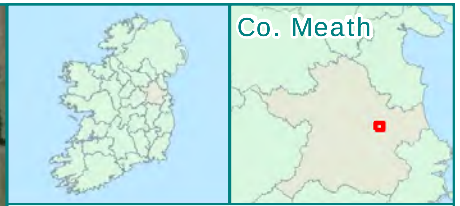
6.4.5 Existing Environment - Human Health

A human health risk assessment is the process to estimate the nature and probability of adverse health effects in humans in relation to the proposed development. This section of the EIAR considers this probability of adverse health effects. The assessment has regard to the findings of other chapters of this EIAR and provides a summary of each herein. The primary chapters of relevance to Human Health include:

- Chapter 7 Air and Climate;
- Chapter 9 Noise and Vibration;
- Chapter 11 Land, Soils and Geology; and,
- Chapter 12 Hydrology and Surface Water Quality.

Knockharley Landfill is an existing long-established facility operated by Knockharley Landfill Ltd. The existing Knockharley Landfill, operates is licensed by the EPA (Industrial Emissions Licence Register No. W0146-02). The existing facility encompasses an engineered lined landfill, environmental monitoring infrastructure, groundwater management infrastructure, leachate management system, surface water management system, gas management system, landfill capping, and landfill void. The waste acceptance hours of the site are 08.00 to 18.00 Monday to Saturday. The site does not operate on Sundays or Bank Holidays. This constitutes 312 no. working days per annum. A full description of the existing facility is provided in Chapter 2 Proposed Development of Volume 2 of this EIAR.

The surrounding environment is rural in nature. The nearest residential dwellings are located adjacent to the northern and eastern site boundaries. A map of surrounding residential properties is provided in Figure 6.5.



Legend

Site Boundary

Building Use

- Both Residential and Commerical
- Commercial
- Residential
- Unknown

Date	23/11/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Dwellings within the Vicinity of the Proposed Landfill
Figure No.	6.5
Rev.	A
Scale	1:15,000 @ A4

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6.5 Potential Significant Effects

6.5.1 Potential Significant Effects – Population

Construction Phase Effects (Direct & Indirect)

Construction of the proposed development will take place on a phased basis. The site will continue to operate during the construction process. During the construction phases of the proposed development, construction workers will travel daily to the site from the wider area. The impact of the construction phase is effect on the permanent population or settlement patterns will be imperceptible.

Operational Phase Effects (Direct & Indirect)

It is not envisaged that the operational phase of the proposed development will give rise to any direct or indirect effects on the population or settlement patterns in the study area through an increase or decrease in population or through the influencing of settlement patterns in the study area.

It is considered that the development of future residential dwellings will not be curtailed due to the proposed development as any new development will be within the existing site boundary. It should be noted that the lands within the vicinity of the site are unzoned white lands and have not on this basis has not been identified to accommodate specific residential or other development within the lifecycle of the Plan. The potential impact of the operational phase will be imperceptible.

6.5.2 Potential Significant Effects – Land Use

Construction Phase Effects (Direct & Indirect)

The construction phases associated with the proposed development will be undertaken on a phased basis, as described in Chapter 2 Description of the Development of Volume 2 of this EIAR. The construction of the proposed surface water management infrastructure, will be carried out first in a single phase, over an expected 3 – 6 month period.

These works will generate a direct, permanent effect on land use at the proposed development locations that will be realised from the construction phase onwards.

The impact on land use beyond the proposed development boundary will be imperceptible.

Operational Phase Effects (Direct & Indirect)

The proposed development will be located within the existing site boundary and will not directly or indirectly affect land use beyond the proposed development boundary during the operational phase of the development.

The land use at the proposed development will change from the existing undeveloped grasslands and vegetative habitats, to constructed lands and, as such, will be a direct effect. As the land is within the footprint of an existing waste facility, the potential for alternative land use is limited and therefore the potential impact will be not significant.

The land use in areas proposed for felling, to facilitate the development of screening berms, particularly along the western flank of the site, will be directly affected in changing from areas of mixed broadleaf and conifer plantations to constructed berms. Regardless of the proposed development, this is commercial forest which would be felled once it matures regardless of the proposed development. It is proposed to replant these screening berms as mixed broadleaf and conifer plantations.

The potential impact on land use in the forested areas of the site will therefore be slight in the short term and imperceptible in the long term.

6.5.3 Potential Significant Effects – Socio-economics, employment and economic activity

Construction Phase Effects (Direct & Indirect)

The proposed development will positively affect employment in the area through the provision of up to 30 temporary construction jobs over the different construction phases. This will benefit the economy of the area both directly through employment provision and indirectly through the purchase of construction materials from suppliers within Meath and beyond. This is positive, short term and Not Significant.

Operational Phase Effects (Direct & Indirect)

The proposed development will positively directly affect employment in the area through the provision of an estimated 10 further long-term employment positions, primarily associated with the extra staffing requirement to operate the IBA facility, the biological treatment facility and the leachate management facility.

The continued operation of the site will also provide the commercial and industrial sectors with an available outlet for the management of waste generated by these sectors, thus indirectly and positively supporting the economic activity of the Greater Dublin Area, and beyond, and contributing to meeting the needs of the Eastern & Midlands, and other regions in terms of waste management. This is positive, medium to long term and Not Significant.

6.5.4 Potential Significant Effects – Recreation, Amenity and Tourism

Potential significant direct and indirect construction and operations phase effects on identified elements of the amenity (visual appearance/landscape, and traffic) of the study area are addressed in individual chapters of this EIAR. A summary of potential significant effects of these elements as they relate to this chapter is included hereunder. Recreation options and open spaces are discussed thereafter.

Landscape and Visual Impact

The proposed development will continue the emerging trend within the site. The main landscape impacts associated with the proposed development will be the removal of existing woodland boundary planting and the construction of soil berms along boundaries to the north of the site. The proposed development will not result in significant changes in the size, elevation or landscape character and will continue to alter the landscape character in a same degree as before. In distant views the proposed biological treatment facility is well integrated due its low position on the site and the adjacent existing screen vegetation. In conjunction with the permitted solar farm, the highest visual impact of the proposed development is deemed to be Slight-Imperceptible.

Traffic

Traffic Levels – Construction Phase Effects (Direct & Indirect)

Traffic is assessed in this chapter on the basis of its potential impact on both safety and amenity in the area. The access road from the N2 to the administration area is approximately 900 m long running east to west. This is the only access point to the site for customers and construction vehicles. The existing site access geometry includes a ghost island right turn lane and nearside auxiliary turning lane which provide for the safe and efficient movement of development generated traffic with minimal disruption to N2 mainline flow. The site access has been designed in accordance with the requirements of the NRA and this design in turn has been confirmed satisfactory by the relevant planning authorities through the NRA road safety audit process at the initial design stage, at the detailed design stage and again after construction.

Construction plant is expected to mainly consist of rigid body vehicles, 8-wheel tippers, ready-mix HGV and articulated vehicles. The primary generators of traffic during construction will be construction staff and the delivery of construction materials. Construction materials are expected to be predominantly structural steel, cladding and concrete for the development of the biowaste facility building and leachate infrastructure. it is estimated that no more than 25No. HGV trips per day would be required to cater for the delivery of these materials to the site during the most intensive construction period.

This figure is considered to represent upper value or robust estimate of construction HGV traffic generation. Average construction HGV traffic generation is expected to be in the region of 15No. HGV trips per day.

Traffic generation during the construction of site infrastructure is considerably less than when such infrastructure is completed, is fully operational and receiving materials. Lesser volumes of traffic arise during the construction period and it follows that such traffic is likely to have a lesser impact than operational traffic. The local roads infrastructure has been assessed as having adequate capacity to cater for these traffic movement. The impact of construction traffic on recreation, amenity and tourism as well as road safety is therefore considered to be not significant.

Traffic Levels – Operational Phase Effects (Direct & Indirect)

Traffic is assessed in this chapter on the basis of its impact on both safety and its amenity in the area.

The road link which is expected to carry the most operational traffic is the portion of the N2 between the site access and Balrath Cross. The figures (as per Chapter 9 of Volume 2) show that the proposed development is unlikely to give rise directly to a significant increase in the number of vehicles using the regional and local roads in the vicinity of the site.

The forecast percentage incremental increases in traffic arising as a direct result of the development are considered to be within typical daily fluctuations in traffic volumes on the roads network.

In the context of the standard of access provided at the existing landfill it can be concluded that the potential incremental increase in traffic generation arising at the existing site are highly unlikely to compromise the capacity or the level of service provided by the existing local or strategic roads network serving the site. The impact of the traffic arising from the proposed development of the site will not give rise to significant impact upon the capacity and operational efficiency of the receiving road network principally the N2. The impact of operational phase traffic on recreation, amenity and tourism as well as road safety is therefore considered to be not significant.

Recreation and Open Spaces

Construction Phase Effects (Direct & Indirect)

The construction phase of the proposed development will not affect recreation options and open spaces, given that the wider development site is a functional space for dedicated waste management activities. The impact is Imperceptible.

Operational Phase Effects (Direct & Indirect)

The operational phase of the development will have a positive, direct, medium to long term effect on recreation options and open spaces through the continued support provided to local sporting facilities and teams by Knockharley Landfill Ltd., either through the Community Development Fund and/or through direct sponsorship.
The potential impact on recreation options and open spaces in the local area is positive and slight.

6.5.5 Potential Significant Effects – Human Health

The process of estimating the probability of potential adverse health effects because of the proposed development is determined by undertaking human health risk assessment. The description of the proposed development is outline is Chapter 2 – Proposed Development.

According to the US EPA, conducting human health risk assessment includes four steps:

1. Hazardous Identification
2. Dose-Response Assessment
3. Exposure Assessment
4. Risk Characterisation

Step 1 - Hazard Identification

The operation of waste management facilities e.g.an engineered non-hazardous landfill, IBA storage and a biological treatment facility have the potential for a wide variety of exposures and exposure scenarios involving a variety of factors.

Factors which can affect the likelihood of potential harmful exposure include: engineering and containment, hydrogeology and topography, the type and quantity of waste accepted leachate and gas generation

In the absence of appropriated engineering controls and abatement, the primary risk to human health mainly associated with operation of waste facilities are discharges to air and water.

To inform the hazard identification assessment, a detailed literature review of health-related literature was undertaken in the context proposed development. The focus of this review is to identify, and review published scientific literature on the potential adverse effects of operating engineered waste facilities on human health particular those handling non- hazardous wastes and IBA.

In 2003 Dublin Institute of Technology (DIT) School of Food Science and Environmental Health undertook a review of the *Health and Environmental, Effects of Landfilling and Incineration of Waste – A Literature Review,* on the request of the Department of Environment and Local Government. The aim of this review was to inform policy makers of (a) the technical aspects of both landfill and incineration practices in Ireland and (b) and adverse effects that these practices may have on the environment and human health. This study concludes that interpretation of evidence from epidemiological studies is especially difficulty to determine and that while many studies have been undertaken, evidence from research shows that wide-ranging value judgement are often made. Evidence between specific health outcomes and landfill exposure is still inconclusive.

The DIT Report identified the main potential impacts on health arise from landfill gas and leachate emissions but that direct exposure requires human contact and that much of the existing evidence on emissions relate to sites using older technologies that are not directable comparable to the emission control technologies in place at Knockharley which are considered the Best Available Techniques (BAT).

In 2004, the University of Birmingham/Enviros Consulting Limited published a review entitled *Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes.* This report was commissioned by the Department of Environment, Food and Rural Affairs. The focus of the report was to improve understanding of emissions from operations involving MSW and understand the health impacts of managing MSW. The information in the report can be used to support a “source-pathway-receptor” model for risk assessment of an individual facility, or of a waste management strategy.

The possible sources, pathways and receptors associated with management of MSW are summarised in Table 6.10 over.

Table 6-10: Possible Sources, pathways, emission and potential effects of waste management

Waste Disposal Method	Emission(s)	Pathway(s)	Receptor(s)	Potential Effects: Human	Potential Effects: Environmental
Landfill	Dust; odour; microorganisms; litter; landfill gas (CH_4, CO_2 and numerous trace compounds); exhaust gases from combustion of landfill gas (including carbon dioxide, carbon monoxide, oxides of nitrogen, sulphur dioxide, and other trace components).	Air- emissions of materials to air directly from the landfill during tipping, compacting, covering and storage activities; emissions to air of fugitive landfill gas; emissions to air of products of landfill gas combustion.	Nearby sensitive receptors in the vicinity of the landfill site; nearby sensitive habitats.	Potential for exposure to a variety of potentially harmful materials which have been investigated in connection with birth defects, asthma, respiratory disease and cancer.	Potential for soil acidification due to deposition of acid gases; increases in soil metals; vegetation damage due to oxides of nitrogen (NO_x) and sulphur dioxide (SO_2).
	Leachate containing salts, heavy metals, biodegradable and persistent organics to groundwater, surface water and sewer.	Water- leaching of materials into groundwater and surface waters due to fugitive escapes of leachate; emissions of treated and untreated leachate via permitted routes.	Nearby sensitive receptors, groundwater users and surface water users; nearby sensitive habitats.		Potential for contamination of ground and surface water with metals, organic compounds, bioaccumulation of toxic materials.
	Metals (Zinc (Zn), lead (Pb), copper (Cu), arsenic (As)), and various organic compounds.	Land contamination of land during postoperative phase.	Nearby sensitive receptors and users of postoperative site.		Potential for contamination of flora and fauna in contact with contaminated land, and possible bioaccumulation of toxic materials in flora and fauna.

In 2007, World Health Organisation (WHO) undertook a review of a wide range of waste management options entitled *Population Health and Waste Management – Scientific Data and Policy Options.*

The report considered landfills under three primary themes including:

- Emissions and Exposure;
- Scientific Evidence; and
- Critical Case Studies

In relation to emissions and exposure the 2007 report WHO notes that:

> *"With regard to landfills a wide variety of exposures, exposure pathways and exposure scenarios are involved, entailing a large complexity and difficulty in estimating the health risks and possibility involved. Only few epidemiological studies have evaluated sites with respect to the types of chemicals they contain and release; most studies on the health effects of waste landfills in fact lack direct exposure measurement and rely on residential distance from the site or sometimes on exposure modelling. Many health endpoints have been considered in epidemiological studies, including cancer incidence and mortality and reproductive outcomes such as birth defects and low birth weight. Despite the methodological limitations, the scientific literature on the health effects of landfills provides some indication of the association between residing near a landfill site and adverse health effects. The evidence, somewhat stronger for reproductive outcomes than for cancer, is not sufficient to establish the causality of the association. However, in consideration of the large proportion of population potentially exposed to landfills in many European countries and of the low power of the studies to find a real risk, the potential health implications cannot be dismissed."*

The 2007 WHO Report prepared a number of studies on waste management facilities most of which were not directly comparable to the Knockharley site.

In 2009 a *Systematic Review of Epidemiological Studies on Health Effects Associated with Management of Solid Waste* was undertaken by academics Porta D*, et al*. Because of the wide range of pollutants, the different pathways of exposure, long-term low-level exposure, and the potential for synergism among the pollutants, concerns remain about potential health effects but there are many uncertainties involved in the assessment. The aim of the review was to systematically review the available epidemiological literature on the health effects near landfills and among workers at waste-processing plants to derive usable excess risk estimates for health impact assessment.

The review reported that:

> *"In most cases the overall evidence was inadequate to establish a relationship between a specific waste process and health effects; the evidence from occupational studies was not sufficient to make an overall assessment. For community studies, at least for some processes, there was limited evidence of a causal relationship and a few studies were selected for a quantitative evaluation. In particular, for populations living within two kilometres of landfills there was limited evidence of congenital anomalies and low birth weight with excess risk of 2 percent and 6 percent, respectively."*

In summary the main difficulties about reviews of epidemiological evidence is that they are by their nature, historical. While the literature and scientific evidence may reflect the situation as it was, with far lesser engineering controls. Current management of emissions and higher levels of supervision at landfills including EPA licensing of landfills ensures much stricter controls.

While there are anecdotal reports of increased risk of respiratory, skin, nose, eye and gastrointestinal illnesses, fatigue, headaches, allergies and psychological disorders are based mainly on self-reported symptoms, which scientific research has not supported. Although this evidence must not be dismissed, consideration should be given to the strong possibility of bias and the influence of fears and worry related to the waste. In the survey by Ozonoff *et al*., residents who indicated they were worried about neighbourhood pollution reported more symptoms than those who were not worried, both in the exposed and the control area.

The literature review did not identify any studies that examined IBA storage.

With respect to the biological treatment facility, a study title "*Exposures and health outcomes in relation to bioaerosol emissions from composting facilities: a systematic review of occupational and community*" as reviewed. This study reviewed published information and database from 1960 to 2014. The study concluded that exposure information was limited and evidence based on health effects of bioaerosol emissions from composting facilities is still limited, although there is sufficient evidence to support a precautionary approach for siting facilities 250m from the nearest residence. The proposed facility in Knockharley is greater that 250m from the nearest residences.

In the context of major accidents of natural disaster, the potential sources of pollution onsite during the construction and operational phases of Knockharley Landfill are limited. The primary sources of pollution with the potential to cause significant environmental pollution and associated negative effects on human health include the bulk storage of hydrocarbons and leachate. In the case of the proposed development onsite the storage of hydrocarbons will be very limited. The leachate management system is designed in accordance with the Landfill Directive and relevant EPA guidance and operated in accordance with the IE licence, therefore the potential to cause significant negative effects on human health is very low.

There is limited potential for significant natural disasters to occur at Knockharley. Ireland does not suffer from the extremes of temperatures experiences by many countries at a similar latitude due to the dominant influence of the Gulf Stream. This provides Ireland with a mild temperate climate. Potential natural disasters that may occur are therefore limited to:

- Flooding; and
- Fire;

Should a major accident of natural disaster occur the potential sources of pollution onsite during the construction and operational phases of Knockharley are limited. The primary sources of pollution with the potential to cause significant environmental pollution and associated negative effects on human health include the bulk storage of leachate.

The risk of flooding is addressed in Chapter 12 Hydrology and Surface Water Quality of Volume 2 of this EIAR which concludes that the increase in flood levels as a result of the proposed development is considered low in significance.

Major industrial accidents involving dangerous substances pose a significant risk to human health and to the environment both on and off the site of the accident. The proposed development is not close to any site, nor is the site itself regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO.

Step 2 - *Dose Response Principal*

In principal, the term dose response suggests that the greater the dose to which an individual is exposed the greater either the likelihood of health response and/or the greater the severity of that response. Inbuilt to this term is the principle of a threshold. The threshold is the level of an agent below which one would expect no adverse response. This is a concept on which many health-based standards are based. The thresholds for these exposures are set out primarily in Chapter 7 Air and Climate and Chapter 9 Noise in Volume 2 of this EIAR. For example, in the case of noise, while there is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project The appropriate emission criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise, sets out methods and thresholds for the assessment of the significance of noise effects. Minimum criteria that are applicable to construction noise where existing noise levels are low and construction activities continue for more than one month. These are 45, 55 and 65 dB LAeq,1hr, for night-time (23:00-07:00), evening and weekends, and daytime (07:00-19:00) including Saturdays (07:00-13:00) respectively, to be applied at any nearby dwelling. Beyond this threshold, noise levels could be considered a nuisance.

Step 3 - *Exposure Assessment*

Health based standards therefore rely on the dose response concept and try to identify by scientific means the threshold below which no significant health effects would occur.

When standards are scientifically set by reliable and recognised or statutory agencies, they are a useful method in assessing the effect of any proposed change.

For example, in order to protect our health, vegetation and ecosystems, EU Directives have set out air quality standards for Ireland and the other member states for a wide variety of pollutants. These Directives include how we should monitor, assess and manage ambient air quality. The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive. Four "daughter" directives lay down limits for specific pollutants:

- 1st Daughter Directive: Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
- 2nd Daughter Directive: Carbon monoxide and benzene;
- 3rd Daughter Directive: Ozone;
- 4th Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

With regards to particulate matter, for example, the standards relate to relatively smaller particles that is, for example, PM_{10}, which is particulate matter with a diameter of less than 10µm. Larger particles which are greater than 10 µm but less than 30 µm are potentially inhaled, that is enter the nose or mouth but do not enter the alveoli and are not respired. These are usually swallowed and do not have effects on the respiratory system. Under the existing IE licence conditions for Knockharley landfill, there is a requirement to monitor dust deposition, PM_{10}, landfill gas, emissions from the landfill gas flares and utilisation plant, as well as volatile organic compounds (VOC). Monitored results are compared with the Ambient Air Quality Standard (SI. 271 of 2002) which sets a PM_{10} 24-hour limit value of 50 µg/m^3 for protection of human health. This limit value is not to be exceeded more than 35 times per year.

Dust particles which are greater than 30 µm are not inhalable so do not have an effect on human health hand typically fall to the ground. It is only if the smaller particles are increased that human health issues may arise. High sensitivity receptors to the health effects of PM_{10} are:

- Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10}

The residential dwellings located on the local roads to the immediate north and east of the landfill are considered to be sensitive receptors. Table 7.6 in Chapter 7 of Volume 2 of this EIAR sets out the sensitivity of the surrounding area to human health impacts by PM_{10} concentration. PM_{10} monitoring is undertaken annually at six monitoring locations (PM1- PM6) at the Knockharley facility. The monitoring frequency was reduced from quarterly to annually in the 3rd quarter of 2013. Monitored results are compared with the Ambient Air Quality Standard (SI. 271 of 2002) which sets a PM_{10} 24-hour limit value of 50 µg/m^3 for protection of human health. This limit value is not to be exceeded more than 35 times per year. Monitoring results are submitted annually to the EPA. There were no exceedances in the period 2013-2018.

Step 4 - *Risk Characterisation*

Risk assessment seeks to characterise the nature and magnitude of human health or environmental risk. In this step, data on the dose-response relationship of an agent are integrated with estimates of the degree of exposure in a population to characterise the likelihood and severity of potential impact. The potential primary human health impacts arise from air and noise emissions and emissions to water in the absence of mitigation. Each potential significant effect is considered hereunder.

Air Emissions

The main issues examined with respect to the potential impacts from the proposed development on air quality and climate are:

- vehicle emissions
- dust/particulate emissions
- landfill gas utilisation emissions
- process emissions
- odour emissions

The appraisal of the potential impact of dust has been carried out in accordance with guidance produced by the UK Institute of Air Quality Management (IAQM)[2]. The appraisal of vehicle emissions has been carried out using the UK Highways Agency's DMRB[3] model to predict vehicle emissions. Air dispersion modelling was carried out using AERMOD.

Climate

A desktop assessment of the potential impacts on climate was carried out. During the construction phase of Knockharley Landfill there will be an imperceptible impact on the general and national climate. During the operational phase, the proposed development will positively impact the local and national climate. Benefit to the climate will be by reducing the emission of greenhouse gases by diverting biodegradable waste from landfill for treatment and by the generation of energy in the landfill gas utilisation plant and the subsequent savings of fossil fuels at a power plant.

Air

Dust Emissions

The risk posed from earthworks, construction and track out activities during the construction phase and operational phase is deemed to be Low Risk.

Mitigation measures to be implemented during the construction and operational phases are outlined in detail in Volume 2 of this EIAR. Examples include a dust control plan, covered loads, use of vehicle wheel wash, the spraying of access roads and internal site roads during periods of dry weather to prevent dust migration from the site, monitoring in accordance with IE licence, the implementation of a speed limits on facility roads and regular inspections to mitigate dust nuisance.

Following the implementation of mitigation measure, no adverse impacts on receptors will arise from dust generation. The residual effects of dust generation at the site are considered to be 'not significant.'

Vehicle Emissions

Predicted vehicle emissions associated with the proposed development during the construction phase will be comfortably within the relevant air quality guidelines and will have an imperceptible impact on ambient air quality. During the operation phase there will be an imperceptible impact the N2 national road and an imperceptible/negligible impact on the R150 regional road. No mitigation measures are required.

[2] IAQM.2014. Guidance on the assessment of dust from demolition and construction version 1.1.www.IAQM.co.uk

[3] Design Manual for Roads and Bridges (DMRB) (Volume 11, Section 3 Air Quality, May 2007), UK Highways Agency

Landfill Gas Utilisation Emissions

The results of the modelling assessment indicate that predicted emissions are compliant with the statutory limits set out in the EU Ambient Air Quality Directive (EU 2008/50/EC) and other relevant standards (2004/107/EC, the Air Quality Standards and Environment Agency guidance) at any nearby sensitive receptors and will not impact significantly on the ambient air quality of the area. On this basis the significance of impact of emissions from the gas utilisation plant on human health is considered to be 'Not significant'

Biological Treatment Facility Emissions

Emissions from the proposed biological treatment facility will be discharged to air through a biofilter. Potential emissions from the biofilter will include ammonia, hydrogen sulphide and bioaerosols. The predicted impact of emissions from the biological treatment facility is predicted to be low.

Odour Emissions

No odour generation will be associated with the construction phase of the proposed development. No mitigation measures are therefore proposed for this phase.

The proposed changes in operation to Knockharley landfill to accept 440,000 tpa of varying types of waste has the potential to influence odour emissions generated from the site in three fundamental ways:

1. The construction of a biological waste treatment facility will introduce new sources of odour to the site which may act in combination with emissions generated from landfilling activities.
2. The quantity and quality of the waste received at the site will change and over time the location of the operational area will change as the site develops. This includes construction of an IBA facility.
3. The construction of leachate storage tanks to store the increased leachate generated from the increased acceptance of waste.

For the purposes of <u>comparing</u> the impact risk between the various operational scenarios studied in this case and evaluating the potential significance of impact in EIA terms, the following criteria for assessing potential have been applied:

- Landfilling operations (high offensive odours) threshold: $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$.
- Biological treatment facility emissions (moderately offensive odour) threshold: $C_{98,\ 1\text{-hour}} \geq 3\ ou_E/m^3$.

It is noted in Chapter 7 of this EIAR, that whilst examples are provided of the industries which may generate odours that fall into each offensiveness category, the guidance does not specify specific criteria for all industrial sectors. It is also important to note that the criteria are intended as indicative benchmarks for development of odour impact *risk*, but are not absolute standards and may vary due to local factors such as population density, complaint behaviour, receptor sensitivity etc. Selection of an appropriate criteria is therefore a matter of specialist judgement.

IAQM guidance states that based on the current evidence available, odour annoyance can develop at odour exposure levels of between $C_{98,\ 1\text{-hour}} = 1\ ou_E/m^3$ to $C_{98,\ 1\text{-hour}} = 10\ ou_E/m^3$ depending upon the offensiveness of the odour and local conditions.

Matrices are provided in Chapter 7 which outline the possible effect of odour exposure on receptors with different sensitivities (i.e. odours that are classified as 'most offensive' and 'moderately offensive'). In these matrices the likely effect is considered at different exposure levels and receptor sensitivities, ranging from negligible to substantial.

The odour impact assessment considered the odour emissions and exposure levels under the following operational scenarios:

- Scenario 0: Baseline conditions in 2018.
- Scenario 1: Year 4 'do nothing'. The situation which is likely to occur in the final active deposition stages of the landfill if it continues to operate in line with current planning and licence conditions (i.e. the development does not go ahead).
- Scenario 2: Year 4 of proposed development.
- Scenario 3: Year 6 of proposed development. The situation which will occur in the final stages of the landfill if permission is granted.

Under baseline conditions (Scenario 0), emissions from landfilling activities are predicted to be higher than for the future operational scenario (year 4) under current licence conditions (Scenario 1). This is linked to the current gas generation rates and number of cells currently with intermediate capping in place. Going forward, it is assumed that all cells will have permanent capping applied within a year of filling thus reducing potential fugitive emissions released to atmosphere.

The total emissions generated from the landfilling operations are predicted to decrease as a result of the proposed development in comparison to the current operational scenario (Scenario 0) and year 4 operation if the proposed development does not go ahead (Scenario 1). This is due to the enhanced containment of landfill gas emissions which will be achieved by the proposed development.

In overall terms, the emissions from the proposed development are predicted to increase due to the inclusion of a new biological treatment facility (Scenario 2 and 3). However, enhanced odour control techniques provisions will be provided to ensure any odours from this facility are treated prior to release through an elevated stack which will serve to disperse residual odours in the atmosphere. The offensiveness of the odours released will also be lower due to the nature of the treatment process and treatment of the air prior to release in a biofilter.

It is therefore evident that the development will lead to an overall reduction in offsite odour exposure and impact risk in comparison to the baseline and the 'do nothing' situation, up until 2022, when the existing planning approval expires. A potentially significant risk of odour impact will remain to a handful of properties to the north of the site during the remaining life of active deposition and subsequent completion of permanent capping which is estimated to be in the order of 2 no. years. Although an odour exposure of $C_{98,\ 1\text{-hour}} \geq 1.5$ is considered 'significant' according to IAQM planning guidance criteria, and in Odournet's experience it is possible for a significant adverse odour impact to develop at exposure levels as low as $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$, it should be noted that such instances are relatively rare and hence the thresholds should be considered as precautionary.

The overall conclusion of the odour impact assessment is that the development will have a beneficial effect on odour exposure and impact risk in comparison to the do-nothing scenario in the next four years. A residual risk of impact will remain to up to 4 no. properties during this period and up to 6 no. properties until the landfill is completed, based on application of the precautionary indicative odour impact criteria applied in the study.

Noise Emissions

By comparing the predicted noise emissions as detailed in Chapter 9 Noise & Vibration in Volume 2 of this EIAR, with reliable noise standards, we can determine if any health impacts are likely as a result.

The construction phases have been assessed with regard to BS 5228-1:2009+A1:2014 while the operational noise limits are assessed the limits set out the IE Licence. The two phases will occur simultaneously the cumulative impact of the construction and operational phases are assessed with regard to BS 5228-1:2009+A1:2014.

Construction Phase Effects (Direct & Indirect)

During the construction phase a conservative assumption was made that mobile plant will operate for a percentage on-time of 80% for the purpose of the noise impact assessment, mobile plant is located such that the distant between the respective construction activity and the nearest receptor is at a minimum. In practice, all mobile plant will not operate simultaneously and the distance between the plant and the nearest receptor will often be greater than the distances used in the noise model. Construction activities will be below the construction noise limit of 65 dB $L_{Aeq,1hr}$ at noise sensitive locations.

Operational Phase Effects (Direct & Indirect)

During the operation phase, a number of operational scenarios were modelled. For the majority of the scenarios modelled and the majority of receptors, the predicted noise levels are below the daytime noise limit as outlined in the sites IE Licence. However, there are 3 no. scenarios (2b, 3a and 3b) where the predicted noise levels are above the daytime noise limit at 4 no. receptors (2 no. ground floor receptors and 2 no. first floor receptors). One of the receptors is within the ownership boundary. These predicted exceedances are predominantly attributed to felling of trees (1-week duration) and construction of earth berms A and B (2-3 weeks each). These works will ultimately serve to protect the noise sensitive locations in the long term but given the close proximity of these activities to some of the noise sensitive locations there is potential for short term elevated noise levels. In the long term, once these activities are completed, no significant effects are predicted.

The cumulative impact of the combined construction and operational phases was determined to be within the relevant assessment criteria and is addressed in detail in Chapter 9 Noise and Vibration, Volume 2.

Emissions to Surface Water and Groundwater

The potential effect on water is assessed in Chapter 11 Soils, Geology and Hydrogeology, with regard to groundwater and Chapter 12 Hydrology and Surface Water Quality, with regard to surface water.

Construction Phase Effects (Direct & Indirect)

During the construction period, the development has the potential to impacts on groundwater, hydrology and surface water quality unless appropriate mitigation is applied. The proposed development at Knockharley Landfill has the potential in the absence of mitigation measures to have a Slight to Not Significant impact during the construction phase. These potential impacts include:

- Increased run-off
- Flooding
- Sediment loading
- Nutrient loading
- Exposure of groundwater
- Spills

Operational Phase Effects (Direct & Indirect)

During the operational period, the development has the potential to impact on groundwater, hydrology and surface water quality unless appropriate mitigation is applied. The proposed development at Knockharley Landfill has the potential in the absence of mitigation measures to have a Slight to Not Significant impact during the operational phase. These potential impacts include:

- Increased run-off
- Flooding
- Sediment loading
- Nutrient loading

- Uncontrolled leachate breakout
- Spills

6.5.6 Do Nothing Impact

If the proposed development does not proceed, the existing facility will continue to operate under its current consents. A direct negative impact in the form of no increased contribution to the Community Development Fund will result.

6.6 Mitigation Measures

6.6.1 Mitigation Measures– Population

No mitigation measures are proposed in relation to population, given the lack of significant direct construction and operational phase effects resulting from the proposed development.

No traffic mitigation measures are required to facilitate the proposed development, save for a commitment to adhere to the existing HGV routing arrangements.

6.6.2 Mitigation Measures – Land Use

No mitigation measures are proposed in relation to land use, given the lack of significant direct and indirect effects on land-use beyond the proposed development boundary.

6.6.3 Mitigation Measures – Socio-Economics, Employment and Economic Activity

No mitigation measures are proposed in relation to local employment and economic activity as the proposed development is considered as having positive, direct and indirect effects during the construction and operational phases.

6.6.4 Mitigation Measures – Recreation, Amenity and Tourism

No specific mitigation measures are proposed in relation to recreation, amenity and tourism given the lack of significant direct or indirect construction and operational phase effects resulting from the proposed development on recreational activity and open spaces.

6.6.5 Mitigation Measures – Human Health

Appropriate mitigation measures for potential significant effects on population and human health associated with noise, air, surface water, groundwater and soil are identified in full in their respective chapters of this EIAR.

6.7 Residual Effects after Mitigation

There are no specific mitigation measures proposed with regard to population, land use, socio-economics, employment and economic activity or Recreation, Amenity and Tourism. The residual impacts for these sections are therefore the same as those detailed in section 6.5. However, as stated previously human health also interacts with many other aspects of the environment.

The residual and cumulative impact in relation to these aspects are detailed in the individual chapters as follows:

- Chapter 7 Air and Climate
- Chapter 8 Roads, Traffic and Transportation
- Chapter 9 Noise and Vibration
- Chapter 11 Soils, Geology and Hydrogeology
- Chapter 12 Hydrology and Surface Water Quality a
- Chapter 13 Landscape and Visual Impact Assessment.

6.8 Monitoring

There is no specific monitoring proposed with regard to population, land use, socio-economics, employment and economic activity or recreation, amenity and tourism. However, monitoring requirements in relation to the following aspects are detailed in the individual chapters as follows:

- Chapter 7 Air and Climate
- Chapter 9 Noise and Vibration
- Chapter 11 Soils, Geology and Hydrogeology
- Chapter 12 Hydrology and Surface Water Quality a
- Chapter 13 Landscape and Visual Impact Assessment.

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KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 7 – AIR QUALITY & CLIMATE

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan, Co.Meath

FEHILY TIMONEY & COMPANY

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7 AIR QUALITY AND CLIMATE

This chapter was prepared by Dr Andrew Meacham and Mr Paul Ottley of Odournet UK Ltd, and Mr Adam Dawson (formerly of Odournet UK Ltd). Mr Nick Jones of Odournet UK Ltd co-authored Appendix, 7.1 the odour impact appraisal which informs the odour aspects of this Chapter.

Nick Jones is Managing Director of Odournet UK Ltd. He has over twenty-six years of experience in odour and air quality related issues. He has worked exclusively as an odour specialist for Odournet UK Ltd since 1998. He holds an Honours Bachelor of Science degree from the University College of North Wales: Bangor, in Marine Biology and Oceanography. He is a qualified Environmental Auditor and his professional memberships include the International Water Association (IWA) and the Institute of Directors (IoD).

Dr Andrew Meacham is a principal consultant and holds a BSc and PhD in chemistry. Andrew has been employed at Odournet as a specialist environmental odour consultant for 12 years.

Mr Paul Ottley is also a principal consultant and holds a BSc in Environmental Science. Paul is a member of the Institute of Air Quality Management and has been employed at Odournet as a specialist environmental odour consultant for 14 years.

Mr Adam Dawson was a consultant at Odournet for approximately 2 years, and prior to that was employed by the Environment Agency's Air Quality Modelling and Assessment Unit. Adam holds a bachelor's degree in Meteorology and Atmospheric Science and an MSc in Applied Meteorology and Climatology.

There was input to this chapter from Ms Tanya Ruddy and Ms Donna O' Halloran of Fehily Timoney and Company. Ms Tanya Ruddy is a Principal Scientist and holds a BA Mod in Environmental Science and an MSc in Environmental Management. She is a Chartered Scientist and has been employed by FT as a waste consultant for 17 years. She Ms. Donna O' Halloran is a Project Scientist. Ms Donna O' Halloran has a BSc in Agricultural Science and a MSc in Environmental Resource Management and a MSc in Ecological Assessment. She has been employed at FT for 3 years where she has carried out air and climate impact appraisals for EIS and EIAR.

Odournet UK Ltd. carried out the air quality assessment with input from Fehily Timoney and Company on the dust impact assessment and preparation of the landfill gas prediction model. Fehily Timoney and Company carried out the climate impact assessment.

7.1 Introduction

This chapter of the EIAR examines the potential effects of the proposed development on air quality and climate. It considers the potential impacts that may arise on the environment at and near the site of the proposed development and the measures proposed to mitigate such potential effects. Consideration is given to both the construction and operational phases of the proposed development. The main issues examined with respect to the potential impacts from the proposed development on air quality and climate are:

- vehicle emissions
- dust/particulate emissions
- landfill gas utilisation emissions
- process emissions
- odour emissions

An appraisal has been made with regards to the operation of the existing facility and the proposed development elements comprising the intensification of the rate of waste acceptance, storage of incinerator bottom ash (IBA), biological processing of residual municipal solid waste (MSW) fines and the storage and treatment of leachate.

The following have been considered in the preparation of this EIAR:

- Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU), (EC, 2017)
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft, (EPA, 2017)
- Guidance on the assessment of odour for planning, Version 1.1, (IAQM, 2018)
- Odour Impact Assessment Guidance for EPA Licensed Sites AG5, (EPA, 2010)
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, (NRA, 2011)
- Guidance on the assessment of dust from demolition and construction, (IAQM, 2014)
- Design Manual for Roads and Bridges (DMRB, 2007)

7.1.1 Consultation

The scope for this assessment has been informed by pre-application consultation with An Bord Pleanála, Meath County Council, prescribed bodies and other interested parties as summarised in Chapter 5 of Volume 2 of the EIAR.

This chapter considers the responses received from the consultation relating to air and climate issues.

The comments expressed in particular by Meath County Council, the Health Service Executive (HSE), and An Táisce in written consultations received from as part of the process leading up to the preparation of this EIAR were considered in the preparation of this chapter.

7.2 Existing environment

From the perspective of air quality pollutants, the site is located in a Zone D area as defined within AG4 guidance (rural Ireland, including towns with a population of less than 15,000). The nearest EPA air quality monitoring station within a comparably rural location is located at Monaghan (Kilkitt) and this measures a range of air quality parameters. Review of the monitoring data collected at this station over the last 3 years indicates that the measured background concentrations of relevant pollutants are substantially below their applicable limit values and Air Quality Standards.

Under the existing IE licence conditions, there is a requirement to monitor dust deposition, PM_{10}, landfill gas, emissions from the landfill gas flares and utilisation plant, as well as volatile organic compounds (VOC) from the surface of the landfill. A monitoring location map illustrating the location of each of these existing monitoring points is provided in Volume 4 of this EIAR. Figure 7.1 shows the dust and PM_{10} monitoring location points.

There are 8 no. dust monitoring points. Dust deposition results for the facility from 2013- Quarter 3 2018 have been within the EPA limit value of 350 mg/m^2/day throughout 2013-Quarter 3 2018 except for two results in Quarter 2, 2014 and one result in Quarter 4 2015 where algal growth in the dust pots (as opposed to landfill operations) resulted in levels recorded above the licence limit. The elevated levels were not attributable to site activities.

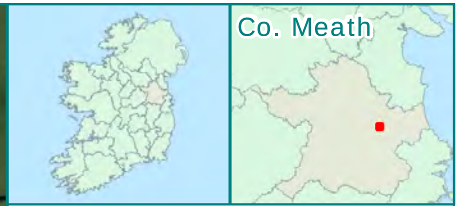
PM_{10} (i.e. particulate matter less than 10 microns) monitoring is undertaken annually at six monitoring locations (PM1- PM6) at the facility. Monitored results are compared with the limit values for the protection of human health in SI No 180 of 2011 which sets a PM_{10} 24-hour limit value of 50 µg/m^3 for protection of human health. This limit value is not to be exceeded more than 35 times per year. There were no exceedances of the 50 µg/m^3 at Knockharley in the 5 year 2014-2018, all results were <10 µg/m^3.

Flare and engine stack monitoring is undertaken annually on site in accordance with Condition 6.3.2 and 6.3.3 and Schedule D of the licence. Stack testing results are available online on the EPA website. The results for the past 5 years (2014-2018) were within the Emission Limit Values (ELVs) set by the licence.

In accordance with the licence and the Odour Management Plan, odour assessments are carried out by the licensee. The landfill staff are trained to carry out odour impact assessment in accordance with AG5[1]. If odour nuisance is detected, or in response to an odour compliant, the potential source of odour is investigated and mitigated.

[1] Odour Impact Assessment Guidance for EPA Licensed Sites (AG5), EPA 2010.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig7-1_DustAndPM10MonitoringLocations_A4.mxd



Legend

- PM$_{10}$ Monitoring Locations
- Dust Monitoring Locations
- Site Boundary

Date	19/07/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Dust and PM$_{10}$ Monitoring Locations
Figure No.	7.1
Rev.	A
Scale	1:10,000 @ A4

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7.3 Assessment Methodology

This appraisal methodology involved the review and assessment of the proposed technology and infrastructure comprised in the proposed development in order to identify potential impacts on air and climate. The methodologies used to examine the potential impacts on air and climate arising in both the construction and operation phases are outlined below.

7.3.1 Assessment of Construction Impacts

As part of the proposed development, it is proposed to construct a new incinerator bottom ash (IBA) facility including a building, leachate management facility comprising tanks and lagoons, screening berms, two ESB sub-stations and a biological treatment facility. The existing landfill will continue to operate including construction of permitted landfill cells. Felling of existing commercial forestry is required to facilitate construction of the screening berms which will be re-planted. The principal potential impacts on local air quality are the emissions of dust and PM_{10} (particles with a diameter of 10 microns or less, released into the air via direct emissions from wind-blown soil, combustion engines) from soil movement and construction vehicles during construction itself and emissions of NO_x, CO and Benzene as a result of additional traffic from construction vehicles.

The closest receptors to the site are residential developments and are listed in Table 7.5.

7.3.1.1 Construction dust

During the construction phase of this project, dust emissions are likely to arise due to particulate matter becoming airborne. This airborne dust is then available to be carried downwind from the source.

The amount of dust generated and emitted from the proposed development at the Knockharley landfill facility and the potential impact on surrounding areas will vary according to the following:

- the type and quantity of material and working method
- distance between site activities and sensitive receptors
- climate/local meteorology and topography

Potential dust particles generated from construction and site operations within the site will primarily comprise of larger dust particulates (i.e. above 30 µm) which will deposit over short distances. Likely nuisance effects from this dust are deposition on buildings and vegetation surrounding the site of the construction activities. In the absence of specific Irish guidance on the matter, the appraisal comprised in this section of the EIAR has been carried out in accordance with guidance produced by the UK Institute of Air Quality Management (IAQM)[2]. The IAQM methodology considers the effects on both residential and ecological receptors from dust and PM_{10} and an assessment is undertaken for four separate construction related activities:

- Demolition
- Trackout
- Construction
- Earthworks

The terms are defined by the IAQM guidance as:

Demolition - Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time.

[2] IAQM.2014. Guidance on the assessment of dust from demolition and construction version 1.1.www.IAQM.co.uk

Trackout - The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

This arises when heavy duty vehicles (HDVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

Construction - Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc.

Earthworks - Covers the processes of soil-stripping, ground-levelling, excavation and landscaping

The IAQM methodology suggests a four-step approach as detailed below:

- Step 1: screens the requirement for more detailed assessment
- Step 2: assesses the risk, considering the scale of the works and the sensitivity of the area
- Step 3: determines site-specific mitigation for the activities carried out
- Step 4: determines residual effects and whether or not they are significant

Following the IAQM guidance a dust assessment is recommended to be undertaken where there are human sensitive receptors:

- within 350 m of the Site boundary; and/or
- within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s).

or ecological receptors:

- within 50 m of the Site boundary; and/or
- within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s).

As there are sensitive human receptors within 350 m of the site boundary and within 50 m of the route(s) used by construction vehicles on the public highway, a full dust risk assessment has been undertaken. There are no sensitive habitat sites (i.e. Natural Heritage Areas (NHAs), proposed NHAs or European sites/Natura 2000 sites) within 50 m of the site boundary or of the route(s) used by construction vehicles on the public highway so there was no consideration of ecological receptors with regards to dust. The closest NHA/proposed NHA (pNHA) is Balrath Woods pNHA located circa 620 m from the site boundary and the closest European site is River Boyne and River Blackwater candidate Special Area of Conservation (cSAC) located approximately 4.3 km from the site boundary.

7.3.1.2 Construction Vehicle Emissions

During the construction phase of this project, traffic emissions are likely to arise due to the increase in construction vehicles required for the construction phase. These traffic emissions are airborne from the source (i.e. local road network used by construction vehicles) before dissipating.

The amount of traffic emissions generated and emitted from the proposed development at Knockharley landfill and the potential impact on surrounding areas will vary according to the following:

- the quantity and type of construction vehicles
- distance between routes used by construction traffic (local road network) and sensitive receptors
- climate/local meteorology

Potential traffic emissions from construction vehicles are comprised of a number of different polluting gases; the most notable are particulates (PM_{10}), nitrous oxides (NOx) and carbon dioxide (CO_2). These gases will be discharged into the local environment.

Particulates are known to negatively impact human health whilst NOx and CO_2 are greenhouse gases which when released can cumulatively impact on climate in the local and greater environment. The appraisal comprised in this section of the EIAR has been carried out in accordance with guidance produced by the National Road Authority[3] (NRA); now called Transport Infrastructure Ireland. This was considered the most appropriate guidance. The NRA methodology considers the potential effects on both residential and ecological receptors. The following approach was taken:

- Attain baseline air quality levels: Annual background pollutant concentrations were sourced from the EPA's three most recent ambient air quality reports (2015 - 2013) ((EPA, 2015[4]), (EPA, 2014[5]) & (EPA, 2013[6])). No values for 1,3-butadiene were available within the EPAs reports and values for benzene were not available for Zone D[7]; and will not be considered in calculations.
- Attain baseline local traffic flows: sourced from 2015 and 2016 surveys carried out by Abacus Transportation Surveys Ltd for the National road N2 and Regional road R150.
- Attain predicted construction phase traffic information: predicted traffic flows, vehicle composition (i.e. percentage cars and percentage heavy vehicles), average speed on routes being assessed.
- Determine the closest sensitive receptor to National road N2 and Regional road R150: This was done via a desktop survey of buildings and satellite imagery. The NRA (2011) defines a sensitive receptor as *"locations include: residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present."* Also, 'designated habitats' can also potentially be sensitive receptors i.e. Natural Heritage Areas (NHAs), proposed NHAs or European sites/Natura 2000 sites).
- Use the UK Highways Agency's DMRB[8] screening model as recommended in the NRA (2011) guidance to predict existing traffic emissions and predicted traffic emissions. The DMRB model predicts vehicle emissions for SO_2, NO_2 and NO_x, PM_{10}, 1,3-butadiene, benzene and CO.
- Compare predicted emissions with air quality standards: Findings were compared with the Irish ambient air quality standard - S.I. No 180 of 2011 – Air Quality Standards Regulations, 2011. These regulations set limit values and averaging periods, which are used to assess the impact of emissions on human health, vegetation and ecosystems.
- Determine the impact magnitude: The increase in predicted traffic emissions findings, between existing and construction phase were assessed according to the NRA's (2011) guidelines:
  - *Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations* (see Table 7.1)
  - *Details of the descriptors for changes in annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ at receptors* (see Table 7.2).
- If the screening model assessment predicts concentrations that exceed 90% of the air quality standards/limit values, then detailed dispersion modelling is required.
- Identify any mitigation measures to be implemented during both the construction and operational phases.

[3] NRA, 2011. Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes. Revision 1, 8TH May 2011.

[4] Air Quality in Ireland 2015, Key Indicators of Ambient Air Quality. Environmental Protection Agency, 2015

[5] Air Quality in Ireland 2014, Key Indicators of Ambient Air Quality. Environmental Protection Agency, 2014.

[6] Air Quality in Ireland 2013, Key Indicators of Ambient Air Quality. Environmental Protection Agency, 2013.

[7] Under the Air Quality Framework Directive (1996/62/EC), Ireland has been divided into four air management areas. Dublin is Zone A and Cork is defined as Zone B. Zone C consists of 16 towns with a population of greater than 15,000, while Zone D covers the remainder of the country (all towns with a population of less than 15,000 and all rural areas).

[8] Design Manual for Roads and Bridges (DMRB) (Volume 11, Section 3 Air Quality, May 2007), UK Highways Agency.

Table 7-1: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations (NRA[2])

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. Days with PM_{10} conc. >50 μg/m³	Annual Mean PM_{10}
Large	Increase/Decrease ≥4 μg/m³	Increase/Decrease > 4 days	Increase/Decrease ≥2.5 μg/m³
Medium	Increase/Decrease 2-< 4 μg/m³	Increase/Decrease 3 or 4 days	Increase/Decrease 1.25 - <2.5 μg/m³
Small	Increase/Decrease 0.4 - <2 μg/m³	Increase/Decrease 1 or 2 days	Increase/Decrease 0.25 - <1.25 μg/m³
Imperceptible	Increase/Decrease <0.4 μg/m³	Increase/Decrease <1 day	Increase/Decrease <0.25 μg/m³

Table 7-2: Descriptors for changes in Annual Mean Nitrogen Dioxide, PM_{10} and $PM_{2.5}$ at Receptors (NRA[2])

Absolute Concentration In relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value with Scheme (≥40 μg/m³ of NO_2 or MP_{10}) (≥25 μg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective/limit value with scheme (36- <40 μg/m³ of NO_2 or PM_{10}) (22.5 - <25 μg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below objective/limit value with scheme (30- <36 μg/m³ of NO_2 or PM_{10}) (18.75 - < 22.5 μg/m³ of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well below objective/limit value (<30 μg/m³ of NO_2 or PM_{10}) (<18.75 μg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Scheme			
Above objective/limit value without scheme (≥40 μg/m³ of NO_2 or PM_{10}) (≥25 μg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just below objective / limit value without scheme (36 - <40 μg/m³ of NO_2 or PM_{10}) (22.5 - <25 μg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below objective/limit value without scheme (30 - <36 μg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 μg/m³ of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well below objective/limit value without scheme (<30 μg/m³ of NO_2 or PM_{10}) (<18.75 μg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

7.3.1.3 Assessment of Climate Impacts

A desktop assessment of the potential impacts on climate was carried out. This chapter includes an assessment of the likely impacts on climate change.

A flood risk assessment was carried out to determine the risks associated with increased rainfall as a consequence of climate change. This is included in Chapter 12 of this EIAR.

7.3.2 Assessment of Operational Impacts

An assessment of the site operations has been undertaken to determine the impact of emissions to air as a result of operating under the proposed development. The operation of the proposed facility could result in potential emissions to air from the gas utilisation plant, dust, vehicle emissions from transferring waste to site, odour emissions from deposition or handling of waste and from the biological treatment plant. To assess the extent of the emissions from the proposed development the following scenarios will be considered:

- Impact on nearby residential and ecological receptors from operation of the landfill gas utilisation plant.
- Impact to human health on nearby residential receptors from road traffic due to operation of the landfill.
- Impact on human receptors in relation to odour exposure relating to operation of the landfill and the associated landfill gas utilisation plant and biological treatment plant.

During derivation of emission rates and modelling parameters, conservative assumptions have been assumed with details presented in the following sections. Considering the potential impacts stated above, the emission limits in the following sections have been deemed to be applicable.

7.3.2.1 Assessment of landfill gas utilisation emissions

To fully assess the operational impact of the landfill gas utilisation plant upon both residential and ecological receptors consideration was given to the following pollutants:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2);
- Total dust (as PM_{10});
- Carbon monoxide (CO);
- Hydrogen chloride (HCL);
- Hydrogen fluoride (HF);
- Total non-methane volatile organic compounds (TNMVOC)
- Nitrous oxides (NOx)

To assess the potential impact of the emissions from the landfill gas utilisation plant, an air dispersion modelling study was undertaken in accordance with the EPA guidance [9]. In accordance with this standard the results of the modelling study were compared to the EU Ambient Air Quality Directive (EU 2008/50/EC) as shown in Table 7.3.

[9] Air Dispersion Modelling from Industrial Installations Guidance Note (AG4), (EPA, 2010).

Relevant Standards

The European air quality objectives presented below have been transposed into Irish legislation by the *Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)* with the EU 4th Daughter Directive passed into the *Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009* (S.I. No. 58 of 2009). In the absence of EU ambient air quality limit values for hydrogen chloride (HCl) and hydrogen fluoride (HF), Environmental Assessment Levels (EALs) from the UK were examined for limit values for these parameters and are shown in Table 7.4.

Table 7-3: European Union Limit and target values as outlined in Directives 2008/50/EC and 2004/107/EC

Pollutant	Obligation	Time Period	Legal Nature	Allowable Exceedances
Nitrogen Dioxide	200 µg/m³	1 hour	Limit Value	18 (99.79 %ile)
	40 µg/m³	Annual	Limit Value	n/a
Sulphur Dioxide	350 µg/m³	1 hour	Limit Value	24 (99.79 %ile)
	125 µg/m³	24 hours	Limit Value	3 (99.18 %ile)
PM_{10}	50 µg/m³	24 hours	Limit Value	35 (90.41 %ile)
	40 µg/m³	Annual	Limit Value	n/a
$PM_{2.5}$	25 µg/m³	Annual	Target Value	n/a
Carbon Monoxide	10 mg/m³	Maximum daily 8 hour mean	Limit Value	n/a
Benzene	5 µg/m³	Annual	Limit Value	n/a
Lead	0.5 µg/m³	Annual	Limit Value	n/a
Ozone	120 µg/m³	Maximum daily 8 hour mean	Target Value	25 (Over three years)
Arsenic	6 ng/m³	Annual	Target Value	n/a
Cadmium	5 ng/m³	Annual	Target Value	n/a
Nickel	20 ng/m³	Annual	Target Value	n/a
Polycyclic Aromatic Hydrocarbons (As B_aP)	1 ng/m³	Annual	Target Value	n/a
NO_x (Annual critical level for the protection of vegetation & natural ecosystems)	30 µg/m³	Annual	Limit Value	n/a

In order to ensure a robust and conservative assessment, as a precaution, all TNMVOC will be assumed to be benzene and compared against the European limit value of 5 µg/m³.

Table 7-4: Hydrogen Chloride and Hydrogen Fluoride EALs as per Environment Agency air emissions risk assessment[10]

Pollutant	Obligation	Time Period	Allowable Exceedances
Hydrogen Fluoride	160 µg/m^3	1 hour	None (100th percentile)
	16 µg/m^3	Annual	Annual
Hydrogen chloride	750 µg/m^3	1 hour	None (100th percentile)

An assessment was also made against the Annual critical level for the protection of vegetation and natural ecosystems as required by AG4. There are no specific screening distances stated by AG4, so a screening distance of 15 km (which exceeds the Environment Agency's Air emissions risk assessment[9] guidance screening distance of 10 km) for all designated European sites (special protection areas, candidate special areas of conservation or Ramsar sites) was used. This therefore requires assessment of the potential air quality and climate impacts arising on the following:

- River Boyne and River Blackwater cSAC (site code 002299)
- Boyne Estuary SPA (site code 004080)
- River Boyne and River Blackwater SPA (site code 004232)

In addition, the River Nanny Estuary and Shore SPA (site code 004158) which is located greater than 15 km, but is ecologically connected via the River Nanny, is also considered.

Predicted concentrations at these locations will be compared against the NO_x Annual critical level of 30 µg/m^3.

Model Selection

AERMOD is an advanced air model which increases the reliability and accuracy of the predictions and allows the calculation of emission concentration percentiles for the comparison to ambient air quality regulations. Based on guidance issued by the EPA (AG4), it is considered that AERMOD is appropriate for the assessment of impacts of pollutant emissions from this facility. The AERMOD regulatory option for multiple pollutant modelling was used in this assessment.

This model is appropriate for this assessment as in the region of the site there are no complex terrain features which would significantly alter meteorological conditions. Also, due to the low source stack heights in this assessment, pollutant concentrations over long distances are not considered significant.

Receptors

A receptor is a location at which the model will calculate a specific ground level concentration. The height of the receptor is set at 1.5 m which represents the breathing level of humans.

The model was set up to assess the impact of emissions on discrete receptors which were placed on 25 of the sensitive residential receptors in the vicinity of the site. A complete list of the residential receptors that were considered is presented below with their locations presented in Figure 7.2.

[10] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Table 7-5: List of Sensitive Residential Receptors considered within the Model

Receptor ID	Receptor	UTM Easting (m)	UTM Northing (m)
1	Residential	663914	5947101
2	Residential	663964	5946962
3	Residential	663964	5946923
4	Residential	664022	5946690
5	Residential	664058	5946521
6	Residential	664179	5946270
7	Residential	663986	5945868
8	Residential	663732	5945583
9	Residential	663227	5945341
10	Residential	662604	5945704
11	Residential	661972	5946400
12	Residential	661868	5947142
13	Residential	661960	5947375
14	Residential	662181	5947349
15	Residential	662566	5947552
16	Residential	662829	5947662
17	Residential	662958	5947709
28	Residential	663191	5947772
19	Residential	663421	5947848
20	Residential	663537	5947794
21	Residential	663600	5947901
22	Residential	663805	5947914
23	Residential	663824	5947794
24	Residential	663838	5947673
25	Residential	663909	5947366

Figure 7-2: Location of sensitive receptors included within the dispersion model as blue dots with the planning boundary of Knockharley Landfill shown in red

Building Downwash

Good engineering practice is to select a stack height which is sufficiently high to avoid structural or building wake-effect induced downwash. Downwash brings pollutants closer to ground level at a shorter downwind distance giving the worst-case scenario for a particular site.

Relevant building dimensions were inputted into the model. The model software Building Profile Input Parameters (BPIPRPIME) was run to calculate the potential for building downwash on each emission source in each of the 36 wind direction sectors (10° width/sector). This model also calculates GEP heights where the effect of building downwash is eliminated. This data is then used in AERMOD to calculate plume downwash (i.e. adjusted plume centreline due to building wake affects). The effect of building downwash is only considered for point sources.

Meteorological Data

The meteorological data used by the model to simulate the dispersion and dilution effects generated by the atmosphere has been selected with reference to the AERMOD Implementation Guide[11], which advises that the most representative meteorological dataset should be utilised. This will be influenced by both proximity to the study site and the representativeness of the surface characteristics of the meteorological station in comparison to the study site.

[11] AERMOD Implementation Guide, Published by the US EPA, Last Revised: August 2015

Sequential hourly average meteorological data from Dublin Airport was utilised for the years 2012 – 2016[12]. This complies with Irish EPA AG4 guidance that states that the last year of meteorological data used must be within 10 years of the assessment year. Dublin Airport is located approximately 30 km to the south-east of the site and the estimated annual mean windspeed at the site is between 4-6 m/s from the Met Éireann website. The annual wind speed of the data between 2012-2016 from Dublin airport is 5.6 m/s therefore is within the expected range for this area of Ireland. The meteorological data was adjusted to reflect the surface characteristics of the study site in accordance with the guidelines in the AERMOD User Guide issued by the US EPA[5].

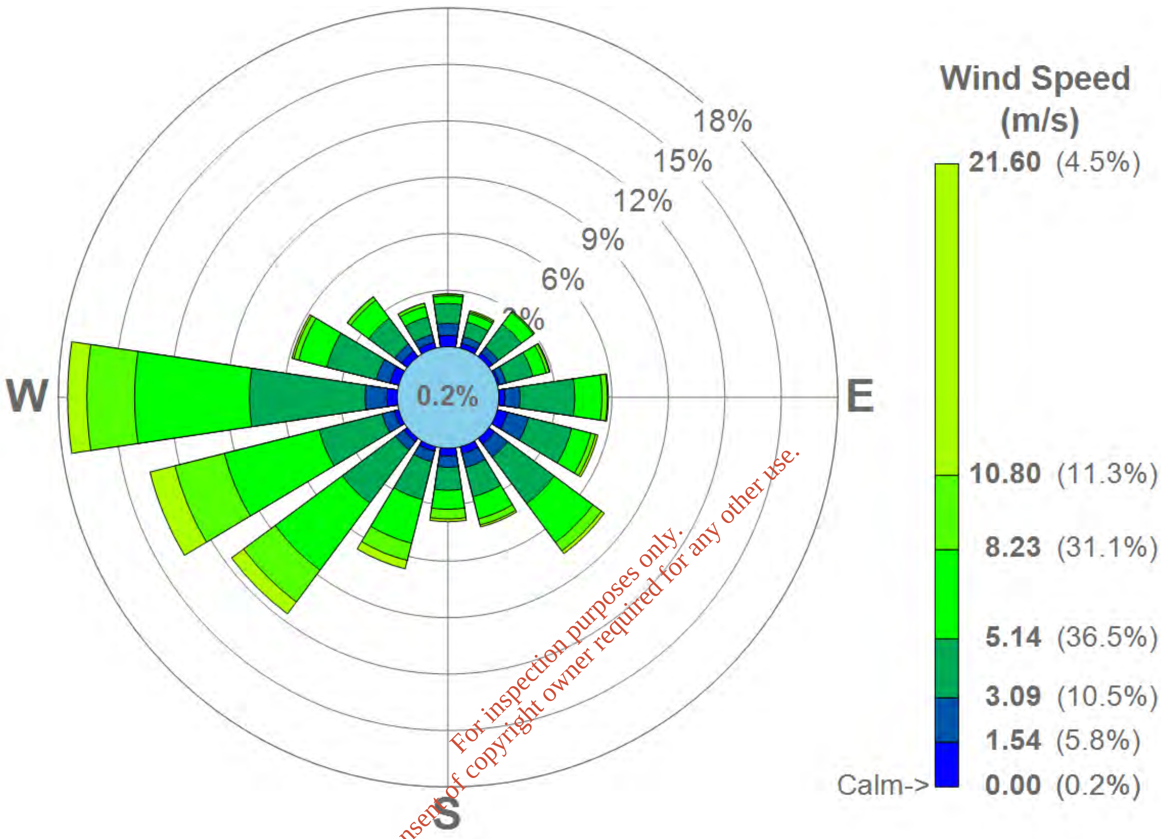

Figure 7-3: Windrose for Dublin airport (2012-2016)

Nitric Oxide to Nitrogen dioxide conversion

In line with AG4 guidance, the PVMRM NO_2/NO_X conversion method was used in AERMOD to take into account the portion of NOx converted to NO_2 in the atmosphere. This conversion assumes that 90% of the released emissions are nitric oxide and that there is an ambient ozone concentration of 57 µg/m^3. This is based on data collected by the EPA[13] at Macehead Galway in 2016. 2016 is the latest hourly ozone published by the Irish EPA and Macehead Galway is considered to be in Zone D (a town with a population less than 15,000). Therefore, based on the guidance outlined in AG4 Galway is considered to be representative of ozone concentration at Kentstown, near Knockharley landfill.

Background concentrations

The modelled facility contribution was also added to maximum EPA monitored rural background concentrations and compared to the relevant ambient air quality guidelines, in accordance with AG4.

[12] www.meteireann.ie

[13] http://www.epa.ie/air/quality/monitor/

The table of relevant background monitoring data is presented below:

Table 7-6: Background pollutant data used within this assessment

Location	Pollutant	Hourly average pollutant concentration (µg/m³) unless stated			
		2014	2015	2016	Average
Monaghan_Kilkitt	NO_2 (µg/m³)	2.64	-	3.01	2.82
Monaghan_Kilkitt	SO_2 (µg/m³)	1.7	2.15	1.18	5.03
Monaghan_Kilkitt	PM_{10} (µg/m³)	8.89	9.22	8.14	8.75
Monaghan_Kilkitt	CO (mg/m³)	-	-	0.4	0.4
Kilkenny (Seville Lodge)	Benzene	0.09	0.13	0.2	0.14

Background concentrations for HCL or HF are not routinely monitored in Ireland or in the UK and are unlikely to be high in rural locations such as Kentstown near Knockharley landfill; for this assessment their background concentrations have been assumed to be zero.

In line with AG4, the above background levels are doubled when assessing against short term emission standards with the exception of PM_{10} where under standard practice this is not undertaken due to the small ratio between the annual and 24-hourly standard.

Assessing significance

To assess the significance of the process contribution to each pollutant's standard (short term and long term) the PC has been compared to AG4's Maximum Allowable Process Contribution:

Maximum Allowable Process Contribution = (AQS – Background Concentration) / 1.5).

This is key to ensuring that future developments can be permitted while ensuring compliance with Irish limit values.

The draft EPA "Guidelines on The Information to Be Contained in Environmental Impact Assessment Reports" (2017) describes the following seven generalised degrees of impact significance that are commonly used in EIA:

- **Imperceptible** - An effect capable of measurement but without significant consequences.
- **Not Significant** - An effect which causes noticeable changes in the character of the environment but without significant consequences.
- **Slight** - An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- **Moderate** - An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
- **Significant** - An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
- **Very Significant** - An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
- **Profound** - An effect which obliterates sensitive characteristics

For each pollutant assessed, one of the significance descriptors was applied, taking into account the above descriptions.

7.3.2.2 Assessment of Vehicle Emission Impacts

The assessment of the impact of vehicle emissions during the operational phase was carried out using the same methodology as for the assessment of vehicle emissions for the construction phase and this is described in Section 7.3.1.1.

7.3.2.3 Assessment of Odour Emission Impacts

Estimation of the odour emissions generated was undertaken for both current (2018) and proposed future operational scenarios. An assessment has been undertaken using information gathered from:

- Site visits;
- Onsite odour measurement data;
- Dispersion modelling.

Specific consideration was given to the changes to the current site operations which are likely to occur as a result of the proposed development (e.g. in terms of variation in the quantity and type of waste received and location of the filling activities) and the contribution of odours from any additional odour sources which may be introduced to the site as part of the proposed biological waste treatment facility. The description of the proposed development is in Chapter 2 of Volume 2 of this EIAR.

The study assessed the potential odour emissions and predicted exposure levels under the following operational scenarios:

- Scenario 0: Baseline conditions in 2018.
- Scenario 1: Year 4 'do nothing'. The situation which is likely to occur in the final active deposition stages of the landfill if it continues to operate in line with current planning and licence conditions (i.e. the proposed development does not proceed).
- Scenario 2: Year 4 of proposed development.
- Scenario 3: Year 6 of proposed development. The situation which will occur in the final stages of the landfill if the proposed development is permitted.

For each operational scenario, the odour emissions generated from the landfill were estimated in terms of European odour units (ou_E/m^3)[14] by development of a 'site emission model' using on-site odour concentration measurements of the waste and landfill gas, operational details of the site supplied by the client and estimation of gas leakage using a landfill gas production model (current and future operating scenario).

In order to assess the veracity of this model and how it is likely to compare to real world conditions, a series of field assessments were also conducted under the current baseline conditions. This dual approach for assessment is consistent with current best practice.[15] Further details of the methodology are presented in Appendix 7.1.

The emission estimates derived from this approach were then inputted into a dispersion model which was applied to assess the level of exposure to odour that is likely to occur around the site under the full range of meteorological conditions representative of the area.

The outputs of the model were then compared against published odour impact criteria (see below) to assess how the risk of odour impact is likely to change as a result of the development.

[14] A European Odour Unit is defined that amount of odorant(s) that, when evaporated into 1 cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in one cubic metre of neutral gas at standard conditions. One EROM is equivalent to 123 mg n-butanol (CAS-Nr. 71-36-3) evaporated in 1 cubic metre of neutral gas this produces a concentration of 0,040 mmol/mol.

[15] Guidance on the assessment of odour for planning, Version 1.1 - July 2018, Institute of Air Quality Management, UK

The model was constructed using the AERMOD atmospheric dispersion model published by the US Environmental Protection Agency (US EPA), with meteorological data sourced from Dublin airport. Impact risk was assessed on the basis of the worst case meteorological year from a 5-year data set of sequential hourly average data.

The model was constructed and applied in accordance with guidance published by the model developer (the US EPA) and relevant guidance published by the Irish EPA[16], the UK Environment Agency[17] and the Institute of Air Quality Management (IAQM)[18].

All dispersion modelling for odour emissions was undertaken using the same base model construction as for the air quality assessment in Section 7.3.2.1, with the following exceptions:

- A receptor grid of 3.7 km by 3.7 km (50 m resolution), centred on the site, was utilised in the model. The height of the receptor is set at 1.5 m which represents the breathing level of humans.
- The 2012 meteorological year was considered the worst-case year for proposed operational conditions. [19]
- The model only considered emissions generated under the normal running conditions for the facility.
- The receptors presented in Figure 7-4 were also included within the dispersion model, to allow a comparison of predicted odour exposure levels between the modelled scenarios.

Map imagery: Google Earth. The red line indicates the planning boundary of the facility. Discrete receptors considered within the dispersion model are presented as blue stars.

Figure 7-4: Discrete receptors considered within odour dispersion model

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[16] Irish EPA (2010). Air Dispersion Modelling from Industrial Installations Guidance Note (AG4). Irish EPA

[17] IPPC H4 Technical Guidance Note “H4 Odour Management”, Environment Agency (England), March 2011.

[18] Guidance on the assessment of odour for planning, Version 1.1 - July 2018, Institute of Air Quality Management, UK

[19] The worst case meteorological year has been defined on the basis of highest predicted odour exposure at a residential property in any of the future operational scenarios.

In general terms, odour impact is recognised as a symptom that develops because of intermittent but regular exposure to odours that are recognisable and have an offensive character. The key factors that contribute to the development of odour annoyance can be usefully summarised by the acronym FIDOL:

- Frequency of exposure
- Intensity or strength of exposure
- Duration of exposure
- Offensiveness
- Location sensitivity

In acknowledgement of these factors, odour impact assessment techniques have been developed in Europe and internationally that involve the application of atmospheric dispersion models and indicative odour impact criteria. These criteria are generally defined in terms of a minimum concentration of odour (reflecting the intensity/strength element of FIDOL) that occurs for a defined minimum period of time (reflecting duration and frequency element of FIDOL) over a typical meteorological year. The concentration element of these criteria can be increased or lowered to reflect variations in the offensiveness of the odours released from a specific type of facility, and the sensitivity of nearby sensitive locations.

The unit used to express exposure concentration in these criteria is the European odour unit (ou_E).[20]

In the UK and Ireland, the most commonly applied odour impact criteria are derived from research conducted by the UK Environmental Agency which were originally published in the UK guidance note H4. These criteria are also referenced in more recent guidance note AG4[21] published by the Irish Environmental Protection Agency. The criteria define odours in three offensiveness brackets as indicated in the table below and have been designed for application to permanent residential properties which are considered to be the most sensitive from an impact risk perspective.

Table 7-7: Impact criteria defined in H4 and AG4

Exposure level	Relative offensiveness of odour	Example industrial sectors
$C_{98,\ 1\text{-hour}} \geq 1.5$ ou_E/m^3	High (or most offensive)	Rendering, Fish Processing, Oil Refining, Creamery, WWTP, Fat & Grease Processing, biological landfill odours.
$C_{98,\ 1\text{-hour}} \geq 3$ ou_E/m^3	Medium	Intensive Livestock Rearing, Food Processing (Fat Frying), Paint-spraying Operations, Asphalt Manufacture
$C_{98,\ 1\text{-hour}} \geq 6$ ou_E/m^3	Low (or least offensive)	Brewery, Coffee Roasting, Bakery, Chocolate Manufacturing, Fragrance & Flavouring

It is important to note that whilst examples are provided of the industries which may generate odours that fall into each offensiveness category, the guidance does not specify specific criteria for all industrial sectors. It is also important to note that the criteria are intended as indicative benchmarks for development of odour impact *risk* but are not absolute standards and may vary due to local factors such as population density, complaint behaviour, receptor sensitivity etc. Selection of an appropriate criteria is therefore a matter of specialist judgement.

In terms of planning, further informative guidance has been published by the UK Institute of Air Quality Management (IAQM)[22].

[20] EN13725: 2003. Air Quality: Determination of odour concentration by dynamic olfactometry

[21] Air Dispersion Modelling from Industrial Installations Guidance Note 4 (AG4), Environment Protection Agency.

[22] Guidance on the assessment of odour for planning, published by IAQM: July 2018

This guidance states that based on the current evidence available to the authors, odour annoyance can develop at odour exposure levels of between $C_{98,\ 1\text{-hour}}$ = 1 ou_E/m^3 to $C_{98,\ 1\text{-hour}}$ = 10 ou_E/m^3 depending upon the offensiveness of the odour and local conditions.

Two matrices are then provided which outline the possible effect of odour exposure on receptors with different sensitivities (i.e. odours that are classified as 'most offensive' and 'moderately offensive') as indicated in the figures below. In these matrices the likely effect is considered at different exposure levels and receptor sensitivities, ranging from negligible to substantial. Where the effect is above 'slight', it is likely to be considered significant in EIA terms.

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Moderate	Moderate	Substantial
3-<5	Slight	Moderate	Moderate
1.5-<3	Negligible	Slight	Moderate
0.5-<1.5	Negligible	Negligible	Slight
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

Figure 7-5: Proposed odour effect descriptors for impacts predicted by modelling- 'Most offensive' odours (Source: IAQM[21])

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Slight	Moderate	Moderate
3-<5	Negligible	Slight	Moderate
1.5-<3	Negligible	Negligible	Slight
0.5-<1.5	Negligible	Negligible	Negligible
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

Figure 7-6: Proposed odour effect descriptors for impacts predicted by modelling- 'Moderately'' odours (Source: IAQM[21])

Review of the figures indicate that for odours that fall into the 'most offensive' category, the threshold for development of a risk of significant impact from an EIAR perspective occurs at exposure levels of $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$ for highly sensitive receptors (e.g. residential property), whilst for an odour that is considered to be moderately offensive, the threshold is $C_{98,\ 1\text{-hour}} \geq 3\ ou_E/m^3$. As exposure levels increase above these threshold levels, the probability of a significant impact occurring also increases.

Bearing in mind that odorous emissions from landfilling operations generally comprise a mixture of landfill gas and waste odour which fall into the high (or most) offensive category, these thresholds are generally consistent with Odournet's experience, which indicates that it is possible for a significant adverse odour impact to develop at exposure levels as low as $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$. However, it should be noted that such instances are relatively rare and hence the thresholds should be considered as precautionary. This position also appears to be supported by research published by SNIFFER[23] in a study that was co-funded by the Environmental Protection Agency (EPA), which states: 'for odour from landfill sites an impact criterion of $C_{98,\ 1\text{-hour}} = 3\ ou_E/m^3$ or less is usually applied in the UK and the Republic of Ireland for purposes of assessment and regulation'.

For the purposes of comparing the impact risk between the various operational scenarios studied in this case and evaluating the potential significance of impact in EIA terms, the following criteria for assessing potential have been applied:

- Landfilling operations (high offensive odours) threshold: $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$.
- Biological treatment facility emissions (moderately offensive odour) threshold: $C_{98,\ 1\text{-hour}} \geq 3\ ou_E/m^3$.

For odour, dispersion modelling of the existing environment (current baseline (April 2018)), is presented in Section 7.4.2.4.

7.3.2.4 Assessment of Climate Impacts

The assessment of the impact on climate during the operational phase was carried out using the same methodology as for the assessment of climate impacts for the construction phase and this is described in Section 7.3.2.

7.4 Assessment of Potential Impacts

7.4.1 Construction Phase

As already stated the principal potential sources of air emissions during the construction of the proposed facility are dust, PM_{10} and vehicle emissions. These impacts have been assessed individually below.

7.4.1.1 Dust Emissions

As discussed in section 7.3.1 above the IAQM dust guidance uses a 4-step assessment methodology to assess the risk of dust during construction.

Step 1 Screening

There are sensitive human receptors within 350 m of the site boundary and within 50 m of the route(s) used by construction vehicles on the public highway, so a full dust risk assessment was undertaken. There are no sensitive ecological receptors within 50 m of the site boundary or of the route(s) used by construction vehicles on the public highway, so no consideration has been made of ecological receptors with regards to dust.

[23] SNIFFER, Odour Monitoring and Control on Landfill Sites, ER31, February 2013; and Odour Management Plan Reports for Landfills, ER31, February 2013

Step 2a – Defining the Potential Dust Emission Magnitude

The magnitude of dust emissions, either small, medium or large is assigned to 4 aspects of construction that have the potential to cause a large amount of dust.

As stated in section 7.3.1 these are demolition, earthworks, construction and trackout. There is no planned demolition because of the proposed development at Knockharley, so this will not be assessed further.

Based on the scale and nature of the proposed works at the site, the magnitude of potential dust emission from the site was determined for earthworks, construction and trackout in Table 7.8.

Table 7-8: Assessment of Dust Emission Magnitude (IAQM)

Activity	Dust Emission Magnitude
Earthworks	Large
Trackout	Large
Construction	Medium

The basis for identifying the above magnitudes for each activity is outlined below:

- Earthworks: Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.
- Trackout: >50 HDV (Heavy Duty Vehicles) (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m.
- Construction: Total buildings volume > 100,000 m^3, but large areas of these buildings will be hollow as the main function of volume is to facilitate plant operation and main activities are reception and composting and weathering.

Step 2b – Defining the Sensitivity of the Area

The sensitivity of the area is then defined by the nature of the receptor and the number of receptors and distances from construction operations.

The sensitivity of the area with regards to:

- Dust sensitivity is considered to be low; while the main nearby receptors are residential and would expect a high level of amenity there are less than 10 receptors within 100 m of likely area of construction or trackout.
- PM_{10} sensitivity is considered to be low; the background levels for PM_{10} are around 9 µg/m^3 which is considerable lower than 24 µg/m^3 where IAQM guidance indicates that sensitivity may increase; dependant on the number of nearby receptors.
- Ecologically sensitive receptors are considered to be low; the closest NHA/proposed NHA (pNHA) is Balrath Woods pNHA located circa 620 m from the site boundary and the closest European site is River Boyne and River Blackwater candidate Special Area of Conservation (cSAC) located approximately 4.3km from the site boundary.

For both assessments, the source of dust deposition was conservatively taken as the centre of the proposed IBA facility, approximately 100 m north east of the current office administration buildings located on site.

Step 2c - Define the Risk of Impacts

The dust emission magnitude determined in step 2a is combined with the sensitivity of the area determined at step 2b to determine the risk of impacts with no mitigation applied for each section (construction, and trackout). As the sensitivity of the area was determined to be low, IAQM suggests that the risk is always considered to be low regardless of the emission magnitude, with the exception for demolition works which are not considered in this assessment.

The results of the assessment are presented below:

Table 7-9: Risk of Impact

Activity	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Low Risk	Low Risk
Human Health	Low Risk	Low Risk	Low Risk
Ecological	Negligible	Negligible	Negligible

With regard to dust (dust soiling) and PM_{10} (human health), the risk from earthworks, construction and trackout activities during the construction phase is deemed to be Low Risk. Less than 10 sensitive receptors (residents/buildings) are located to the north and east of the redline (planning) boundary. Commercial forestry is also located within the site and this includes the areas of the northern and eastern boundaries of the site. Existing forestry will help to buffer dust and PM_{10} contributing to further mitigation of the Low Risk impact to sensitive receptors located within 100 m from the redline boundary.

With regard to ecology, the risk from earthworks, construction and trackout activities during the construction phase are deemed to be Negligible as ecologically sensitive receptors are located outside the zone of potential impact from dust and PM_{10}.

7.4.1.2 Vehicle Emissions

The baseline air quality levels (for Zone D in which the site is located) were sourced from the EPA's three most recent ambient air quality reports (2015 - 2013) which were averaged. Existing traffic flows and predicted construction traffic flows as well as vehicle composition, average speed and closest sensitive receptors for the local road network (National road N2 and Regional road R150) were attained. This information was then inputted into a DMRB screening model to predict existing and construction phase traffic emissions for the National road N2 and Regional road R150. The closest sensitive receptor for the N2 was located 10 m from the national road while the closest sensitive receptor for the R150 was 3 m from the regional road. Existing (2018) and the construction phase/year 1 (2019) emissions of CO, NO_x, NO_2 and PM_{10} were calculated for the N2 and R150 between the N2 and Duleek (see Table 7-11 for results).

The results were then compared with Air Quality Standards Regulations 2011 limits (Table 7-10) which indicate that traffic emissions during year 1 (2019) of the development will remain within acceptable Air Quality Standards Regulations 2011 limits. The increase in traffic emission between existing traffic emissions and year 1 (2019) (Table 7-11) were then compared with Table 7-1 NRA's Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations and Table 7-2 Descriptors for changes in Annual Mean Nitrogen Dioxide, PM10 and PM2.5 at Receptors which indicates that the increase in traffic emissions will be imperceptible.

As results indicate the impact from traffic emissions from the construction phase will be imperceptible, detailed dispersion modelling was not required, nor were mitigation measures.

To conclude, the impact from increased traffic flows will have an imperceptible impact on sensitive receptors along N2 (closest receptor 10m from road edge) and R150 (closest receptor 3m from road edge).

Table 7-10: Air Quality Standards Regulations 2011 limits

Pollutant	Air Quality Limits
CO	10,000 µg/m³ or 8620 ppb maximum daily 8 hour mean
NO_x	30 µg/m³ measured over a calendar year
NO_2	200 µg/m³ or 105ppb measured over 1 hr or 40 µg/m³ or 21 ppb measures over a year
PM_{10}	50 µg/m³ measured over 24hrs and 40 µg/m³ measured over a calendar year

Table 7-11: Predicted Levels of Pollutants from Traffic Emissions for Year 1 (2019)

N2 south of site					
Pollutant	**CO (mg/m³)**	**NOx (µg/m³)**	**NO_2 (µg/m³)**	**PM_{10} Annual Mean (µg/m³)**	**PM_{10} >50 µg/m³**
Present (2018)	0.45	17.03	8.98	13.58	0.00
Year 1 (2019)	0.45	16.97	8.96	13.58	0.00
Increase/decrease	**0.00**	**-0.06**	**-0.02**	**0.00**	**0.00**
R150 between N2 and Duleek					
Present (2018)	0.43	12.23	7.45	13.19	0.00
Construction Phase (2019)	0.43	12.21	7.44	13.19	0.00
Increase/decrease	**0.00**	**-0.02**	**-0.01**	**0.00**	**0.00**

7.4.1.3 Climate Impacts

There is the potential for the emission of greenhouse gases such as CO_2 and NOx to the atmosphere during the construction of the development from general earthworks, forestry felling, vehicle emissions, the use of materials such as concrete and the contribution from fugitive landfill gas within the site. The site is located within an agricultural environment and connected to urban areas via national and regional roads. Within the agricultural environment greenhouse gases are released seasonally via harvesting and tilling of the land and this would be the norm within the area of the site. While traffic will increase during the construction phase, the increase in emissions (see Section 7.4.1.2) will be imperceptible for sensitive receptors. It can be deduced that while there will be an increase in the production of greenhouse gases from the construction phase, compared with what is the norm for the area, the impact to local and national climate will be imperceptible. In addition, the generation of renewable electricity from waste will also off-set or avoid carbon dioxide emissions generated from energy generation at traditional fossil fuel plants.

7.4.2 Operational Phase

Dust particles may be generated from the movement of vehicles around the site. Dust emissions may also be generated from the proposed landfilling of non-hazardous stabilised and inert waste at the northern face of the landfill and placement of IBA. Operational controls such as maintaining high moisture content of IBA will be undertaken to ensure a high degree of compaction within the landfill to prevent dust emissions.

Similar to the construction dust emissions impacts outlined in Section 7.4.1, vehicle movement occurring onsite, the placement of IBA and the continued operation of the landfill will generate airborne dust/particulate emissions.

However, these activities will be smaller in nature than the construction of the IBA facility, screening berms, leachate management facility, ancillary infrastructure, surface water management infrastructure, ESB substations, landfill cells and biological treatment facility and therefore the risk from dust emissions is still considered to be low.

With regard to ecology, the risk from earthworks, construction and trackout activities during the operational phase are deemed to be Negligible as ecologically sensitive receptors are located outside the zone of potential impact from dust and PM_{10}.

Smaller dust particulates such as PM_{10} can be emitted from the existing gas engines and the impact of these emissions are assessed using the air prediction model AERMOD. The results of this assessment are provided in later sections.

7.4.2.1 Vehicle Emissions

The baseline air quality levels (for Zone D in which the site is located) were sourced from the EPA's three most recent ambient air quality reports (2015 - 2013) which were averaged. Existing traffic flows and predicted operation traffic flows as well as vehicle composition, average speed and closest sensitive receptors for the local road network (National road N2 and Regional road R150) were attained. This information was then inputted into a DMRB screening model to predict existing and operational phase traffic emissions for the National road N2 and Regional road R150. The closest sensitive receptor for the N2 was located 10 m from the national road while the closest sensitive receptor for the R150 was 3 m from the regional road. Existing (2018) and the operation phase (2024/ Year 6) emissions of CO, NO_x, NO_2 and PM_{10} were calculated for the N2 and R150 between the N2 and Duleek (see Table 7-12 for results).

The results were then compared with Air Quality Standards Regulations 2011 limits (see Table 7-10) which indicate that traffic emissions during the operation phase (2024/Year 6) of the development will remain within acceptable Air Quality Standards Regulations 2011 limits. The increase in traffic emissions between existing traffic emissions and the operation phase (2024/Year 6) (Table 7-12) were then compared with Table 7-1 NRA's Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations which indicate that the increase in traffic emissions will be imperceptible. The increase in traffic emissions between existing traffic emissions and the operation phase (2024/Year 6) traffic emissions (Table 7-12) were then compared with Table 7-2 NRA's Descriptors for changes in Annual Mean Nitrogen Dioxide, PM_{10} and $PM_{2.5}$ at Receptors. The comparison indicates that during 2024 (operation phase) along the N2, the impact will be imperceptible. Along the R150 there will be a medium increase in NO_2 and a small increase in PM_{10}. However according the NRA (2011) (see Table 7-2) these increases will result in an impact deemed negligible.

As results indicate the impact from traffic emissions for the operation phase will be imperceptible for N2 and an imperceptible/negligible for the R150, detailed dispersion modelling was not required, nor were mitigation measures.

To conclude, the impact from increased traffic flows will have an imperceptible impact on sensitive receptors along the N2 (closest receptor 10m from road edge) and a negligible/imperceptible impact on the R150 (closest receptor 3 m from road edge).

Table 7-12: Predicted Levels of Pollutants from Traffic Emissions for 2024 (Year 6)

N2 south of site					
Pollutant	**CO (mg/m^3)**	**NOx ($\mu g/m^3$)**	**NO_2 ($\mu g/m^3$)**	**PM_{10} Annual Mean ($\mu g/m^3$)**	**PM_{10} >50 $\mu g/m^3$**
Present (2018)	0.45	17.03	8.98	13.58	0.00
2024 (Year 6)	0.45	17.04	8.98	13.61	0.00
Increase/decrease	0.00	0.01	0.00	0.03	0.00
R150 between N2 and Duleek					
Present (2018)	0.43	12.23	7.45	13.19	0.00
2024 (Year 6)	0.46	19.4	9.68	13.76	0.00
Increase/decrease	0.06	7.17	2.23	0.57	0.00

7.4.2.2 Landfill Gas Utilisation Emissions

Emissions from the landfill gas flares and utilisation engines have been modelled using the air prediction model AERMOD. Current baseline or background concentrations have been discussed in section 7.3.2.1 and in summary the concentration for all pollutants is low and not approaching current EU limit values.

Model Input data

A landfill gas production model was prepared. This model predicts a peak in landfill gas production from the proposed landfill of approximately 2,155 m³/hr in 2024. Assuming a 100% gas collection efficiency, then a maximum capacity of 2,155 m³/hr is required to be utilised or flared.

The existing capacity of the landfill engines and flares onsite is:

- 4 no. landfill engines with a combined capacity of approximately 3,600 m³/hr
- Flare 1 has a capacity of 1,500 m³/hr
- Flare 2 has a capacity of 1,500 m³/hr
- Flare 3 has a capacity of 2,500 m³/hr
- Flare 4 has a capacity of 500 m³/hr. This is used for odour control.

Flare 3 cannot be used in conjunction with the landfill gas engines as it provides the pulling power for the engines. This gives a total gas handling capacity of 6,600 m³/hr. This does not include flare 4 which is an open flare and used for odour control only. Therefore, there will be sufficient landfill gas handling capacity in the landfill gas management plant at the site in the future (6,600 m³/hr capacity vs 2,155 m³/hr predicted).

Landfill gas is utilised in the landfill gas engines at Knockharley to generate electricity which is fed to the national grid. The combustion of landfill gas in engines and flares results in the conversion of methane to carbon dioxide and water. The avoidance of greenhouse gas emissions is crucial as its global warming potential is 21 times greater than that of carbon dioxide. In addition, the generation of renewable electricity from waste will also off-set or avoid carbon dioxide emissions generated from energy generation at traditional fossil fuel plants.

Emissions from the engines and flares were modelled as point sources. Table 7.13 outlines the physical parameters of the emission sources which are based on the results of the 2017 stack emission testing[24] and Table 7.14 shows the emission concentrations applied in the modelling.

Table 7-13: Summary of Physical Parameters Input to the Model

Source	Stack (Release) Height (m)	Stack Diameter (m)	Exhaust Temperature (K)	Actual Flow Rate (m^3/s)	Normalised Flow Rate (m^3/s)
Enclosed Flare 1	8.75	1.6	1323	2.92[1]	0.39[4]
Enclosed Flare 2	10	1.6	1298	2.92[1]	0.40[4]
Gas Engine 1	10	0.4	683	0.82[2]	0.27[3]
Gas Engine 2	10	0.4	706	0.74[2]	0.24[3]
Gas Engine 3	10	0.4	702	0.78[2]	0.26[3]
Gas Engine 4	10	0.4	729	0.78[2]	0.24[3]

[1] At 9% O_2 and 101.3 kPa
[2] At 6% O_2, 10% moisture and 101.3 kPa
[6] Assumes an air to fuel ratio of 7:1
[3] At reference conditions of 5% O_2, dry, 273K and 101.3 kPa
[4] At reference conditions of 3% O_2, 273K and 101.3 kPa

Table 7-14: Emission concentrations Input to the Model

Parameter	Emission concentration mg/m^3					
	Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2
NO_x as NO_2	500	500	500	500	150	150
SO_2	1290	1353	1332	1312	1584	6264
CO	1400	1400	1400	1400	50	50
Particulates	130	130	130	130	-	-
Total non-Methane VOC (expressed as benzene)	75	75	75	75	-	-
Hydrogen Chloride	50	50	50	50	50	50
Hydrogen Fluoride	5	5	5	5	5	5

Pollutant concentrations for NOx, particulates, hydrogen chloride and hydrogen fluoride have been taken from the ELVs in the facility's IE Licence (W0146-02). The concentration for carbon monoxide has been taken from the ELV presented in AG7 published in 2012. The concentration for NMVOC has been taken from the typical emission value presented in AG7. In the absence of a limit of SO_2 in the licence or AG7, the concentration for sulphur dioxide has been taken from the 2017 flare and gas engine monitoring data[25]. Modelling took place in advance of the 2018 stack testing regime which was carried out in August, therefore 2017 stack testing data was used.

The stack emission testing results for the engines are shown in Table 7.15 and the results for the flares are shown in Table 7.16.

[24] Air Scientific Air Emissions Compliance Monitoring Emissions Reports (monitoring date 28th September 2017)
[25] Air Scientific Air Emissions Compliance Monitoring Emissions Reports (monitoring date 28th September 2017)

Table 7-15: Stack Emission Testing Result from Gas Utilisation Engines (28/09/2017)

Parameter	Licence ELV for Engines* Nmg/m^3	Measured concentration mg/m^3			
		Engine 1	Engine 2	Engine 3	Engine 4
NO_x as NO_2	500	300	258	239	221
SO_2	-	1290	1353	1332	1312
CO	1400**	1088	1045	1038	1033
Particulates	130	3.3	2.8	1.4	2.3
Total non-Methane VOC	-	-	<0.1	<0.1	<0.1
Hydrogen Chloride	50	0.3	<0.3	<0.3	<0.3
Hydrogen Fluoride	5	4.7	<0.3	0.3	2.3

*There are recommended ELVs for engines commissioned after 2005 for NOx (500 mg/m^3), CO (1,400 mg/m^3) and TVOC (1,000 mg/m^3) (EPA, 2012[26])
**The ELV for CO was increased from 650 mg/m^3 to 1,400 mg/m^3 (EPA approved)

Table 7-16: Stack Emission Testing results from Gas Flares (28/09/2017)

Parameter	Licence ELV for Flares * mg/m^3	Measured concentration mg/m^3	
		Flare 1	Flare 2
NOx as NO_2	150	52.3	51.6
SO_2	-	1584	6264
CO	50	<1.7	<1.7
Hydrogen Chloride	50	0.5	<0.4
Hydrogen Fluoride	5	<0.4	4.2

[1] Dry gas referenced to 273k and 3% oxygen

* There are recommended ELVs for flares commissioned after 2003 for NOx (150 mg/m^3), CO (50 mg/m^3) and TVOC (10 mg/m^3) (EPA, 2012[27])

Air Modelling Results

Predicted process contributions (PC) for the worst-case year (2012) of a 5 years meteorological dataset (2012-2016) are presented at the receptor with the highest PC and compared with the relevant limit values (air quality standard).

The worst-case year has been defined as the year where the PC is the highest in comparison to its applicable limit value (presented in 2008/50/EC), in this case this is 24-hour SO_2 limit value in 2012. The predicted concentrations are summarised in Table 7.17 over.

[26] Guidance Note on Landfill Flare and Engine Management and Monitoring, AG7, EPA, 2012.

Table 7-17: Summary of PC to Limit Value at Most Sensitive Receptor

Parameter	Period	Modelled ground level concentration (ug/m³) at most sensitive human receptor	Modelled ground level concentration (ug/m³) at most sensitive human receptor as a percentage of Limit Value	Limit Value (ug/m³) [27]
NOx as NO_2	1-HR - 99.79%	22.5	11.2%	200
	Annual	1.9	4.7%	40
CO	8-HR	50.1	0.5%	10,000
SO_2	1-HR - 99.73%	130.4	37.3%	350
	24-HR - 99.18%	53.7	43.0%	125
Particulates	24-HR – 90.41%	1.4	2.8%	50
	Annual	0.5	1.2 %	40
HCL	1-HR -100%	3.2	0.4 %	750
HF	1-HR – 100%	0.3	0.2 %	160
	Annual	<0.1	0.1%	16
TNMVOC (as benzene)	Annual	0.3	5.4%	5

The maximum predicted receptor concentrations are added to the estimated background concentration for the area to give the total predicted environmental concentration (PEC) for comparison with the relevant air quality objectives. The background for short term standards, except for PM_{10} have been doubled in accordance with guidance in AG4. This is shown in Table 7.18.

[27] Limit values from 2008/50/EC, 2004/107/EC and Environment Agency Air Emissions Risk Assessment (https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit)

Table 7-18: Summary of PC Plus Background at Most Sensitive Receptors

Parameter	Period	Modelled Ground level Concentration (ug/m^3) at most sensitive human receptor	Modelled Ground level Concentration + Background Concentrations (ug/m^3) at most sensitive human receptor	Modelled Ground level Concentration + Background Concentrations as percentage of limit value	Limit Value (ug/m^3) [28]
NOx as NO_2	1-HR - 99.79%	22.5	28.1	14.1%	200
	Annual	1.9	4.7	11.7%	40
CO	8-HR	50.1	850.1	8.5%	10,000
SO_2	1-HR - 99.73%	130.4	140.5	40.1%	350
	24-HR - 99.18%	53.7	58.7	47.0%	125
Particulates	24-HR – 90.41%	1.4	10.1	20.3%	50
	Annual	0.5	9.2	23.0	40
TNMVOC (as benzene)	Annual	0.3	0.4	8.2%	5

The PC has also been compared against the maximum allowable PC (as outlined in the 'Assessing Significance' section of this chapter, Section 7.3.2.1). This is shown Table 7.19 below.

Table 7-19: Comparison of PC to Maximum allowable PC

Parameter	Period	Modelled Ground level Concentration (ug/m^3) at most sensitive human receptor	Maximum Allowable PC	Modelled Ground level Concentration as percentage of maximum allowable PC
NOx as NO_2	1-HR - 99.79%	22.5	131	17%
	Annual	1.9	25	8%
CO	8-HR	49.5	6400	<1%
SO2	1-HR - 99.73%	130.4	230	57%
	24-HR - 99.18%	53.7	80	67%
Particulates	24-HR – 90.41%	1.4	28	5%
	Annual	0.5	21	2%
HCL	1-HR -100%	3.2	500	<1%
HF	1-HR – 100%	0.3	107	<1%

[28] Limit values from 2008/50/EC

Parameter	Period	Modelled Ground level Concentration (ug/m^3) at most sensitive human receptor	Maximum Allowable PC	Modelled Ground level Concentration as percentage of maximum allowable PC
	Annual	<0.1	11	0.2
TNMVOC (as benzene)	Annual	0.3	3	8.3%

A modelling exercise was conducted to assess the impact of emissions from the landfill gas flares and utilisation engines. The results of the modelling assessment indicate that predicted emissions are in compliance with the statutory limits set out in the EU Ambient Air Quality Directive (EU 2008/50/EC) and other relevant standards (2004/107/EC, the Air Quality Standards and Environment Agency guidance) at any nearby sensitive receptors. The predicted concentrations are below AG4's maximum allowable PC for all pollutants.

On this basis the significance of impact of emissions from the gas utilisation plant on human health is considered to be 'Not significant'.

The results of the Habitats Directive assessments indicate that predicted annual concentrations of NOx as a result of the emissions from the facility are below 0.1 µg/m^3 at all of the four designated European sites. This is very substantially below the annual critical level for the protection of vegetation & natural ecosystems (30 µg/m^3).

On this basis the significance of impact of emissions from the gas utilisation plant on local designated habitats is considered to be 'Imperceptible'.

Cumulative impacts of traffic and stack emissions

A summary of the cumulative impact of traffic and stack emissions associated with the development is presented in the Table below. As a conservative approach, the impact predicted from traffic has been added to the receptor with the worst-case modelling from the gas utilisation plant.

Table 7-20: Summary of the Cumulative Impact of Traffic and Stack Emissions

Parameter	Period	Modelled Ground level Concentration (ug/m^3) at most sensitive human receptor	Predicted concentrati on increase from road traffic (ug/m^3)	Total concentration (ug/m^3)	Modelled Ground level Concentration as percentage of allowable process contribution
NOx as NO_2	1-HR - 99.79%	22.5	4.5	27.0	20.5%
	Annual	1.9	2.2	4.1	16.4%
Particulates	24-HR – 90.41%	1.4	0.6	2.0	7.2%
	Annual	0.5	0.6	1.1	5.3%
CO	8-HR	50.1	60.0	110.1	1.7%

The table above indicates that the impact on overall air quality is well below the maximum allowable PC after considering the emissions from increased traffic associated with the proposed development.

In conclusion, the existing and proposed air emissions from both the landfill gas plant and traffic at Knockharley landfill are within the relevant air quality standards and will not impact significantly on the ambient air quality of the area.

7.4.2.3 Biological Treatment Facility Emissions

Emissions from the proposed biological treatment facility will be discharged to air through a biofilter. Potential emissions from the biofilter will include ammonia, hydrogen sulphide and bioaerosols.

Composting is a process that utilises a range of micro-organisms to consume the organic portion of waste material. During the composting process, waste material is moved through the system resulting in the agitation of the material and the dispersal of fine particles into the air. These particles tend to be composed of a range of micro-organisms and organic constituents of microbial and plant origin and are generally known as bioaerosols. Bioaerosols consist of a range of fungi, bacteria, actinomycetes, protozoa, algae and endotoxins (outer cell wall of bacteria). In most cases, these micro-organisms are bound to fine organic particles. Bioaerosols are present everywhere and associated with various sources such as composing, agriculture, handling cereal grains, wood, hay, cotton, wool, etc. Therefore, it is difficult to associate concentrations measured downwind of a source to the correct source.

As temperature varies during the composting process, the types of bioaerosols also vary. The composting process generally begins with medium temperatures (mesophilic phase up to 40ºC) and is dominated by mesophilic micro-organisms, but then progresses to higher temperatures (the thermophilic phase over 40ºC) in later stages. During the thermophilic phase, thermophilic and thermotolerant fungi and bacteria are essential for the composting process to continue. In the thermophilic phase the numbers of actinomycetes (resemble fungi but are filamentous spore forming bacteria) and fungi, particularly Aspergillus fumigatus, increase.

In relation to the measurement and sampling of bioaerosols, the focus to date has largely been on fungi and bacteria. *Aspergillus fumigatus* has been used as the indicator organism of choice in a number of EPA licences issued for composting facilities to date. *Aspergillus fumigatus* is a very common fungus that is associated with soil, hay, straw, manure and grass as well as composting waste material.

A number of reports have been prepared to assess the risk of bioaerosols emissions particularly from waste composting facilities on workers and on the wider environment. The most recent documents were prepared by:

- Health and Safety Executive (HSE) in 2010 is entitled 'Bioaerosol emissions from waste composting and the potential for workers' exposure' (HSE, 2010). In this report, bioaerosols were sampled at a number of composting sites. The dispersion of bioaerosols downwind was also assessed by monitoring at distances downwind of activities. Of the 25 composting sites assessed in this report, 20 sites undertook composting activities outdoors.
- Sniffer in 2014 is entitled "Understanding biofilter performance and determining emission concentrations under operational conditions assess the variation of emissions between different technologies used to abate pollutants from waste management sites".

The results of the HSE and Sniffer reports found that:

- There was a general trend of rapidly decreasing bioaerosols with distance.
- Bioaerosols concentrations 50 m upwind of a facility are within 'typical' background levels of less than 1,000 cfu/m^3.
- 100 to 250 m downwind of the majority of facilities, less than 1,000 cfu/m^3 was recorded. 93% of bacteria and 98% of *Aspergillus fumigatus* were less than 5,000 cfu/m^3 and could be considered to be within the range of 'typical' background levels.
- There was little evidence that compost facilities have a major contribution to the overall bioaerosol concentrations by a distance of 250 m from activities.

- Removal of hydrogen sulphide and ammonia using a combination of acid scrubber and biofilter was found to be greater than 90% efficiency.

This setback distance of 250 m is also referenced in a number of other reports such as:

- UK Environmental Agency policy on composting and potential health effects from bioaerosols (2007)
- UK Environmental Agency report 'Development of Amenity Risk Assessments at Organic Waste Treatment Facilities' (October 2008)
- A literature evaluation on Bioaerosols and Composting undertaken by Cré, the Composting Association of Ireland and funded by the Irish EPA (2004).

The proposed biological waste treatment facility is greater than 250 m from the nearest sensitive receptors (residential properties). The nearest sensitive receptor is 346 m from the closest point on the building. This is outside the recommended setback distance outlined. In addition, all activities associated with the dry fermentation/composting process proposed will be carried out indoors, with an air handling system and fast shutting doors which has a fundamental impact on the emissions of bio-aerosols from the proposed facility, with emissions being minimised to the point source emissions from the biofilter. This will further reduce any impacts associated with the facility.

With regards to ammonia and hydrogen sulphide, the concentrations that will be produced are unknown and will vary significantly dependant on the waste accepted and the type of technology used. A paper published by SEPA[29] indicates that removal of these compounds by a biofilter and scrubber type system will be greater than 90%. Given the distance of the receptors from the stack (>350m), the enhanced dispersion characteristics of the biofilter emissions stack (20 m tall stack with an exit velocity of 27 m/s) and relatively high limit values for these pollutants the predicted impact is low.

7.4.2.4 Odour emissions

The proposed changes in operation to Knockharley landfill to accept 440,000 tpa of varying types of waste has the potential to influence odour emissions generated from the site in three fundamental ways:

1. The construction of a biological waste treatment facility will introduce new sources of odour to the site which may act in combination with emissions generated from landfilling activities.
2. The quantity and quality of the waste received at the site will change and over time the location of the operational area will change as the site develops. This includes construction of an IBA facility.
3. The construction of leachate storage tanks to store the increased leachate generated from the increased acceptance of waste.

The implications of each are discussed in greater detail below and in Appendix 7-1.

Construction of the new biological treatment facility

The proposed biological waste treatment facility will undertake activities that have the potential to generate odour emissions. These include:

- reception of MSW fines and MSW baled waste
- composting activities

The composting is undertaken in concrete tunnels and all reception and processing of MSW fines occurs indoors, with both the tunnels and reception area ventilated via a combination acid scrubber and biofilter OCU. With odour management and mitigation as per 7.5.2, the only potential release of emissions will be from the biofilter.

[29] Sniffer. 2014. Understanding biofilter performance and determining emissions concentrations under operational conditions.

Changes to the landfill operations

The total quantity of waste that will be accepted at the site will increase to 440,000 tpa if permission is granted for the proposed development, reaching a peak in terms of the total cumulative quantity of waste deposited in the landfill approximately 6 years after the new operations commence. Table 7-21 shows an approximation of the amount of different types of waste that is proposed to be accepted. If the facility attracts waste at the maximum rate, the landfill is expected to run out of void during year 6. At that point both the IBA facility and the biological treatment facility will continue to operate.

The odour impact assessment considered the odour emissions and exposure levels under the following operational scenarios:

- Scenario 0: Baseline conditions in 2018.
- Scenario 1: Year 4 'do nothing'. The situation which is likely to occur in the final active deposition stages of the landfill if it continues to operate in line with current planning and licence conditions (i.e. the development does not go ahead).
- Scenario 2: Year 4 of proposed development.
- Scenario 3: Year 6 of proposed development. The situation which will occur in the final stages of the landfill if permission is granted.

65,000 tpa of biodegradable waste (BMW) was inputted into the landfill gas prediction model to inform odour modelling. This figure was selected on the basis that if 100% waste accepted at the facility was MSW, of which 15% was BMW. This is a worst-case scenario as it is proposed to accept a variety of fractions of waste other than MSW.

Table 7-21: Summary of Quantities of each Waste Type Received

Summary of changes to operational conditions	Scenario 0: Current operations (2018)	Future Operations		
		Scenario 1: Do nothing Year 4 + active deposition	Scenario 2: Proposed development Year 4	Scenario 3: Proposed development Year 6
Biodegradable municipal waste and fines (tpa)	40,000	40,000	65,000	65,000
Biological treatment facility in operation (tpa)	no	no	25,000	25,000
Total landfill gas generation potential (m3/hour)	1,620	1,438	2,059	2,150
Filling of stabilised, inert waste and MSW* (tpa)	48,000	48,000	225,000***	225,000***
Acceptance of incinerator bottom ash (tpa)	yes**	yes**	150,000	150,000

*non-biodegradable fraction
**IBA tonnage included in stabilised and inert fraction
***inclusive of 25,000 tpa stabilised in biological treatment facility

Permission is sought for the intensification of the rate of waste acceptance within the current permitted footprint and this will be accommodated by increasing the height of the final contours. The schedule of filling of both stabilised waste and non-stabilised waste is also proposed to change; stabilised waste will be deposited starting at the north end of the landfill (cells 27/28 to cells 20/22), with non-stabilised waste continuing to fill from the south. This has been proposed in order to reduce the odour exposure levels at the residential receptors to the north of the landfill, along with the benefits of separating leachate by type and separating aerobic from anaerobic cells.

The stabilised waste, along with inert waste and non-biodegradable MSW is assumed to be inert and therefore will not continue to break down and produce landfill gas, therefore the only emissions associated with the stabilised waste will be the initial deposition of waste within the landfill. The proposed phasing and fill sequence is described in more detail in Chapter 2 of Volume 2 of this EIAR.

The use of hermetically sealed geo-multicovers for intermediate capping is expected to enhance containment of landfill gas and reduce fugitive odour releases from these cells.

Construction of leachate storage tanks

During visits to the site in 2010 and 2018 odour from the current leachate storage was only (barely) detectable in the immediate area of the lagoon. As a result, this area was not considered to be a significant generator of emissions from an off-site exposure perspective. Under proposed operations the additional leachate will be stored within covered tanks and lagoons and is therefore unlikely to cause any significant offsite impact if the existing mitigation measures are implemented for new leachate infrastructure.

Estimation of odour emissions

For each operational scenario, the odour emissions generated from the landfill were estimated in terms of European odour units (ou_E) by development of a 'site emission model' using on-site odour measurements of the waste and landfill gas, operational details of the site supplied by the client and estimation of gas leakage using a landfill gas production model (current and future operating scenario).

In order to assess the veracity of this model and how it is likely to compare to real world conditions, a series of field assessments were also conducted under the current baseline conditions. This dual approach for assessment is consistent with current best practice.[30] Further details of these techniques are presented in Appendix 7.1.

A summary of the odour emissions estimated for each operational condition are presented in Table 7-22 below:

Table 7-22: Estimated emissions for each operational scenario

Activity	Source	Time weighted emission [x 10^3 ou_E/s]			
		Scenario 0	Scenario 1	Scenario 2	Scenario 3
Landfilling	Active cell operations	24.9	15.9	26.1	26.1
	Intermediate and final capping	73.4	62.4	39.2	41.8
	Subtotal	98.3	78.3	65.3	67.9
Biological treatment	Odour control plant	n/a	n/a	80.0	80.0
	Total	**98.3**	**78.3**	**145.3**	**147.9**

[30] Guidance on the assessment of odour for planning, Version 1.1 - July 2018, Institute of Air Quality Management, UK

Review of the table above indicates that the following:

1. Under the baseline conditions (Scenario 0), emissions from landfilling activities are predicted to be higher than for the future operational scenario (year 4) under current licence conditions (Scenario 1). This is linked to the current gas generation rates and number of cells currently with intermediate capping in place. Going forward, it is assumed that all cells will have permanent capping applied within a year of filling thus reducing potential fugitive emissions released to atmosphere.
2. The total emissions generated from the landfilling operations are predicted to decrease as a result of the proposed development in comparison to the current operational scenario (Scenario 0) and year 4 operation if the proposed development does not go ahead (Scenario 1). This is due to the enhanced containment of landfill gas emissions which will be achieved by the proposed development.
3. In overall terms, the emissions from the proposed development are predicted to increase due to the inclusion of a new biological treatment facility (Scenario 2 and 3). However, enhanced odour control techniques provisions will be provided to ensure any odours from this facility are treated prior to release through an elevated stack which will serve to disperse residual odours in the atmosphere. The offensiveness of the odours released will also be lower due to the nature of the treatment process and treatment of the air prior to release in a biofilter.

Odour dispersion modelling

In order to assess the impact of the operational scenarios, a dispersion model was applied to assess the likely levels of odour exposure for the worst meteorological year and evaluate odour impact risk.

Since the odours from the biological treatment of waste had a different character and offensiveness rating to the landfill odours, these emissions were modelled separately. The modelled scenarios were therefore as follows:

Table 7-23: Modelled odour emission scenarios

Odour Type	Odour Model Scenario	Corresponding Operational Scenario
Landfilling	1	Scenario 0
	2	Scenario 1 (landfill activities only)
	3	Scenario 2 (landfill activities only)
	4	Scenario 3 (landfill activities only)
Treated odours from biological treatment	5	Scenario 2&3 (biological treatment only)

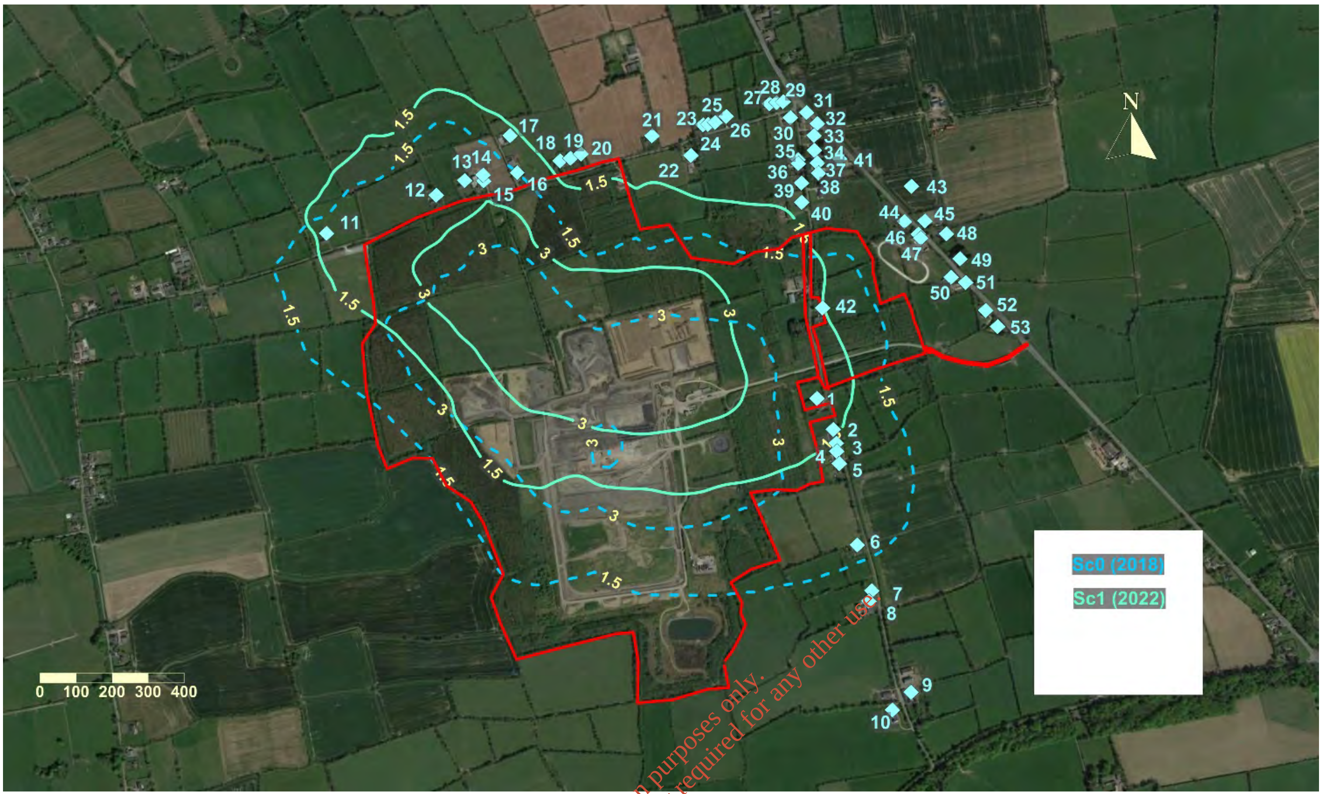
The following significance criteria were applied:

- Landfilling operations: $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$.
- Biological treatment facility emissions: $C_{98,\ 1\text{-hour}} \geq 3\ ou_E/m^3$.

Odour impact of landfilling operations

The outputs of the dispersion modelling are presented below for each modelled scenario. The figures present isopleths defining the area where the predicted odour exposure level is equal to $C_{98,\ 1\text{-hour}} = 1.5\ ou_E/m^3$ and $C_{98,\ 1\text{-hour}} = 3\ ou_E/m^3$.

The plots present results from the 2012 meteorological data, the worst-case year of the dataset (2012-2016).[31]



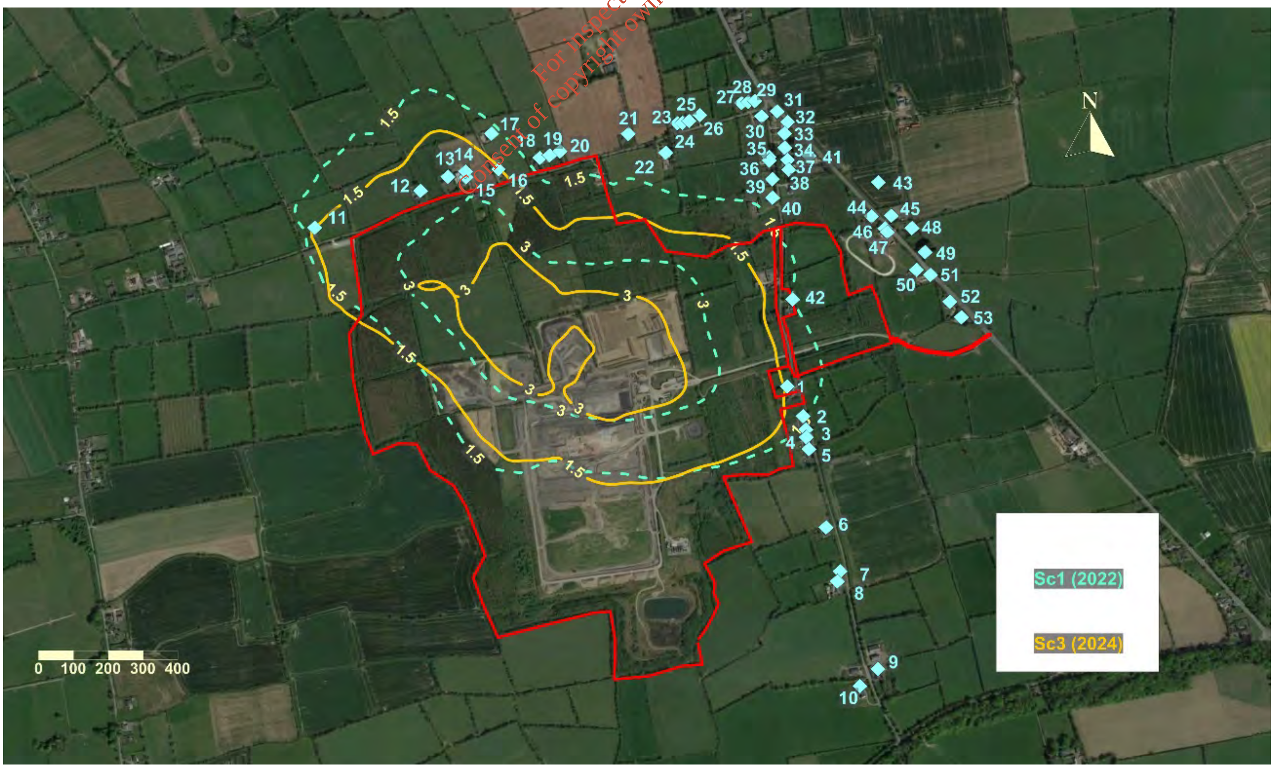
Map imagery: Google Earth. The red line indicates the planning boundary of the facility. Residential properties are presented as blue stars.

Figure 7-7: Predicted odour exposure levels from landfilling operations for Scenario 0 and Scenario 1 (Year 4 'do nothing')

[31] The worst case meteorological year has been defined on the basis of highest predicted odour exposure at a residential property in any of the future operational scenarios.

Map imagery: Google Earth. The red line indicates the planning boundary of the facility. Residential properties are presented as blue stars.

Figure 7-8: Predicted odour exposure levels for landfill operations for Scenario 1 (Year 4 do nothing) & Scenario 2 (year 4 development)



Map imagery: Google Earth. The red line indicates the planning boundary of the facility. Residential properties are presented as blue stars.

Figure 7-9: Predicted odour exposure levels for landfill operation for Scenario 1 (Year 4 do nothing) & Scenario 3 (year 6 development)

Table 7-25 presents a summary of the area of land predicted to be exposed to $C_{98,\ 1\text{-hour}} \geq 3.0\ ou_E/m^3$ for each model scenario.

Table 7-24: Predicted odour exposure ($C_{98,\ 1\text{-hour}}$) at modelled discreet receptor locations

Receptor	Maximum $C_{98,\ 1\text{-hour}}$				Predicted change in odour exposure in comparison to baseline		Predicted change in odour exposure in comparison to Sc1	
	Sc0: Baseline	Sc1: Yr 4 do nothing	Sc2: Yr 4 development	Sc3: Yr 6 development	Sc2 Yr 4	Sc3 Yr 6	Sc2 Yr 4	Sc3 Yr 6
1	2.15	1.77	1.37	1.46	-36%	-32%	-22%	-17%
5	2.14	1.32	1.30	1.19	-39%	-44%	-1%	-10%
6	1.68	0.81	0.89	0.77	-47%	-54%	+11%	-4%
11	1.74	1.81	1.29	1.56	-26%	-10%	-29%	-14%
12	1.91	2.46	1.43	1.76	-25%	-7%	-42%	-28%
15	2.07	2.58	1.65	2.03	-20%	-2%	-36%	-21%
16	1.49	2.22	1.27	1.58	-15%	+4%	-43%	-30%
18	1.09	1.20	0.76	0.81	-30%	-26%	-37%	-33%
22	0.93	1.14	0.67	0.88	-28%	-6%	-41%	-23%
40	0.98	1.33	0.78	0.95	-21%	-2%	-42%	-28%
42	2.00	1.57	1.27	1.31	-36%	-34%	-19%	-16%

Table 7-25: Area encompassed within $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$ isopleth and $C_{98,\ 1\text{-hour}} \geq 3.0\ ou_E/m^3$ isopleth

Scenario	$C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$ isopleth area		$C_{98,\ 1\text{-hour}} \geq 3.0\ ou_E/m^3$ isopleth area	
	Area of land exposed (km^2)	Percentage reduction relative to baseline	Area of land exposed (km^2)	Percentage reduction relative to baseline
Sc0: Baseline (2018)	1.47	-	0.53	-
Sc1: Year 4 do nothing	1.09	26%	0.36	32%
Sc2: Year 4 development	0.81	45%	0.14	74%
Sc3: Year 6 development	0.85	42%	0.18	66%

Review of the model outputs prompts the following observations:

Review of the current baseline impact isopleths (Sc0 Figure 7-7 and Table 7.5) indicate that the area of land that is exposed to odours above the risk threshold of $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$ is approx. 1.47 km^2 and includes 12 no. properties located to the north and east of the site.

Comparison of Sc0 (current baseline) and Sc1 (year 4 do nothing) (Figure 7-7 and Table 7-25) indicates that odour exposure levels around the site are generally predicted to reduce, leading to a reduction in the land exposed to odour levels above the impact threshold by 26%. The development of the landfill to the north does however push the exposure isopleths northwards and leads to an increase in predicted odour exposure at the properties located to the north of the site in comparison to current baseline conditions. A corresponding reduction in odour exposure is predicted to the east of the site. The number of properties potentially at risk of significant odour impact is 10.

Comparison of Sc1 (year 4 do nothing) with Sc2 (year 4 with development) (Figure 7-8 and Table 7-25) indicates that the proposed development has a beneficial effect on offsite exposure in comparison to the do-nothing scenario. In this scenario, the area of land potentially exposed to odours above the risk threshold reduces by 47% in comparison to the current baseline. The number of properties at risk of potentially significant impact reduces to 4, all of which are located to the north.

Comparison of Sc3 (year 6 with the proposed development) and Sc2 (year 4 with the proposed development) indicates a slight increase in odour exposure during the final years of the landfill although the number of properties at risk of potentially significant impact is 6. This risk is likely to persist until the operational cells are closed and permanent capping is installed.

An increase in odour exposure between Sc0 and Sc3 is predicted for one of the discrete receptors (No. 16) included in the odour dispersion model. This increase results from the progression of landfilling activities to more northerly cells. However, this increase in odour exposure is expected even if the proposed development does not proceed and compared to the 'do nothing' scenario, this receptor is predicted to experience a reduction in odour exposure for operating conditions if the proposed development proceeds.

Table 7-25 also shows that there is a predicted increase in odour exposure for Receptor 6 between the 'do nothing' scenario (Sc1) and Year 4 of the proposed development (Sc2). The predicted odour exposure at this location is below levels where adverse odour impact is expected to develop for all future operational scenarios considered, so this increase in odour exposure is not significant when considering risk of odour exposure using IAQM planning guidance[32] criteria.

[32] Guidance on the assessment of odour for planning, published by IAQM: July 2018

It is therefore evident that the development will lead to an overall reduction in offsite odour exposure and impact risk in comparison to the baseline and the 'do nothing' situation, up until 2022, when the existing planning approval expires. A potentially significant risk of odour impact will remain to a handful of properties to the north of the site during the remaining life of active deposition and subsequent completion of permanent capping which is estimated to be in the order of 2 no. years. Although an odour exposure of $C_{98,\ 1\text{-hour}} \geq 1.5$ is considered 'significant' according to IAQM planning guidance criteria, and in Odournet's experience it is possible for a significant adverse odour impact to develop at exposure levels as low as $C_{98,\ 1\text{-hour}} \geq 1.5\ ou_E/m^3$, it should be noted that such instances are relatively rare and hence the thresholds should be considered as precautionary.

Odour impact of biological treatment facility

The model output for the biotreatment facility is presented in Table 7-26 below:

Table 7-26: Predicted odour exposure ($C_{98,\ 1\text{-hour}}$) at modelled discreet receptor locations

Receptor	Maximum $C_{98,\ 1\text{-hour}}$
	Biological Treatment Facility
1	1.54
5	1.14
6	1.14
11	0.37
12	0.42
15	0.46
16	0.47
18	0.43
22	0.15
40	0.35
42	0.78

Review of the predicted exposure levels indicates that the odour exposure at all modelled receptors fall below the levels at which a significance impact is predicted. The predicted odour exposure is below $C_{98,\ 1\text{-hour}} = 3\ ou_E/m^3$ across the entire model domain. As a result, the impact risk posed by this element of the development is considered to be negligible.

7.4.2.5 Climate Impacts

Under the Kyoto Protocol, Ireland is obliged to reduce its greenhouse gas emissions to a level that is 13% above 1990 levels by 2012.

The Paris Agreement consists of a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C and to drive efforts to limit the temperature increase even further to 1.5 °C above pre-industrial levels. It requires countries to make their own unique contribution to the prevention of dangerous climate change. Ireland, through the European Union, indicated its commitment through the agreement to reduce greenhouse gas emissions by at least 40% by 2030, compared with 1990 levels.

Under the European Commission's 2020 Climate and Energy Package, EU members must meet 2020 reduced greenhouse gas emission. According to recent EPA (2018) greenhouse gas emission projections, Ireland will not meet 2020 targets.

The proposed biological waste treatment facility will provide alternative infrastructure to stabilise 25,000 tpa of biodegradable material. The facility will treat waste in compliance with the EPA standard for bio-stabilised residual wastes (Respiration Activity after four days (AT4) of <7 mg O2/g DM). This stabilised waste will then be placed in an inert/stabilised cell along with stabilised waste treated at other biological treatment facilities, thereby reducing environmental impacts of landfilling, such as landfill gas generation. The stabilised material will be recovered rather than disposed. Landfill gas is utilised in the landfill gas engines at Knockharley to generate electricity which is fed to the national grid. The combustion of landfill gas in engines and flares results in the conversion of methane to carbon dioxide and water.

The avoidance of greenhouse gas emissions is crucial as its global warming potential is 21 times greater than that of carbon dioxide. In addition, the generation of renewable electricity from waste will also off-set or avoid carbon dioxide emissions generated from energy generation at traditional fossil fuel plants. Based on the quantity of methane captured for utilisation in 2013, peak gas generation and in 2017, it is calculated that the proposed development will utilise 4,947 tonnes of methane during the year of peak landfill gas generation (2024), which will displace the need for that quantity of fossil fuel, e.g. methane in natural gas. This is approximately 104,000 tonnes of carbon dioxide equivalent at peak gas generation.

During the operation phase the site will have an overall positive impact on both local and national climate due to the collection and conversion of landfill gas that would have directly contributed to greenhouse gas emissions and the generation of renewable electricity which will help to contribute towards Ireland's move from dependence on fossil fuels to use of renewable energy.

7.4.3 Cumulative Impacts

There are a number of facilities within the surrounding hinterlands that operate under licences issued by the EPA:

- Kentstown Sow Unit (transferred to Marry Pig Farms Limited) is located approximately 4 km south of the Knockharley Landfill facility in Danestown. It is operated under an IE licence P0456-01 from the EPA. It is a piggery with approximately 4,000 pigs and employs 3 people. Planning permission was granted in January 2015 for the demolition and reconstruction of facility buildings
- There is a poultry farm in Gerrardstown, Garlow Cross, located approximately 3.5 km south west of the facility. The poultry farm produces eggs and currently has capacity for 40,000 layers and is licensed for 117,500 layer spaces. The facility is licensed by the EPA through IE licence P0917-01. The 2015 AER lists one employee.
- A poultry farm in Garballagh, Duleek rears c. 3,000 broilers per annum. It is operated under IE licence P0887-01. It is approximately 4 km west of the facility and employs one person.
  Dunbia operates a meat processing facility in Beauparc under IE licence P0811-02 the operation of slaughterhouses with a carcass production capacity greater than 50 tonnes per day. It has over 70 employees and is 3.5 km north of the facility.
- Cooksgrove Ltd., trading as Euro Farm Foods, operates as cattle slaughterhouse in Cooksgrove, Duleek. It has an IE licence P0822-01 with a throughput of 300 cattle a day. It has over 100 employees. The facility is approximately 8 km west of the Knockharley Landfill facility.
- Nurendale Ltd. trading as Panda Waste Services Ltd. owns and operates a large Materials Recovery Facility at Rathdrinagh Cross Roads, approximately 4 km north east of the facility on the N2 to Slane. It is operated under a licence from the EPA, W0140-04 and is licenced to accept up to 250,000 tonnes per annum of household, commercial and industrial waste, biowaste and biodegradable waste, and construction and demolition waste and the facility employs approximately 160 people. A licence review application for, *inter alia*, the acceptance and processing of incinerator bottom ash is at time of writing under consideration by the Agency.
- Advanced Environmental Solutions (AES) Ltd. owns and operates a waste transfer facility in Navan under IE licence no. W0131-02, approximately 10 km west of Knockharley Landfill. The licensed capacity of the facility is 95,000 tonnes per annum. The facility has approximately 15 employees.

- Perma Pigs Limited, is an operational pig farm located at Littlegrange, Drogheda, County Louth, approximately 9 km north east of Knockharley Landfill. Perma Pigs Limited operates under EPA licence P0431-02. It is a piggery with No. 9,868 stock at the farm according to 2017 AER and is licensed to house 11,490 pigs, ranging from dry sows to weaners. The 2017 AER lists 5 no. employees.

- Irish Cement Limited, located at Platin Works, Platin, Drogheda, County Meath operates a cement production which includes a limestone quarry under the EPA licence register number P0030-05. The facility is approximately 10 km north east of Knockharley Landfill. Irish Cement EPA licence allows for the acceptance of alternative fuel which include meat and bone meal (40,000 tonnes per annum), chipped tyres (30,000 tonnes per annum) and solid recovered fuel (90,000 tonnes per annum). The 2016 AER lists 103 no. employees. Irish Cement Limited has submitted a licence review application to the EPA (P0030-06) to allow for the further replacement of fossil fuels with alternative fuels and the use of alternative raw materials (600,000 tonnes of waste per annum) at their Cement Works in Platin, Co. Meath.

- A poultry farm, located at Dowth, Slane, County Meath, approximately 7 km north east of Knockharley Landfill. The poultry farm produces eggs and currently has capacity for No. 78,000 birds (broilers) at the farm. The facility is licensed by the EPA - IE licence P0951-01. The 2016 AER lists one employee.

- Indaver Ireland Limited operate a waste incineration plant at Carranstown, Duleek, Co. Meath under EPA IE licence no. W0167-03. The plant is approximately 10 km north east of Knockharley Landfill. It is licensed to accept up to 235,000 per annum of household, commercial and industrial waste, sewage and industrial waste, aqueous waste and construction and demolition waste and hazardous waste and the facility employs approximately thirty-nine people.

Each of these facilities is licensed by the EPA and subject to monitoring as part of their licences. These licensed facilities cumulatively are unlikely to have a negative impact. Due to the distance between the aforementioned developments and Knockharley Landfill no impact is envisaged with regard to odour emissions, vehicle emissions, landfill gas utilisation emissions or dust. With regards to climate, the impact during the construction phase of Knockharley Landfill will be imperceptible and no cumulative impact is therefore envisaged. During the operation phase of Knockharley Landfill, the impact on climate will be an overall positive one and no cumulative impact is envisaged on climate.

There are a are a number of permitted housing and commercial building developments within the surrounding hinterlands:

- Application No. AA170888 - 39 residential units, 4,358sqm open space, 78 carparking space and associated work (ABP 301299-18). Located 1.5 km from site.

- Application No. AA170637 - 29 guest suites, gate lodge, 107 car parking spaces and other works. Located 1.5km from site. Located 6.5 km from site.

- Application No. LB170035 - community facility - recreation hall, training areas. astro turf area, 100m sprint lane, changing rooms, office, meeting room, carpark. Located 6 km from site.

- Application No. LB180687 - 11 housing units. Located 6.5 km from site.

- Application No. LB170187 - refurbishment of protected structure for a 19 bed hotel. Located 7 km from site.

- Application No. NA160607 - 218 units, demolition of existing outbuildings, ancillary works. Located 9.3 km from site.

- Application No. NA170997 - construction of 5 buildings - carpark, apartment blocks, solar panels on roof, substation and other associated site works - res / mixed dev ABP REF: 300959-18. Located 8.5 km from site.

- Application No. NA161219 - advanced technology building (other apps for buildings, carpark etc within this area / business park). Located 8.5 km from site.

Due to the nature of housing and commercial building developments, there is no cumulative impact from odour emissions or landfill gas utilisation emissions between the aforementioned developments and Knockharley Landfill. Due to the distance between Knockharley Landfill and housing/commercial developments no impact is envisaged with regard to dust emissions.

With regards to climate impacts and vehicle emissions, the impact during the construction phase of Knockharley Landfill will be imperceptible and no cumulative impact is therefore envisaged. During the operation phase of Knockharley Landfill, the impact on climate will be an overall positive one and no cumulative impact is envisaged on climate.

There are a number of solar farm developments which have been applied for, and permitted developments within the surrounding hinterlands:

- Application No. LB180570 - solar farm 3 MW and substation and associated site work. Located 2.5 km from site.
- Application No. AA180383 - solar farm 8.7 MW on 10.82 hectares. Located 9.5 km from site.
- Application No. AA170706 - solar farm 15 MW on 25.76 hectares. Located 9.8 km from site.
- Application No. LB160898 - solar farm 75 MW (ABP Ref. PL17248146) 150.29 hectares. Located 5 km from site.
- Application No. AA180145 – 3 MW solar farm on capped landfill. On site.

Solar farm developments by their nature produce no odour, landfill gas utilisation emissions, limited dust or PM_{10} during construction and decommissioning and no dust or PM_{10} during operation. The potential impact of vehicle emissions from the proposed development at Knockharley Landfill is imperceptible and therefore there will be no cumulative impact with solar farm developments. No cumulative impact is therefore envisaged between the aforementioned solar farms and Knockharley Landfill. Solar farms do however, offer an alternative to fossil fuels; providing renewable energy. During the construction phase of Knockharley the impact to climate will be imperceptible and no cumulative impact is envisaged between Knockharley Landfill and the aforementioned solar farms. During the operation phase of Knockharley Landfill, there will be a positive impact on climate. Cumulatively, Knockharley Landfill and the aforementioned solar farms will have an overall positive impact during their operation.

7.5 Mitigation Measures

7.5.1 Construction Phase

7.5.1.1 Dust Emissions

As per the IAQM methodology outlined in Section 7.3.1, Step 3 determines site-specific mitigation for the activities carried out.

The results of Steps 1 and 2 determined dust impact is considered low risk. The implementation of the following mitigation measures will result in an imperceptible impact from dust or PM_{10} during the construction phase of the proposed development.

- The developer in association with the contractor will develop and implement a dust control plan. This plan will address aspects such as excavations, filling activities & temporary stockpiling. The plan will be prepared prior to any construction activities and will be established and maintained through the construction period. Dust controls will be as per the CEMP in Appendix 2.0 of Volume 3 of this EIAR. The dust control plan will include the following mitigation measures:
  - All vehicles will comply with the onsite speed limit. The speed limit will be reduced appropriately on internal haul routes in extremely dusty environments
  - Stockpiles (soil) during the construction phase will be sprayed during periods of dry weather in order to suppress dust migration from the site.
  - The earthen berms will be replanted in forestry immediately following construction in order to establish vegetated cover to prevent windblown erosion and associated dust emissions.
  - Availability of a water bowser to spray work areas and haul road. The amount of water sprayed will be sufficient to suppress the dust and not be such as to allow any run-off into watercourses.
  - The earthworks foreman will inspect internal haul roads as part of his daily supervision of the site. If dust is causing a problem a water bowser will be engaged.
  - Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions.
  - Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary. Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting, or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.
  - Vehicles exiting the site will use the wheel wash at the administration area to mitigate track out onto the public road.
  - All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions
- In the event of dust complaints, they will be recorded and actioned in accordance with the licence for the facility and the complaints procedure.
- A monitoring programme at the site will continue to measure dust and PM_{10} in accordance with the IE licence for the facility. The results of monitoring will inform the licensee of the effectiveness of dust control and mitigation.

7.5.1.2 Vehicle Emissions

Predicted vehicle emissions associated with the proposed development are within the relevant air quality guidelines and therefore will have a neutral impact on ambient air quality. No mitigation measures are therefore required.

7.5.2 Operational Phase

7.5.2.1 Dust Emissions

The risk of impact from dust during the operational phase is considered to be low whilst the risk to ecology is deemed to be negligible.

The facility is currently operating and carrying out construction activities (cell construction and landfill capping) in compliance with dust and PM_{10} limits in the licence. The following management mitigation measures will continue to be implemented at the site to prevent dust nuisance during the operation of the facility:

- The existing access road from the N2 to the administration area is surface sealed as are other internal roadways where required. The IBA facility haul roads will be surfaced to mitigate dust.
- Speed limits are in place on site to mitigate dust nuisance.
- The access roads and internal site roads will be sprayed during periods of dry weather in order to suppress dust migration from the site.
- All vehicles leaving the site are and will be required to pass through the wheel wash.
- A water bowser and road sweeper is used daily to control dust nuisance.
- IBA stockpiles will be weathered under cover in the IBA facility building.
- All IBA handled at the facility will be handled at an appropriate moisture content to prevent dust emissions.
- Waste including IBA will be hauled in covered trucks to prevent windblown dust.
- All waste disposed of in the landfill is covered daily.
- A monitoring programme at the site will continue to measure dust and PM_{10} in accordance with the IE licence for the facility
- A biofilter will remove dust emissions generated from the biological waste treatment building and therefore preventing any release of dust to the atmosphere.
- All waste handling at the biological waste treatment facility including handling of finished product will be carried out indoors under negative air pressure and the building will be fit with fast action roller shutter doors.

7.5.2.2 Landfill Gas Plant Emissions

Predicted emissions from the landfill gas plant onsite are within the relevant air quality guidelines and therefore will not have a significant impact on ambient air quality. However, ensuring the servicing of the flares, in particular flare number 2 will reduce the risk of impact from SO_2 at nearby receptors.

7.5.2.3 Vehicle Emissions

Predicted vehicle emissions associated with the proposed development are within the relevant air quality guidelines and therefore will not impact on ambient air quality. No mitigation measures are required.

7.5.2.4 Odour

The proposed operations at Knockharley will involve the following activities that have the potential to generate odour emissions:

- Reception of MSW fines for composting within a biological treatment building
- Landfilling of waste and fugitive emissions associated with landfill gas

The Odour Management Plan for the existing facility will be updated for the proposed development and submitted to the EPA for approval with the licence application.

However, in accordance with best practice a range of odour control measures, which are included in the mitigation measures identified below, will be incorporated into the design to mitigate such potential emissions.

There is a description of the proposed development in Chapter 2 of this EIAR. Odour mitigation measures have been incorporated into the preliminary design of the facility. These include:

- Modification of the filling schedule so stabilised and inert waste and non-biodegradable fractions of MSW will commence filling from cells 27/28 and move south. Waste with a potential to generate landfill gas will not be landfilled north of cells 21/22, to reduce exposure to receptors to the north thus mitigation by design.
- The proposed development will use hermetically sealed geo-multicovers for intermediate capping to mitigate the potential for fugitive emissions through the intermediate capping.
- All waste activities at the biological treatment facility will be carried out within a ventilated building which will be extracted to a biofilter odour control system. The building will operate under negative pressure with up to 3 air changes per hour. Ventilation pipe work installed in the headspace of the building will be connected to a high-volume medium-pressure blower that will draw off the warm, buoyant building air that will be generated by a combination of emissions from the input materials in the intake area and from fugitive emissions from the movement of the material between composting tunnels.
- The main entrances to the biological treatment facility building will be fitted with rapid response roller shutter doors. A closed-door management strategy will be enforced.
- Treated emissions from the odour control plant in the biological treatment facility building will be discharged via a 20 m stack to enhance dispersion.
- Vehicles exiting the biological treatment facility through the roller shutter door on the western flank will be subjected to cleaning procedures in accordance with the DAFM Conditions Document in a designated cleaning area located outside of this door.

The following key mitigation measures which are currently in place at the facility will continue:

- Scrutiny and screening of waste intake to prevent particularly odorous material being accepted at the landfill for disposal. Regular patrols of the site will be undertaken to identify any odour problems and any complaints received will be promptly investigated.
- The immediate compaction of the waste within a small controlled area will minimise the available area for odours to escape from the daily tipping area. Additionally, operating procedures at the facility will require immediate landfilling of waste once tipped or ejected from trailers.
- The primary odour control measure is the use of daily cover in accordance with the provisions of the licence. Daily cover comprises a minimum of 150 mm of soil-like material covered with a 100 mm deep layer of woodchip, the microbial population on the latter being a well-documented medium used to treat odorous compounds in bio-filters. Before being covered the waste is compacted.
- Leachate is removed regularly by a licensed waste contractor thus minimising the potential for odours which can form as a result of leachate stagnating and becoming anaerobic. The leachate lagoon is covered and exhaust fumes from the vacuum tankers are vented through carbon filters. Any additional leachate tanks and lagoons will be property enclosed and maintained at all times.
- A mobile fog spray system is present on site and is used as required.
- Long term odour control will be achieved via the active landfill gas extraction system, which collects landfill gas under negative pressure, reducing the potential for odours to be released in an uncontrolled manner. This is a requirement of the existing licence and any future licence. The design of the landfill gas extraction system is subject to EPA approval. The design of the system will mitigate uncontrolled landfill gas.

The existing gas extraction system comprises the following:

- horizontal sacrificial gas extraction pipework in the waste disposal cells (to facilitate extraction, under negative pressure, of landfill gas, as may be required in cells designated for the placement of non-stabilised waste)
- a network of vertical landfill gas extraction wells (constructed progressively with the development of the landfill, at 50 metre lateral and longitudinal centres. Additionally, vertical wells shall be drilled into the waste as required and determined by surveys of fugitive emissions, in order to minimise or eliminate landfill gas migration. The additional drilled wells shall be installed between the constructed main gas extraction wells, so as to reduce the distances between the individual wells and to increase the capture rate of landfill gas. Where appropriate, sacrificial vertical "pin" or "spike" wells will also be installed. It shall be ensured that the vertical gas wells are sealed at surface with bentonite as required in order to minimise the ingress of oxygen and the potential for migration of landfill gas.)
- pipework to convey landfill gas from the wells to the landfill gas utilisation plant
- landfill gas utilisation plant (Section7.4.2.2)
- All vertical and horizontal landfill gas extraction wells shall be connected to the gas collection pipe network which shall consist of a 355 mm ring main around the landfill footprint and 180 mm branches laid across the landfill surface. Each individual landfill gas well, as well as each individual branch shall, prior the point of connection into the next higher collection level (i.e. well-branch connections and branch-ring main connections) be equipped with shut-off valves, in order to enable flow restriction or isolation of individual wells or branches.
- In order to continuously remove condensate from the landfill gas extraction network and therefore avoid uncontrolled flow restriction and pulsating, the ring main shall be connected to the gas flaring and utilisation plant via condensate knockout pots. The condensate accumulating in these pots shall be removed by pneumatic/electric pumps and piped back into the leachate riser pipes, from where it can drain to the cell base and be removed with the leachate.
- Daily checks of the landfill gas field and combustion plant shall be undertaken to ensure optimum operation. Monitoring of internal and external landfill gas wells is carried out in accordance with the licence.
- The landfill gas collected in the landfill gas extraction and collection network shall, after passing through the condensate knockout pots, be flared off in an enclosed flare or utilised in landfill gas combustion engines with electricity generation, as appropriate. Contingency arrangements are currently in place in accordance with the licence to avoid gas venting in the case of plant failures.
- Operational procedure for the operation of landfill gas flares addresses the operational requirements to optimise the combustion rates and maintain compliance with emission limits and monitoring requirements. Any significant downtime of landfill gas flares or other utilisation equipment shall be logged by Bioverda Power Systems (landfill gas plant operator). Should significant downtime of landfill gas flares or other utilisation equipment occur and cause potential for environmental pollution, the Environmental Protection Agency shall be notified in accordance with procedure EMS-OP-23.

The landfill gas system is described in more detail in Chapter 2 of Volume 2 of the EIAR.

- The use of odour assessments and VOC surface emission surveys in accordance with the licence and the EPA guidance documents to determine any issues that may have a potential impact and implementation of mitigation measures.

7.5.2.5 Climate

The proposed development will positively impact the local and national climate. Benefit to the climate will be by reducing the emission of greenhouse gases via stabilisation of biodegradable waste prior to landfilling capture of methane and other trace gases in in landfill gas. The generation of renewable electricity predicted at 2MW from waste and the proposed solar farm (3 MW) will also off-set or avoid carbon dioxide emissions generated from energy generation at traditional fossil fuel plants.

Therefore, no mitigation measures are required.

7.6 Predicted Residual Impacts

Dust
Step 4 of the IAQM methodology for the assessment of dust emissions is the determination of residual impacts and whether or not they are significant.

In the absence of mitigation measures, there is a Low Risk of dust impact. Taking into account the current operational controls in place to manage dust, the licence requirements and the proposed mitigation measures, there will be no residual dust impact.

Traffic
The estimation of vehicle emissions from the construction and operation of the proposed development indicate the impact from traffic emissions will be imperceptible /negligible. Mitigation measures are not required and there are no residual impacts.

Landfill Gas Plant
Predicted emissions from the landfill gas plant onsite are within the relevant air quality guidelines and therefore will not have a significant impact on ambient air quality. Monitoring will be carried out in accordance with the licence and servicing in accordance with the manufacturers recommendations. There are no residual impacts.

Odour
The odour exposure levels that are predicted to occur around the site as a result of landfilling operations are predicted to be lower than the current baseline and the 'do nothing' situation for the first 4 years, if the proposed development goes ahead. The development is therefore predicted to have a beneficial effect on odour exposure and impact risk during this period. The number of houses exposed to odour levels that exceed the threshold where a potentially significant risk of odour impact could develop falls from 12 no. residential properties under baseline conditions and 10 no. in year 4 of 'do nothing', to 4 no. residential properties in year 4 of the proposed development.

A risk of impact will remain whilst the landfill is operating beyond year 4 which is predicted to be at its highest in the final year of the landfill (year 6). Under this scenario, 6 no. properties are predicted to be exposed to odour levels that exceed the threshold where a potentially significant risk of odour impact could develop, based on application of the precautionary indicative odour impact criteria applied in the study.

The odour emissions from the biological treatment facility are not predicted to pose any risk of impact at any area within or outside the facility.

Climate
Benefit to the climate will be by reducing the emission of greenhouse gases by diverting biodegradable waste from landfill for treatment and by the generation of energy in the landfill gas utilisation plant, export to the national grid and the subsequent savings of fossil fuels at a power plant.

7.6.1 Monitoring

Existing and Proposed Environmental Monitoring Locations are shown on Drawing No. LW14-821-01-P0050-004 and Drawing No. LW14-821-01-P0050-005 in Volume 4 of this EIAR.

Landfill gas monitoring will continue in compliance with the licence at perimeter monitoring wells and at in-waste wells. Landfill gas perimeter monitoring wells will be installed 12 months prior to waste acceptance at 50 m centres outside the landfill body. In-waste wells will be installed during and following landfilling.

Dust and PM_{10} monitoring will continue in compliance with the licence. There are no new proposed monitoring locations. Dust monitoring point DM2 will be moved east to the boundary line during the construction of the screening berm and it is proposed to return it to its existing location once the berm is constructed where it will sit on the berm clear of the tree line.

Stack emissions monitoring will continue in compliance with the licence.

All monitoring will be completed by suitably qualified personnel and samples will be analysed at an accredited laboratory. Monitoring equipment will be calibrated when required and records maintained.

All results will continue to be reported to the EPA in accordance with the Schedules of the licence.

Odour monitoring will continue to be carried out in compliance with AG5[33],

Monitoring of bioaerosols will be included in the new monitoring regime. New monitoring points relevant to the proposed development will be included in future monitoring. These proposed monitoring points are shown in Drawing No. LW14-821-01-P0050-008 in Volume 4 of this EIAR.

Ongoing monitoring will measure the effectiveness of the mitigation measures proposed in this development and if breaches of the EPA licence limit values or conditions are recorded, facility operations and mitigation measures will be reviewed, and corrective action procedures put in place.

A continuous monitoring system under SCADA control will monitor the operation of the air control system at the biological waste treatment facility. Any deviations in key design parameters will be detected and appropriate preventative maintenance will be undertaken to minimise air emissions.

7.7 Summary of Effects

This chapter examined the potential impacts of the proposed development on climate and air quality in the surrounding environment. Both the construction and operational impacts of the development were assessed. Potential impacts associated with the proposed development on climate and air quality are vehicle emissions, dust/particulate emissions, landfill gas utilisation emissions, biofilter emissions and odour emissions. Dust and vehicle emissions from the construction phases of the project were assessed and it was concluded that construction activities will not significantly affect the surrounding environment.

Operational emissions from the landfill gas utilisation plant and the biological treatment plant were assessed using the air dispersion model AERMOD, to predict the maximum ground level concentrations of pollutants from the proposed development. The results were compared against the relevant ambient air quality standards and guidelines. The results of the conservative modelling assessment indicate that predicted emissions are in compliance with the statutory limits set out in the EU Ambient Air Quality Directive (EU 2008/50/EC) and other relevant standards (2004/107/EC, the Air Quality Standards and Environment Agency guidance) at any nearby sensitive receptors. The predicted concentrations are also within the maximum allowable PC as defined by AG4 guidance even assuming a very conservative operational scenario that involved the combustion of 6,600 m^3/hr of landfill gas. In conclusion, the proposed air emissions from both landfill gas utilisation plant and the proposed biological waste treatment facility at Knockharley landfill, will not significantly impact on the ambient air quality of the area.

In addition, the proposed biological waste treatment facility is greater than 250 m from the nearest sensitive receptors. This is outside the recommended setback distance where there is a risk of impacts of bioaerosols.

Also, all activities associated with the composting process proposed will be carried out indoors under negative air pressure, meaning that the only emissions will be from the biofilter. This further reduces any risk of impacts associated with the facility.

Due to mitigation measures in place already, and additional mitigation measures as set out, dust emissions from vehicle movement onsite will not significantly affect the surrounding environment. Traffic pollutants of most concern were also examined using a basic air quality prediction screening model and predicted traffic emissions from existing and proposed traffic flows are within the relevant air quality guidelines and therefore will not impact significantly on ambient air quality.

From an odour emissions perspective, the total odour emissions generated from landfilling activities are predicted to decrease as a result of the proposed development in comparison to current baseline levels and the emissions that would occur if the proposal did not go ahead (2022). This is due to the enhancement in capping proposed as part of the development and the fact that the majority of additional waste which will be accepted by the landfill is stabilised, inert or non-biodegradable and hence has a low odour generation potential.

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[33] Odour Impact Assessment Guidance for EPA Licensed Site AG5 EPA, 2010

Additional emissions will be generated from the biological waste facility, however, such emissions will be treated in an odour control system prior to release through a 20 m stack which will enhance dilution and dispersion.

The emissions from the biological treatment facility are not predicted to pose any risk of impact at any area within or outside the facility.

The odour exposure levels that are predicted to occur around the site as a result of landfilling operations are predicted to be lower than the current baseline and the 'do nothing' situation for the first 4 years, if the development goes ahead. The development is therefore predicted to have a beneficial effect on odour exposure and impact risk during this period. The number of houses exposed to odour levels that exceed the threshold where a potentially significant risk of odour impact could develop falls from twelve no. under baseline conditions and ten no. in year 4 of 'do nothing', to four no. in year 4 of the development. The odour exposure in year 4 of the development at these 4 no. properties is predicted to fall in the range of >1.5 ou_E/m^3 to <1.7 ou_E/m^3.

A risk of impact will remain whilst the landfill is operating beyond year 4 which is predicted to be at its highest in the final year of the landfill (year 6). Under this scenario, six no. properties are predicted to be exposed to odour levels that exceed the threshold where a potentially significant risk of odour impact could develop. The odour exposure in year 6 of the development at these 6 no. properties is predicted to fall in the range of >1.5 ou_E/m^3 to <2.1 ou_E/m^3. The emissions from the biological treatment facility are not predicted to pose any risk of impact at any area within or outside the facility.

The overall conclusion of the odour impact assessment is that the development will have a beneficial effect on odour exposure and impact risk in comparison to the do-nothing scenario in the next four years. A residual risk of impact will remain to up to 4 no. properties during this period and up to 6no. properties until the landfill is completed, based on application of the precautionary indicative odour impact criteria applied in the study.

From a climate perspective, the proposed development will positively impact the local and national climate. Benefit to the climate will be by reducing the emission of greenhouse gases by diverting biodegradable waste from landfill for treatment and by the generation of energy in the landfill gas utilisation plant and the subsequent savings of fossil fuels at a power plant.

7.8 References

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18. IAQM (2018) Guidance on the assessment of odour for planning, Version 1.1.

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 8 – ROADS, TRAFFIC & TRANSPORTATION

NOVEMBER 2018

Knockharley Landfill Ltd.

Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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8 ROADS, TRAFFIC & TRANSPORTATION

This chapter was prepared by Trafficwise Ltd.

8.1 Introduction

The Knockharley Landfill opened in December 2004 and accepts residual household, commercial and industrial wastes together with construction and demolition wastes.

The residual waste landfill operates on foot of two permissions Planning Reg. Ref. Nos. 01/5006 & NA/60336, and in accordance with Environmental Protection Agency (EPA) Industrial Emission Licence Ref. No. W0146-02. The EPA licence covers the acceptance of 200,000 tonnes of waste per annum of which 175,000 tonnes is for disposal and 25,000 tonnes is for recovery. Condition No.3 of the current planning consent (An Bord Pleanála Case Ref. PL17.220331) authorises the acceptance of up to 132,000 tonnes waste annually until end December 2010 with the permitted volume of waste reducing to 88,000 tonnes per annum after 2010.

It is proposed to increase the acceptance of waste at the landfill up to 440,000 tonnes per annum. The proposed development will include for acceptance of non-hazardous incinerator bottom ash, as well as household, commercial and industrial wastes, non-hazardous contaminated soils and construction and demolition (C&D) waste, residual fines material etc. The proposed development includes for the construction of dedicated IBA facility together with an increase in void capacity within the existing landfill footprint. The development includes for a leachate treatment plant for pre-treatment of leachate generated from the landfill, prior to its removal offsite and the construction of a biowaste treatment facility to stabilise biological fines.

8.1 Study Area and Methodology

8.1.1 Traffic & Transport Study Methodology

The traffic study has been conducted in accordance with the National Roads Authority (NRA) *'Traffic and Transport Assessment Guidelines*' (May 2014) whilst this report is structured in accordance with the general advice provided in the Chartered Institution of Highways & Transportation (CIHT) document '*Guidelines for Traffic Impact Assessment*' (September 1994); a document which is recognised by the NRA to represent a structured approach to the preparation and presentation of Traffic and Transport Assessments (formerly Traffic Impact Assessments).

This study identifies receiving road network traffic conditions together with the permitted traffic generation of the development and provides an assessment of the potential impact likely to arise directly from the current proposal. All sources of traffic generation are taken into consideration and include waste related transportation, construction traffic and traffic associated with the day to day operation of the landfill which includes for the removal of leachate off site and felled forestry.

To frame the traffic assessments in the context of previous applications determined for the site, reference is made to previous Traffic Impact Assessment reports and comparison is made with the assessment scenarios and the results of various sensitivity analyses which, from the perspective of traffic and transportation, the determination of the current permission is predicated.

8.1.2 Study Area

The study identifies how traffic from the proposed development can be accommodated on the local and strategic road network. Where appropriate, measures to address the management of both existing traffic and proposed development traffic on the road network are discussed.

8.1.3 Relevant Data Sources - Overview of Previous Planning Applications

In 2000, a Traffic Impact Assessment report accompanied the original planning application (Planning Reg. Ref. PL01/5006) for a residual landfill at Knockharley.

In 2005, the original report was reviewed and updated with new traffic surveys. The updated report addressed the traffic impact under application (PLNA/60336) which sought an increase in waste acceptance at the site. Both reports were prepared by Trafficwise Ltd.

Summary of Findings from Original Traffic Report (PL01/5006)

The traffic report which accompanied the original planning application (PL01/5006) was based upon the proposed acceptance threshold of 180,000 tonnes of waste per annum. In that report a 'sensitivity' assessment was carried out to investigate the traffic impact arising from a theoretical waste acceptance rate equating to 250,000 tonnes per annum.

The landfill was proposed to be served by a high-quality ghost island directing vehicular access to the N2 National Primary Road. The site access, as now serves the site, was designed by Trafficwise Ltd. to the NRA standard for a ghost island junction on the national primary road network and is provided with a right turn lane and a nearside auxiliary left turning lane. The geometry of the access was designed to Design Manual for Roads and Bridges (DMRB):TD42 '*Geometric Design of Major/Minor Priority Junctions*' and constructed in accordance with the requirements of the NRA: DMRB for a 100kph Design Speed. The access was subject to independent Road Safety Audits, Stages 1 and 2 at the design stage and Stage 3 Road Safety Audit was prepared upon completion of construction. All road safety auditing was carried out in accordance with NRA standard HD/19. The access infrastructure granted permission under the original application is the infrastructure which exists today.

Since the original permission for the landfill development was granted there is an increased pre-treatment obligation required for waste before being disposed at landfill. The forecast traffic figures in the traffic assessment report that accompanied the original application considered the then prevailing payloads of vehicles transporting untreated wastes to landfills. Typically wastes to landfill had arrived in refuse collection vehicles with average payloads of 8.5 tonnes and 14.5 tonnes. In the original traffic report, one third of all waste was assumed to arrive in typical refuse collection vehicles with a capacity for 8.5 tonnes and the remaining two thirds was assumed to arrive in larger bulk containers carrying 14.5 tonnes. These estimates of vehicle payload were based upon empirical data recorded at landfills operating at that time of preparing the traffic study and report.

The original proposed development for the disposal of 180,000 tonnes was estimated to have the potential to generate approximately **15,334 HGV trips per annum**. This equates to an average of **51 HGV trips per day** associated with the delivery of waste materials for both disposal and recovery. A vehicle 'trip' is defined by a vehicle 'movement' to and a vehicle 'movement' from the site.

Under the above traffic flow assessments, the development was shown through detailed network traffic modelling analyses not to have a significant impact on the operation and capacity of the receiving road network including the N2 National Primary Road, the R150 and the R153 Regional Roads.

Under planning application PL01/5006 the landfill was granted permission to accept 132,000 tonnes of material per annum.

It can be appreciated that when it was decided that the landfill could receive 132,000 tonnes of waste per annum, that decision was based upon the then prevailing policy where untreated waste was acceptable at landfill. Based on the principles of the original traffic assessment and the prevailing payloads of vehicles carrying untreated waste, the permitted 132,000 tonnes of untreated material was estimated as likely to have generated 5,175 refuse collection vehicles and 6,069 articulated vehicles per annum. This equates to a total potential HGV traffic generation of **11,245 HGV trips per annum** which in turn equates to an average value of **38 HGV trips per day** for the disposal or recovery of waste. This is the average traffic generation rate envisaged in the determination of that planning application.

Summary of 2005 Traffic Report Findings – (PL NA/60336)

Planning application PLNA/60336 sought to increase the annual volume of waste received at the site to 200,000 tonnes.

Since the grant of planning permission for the site under PL01/5006, national policy had been amended so that most waste received at landfill sites is pre-treated. The logistical implications of the waste treatment policy are that most waste arriving at the landfill must have been treated at a materials recovery or waste transfer facility where waste is bulked up which results in a significant increase of the average payload of vehicles arriving at landfill sites; correspondingly for the same annual disposal tonnage the traffic generation for landfill sites had decreased significantly since the original Traffic Impact Assessment (PL01/5006).

From a review of weighbridge data recorded at the site in 2005, the average payload of vehicles arriving at the site was 21.4 tonnes.

The proposed 200,000 tonnes annual threshold for treated waste in accordance with the 2005 traffic and transport assessment report was estimated to result in the generation of **9,345 HGV trips** per annum. This equated to **1,900 HGV trips** less than had already been considered in the determination and grant of the permission to receive 132,000 tonnes of untreated waste (the original permission).

The proposed 200,000 tonnes threshold was estimated to result in an average HGV traffic generation of **31 HGV trips per day**.

The forecast potential average traffic generation of 31 HGV per day operating at the proposed 200,000 tonnes threshold for treated waste is approximately 20% lower than the 38 HGV per day estimated to be generated by the permitted PL01/5006 development which included for 132,000 tonnes of untreated waste.

8.2 Existing Environment

8.2.1 General Location of Site and Road Network

The site is located in the townland of Knockharley, approximately 6km south of Slane on the west side of the N2 National Primary Route. Navan is located approximately 13km to the west of the site via Balrath Cross and the R153 Regional Road.

To the north, the site is bounded by the CR384 County Road running east-west. To the east the site is bounded by the CR384 running north-south between the N2 and R150. The CR384 in this location runs almost parallel to the N2. To the south, the site is bounded by farmland, which is generally located adjacent to the R150 on the Kentstown side of the N2. To the west, the site is bounded by mainly gently sloping farmland, mostly in large fields generally defined by mature hedgerows with some groups of trees.

The N2 has a posted speed limit of 100kph in the vicinity of the site and is the primary access route to and from the site.

Save for the CR384, which is not used by site traffic, the general road infrastructure in the immediate vicinity of the development site is of a relatively good standard in terms of road alignment, surfacing and cross-section.

8.2.2 Existing Site Access

The existing site enjoys direct vehicular access to the national roads network with primary access facilitated at a ghost island junction on the N2. The ghost island provides sheltered access for right turning vehicles travelling from the north. This is complimented with an auxiliary left turn deceleration lane to facilitate access for vehicles coming from the south. Both turning facilities aid in preserving the flow, speed and therefore the capacity of through traffic on the N2. The junction has been designed and constructed in accordance with the NRA: Design Manual for Roads and Bridges (DMRB) and has been the subject of Roads Safety Auditing (Stages 1, 2 and 3) in accordance with procedures set out in the relevant NRA guidelines.

The access road to the site from the N2 runs due west through arable lands, thereafter running under the CR384 County Road. The entrance proper to the site is located approximately 80 to 100 metres west of the underpass of the CR384. A security gate with closed circuit television is located on the access road. This aids site security staff in preventing unauthorised traffic from entering the site.

8.2.3 Existing HGV Routing

The original grant of permission conditions the site operator to provide a traffic management plan. The traffic management plan includes provisions for prohibiting traffic directly associated with the landfill from travelling along the R150 between its junctions with the N2 and the R153 in Kentstown. After the opening of the landfill site it was found at subsequent planning forums that the traffic management system of prohibiting landfill traffic by means of a contracted arrangement functions successfully and to the satisfaction of the Planning Authority. It should be noted nonetheless that other HGVs including waste industry related vehicles generated by nearby waste treatment facilities are not prohibited from using the R150.

8.2.4 Existing Policy - Local Authority Roads Network Objectives

In summarising the transport policies and programmes for County Meath and the local area in particular, reference has been made to the Meath County Development Plan 2013-2019.

In June 2006, the N2 Realignment Scheme (incorporating a Bypass of Ashbourne) opened for public traffic. The M3 Clonee to Kells Motorway opened in June 2010. This project involved the construction of a 50km section of motorway/dual carriageway and 11km of single carriageway. The scheme also involved the construction of a further 24km of link roads and widening and re-alignment of other roads. The improvement to the N3 is acknowledged to have afforded direct traffic relief to the N2. It is considered likely that a portion of traffic on the regional roads linking between the N2 and N3 through Rathoath (R155, R125), Dunshaughlin (R125), Kentstown (R153, R150) etc. may have been attracted to transfer from the N2 to the upgraded N3 which is vastly improved over the quality and capacity of the N2.

Minor improvements, including resurfacing works, have been implemented at the nearby Rathdrinagh Crossroad Junction, R150 crossroad and the R153 Balrath Cross and the approach roads leading to these junctions. Save for isolated junction improvement works, overlays for pavement strengthening, traffic calming and other low-cost safety and further general road maintenance measures it is understood that the Local Authority has no proposals to significantly upgrade the N2 in the vicinity of the site.

The Meath County Development Plan 2013-2019 outlines its commitment to reviewing proposals for the construction of a bypass at Slane.

In the long term, the Leinster Outer Orbital Route has been identified by the Dublin Regional Authority and the Mid-East Regional Authority, now known as the Eastern and Midlands Regional Assembly, as a key strategic link between Drogheda-Navan-Trim-Maynooth-Naas-Wicklow. This scheme would comprise a road corridor connecting Drogheda and Navan with Enfield and Naas. It would serve as a second bypass of Dublin City to complement the M50 and would link the majority of Dublin's main radial routes: M1, M2, M3, M4 and M7. The M11 would not be served by the Leinster Orbital Route. The proposed scheme would be provided with a new interchange with the existing N2 or future M2 Ashbourne to Ardee Road. If built, the interchange is expected to be located in the vicinity of the existing Knockharley landfill. Notwithstanding the fact that access to the existing landfill is of high quality, a nearby interchange providing additional accessibility to new strategic infrastructure would benefit the landfill development. NRA appointed consultants undertook a Feasibility Study for the proposed Leinster Orbital Route and this was submitted to the Department of Transport in 2007. It appears unlikely that the orbital route will be constructed during the lifetime of the landfill development. The Transport Strategy for the Greater Dublin Area 2016-2035 confirms that up to the horizon year of the plan, no work will take place on this road, though its route will be kept clear of development for possible later implementation.

8.2.5 Existing Opening Hours

The operational hours of the site are:

- Operating hours are 07:300-18:30 hrs Monday to Saturday inclusive
- Waste acceptance hours are 08:00-18:00 hrs Monday to Saturday inclusive.

The site does not operate on Sundays or Bank Holidays. This constitutes approximately 300 working days per annum. Although the site does not accept waste before 08:00 hrs, in the interest of traffic safety on the N2 vehicles arriving from 07:30 hrs are permitted to enter the site, however they are not permitted to cross onto the weighbridge before 08:00 hrs. The length of the internal road network is approximately 800m from the N2 to the weighbridge and this ensures that any short-term queuing arising does not have the potential to back up to and interfere with the free flow of traffic on the N2.

8.2.6 Existing Traffic Flows

Overview of Surveys

Classified CCTV traffic turning count surveys have been carried out by Abacus Transportation Surveys Ltd. at the existing access to the landfill site. The turning count survey was undertaken on Tuesday 10th February 2015 between 07:00 hrs and 19:00 hrs. A further classified CCTV traffic turning count survey was undertaken at N2/R150 O'Brien's Cross on 5th September 2016. In addition, Abacus also carried out an Automatic Traffic Counter (ATC) survey on the N2 mainline carriageway at a location approximately 100m south of the site access. The ATC count spans the period from midnight on Thursday 5th February 2015 to midnight on Thursday 12th February 2015. A further ATC survey was undertaken at the same location and spans Saturday 3rd September 2016 to Friday 9th September 2016.

To provide empirically based forecasts of the likely distribution of traffic generation to and from the landfill, reference is made to previous traffic counts undertaken on behalf of Trafficwise Ltd. by Abacus Transportation Surveys in May 2010 at Rathdrinagh Cross, O'Brien's Cross and Balrath Cross. Abacus were instructed by Trafficwise Ltd. to identify and separate landfill HGV traffic from all other HGV at each count location thus providing a distribution to the greater road network. Notwithstanding that the data is from 2010, these surveys combined with other data sources and current weighbridge data are considered a reasonable basis upon which to estimate the likely future distribution of site generated HGV on the road network in the vicinity of the site.

All turning count survey data from 2016, 2015 and the origin destination survey data from 2010 including survey location mapping is provided in Appendix 8.1.

Receiving Road Traffic Flows

The automatic traffic counter survey data provides a continuous record of:

- Traffic Volume by Direction
- Vehicle Classification (Category of Vehicle) by Direction
- Vehicle Speed by Direction.

Comprehensive summaries and analyses of the ATC survey data are provided in Appendix 8.2.

The principal receiving road in the vicinity of the site which currently carries practically all landfill generated traffic and which has the potential to carry traffic from the proposed development is the N2 National Primary Road and to a lesser extent the R150 (east of O'Brien's Cross Roads) and the R153 (west of Balrath Cross Roads).

Analysis of the traffic flow data on the N2 recorded by the ATC surveys is summarised in the graphical output provided in Appendix 8.2 as follows:

- Figure 1 Total & Average Daily Two-way Traffic Flows 2015
- Figure 2 Total & Average Daily Traffic Flows by Direction 2015
- Figure 3 Hourly Traffic Flow - Friday 6 February 2015
- Figure 4 Hourly Traffic Flow - Saturday 7 February 2015
- Figure 5 Hourly Traffic Flow - Sunday 8 February 2015
- Figure 6 Hourly Traffic Flow - Monday 9 February 2015

- Figure 7 Hourly Traffic Flow - Tuesday 10 February 2015
- Figure 8 Hourly Traffic Flow - Wednesday 11 February 2015
- Figure 9 Hourly Traffic Flow - Thursday 12 February 2015
- Figure 10 Average Weekday Hourly Traffic Flow 2015
- Figure 11 Total & Average Daily Two-way HGV Traffic Flows 2015
- Figure 12 Total & Average Daily HGV Traffic Flows by Direction 2015
- Figure 13 Hourly HGV Traffic Flow - Friday 6 February 2015
- Figure 14 Hourly HGV Traffic Flow - Saturday 7 February 2015
- Figure 15 Hourly HGV Traffic Flow - Sunday 8 February 2015
- Figure 16 Hourly HGV Traffic Flow - Monday 9 February 2015
- Figure 17 Hourly HGV Traffic Flow - Tuesday 10 February 2015
- Figure 18 Hourly HGV Traffic Flow - Wednesday 11 February 2015
- Figure 19 Hourly HGV Traffic Flow - Thursday 12 February 2015
- Figure 20 Average Weekday Hourly HGV Traffic Flows 2016
- Figure 21 Total & Average Daily Two-way Traffic Flows 2016
- Figure 22 Total & Average Daily Traffic Flows by Direction 2016
- Figure 23 Hourly Traffic Flow - Friday 6 February 2016
- Figure 24 Hourly Traffic Flow - Saturday 7 February 2016
- Figure 25 Hourly Traffic Flow - Sunday 8 February 2016
- Figure 26 Hourly Traffic Flow - Monday 9 February 2016
- Figure 27 Hourly Traffic Flow - Tuesday 10 February 2016
- Figure 28 Hourly Traffic Flow - Wednesday 11 February 2016
- Figure 29 Hourly Traffic Flow - Thursday 12 February 2016
- Figure 30 Average Weekday Hourly Traffic Flow 2016
- Figure 31 Total & Average Daily Two-way HGV Traffic Flows 2016
- Figure 32 Total & Average Daily HGV Traffic Flows by Direction 2016
- Figure 33 Hourly HGV Traffic Flow - Friday 6 February 2016
- Figure 34 Hourly HGV Traffic Flow - Saturday 7 February 2016
- Figure 35 Hourly HGV Traffic Flow - Sunday 8 February 2016
- Figure 36 Hourly HGV Traffic Flow - Monday 9 February 2016
- Figure 37 Hourly HGV Traffic Flow - Tuesday 10 February 2016
- Figure 38 Hourly HGV Traffic Flow - Wednesday 11 February 2016
- Figure 39 Hourly HGV Traffic Flow - Thursday 12 February 2016
- Figure 40 Average Weekday Hourly HGV Traffic Flow 2016

Appendix 8.2, Figure 2 shows, by direction, the total daily traffic flow passing the existing site access location on National Road N2. The average daily traffic flow in 2015 was 3,295 vehicles northbound (toward Slane) and 3,635 vehicles per day southbound (toward Ashbourne). In September 2016 some 19 months later, the average daily traffic flow was 4,253 vehicles northbound and 4,377 vehicles southbound.

Excluding weekend traffic, the average weekday traffic flow in 2015 was 3,564 northbound and 3,895 southbound. The equivalent flow in 2016 was 4,592 northbound and 4,488 southbound.

The lowest 2015 daily traffic flow occurred on Sunday with 2,529 vehicles northbound and 3,064 southbound in 24 hours whilst the highest daily flow occurred on Monday with 3,898 vehicles northbound and 3,846 southbound. The lowest 2016 daily traffic flow similarly occurred on Sunday with 2,783 vehicles northbound and 2,938 southbound in 24 hours whilst the highest daily flow recorded in 2016 occurred on Tuesday with 4,717 vehicles northbound and 5,025 southbound.

Appendix 8.2, Figures 3 to 9 show the recorded hourly traffic flow over the course of the 2015 weeklong survey whilst Figure 23 to 29 show the corresponding traffic flows recorded in the 2106 surveys. In both cases the profile for the average daily weekday flows shows typical tidal commuter traffic pattern with peaks occurring generally between 07:00-08:00 hrs and 17:00-18:00 hrs respectively in the morning and evening.

Common to both the 2015 and 2016 surveys is that the predominant weekday traffic flow is southbound in the morning (toward Ashbourne) and northbound in the evening. As is typical for commuter traffic, the morning peak is more intense with an average morning weekday peak flow of 509 vehicles southbound and 152 northbound between 07:00-08:00 hrs in 2015.

The corresponding flows in 2016 show a decrease in the morning peak southbound flow to 439 vehicles and an increase to 223 vehicles northbound. Both surveys show that weekday evening peak is less intense but more prolonged than in the morning. Extending from 16:00 to 19:00 hrs the weekday evening peak flows in 2015 were approximately 382 northbound and 185 southbound per hour. In 2016 the evening peak hour flows were in the order of 444 northbound and 247 southbound.

Appendix 8.2, Figure 10 shows the average traffic flow recorded for each hour of the day over the course of the 2015 survey whilst Figure 20 shows the corresponding data for 2016. In 2015 the average weekday traffic flow between the hours of 07:00 and 19:00 hrs is 231 vehicles northbound and 232 vehicles southbound per hour. In 2016 the corresponding average weekday hourly traffic flows are 292 vehicles northbound and 297 vehicles southbound per hour. Weekday daily traffic flows are consistent both in terms of hourly flow and daily pattern and this is highlighted in the graphical output of Appendix 8.1.

The weekday morning peak hour occurs during 07:00 to 08:00 hrs when, in 2015 the road carried an average of 509 vehicles northbound and 152 vehicles southbound. The corresponding flows in 2016 show a decrease in the morning peak southbound flow to 439 vehicles and an increase to 223 vehicles northbound.

The recorded weekday morning peak two-way flow is approximately 1.4 times the recorded weekday average hourly traffic flow between 07:00 and 19:00 hrs in 2015, reducing to approximately 1.25 in the 2016 surveys.

The weekday evening peak hour period in both ATC traffic surveys is less well defined as there is a general rise in traffic flows for a three-hour period between 16:00 and 19:00 hrs. During the recorded peak of 16:00 to 17:00 hrs the road carries 357 vehicles northbound and 193 vehicles southbound in 2015 increasing to 400 vehicles northbound and 250 vehicles southbound in 2016. The evening peak two-way flow in 2015 is approximately 1.2 times the recorded weekday average hourly traffic flow between 07:00 and 19:00 hrs, in 2016 the peak equates to 1.3 times the hourly average.

Table 8.1 provides a summary of the recorded 2015 and 2016 speed statistics for northbound and southbound traffic passing the existing site access over the course of the 7-day survey. The separation distance is set at a standard 4 seconds to avoid records of platooning traffic.

Receiving Road HGV Traffic Flows 2015 Surveys

Appendix 8.2, Figure 12 shows the 2015 average weekday daily HGV traffic flow is 600 vehicles per day northbound (toward Slane) and 586 vehicles per day southbound (toward Ashbourne). The lowest daily HGV traffic flow was Sunday with 236 HGV northbound and 92 southbound in 24 hours whilst the highest daily flow was occurred on Wednesday with 669 HGV northbound and 597 southbound.

Appendix 8.2, Figures 13 to 19 show the 2015 recorded hourly HGV traffic flow over the course of the weeklong survey. The profile for the average weekday daily HGV flow is considered typical of the pattern of commercial traffic flows expected on regional and national roads which tend to show a distribution curve resembling the mathematical 'standard normal distribution' (Gaussian).

Appendix 8.2, Figure 20 shows the weekday average HGV traffic flow recorded for each hour of the day over the course of the survey. **The average weekday traffic flow on the N2 between the hours of 07:00 and 19:00 hrs was recorded in 2015 as 38 HGV northbound and 37 HGV southbound per hour**.

The 2015 morning peak hour HGV traffic flow occurred between 09:00 to 10:00 hrs which was two hours after the commuter peak hour period nevertheless it should be noted that the peak two-way HGV flow of 89 was only marginally higher than the average (practically a constant value) two-way flow for the period 07:00 to 16:00 hrs which is 79 HGV per hour.

During the weekday HGV morning peak hour 09:00 to 10:00hrs the N2 in 2015 carried a two-way flow of 89 HGV which is approximately 1.1 times the recorded weekday average hourly HGV traffic flow between 07:00 and 19:00 hrs. The evening peak hour period was less intense with a total two-way HGV flow of 81 vehicles between 16:00 and 17:00 hrs which was practically equivalent to the weekday hourly average recorded between 07:00hrs and 19:00 hrs.

Receiving Road HGV Traffic Flows 2016 Surveys

Appendix 8.2, Figure 32 shows the 2016 average weekday daily HGV traffic flow is 590 vehicles per day northbound (toward Slane) and 527 vehicles per day southbound (toward Ashbourne). This constitutes a reduction in the average daily HGV flow in the order of approximately 6% between 2015 and 2016. The lowest daily HGV traffic flow in 2016 is recorded as Sunday with 176 HGV northbound and 96 southbound in 24 hours whilst the highest daily flow occurred on Wednesday with 652 HGV northbound and 663 southbound.

Appendix 8.2, Figures 33 to 39 show the recorded hourly HGV traffic flow over the course of the weeklong survey. The profile for the average weekday daily HGV flow is considered typical of the pattern of commercial traffic flows expected on regional and national roads.

Appendix 8.2, Figure 40 shows the weekday average HGV traffic flow recorded for each hour of the day over the course of the survey. **The average weekday traffic flow on the N2 between the hours of 07:00 and 19:00 hrs is 37 HGV northbound and 31 HGV southbound per hour**.

The morning peak hour HGV traffic occurs between 09:00 to 10:00 hrs which is two hours after the commuter peak hour period. The peak two-way HGV flow of 77 is only marginally higher than the average (practically a constant value) two-way flow for the period 07:00 to 16:00 hrs which is 69 HGV per hour.

During the weekday HGV morning peak hour 09:00 to 10:00hrs the N2 carries a two-way flow of 77 HGV which is approximately 1.1 times the recorded weekday average hourly HGV traffic flow between 07:00 and 19:00 hrs. The evening peak hour period is less intense with a total two-way HGV flow of 77 vehicles between 16:00 and 17:00 hrs which is equivalent to the weekday hourly average recorded between 07:00hrs and 19:00 hrs.

Recorded Vehicle Speeds

Table 8.1 below provides a summary of the recorded 2015 and 2016 speed statistics for northbound and southbound traffic passing the existing site access over the course of the 7-day surveys.

Table 8-1: ATC Speed Records

Speed (kph)	2015 Speed Survey				2016 Speed Survey			
	Northbound		Southbound		Northbound		Southbound	
	No.	%	No.	%	No.	%	No.	%
00-10	0	0%	0	0%	0	0.0	0	0.0
10-20	2	0%	0	0%	1	0.0	1	0.0
20-30	17	0%	3	0%	30	0.2	17	0.1
30-40	15	0%	15	0%	23	0.3	10	0.2

Speed (kph)	2015 Speed Survey				2016 Speed Survey			
	Northbound		Southbound		Northbound		Southbound	
	No.	%	No.	%	No.	%	No.	%
40-50	39	1%	36	0%	89	0.9	67	0.6
50-60	66	1%	39	1%	96	1.4	104	1.2
60-70	187	3%	176	2%	253	3.0	201	2.5
70-80	1,062	11%	1,136	11%	1,499	12.0	1,135	9.5
80-90	4,118	43%	3,959	44%	5,620	45.9	4,746	38.9
90-100	4,941	82%	4,225	78%	5,635	79.9	5,681	74.1
100-110	1,652	95%	1,805	93%	2,294	93.7	2,749	91.1
110-120	438	99%	593	98%	705	97.9	930	96.9
120-130	114	100%	158	99%	214	99.2	345	99.0
130-140	41	100%	61	100%	85	99.8	93	99.6
140-150	12	100%	19	100%	26	99.9	49	99.9
150-160	2	100%	9	100%	9	100.0	15	100.0
160-170	2	100%	3	100%	3	100.0	3	100.0
Total Sample	**12,708**	**100%**	**12,240**	**100%**	**16,582**	**100%**	**16,146**	**100%**
Average	**91kph**		**92kph**		**92kph**		**94kph**	
85th Percentile	**101kph**		**103kph**		**103kph**		**105kph**	

8.2.7 Traffic Generation of Existing Landfill (Traffic Survey Data)

Light Traffic

The classified traffic turning count surveys undertaken on Tuesday 10 February 2015 included the existing site access. The recorded data includes the cumulative traffic flows generated at the existing access which are shown in Appendix 8.1.

The 2015 survey recorded a total of 14 cars and vans inbound movements (11 car and 3 vans) at the existing access and some 14 outbound movements of which 11 were cars and 3 were vans.

The 2015 survey established that the morning peak hour for light vehicles at the existing site access occurs between 08:00 and 09:00 hrs, during which a total of 5 inbound vehicle movements and 1 outbound movement were recorded. The preceding hour similarly had 5 inbound vehicles but no outbound vehicles.

The evening peak hour for light vehicles at the existing site access occurred from 17:00-18:00 hrs, during which a total of 5 outbound movements was recorded with no inbound movements. From discussions with the operators of the site, the recorded light traffic generation is considered representative of current traffic generation.

HGV Traffic

The 2015 survey data shows a total of 5 No. inbound HGV movements and 5 outbound HGV movements were generated at the existing site access. HGV traffic was generated continuously throughout the day from 07:00 hrs through to 16:00 hrs, albeit that the level of HGV activity is generally greater in the mid-morning than in the evening. HGV traffic generation during the survey dropped after 16:00 hrs.

The development peak hour for HGV traffic was recorded as 10:00 to 11:00 hrs during which a total of 1No. HGV leaves the site and 3No. HGV enter. Over the 12 -hour survey period 07:00-19:00 hrs the site generated an average of less than one HGV movement inbound and outbound every two hours.

8.2.8 Daily Traffic Profile and Distribution

Over the course of the traffic surveys in February 2015 the site generated low HGV traffic volumes as waste acceptance was generally confined to importing ash from the incineration plant located nearby in Duleek, due to a temporary period of limited waste acceptance at the site. The recorded volume of traffic is not considered a large enough sample from which to derive a reasonable and representative daily profile of HGV traffic movements or to determine a meaningful distribution of the volumes of traffic forecast as likely to be generated by the proposed development when operating at greater capacity and receiving greater quantities of waste.

Trafficwise Ltd. prepared the original planning application for the landfill and also prepared traffic assessments and analyses for various other proposals at the site. A comprehensive traffic study was undertaken by Trafficwise Ltd. in 2010. Based upon our experience of landfill and other waste recovery infrastructure and given our knowledge of this particular site the daily traffic pattern of arrivals and departures recorded in the 2010 analysis are considered representative. Normal daily HGV traffic patterns are manifest at the site access and the profile resembles a flat 'normal' type distribution typical of landfill sites, with a modest peak generally occurring before noon and stretching into the late afternoon. HGV traffic generation at the site access is typically low in the commuter peak hour periods in the morning and evening.

In addition to the 2010 detailed analysis of traffic movements current estimates of daily traffic patterns and the distribution of HGV to the receiving road network are informed by the examination of recent weighbridge data recorded between January 2016 to and September 2016.

Daily Profile of HGV Traffic Generation

Appendix 8.3, Figure 1 shows the daily profile of inbound and outbound HGV traffic movements over the course of the 2010 traffic surveys and also shows the cumulative two-way HGV traffic generation over the course of the working day. Trend lines are provided to show the typical distribution of traffic streams throughout the working day. The 2016 weighbridge data confirms a similar average daily pattern of HGV traffic movements.

The 2010 survey data shows that the landfill site generated a total two-way flow of 73No. HGV movements (**36No. Inbound and 37No. Outbound**). An average of 6No. HGV movements per hour were generated over the same timescale. During the development peak hour of 11:00 to 12:00 hrs a total of 15No. HGV movements were generated, 9No. in and 6No. out. The average weekday HGV traffic generation of the site in 2016 was **48 vehicle trips** which equates to an increase of approximately 30% over the date of the 2010 survey.

The daily profiles shown in Appendix 8.3 show that there are relatively low numbers of HGV generated at the site in the traditional morning commuter peak hour (08:00-09:00 hrs) and there is no HGV traffic generated in the traditional evening commuter peak hour (17:00-18:00 hrs). From experience in reviewing and assessing weighbridge data at this and other landfill sites together with the records of Materials Recovery Facilities, the above profile of HGV traffic generation is considered representative for Knockharley Landfill and indeed typical of the daily profile or pattern of flow recorded at landfill developments in general. Appendix 8.3, Figure 2 shows the 2010 recorded HGV traffic generation pattern based upon the hourly percentage of the total inbound, outbound and two-way HGV flows respectively.

Daily Profile of Light Traffic Generation

Appendix 8.3, Figure 3 shows the daily profile of inbound and outbound light traffic movements over the course of the 2010 traffic surveys and also shows the cumulative two-way flow traffic generation over the course of the working day. The recorded pattern and volume of traffic is considered representative of the current levels of light vehicle traffic generation. The 2010 survey shows that the landfill site generated a total two-way flow of 29No. light vehicle movements (15No. Inbound and 14 No. Outbound).

Save for the entry and egress of staff in the morning and evening there was an average of less than 1 No. light vehicle movement per hour generated over course of the working day. Sources of such traffic include visitors, meter readers, postman and other traffic associated with the day-to-day running of the site.

Some 40% of the total daily inbound light traffic is manifest principally by staff entering between 07:00-08:00 hrs whilst some 57% of the total outbound light traffic is manifest by staff leaving the site in the period 17:00-18:00 hrs. Appendix 8.3, Figure 4 shows the light traffic generation pattern based upon the hourly percentage of the total inbound, outbound and two-way light traffic flows respectively.

Distribution of Existing Landfill Traffic

The traffic count surveys of May 2010 identified the following distribution patterns at the site access:

Table 8-2: Local Distribution of Landfill Traffic (at Site Access)

Vehicle Type	HGV		Cars	
Direction of Travel	To/From North	To/From South	To/From North	To/From South
%age	52%	48%	41%	59%

The figures shown in Table 8.2 above for HGV distribution should only be considered in the context of the local turning movements of traffic to and from the existing site access. They are not representative of the distribution of landfill HGV traffic in the wider context of the receiving road network. Table 8.2 shows that 52% of HGV traffic in the surveys arrived at/departed the landfill access from/to the North, this does not however mean that 52% of all HGV traffic originated generally from the north or were required to pass through, say Ardee or Slane. This is because the existing Panda Waste MRF at Rathdrinagh Crossroads (north of the landfill) was, at the time of the traffic survey in 2010, pre-treating approximately 50% of all inbound Residual MSW before it was brought to landfill for disposal. At that time, this HGV traffic transporting residual MSW had predominantly travelled from the south, passing the landfill access on the way to the Panda Waste MRF before arriving at the landfill access. This local distribution of traffic is confirmed in the base traffic survey video data.

To establish the distribution of HGV traffic from the wider strategic road network weighbridge records for the site for 2016 have been analysed. The recorded weighbridge data for the site includes customer data which enables identification of the origin of waste and thus facilitates an analysis of HGV traffic distribution on a wider scale. The roads network serving the site and the number of route options is not complex and in the interest of maintaining such simplicity the distribution of HGV traffic to the wider road network has been analysed based upon routing north/south/east/west of the existing site. For the purposes of this study the local road network has been defined as that portion of the N2 between Rathdrinagh Cross and Balrath Cross. The categorised traffic surveys of 2010 taken in concert with the weighbridge data for 2016 shows that HGV generated by the site is currently distributed in the following proportions shown in Table 8.3. For the purposes of the traffic assessments and in the interest of simplicity it is assumed that light traffic distribution to the greater roads network is in the same proportions as that shown for HGV in Table 8.3.

Table 8-3: Distribution of Landfill Traffic (Greater Road Network)

Direction	To/From N2 North	To/From N2 South	To/From R150	To/From R153
%age	5%	85%	5%	5%

8.3 Forecast Traffic Generation of the Proposed Development

8.3.1 Overview

It is proposed to increase the acceptance of waste at the landfill from the current permitted annual rate of 88,000 tonnes to a maximum annual total of up to 440,000 tonnes.

The development proposal includes the following pre-treatment, recovery and disposal activities:

1. Landfilling of non-hazardous household, commercial and industrial wastes, including stabilised residual fines
2. Landfilling of Construction & Demolition (C&D) waste, including non-hazardous contaminated soil
3. Acceptance of incinerator bottom ash (IBA)
4. Biowaste treatment

Landfilling of Non-hazardous household, commercial and industrial wastes

Landfilling of non-hazardous household, commercial and industrial waste including stabilised residual fines is currently undertaken at the facility and the proposal includes for an increase in the quantum of this material accepted for landfilling at the site. The proposed increase will be accommodated within the current permitted landfill footprint. These materials will be delivered in bulk articulated delivery vehicles carrying a typical average payload of 23.8 tonnes. These vehicles enter the site laden and leave empty.

Landfilling of C&D waste incl. non- hazardous contaminated soil

Landfilling of soils is currently undertaken at the facility. C&D wastes will be transported in articulated tipper trailers. For the purposes of the traffic assessment it is assumed from inspection of site weighbridge records that the capacity of such trailers carrying C&D wastes including non-hazardous soil and stones is 24.1 tonnes.

Acceptance of Incinerator Bottom Ash

It is proposed to develop a dedicated area for the placement of incinerator bottom ash (IBA). IBA will be transported in articulated vehicles. For the purposes of the traffic assessment it is assumed from inspection of site weighbridge records that the capacity of such trailers carrying IBA is 25.6 tonnes.

There is potential for IBA to be exported from the site for potential reuse trials in future years depending to aid the development of a future market for IBA re-use market. It is assumed that this material can be exported in similar vehicles carrying similar tonnages to those vehicles that transported the material to the site. Therefore, in the potential event that IBA material was being both imported to the site and exported from the site at the same time, backhaul of this material is expected - accordingly whether these materials remain within the site or get exported the volume of traffic generated at the facility is assumed to be unaffected.

Other Sources of HGV Traffic Generation

In addition to the schedule of waste imports outlined above, the landfill will also have the potential to generate HGV arising from the transport of construction fill and cover materials. It is calculated that up to a total of 50,000 tonnes of fill and cover material may be needed at the site, but this is expected to be won principally on site and from the proposed acceptance of soil and stones and C&D waste materials. The inclusion of an allowance for the importation of fill materials is considered to be a conservative approach.

The export of leachate from the existing landfill also generates HGV traffic. Currently leachate removal results in an average of 2No. HGV trips per day. For the purposes of assessment and based on the data presented in Chapter 2 – 'Description of the Development', it is calculated that the development could generate some 45,000 tonnes of leachate which will be tankered from the site. Tree felling could generate up to 75 HGV movements over a 5-year period.

8.2.1 Tonnages for Acceptance/Export

Table 8.4 provides a summary of the proposed potential tonnages of waste materials accepted at the site and materials exports from the site.

Table 8-4: Potential Tonnages Accepted

Waste Stream	Potential Tonnage	
Incinerator Bottom Ash	150,000t	150,000t
Non-hazardous Soil & Stones and C&D Waste	50,000t	290,000t
Residual MSW	140,000t	
Residual Fines	55,000t	
Bulky Waste/Street Cleanings	45,000t	
Leachate Disposal	45,000t	Export
Felled Timber and Barsh	360t (over a 5 yr period)	Export
Cover Material (Provisional)	(50,000t)	(50,000t) Won on site or from inputs

Based upon the above potential tonnages proposed to be accepted at the site together with ancillary processes such as cover materials import leachate disposal and timber the following Table 8.5 provides an estimate of the potential annual and daily average traffic generation of the landfill site under the current proposals. The average payload for each waste stream has been determined empirically from weighbridge data. In the interest of simplicity, it is assumed for the purposes of the traffic assessment that the proposed development will reach the proposed acceptance capacity of 440,000 tonnes per annum in the Opening Year assumed to be 2019. It is proposed that the development site will import and export waste between the hours of 07:30 and 18:00 hrs Monday to Saturday inclusive. Current weighbridge data shows that activity on Saturdays is on average approximately one quarter of that for weekdays. For the purposes of the assessment of traffic it is assumed that the site operates for a total of 258 days per annum based upon [(52 wks x 5 days) +(52 wks x ¼ days) – 15 days] where the 15 days include 9 bank holidays and Christmas.

Table 8-5: Potential Annual Traffic Generation

Waste Stream	Tonnage	Vehicle Payload	Annual Vehicle Trips			Daily Trips
			Waste Inbound	Bi-product Outbound	Total Trips	
Incinerator Bottom Ash	150,000t	25.6t	5,556	--	5,556	23
Non-hazardous Soil & Stones and C&D Waste	50,000t	24.1t	2,174	--	2,174	8
Residual MSW#	140,000t	23.8t	6,087	--	6,087	23
Residual Fines	55,000t	23.4t	2,391	--	2,391	9

Waste Stream	Tonnage	Vehicle Payload	Annual Vehicle Trips			Daily Trips
			Waste Inbound	Bi-product Outbound	Total Trips	
Bulky Waste/Street Cleanings	45,000t	22.5t	1,957	--	1,957	8
Total Waste Streams	**440,000t**	**NA**	**18,164**	**--**	**18,164**	**71**
Leachate Disposal	45,000	NA/27t	--	1,667	1,667	7
Timber and brash	360	NA/25	--	15/an	15/an	0
Cover Material (Provisional)	(50,000t)	(23t/NA)	(2,174)	--	(2,174)	(7)

The average daily HGV traffic generation of **78** vehicles is based upon the assumption that the export of any potential recovered materials e.g. IBA for a re-use trials, would be by backhaul.

8.2.2 Construction Phase – HGV Traffic Generation

Construction traffic will be generated by the proposed development. In the interest of simplicity, it is assumed that all site infrastructure will be developed in a single construction phase. In practice however, it is highly likely that various construction projects may be progressed over a long period of time generally dictated by market forces. For the purposes of this robust traffic assessment, a singular construction period of less than twelve months is envisaged for each phase as this assumes a 'worst case' construction scenario from a traffic viewpoint.

The primary generators of traffic during construction will be construction staff and the delivery of construction materials. Construction materials are expected to be predominantly structural steel, cladding and concrete for the development of the biowaste facility building and leachate infrastructure. Based on our experience of similar projects, including the planning and development of the existing landfill facility and the planning and development of various waste treatment and waste handling facilities (examples incl. Ballynagran Landfill Wicklow, East Galway Landfill, MRF Millennium Business Park, MRF Cappagh Road, MRF Rathdrinagh, MRF Ballymount) it is estimated that no more than 25No. HGV trips per day would be required to cater for the delivery of these materials to the site during the most intensive construction period. This figure is considered to represent upper value or robust estimate of construction HGV traffic generation. Average construction HGV traffic generation is expected to be in the region of 15No. HGV trips per day.

Construction plant is expected to mainly consist of rigid body vehicles, 8-wheel tippers, ready-mix HGV and articulated vehicles.

The ongoing construction of new cells for the currently permitted landfill footprint at Knockharley has been granted planning permission under Planning Reg. Ref. PL01/5006. No additional cells are proposed to be constructed under the current application for the currently permitted footprint; nonetheless the traffic analysis acknowledges the likely traffic generation arising from the ongoing construction of these cells. In addition, the proposed dedicated IBA area included within this application will comprise of portal frame building and newly constructed cells, which will be constructed in the same manner as those within the currently permitted footprint.

New cells associated with currently permitted footprint must be constructed on average every 1 - 2 years. Construction usually occurs over approximately a 10-week period. Materials imported on site are primarily made up of liner, granular and drainage materials. Based upon the construction of previous landfill cells, the construction of new landfill cells associated with the permitted footprint is likely to result in an average daily traffic generation of 10No. HGV per day. No more than 10No. staff members are usually required to carry out the work; such staff could further generate some 15No. car/van trips per day. In practice, and from a sequencing and cost viewpoint, construction of new cells within the permitted footprint, construction of new cells associated with the dedicated IBA area and construction of the biowaste facility will be undertaken as one project.

Therefore, the only impact of including the construction of the new IBA cells will be a longer construction duration, which can be assumed to be approximately a further 8 weeks – thus, the average daily traffic generation of 10No. HGV per day is assumed but over a longer construction period of approximately 18 weeks.

Following discussions with the Applicant construction of new landfill cells (permitted area and IBA area) will be programmed so it is not concurrent with construction activities arising from the proposed facility building and leachate plant infrastructure development as such the years in which construction of these new elements are likely to occur does not take no account of traffic arising from the construction of further landfill cells. Traffic arising from construction of new landfill cells has not been included in the forecast construction traffic generation values since this work gives rise to a less intensive daily traffic generation typically carried out over an approximate 18-week period.

The objective of the traffic assessment is to analyse the impact arising from upper value or robust forecasts of traffic generation arising at the proposed development site. The traffic generation at the development is greatest when it is fully operational and that is therefore the scenario which is subject of detailed analysis. Traffic generation during the construction of site infrastructure is considerably less than when such infrastructure is completed, is fully operational and receiving materials. Lesser volumes of traffic arise during the construction period and it follows that such traffic is likely to have a lesser impact than operational traffic accordingly the traffic assessments do not include for a separate capacity analysis during the construction period. In all cases the HGV traffic generated by the operation of the proposed development exceeds that of the respective construction periods combined with existing landfill traffic generation, accordingly it follows that the traffic scenarios where the proposed development is operational represents a worst-case scenario typically associated with the upper values used in traffic impact studies.

The Applicant to comply with Local Authority policy on maintaining the roads serving the site clean of dirt and debris associated with the development of the site. An outline Construction Traffic Management Plan has been prepared as part of the outline Construction Environmental Management Plan (CEMP) provided in Appendix 2.1.

8.2.3 HGV Traffic Profile and Peak Hour HGV Generation

Based upon the HGV traffic profile shown in Figures 1 and 2 of Appendix 8.3, Appendix 8.4, Figure 1 shows the forecast average HGV assessment value traffic generation of the proposed development.

Appendix 8.4 Figure 1 shows that the development peak hour under the upper assessment value occurs between 11:00-12:00 hrs and includes some 21 HGV entering the site and 13 HGV departing.

The traffic generation forecast during the traditional commuter peak hour 08:00-09:00 hrs is 5 HGV entering the site and 7 HGV departing.

No HGV traffic is generated in the traditional evening commuter peak hour 17:00-18:00hrs.

8.2.4 LGV Traffic Generation

The proposed development will also generate LGV trips daily. LGV traffic will arise primarily from landfill a facility staff, construction staff, sundry visitors etc.

At the time of the May 2010 traffic surveys upon which base LGV profiles have been established, the existing landfill site employed some 10No. staff (8No. Operations/Management staff and 2No. Machine Operators). These staff members are based on site for the majority of any working day. The 2010 traffic count survey recorded a total of 15No. inbound and 14No. outbound LGV entering and exiting the site. These values tally with a typical traffic generation rate of 1.5 LGV trips per day for staff members.

Following the proposed development, it has been assumed that 10No. additional staff will be hired full time on site following the realisation of the extra activities associated with the proposed development. Each staff member is expected to generate 1.5 car/van trips per day. This allows for staff arriving on site in the morning and departing the site in the evening, together with trips at lunchtime and sundry private activities.

Based upon the survey data it is expected that there would be and average of 15 additional LGV trips per day associated with the day-to-day running of the site.

Based upon the HGV traffic profile shown in Figure 3 of Appendix 8.3, Figure 3 of Appendix 8.4 shows the forecast assessment value inbound and outbound LGV traffic generation of the proposed development.

During the development peak hour 11:00-12:00 hrs some 2 LGV enter the site whilst 3 LGV leave. The LGV traffic generation forecast during the traditional commuter peak hour 08:00-09:00 hrs is some 5 LGV entering the site and 5 LGV departing. In the evening commuter peak hour 5 LGV enter and 20 LGV depart.

8.2.5 Forecast Peak Hour Traffic Generation (HGV & LGV)

Development peak hour traffic flows have been calculated based upon the traffic flow patterns recorded at the existing landfill site access in the 2010 classified turning count surveys taken in concert with the 2016 weighbridge data. The peak hour for traffic at the existing landfill has been identified as 11:00hrs to 12:00 hrs. Table 8.6 provides a summary of the total daily traffic generation of the site for HGV and LGV with both existing average and proposed assessment values. In order to facilitate the determination of the potential incremental increase in traffic arising from the proposed development Table 8.6 also shows the recorded average traffic generation of the existing landfill based upon 2016 weighbridge data for HGVs.

Table 8-6: Daily Traffic Generation

Peak Hour	HGV		LGV		Total	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Assessment Value	78	78	35	35	113	113
Current 2016	48	48	20	20	68	68

Table 8.7 provides a summary of the total development and commuter peak hour traffic generation at the site for the forecast assessment traffic generation potential of the proposed development.

Table 8-7: Forecast Peak Hour Assessment Value Traffic Movements

Peak Hour	HGV		LGV		Total	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Morning Peak Hour 08:00-09:00hrs	4	7	5	5	9	12
Development Peak Hour 11:00-12:00hrs	21	13	2	3	23	16
Evening Peak Hour 17:00-18:00hrs	0	0	5	20	5	20

8.2.6 Distribution of Development Traffic at Site Access and to Greater Road Network

Existing distribution patterns for landfill related traffic are provided in Tables 8.2 and 8.3. As a result of the proposed development traffic distribution patterns are expected to reflect those of the May 2010 surveys when the site was receiving quantities of waste close to those permitted (132,000 tonnes).

For the purposes of the traffic assessment, save for the acceptance of IBA from Duleek and the R150, the traffic distribution is assumed unlikely to change appreciably from that established from the 2010 classified distribution turning count which is considered a reasonable assumption upon which to base the traffic analyses.

At the time of the 2010 traffic count survey a large proportion of traffic at the landfill had arisen from a nearby MRF located approximately 2.4km north of the application site access. Approximately 50% of inbound loads were pre-treated at this MRF. Under the current application, it is expected that in general the proposed development will result in a higher volume of stabilised waste arriving at the landfill.

HGVs bringing stabilised waste to the site are considered more likely to arrive from the south. Given the proposal to import a larger proportion of IBA (c. 35% of maximum incoming tonnages) it is also likely that a larger proportion of HGV traffic will arrive from the south of the site access. For the purposes of the traffic analyses the established 2010 surveyed traffic distribution patterns (shown in Table 8.3) for the greater road network are considered a reasonable estimate of the likely future site traffic distribution locally at the site access.

Forecast future traffic distribution patterns at the site access are shown in Table 8.8 below whilst traffic on the greater road network is shown in Table 8.9 which makes allowance for a greater proportion of incoming IBA materials arising from the nearby Indaver incinerator at Carranstown, Duleek.

Table 8-8: Future Development Traffic Distribution (Site Access & Greater Network)

Location	HGV		LGV	
	To/From North	To/From South	To/From North	To/From South
At Site Access	5%	95%	41%	59%

In the case of development generated LGV beyond the local road network catchment, these vehicles are expected to generally continue travelling on the N2 either north or south. It is acknowledged that some of this traffic will travel to/from the Navan and Duleek directions and perhaps locally. The daily volume of LGV traffic arising at the site is low in any case and is unlikely in and of itself to give rise to a significant impact upon the operation of local junctions. As can be appreciated, the local movements of staff would be likely to arise on the roads network in any case regardless of the current proposals. Comparing the surveyed figures in Table 8.3 to those in Table 8.9 it can be seen that it is forecast that there would be a potential increase in R150 traffic arising from the proposal to accept incinerator bottom ash material. Since a greater volume of development traffic originates from the south of the site (N2 and R150) it follows that there is a resultant proportional uplift in traffic from the south and thus a lesser percentage of the total traffic generation arises from the north.

Table 8-9: Distribution of Landfill Traffic (Greater Road Network)

Direction	To/From **N2 North**	To/From **N2 South**	To/From **R150**	To/From **R153**
%age	1%	86%	10%	3%

8.4 Summary of Potential Significant Effects of Development Traffic upon the Local Road Network

The corridor upon which development generated traffic will have the greatest impact is the N2 including O'Brien's Cross. NRA Project Management Guidelines 'Unit 16.2 Expansion Factors for Short Period Traffic Counts' can be used to derive a value for AADT from the weeklong ATC traffic surveys undertaken near and to the south of the site access. AADT values for the R150 at O'Briens Cross can be calculated from the Classified 12 hour Turning Count survey undertaken on Tuesday 6th September 2016. Factors are calculated using the NRA published traffic flow profiles provided in Unit 16.2 Annex A which are then used to convert the average hourly traffic flows recorded for each hour of the day over the week.

Using this method, the average daily two-way traffic flow on the N2 at the site access is calculated to be 8,276 vehicles in September 2016, based upon a week's data. Using a Monthly Flow Index value of 0/96 from 'Unit 16.2 Annex C' for September, the estimated AADT in 2016 on the N2 south of the site access is 8,621 vehicles. Using the corresponding factors for the 12 hour classified turning count at O'Briens Cross the AADT on R150 is estimated to be 2,905.

In order to provide an evaluation of the likely volume of development traffic arising on the local road network, we reference the site HGV traffic generation arising from the weighbridge records for 2016, which show an average traffic generation rate of 48 HGV per day, whilst the turning count data at the site access from 2010 shows that the current complement of staff traffic movements. Table 8.10 over provides a summary of the current and forecast future traffic flows on the receiving road network arising from the landfill. The figures are based upon the above estimated AADT values for the N2 and R150 which are the roads affected by the proposed development.

Forecast future year AADT is based upon NRA Project Management Guidelines 'Unit 5.5: Link-Based Traffic Growth Forecasting' medium growth rates which are as follows: 1.011 Cars (1.008 HGV) for the period 2006-2025 and 1.009 (1.001) thereafter.

Table 8-10: Development of Traffic relative to Local Road Network Traffic

Road Link	AADT			Potential Development Traffic Generation Daily Two-way Movements		
	2018	2019 Opening	2029 +10 Yrs	2016	Proposed Opening 2019	Opening + 10yrs 2029
N2 South of Site Access	AADT 8,812 HGV (11.6%) 1,022	AADT 8,909 HGV (11.6%) 1,033	AADT 9,860 HGV (11.6%) 1,144	95 HGV 40 LGV (1.56% of AADT) [Existing]	162 HGV (+67) 69 LGV (+30) (2.6% of AADT) [Existing +1.1%]	162 HGV (+67) 69 LGV (+30) (2.3% of AADT) [Existing +1.0%]
R150 Between N2 and Duleek	AADT 2,969 HGV (12.4%) 368	AADT 3,002 HGV (12.4%) 372	AADT 3,323 HGV (12.4%) 412	10 HGV 4 LGV (0.47% of AADT) [Existing]	16 HGV (+6) 7 LGV (+3) (0.77% of AADT) [Existing +0.3%]	16 HGV (+6) 7 LGV (+3) (0.7% of AADT) [Existing +0.3%]

Since traffic is assumed in the NRA forecasts only to grow it follows that the proposed development is likely to have the greatest direct impact upon the local road network in the Opening Year 2019, during which development traffic could constitute an average of 2.6% of overall N2 daily traffic flows between the site access and O'Briens Cross with values dropping to the south due to a proportion of development traffic using the R150.

These figures represent an incremental increase over the traffic generation of the existing development in the order of 1.1%. These figures which are shown in the box brackets in Table 8.10 are not significant in the context of the overall carrying capacity of the strategic N2 National Primary Road.

The road link which is expected to carry the most development traffic is the portion of the N2 between the site access and Balrath Cross. The figures show that the proposed development is unlikely to give rise directly to a significant increase in the number of vehicles using the regional and local roads in the vicinity of the site. While some IBA material from the Indaver incinerator at Duleek is currently accepted at the landfill, there is expected to be an increase in the number of vehicles transporting IBA from that facility, however it can be appreciated that this traffic is already on the network in any case and is not directly generated by the landfill site, as all IBA generated at Duleek is consigned for management at a number of facilities, of which Knockharley Landfill is one.

The forecast percentage incremental increases in traffic arising as a direct result of the development are considered to be within typical daily fluctuations in traffic volumes on the roads network. Furthermore, the forecast increases are significantly below the threshold of 10% in uncongested areas set out in the NRA's Traffic and Transport Assessment Guidelines as requiring detailed traffic modelling assessments of junction performance.

In the context of the standard of access provided at the existing landfill it can be concluded that the potential incremental increase in traffic generation arising at the existing site are highly unlikely to compromise the capacity or the level of service provided by the existing local or strategic roads network serving the site. In summary, the impact of the traffic arising from the proposed development of the site will not give rise to significant impact upon the capacity and operational efficiency of the receiving road network principally the N2.

8.4.1 Performance of Landfill Access

Tables 8.6 and 8.7 provide a summary of the forecast traffic generation of the site for the various traffic peaks. In the morning and evening when N2 commuter traffic is heaviest the traffic generation of the proposed development is low. Conversely during the peak hour at the development, the flows along the N2 are lower than at peak times.

DMRB TD41-42 (Superseded) Figure 2/2 provides a guide to the relative major/minor road flows which can be accommodated at various junctions. Figure 2/2 shows that existing site access infrastructure can accommodate many multiples of the forecast traffic flow to the site. It follows that the site access will operate well within capacity for the foreseeable life of the development. Given the configuration of the existing landfill access with ghost island right turn lane and auxiliary left turn lane it is not considered necessary to undertake detailed computer modelling analyses (PICADY or similar) of the capacity of the access.

It is unsurprising that the landfill access would have a significant level of reserve capacity even after implementation of the proposed development. The existing site access junction was designed in accordance with the NRA: Design Manual for Roads and Bridges. Such junctions are designed to accommodate significantly more traffic than the site could reasonably be expected to generate. The proposed access has the capacity to accommodate over 10 times forecast traffic flow to and from the site. The right and left turning lanes at the site access aid in reducing to a minimum potential delay to following traffic and this helps to maintain the carrying capacity of the national road. The potential additional traffic arising at the development site will have no significant effect upon the operation of the existing site access junction.

8.5 Road Safety Review

The objective of this section is to consider road safety implications of the proposed development through analysing collision data and investigating whether any safety hazards exist in the vicinity of the site.

8.5.1 NRA Consultation

Under a previous pre-planning consultation relating to planning at the existing landfill site in 2010, the NRA had issued a letter to the then Applicant suggesting scoping issues which should be included in the EIS.

Given that the roads infrastructure parameters have not changed materially since then it is assumed that the NRA suggested scoping issues are relevant in the context of the current application using the same existing site access and generating traffic with similar characteristics. The following bulleted points are those NRA scoping issues pertaining to road and traffic issues; each is addressed.

- The Applicant should consult with the National Roads Design Office/Local Authority with regard to the future routing of the Leinster Orbital Route.

Having reviewed the Leinster Orbital Route Feasibility Study, which was prepared by the Roughan & O'Donovan – Faber Maunsell Alliance in 2007, Map R1 shows the proposed route corridor between Drogheda and Navan. The proposed route corridor runs through the existing Landfill site however there is no reference to the Landfill site within the Feasibility Report.

In 2010 Trafficwise Ltd. contacted Mr. Nigel O'Neill a Senior Project Manager of the NRA Strategic Planning Division, Mr. Stephen Smith of Meath County Council's Infrastructure Division and Ms Fiona Redmond of Meath County Council's Planning Division. In liaising with Mr. Nigel O'Neill of the NRA we were directed to discuss particulars of the scheme with the Planning and/or Transport Department of Meath County Council, as this is the Planning Authority for the scheme. Correspondence was issued to both the Planning and Infrastructure Divisions of Meath County Council; but no reply was received. Informal discussions with Local Authority Officials nonetheless confirmed that the Route Corridor shown in the Feasibility Study Report was indicative at any rate and that it was reasonable to assume that the development of the future Leinster Orbital Route alignment would reasonably be expected to avoid the existing Landfill site.

- The NRA would be concerned if the proposed development resulted in any significant impacts on the N2.

The traffic assessment results provided in this section of the EIS clearly show that when measured against NRA traffic flow thresholds and when the access capacity is evaluated against NRA standard graphs the proposed development is extremely unlikely to have an adverse impact upon the capacity or level of service of the existing local or strategic road network. The existing ghost island site access junction together with auxiliary deceleration and left turning lane has been designed and constructed wholly in accordance with the NRA Design Manual for Roads and Bridges. The turning lanes are not warranted on capacity grounds and are provided to increase safety and to preserve the capacity and mainline flow of traffic in the vicinity of the access.

- A Traffic and Transport Assessment should be carried out.

This section of the EIS is a Traffic and Transport Assessment as defined by the NRA and is compliant with the methodology set out in the current NRA Traffic and Transport Assessment Guidelines (May 2014).

- Consult the NRA HD 19/09 to determine if a Road Safety Audit is required.

The existing site access was designed and constructed in accordance with the NRA Design Manual for Roads and Bridges and also underwent the full Roads Safety Audit procedure from feasibility stage to post construction Stage 3 auditing.

The remit of a Road Safety Audit as defined by the NRA in HD19 covers permanent physical alteration to the road network and does not cover intensification of use; accordingly, in the case of the proposed development a further Road Safety Audit is not required.

This is confirmed by the An Bord Pleanála Inspectors Report relating to a previous appeal of a separate planning application proposed at the subject site (PL 17.PA0009). The Inspector in that case states the following as part of her Assessment relating to Road and Traffic matters:

> *"Reference was made to paragraph 1.2 of the NRA DMRB HD 19, which defines a Road Safety Audit. It was observed that since the site access is not a new piece of infrastructure and does not involve new works, it was concluded that there was no subject matter for such an audit on the site access junction with the N2, as required by the NRA.*

The junction was designed and constructed in accordance with DMRB TD 42 'Geometric Design of Major/Minor Priority Junctions' and supervised during construction by Meath County Council. It was confirmed that the junction was the subject of a Road Safety Audit during the design process, details of which lie on the parent application file to the planning authority. It would appear reasonable to conclude on the basis of the forgoing that since the audit procedure essentially investigates the potential safety hazards of the design of roads prior to construction, or a proposed permanent change to a road layout, that a road safety audit is not warranted in the case of the existing junction".

8.5.2 TII Consultation

TII were consulted in relation to the current proposals. By letter dated 10th November 2016 and 29th March 2018 (Response Ref. TII16-95955 & TII18-101318) general guidance on the recommended EIAR scoping was provided in a bullet point format which is commented upon below.

- Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national roads schemes; Leinster Orbital Route (LOR).

Section 8.5.1 above documents previous relevant consultation regarding LOR.

- The Authority would be specifically concerned as to the potential significant impacts the development would have on any national roads (and junctions with national roads) in the proximity of the proposed development; N2.
- It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment 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.

The Authority's Traffic and Transport Assessment Guidelines (2014) should be referred to in this regard. The scheme promoter is also advised to have regard to Section 2.2 of the TTA Guidelines which addresses requirements for sub-threshold TTA.

This section of the EIAR is a Traffic and Transport Assessment. The volume of new traffic generated by the proposed development does not meet the appropriate thresholds and is therefore prepared under sub-threshold criteria in that it will result in a relatively modest intensification of use of an existing access on the national road network.

The traffic analyses show that the potential impact of the proposed development is unlikely to be significant on the adjoining national road or junctions thereupon:

- The developer, in conducting Environmental Impact Assessment, should have regard to TII Publications (formerly NRA DMRB and NRA Manual of Contract Documents for Road Works).
- The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required.
- In the interest of maintaining the safety and standard of the national road network, the EIS should identify the methods/techniques proposed for any works traversing/in proximity to the national road network.

The proposed development involves no modifications whatsoever to the layout and geometry of the road network or the development access on the N2. All works are internal to the site which is served by an access road of some 800m length and thus well removed from the N2. The development access already exists and was designed in accordance with the former NRA DMRB standard and complies with the corresponding current TII standard renumbered from the NRA DMRB but for the most part unchanged in terms of technical requirements. The design and construction of the existing access from the N2 was subject to a Road Safety Audit to the satisfaction of the relevant authority as follows, Stage 1 at planning application, Stage 2 prior to construction and Stage 3 post construction. Since there is no proposed permanent alteration to the road network there is no subject matter in the current proposal that might warrant a Road Safety Audit.

- In relation to haul route identification, the applicant/developer should clearly identify any haul routes proposed (construction and operation) 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.

The haul routes are clearly identified in this section of the EIAR and principally involve the N2, R153 and R150 which have been the haul routes that have served the existing development for in excess of a decade. No abnormal loads are proposed.

8.5.3 Collision Analysis

The Road Safety Authority (RSA) currently provides collision data on the website www.rsa.ie. That online data covers the period from 2005 to 2013 and is map based and searchable. Previously, the RSA had provided accident history data directly upon request. Trafficwise Ltd. obtained traffic collision data in 2010 for a section of the N2 in the vicinity of the site. The data included a section of the N2 measuring approximately 4km in length, extending from the N2/R150 (O'Briens Cross) crossroad junction northward to the Rathdrinagh Crossroad junction.

The data provided by the RSA in 2010 contains all fatal, serious and minor injury accidents from 1990 up to and including the then most recently published 2008 data. A copy of the collision reports together with a map showing the location of each collision is provided in Appendix 8.5. The RSA data showed no collisions had been recorded at the existing site access since the opening of the Landfill in December 2004 up to the end of 2008. The data shows that some six collisions occurred on the N2 within 1km of the site access location prior to its opening.

Of the six recorded collisions within 1km of the site access, 2No were classified as 'minor injury'; 2No were classified as 'serious injury'; and 2No resulted in fatalities. Four out of the six recorded collisions occurred during the day when lighting conditions and visibility was reported as good. Conditions were recorded as icy or frosty for three collisions; wet for two collisions; and dry for one collision.

Two out of the six collisions involved two separate cars colliding with each other; two involved a single car losing control and veering into the verge and hitting a wall/gate; one involved a car attempting to overtake; and one involved a car taking action to avoid an oncoming car. Of the 2No fatal collisions, one involved a single vehicle crashing into a wall/gate along the roadside boundary approximately 1km to the north of the site access (NRA Ref.: 1991-142).

This collision occurred during the daytime when weather conditions were dry. The second recorded fatal collision involved a car losing control in icy conditions to the south of the site access (NRA Ref.: 1992-376). This collision involved two vehicles and occurred during the daytime.

The data shows a total of 30No collisions were recorded on the N2 between the Rathdrinagh Cross Roads and the N2/R150 Cross Roads between 1990 and 2008.

A total of four collisions have been recorded on the N2 between the Rathdrinagh and N2/R150 Cross Roads since the landfill opened in December 2004. None of these collisions involved HGV or Refuse Lorries, which might have been generated by the landfill. Two of the four collisions occurred in the vicinity of the Rathdrinagh Cross Roads; with the other two at the N2/R150 Cross Roads. There were two collisions in 2005; one in 2006; and one in 2007.

Collision data pertaining specifically to HGV has been analysed. Six out of the 30No collisions between 1999 and 2008 involved HGV. Three of these collisions occurred at the N2/R150 Cross Roads; two at the Rathdrinagh Cross Roads; and one was recorded on the straight stretch of road between these two junctions. A single HGV collision was recorded in the years 1990; 1991; 1992; 1993; and two HGV collisions were recorded in 2001. Five of these collisions resulted in serious injury; whilst one resulted in minor injury and one in death.

The accident/collision assessment for 1999 to 2008 clearly shows that no accidents occurred at the existing site access.

The current data on the RSA website covers the period 2005 to 2014 and shows a cluster of 5 minor accidents in and around O'Briens Cross with two serious accidents, one in 2006 involving a single vehicle and one in 2014. The data also shows a serious injury collision in 2010 at the intersection of the CR384 County Road with the N2 again a single vehicle accident.

The data shows one minor accident in the vicinity of the site access and suggests it involved a single car travelling on a Monday evening. This accident is miss-reported in that the speed limit for the N2 road is stated in the report as 30kph.

The available accident data since the landfill opened in 2004 does not show any accidents involving turning vehicles at the existing site access junction. Since the opening of the facility there has been no local increase in accidents involving HGV either at or on the approaches to the site access. None of the accidents on the RSA database involved traffic generated by the site.

8.6 Mitigation Measures

No mitigation measures are required to facilitate the proposed development, save for a commitment to adhere to the existing HGV routing arrangements.

Significant roads infrastructure both within and serving the site was provided as part of the original landfill development. The existing infrastructure serving the site is provided with features (auxiliary turning lanes) designed to increase road safety and to preserve the mainline flow of traffic and to preserve the carrying capacity of the road. This section of the EIAR demonstrates that the existing infrastructure is satisfactory for the proposed intensified use. Reserve capacity at the existing site access is likely to be in the region of 90% over the life of the development.

Since the opening of the landfill development in 2004, the opening of the N2 Realignment Scheme/Ashbourne Bypass further reduces traffic impact and the need for mitigation measures since it provides a high standard connection from the landfill to the M50 motorway and the Dublin Region. This route to the site is relatively free of vulnerable road users and does not pass through any villages or towns.

8.7 Residual Impacts after Mitigation

There will be no residual impacts on traffic and transportation in relation to the proposed development.

8.8 Conclusion & Summary

From a road safety and accessibility point of view, the Knockharley Landfill site is considered to have a number of benefits. The primary benefit is that it is located adjacent to the national primary strategic road network, which will continue to accommodate all traffic coming to and from the site. Strategic infrastructure is appropriately accessed by the Strategic Road Network.

The existing site access geometry includes a ghost island right turn lane and nearside auxiliary turning lane which provide for the safe and efficient movement of development generated traffic with minimal disruption to N2 mainline flow. The site access has been designed in accordance with the requirements of the NRA and this design in turn has been confirmed satisfactory by the relevant planning authorities through the NRA Road Safety Audit process at the initial design stage, at the detailed design stage and again after construction.

The proposed development peak hour is not expected to correspond with the recorded network peak hours on the N2 and adjoining regional roads and this reduces the potential for conflict with commuter based traffic and impacts upon the efficiency of the wider road network. The traffic assessment shows that the impact or effect of traffic arising at the proposed development upon the capacity and operation of the receiving road network will not be significant. Save for at the site access it is unlikely that the additional traffic forecast as arising from the development will be perceptible to existing road users.

The proposal at the site will result in very modest increases in traffic flows relative to the strategic road network serving the existing site. The effect of such additional traffic from the proposed development on the operation of the existing receiving road network will accordingly not to be significant. The existing development access has not resulted in increased hazard on the adjoining national road. Given the safety record of the existing access, it is reasonable to conclude that the potential intensification in vehicular use is unlikely in itself to create a significant traffic hazard.

8.9 References

Chartered Institution of Highways & Transportation (CIHT) document '*Guidelines for Traffic Impact Assessment*' (September 1994)

Design Manual for Roads and Bridges (DMRB):TD42 '*Geometric Design of Major/Minor Priority Junctions*'

Meath County Development Plan 2013-2019

NRA Project Management Guidelines 'Unit 5.5: Link-Based Traffic Growth Forecasting'

NRA Project Management Guidelines 'Unit 16.2 Expansion Factors for Short Period Traffic Counts'

National Roads Authority (NRA) '*Traffic and Transport Assessment Guidelines*' (May 2014).




ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESEMNT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 9 – NOISE & VIBRATION

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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9 NOISE & VIBRATION

9.1 Introduction

This chapter contains the appraisal of potential noise and vibration impacts from the proposed development at Knockharley Landfill, Knockharley, Co. Meath. A description of the proposed development is provided in Chapter 2 – Description of the Proposed Development in Volume 2 of the EIAR. This project description was used to carry out the predictive noise modelling as described in this chapter and to appraise the resultant noise impact.

The operational noise impact appraisal of the proposed development was carried out with reference to the existing Industrial Emissions (IE) licence W146-02 and the *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*, EPA 2016. The construction noise impact appraisal of the proposed development was carried out with reference to *BS 5228-1:2009:A1+2014, Code of practice for noise and vibration control on construction and open sites - Part 1: Noise*.

Vibration relating to the proposed development was appraised by identifying appropriate guidance and evaluation criteria, establishing whether the project has potential to generate vibrational impact from construction activities and from the increase in operational activities and evaluating the resultant impacts.

9.2 Potential Noise & Vibration Impacts

9.2.1 Summary of the Proposed Development

The existing facility comprises a landfill and ancillary facilities. It is proposed to increase the waste acceptance at the site up to 440,000 tonnes per annum. Further details on the proposed development can be found in Chapter 2 of Volume 2 of this EIAR.

9.2.2 Potential Construction Noise Impacts – Direct & Indirect

Noise during the construction phase will arise from the delivery of material to site, site clearance and preparation works, construction of the northern surface water attenuation pond, holding pond, and wetland, construction of IBA cells, construction of buildings, installation of plant, construction of haul roads and service works. The proposed construction will be undertaken in a number of phases but for the purpose of the construction impact assessment a single phase has been modelled.

In practice construction activities may be progressed over a long period if the rate of waste acceptance is lower than the maximum allowable intake. The construction activities and operational activities (discussed in the next section) will occur simultaneously and total noise impact is appraised against noise limit criteria in BS 5228-1:2009+A1:2014.

It is noted that the construction, operation and restoration of the landfill is permitted under the current planning approval and is licensed by the EPA. This application seeks to intensify the existing permitted landfill by increasing the rate of waste acceptance and increasing the height of the landfill. This assessment includes an appraisal of the cumulative noise impact by all activities permitted and proposed.

9.2.3 Potential Operational Noise Impacts – Direct & Indirect

Noise during the operational phase will arise from activities during the construction of landfill cells and activities including waste placement. In addition, there is potential for noise to be generated from the IBA weathering area, biological treatment facility, existing landfill gas utilisation plant and site traffic. Traffic movements (notably the HGVs) on the site access road and moving around the site have the potential to generate noise. It is proposed that the facility will operate in accordance with the requirements set out in the existing IE licence W0146-02 ('*Waste shall only be accepted at the facility for disposal at the landfill between the hours of 8.00 to 18.00 Monday to Saturday inclusive' and 'The facility shall only be operated during the hours of 7.30 to 18.30 Monday to Saturday inclusive.'*). The existing landfill gas plant operates continuously as will the biological treatment facility when in use.

9.2.4 Potential Vibration Impacts – Direct & Indirect

The potential for vibration at neighbouring sensitive locations during construction and operation is typically limited to excavation works and HGV movements on uneven road surfaces. Considering the distances from the majority of works to the nearest sensitive locations, it is expected that vibration arising from operational and construction activities will not be perceptible at nearby sensitive locations, and any vibration arising from such activities will be significantly below any thresholds for structural damage to property.

9.3 Methodology

The methodology adopted for this noise assessment is as follows:

- Review of appropriate guidance, review of IE licence and specification of suitable construction and operational noise criteria;
- Review of historical noise monitoring data;
- Characterisation of the proposed development;
- Prediction of the noise impact associated with the construction and operation of the existing and proposed development, and;
- Evaluation of noise impacts.

9.3.1 Relevant Guidance

A list of relevant guidance documents is provided below.

Noise Standards and Technical Advice:

- International Standard ISO 9613-2:1996, Attenuation of sound during propagation outdoors, Part 2: General method of calculation[1]
- British Standard BS 4142:2014, Methods for rating and assessing industrial and commercial sound
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), Environmental Protection Agency, January 2016
- Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector – Waste Transfer and Materials Recovery, Environmental Protection Agency, December 2011
- Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988
- Highways Agency, Design Manual for Roads and Bridges HD213/11, Volume 11, Section 3, Part 7, Revision 1
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004, Transport Infrastructure Ireland
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, 2014, Transport Infrastructure Ireland
- County Meath Noise Action Plan 2013, Summary Document

The EPA draft guidance documents 2015 and 2017 relating to the preparation of EIAR have been considered in the preparation of this EIAR.

- Guidelines on Information to be contained in Environmental Impact Assessment Reports, Draft EPA, 2017
- Advice Noes for Preparing Environmental Impact Statements, Draft, EPA, 2015

[1] Prediction modelling recommended in Management Techniques of Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector – Waste Transfer and Materials Recovery, EPA 2011

9.3.2 Study Area

The landfill is located in Knockharley, Navan, Co. Meath and is located on a 135.2 hectare site. The existing landfill footprint is positioned near the centre of the landholding. It is located in the townland of Knockharley, approximately 10 km east of Navan Town.

The site is currently operating as a landfill. The current planning permission permits the development of approximately 25 ha of landfill cells. The landfill is being developed in seven phases. To date, four phases of the seven planned cell phases have been fully constructed. Landfilling activities are currently taking place in Phase 4. Phase 5 is under construction.

An aerial view of the site is presented in Figure 1.2 in Chapter 1 Introduction of this EIAR. The location of the existing noise monitoring locations in accordance with the licence is provided in Table 9.1 and are shown on Drawing No. LW14-821-01-P-0050-001 Existing Environmental Monitoring Locations in Volume 4 of this EIAR.

Table 9.1: Boundary Noise Monitoring Locations

Monitoring Location	Easting	Northing	Description
N1	297290	267999	Situated at the northern boundary of the site, adjacent to a minor road and a number of residences.
N2	297901	267565	Situated to the east of the site, north of the site access road, adjacent to a minor road at the rear of a residence.
N3	297858	267207	Situated to the east of the site, south of the site access road, to the rear of two residences.
N4	296921	267882	Situated on the northern boundary of the site, adjacent to a minor road and a number of residences.

The closest inhabited residential dwellings are located to the northern and eastern site boundaries. For the purpose of the impact assessment, 72 no. receptors were modelled, and these are identified in Figure 9.1. The co-ordinates and Figure 9.1 are presented in Appendix 9.1.

9.4 Evaluation Criteria

9.4.1 Construction Noise Criteria

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In the absence of specific noise limits, appropriate emission criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise.

BS 5228-1:2009+A1:2014 contains a number of methods for the assessment of the significance of noise effects. The *ABC Method* from BS 5228-1:2009+A1:2014 is used to derive appropriate noise limits for the proposed development. The threshold limits as defined in Table 9.2 based on existing ambient levels, which if exceeded, indicate a significant effect.

Table 9.2: Example Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold Value, in decibels (dB)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB. The noise environment at noise monitoring location N2 is similar to noise environment at the closest residential dwelling and the ambient noise levels measured at noise monitoring location N2 are used to determine the appropriate construction noise limit for the proposed development.

The ambient (free-field) noise level at noise monitoring location N2 ranged between 51 and 58 dB L_{Aeq} (See Section 9.5 for further details on historic noise levels). A correction of +3dB was added to the noise levels to convert free-field noise levels to façade noise levels. The ambient façade noise level when rounded to the nearest 5dB is a maximum of 60 dB L_{Aeq}. The nearest residential dwellings to the proposed development are afforded Category A designation (65 dB $L_{Aeq,1hr}$ during daytime periods).

Section 9.6.1 provides the detailed appraisal of construction activity in relation to this site. If the modelled total noise level (including construction noise and operational noise) exceeds the appropriate category value (e.g. 65 dB $L_{Aeq,1hr}$ during daytime periods) then a potential significant effect is predicted.

9.4.2 Operational Noise Criteria

Existing Industrial Emissions Licence Compliance

Schedules C.1, D.1 and D.4 of the Industrial Emissions (IE) licence includes noise limits, noise emission criteria and monitoring requirements. The details of these schedules are reproduced in Table 9.3, Table 9.4 and Table 9.5.

Noise monitoring is undertaken during daytime periods only as landfilling activities do not occur during night-time periods.

Table 9.3: IE Licence (W0146-02) Noise Emission Limits (Table C.1 –Licence)

Daytime dB(A) L_{Aeq} (30 minutes)	Night-time dB(A) L_{Aeq} (30 minutes)
55	45

Table 9.4: Noise Monitoring Frequency and Technique (Table D.4.1)

Parameter	Monitoring Frequency	Analysis Method / Technique
$L(A)_{EQ}$ [30 minutes]	Quarterly	Standard[Note1]
$L(A)_{EQ}$ [30 minutes]	Quarterly	Standard[Note1]
$L(A)_{EQ}$ [30 minutes]	Quarterly	Standard[Note1]
Frequency Analysis (1/3 Octave band analysis)	Quarterly	Standard[Note1]

Note 1: "Internal Standards Organisation ISO 1996. Acoustics – Description and Measurement of Environmental noise. Parts 1, 2 and 3.

If planning permission is granted for the proposed development, an updated licence will be required. In line with NG4, a new evening period (19:00 to 23:00) will form part of the updated licence. A summary of the expected revised operational noise limits and their associated periods are presented in Table 9.5.

Table 9.5: Expected Operational Noise Emission Limits

Period	Noise Limit
Daytime (07:00 to 19:00 Hrs)	55 dB(A) $L_{Ar,T}$
Evening-time (19:00 to 23:00 Hrs)	50 dB(A) $L_{Ar,T}$
Night-time (23:00 to 07:00 Hrs)	45 dB(A) $L_{Aeq,T}$

Traffic Noise Criteria

There is no existing legislation that limits environmental noise levels from traffic to a particular value. The County Meath Noise Action Plan 2013 – Summary Document identifies the N2 National Primary route as eligible for noise mapping as part of the Environmental Noise Regulations (Statutory Instrument No. 140 of 2006). The noise action plan includes a set of guideline values are proposed as onset limits for the prioritisation of noise management relating to road traffic noise. Onset levels for noise mitigation measures are 70 dB(A) L_{den} and 57 dB(A) L_{night} and the onset levels for measures to preserve the existing noise situation as 55dB(A) L_{den} and 45dB(A) L_{night}.

The proposed development at Knockharley Landfill has potential to result in increased traffic to and from the landfill. The increase the traffic as a result of the proposed development has potential to impact on residences and it is important to assess any potential impact. Traffic noise impact is assessed with respect to the Highways Agency in the UK who published the Design manual for roads and bridges HD 213/11 Volume 11, Section 3, Part 7 Revision 1 – Noise and vibration. The Highways Agency's document presents details on the classification of magnitude of noise impacts in the short term (e.g. when a project is opened) and long term (typically 15 years after project opening). A change in road traffic noise of 1 dB in the short term is the smallest that is considered perceptible. In the long term, a 3 dB change us considered perceptible. The significance that can be attached to changes in noise levels (perceptible to human beings) applies to traffic noise is shown in Table 9.6 overleaf. However, the changes are subjective and will vary among individuals.

Table 9.6: Classification of Magnitude of Noise Impacts in the Long Term (Highways Agency, UK)

Magnitude of Impact	Noise Change, $L_{A10\ (18\ hour)}$	
	Short Term	Long Term
No Change	0	0
Negligible	0.1 – 0.9	0.1 – 2.9
Minor	1 – 2.9	3 – 4.9
Moderate	3 – 4.9	5 – 9.9
Major	5+	10+

9.4.3 Scoping and Consultation Requirements

Requirements from the scoping and consultation process are presented in Chapter 5. A summary of noise appraisal requirements from the HSE, TII and the public consultation event are outlined below.

The Health Service Executive had the following comments:

- Baseline noise monitoring and noise assessment modelling to assess the impact of noise from the construction and operational phases should be carried out, with results displayed in the EIS, as well as analysis on their significance and potential cumulative effects.
- Mitigation measures should be outlined.

A noise impact assessment for the proposed operation and construction phases is detailed later in this section. As part of the IE Licence (W0146-02), quarterly noise monitoring is required and historic noise levels from 2015 to 2018 have been used to outline the baseline noise environment. A summary of the historic noise measurements is presented in Section 9.5.

Transport Infrastructure Ireland had the following comments:

The developer should have regard, *inter alia*, to the following:

- The EIAR should consider the Environmental Noise 2006 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))

The noise impact assessment considers the noise impact from traffic generated by the proposed development. This aspect is assessed in Section 9.6.3.

Consultation with the Public

A public information event was held on Monday 14th November 2016 at Knockharley Landfill. The public raised the issue of potential noise impact. The proposed development recognises the concerns of neighbours and has proposed mitigation measures to reduce any potential noise impact from the proposed development.

9.5 Receiving Environment

9.5.1 Historical Noise levels

The noise sources around the site are typically rural with more noticeable traffic noise from the N2 National Primary route to the east of the site. Historical noise monitoring results indicate an occasional noise from overhead aircraft.

Quarterly noise monitoring is ongoing in accordance with the IE licence and it is undertaken at four boundary locations shown in Table 9.1 and on Drawing No. LW14-821-01-P-0050-001 Existing Environmental Monitoring Locations in Volume 4 of this EIAR.

The historical monitoring data is presented in Table 9.7. Monitoring locations N1 and N4 are located on the road running parallel to the northern boundary. The noise sources in this area are traffic audible from the N2 National Primary route and local traffic, occasional overhead aircraft and rural background sources such as birdsong. Site noise is typically not audible at these locations.

Monitoring location N2 is located along the eastern boundary of the site. The main noise sources audible at this location are traffic from the N2 National Primary route, local traffic and rural noise sources as before. Site noise is occasionally audible, typically truck movements on the access road and reversing sirens.

Monitoring location N3 is also located on the eastern boundary south of monitoring location N2. Similar noise sources to those recorded at monitoring locations N1 and N4 are audible at monitoring location N3. Site noise is also audible at this location.

In the period 2015 to Q3 2018, there have been no exceedances of the daytime noise limit at the facility.

Table 9.7: Historical Daytime Noise Levels Reported for Licence Compliance

Year	Site Boundary Locations							
	N1				N2			
	Northern boundary of site				Eastern boundary of site			
	L_{Aeq}	L_{A10}	L_{A90}	Specific L_{Aeq}*	L_{Aeq}	L_{A10}	L_{A90}	Specific L_{Aeq}*
2015 Q1	46	41	33	<33	57	47	39	<39
2015 Q2	53	51	36	<<36	51	49	38	<<38
2015 Q3	50	45	37	<<37	57	51	42	<42
2015 Q4	55	50	43	<43	58	55	47	<47
2016 Q1	53	49	40	40	55	51	43	43
2016 Q2	53	51	41	41	55	53	46	46
2016 Q3	49	47	39	<39	53	49	44	<44
2016 Q4	52	48	38	<39	54	53	45	<45
2017 Q1	55	49	39	39	57	55	44	<44
2017 Q2	56	54	39	<39	52	54	48	47
2017 Q3	47	42	36	<36	53	47	38	<38
2017 Q4	51	49	38	<38	55	45	36	<55
2018 Q1	54	49	41	39	58	54	46	45
2018 Q2	53	54	45	<45	56	54	47	26
2018 Q3	51	45	36	<36	54	49	40	<40

Year	N3				N4			
	Eastern boundary of site				Northern boundary of site			
	L_{Aeq}	L_{A10}	L_{A90}	Specific L_{Aeq}*	L_{Aeq}	L_{A10}	L_{A90}	Specific L_{Aeq}*
2015 Q1	42	44	38	38	49	42	30	<30
2015 Q2	45	48	40	<32	45	48	34	<<34
2015 Q3	43	43	33	33	49	47	36	<<36
2015 Q4	48	50	45	<<45	55	49	42	<42
2016 Q1	48	42	33	33	48	42	33	33
2016 Q2	48	50	45	45	50	48	37	35
2016 Q3	45	47	43	<43	52	47	36	<36
2016 Q4	50	52	47	<47	54	46	39	<39
2017 Q1	48	50	38	38	53	48	34	38
2017 Q2	50	52	46	50	50	48	38	<38
2017 Q3	46	49	41	<41	47	44	35	<35
2017 Q4	48	50	45	45	48	43	32	<32
2018 Q1	45	47	43	45	51	48	41	42
2018 Q2	50	52	46	<46	53	49	43	<43
2018 Q3	45	47	42	<42	48	44	34	<34

Note 1: * - '*Specific L_{Aeq}: Level considered attributed to source under consideration, determined using real time assessment, field notes, time history profiles, statistical analysis, frequency spectra and near field correction if applicable.*' Extract from '*2015 Q1 environmental noise survey at Knockharley Landfill Ltd., Navan, Co. Meath – Waste licence W0146-02 dba report 012.1.1*', Damian Brosnan Acoustics

9.5.2 History of Noise Compliance, Non-Compliances and Complaints

All non-compliances or complaints are reported to the EPA. The following describes the summary of noise compliance, non-compliances or complaints for the period 2015 to 2018:

- **2015:** The boundary noise levels measured were compliant with the daytime noise limit and no noise complaints were received during 2015.
- **2016:** The boundary noise levels measured were compliant with the daytime noise limit. During 2016 there were 8 noise related complaints from 6 separate households. All complaints were investigated and closed off on EDEN (the EPA web-portal for licensee reporting).
- **2017:** The boundary noise levels measured were compliant with the daytime noise limit. During 2017 there were 14 noise/vibration related complaints. The complaints originated from two households. All complaints were investigated and closed off on EDEN.
- **2018:** At time this chapter was prepared, boundary noise levels for Q3 2018 were available and the boundary noise levels measured were compliant with the daytime noise limit. As of the 12th November 2018 there were four noise/vibration related complaints. The complaints originated from three households and two of the households who made complaints also made complaints in 2017. All complaints were investigated and closed off on EDEN.

9.6 Summary of Potential Impacts

The potential impacts during the construction and operational phase are discussed in following sections. Noise sensitive locations within 500m of the development boundary were appraised. If the noise limits can be met at noise sensitive locations within 500m of the proposed development, compliance at more distant (i.e. greater than 500m) noise sensitive locations can be inferred. Figure 9.1 presents the locations of the nearest noise sensitive locations and details on the co-ordinates of the noise sensitive locations and both are presented in Appendix 9.1.

9.6.1 Potential Impacts during Construction Phase

The predicted construction noise levels at the nearest noise sensitive locations were calculated using data sourced from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1 Noise. The standard sets out sound power levels and L_{Aeq} noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

For the purpose of this assessment, it has been conservatively assumed that mobile plant will be operating simultaneously and for a percentage on-time[2] of 80%, except for the tipper trucks tipping material where a percentage on-time of 20% is modelled due to short duration of this activity. The reality is that some of the plant will only operate intermittently. The ground cover between the facility and noise sensitive locations is acoustically soft ground (G=1). However, a conservative ground cover of G=0.75 was used in the construction noise model. Roads, hardstands and other acoustically hard or reflective surfaces were modelled with a ground cover of G=0. For each construction activity, the location of mobile plant was selected such that the distance between the mobile plant and the nearest receptor was at a minimum. The parameters outlined above are conservative making the noise modelling assessment a conservative exercise.

Construction activities were assessed against noise limit criteria in BS 5228-1:2009+A1:2014[3]. The construction work will be confined to 07:30 to 18:30 Monday to Saturday unless otherwise approved by the relevant regulatory authorities.

To evaluate the noise during the construction phase of the development, it is necessary to define the various activities that will be undertaken. It is proposed to develop the facility in 4 construction phases as outlined in Chapter 2 Details of the Proposed Development in Volume 2 of this EIAR.

[2] Percentage on-time - percentage of the assessment period for which the activity takes place.

[3] Predicted construction noise levels are façade noise levels as per BS5228-1:2009+A1:2014. Façade noise levels include reflection from the building façade. Façade noise level = Free-field noise level + 3dB

However, for noise modelling, a worst-case construction scenario was selected. Details of the construction activities and phasing are as follows:

- Construction of IBA Cells 29 & ½ of 32
- Construction of IBA Facility Building
- Construction of Substations
- Construction of Biological Treatment Plant
- Construction of Leachate Management Facility
- Construction of Leachate Lagoon
- Construction of Surface Water Attenuation Pond, Holding Pond and Wetland

In addition to on-site construction works, the construction of some elements of the proposed development will lead to construction related traffic (HGV and LGV) on the existing public road network over the duration of the construction works. Further details on traffic appraisal can be found in Chapter 8 Roads, Traffic and Transportation in Volume 2 of this EIAR.

The construction activities and waste management activities will occur simultaneously, and the cumulative noise impact from the construction activities and the ongoing operations at Knockharley landfill are appraised against noise limits from BS 5228-1:2009+A1:2014.

Site Traffic

To assess the impact of the additional construction related traffic on the existing road network, it is first required to estimate the amount of construction traffic that will be generated (trip generation) because of the project. Detailed information on construction traffic is presented in Chapter 8 Roads, Traffic and Transportation of Volume 2 of this EIAR. To summarise, additional light goods vehicles travelling to and from the site during the construction phase would be expected to peak during the morning (arrival of contractors at the site) and evening (departure of contractors from the site) and will not be a continuous source of noise emissions from the site during a typical working day. The impact from construction personnel movements to and from the site is expected to be low.

Construction related traffic will vary throughout the works depending on the nature of works being undertaken in a given week. For the noise appraisal, a worst case busiest period has been assumed. Construction traffic movements are expected to peak at 25 trips per day (i.e. delivery of construction materials). This is based on figures presented in Chapter 8 Roads, Traffic and Transportation of Volume 2 of this EIAR and represent the upper value of HGV generation. The additional traffic on the N2 National Primary Route will result in a negligible increase in noise levels at noise sensitive locations. Furthermore, the noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to operational hours 07:30 to 18:30 and exclude Sundays in line with the existing IE licence W0146-02, unless specifically agreed otherwise.

Construction of IBA Cells

It is proposed to develop five dedicated IBA cells (no. 29 through no. 33) for the acceptance and placement of IBA material only. Construction of Cell 29 and ½ Cell 32 will form part of the construction works, the remaining cells will form part of the operational works. Construction of new cells will require overburden to be stripped from each of the cells using tracked excavators and dozers. Some of the overburden material will need to be screened and it is proposed that a mobile screening unit is located within the cell footprint. There is also a requirement to roll and compact the cell floor and a vibratory roller will be used. There will also be a requirement to import stone for the drainage layer and a water bowser may be used intermittently to suppress dust.

Material to be used for the construction of screening berms will be loaded into articulated dump trucks and transported to the berm location (construction of screening berms is discussed below). Table 9.8 presents the assumed plant required for cell construction.

Table 9.8: Cell Construction – Assumed Plant and Predicted Noise Levels

Plant	BS 5228 Ref.	Activity
Tracked excavator (x4)	C.8.12	Cell Excavation and loading of material
Articulated dump truck * (x2)	C.8.16	Distribution of material (IBA Cells four two-way trips per hour)
Dozer (x2)	C.8.17	Cell excavation and distribution of material
Conveyor drive unit	C10.20	Conveyor for screener
Water bowser (discharging)	C.6.37	Spraying water
Screen Stockpiler	C.10.15	Screening material
Lorry*	C11.9	Delivery of Material (Two two-way trips per hour)
Articulated dump truck (tipping fill)	C.2.32	Tipping fill at cell
Vibratory roller *	C.5.21	Rolling and compaction
* Drive-by maximum sound pressure level in L_{max} (octave bands) and L_{Amax} (overall level)		

The nearest occupied dwelling is approximately 190 m from the Cell 29. The predicted noise levels are below the construction noise limit of 65 dB $L_{Aeq,1hr}$ with the cumulative noise levels of all activities of 62 dB $L_{Aeq,1hr}$.

Construction of Buildings

The construction of a number of buildings will occur during the construction phase of the proposed development. These include the IBA Facility building, biological treatment facility and two substations. It is expected that the works will be progressed on a phased basis and plant will move around the site. The construction works will be progressed in a number of phases:

- Site clearance
- Preparation and pouring of foundations and floor areas
- Preparation of subbases, hardstanding areas and pouring of concrete
- Erection of steel work

For the purpose of this assessment, the noise sensitive locations nearest to each of the buildings are assessed. Table 9.9 presents the assumed plant required for the different construction phases of the proposed buildings to be constructed on site.

Table 9.9: Construction of Buildings – Assumed Plant

Phase	Plant	BS 5228 Ref.	Activity
Site Preparation	Tracked excavator (22t)	C2.3	Clearing Site
	Articulated Dump Truck *	C2.33	Delivery and removal of material (7 two-way trips per hour)
	Dozer (20t)	C2.12	Ground excavation/ earthworks
	Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks

Phase	Plant	BS 5228 Ref.	Activity
Preparation and pouring of Foundations	Wheeled Loader (23t)	C10.4	Loading sand / soil
	Mobile telescopic crane (80t)	C4.39	Lifting reinforcing steel
	Concrete mixer truck & concrete pump	C4.28	Concrete mixer truck (discharging) & concrete pump (pumping)
	Articulated dump truck (tipping fill) (23t)	C2.32	Tipping Fill (20% percentage on time)
	Articulated dump truck* (23t)	C2.33	Delivery and removal of material (maximum of 7 two-way trips per hour)
	Lorry *	C11.9	Delivery of material (maximum of 2 two-way trips per hour)
Preparation of subbases and hardstanding's and pouring of concrete	Tracked Excavator (25t)	C2.19	Ground excavation/earthworks
	Articulated Dump Truck (23t)	C2.32	Tipping Fill
	Dozer (14t)	C5.12	Spreading chipping/fill
	Vibratory roller	C5.21	Rolling and Compaction
	Concrete mixer truck & concrete pump	C4.28	Concrete mixer truck (discharging) & concrete pump (pumping)
	Lorry *	C11.9	Delivery of material (maximum of 2 two-way trips per hour)
Erection of steel work, block work and installation of concrete slabs	Mobile telescopic crane (80t)	C4.39	Lifting steel
	Lorry *	C11.9	Delivery of material (maximum of 2 two-way trips per hour)
* Drive-by maximum sound pressure level in L_{max} (octave bands) and L_{Amax} (overall level)			

The nearest occupied dwelling to the IBA facility building is approximately 420 m away with cumulative noise levels from all activities of 56dB $L_{Aeq,1hr}$. The nearest occupied dwelling to the proposed biological treatment facility is approximately 340 m away with cumulative noise levels from all activities of 56dB $L_{Aeq,1hr}$. The nearest occupied dwelling to the substations is approximately 290 m away with cumulative noise levels from all activities of 56dB $L_{Aeq,1hr}$. In all instances, the predicted noise levels are below the construction noise limit of 65 dB $L_{Aeq,1hr}$.

Construction of Leachate Management Facility

The leachate management facility comprising 5 no. bunded above ground tanks for leachate (raw, treated and concentrated), 6 no. of modular containerised plant units for leachate treatment, 3 no. of bunded storage tanks for dosing and other compounds and a loading area for 2 no. 25 tonne articulated tankers. The predicted noise from the construction of 3 no. leachate lagoons is discussed later in this chapter. As part of the leachate management facility, it is proposed prepare a hardstanding area with a number of concrete pads for the bunded tanks and the containerised leachate processing modular units. Table 9.10 presents the assumed plant required during the different construction phases. The nearest occupied dwelling is approximately 250 m from the proposed leachate management facility. The predicted noise levels are below the construction noise limit of 65 dB $L_{Aeq,1hr}$ with the cumulative noise levels of all activities of 59 dB $L_{Aeq,1hr}$.

Table 9.10: Construction of Leachate Management Facility – Assumed Plant and Predicted Noise Levels

Phase	Plant	BS 5228 Ref.	Activity
Site Preparation	Tracked excavator (22t)	C2.3	Clearing Site
	Articulated Dump Truck *	C2.33	Delivery and removal of material (15 trips per hour)
	Dozer (20t)	C2.12	Ground excavation/ earthworks
Preparation of hardstanding areas	Tracked Excavator (25t)	C2.19	Ground excavation/earthworks
	Articulated Dump Truck (23t)	C2.32	Tipping Fill
	Dozer (14t)	C5.12	Spreading chipping/fill
	Vibratory roller	C5.21	Rolling and Compaction
Preparation and pouring of Foundations	Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks
	Wheeled Loader (23t)	C10.4	Loading sand / soil
	Mobile telescopic crane (80t)	C4.39	Lifting reinforcing steel
	Concrete mixer truck & concrete pump	C4.28	Concrete mixer truck (discharging) & concrete pump (pumping)
	Articulated dump truck (tipping fill) (23t)	C2.32	Tipping Fill (20% percentage on time)
	Articulated dump truck* (23t)	C2.33	Delivery and removal of material (2 trips per hour)
Pouring of bunded walls	Concrete mixer truck & concrete pump	C4.28	Concrete mixer truck (discharging) & concrete pump (pumping)
Installation of containers, storage tanks and electrical and mechanical plant	Mobile telescopic crane (80t)	C4.39	Lifting containers and storage tanks
	Telescopic handler	C4.54	Lifting pumps into position
	Angle grinder (grinding steel)	C4.93	Miscellaneous

* Drive-by maximum sound pressure level/ sound power level

Construction of Leachate Lagoon, Attenuation Pond, Holding Pond and Wetland

The construction of the leachate lagoon, holding pond and the attenuation pond will require the excavation of material and installation of a composite barrier, comprising a 2 mm HDPE membrane on a 1 m clay layer. Construction of the wetland will require the excavation, distribution and placement of material. The assumed plant required for the construction of the leachate lagoons, the attenuation pond, holding pond and wetland are presented in Table 9.11. The nearest occupied dwelling to the leachate lagoons is approximately 350 m away and the predicted noise level is below the construction noise limit of 65 dB $L_{Aeq,1hr}$ with the cumulative noise levels of all activities of 53 dB $L_{Aeq,1hr}$. The nearest occupied dwelling to the attenuation pond is approximately 260 m away and the predicted noise level is below the construction noise limit of 65 dB $L_{Aeq,1hr}$ with the cumulative noise levels of all activities of 55 dB $L_{Aeq,1hr}$.

The nearest occupied dwelling to the wetland is approximately 260 m away and the predicted noise level is below the construction noise limit of 65 dB $L_{Aeq,1hr}$ with the cumulative noise levels of all activities of 50 dB $L_{Aeq,1hr}$.

Table 9.11: Construction of Leachate Lagoon, Attenuation Pond and Wetland – Assumed Plant and Predicted Noise Levels

Construction Activity		Plant	BS 5228 Ref.	Activity
Leachate Lagoon, Holding Pond and Attenuation Pond		Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks
	Wetland	Tracked Excavator	C10.2	Face shovel extracting/loading dump trucks
		Articulated dump truck *	C2.33	Distribution of material (6 trips per hour)
		Articulated dump truck (tipping fill)	C.2.32	Tipping fill
		Tracked excavator	C.2.19	Placement of material
		Dozer (14t)	C5.12	Spreading fill
		Vibratory roller	C5.21	Rolling and Compaction
* Drive-by maximum sound pressure level in L_{max} (octave bands) and L_{Amax} (overall level)				

The cumulative construction impacts, and operational impacts were appraised, and it was found that the predicted noise impacts are compliant with the 65 dB $L_{Aeq,1hr}$ noise limit derived from BS 5228-1:2009+A1:2014. For the purpose of this assessment, a conservative assumption was made that mobile plant will operate for a percentage on-time of 80% unless stated otherwise. For the purpose of the noise impact assessment, mobile plant is located such that the distant between the respective construction activity and the nearest receptor is at a minimum. In practice, all mobile plant will not operate simultaneously and the distance between the plant and the nearest receptor will often be greater than the distances used in the noise model. Hence, it is expected that the potential noise impact will be lower than that modelled.

9.6.2 Potential Impacts during Operation – Direct & Indirect

The operating hours of the facility i.e. waste acceptance and processing hours will remain as per those currently allowed for under W0146-02 Monday to Saturday.

The noise sources associated with the operation of the development currently include:

- delivery of waste material to the facility (day time only)
- transportation of waste material around the facility (day time only)
- waste placement
- placement of daily cover, intermediate cap and final cap
- construction of cells
- leachate management system
- Landfill Gas Engines and Flares

The additional noise sources associated with the operation of the proposed development include:

- an increase in the delivery of waste material to the facility (day time only)
- activity at the biological treatment facility (waste acceptance day time only)
- an increase in the transportation of waste material around the facility (day time only)
- IBA handling and placement (day time only)
- construction of berms
- tree felling

Noise Prediction Modelling - Overview

The predicted noise levels associated with stationary or minimal movement sources, as well as on-site traffic movements, at the site were predicted according to the International Standard ISO 9313-2: 1996 *Acoustics -Attenuation of sound outdoors - Part 2: General Method of Calculation* and using Brüel & Kjær Predictor software.

This noise propagation model allows for octave band calculation of noise from multiple sources, including diffraction and reflection around buildings, terrain and ground effects. This allows all significant noise sources and propagation effects to be accounted for in the model.

The modelling assumes that all plant will be operating simultaneously. It has been assumed that all stationary plant will operate 100% of the time, mobile plant will operate 80% of the time except for tipper trucks where the tipping of material will be for a short duration. The reality is that many of the noise sources will only operate intermittently versus the quasi continuous assumption used in the noise model. This makes the noise modelling assessment a conservative exercise.

The geographical features of the area, including existing buildings, all noise sources and propagation effects were accounted for in the model. This includes site structures and neighbouring dwelling buildings. The ground factor ranges from 0 for hard reflective surfaces to 1 for soft porous surfaces. Roads, hardstanding's and IBA cells were modelled as hard surfaces. Other surfaces can be described as porous surfaces and would have a ground factor akin to 1. However, a conservative ground factor of 0.75 was used to model the porous surfaces. Atmospheric conditions of 10 ˚C and 70 % humidity were used as they represent a reasonably low level of air absorption. In absence of representative spectral data, an air absorption rate corresponding to the 250 Hz octave band was used. 72 no. receptors were modelled. Receptor heights of 1.5 m were modelled for dormer bungalows and bungalows, and a receptor height of 4 m was modelled for two-storey dwellings.

Noise Prediction Modelling – Site Noise Sources

Each of the potential noise sources on the site were identified and reference sound power data or sound pressure level data assigned. The data has been sourced from literature, FT file measurements from similar sites/ equipment and BS 5228-1:2009+A1:2014.

An estimate has been made for the acoustic performance of the building shell, based on FT file measurements and published data.

Site Noise Sources

The landfill has been accepting waste since 2004 and there are a number of existing on-site noise sources associated with the operation of the landfill including cell construction, landfill waste acceptance and placement, capping of cells, leachate tankering and operation of a gas plant. As part of the proposed development the existing activities will continue and there will be some additional and redeployment of resources. The existing operation of the landfill as well as the proposed development and the associated noise sources are described below.

Tree Felling

The construction of the permitted landfill cells, development of the proposed IBA Facility and surface water management infrastructure require the excavation of soil. It will be used to create screening berms. The proposed development will require the felling of approximately 12.5 ha. of commercial forestry currently in place within the boundary of the existing site. The felling of commercial forestry will occur irrespective of whether the development proceeds but for completeness it has been considered as part of the operational impacts.

It is assumed that an average of approximately 25 tonnes of timber can be transported per truck. Therefore, approximately 15 trips will be required per hectare to transport the timber and brash off site, which amounts to approximately 188 trips for the 12.5 ha felling required.

It is proposed that tree felling will occur over a number of years. Drawing No, LW14-821-01-P-0050-003 Existing Forestation, Proposed Felling & Compensatory Planting in Volume 4 of this EIAR presents the areas of forestry to be felled. The total felling time is expected to be 8 no. weeks in total. However, felling will be on a phased basis and areas of forestry will be felled ahead of the installation of screening berms. Felling will occur between September and February, and it is expected that the construction of cells and berms will occur outside of this time period.

A noise model has been prepared to predict the expected noise emissions from tree felling activities. Table 9.12 presents the assumed plant required for felling of trees.

Table 9.12: Tree felling – Assumed Plant and Predicted Noise Levels

Plant	BS 5228 Ref.	Activity
Harvester §	D2.14	Harvesting trees
Forwarder µ	C4.53	Moving felled trees
Lorry *	C11.9	Transporting timber and brash off site (2 two-way trips per hour)
* Drive-by maximum sound pressure level in L_{max} (octave bands) and L_{Amax} (overall level) § - Excavator BS 5228 Ref C2.5 µ - Lorry with lifting boom – C4.53		

Construction of Screening Berms

Screening berms will mitigate against potential noise impacts or visual impacts from the proposed development. Material excavated as part of cell construction and other construction works will be transported using articulated dump trucks to the berm locations. Screening berms A and B will be constructed first to protect noise sensitive receptors. The construction sequencing of the screening berms is as follows (Refer to Drawing No. LW14-821-01 P-0050-011 Cut/Fill Phasing Plan in Volume 4 of this EIAR:

- Berms to the east and north of IBA area (Berm A), and to the southwest of the site (Berm B).
- Berm to west of site (Berm C)
- Berm to west of site (Berm D)
- Berm to west of site (Berm E)

The assumed plant required for the construction of screening berms is presented in Table 9.13. Note: the articulated dump truck movements partly associated with this activity are captured in the cell construction phase of the developments.

Table 9.13: Construction of Screening Berms – Assumed Plant and Predicted Noise Levels

Plant	BS 5228 Ref.	Activity
Articulated dump truck (tipping fill)	C.2.32	Tipping fill
Tracked excavator	C.2.19	Placement of material
Dozer	C.2.12	Distribution of material

Construction of Cells

Future cell construction within the currently permitted development will continue to be constructed in the same manner as cells currently constructed. As of January 2018, Cells 1 through 16 (See Drawing LW14-821-01-P-0000-002 in Volume 4 of this EIAR) have been constructed, Cells 17 and 18 are under construction and Cells 19 through 28 have yet to be constructed.

The proposed changes to the operation of the landfill under this application include the intensification of landfilling, and the operation of 2 no. active faces within the permitted landfill development, one for non-stabilised waste and one for stabilised and inert waste.

It is proposed to develop five dedicated IBA cells (no. 29 through no. 33) for the acceptance and placement of IBA material only. Construction of cells 29 and ½ of 32 were assessed against BS 5228-1:2009+A1:2014 as they form part of the construction works of the proposed development. The construction of cells will occur on a phased basis. The proposed construction sequence is presented in Chapter 2 Proposed Development in Volume 2 of this EIAR. The process involved in the construction of new cells is described in 9.6.1.

Table 9.14 presents the assumed plant required for cell construction.

Table 9.14: Cell Construction – Assumed Plant and Predicted Noise Levels

Plant	BS 5228 Ref.	Activity
Tracked excavator (x4)	C.8.12	Cell Excavation and loading of material
Articulated dump truck * (x2)	C.8.16	Distribution of material (Landfill Cells 7 trips per hour and IBA Cells four trips per hour)
Dozer (x2)	C.8.17	Cell excavation and distribution of material
Conveyor drive unit	C10.20	Conveyor for screener
Water bowser (discharging)	C.6.37	Spraying water
Screen Stockpiler	C.10.15	Screening material
Lorry*	C11.9	Delivery of Material (Two two-way trips per hour)
Articulated dump truck (tipping fill)	C.2.32	Tipping fill at cell
Vibratory roller *	C.5.21	Rolling and compaction
* Drive-by maximum sound pressure level in L_{max} (octave bands) and L_{Amax} (overall level)		

Waste Placement Operations

For the purposes of the modelling the noise impact from the proposed development, it is assumed that waste placement will occur in three cells simultaneously: (1) Cells 29-33 placement of IBA, (2) Cells 17-21 (excluding Cell 20) for the landfilling of non-stabilised waste, i.e. that with a biodegradable fraction and (3) Cell 20 and 22-28 for placement of stabilised, bulky and inert waste Table 9.15 presents a list of the plant associated with the placement of waste.

Table 9.15: Waste Placement Operations – Noise Sources

Noise Source	Number	Hours of Operation	Location	Sources of Data
Landfilling of non-stabilised waste				
Lorry * (Transport of waste to cell)	40 trips per day	08:00 -18:00	Haul route to cell	BS 5228-1 C11.9
Ejector Trailer (Noise from Donkey Engine) §	-	07:30 -18:30	Cells 20 & 22 - 28	BS 5228-1 C4.84
Tracked Excavator	1	07:30 -18:30	Cells 20 & 22 - 28	BS 5228-1 C8.10
Dozer	1	07:30 -18:30	Cells 20 & 22 - 28	BS 5228-1 C8.9
Waste Compactor	1	07:30 -18:30	Cells 20 & 22 - 28	BS 5228-1 C8.1
Landfilling of stabilised, bulky and inert waste				
Tipper Lorry * (Transport of waste to cell)	8 trips per day	08:00 -18:00	Haul route to cell	BS 5228-1 C8.20
Tractor (towing trailer) * (Transport of waste to cell)	9 trips per day	07:30 -18:30	Haul route to cell	BS 5228-1 C4.75
Tipping Fill	-	07:30 -18:30	Cells 17 - 19 & 21	BS 5228-1 C2.32
Tracked Excavator	1	07:30 -18:30	Cells 17 - 19 & 21	BS 5228-1 C8.10
Dozer	1	07:30 -18:30	Cells 17 - 19 & 21	BS 5228-1 C8.9
Waste Compactor	1	07:30 -18:30	Cells 17 - 19 & 21	BS 5228-1 C8.1
IBA Placement µ				
Articulated dump truck *	23 trips per day	08:00 -18:00	Haul route between IBA weathering area and Cells 29 - 31	BS 5228-1 C2.33
Articulated dump truck (tipping fill)	-	07:30 -18:30	Cells 29 - 31	BS 5228-1 C2.32
Vibratory Roller	1	07:30 -18:30	Cells 29 - 31	BS 5228-1 C5.21
Dozer	1	07:30 -18:30	Cells 29 - 31	BS 5228-1 C8.9

* Drive-by maximum sound pressure level/ sound power level
§ Noise emissions from donkey engine modelled as diesel engine
µ Acceptance of IBA material is modelled as part of the IBA handling operations

IBA Facility Building

It is proposed to construct an IBA facility building primarily to mitigate against leachate generation in the weathering phase. The building may also be used to facilitate IBA processing trials such as screening, washing and metal recovery). This building will be constructed within cell 32 as part of the construction phase of the overall development. The proposed building is 75 m in length, 75 m in width and up to 15 m in height, of portal frame construction, with metal cladding around the top 3 meters. The building façades will predominantly be open and for the purpose of this assessment it has been assumed that there is no attenuation from the roof structure. Table 9.16 presents a list of the plant associated with the proposed IBA facility building.

Table 9.16: IBA Facility Building– Noise Sources

Noise Source	Number	Hours of Operation	Location	Sources of Data
IBA Weathering				
Lorry * (Transport of IBA to Weathering area)	23 trips per day	08:00 -18:00	Haul route to IBA weathering area	BS 5228-1 C8.20
Tipping Fill	-	07:30 -18:30	IBA Weathering Area	BS 5228-1 C2.32
Tracked Excavator	1	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.1
Wheeled Loader	2	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.4
IBA Processing Trials				
Articulated dump truck * µ	23 trips per day	07:30 -18:30	Haul route between IBA weathering area and Cells 29 – 31	BS 5228-1 C2.33
Screener / Stockpiler	1	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.14
Conveyor Drive Unit	3	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.21
Feed Hopper	1	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.22
Tracked Excavator	1	07:30 -18:30	IBA Weathering Area	BS 5228-1 C10.2
Eddy Current Separator	1	07:30 -18:30	IBA Weathering Area	-
Drum Separator (Magnetic)	3	07:30 -18:30	IBA Weathering Area	-

* Drive-by maximum sound pressure level/ sound power level

µ Articulated dump truck movements between the IBA weathering facility and landfill cells was modelled as part of landing filling operations

§ Noise data not available and modelled a maximum of 105 dB

Biological Treatment Facility

It is proposed to develop a purpose built aerobic biological treatment facility as part of the overall development. A sketch of the proposed facility is shown in Figure 2.10 in Chapter 2 Proposed Development of Volume 2 of this EIAR. The main noise sources associated with the proposed biological treatment facility will be located internally.

The sound power pressure levels and sound power levels of individual noise sources associated with the proposed biological treatment facility were sourced from British Standard 5228-1:2009+A1:2014 'Code of Practice for noise and vibration control on construction and open sites Part 1: Noise' and Bruel & Kjaer Source DB software. Table 9.17 presents a list of the plant associated with the proposed biological treatment facility. The A-weighted octave band sound power level data for each of the noise sources is presented in Table 9.18.

Table 9.17: Biological Treatment Facility – Noise Sources

Noise Source	Number	Hours of Operation	Location	Sources of Data
Mobile Sources				
Transfer trailers input – Travel to and from facility*	9 trips per day	08:00 -18:00	Outside	BS 5228-1 C8.20
Transfer trailers input – Tipping Fill	9 trips per day	08:00 -18:00	Within Facility	BS 5228-1 C2.32
Tractor (towing trailer) – Travel to and from landfill cells*	9 trips per day	08:00 -18:00	Outside	BS 5228-1 C4.75
Wheel loaders	2	08:00 -18:00	Within Facility	BS 5228-1 C10.4
Fixed Sources				
Ventilation Blower	2	Full time	Within Facility	Source DB
Composting Pressure Blowers	12	Full time	Within Facility	Source DB
Percolate tank purge blower	2	Full time	Within Facility	Source DB
Biofilter pump	1	Full time	Submersible within tank within facility	Source DB
* Drive-by maximum sound pressure level/ sound power level				

Table 9.18: Biological Treatment Facility - Sound Power Level – L_{WA}, dB(A)

Equipment	A-weighted Octave Band Centre Frequency (Hz)									Overall L_{WA}
	31.5	63	125	250	500	1k	2k	4k	8k	
Transfer trailers input – Travel to and from facility *	-	89.8	93.9	93.4	98.8	102	102.2	99	93.9	107.5
Transfer trailers input – Tipping Fill	-	81.8	87.9	92.4	94.8	97	95.2	92	84.9	102.0
Tractor (towing trailer) – Travel to and from landfill cells *	-	94.8	97.9	95.4	100.8	101	101.2	93	85.9	107.2
Wheel loaders	-	88.8	98.9	104.4	99.8	104	103.2	98	88.9	109.9
Ventilation Blower	47.8	60.8	68.8	78.8	81.8	75.8	73.8	65.8	50.8	84.8

Equipment	A-weighted Octave Band Centre Frequency (Hz)									Overall L_{WA}
	31.5	63	125	250	500	1k	2k	4k	8k	
Composting Pressure Blowers	42.8	55.8	63.8	73.8	76.8	70.8	68.8	60.8	45.8	79.8
Percolate tank purge blower	47.8	60.8	68.8	78.8	81.8	75.8	73.8	65.8	50.8	84.8
Biofilter pump	-	68.8	76.9	84.4	88.8	91	92.2	89	80.9	96.9
* Drive-by maximum sound pressure level/ sound power level										

The reverberant noise level from all plant operating within the biological treatment facility was calculated using the data presented in Table 9.18. It has been conservatively assumed that the absorption characteristics of the internal surface of the biological building are the same as those for concrete. The building is constructed from a range of materials including poured concrete, standard industrial lightweight panel (Kingspan AWP/60) and metal sheeting for roller shutters. Table 9.19 presents the attenuation due to construction materials. The façades are composed of a combination of materials and an average attenuation for each façade and roof was calculated, and this was used to calculate the breakout noise from the building.

Table 9.19: Attenuation due to construction materials

Attenuation	Data Source	Octave Band Centre Frequency (Hz)								
		31.5	63	125	250	500	1k	2k	4k	8k
AWP/60 no lining	Manufacturer	-	15	16	19	23	26	22	39	39*
Concrete wall	Noise Modelling Software Database	30	35	40	44	49	53	57	57	57
Metal façade 1mm steel	Noise Modelling Software Database	4	9	14	16	20	25	29	29	29
* - Assumed based off the acoustic performance frequency trends of other similar materials										

Landfill Gas Engines and Flares

Four landfill gas engines and three landfill gas flares are currently installed and operational. Details on the plant are presented in Table 9.20. There are no proposed changes to the landfill gas plant. The sound power levels from the plant are presented in Table 9.21.

Table 9.20: Engine and Flare Sound Power Levels

Noise Source	Number	Hours of Operation	Location	Source
Biogas Engine	4	Full time	Insulated Containers to within gas compound	Manufacturers datasheet and file Measurements CHP Engine (Finning Ireland / Bioverda Greenstar TG 2016-3-1256(01))
Biogas Engine Exhaust	4	Full time	Insulated Containers to within gas compound	Manufacturers datasheet and File Measurements CHP Engine (Finning Ireland / Bioverda Greenstar TG 2016-3-1256(01))
Flare	3	Full-time	Gas compound	File Measurements

Table 9.21: Landfill Gas Engines and Flares - Sound Power Level – L_{WA}, dB(A)

Equipment	Octave Band Centre Frequency (Hz)									Overall L_{WA}
	31.5	63	125	250	500	1k	2k	4k	8k	
CHP Engine	55.9	82.3	96.4	106.9	106.1	107.5	108.6	110.2	110.5	116.5
CHP Exhaust	-	57.8	77.9	91.4	91.8	93	95.2	89	79.9	99.6
Flare	-	65	70	72	73	70	65	-	-	77.9

The landfill gas engines are located within insulated containers. Table 9.18 presents the typical façade sound insulation. The breakout noise was calculated and each of the engines was modelled as a point source in the noise model. The noise emissions from the exhausts were also modelled as point sources. The manufacturers' data with silencers and other noise attenuating technology was adjusted such that the noise levels from the actual operational plant were aligned with the predicted noise levels.

There are no proposed changes to the existing landfill gas plant. The predicted noise levels are as per measurements adjacent to the gas plant and historic measurements previously undertaken at noise monitoring locations. Noise monitoring results were compliant with daytime licence levels during the period 2015 to Q1 2018.

Leachate Management Facility

There is an existing leachate storage lagoon in the facility. Electric pumps are located at the low point of cells and leachate is pumped from the side riser sumps to the perimeter leachate collection rising main. The leachate collection rising main, which will ultimately be laid around the entire perimeter of the landfill, discharges to the leachate lagoon.

As part of the proposed development it is planned to construct a leachate management facility to store and pre-treat the leachate generated by the landfilling activities, biological treatment and from IBA. The leachate management facility will consist of a small number of electric pumps and aerators. These will operate within the storage tanks and containerised units and the noise contribution will be negligible beyond the leachate management area.

Leachate generation in 2017 was 16,753 m^3. At peak operations in the proposed development, leachate generation is predicted to be 45,000 m^3 per annum. Leachate tankers will transfer stored and pre-treated leachate off-site to a wastewater treatment plant. This will generate 7 trips a day between the weighbridge and the leachate management facility.

Traffic on site (Access Road)

Traffic movements on site were modelled from the site entrance on the N2 National Primary route to the weighbridge. Traffic movements from the weighbridge to other part of the sites were considered as part of the other activities discussed above. Table 9.22 presents the traffic movements and assumed plant/vehicles. These were combined to give an overall sound power level which was used to model the noise impact along the access road. The average daily HGV traffic generation of 78 trips is based upon the assumption that the export of any potential recovered materials e.g. IBA for a re-use trials, will be by backhaul. The impact of the traffic on site (i.e. from weighbridge to waste infrastructure) is not considered on its own but as part of the overall impact from the proposed development.

Table 9.22: Traffic Movement Noise Sources

Waste Stream	Hours of Operation	Annual Vehicle Trips			Daily Trips	Sources of Octave Band Data
		Waste Inbound Trips	Bi-product Outbound Trips	Total Trips		
Incinerator Bottom Ash	08:00 – 18:00	5,556	--	5,556	23	C11.9
Non-hazardous Soil & Stones and C&D Waste	08:00 – 18:00	2,174	--	2,174	8	C8.20
Residual MSW	08:00 – 18:00	6,087	--	6,087	23	C8.20
Residual Fines	08:00 – 18:00	2,391	--	2,391	9	C8.20
Bulky Waste/Street Cleanings	08:00 – 18:00	1,957	--	1,957	8	C8.20
Total Waste Streams	08:00 – 18:00	**18,164**	**--**	**18,164**	**71**	Combined
Leachate Disposal	08:00 – 18:00	--	1,667	1,667	7	C4.15
Timber and brash	08:00 – 18:00	--	15/an	15/an	0	
Cover Material (Provisional)	08:00 – 18:00	(2,174)	--	(2,174)	(7)	C11.9

Noise Prediction Modelling - Results

For the purpose of this assessment, predicted operational noise levels were calculated at 72 no. receptor locations and assessed against operational noise criteria described in Section 9.4.2. However, one of the receptor locations (R44) is unoccupied and is not considered a noise sensitive location and it has not been appraised. It has been assumed that all stationary plant will operate 100% of the time, mobile plant will operate 80% of the time except for the trucks tipping material which operates for 20% of the time. A receptor height of 1.5 m was modelled bungalows, and receptor heights of 1.5 m[4] and 4 m[5] was modelled for dormer bungalows and two storey dwellings. Both daytime and night-time scenarios were modelled.

Daytime

During daytime periods, twelve scenarios were assessed to reflect the dynamic nature of the waste management facility and associated activities. The purpose of modelling a high number of scenarios was to ensure that the worst case at various different stages throughout the lifetime of this development were modelled. The noise models assessed scenarios where the given activities were likely to be at their worst. Hence, this assessment is conservative, and these noise levels are maximum predicted noise levels and not likely to be achieved in practice. All scenarios modelled include existing on-site noise sources associated with the operation of the landfill including cell construction, landfill waste acceptance and placement, capping of cells, leachate tankering and operation of the landfill gas plant.

[4] A receptor height of 1.5 m equates to ground floor level

[5] A receptor height of 1.5 m equates to first floor level

Scenarios 2 to 8 also include activities associated with the biological treatment facility, leachate management facility and IBA facility. Specific details unique to each scenario are as follows:

Scenario 1

- Existing Activity (Cell 15 and 16)

Scenario 2a

- Existing Activity (Cell 15 and 16)
- Construction of Cell 28
- Tree felling (Areas b1, b2, b3, b6, b8, b9, b10 and b11 as per Drawing No. LW14-821-01-P-0050-003 Existing Forestation, Proposed Felling and Compensatory Planting in Volume 4 of this EIAR)

Scenario 2b

- Existing Activity (Cell 15 and 16)
- Construction of Cell 28
- Construction of Screening Berms (Berm A and B)

Scenario 3a

- Landfilling Activity (Cell 19 and 20)
- Construction of Cell 28
- Tree felling (Areas b1, b2, b3, b6, b8, b9, b10 and b11 as per Drawing No. LW14-821-01-P-0050-003 Existing Forestation, Proposed Felling and Compensatory Planting in Volume 4 of this EIAR)

Scenario 3b

- Landfilling Activity (Cell 19 and 20)
- Construction of Cell 28
- Construction of Screening Berms (Berm A and B)

Scenario 4a

- Landfilling Activity (Cell 22 and 28). IBA placement Cell 29
- Construction of Cell 26
- Tree felling (Area b7)
- Construction of Screening Berm (Berm C)

Scenario 4b

- Landfilling Activity (Cell 22 and 28). IBA placement Cell 29
- Construction of Cell 27
- Tree felling (Area b7)
- Construction of Screening Berm (Berm C)

Scenario 5a

- Landfilling Activity (Cell 22 and 28. IBA placement Cell 29)
- Construction of Cell 25
- Tree felling (Area b5)
- Screening Berm (Berm D)

Scenario 5b

- Landfilling Activity (Cell 22 and 28.IBA placement Cell 29)
- Construction of Cell 30
- Tree felling (Area b5)
- Screening Berm (Berm D)

Scenario 6

- Landfilling Activity (Cell 22 and 28. IBA placement Cell 29)
- Construction of Cell 30
- Tree felling (Area b4)
- Construction of Screening Berm (Berm E)

Scenario 7

- Landfilling Activity (Cell 23 and26. IBA placement Cell 31)

Scenario 8

- Landfilling Activity (Cell 23 and24. IBA placement Cell 33)

Night-time

During night-time periods, waste placement activities and ancillary works cease, and static plant such as pumps and blowers in the biological treatment facility and the landfill gas plant remain operational. These sources were modelled and assessed against the evening and night-time noise limits. A single scenario was modelled.

Table 9.23 and 9.24 present the predicted noise levels from the twelve daytime scenarios at ground floor and first floor level (where applicable), respectively. Grey shaded cells indicate an exceedance of the licence daytime noise level (55 dBA).

Table 9.23: Predicted Operational Daytime Noise Levels at Ground Floor Level

Receptor ID	Predicted $L_{Aeq,\ 30min}$ Noise Level for a range of Daytime Scenarios										
	1	2a	2b	3a	3b	4a	4b	5a	5b	6	7	8
R1	33.8	38.7	38.8	41.9	41.9	42.4	42.8	43.2	42.1	44.1	38.1	38.8
R2	35.1	39.5	39.4	42.4	42.4	43.4	43.7	44.0	43.1	44.6	38.1	38.7
R3	34.3	39.8	39.7	43.0	43.0	43.8	44.2	44.6	43.5	45.7	37.5	39.1
R4	33.8	39.4	39.3	42.7	42.6	43.5	43.9	44.1	43.1	45.0	37.7	38.6
R5	34.8	40.8	40.8	44.8	44.8	45.5	46.0	46.3	45.0	47.6	39.5	40.6
R6	38.5	43.9	43.8	46.4	46.3	46.1	46.9	47.8	45.7	49.8	42.0	41.9
R7	42.6	48.2	48.1	49.8	49.7	49.3	50.6	50.5	48.6	50.0	44.7	45.1
R8	43.3	49.2	48.9	50.7	50.5	49.9	51.2	50.6	49.0	50.1	44.9	45.3
R9	40.0	46.5	45.7	48.4	47.9	48.8	51.3	51.1	49.0	49.9	44.1	45.5
R10	38.9	47.7	47.2	48.9	48.5	48.5	48.4	49.4	46.7	47.5	44.9	43.9
R13	45.4	51.9	53.8	53.1	52.7	52.6	53.4	51.7	51.2	51.8	46.6	46.2
R14	39.5	48.2	48.0	50.2	50.0	50.0	49.0	48.8	48.7	49.0	43.5	42.5
R15	45.4	52.8	51.7	54.1	53.3	53.1	53.5	52.1	51.8	52.3	45.6	45.9
R16	45.3	53.0	51.8	54.2	53.3	53.2	53.5	52.1	52.0	52.4	45.7	46.6
R17	46.2	53.4	52.0	54.4	53.3	53.2	53.7	52.3	52.0	52.4	45.7	45.6
R18	43.9	52.5	50.6	53.0	51.3	51.4	51.0	50.0	49.7	50.4	44.8	45.0
R19	42.7	52.3	50.6	53.2	51.9	50.9	51.1	50.3	49.8	50.9	44.2	45.3
R20	40.5	47.6	46.6	49.2	48.6	48.1	48.6	48.0	48.0	48.5	43.0	42.2
R21	39.6	47.3	46.5	49.1	48.5	48.1	48.1	47.8	48.0	48.4	43.2	42.5
R22	38.7	46.9	46.2	48.9	48.4	48.5	47.9	47.9	48.0	48.6	43.4	43.2
R23	38.6	46.1	46.3	48.2	48.4	48.3	48.1	47.9	48.0	48.4	43.7	43.5
R24	32.9	39.6	39.5	42.7	42.6	43.8	43.6	43.5	43.9	43.8	40.1	39.9
R25	33.6	40.0	39.8	42.6	42.5	43.1	43.1	43.0	43.0	43.1	39.4	39.5
R26	35.2	43.0	43.1	44.9	45.0	44.1	43.9	43.7	44.2	44.4	40.9	40.6
R27	39.1	46.1	46.6	47.5	47.9	46.6	46.9	46.2	46.6	46.9	43.0	42.6
R28	39.5	46.0	46.4	47.3	47.7	46.5	47.0	46.2	46.5	46.7	43.0	42.6
R29	38.2	46.1	46.2	47.5	47.6	46.8	47.0	46.2	46.2	46.9	42.6	42.5
R30	37.5	44.3	44.6	46.7	46.8	46.9	46.5	46.5	47.0	47.4	43.3	42.9
R31	38.7	45.5	45.6	47.4	47.5	46.5	46.6	46.2	46.7	47.0	42.9	42.8

Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level for a range of Daytime Scenarios											
	1	2a	2b	3a	3b	4a	4b	5a	5b	6	7	8
R32	36.2	44.5	44.1	47.0	46.8	46.7	46.1	45.9	46.7	47.1	43.9	42.9
R33	39.2	45.7	46.5	48.6	49.0	48.0	47.9	47.5	48.7	48.3	44.5	43.9
R34	35.3	43.2	43.8	46.6	46.9	46.5	46.2	46.0	46.7	46.3	42.8	42.2
R35	35.3	40.3	44.2	44.6	46.4	43.9	43.8	43.7	45.9	45.1	41.8	40.7
R36	40.6	46.9	48.5	48.9	50.0	48.1	47.6	47.4	47.5	47.8	44.9	42.6
R37	38.7	43.5	44.5	46.9	47.4	46.7	46.4	46.4	47.2	46.9	44.2	42.8
R38	42.2	49.5	50.1	51.2	51.6	49.6	49.0	48.9	49.7	49.8	46.7	46.2
R39	41.8	48.4	49.6	48.8	50.0	47.5	47.4	47.2	47.4	47.4	45.1	44.0
R40	40.8	45.8	46.9	48.2	48.9	48.8	48.5	48.4	49.3	49.5	45.7	45.5
R41	41.5	48.2	50.0	49.7	51.0	48.3	47.8	47.6	48.2	48.4	45.5	45.6
R42	41.5	47.5	48.5	49.1	49.8	48.6	48.2	48.1	48.9	48.8	45.5	45.3
R43	44.0	53.9	57.1	54.6	57.4	50.8	50.6	50.5	50.7	51.0	49.0	47.0
R45*	48.0	53.9	57.3	54.3	57.5	51.2	51.0	51.0	51.3	51.5	51.0	51.0
R46*	45.6	49.7	52.7	50.8	53.3	49.6	49.4	49.2	49.5	49.8	49.8	49.2
R47*	45.5	46.5	47.6	47.6	48.5	47.7	47.6	47.6	48.0	47.9	49.2	48.9
R48	45.3	48.4	51.0	49.7	51.8	49.3	49.1	49.0	49.6	49.5	49.5	49.1
R49*	45.1	47.8	50.2	49.3	51.1	49.1	48.9	48.9	49.4	49.3	49.3	49.0
R50	37.8	45.1	45.6	47.9	48.1	47.7	47.2	47.0	47.7	47.8	43.7	43.7
R51	43.7	45.1	46.3	46.5	47.4	47.1	47.0	46.9	47.4	47.3	48.3	46.8
R52	42.3	43.6	44.6	45.0	45.7	45.5	45.5	45.3	45.7	45.6	46.3	46.1
R53	42.7	43.9	45.0	45.2	46.0	45.5	45.4	45.3	45.7	45.6	46.1	46.3
R54	35.6	38.0	38.6	40.0	40.4	40.8	40.7	40.5	40.5	40.4	39.2	39.0
R55	30.8	33.4	34.3	36.0	36.6	38.3	38.2	37.8	38.0	37.9	37.4	37.2
R56	33.9	36.0	36.9	38.4	38.9	39.7	39.7	39.4	39.5	39.5	39.4	40.6
R57	35.7	37.0	37.6	38.8	39.2	39.9	39.8	39.6	39.8	39.8	39.6	39.6
R58	35.6	37.0	37.6	38.7	39.2	39.8	39.7	39.5	39.7	39.7	39.5	39.5
R59	36.4	41.0	42.1	43.1	43.8	42.9	42.7	42.7	43.7	43.5	42.4	41.8
R60	35.4	40.9	41.5	43.3	43.6	43.1	42.9	42.9	43.8	43.6	41.0	41.2
R61	39.7	45.2	46.6	47.1	48.1	45.9	45.7	45.6	46.7	46.5	44.7	44.7
R62	39.2	44.5	45.8	46.4	47.3	45.3	45.0	44.9	46.0	45.8	44.3	44.1
R63	40.3	45.1	46.5	46.8	47.8	45.8	45.5	45.4	46.1	46.3	44.7	44.2
R64	40.7	45.2	46.6	46.9	47.9	45.9	45.6	45.6	46.3	46.5	44.6	44.3
R65	39.3	43.1	44.6	45.2	46.2	45.2	44.9	44.7	45.5	45.6	43.7	43.5
R66	40.4	41.4	42.6	41.4	42.6	37.0	35.5	35.0	39.3	39.4	43.8	43.5
R67	43.8	45.4	46.3	46.9	47.5	46.8	46.6	46.5	47.2	47.1	46.2	45.9
R68	43.9	45.6	46.7	46.9	47.8	46.5	46.4	46.3	46.9	46.8	46.1	45.8
R69	45.0	46.9	47.2	48.2	48.5	47.8	47.6	47.5	48.0	47.9	46.7	46.6
R70	48.5	49.1	49.4	49.6	49.8	49.5	49.5	49.5	49.7	49.6	49.3	49.3
R71	31.2	33.8	34.5	36.6	36.9	37.6	37.5	37.3	37.9	37.7	35.9	36.7
R72	36.0	37.8	39.1	39.7	40.6	40.2	40.0	39.9	40.5	40.4	39.6	39.8

R11, R12 and R44 are unoccupied derelict dwellings and they are located within the landownership boundary. These receptors are not noise sensitive locations and have not been assessed.
R45, R46, R47 and R49 are located within the landownership boundary.

Table 9.24: Predicted Operational Daytime Noise Levels at First Floor Level

Receptor ID	Predicted $L_{Aeq,\ 30min}$ Noise Level for a range of Daytime Scenarios										
	1	2a	2b	3a	3b	4a	4b	5a	5b	6	7	8
R1	34.7	40.0	40.1	43.9	43.9	44.4	44.7	45.0	44.2	45.6	39.2	39.2
R4	35.3	40.9	40.8	44.7	44.6	45.3	45.6	45.8	44.9	46.3	38.8	39.0
R16	46.0	53.8	52.7	55.2	54.4	54.3	54.6	53.3	53.6	54.0	46.3	47.4
R17	46.8	54.1	52.8	55.3	54.4	54.4	54.8	53.4	53.1	54.0	46.3	46.4
R19	43.8	53.1	51.5	54.1	52.9	52.1	52.3	51.2	50.6	51.7	44.7	46.4
R22	39.9	48.1	47.4	49.9	49.5	49.5	49.2	49.1	49.1	49.6	43.8	43.9
R24	36.4	43.9	43.9	45.4	45.4	46.1	45.4	45.0	45.2	45.3	40.9	41.3
R25	36.7	44.0	43.6	45.4	45.0	44.6	44.9	43.9	43.3	44.2	39.6	40.3
R26	36.0	44.1	44.2	46.1	46.2	45.2	45.5	44.7	45.1	45.4	41.5	41.2
R30	38.6	45.9	46.0	48.3	48.4	48.4	48.2	48.0	48.3	48.7	44.0	43.8
R31	39.4	46.5	46.6	48.3	48.4	47.5	47.6	47.0	47.4	47.8	43.6	43.6
R32	37.5	45.7	45.5	48.5	48.4	48.5	48.1	47.6	48.1	48.0	44.5	43.9
R38	43.1	50.7	51.1	52.1	52.5	50.6	50.1	50.0	50.6	50.8	47.5	47.3
R40	41.7	47.1	48.1	49.3	50.0	50.1	49.9	49.8	50.5	50.7	46.8	46.7
R41	42.4	49.2	50.7	50.6	51.8	50.2	49.8	49.7	50.1	50.3	46.9	47.0
R42	42.5	48.5	49.5	50.0	50.8	49.7	49.4	49.3	49.9	49.9	46.3	46.7
R54	37.5	39.9	40.5	41.9	42.3	42.8	42.7	42.6	42.7	42.6	41.3	41.0
R55	33.0	35.9	36.6	38.8	39.2	40.4	40.4	40.0	40.3	40.2	39.8	39.6
R59	37.6	42.4	43.2	44.2	44.8	44.5	44.3	44.3	44.9	45.0	43.1	42.5
R60	36.4	42.2	42.6	44.4	44.7	44.4	44.1	44.1	44.8	44.8	41.8	42.2
R63	41.9	46.4	47.5	47.9	48.7	47.0	46.7	46.6	47.2	47.4	45.6	45.5
R64	42.2	46.6	47.6	48.0	48.8	47.1	46.8	46.8	47.3	47.6	45.7	45.7
R65	41.1	44.6	45.8	46.3	47.2	46.3	46.1	46.0	46.6	46.8	44.6	45.2
R69	45.4	47.6	47.8	49.0	49.1	48.5	48.3	48.2	48.6	48.7	47.1	46.9
R71	33.2	36.2	37.1	39.3	39.8	40.1	39.9	39.8	39.4	40.3	38.5	39.0
R11 is an unoccupied derelict dwelling and it is located within the landownership boundary. This receptor is not a noise sensitive location and has not been assessed.												

In general, the predicted noise levels are below the daytime noise limit in the licence. However, there are 2 no. scenarios (2b and 3b) where the predicted noise levels are above the daytime noise limit at a 2 no. noise sensitive receptors (ground floor level). One of these noise sensitive receptors is within the landownership boundary. Scenario 3a shows predicted noise levels above the daytime noise level at 2 no. receptors at first floor level. These exceedances must be considered in the context that the noise predictions assumed the worst-case scenario in terms of distance from the plant to the nearest noise sensitive locations and simultaneous operation of activities. In practice, not all activities will occur simultaneously, and it is likely that activities may occur more intermittently than was modelled and the noise impact from the proposed development will be lower than the predicted noise levels presented above.

Scenario 2b represents a situation with cell construction, construction of Berm A and B, ongoing landfilling activities and the operational landfill gas plant. Scenario 3b is similar to scenario 2b with the addition of noise emissions from the IBA facility, leachate management facility and activities associated with the biological treatment facility.

The ground floor exceedances are predominantly due to the construction of nearby earth berms. The earth berms are being installed to mitigate against any future potential impacts from the proposed development and they shall be constructed when material is made available. The overall duration for the construction of each of Berms A and B is estimated at 2-3 weeks, however this may be spread out over a longer period. In some instances, during the construction of the earth berms, plant will be close to nearby noise sensitive locations. Once the construction of earth berm activities that are close to the noise sensitive locations cease, the noise emissions from the rest of the proposed development will be below the daytime noise limit. It is expected that the maximum noise levels predicted will be for a short duration and given the positive impact the earth berms will have on noise sensitive locations; this short term negative impact is deemed to be reasonable, given the net positive outcome because of the construction of the earth berm.

Scenario 3a represents a situation with the construction of a new cell, felling of forestry and operation of landfill, IBA facility, leachate management facility, biological treatment facility and the landfill gas plant. As previously noted, the forestry to be felled is commercial forestry and it will be felled irrespective of whether this development proceeds. For completeness, the impacts from felling of forestry is included as part of the noise impact assessment as the felling of the commercial forestry is required to construct the earth berms.

The predicted noise levels for scenario 3a exceed the noise limit at 2 no. noise sensitive locations at first floor level. There are no exceedances at ground floor level. The level of exceedance is negligible and will be for a short duration. Felling will occur on a phased basis and the maximum noise levels predicted will be for a short duration (less than 1 weeks).

These works will ultimately serve to protect the noise sensitive locations in the long term but given the close proximity of these activities to some of the noise sensitive locations there is potential for short term elevated noise levels. In the long term, once these activities are completed, no significant effects are predicted.

Table 9.25 and 9.26 present the predicted noise levels during evening and night-time periods ground floor and first floor level (where applicable), respectively. The predicted noise levels are below the evening and night-time noise limits as per the IE Licence and no significant effect are predicted.

Table 9.25: Predicted Operational Evening and Night-time Noise Levels at Ground Floor Level

Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level	Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level
R1	22	R37	25.3
R2	23.3	R38	27.2
R3	22.1	R39	26.4
R4	21.5	R40	28.2
R5	22.2	R41	26.7
R6	23.4	R42	26.9
R7	24.4	R43	31.5

Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level	Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level
R8	24.5	R45	37.3
R9	24.8	R46	32.6
R10	27.1	R47	39.9
R13	24.1	R49	38.8
R14	25.2	R50	26.2
R15	25.2	R51	39.6
R16	25.2	R52	38.5
R17	25	R53	38.5
R18	26.4	R54	29.8
R19	24.8	R55	30
R20	24.8	R56	30.4
R21	24.7	R57	32.7
R22	24.6	R58	32.7
R23	22.3	R59	26.3
R24	25	R60	25.2
R25	23	R61	28.5
R26	24.3	R62	27.4
R27	24.2	R63	29
R28	24.2	R64	29.1
R29	24.6	R65	26.9
R30	24.3	R66	27.7
R31	27.2	R67	29.6
R32	27.4	R68	29.5
R33	25.3	R69	28.5
R34	25.6	R70	28.1
R35	26.8	R71	26.7
R36	22	R72	27.8
R48	38.6		

R11, R12 and R44 are unoccupied derelict dwellings and they are located within the landowner boundary. These receptors are not noise sensitive locations and have not been assessed.
R45, R46, R47 and R49 are located within the landowner boundary.

Table 9.26: Predicted Operational Evening and Night-time Noise Levels at First Floor Level

Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level	Receptor ID	Predicted $L_{Aeq, 30min}$ Noise Level
R1	23	R40	28.2
R4	21.6	R41	26.7
R16	25.2	R42	26.9
R17	25.2	R54	32.1
R19	26.4	R55	31.3
R22	24.8	R59	27.5
R24	22.5	R60	26.4
R25	22	R63	30.6
R26	23.1	R64	30.8
R30	24.7	R65	27.6
R31	24.4	R69	29.8
R32	28	R71	28.1
R38	28.2		
R11 is an unoccupied derelict dwelling and it is within the landowner boundary. This receptor is not a noise sensitive location and has not been assessed.			

9.6.3 Noise Impacts due to off-site traffic

The potential traffic noise impacts have been assessed with respect to the Highways Agency's Design manual for roads and bridges HD 213/11 Volume 11, Section 3, Part 7 Revision 1 – Noise and vibration.

The proposed development will result in an increase in traffic levels along the N2 National Primary Route and the dedicated access road as detailed in the Chapter 8 Roads, Traffic & Transportation in Volume 2 of this EIAR.

The anticipated daily number of vehicles accessing the facility will be on average 156 HGV movements (78 trips) during the daytime. Peaks of 34 HGV movements during 11:00-12:00 hrs are predicted. This includes both existing landfill traffic and the traffic associated with the proposed development.

In 2016, the N2 National Primary Route had an AADT[6] of 8,812 with daily HGV traffic of 1,022. The addition of 60 no. 2-way HGV movements (30 trips) per day will see this daily HGV traffic rise by 5.9% to 1,082 during the operational phase of the development.

The predicted noise from road traffic was modelling using CRTN[7]. When the predicted operational traffic flow is added to the existing baseline traffic flow, the baseline noise level shows a negligible[8] increase in predicted traffic noise level.

[6] Annual average daily traffic

[7] Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988

[8] The classification of magnitude of noise impacts in the long term was sourced from *Highways Agency, Design Manual for Roads and Bridges HD213/11, Volume 11, Section 3, Part 7, Revision 1* (Table 9.6)

9.6.4 Cumulative Impacts

Cumulative Operational Impacts

All waste management activities associated with the existing and proposed development and on-site HGV movements were considered in the noise model therefore cumulative impacts from site activities have been considered already.

The noise impacts due to off-site traffic with and without the proposed development have been considered.

Cumulative impacts as discussed in Section 1.7 of Chapter 1 Introduction of Volume 2 of the EIAR. None of these proposed developments are close enough to result in a cumulative noise impact.

9.7 Mitigation Measures

9.7.1 Mitigation Measures during Construction

The noise impact for construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise.

The construction works on-site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out in Appendix 2.0 Construction Environmental Management Plan (CEMP) in Volume 3 of this EIAR.

The hours of construction activity will be limited to avoid unsociable hours. Construction operations shall be restricted to between 07:30 hours and 18:30 hours Monday to Saturday in accordance with the IE licence, unless specifically agreed otherwise.

Mitigation measures shall be implemented to reduce impacts related to construction noise and vibration. BS 5228-1:2009+A1:2014 provides a detailed list of mitigation measures to minimise the noise impact from construction activities and these recommendations should be implemented:

- It is recommended that construction activities shall be carried out during normal working hours;
- A site representative responsible for matters relating to noise should be appointed; and
- Noise monitoring at noise sensitive locations should be performed during critical periods.

There are many general measures that will be taken to reduce noise levels:

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Select equipment conforming to international standards on noise and vibration;
- Select equipment with quiet and low vibration emissions, and ensure equipment is regularly maintained ensuring it operates in an efficient manner. If possible, all mechanical plant will be fitted with effective exhaust silencers;
- Compressors will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; and
- Locate equipment as far away as noise sensitive receivers as possible within constraints of the site.

9.7.2 Mitigation Measures during Operation

The noise prediction results from the different scenarios demonstrate the dynamic nature of the waste management activities in the proposed development. The predicted noise levels are below the evening and night-time noise limits at all receptor locations and no additional mitigation measures are required.

In most scenarios modelled and at the majority of receptors, the predicted noise levels are below the daytime noise limit. However, there are 3 no. scenarios (2b, 3a and 3b) where the predicted noise levels are above the daytime noise limit at 4 no. receptors (2 no. ground floor receptors and 2 no. first floor receptors). One of the receptors is within the ownership boundary. These exceedances are predominantly attributed to felling of trees (1-week duration) and construction of earth berms A and B (2-3 weeks each). These works will ultimately serve to protect the noise sensitive locations in the long term but given the close proximity of these activities to some of the noise sensitive locations there is potential for short term elevated noise levels. In addition to the mitigation measures specified during construction, noise impacts will be mitigated where reasonably practicable by:

- Planning of Berm A and B construction phase to take account of potential short-term noise impacts, including starting closest to receptor and building away to mitigate potential ongoing berm construction noise impact;
- Orientating plant to minimise the noise impact on nearby receptors where practicable;
- Erection of temporary noise barriers where practicable to provide acoustic screening;
- Ensuring that noisy plant and equipment are not used for long periods of time and at inappropriate times;
- Phasing of works and reduce percentage on-time to lower the noise impact;
- Carrying out regular monitoring of noise levels as per requirements of the licence. Carry out additional monitoring during critical periods; and
- Investigate and record noise complaints and take action to mitigate where levels are above the licence limit as is the case as part of the current operations at Knockharley landfill.

The above mitigation measurements will also be implemented for the wider development to minimise the noise impact from the proposed development.

In addition to the above mitigation measurements, a number of earth berms will be constructed. The construction of Berm A will be carried out first due to the long term positive impact for receptors to the east and north east of the proposed development. The areas on site were material will be excavated to construct the berm are shown in Drawing No, LW14-821-01-P-0050-011 Cut/Fill Phasing Plan in Volume 4 of this EIAR. The material excavated from site to be used for construction of Berm A will be sourced where practical from locations on site as far away from noise sensitive receptors. The construction of Cell 29 will commence after the construction of Berm A.

In addition to the above, the programme for construction and filling of cells was developed to minimise noise impacts were practicable. Cells 27, 28 and 29 will be filled in a manner that minimises the noise impact by starting closest to receptors and moving away so that the filled cells will also be used as berms to minimise the noise impact on nearby receptors.

With mitigation measures, the temporary noise impact from the felling of trees and construction of Berm A and B are expected to be below the noise limit. The operational noise impact from the remainder of the proposed development will also be below the daytime noise limit.

9.8 Residual Impacts

For the majority of scenarios modelled and the majority of receptors, the predicted noise levels are below the daytime noise limit. However, there are 3 no. scenarios (2b, 3a and 3b) where the predicted noise levels are above the daytime noise limit at a total of 4 no. receptors, one of which is within the landownership boundary. The exceedances are at a limited number of noise sensitive locations and are attributed to short term activities: felling of trees and construction of earth berms A and B.

With the implementation of the identified noise mitigation measures, the predicted noise impact will be below the daytime noise limit and there will be no residual impact.

The predicted noise levels during evening and night-time periods are below the noise limits and there are no residual impacts.

Construction activities are expected to be below the construction noise limit of 65 dB $L_{Aeq,1hr}$ at noise sensitive locations. Cumulative construction and operational activities are also expected to be below the construction noise limit of 65 dB $L_{Aeq,1hr}$ at noise sensitive locations. However, mitigation measures will be employed to minimise the noise impact.

9.9 Monitoring

Monitoring of noise levels on site will be a requirement of the IE licence for the site. These limits will be applied from the commencement of waste acceptance during the operational phase of the development. Noise monitoring will be undertaken during the construction phase in adherence with the procedure identified in Appendix 2.0 CEMP in Volume 3 of this EIAR.

9.10 Conclusion & Summary

Operational noise levels were predicted for activities associated with the proposed development. As part of the proposed development the existing activities will continue on site. The proposed development will result in increased noise levels at nearby noise sensitive locations during daytime periods. There will also be increased traffic volumes on the N2 National Primary Route with an expected increase of 30 HGV trips per day.

For most of the scenarios modelled and the majority of receptors, the predicted noise levels are below the daytime noise limit. However, there are 3 no. scenarios (2b, 3a and 3b) where the predicted noise levels are above the daytime noise limit at a total of 4 no. receptors, one of which is a within the landownership boundary. These exceedances are predominantly attributed to felling of trees (1week duration) and construction of earth berms A and B (2-3 weeks duration for each berm). These works will ultimately serve to protect the noise sensitive locations in the long term but given the proximity of these activities to some of the noise sensitive locations there is potential for short term elevated noise levels. These will be mitigated were reasonably practicable and it is expected that with the implementation of the identified noise mitigation measures, the predicted noise impact will be below the daytime noise limit and there will be no residual impact.

The predicted noise levels are expected to be compliant with the evening and night-time noise limit criteria for all noise sensitive locations during the operational phase.

Construction noise levels were predicted and the predicted noise levels from each activity as well as the cumulative noise level from construction and operational phases are below the 65 dB $L_{Aeq,1hr}$ noise limit.

Monitoring of noise emissions will be undertaken during the construction phase in keeping with the procedures outlined in Appendix 2.0CEMP in Volume 3 of this EIAR, while the facility licence will require the monitoring of noise emissions at identified intervals to ensure compliance with limit values applied therein.

Vibration arising from operational and construction activities will not be perceptible at nearby sensitive locations, and any vibration arising from construction activities will be significantly below any thresholds for structural damage to property. Hence, no significant vibration impacts are expected.

9.11 References

International Standards Organisation, ISO 1996-2:2017, Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels

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KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 10 – BIODIVERSITY

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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10 BIODIVERSITY

10.1 Introduction

This chapter of the EIAR comprises an ecological appraisal for the proposed development at the Knockharley Landfill site. Previously commissioned ecological surveys of the proposed development area from 2008 and 2010 were used to inform the current appraisal. Ground truthing of the areas proposed for development were carried out at the site between 2015 and 2016; ecological surveys included habitat appraisal, bird surveys, terrestrial mammal surveys and bat activity survey. Based on the results of these various studies, FT considered potential direct, indirect and cumulative impacts of the proposed development on the existing ecological receptors both outside and within the site and propose appropriate mitigation measures to minimize these potential impacts.

The purpose of this evaluation was to:

- Undertake a desktop review of available ecological data for the site and area, including a review of nationally designated sites within 15 km of the site, based on previous ecological surveys but also ecological surveys conducted as part of the current appraisal. An appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission
- Undertake ecological field surveys of the site and surrounding lands.
- Identify flora and fauna present on the site and immediately adjacent lands within the context of the previously commissioned surveys and any changes that may have occurred to habitats present in the interim period since operation of the facility commenced.
- Evaluate the ecological significance of the site.
- Assess the potential impacts of the facility expansion on the ecology of the site and surrounding areas
- Consider measures to mitigate the potential negative impact(s) of the proposed facility expansion on the ecology of the site and surrounding land.

It is proposed to apply for consent to operate the Knockharley Landfill as an integrated waste management. For information regarding the proposed development and activities, please refer to Chapter 2 Description of the Proposed Development in Volume 2 of this EIAR.

10.2 Study Area

The site is a 135.2 hectare land holding with the existing landfill footprint positioned near its centre. The current planning permissions (PL17.220331) and (NA60336) permits the development of approximately 25 ha of landfill cells in seven phases. As of March 2018, Phases 1-3 of the seven planned cell phases have been fully constructed. Habitats on site comprise of an administration building and artificial surfaces, agricultural lands, wet grassland and lands planted with forestry.

All lands within the site boundary were surveyed, with particular attention being paid to the sites of the proposed new development.

10.3 Methodology

The methodology has been devised in consideration of the following relevant guidance:

- '*Guidelines on the information to be contained in Environmental Impact Statements'* (EPA 2002)
- '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements')* (EPA 2003)
- '*Guidelines on the Information to be contained in Environmental Impact Assessment Reports'* (EPA Draft, 2017)
- '*Advice Notes for Preparing Environmental Impact Statements*' (EPA Draft, 2015),
- '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (DoECLG, 2013),
- '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'* (EU, 2013),
- '*Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal'* (2016) published by the Chartered Institute of Ecology and Environmental Management (CIEEM),
- The Heritage Council publication '*Best Practice Guidance for Habitat Survey & Mapping'* (Smith *et al*., 2011),
- '*Guidelines for Assessment of Ecological Impacts of National Road Schemes*' (NRA, 2009), and
- '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (2008a) as well as '*Guidelines for Baseline Ecological Assessment* (IEA, 1995) and '*Ecological census techniques*' (Sutherland, 2006).

The evaluation of sites of ecological interest used by this study is outlined in Appendix 10.1 Volume 3 of this EIAR. Once the value of the identified ecological receptors (features and resources) is determined, the next step is to assess the potential impact and resulting effect of the proposed cable route on the identified key ecological receptors.

This was carried out with regard to the criteria outlined in various impact assessment guidelines (NRA, 2009; CIEEM, 2016). In line with the EPA Guidelines (EPA, 2017), the following terms are defined when quantifying duration:

- Momentary: from seconds to minutes
- Brief: up to 1 day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

The impacts were assessed under a number of parameters such as magnitude, extent, timing, frequency, duration and reversibility. The impact significance criteria (EPA, 2017) as set out in Table 10-1 over are used where applicable. A glossary of impacts is further outlined in Appendix 10.3 Volume 3 of this EIAR.

Table 10-1 Significance of Effects Criteria

Impact Significance	Criteria
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

10.3.1 Legislative context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order (2015). The Habitats Directive 1992 has been transposed into Irish law, for the purposes of this application for permission by Part XAB of the Planning and Development Act 2000, as inserted. However, it should be noted that an appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of causing or permitting deleterious matter to enter waters. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence. The construction methodology has been devised to so as to ensure compliance with all relevant legislative requirements.

10.3.2 Consultation

A letter was issued to the DAU of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and an acknowledgement received on the 27th October 2016. A response has not been received to date.

IFI responded to consultation on the 7th November 2016 and the 11th of October 2017. The response from the 7th November 2016 stated the following: *Having examined this proposal as it stands IFI is concerned about the potential generation of suspended solids, hydrocarbons and other related deleterious matter that may flow to waters. We are also concerned about the potential blocking of any waters and any proposed new channel diversions. The Nanny River is a tributary of the River Boyne and has significant stocks of Brown Trout and lamprey.*

A response received on the 11th of October 2017 repeated the concerns of the correspondence from the 27th October 2016 regarding the '*potential generation of suspended solids*' and the '*potential blocking*' of waters.

The 2017 response did also state the following: '*Also article 28(2) of the said Regulations states that a surface water body whose status is determined to be less than good shall be restored to at least good status not later than the end of 2015. This application is in close proximity to the Veldonstown tributary of the Nanny River whose status is poor and has to be restored to good status*'.

Both the DAU of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and IFI were consulted again on the 29th of March 2018 with regard to the proposal and no response by either consultee was received (as of 15th of May 2018).

Following consultation with Meath County Council on the 29th of March 2018 an email was received regarding biodiversity on the 18th of April 2018. The response is summarised as follows: Indirect impacts on designated sites in the vicinity must be considered: e.g. Discharge run-off. To determine if an AA is required, and if an NIS should be submitted. Ecological assessment to be carried out on habitats on site. Mitigation measures to be clearly stated. NPWS should be consulted with.

For more information on consultation please see Chapter 5 EIA Scoping, Consultation and Key Issues in Volume 2 of this EIAR.

10.3.3 Designated Nature Conservation Sites

A desktop study was carried out to identify designated sites within 15 km of the landfill site, such as Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). GIS shapefiles were downloaded from the National Parks and Wildlife Service (NPWS) website www.npws.ie for the designated conservation sites. However, for the avoidance of doubt, it should be noted that an appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission.

10.3.4 Habitat and Botanical Investigation

Dominant habitats of the proposed development site were previously classified according to Fossitt (2000) in 2010 (FT, 2010). This involved undertaking a field survey of the site on the 5th and 6th May 2010.

A botanical survey was also carried out in each of the dominant habitats found at the site, with plants recorded to species level using Blarney *et al.*, 2003 Wild *Flowers of Britain & Ireland*. Any rare or protected species of flora were noted. Rare or protected species are listed on the Flora Protection Order (1999), The Irish Red Data Book (Curtis & McGough, 1988) and also under Annex II of the EU Habitats Directive. The importance of habitats recorded overall was assessed by their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC).

A plant species list for the 10-km grid square N96 in which the site occurs was generated from www.npws.ie. This list was then used to determine what rare or protected plants (as listed on the Flora Protection Order (2015) and The Irish Red Data Book (Curtis & McGough, 1988)) have been previously recorded in grid square N96 A desktop review was also undertaken of NPWS historical records of protected flora species occurring in the vicinity of the wider Knockharley site.

The habitats on site were re-visited in March 2015 and February 2016. Any changes to habitats in the interim period since 2010 were evaluated and mapped following the prescribed methods. Further surveys were not required as the existing baseline has remained the same since 2016.

10.3.5 Biological Water Quality and Fisheries

A desktop review of water quality data collected by the EPA for the site and surrounding area was undertaken (http://maps.epa.ie). Biological water quality recorded at the site was also assessed.

Biological monitoring of surface water quality was undertaken by means of a macroinvertebrate 'kick sampling' survey in accordance with Schedule D.5 of the EPA licence for Knockharley Landfill (W0146-02) yearly from 2007 (with the exception of 2012) with the most recent survey undertaken in 2017, at four locations, Sites 1–4. These monitoring locations are detailed in Table 10-2 and are shown on Plate 10-1.

Table 10-2: Biological Monitoring Locations

Sample	Location
Site 1	Less than 1 km downstream receptor site on the Knockharley stream.
Site 2	Upstream control site on the Knockharley stream.
Site 3	Downstream receptor site (corresponds with the EPA site 08/N/01/ 200) on the River Nanny.
Site 4	Upstream control site (Corresponds with EPA site 08/N/01/0110) on the River Nanny.

10.3.5.1 Methodology

Biological assessment, or macroinvertebrate sampling, was carried out by means of Small Stream Risk Score (SSRS) methodology. SSRS is a biological risk assessment system for detecting potential sources of pollution in 1st and 2nd order streams. It was developed by the Environmental Protection Agency (EPA) in association with the Western River Basin District (WRBD) with the primary aim of supporting the programme of measures for the Water Framework Directive (WFD). The main objective of the WFD is the achievement of 'Good' water status in all water bodies by 2015.

SSRS is a simple biotic index based on analysis of the community assemblage and abundance of benthic macroinvertebrates at a monitoring site. The SSRS allows the classification of the stream as 'At Risk', 'Indeterminate – May Be at Risk', or 'Probably Not at Risk'.

SSRS methodology was carried out according to the training manual developed by White Young Green (2009) *SSRS Training Manual – a Pollution Investigation Tool for Use in the Field*[1]. Samples were collected from the four streams and river sites by means of a two-minute kick sample, collecting all macroinvertebrates in a 1 mm pond net attached to a metal frame.

Stone washes and weed sweeps were also carried out where possible. Macroinvertebrates were identified on the bankside, or collected and preserved for later identification, a field sheet was filled in for each site, and a risk score was calculated (see attached field sheets).

The SSRS method is a rapid field methodology for risk assessment that is based solely on macroinvertebrate indicators of water quality and their well-understood response to pollution.

The SSRS method is a method for defining streams that are 'at risk'. The method produces a continuous score and threshold values are used to decide on the degree of risk at a site. It is possible to compare 'before' and 'after' scores, which may be useful in assessing the potential impact of a development[2].

Results of the SSRS place water bodies in to one of three categories:

- At risk (Score = <6.5)
- Probably at risk (Score = 6.5-7.25)
- Probably not at risk (Score = >7.25)

[1] Small Streams Risk Score (SSRS) Training Manual – A Pollution Investigation Tool for Use in the Field – White Young Green, February 2009

[2] Guidance on Application and Use of the SSRS in Enforcement of Urban Waste Water Discharge Authorisations in Ireland, Environmental Protection Agency, April 2015.

In addition to the presence and abundance of macroinvertebrates, physico-chemical characteristics of the environment are also recorded during the assessment, these include:

- modifications to the channel
- Stream flow conditions
- Substratum conditions
- Shading
- Filamentous algae
- Colour, velocity and clarity of the water, and
- DO, water temperature, conductivity and pH (where required)

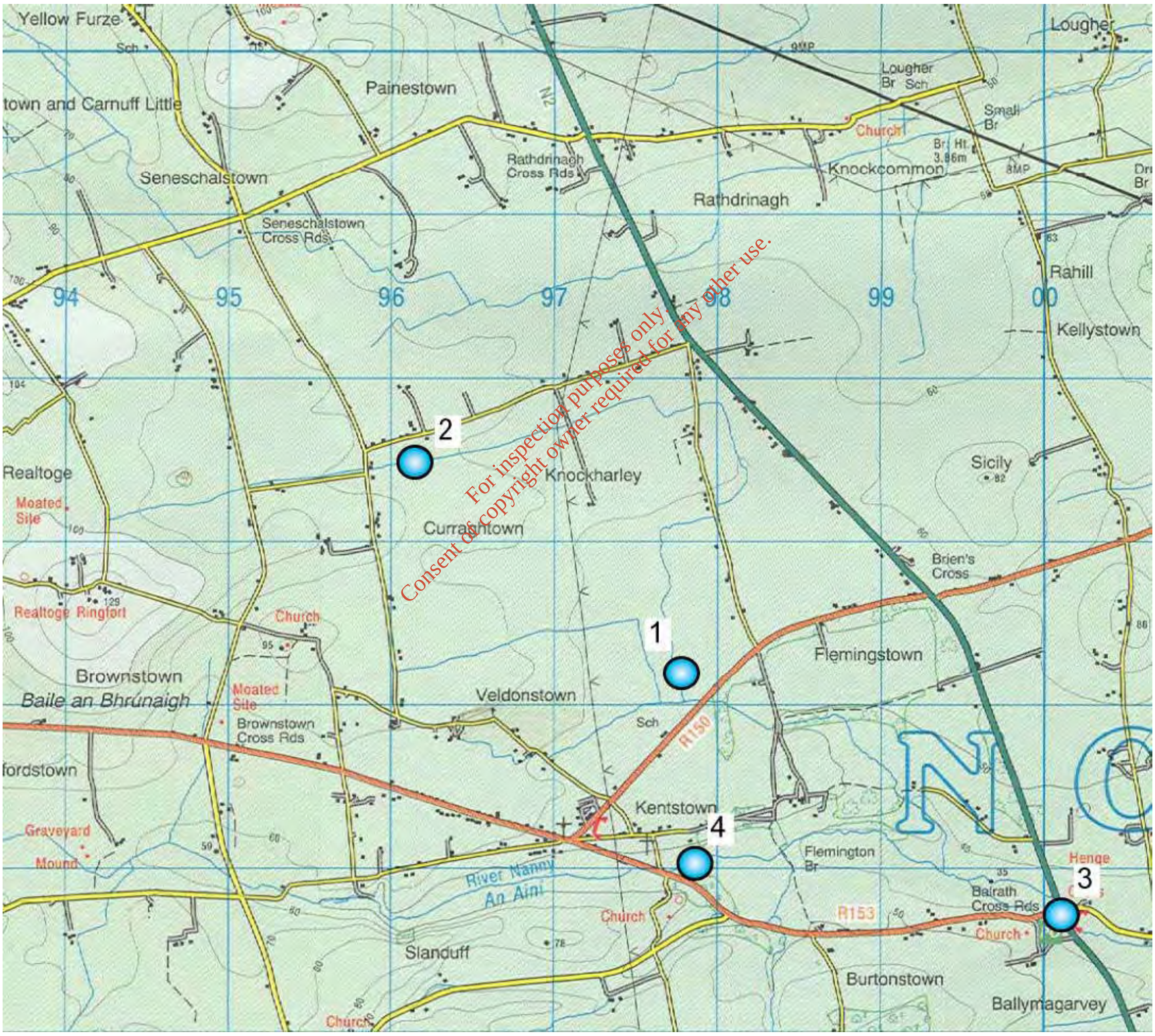


Plate 10-1: Biological Monitoring Locations at Knockharley - 2016

More details on the hydrology of the area is available in Chapter 12 – Hydrology and Surface Water Quality.

10.3.6 Fauna Investigation

Bird Survey

Breeding birds at the site were previously surveyed using a series of survey transects on the 5th and 6th of May 2010 (Bibby *et al*., 2000) (FT, 2010). A total of five transects of approximately 800 m in length were walked during the survey visits (See Figure 10-1). A minimum distance of 250 m was allowed between transects to minimise double-counting of individual birds across the site.

Any additional bird species encountered at the site but outside of the dedicated surveys were also noted. All species encountered (seen or heard) within 100 m of the observer were recorded and their abundance was noted. All species occurring more than 100 m from the observer or flying were not included in the abundance analysis, but were recorded as 'additional' species for separate analysis. The total number of birds per species was derived by adding abundance data from all transects. This allowed a measure of relative abundance to be examined for all breeding bird species recorded.

The above transects were repeated for the current evaluation on 26th March 2015 and 8th July 2016; primarily to determine whether any changes to the existing environment in the interim since the commencement of operation had led to changes in the suite of avifauna present, and/or likely to be affected by the proposed development. Transects were repeated as in the 2010 survey, apart from slight amendments to T1 and T5 due to the presence of security fencing which prevented the original route from being followed. In this manner, a taxa list of the birds present in the area and their relative abundance could be generated.

Winter transects were also carried out on the 16th December 2015, 29th January 2016 and 16th November 2018 and the results are included in this document. Two further winter bird surveys will be carried out in December 2018 and January 2019.

The conservation status of each bird species recorded by this study was assessed. 'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists; *Red-listed* species are of high conservation concern, *Amber-listed* species are of medium conservation concern and *Green-listed* species are considered to be of no conservation concern (see Colhouns & Cummins 2013). The conservation status of the bird species found by this study was also assessed by reviewing if species recorded at the site are listed on Annex I on the EU Birds Directive (2009/147/EC). These species are afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries. Again, it should be noted that, an appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission.

Mammal Survey

The entire site was previously surveyed for mammals on the 5th and 6th of May 2010 (FT, 2010). The mammal survey consisted of a site walkover, with features such as field boundaries, stream banks and access tracks being closely searched for signs of mammals. Any tracks or signs (including droppings, prints, resting places, burrows and setts) of mammals occurring within or in the vicinity of the site were recorded using field notes and/or handheld GPS units (Garmin). In addition, any direct sightings of mammals made during the walkover were recorded.

Signs such as dwellings, feeding traces, tracks or droppings indicate the presence of mammals on site, and occasional direct observations were made. The methods used to identify the presence of mammals in the survey area followed international best practice (Lawrence & Brown, 1973; Clark, 1988; Smal, 1995; Sargent & Morris, 2003; Bang & Dahlstrom, 2004; JNCC, 2004; NRA, 2008b; NRA, 2004). An assessment of the suitability of the habitats on the site for mammals was also made. Potential bat roost sites such as mature trees were also identified on the site. The proposal does not comprise significant removal of mature trees.

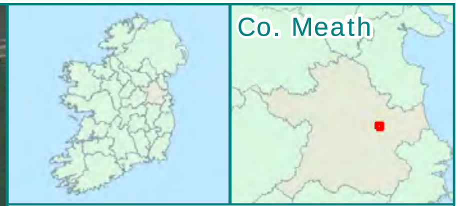
The survey was updated on the 26th of March 2015 with particular attention paid to areas proposed for new development.

Habitats on site proposed for development were also considered for their suitability for bats following habitat surveys. A bat activity survey was carried out on the 29th of August 2016. Transects through favourable habitats for bats were walked within the planned development areas during which bat activity was recorded using heterodyne/frequency division (*BatBox Duet - BatBox Electronics*) and real time, full spectrum recording, super heterodyne (*Elekon Batlogger M with inbuilt GPS*) detectors.

Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (*Kaleidoscope Viewer - Wildlife Acoustics*).

Other Fauna

The presence of any other species (*e.g.* butterflies, reptiles or amphibians) encountered during all ecological surveys was also recorded. Again, an assessment was also made as to the suitability of the habitats present on site for other fauna.



Legend

- Bird Survey Transects
- Site Boundary

Date	18/05/2018	
Client Name	Knockharley Landfill Ltd.	
Project Title	Proposed Development at Knockharley Landfill	
Figure Title	Bird Survey Transects	
Figure No.	10.1	Rev. A
Scale	1:10,500	@ A4

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10.4 Ecology in the Existing Environment

10.4.1 Designated Conservation Sites

While the proposed development site is not located within a site designated for environmental conservation, there are three European Sites and twelve pNHAs within 15 km of the site, as detailed in Table 10-3 and illustrated on Figure 10-2. An appraisal of the potential impacts of the proposed development on the constitutive characteristics of European sites within 15km of the proposed development at the Knockharley landfill is set out in the AA Screening Statement and Natura Impact Statement which accompany this application for permission. Accordingly, whilst all fifteen designated sites (European sites and pNHAs) are detailed below, the appraisals for the purposes of Appropriate Assessment are set out in the AA Screening Statement and Natura Impact Statement.

Table 10-3: Designated sites within 15km of the proposed development

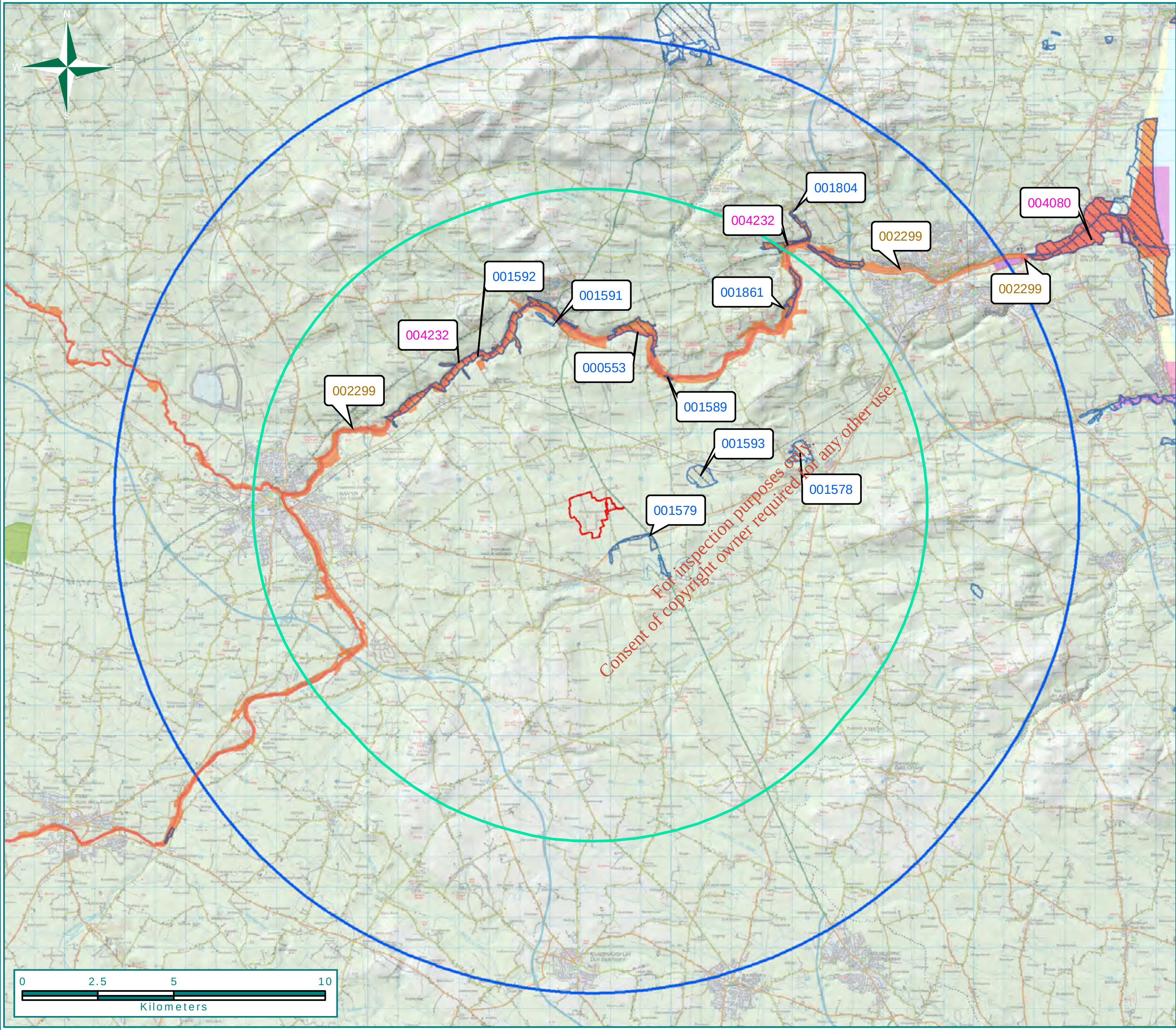
Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
River Boyne and River Blackwater cSAC	002299	River lamprey (*Lampetra fluviatilis*) [1099] Salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355] Alkaline fens [7230] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]	This site comprises most of the freshwater element of the River Boyne from upriver of the Boyne Aqueduct at Drogheda, the Blackwater River as far as Lough Ramor and the principal Boyne tributaries, notably the Deel, Stoneyford and Tremblestown Rivers. The rivers flow through a landscape dominated by intensive agriculture, mostly of improved grassland but also cereals. Much of the river channels were subject to arterial drainage schemes in the past. Natural flood-plains now exist along only limited stretches of river, though often there is a fringe of reed swamp, freshwater marsh, wet grassland or deciduous wet woodland. Along some parts, notably between Drogheda and Slane, are stands of tall, mature mixed woodland. Substantial areas of improved grassland and arable land are included in site for water quality reasons. The main channel of the Boyne contains a good example of alluvial woodland of the *Salicetum albo-fragilis* type which has developed on three alluvium islands. Alkaline fen vegetation is well represented at Lough Shesk, where there is a very fine example of habitat succession from open water to raised bog. The Boyne and its tributaries is one of Ireland's premier game fisheries and offers a wide range of angling, from fishing for spring salmon and grilse to sea trout fishing and extensive brown trout fishing. The site is one of the most important in eastern Ireland for Salmon (*Salmo salar*) and has very extensive spawning grounds. The site also has an important population of River Lamprey (*Lampetra fluviatilis*), though the distribution or abundance of this species is not well known. Otter (*Lutra lutra*) is widespread throughout the site.	4.5km

Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
			Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of Whooper Swan (*Cygnus Cygnus*). Several Red Data Book plants occur within the site, with *Pyrola rotundifolia, Poa palustris* and *Juncus compressus*. Also occurring are a number of Red Data Book animals, notably Badger (*Meles meles*), Pine Marten (*Martes martes*) and frog (*Rana temporaria*). The River Boyne is a designated Salmonid Water under the EU Fish Directive (codified).	
River Boyne and River Blackwater SPA	004232	Kingfisher (*Alcedo atthis*) [A229]	The River Boyne and River Blackwater SPA is a long, linear site that comprises stretches of the River Boyne and several of its tributaries; most of the site is in County Meath, but it extends also into Counties Cavan, Louth and Westmeath. It includes the following river sections: the River Boyne from the M1 motorway bridge, west of Drogheda, to the junction with the Royal Canal, west of Longwood, County Meath; the River Blackwater from its junction with the River Boyne in Navan to the junction with Lough Ramor in County Cavan; the Tremblestown River/Athboy River from the junction with the River Boyne at Kilnagross Bridge west of Trim to the bridge in Athboy, County Meath; the Stoneyford River from its junction with the River Boyne to Stonestown Bridge in County Westmeath; the River Deel from its junction with the River Boyne to Cummer Bridge, County Westmeath. The site includes the river channel and marginal vegetation. The site is a Special Protection Area (SPA) under the EU Birds Directive of special conservation interest for the following species: Kingfisher (*Alcedo atthis*).	4.6km

Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
Boyne Estuary SPA	004080	A048 Shelduck (*Tadorna tadorna*) A130 Oystercatcher (*Haematopus ostralegus*) A140 Golden Plover (*Pluvialis apricaria*) A141 Grey Plover *Pluvialis squatarola*) A142 Lapwing (*Vanellus vanellus*) A143 Knot (*Calidris canutus*) A144 Sanderling (*Calidris alba*) A156 Black-tailed Godwit (*Limosa limosa*) A162 Redshank (*Tringa tetanus*) A169 Turnstone (*Arenaria interpres*) A195 Little Tern (*Sterna albifrons*) A999 Wetlands	The site comprises most of the estuary of the Boyne River, a substantial river which drains a large catchment. Apart from one section which is over 1 km wide, its width is mostly less than 500 m. The river channel, which is navigable and dredged, is defined by training walls, these being breached in places. The site is of considerable ornithological importance for wintering waterfowl, with Black-tailed Godwit occurring in internationally important numbers and nine other species having populations of national importance. Of particular significance is that three species that regularly occur, Golden Plover, Bar-tailed Godwit and Little Tern are listed on Annex I of the E.U. Birds Directive. Part of the Boyne Estuary SPA is a Wildfowl Sanctuary.	14.7km
Balrath Woods pNHA	001579	Woodland	There are three blocks of woodland, which are largely similar in species composition. The main tree species is Oak (*Quercus* sp.), although the non-native Beech (Fagus sylvatica) is widespread and sometimes dominant. Other native tree species include Ash (*Fraxinus excelsior*), Birch (*Betula* sp.) and Wych elm (*Ulmus glabra*).	0.62km
Thomastown Bog pNHA	001593	Raised bog, wet woodland and wet grassland	The site consists of a raised bog surrounded by wet woodland and wet grassland.	2.35km
Rossnaree Riverbank pNHA	001589	Round-fruited Rush	Rossnaree River bank is a small site, on the banks of the River Boyne, approximately 6 miles southeast of Slane.	4.4km

Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
			The site consists of a single field, and an adjacent river island, and is of national scientific interest due to the presence here of Round-fruited Rush (*Juncus compressus*).	
Crewbane Marsh pNHA	000553	Marsh, woodland	Crewbane marsh is a small area of freshwater marsh which occurs on a very wet alluvial floodplain along the northern bank of the river Boyne. In addition to the marsh area the site also includes an area of woodland and scrub located on steep slopes above the marsh. This small site contains one of the last remaining examples of floodplain marsh on the banks of the Boyne. The area of deciduous woodland is one of the best examples of such a feature in the Boyne Valley.	4.89km
Boyne Woods pNHA	001592	Broadleaved woodland	Most of the site is broadleaved woodland which fringes the river on both sides and is composed of a mixture of native and exotic tree species. Ash (*Fraxinus excelsior*) is abundant, also, Sessile Oak (*Quercus petraea*), Wych Elm (*Ulmus glabra*), Beech (*Fagus sylvatica*), Sycamore (*Acer pseudoplatanus*) and occasionally Lime (*Tilia cordata x Platyphyllos*). Coniferous trees, Larch (Larix sp.) and Scots Pine (*Pinus sylvestris*) also occur.	5.44km
Duleek Commons pNHA	001578	Wet grassland	The site consists of drained marsh area that was associated with the floodplain of a tributary running from Thomastown Marsh, through the undulating drift landscape to the River Nanny.	5.59km
Slane Riverbank pNHA	001591	Round-fruited Rush	This is a small site on the banks of the River Boyne, noteable for the presence here of Round-Fruited Rush (*Juncus compressus*). This is a rare plant species which, apart from Co. Meath, has only been located in two other counties in Ireland.	5.64km
Dowth Wetland pNHA	001861	Marsh and woodland	The site consists of an area of floodplain marsh with an associated area of deciduous woodland on steep slopes. The marsh occurs on wet alluvial soils, regularly flooded by the river.	8.33km

Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
King William's Glen pNHA	001804	Woodland	King Williams Glen cuts north from the Boyne about 4km west of Drogheda. Woodland occupies both sides of the glen, and runs into the Townley Hall Wood which slopes above the Slane road.	9.8km
Boyne River Islands pNHA	001862	Willow and alder wet woodland, wet grassland	The Boyne River Islands are a small chain of three islands situated 2.5 km west of Drogheda. The islands were formed by the build-up of alluvial sediment in this part of the river where water movement is sluggish.	10.6km
Cromwell's Bush Fen pNHA	001576	Fen, waders, ducks	Small wetland lying some 6km southwest of Duleek in a pastoral/arable setting over poorly draining glacial drift. A wide range of fen communities are represented on site, from open water to relatively dry coarse grassland. Although small, this wetland contains a diversity of wetland habitats in transition that are unusual in the locality. The site supports an equivalent diversity of wetland waders and ducks, for example Teal, Woodcock, Snipe and Mallard.	11.7km
Melfont Abbey Woods pNHA	001464	Site synopsis not available	Site synopsis not available	14.34km



Legend

- Site Boundary
- 10km from Site Boundary
- 15km from Site Boundary
- Natural Heritage
- Proposed Natural Heritage Areas within 10km (Distance in meters)
  - 000553, Crewbane Marsh, 4868
  - 001578, Duleek Commons, 5578
  - 001579, Balrath Woods, 556
  - 001589, Rossnaree Riverbank, 4380
  - 001591, Slane Riverbank, 5596
  - 001592, Boyne Woods, 5021
  - 001593, Thomastown Bog,
  - 001804, King William's Glen, 9628
  - 001861, Dowth Wetland, 8203
- Special Areas of Conservation within 15km (Distance in meters)
  - 002299, River Boyne And River Blackwater SAC, 4294
- Special Protection Areas within 15km (Distance in meters)
  - 004080, Boyne Estuary SPA, 14560
  - 004232, River Boyne and River Blackwater SPA, 4427

Date 18/05/2018

Client Name
Knockharley Landfill Ltd.

Project Title
Proposed Development at Knockharley Landfill

Figure Title
Designated Sites within 10km and 15km from the Proposed Development

Figure No. 10.2 | Rev. A

Scale 1:175,000 @ A4

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Figure 10-2 shows the location of these designated sites in relation to Knockharley Landfill. The proposed development is not contained within any designated conservation site and, as far as the pNHAs are concerned, there is no potential for direct impacts on any designated conservation site, as there is no ecological link between the sites. There are no NHAs within 15km of the development. There are 12 pNHAs within 15km of the proposed development, however, there is only linkage to Balrath Woods pNHA, as the Knockharley Stream (Flemingstown Stream) flows through part of this site. However, this site is designated for woodland which will not be affected by the proposed development. There is no ecological pathway between the remainder of the pNHAs and the proposed development. The proposed development site is ecologically connected to the River Nanny Estuary and Shore SPA (Site Code: 004158) via a tributary (Flemingstown Stream) of the River Nanny. This SPA is located ca. 21.6km (instream distance) to the east of the proposed development. Again, it should be noted that an AA Screening Statement and Natura Impact Statement accompany this application for permission.

10.4.2 Desktop Records of Protected Species

The NPWS website and National Biodiversity Data Centre (NBDC) website were searched for records of protected species from the 10km grid (NPWS data) and for the 2km grid squares in which the proposed development is located (NBDC data). Table 10-4 illustrates the results of the data searches. No records were available on the NPWS website for the 10km Gird N96 and no records of protected fauna or flora were available on the NBDC website for the 2km Grid Square N96T in which the proposed development is located. A data request was issued to NPWS and records obtained are detailed in Table 10-4.

Table 10-4: NPWS / Records of Protected Species in N96

Latin Name	Common Name	Location	Sample Year	Survey
Erinaceus europaeus	West European Hedgehog	Kenstown, Garlagh Cross, Bonshaw	1981, 1969	Animal Survey IBRC Species Records
Lepus timidus subsp. hibernicus	Irish Hare	Bonshaw	1969	Animal Survey IBRC - Location Species Lists
Lutra lutra	European Otter	Bonshaw, Summerville House, Lismullin House, Drumman House	1969, 1980	Animal Survey IBRC - Location Species Lists; Otter survey of Ireland 1982 - Vincent Wildlife Trust
Meles meles	Eurasian Badger	Bonshaw	1969	Animal Survey IBRC - Location Species Lists
Mustela erminea subsp. *hibernica*	Irish Stoat	Kentstown, Royal Tara Golf Course, SE of Navan, Bonshaw	1969, 1972, 1981, 2002	Animal Survey IBRC Species Records; *Mustela erminea* subsp. *hibernica* Records
Rana temporaria	Common Frog	Kentstown, Money/Tullow	1971, 1979, 2004, 2010	AFF Mammals, Reptiles & Amphibians Distribution Atlas 1978; Frog IPCC data; Frog Frogwatch data 10k squares; Frog - biology.ie records from National Frog Survey 2011
Sorex minutus	Eurasian Pygmy Shrew	Bonshaw	1969	Animal Survey IBRC - Location Species Lists

10.4.3 Habitats in the existing environment

A total of 11 dominant habitats were recorded on the site during the habitat survey (Fossitt, 2000) conducted in 2010 (FT, 2010) and ground truthed in 2015 and 2016. These are listed below, together with their Fossitt (2000) habitat codes:

- Hedgerow (WL1)
- Treeline (WL2)
- Scrub (WS1)
- Immature Woodland (WS2)
- Improved Agricultural Grassland (GA1)
- Mosaic of Improved Agricultural Grassland and Wet Grassland (GA1/GS4)
- Wet Grassland (GS4)
- Artificial Lakes or ponds (FL8)
- Eroding/Upland River (FW1)
- Reed and Large Sedge Swamps (FS1)
- Buildings and Artificial Surfaces (BL3)

In addition to the above the following habitats were noted as present in March 2015:

- Dry meadows and Grassy Verges (GS2)
- Mixed Broadleaved Woodland (WD1)
- Mixed broadleaved/coniferous woodland (WD2)
- Planted Shrubs (WS3)
- Drainage ditches (FW4)

Figure 10-3 displays the location and extent of the dominant habitats recorded on the site in 2010 and also any amendments to these as a result of landscaping and /or further planting of trees in the interim period to March 2015 and February 2016.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig10-3_Habitats on site.mxd

Legend

Site Boundary

Habitat Types

- BL3 - buildings and artificial surfaces
- ED2 - spoil and bare ground
- FL8 - artificial lakes and ponds
- FS1 - reed and large sedge swamps
- GA1 - improved agricultural grassland
- GA1 / GS4 - improved agricultural grassland / wet grassland mosaic
- GS4 - wet grassland
- WD1 - (mixed) broadleaved woodland
- WD2 - mixed broadleaved / conifer woodland
- WS1 - scrub
- FW1 - Eroding Upland River
- WL1 - Hedgerow
- WL2 - Treeline

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Habitats On-site
Figure No.	10.3
Rev.	A
Scale	1:10,500 @ A4

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The habitats on the site have been modified as part of the existing landfill site development. The site surrounding the active landfill site is dominated by mixed broadleaved/coniferous woodland (WD2) which has been planted as part of the development of the site. In the interim since 2010, where some of this woodland had been classified as immature woodland (WS2) has matured and is now classified as mixed broadleaf and conifer woodland (WD2). The trees are largely less than 4-5 m in height. In the immature sections comprise of a mixture of Alder, Silver Birch, Beech and Willow species (among others).

The more mature compartments comprise of trees up to 10m in height though wet conditions underfoot have restricted growth in some locations. The more mature areas are largely in the northwest of the site. The width between planted rows of trees has also allowed the herb layer to remain largely intact with no understorey vegetation visible in compartments visited in March 2015. In the area east of the adjacent forestry compartment, previously classified as immature woodland (WS2) is now best classified as deciduous woodland (WD1) due to the increased canopy height. In some parts of the planted areas Gorse dominates and these areas have been classified as scrub (WS1). In the south of the site a number of screening berms have been constructed. These have been planted with young trees and are included in the immature woodland habitat.

While the mixed broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) located within the site have been planted and have undergone some improvement, these habitats provide both shelter and foraging habitats for local wildlife and are therefore evaluated as Local Importance (Higher Value).

The remainder of the site which has not been planted is dominated by wet grassland (GS4) and a mosaic of wet grassland and improved agricultural grassland (GS4/GA1). Areas of improved agricultural grassland (GA1) are located around the administration buildings, landfill gas compound and in the northeast area of the site. The wet grassland and mosaics with improved agricultural grassland are evaluated as Local Importance (Higher Value) due to the higher diversity of flora species present. Agricultural grassland is evaluated as Local Importance (lower value) due to it being a monoculture, with limited ecological value.

The field boundaries on the site comprise hedgerows (WL1) predominantly with some treelines (WL2) occurring in the northern and eastern portion of the site. Hedgerow and treelines are relatively unmanaged and contain a number of mature trees. The hedgerows (WL1) and treelines (WL2) within the site are evaluated as Local Importance (Higher Value), as they provide habitat for mammals, birds and invertebrates.

Two artificial ponds (FL8) are located in the south of the site. These comprise a surface water attenuation pond and a constructed wetland. The constructed wetland is surrounded by a Reed and Large Sedge Swamp (FS1). These ponds, while manmade are surrounded by reeds which are of some ecological value and are evaluated as of Local Importance (lower value).

The remainder of the site comprises the active landfill area and associated site tracks and buildings (Buildings and artificial surfaces, BL3). Along the entrance road to the site the sloping embankments on either side of the access road have been planted with ornamental shrubs and are classified as ornamental/ non-native shrubs (WS3). These habitats are evaluated as being of negligible ecological value.

The site is surrounded almost exclusively by improved agricultural grassland and arable fields.

Plate 10-2: Improved Agricultural Grassland – Site of Landfill Cells for IBA

Plate 10-3: Wet Grassland / Improved Grassland Mosaic – site of extension for leachate treatment and processing building

Plate 10-4: Berm to the south of the site with immature woodland to be felled, berm to be raised and then replanted

Plate 10-5: Mixed deciduous woodland and immature woodland to the west of the site – to be felled, berm constructed and area replanted

10.4.4 Biological Water Quality and Fisheries

The site is located within the River Nanny catchment and is drained by the Knockharley Stream (Eroding/Upland River, FW1), which initially flows from west to east along the northern portion of the site and then flows from north to south along the western boundary of the site. A network of small drains are also present on the site, however water flow is stagnant in many of these drains. The Knockharley Stream flows into the River Nanny *c.* 3km southeast of the site. The stream is of some ecological value and is evaluated as being of Local Importance (higher value).

The River Nanny holds a small stock of wild trout and is stocked annually with brown trout. It also gets a small run of sea trout (Eastern Regional Fisheries Board). Knockharley Stream appears to have limited habitat for fish and previous surveys have shown that there are no salmonid fish in the stream, although some Three-Spined Stickleback and eels have been recorded (Celtic Waste Ltd, 2000).

Biological water quality in Knockharley Stream is assessed on an annual basis in compliance with the EPA licence. Previous biological monitoring surveys by means of calculating EPA Q-values or using the Q-rating system were carried out at sites (sites 1-4) from 2007 to 2011. Table 10-5 shows the results of the surveys at Knockharley using the Q-rating system, from 2007–2011. The Q Values for all four sites averaged at a Q3 or 'Poor status' according to the Water Framework Directive (WFD); upstream and downstream of Knockharley Landfill. Q-rating is generally more useful in larger rivers and not applicable to 1st and 2nd order streams and rivers such as sites 1–4 surrounding Knockharley landfill.

Biological monitoring was also conducted from 2013–2017 at the same four sites by means of calculating Small Stream Risk Scores (SSRS) which is a more appropriate methodology for the type of stream on site. Due to the different methodologies used between previous surveys (2007-2011) and more recent surveys (2013-2016), direct comparison between the Q-values collected in previous years and the 2013–2017 results are not possible. Table 10-6 shows the results of the SSRS surveys from 2013–2017, at the same four sites.

As previously mentioned, Q-values calculated between 2007 and 2011 were mostly Q3 or 'Poor status' according to the Water Framework Directive (WFD) (see Table 10-5). The 2013-2017 surveys have shown that Sites 1–4 were all 'at risk' of not achieving good status. Thus, both methodologies of biological sampling have revealed water quality which is below the required Q4 or 'Good status'; both upstream and downstream of Knockharley Landfill. This indicates that water quality is below the required Q4 or 'Good status' before it enters the Knockharley Landfill site and remains that way downstream of Knockharley Landfill.

Table 10-5: Q-Values Obtained from 2007–2011 at Knockharley

Sampling Period	Site 1	Site 2	Site 3	Site 4
2007	Q2 – Q3	Q2 – Q3	Q3 – Q4	Q3
2008	Q3	Q2	Q3	Q3 – Q4
2009	Q3	Q3	Q3 – Q4	Q3
2010	Q2	Q3	Q3	Q3
2011	Q3	Q3	Q2	Q2 – 3

Table 10-6: Small Stream Risk Score and Associated Risk Category Obtained from 2013–2016 at Knockharley

Sampling Period	Site 1	Site 2	Site 3	Site 4
2013	3.2 'stream at risk'	3.2 'stream at risk'	5.6 'stream at risk'	3.2 'stream at risk'
2014	0.8 'stream at risk'	2.4 'stream at risk'	6.4 'stream at risk'	2.4 'stream at risk'
2015	1.6 'stream at risk'	2.4 'stream at risk'	1.6 'stream at risk'	1.6 'stream at risk'
2016	4.0 'stream at risk'	2.4 'stream at risk'	4.8 'stream at risk'	2.4 'stream at risk'
2017	2.4 'stream at risk'	1.6 'stream at risk'	2.4 'stream at risk'	2.4 'stream at risk'

10.4.5 Botanical species in the existing environment

A total of 48 botanical species were recorded on the site during the botanical survey undertaken in 2010, 2015 and 2016.Table 10-7, below, lists these species, together with the dominant habitats in which they were recorded.

The most botanically diverse habitat on the site was the mosaic of wet grassland and improved agricultural grassland (GS4/GA1), where 23 species were recorded. This habitat was dominated by a variety of grasses and rushes, as well as a range of flowering plants such as creeping buttercup, dandelion and dock. Hedgerows (WL1) were also botanically diverse and comprised a range of trees and scrubs such as Hawthorn, Goat Willow, Grey Willow, Alder and Gorse as well as an understorey of flowering plants. The botanical species recorded in the treeline habitat were similar to the hedgerow habitat, with fewer flowering plants due to the absence of earthen banks.

The immature woodland planted as part of the development comprises a mix of tree and shrub species, predominantly Alder, Silver Birch and Pine.

The active landfill site and existing tracks and buildings comprise artificial surfaces or spoil and bare ground and therefore do not contain a notable botanical community.

No rare or protected species were found on the site. Desktop studies showed that no protected or threatened botanical species have been recorded historically in the 10 km square (N96) surrounding Knockharley Landfill Site. Slender pocket moss (*Fissidens exilis*) (nationally vulnerable; least concern at European level) was recorded historically (latest record 1978) in the 10km grid square (N96) (http://data.nbn.org.uk; http://maps.biodiversityireland.ie/#/Map).

No invasive species have been recorded at the site.

Table 10-7: Botanical species recorded and their habitat of occurrence

Common Name	Scientific Name	WL1	WL2	GA1/GS4	WS2	FS1
Alder	*Alnus glutinosa*	x			x	x
Ash	*Fraxinus excelsior*	x	x		x	
Beech	*Fagus sylvatica*	x	x		x	
Blackthorn	*Prunus spinosa*	x				
Bramble	*Rubus fruiticosus*	x				
Broad-leaved Dock	*Rumex obtusifolius*			x		
Bulrush	*Typha latifolia*					x

Common Name	Scientific Name	WL1	WL2	GA1/GS4	WS2	FS1
Cleavers	*Galium aparine*			x		
Common Dog Violet	*Viola riviniana*	x				
Common Nettle	*Urtica dioica*	x	x			
Common Ragwort	*Senecio jacobaea*			x		
Common Reed	*Phragmites australis*					x
Common Sedge	*Carex nigra*			x		x
Compact Rush	*Juncus conglomeratus*			x		
Cowslip	*Primula veris*			x		
Crack Willow	*Salix fragilis*	x				
Creeping Bent	*Agrostis stolonifera*			x		
Creeping Buttercup	*Ranuncunlus repens*			x		
Cuckooflower	*Cardamine pratensis*					x
Curled Dock	*Rumex crispus*			x		
Daisy	*Bellis perennis*					x
Dandelion	*Taraxacum officinale*			x		
Elder	*Sambucus nigra*	x				
Goat Willow	*Salix caprea*	x				x
Gorse	*Ulex europaeus*	x	x		x	
Great Willowherb	*Epilobium hirsutum*			x		
Grey Willow	*Salix cinerea*				x	
Hawthorn	*Crataegus monogyna*	x	x		x	
Hogweed	*Heracleum sphondylium*	x				
Ivy	*Hedera helix*	x	x			
Lodgepole Pine	*Pinus contorta*				x	
Meadow Foxtail	*Alopecurus pratensis*			x		
Pedunculate Oak	*Quercus robur*	x	x			
Primrose	*Primula vulgaris*			x		
Red Clover	*Trifolium pratense*			x		
Ribwort Plantain	*Plantago lanceolata*			x		
Rosebay	*Chamerion angustifolium*			x		
Rye Grass	*Lolium spp.*			x		
Scots Pine	*Pinus sylvestris*		x			
Silver Birch	*Betula pendula*				x	
Silverweed	*Potentilla answerina*			x		
Soft Rush	*Juncus effusus*			x		
Spear Thistle	*Cirsium vulgare*			x		
Sweet Vernal Grass	*Anthoxanthum odoratum*			x		
Sycamore	*Acer pseudoplatanus*	x			x	

Common Name	Scientific Name	WL1	WL2	GA1/GS4	WS2	FS1
Tufted Vetch	*Vicia hirsuta*			x		
Wild Cherry	*Prunus avium*	x				
Yorkshire Fog	*Holcus lanatus*			x		
Total no. of species	**48**	**17**	**8**	**23**	**9**	**7**

Habitat Key:
WL1- hedgerows
W2 - treelines
GS4/GA1 -wet grassland and improved agricultural grassland
WS2 - immature woodland
FS1 -Reed and Large Sedge Swamp

10.4.6 Birds in the existing environment

Desktop studies showed that several rare/threatened and/or protected species have been recorded historically in the 10 km square (N96) surrounding Knockharley Landfill Site. Only up-to-date records (made since 2007) have been included (http://maps.biodiversityireland.ie/#/Map) – see Table 10-8.

Table 10-8: Rare/threatened and/or protected bird species recorded since 2007 within grid square N96 (source: NBDC)

Common Name	Scientific Name	Birds Directive	Conservation Status 2013	Wildlife Acts
Barn Owl	*Tyto alba*	No	Red	Yes
Barn Swallow	*Hirundo rustica*	No	Amber	Yes
Black-headed Gull	*Larus ridibundus*	No	Red	Yes
Common Coot	*Fulica atra*	Annex II & III	Amber	Yes
Common Grasshopper Warbler	*Locustella naevia*	No	Amber	Yes
Common Kingfisher	*Alcedo atthis*	Annex I	Amber	Yes
Common Linnet	*Carduelis cannabina*	No	Amber	Yes
Common Starling	*Sturnus vulgaris*	No	Amber	Yes
Common Swift	*Apus apus*	No	Amber	Yes
Eurasian Tree Sparrow	*Passer montanus*	No	Amber	Yes
Eurasian Woodcock	*Scolopax rusticola*	Annex II & III	Amber	Yes
Golden Plover	*Pluvialis apricaria*	Annex I, II & III	Red	Yes
Herring Gull	*Larus argentatus*	No	Red	Yes
House Sparrow	*Passer domesticus*	No	Amber	Yes
Kestrel	*Falco tinnunculus*	No	Amber	Yes
Mew / Common Gull	*Larus canus*	No	Amber	Yes
Mute Swan	*Cygnus olor*	No	Amber	Yes
Northern Lapwing	*Vanellus vanellus*	Annex II	Red	Yes
Peregrine Falcon	*Falco peregrinus*	Annex I	Green	Yes
Ringed Plover	*Charadrius hiaticula*	No	Amber	Yes

Common Name	Scientific Name	Birds Directive	Conservation Status 2013	Wildlife Acts
Sand Martin	*Riparia riparia*	No	Amber	Yes
Skylark	*Alauda arvensis*	No	Amber	Yes
Spotted Flycatcher	*Muscicapa striata*	No	Amber	Yes
Whooper Swan	*Cygnus cygnus*	Annex I	Amber	Yes
Yellowhammer	*Emberiza citrinella*	No	Red	Yes

A total of 24 bird species were recorded during avian surveys on the site in 2010 (FT, 2010). A further 2 species were recorded in March 2015 and a further 9 species in 2016. Table 10-9 shows the total number of birds recorded on all five avian transects in 2010, 2015 and 2016, and their conservation status following the most recent Birds of Conservation Concern in Ireland (BoCCI) list (Colhoun & Cummins 2013). Additional species observed during the surveys is detailed in Table 10-10.

Results of 2010 Survey

The most abundant species recorded during avian surveys were Woodpigeon, Wren, Goldfinch and Willow Warbler (9-10 records each). Skylark and Blackbird were also abundant on the site and these species were recorded on all five of the avian transects. All avian species were recorded on a minimum of two transects. Many of the species were associated with field boundaries, however the immature forestry also provides cover for many species.

Two Buzzards were recorded on the site on both of the surveys days and a third Buzzard was also recorded on the second survey day. Buzzards were recorded on transects 4 and 5 only. This species was observed flying over the northern area of the site and a roost site was located in a mature tree in the north of the site. It is possible that this species nests in the vicinity of the roost site and the birds became very vocal when the roost tree was approached.

No evidence of a nest could be seen however and the presence of a third bird may indicate that these could be non-breeding birds. This species is regularly observed by site staff to the north of the site. Buzzards were not recorded on the site during previous surveys (Celtic waste, 2000, Greenstar, 2008), although it was observed in the wider landscape.

Figure 10-1 shows the location of the avian transects (2010, 2015 and 2016) and Appendix 10.2 Volume 3 of this EIAR gives the locations and habitats occurring on each transect. The habitats surveyed by all transects were similar, being dominated by a mosaic of wet grassland and improved agricultural grassland as well as immature woodland. Transects 2, 4 and 5 were located adjacent to field boundaries, including either hedgerows or treelines.

Avian species richness was highest on transect 5 (16 species) followed by transects 1 and 4 (15 species). Avian species richness was lowest (7 species) on transect 2, which was located to the east of the existing landfill site. It should be noted that a number of additional species were recorded flying over this area towards the landfill site (i.e. Rook and Jackdaw). Disturbance was higher in this area than on the other transects due to human and vehicular activity and this may have contributed to the low number of species recorded here. Furthermore, the areas of improved agricultural grassland here provide little cover and/or food for birds.

A pair of Coots appear to be breeding on the constructed wetland in the south of the site and a Mallard was also seen flying over this area. Two Grey Heron were seen flying over the site in the northern area of the site and Hooded Crow were only recorded on the active landfill site itself. It should be noted that numbers of birds on the active landfill site were low, indicating that the bird control measures in place at the active landfill site were effective at the time of the survey.

Results of 2015 Survey

A total of 17 species were recorded, with distribution, as in previous surveys, mainly along field boundaries and in forestry. Species not recorded previously at the site included Kestrel, recorded twice (assumed to be the same bird) and Mistle Thrush.

As in previous surveys two Buzzards were recorded from transects, however an additional bird was also noted between transect T2 and T3 bringing the total recorded to 3. It is assumed that up to 2 pairs of Buzzard may still be present in the area. Mallard were recorded in a drainage ditch adjacent to T3. Numbers of birds active on the constructed landfill continue to be low with only corvids such as Hooded Crow noted.

The migrant species Grasshopper Warbler, Barn Swallow, Willow Warbler and Chiffchaff were not recorded However this is due to the timing of the survey and all are likely to occur given that suitable habitat still exists.

Results of 2016 Survey

The number of species recorded in 2016 at transects 1 – 5 was 7 (T1); 9(T2); 6(T3); 10(T4) and 9(T5). Species diversity was highest in Transect 4 (10 species) and lowest in Transect 3 (6 species). Additional species compared with previous years included Blackcap, Black-headed Gull, Coal Tit, Spotted Flycatcher, Herring Gull, Hooded Crow, Lesser Black-backed Gull, Long-tailed Tit and Magpie. At Transect 4, there was a lot of disturbance in the environs due to new and ongoing expansion works and cattle were also grazing in the adjacent field. There were no observations of Common Buzzard or Kestrel during the summer surveys in 2016.

Overall, species diversity in T1 was reduced from 15 in 2010, to 3 in 2015 and 7 in 2016. Species diversity increased in T2 from 7 in 2010 to 8 in 2015 and 9 in 2016. Species diversity in T3 was reduced in 2016 (6) compared with 2010 and 2015 (12 each year). At T4, species diversity was reduced from 15 in 2010 to 5 in 2015 and rose to 10 in 2016. At T5, species diversity was also highest in 2010 and reduced to 7 in 2015 and 9 in 2016.

Wintering Survey

A winter survey was conducted in December 2015, January 2016 and November 2018 along each of the five transects. The results are presented in Table 10-11. Additional species recorded during the winter 2015/2016/2018 surveys include Common Gull, Stonechat, Fieldfare, Redwing, Starling, Greenfinch, Collared Dove, Great Black-backed Gull and Yellowhammer. Buzzards were also observed during the winter 2016 and 2018 survey.

Table 10-9: Total number of bird species recorded on all transects on the site 2010, 2015, 2016 and conservation status (BoCCI 2013)

		2010	2015	2016	2010	2015	2016	2010	2015	2016	2010	2015	2016	2010	2015	2016	
Common Name	**Scientific Name**	**T 1**	**T 1**	**T 1**	**T 2**	**T 2**	**T 2**	**T 3**	**T 3**	**T3**	**T 4**	**T 4**	**T 4**	**T 5**	**T 5**	**T 5**	**Conservation Status**
Blackbird	*Turdus merula*	1		3	1	4		1	4		1	2		1			Green
Blackcap	*Sylvia atricapilla*															2	Green
Black-headed gull	*Chroicocephalus ridibundus*									20							Red
Blue Tit	*Cyanistes caeruleus*	1		2							1		2			2	Green
Bullfinch	*Pyrrhula pyrrhula*	1			1		3	1	1					1			Green
Chaffinch	*Fringilla coelebs*		1		1	3	2	2			1			2		2	Green
Chiffchaff	*Phylloscopus collybita*	1					1							1			Green
Common Buzzard	*Buteo buteo*								1		2			1	1		Green
Coal tit	*Periparus ater*												1				Green
Spotted flycatcher	*Muscicapa striata*												1			1	Green
Dunnock	*Prunella modularis*	1		1					1		1	2	1				Green
Goldcrest	*Regulus regulus*					1			1		1		1	1			Amber
Goldfinch	*Carduelis carduelis*	2						2			4			1			Green
Grasshopper Warbler	*Lacustella naevia*							1									Green
Great Tit	*Parus major*						1		1		1					2	Green
Herring gull	*Larus argentatus*									300							Red
Hooded crow	*Corvus cornix*									100							Green
Jackdaw	*Corvus monedula*							1						1			Green
Kestrel	*Falco tinnunculus*								1						1		Amber
Lesser black backed gull	*Larus fuscus*									500							Amber
Linnet	*Carduelis canniabina*						2	1									Amber
Long Tailed tit	*Aegithalos caudatus*			4									3			3	Green
Magpie	*Pica pica*												1			1	Green
Mallard	*Anas platyrhynchos*								3								Green
Meadow Pipit	*Anthus pratensis*		2	2		2		1		2		3	5		1	2	Red

		2010	2015	2016	2010	2015	2016	2010	2015	2016	2010	2015	2016	2010	2015	2016	
Common Name	**Scientific Name**	**T 1**	**T 1**	**T 1**	**T 2**	**T 2**	**T 2**	**T 3**	**T 3**	**T3**	**T 4**	**T 4**	**T 4**	**T 5**	**T 5**	**T 5**	**Conservation Status**
Mistle Thrush	*Turdus viscivorus*						1								1		Amber
Pheasant	*Phasianus colchicus*	1									1			1	1	1	Green
Raven	*Corvus corax*																Green
Reed Bunting	*Emberiza schoeniclus*							1			1						Green
Robin	*Erithacus rubecula*	1		4	2	2	4	1				1	3	1	7		Amber
Rook	*Corvus frugilegus*	1	2			3			2	25							Green
Skylark	*Alauda arvensis*	1			2			1			1			1			Amber
Song Thrush	*Turdus philomelos*	1		1					1		1			2			Green
Swallow	*Hirundo rustica*	1			2									1			Amber
Willow Warbler	*Phylloscopus trochilus*	2					1	3			2			2			Green
Woodpigeon	*Columba palumbus*	2				3			1		3	1	2	5			Green
Wren	*Troglodytes troglodytes*	2			4	2	2		2		1			3	1		Green
Species Count		**15**	**3**	**7**	**7**	**8**	**9**	**12**	**12**	**6**	**15**	**5**	**10**	**16**	**7**	**9**	

Amber = Medium Conservation Concern (*Amber-listed*), Red = High Conservation Concern (*Red-listed*) according to the Birds of Conservation Concern in Ireland list (BOCCI, Colhoun & Cummins 2013). All other species are not currently of special conservation concern in Ireland (*Green-listed*).

Table 10-10: Additional Species recorded within the site in 2010, 2015 and 2016

Common Name	*Latin Name*	Conservation Status
Black-headed gull	*Chroicocephalus ridibundus*	Red
Blue tit	*Cyanistes caeruleus*	Green
Common Buzzard	*Buteo buteo*	Green
Coot	*Fulica atra*	Amber
Grey Heron	*Ardea cinerea*	Green
Herring gull	*Larus argentatus*	Red
Hooded Crow	*Corvus cornix*	Green
House Martin	Delichon urbica	Amber
Jackdaw	*Corvus monedula*	Green

Common Name	*Latin Name*	Conservation Status
Lesser black backed gull	*Larus fuscus*	Amber
Mallard	*Anas platyrhynchos*	Green
Pied Wagtail	*Motacilla alba*	Green
Raven	*Corvus corax*	Green
Rook	*Corvus frugilegus*	Green
Sand Martin	*Riparia riparia*	Amber
Swallow	*Hirundo rustica*	Amber
Woodpigeon	*Columba palumbus*	Green

Table 10-11: Winter Survey Results

Common Name	T1 Dec 15			T1 Jan 16			T1 Nov 18		
	0-25m	25m-100m	Fly over	0-25m	25m-100m	Fly over	0-25m	25-100m	Fly over
Blackbird	1	1					2		1
Blue Tit	1		1	1					
Dunnock				2	1				
Collared Dove							1		
Common Linnet							2		10
Greenfinch							2		
Herring Gull									44
Hooded Crow				1		2			2
Lesser Black-backed Gull			3			3			
Long-tailed Tit				5			1		
Magpie								2	
Meadow Pipit			3	2					
Mew / Common Gull									1
Robin	1			2			4		
Rook						1			
Song Thrush	1			2					
Woodpigeon		2							1
Wren							1		

Common Name	T2 Dec 15			T2 Jan 16			T2 Nov 19		
	0-25m	25m-100m	Fly over	0-25m	25m-100m	Fly over	0-25m	25-100m	Fly over
Blackbird							1		
Black-headed Gull			9			5			
Blue Tit	2								
Bullfinch	1			3					
Chaffinch	1	1		2					
Dunnock							1		
Fieldfare									10
Goldfinch									20
Great Tit				1					
Hooded Crow									6
Herring Gull			2			6			1
Lesser Black-backed Gull			15						
Linnet				1					
Mew / Common Gull									4
Mistle Thrush				1					
Robin	2			2			1		
Song Thrush							1		
Woodpigeon									3
Wren							3		

Common Name	T3 Dec 15			T3 Jan 16			T3 Nov 18		
	0-25m	25m-100m	Fly over	0-25m	25m-100m	Fly over	0-25m	25-100m	Fly over
Woodpigeon		2				3			
Wren	1			2					
Black-headed Gull		10			30				2
Coal Tit							1		
Chaffinch									2
Common Gull			2						
Common Linnet							2		
Goldfinch									1
Great Black-backed Gull								1	
Herring Gull		60	20		200		17	30	6
Hooded Crow		75			200		5	1	30
Jackdaw									6
Lesser Black-backed Gull		40	15		300		3	13	2
Long-tailed Tit							2		
Magpie									2
Meadow Pipit				2					
Mew / Common Gull								2	1
Pied Wagtail							1		1
Robin							4		
Rook		15			35			30	
Song Thrush							1		
Stonechat				2					
Woodpigeon					2				

Common Name	T4 Dec 15			T4 Jan 16			T4 Nov 18		
	0-25m	25m-100m	Fly over	0-25m	25m-100m	Fly over	0-25m	25-100m	Fly over
Black-headed Gull									1
Blue Tit	2	1		2					
Buzzard			1			1			
Coal Tit	2								
Fieldfare		30			40				
Goldfinch	1			1					
Herring Gull									1
Hooded Crow			2			2			4
Jackdaw									2
Lesser Black-backed Gull			15			5			
Long-tailed Tit				3					
Magpie	2			1			1		1
Mistle Thrush							1		
Meadow Pipit	1			3	1				
Pheasant		1			1		1		
Redwing					15				
Robin	1			2	1			1	
Rook			2			12			6
Starling		20			30				4
Woodpigeon		3		2		5	1		1
Blackbird	2	1					4		
Blue Tit		2		2					
Buzzard				1					
Chaffinch	1			3			1		1

Common Name	T5 Dec 15			T5 Jan 16			T5 Nov 18		
	0-25m	25m-100m	Fly over	0-25m	25m-100m	Fly over	0-25m	25-100m	Fly over
Buzzard									1
Chaffinch							2		
Coal Tit	1								
Common Linnet							1		
Dunnock	2			1					
Goldfinch							1		
Great Black-backed Gull									1
Great Tit				2					
Herring Gull									6
Hooded Crow								1	3
Jackdaw									1
Lesser Black-backed gull						12			
Long-tailed Tit				1					
Magpie			2	1					
Meadow Pipit				4					
Pheasant					1				
Pied Wagtail	1								
Robin							1		
Redwing				2					
Rook			6			5			
Song Thrush							1		
Starling					5				
Woodpigeon			4			5	2		
Wren	1								
Yellowhammer	2								

Review of Species Recorded

Overall the general assemblage of birds present is evaluated as not differing significantly from that recorded in previous surveys. Habitats on site have not significantly changed in terms of species likely to occur, with the increased area of immature woodland likely to hold the same species as previously recorded.

Due to the change in the Birds of Conservation Concern in Ireland (BoCCI) list since 2010, the status of a number of species recorded on site has changed since the previous appraisal. This includes Robin, Goldcrest, Greenfinch and Mistle Thrush, which are now amber listed on the basis of short term declines in abundance of at least 25% (Colhoun & Cummins 2013); Meadow Pipit has moved from green to red due to declines in breeding populations (a greater than 50% decline in the short term). Conversely, the Grasshopper Warbler has moved from amber to green on the basis of a short-term increase in breeding population and an increase in the range of the species.

It has been suggested that the short-term declines in species such as Meadow Pipit and other resident passerines, which formed the basis for their revised status in 2013, coincided with the prolonged cold weather experienced during the winters of 2009/10 and 2010/11 (Crowe *et al.* 2011 cited in Colhoun & Cummins 2013). These species are still widespread with very little change in range or distribution.

Barn Owl (*Tyto alba*) was recorded on the site during previous surveys (Greenstar EIS, 2008), however no nocturnal surveys were carried out as part of the work carried out in 2010, 2015, 2016 or 2018. It is likely that this species forages on the site. Golden Plover (*Pluvialis apricaria*) was recorded in arable adjacent to the site in previous surveys (Greenstar EIS, 2008), however the habitats on the landfill site provide limited suitability for this species.

10.4.7 Mammals in the existing environment

Results of 2010 survey

A total of 7 mammal species were recorded on the site during the site walkover. Table 10-12 lists the species recorded, together with the details of the observation and conservation status. Figure 10-4 shows the location of the main mammal records on the site. The most abundant and widespread species on the site is Fox.

Several Fox prints were seen along muddy tracks throughout the site and scent markings were widespread across the site, particularly at access points in the security fencing around the site. It is likely that this opportunistic forager scavenges along the landfill site at night and also may be attracted by Rats and Rabbits which are known to occur on the site.

Several mammal tracks could be seen in vegetation around the site. These tracks are likely to be attributed to Fox or Badger. Evidence of Badger activity was found in the east of the site. A small Badger latrine was found alongside a mammal track adjacent to the access road in the east of the site. No Badger setts were found on the site and no evidence of breeding Badgers was found on the site. It is likely that this species regularly forages across the site.

No rats were seen onsite. Brown Rat prints were observed along the banks of Knockharley Stream in the north of the site.

Several Rabbit burrows were observed in an earthen bank above a drain in the west of the site. No Rabbits were observed during the survey however and it does not appear that this species is abundant on the site, possibly due to predation by Foxes. The Irish Hare appears to be relatively common in the northwest of the site where wet grassland occurs. Several sightings were made of this species and evidence of resting places was seen in long grass.

A Wood Mouse nest was found in long grass in a wet grassland field in the north of the site. It is likely that this species is widespread on the site, however signs of Wood Mouse activity are difficult to detect.

Two Otter spraints were found at conspicuous locations along Knockharley Stream in the northwest of the site. The spraints appeared to be fresh and marked a regularly used pathway along the stream bank. Figure 10-4 shows the location of the spraints. It is unlikely that this species occurs in high numbers on the site due to the small size of the stream and the limited suitability of the habitat further downstream on the site. No evidence of breeding (i.e. an Otter holt) was found.

Other species not recorded on the site but which are likely to occur are Pygmy Shrew (*Sorex minutus*), Irish Stoat (*Mustela erminea hibernica*) and Hedgehog (*Erinaceus europaeus*) may be present within the woodland to the east and north of the site.

The conservation status of all mammals recorded on the site is given in Table 10-12. All species recorded on the site, apart from the Otter, are listed as being of Least Concern on the Irish Red List for Terrestrial Mammals (Marnell *et al*., 2009). The Otter is listed as Near Threatened on the Irish Red Data List and it is also protected under Annex II and IV of the E.U. Habitats Directive. The Irish Hare and pine marten is protected under Annex V of the E.U. Habitats Directive and can be hunted under licence from the NPWS. Badger, Otter, Pine Marten and Irish Hare are also protected under the Wildlife Act 1976 (as amended).

An assessment was made of the suitability of the site for foraging and roost sites. No Bat roosts were found on the site; however, several mature trees were identified on the site which may have potential for roosting Bats. The locations of these are shown on Figure 10-4.

The hedgerows and treelines on the site certainly provide suitable foraging habitat for Bats and both Common and Soprano Pipistrelle (*Pipistrellus* and *P. pygmaeus*) are likely to occur on the site. It is possible that other Bat species also occur on the site from time to time. All Bat species in Ireland are protected under the Wildlife Act and the E.U. Habitats Directive (Annex IV).

Table 10-12: Terrestrial Mammal species observations/signs on the site in 2010

Common Name	Scientific name	Habitat	Note	Conservation Status
Fox	*Vulpes vulpes*	All	Widespread - prints and scent	Least Concern
Brown Rat	*Rattus norvegicus*	FW1	Tracks along banks of Knockharley Stream, probably widespread	N/A
Rabbit	*Oryctolagus cuniculus*	GS4	Burrows in earthen bank in western site	Least Concern
Badger	*Meles meles*	GA1/GS4	Track and latrine found adjacent to access road in eastern site	Least Concern
Irish Hare	*Lepus timidus hibernicus*	GS4	Seen in wet grassland in northwest site	Least Concern
Otter	*Lutra lutra*	FW1	Spraints found along Knockharley Stream	Near Threatened
Wood Mouse	*Apodemus sylvaticus*	GA1/GS4	Nest hole in dry grass northwest of site	Least Concern

<u>Results of 2015 survey</u>

Four mammal species were recorded during the site visit in March 2015 (see Table 10-13). Fox scat and trackways were located along the embankment adjacent to the entrance road in the eastern part of the site. This species is assumed to be present throughout the site.

A small Badger latrine and trackway was found to the south east in the general area of the proposed extension to leachate management facility. The trackway led southwards and badger paw prints were recorded, along with hair in the south eastern corner of the site. No Badger setts were found on the site and no evidence of breeding Badgers was found on the site. It is likely that this species regularly forages across the site.

Evidence of Otter was found at 3 locations across the site. An Otter spraint was found to the west of the existing landfill at a drain crossing point; in addition, an Otter spraint and territorial markings were found along the Knockharley River, and an Otter spraint and the remains of foraged frogspawn were located along a drain in the northeast of the site. No evidence of breeding (i.e. an Otter holt) was found.

Evidence of Brown Rat was recorded in the northwest of the site and the species is assumed to be present throughout.

A Hare track was recorded along the fenceline and it is likely that animals move between the forestry on site and fields as a trackway was present underneath the existing fence. Given the previously recorded abundance it is assumed that the species is still present in suitable habitat throughout the site.

Other species not recorded on the site but which are likely to occur are Pygmy Shrew (*Sorex minutus*), Irish Stoat (*Mustela erminea hibernica)* and Hedgehog (*Erinaceus europaeus*).

No Bat roosts were found on the site; and no further trees were identified on site which may have potential for roosting bats.

The hedgerows and treelines on the site still provide suitable foraging habitat for Bats and both Common and Soprano Pipistrelle (*Pipistrellus* and *P. pygmaeus*) are likely to occur on the site. It is possible that other Bat species also occur on the site from time to time.

Table 10-13: Mammal Species recorded on the Site 2015

Common Name	Scientific name	Habitat	Note	Conservation Status
Fox	*Vulpes vulpes*	GA1	Scat recorded; assumed widespread throughout	Least Concern
Brown Rat	*Rattus norvegicus*	GA1/GS4	Common species in Ireland	N/A
Irish Hare	*Lepus timidus hibernicus*	GA1	Tracks seen in improved agricultural grassland in east of site.	Least Concern
Badger	*Meles meles*	GA1/GS4 and WS2	Track, latrine and hair found in south east of site	Least Concern
Otter	*Lutra lutra*	FW1	Spraints found along Knockharley Stream and channels in three locations	Near Threatened

<u>Results of 2016 bat survey</u>

At the start of the bat survey, a single Leisler's bat was observed emerging from a mature Ivy covered tree considered a temporary retrasionary roost within a treeline within the site (see ID 1 in Table 10-14 for location). This tree along with the treeline has subsequently been removed under the permitted Knockharley landfill.

The survey also highlighted that Leisler's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats are using some of the site's hedgerows and treelines to forage and/or commute (see Figure 10-5 for more information). Whilst the 10km Grid N96 in which the site occurs was found to contain no bat species; this is likely due to under recording as opposed to the lack of bat activity in the area. It is likely that Leisler's bat, brown long-eared bat, common pipistrelle and soprano pipistrelle bats use the hedgerows and treelines throughout the site and in the general area to commute and forage.

Table 10-14: Results of 2016 Bat Survey

ID	Common Name	Scientific Name	Timestamp	Latitude [WGS84]	Longitude [WGS84]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Peak Frequency [kHz]
1	Leisler's bat	*Nyctalus leisleri*	29/08/2016 20:57	53.647825	-6.53098	21.6	22.8	20.7	21.4
2	Leisler's bat	*Nyctalus leisleri*	29/08/2016 21:09	53.647845	-6.53095	22.5	25.1	21.4	21.4
3	Leisler's bat	*Nyctalus leisleri*	29/08/2016 21:09	53.647868	-6.53098	23.1	24.9	22	22.3
4	Brown long-eared bat	*Plecotus auritus*	29/08/2016 21:17	53.647822	-6.531	30.5	34.9	26.6	33.9
5	Leisler's bat	*Nyctalus leisleri*	29/08/2016 21:18	53.647837	-6.53102	25.5	27.8	24.3	26.9
6	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:20	53.647887	-6.53103	43.4	49.9	42.2	42.7
7	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:22	53.647812	-6.53108	54	41.1	34.6	8.2
8	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:29	53.647845	-6.53099	49.4	54.7	48.2	49.7
9	Leisler's bat	*Nyctalus leisleri*	29/08/2016 21:33	53.647848	-6.531	27.4	28.5	24.5	4.6
10	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:47	53.649122	-6.53157	48.9	54.9	47.9	49.7
11	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:48	53.649122	-6.53157	49.2	56	47.9	48.8
12	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 21:49	53.649097	-6.53112	57.2	65.5	55.8	59.8
13	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 21:52	53.649237	-6.52992	56	64.7	54.2	56.5
14	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 21:53	53.649307	-6.52962	46.3	55.7	45.4	44.3
15	Brown long-eared bat	*Plecotus auritus*	29/08/2016 21:55	53.649298	-6.52916	38	40.2	34	7.9
16	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 21:56	53.648835	-6.52882	35.7	37.8	32	53.4
17	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 21:56	53.648647	-6.52869	26.9	30	23.4	26.6
18	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 22:20	53.648222	-6.53138	51.9	60.4	50.9	51
19	Leisler's bat	*Nyctalus leisleri*	29/08/2016 22:20	53.648252	-6.53147	24	30.9	28.2	23.8
20	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:23	53.648097	-6.53181	24	32	26	18.3
21	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:23	53.648107	-6.53215	29.5	32.5	26.2	26.9
22	Soprano pipistrelle	*Pipistrellus pygmaeus*	29/08/2016 22:24	53.648068	-6.53307	52	59.7	50.9	53.7

ID	Common Name	Scientific Name	Timestamp	Latitude [WGS84]	Longitude [WGS84]	Mean Peak Frequency [kHz]	Mean Max Frequency [kHz]	Mean Min Frequency [kHz]	Peak Frequency [kHz]
23	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:26	53.648065	-6.5337	29.5	32.8	26.5	36.6
24	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:26	53.648012	-6.534	30.4	33.6	27.1	9.8
25	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 22:28	53.647912	-6.53494	43.9	54.7	43	43.9
26	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:33	53.648005	-6.53299	29.4	32.6	26.5	22.6
27	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:34	53.648047	-6.5326	22.2	26.2	19.9	12.5
28	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:34	53.64806	-6.53238	34	29.1	23.5	7
29	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 22:35	53.648053	-6.53223	52	39.3	34.7	4.6
30	Common pipistrelle	*Pipistrellus pipistrellus*	29/08/2016 22:35	53.648097	-6.53191	42.2	48.2	41	12.8
31	Brown long-eared bat, Leisler's bat	*Plecotus auritus, Nyctalus leisleri*	29/08/2016 22:38	53.648988	-6.5317	24.1	26.7	22.5	3.7
32	Leisler's bat, Brown long-eared bat	*Nyctalus leisleri, Plecotus auritus*	29/08/2016 22:41	53.649595	-6.53191	27.8	29.7	25.6	24.4
33	Brown long-eared bat	*Plecotus auritus*	29/08/2016 22:48	53.650425	-6.53259	24.8	27.7	22.3	24.4
34	Leisler's bat	*Nyctalus leisleri*	29/08/2016 22:48	53.65083	-6.53253	25.1	27.7	22.9	8.9

10.4.8 Other species in the existing environment

Other species recorded during the site walkover in 2010 and 2015 are listed in Table 10-15. A total of five insect species and one amphibian were recorded on the site during the survey visits. Three Butterfly species were recorded as well as a Ladybird species and a species of Bumblebee. All of these species are common and widespread in the Irish landscape. The Common Frog was also found to be present on the site with tadpoles found in standing water within wet grassland (GS4) (located within the southern section of the site) and in artificial lakes (FL8) (located to the south of the proposed development site). This species is likely to be common on the site considering the abundance of wet habitats here. The wet habitats are also likely to support damsel and dragonfly species.

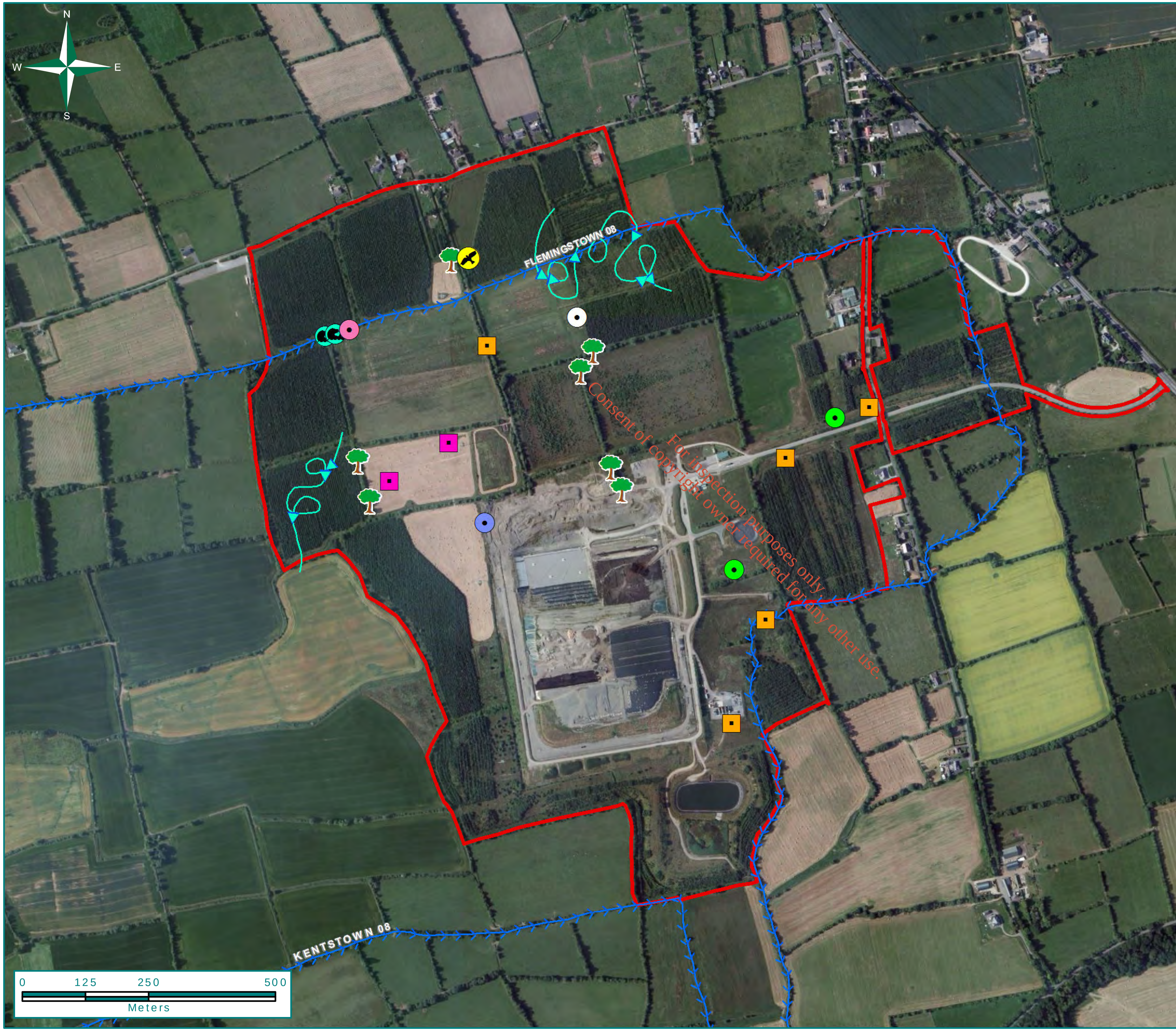
The Common Frog is protected by the Wildlife Act (1976 and Amendment 2000). Common Frog is also listed as a species of International Importance in the Irish Red Data Book (Whilde, 1993) and as species of community interest under Annex V of the EU Habitats Directive. Common frog is still present on site in suitable habitat as frog spawn was identified in Otter prey remains during the site visit in March 2015.

Table 10-15: Other species recorded on the site

Common name	Scientific name	Habitat
Seven-spot ladybird	*Coccinella 7-punctata*	WS2
Bumblebee	*Bombus terrestris*	GA1/GS4
Butterflies		
Speckled Wood Butterfly	*Pararge aegeria*	GA1/GS4
Orange-tip Butterfly	*Anthocharis cardamines*	GS4
Small White Butterfly	*Pieris rapae*	GS4
Amphibians		
Common Frog (tadpoles)	*Rana temporaria*	GA1/GS4

10.4.9 Overall Ecological Evaluation of the Site

The overall site is evaluated as being of Local Importance (Higher Value) as the planted broadleaved woodland and wet grassland are of some ecological value (NRA, 2009).



Co. Meath

Legend

Site Boundary

Fauna Survey Results

- Badger Latrine
- Common Buzzard Roost Site
- Hare Sighting
- Fox Print / Scent
- Otter Spraint
- Rabbit Burrow
- Rat Prints
- Trees with Potential for Bat Roost
- Woodmouse Nest / Hole
- Common Buzzard Flightlines

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Fauna Survey Results (2010 & 2015)
Figure No.	10.4
Rev.	A
Scale	1:10,500 @ A4

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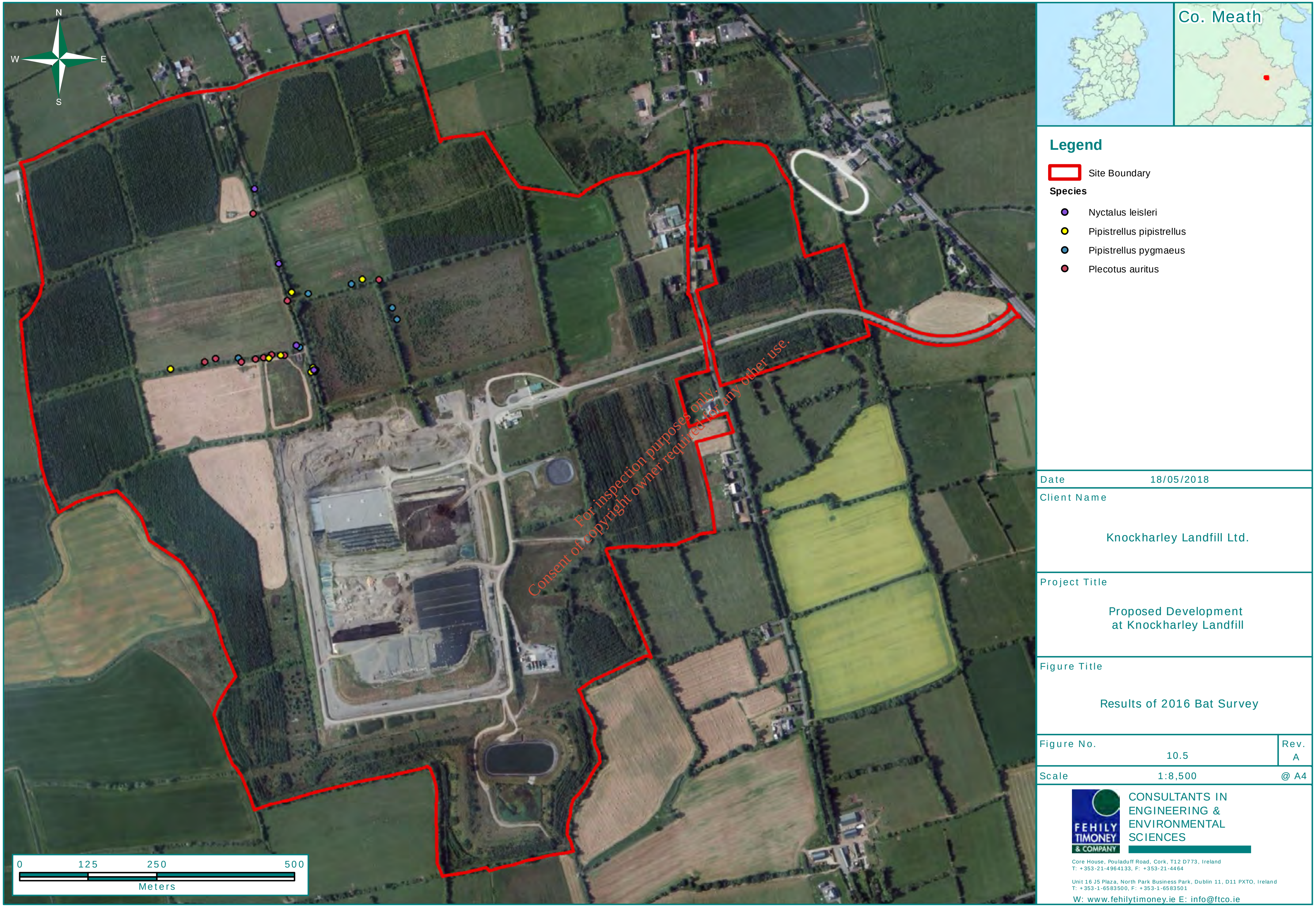

Legend

- Site Boundary

Species

- Nyctalus leisleri
- Pipistrellus pipistrellus
- Pipistrellus pygmaeus
- Plecotus auritus

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Results of 2016 Bat Survey
Figure No.	10.5
Rev.	A
Scale	1:8,500 @ A4

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10.5 Potential Impacts of the Proposed Development on Ecology

The potential impacts of the proposed development are discussed in terms of potential impacts to designated sites, potential impacts to habitats, botanical and aquatic species and potential impacts to fauna.

10.5.1 Do Nothing Impact

In the event that the proposed development does not proceed, there would be no loss of wet/improved grassland within the site. The mixed broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) on site have been planted as part of commercial forestry and will be harvested resulting in a short-term loss before replanting.

10.5.2 Construction Phase

10.5.2.1 Designated Conservation Sites

The site is not located within any Nationally designated conservation sites. There is a direct hydrological link between the site and Balrath Woods pNHA via the River Nanny. However, the pNHA is not designated for any aquatic dependent fauna or habitat and no impact is therefore envisaged. Duleek Commons pNHA which is designated for wet grassland and Thomastown Bog which is designated for wet woodland, wet grassland and raised bog are located along a separate tributary of the River Nanny which is not directly downstream. As these sites are located on a separate tributary of the River Nanny and do not receive waters no impact is envisaged on these pNHAs. The site is connected to the Laytown Dunes/Nanny Estuary pNHA which overlaps with the River Nanny Estuary and Shore SPA (Site Code: 004158) via the River Nanny. Laytown Dunes/Nanny Estuary pNHA is located over 10km from the proposed development, however a Stage 1 Appropriate Assessment Report and Stage 2 Natura Impact Statement accompanies this report and details the potential impacts on European Sites and proposed mitigation.

10.5.2.2 Habitats and Flora

The construction phase of the development is broken into four phases; construction year 0,1 & 2, construction year 3 & 4, construction year 5 & 6 and construction year 7 & 8 and includes the creation of berms (presented in Drawing Nos. LW14-821-01-P-0050-011). In terms of habitats, the construction of the IBA facility, biological treatment, surface water pond and berm creation will result in a loss of agricultural grassland (GA1/GS4), wet grassland (GS4), mixed broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) and section of hedgerow (WL1) and treeline (WL2).

The removal of hedgerow (WL1) and treeline (WL2) will be limited. These habitats provide cover and foraging habitat to local wildlife. Prior to mitigation the loss of these habitats will have a ***Permanent Moderate Impact***.

The proposed extension to leachate management facility will result in the loss of improved agricultural grassland/wet grassland mosaic (GA1/GS4). Improved agricultural grassland/wet grassland mosaic (GA1/GS4) is of Local Importance (lower value) and its loss will have a ***Permanent Slight Impact***.

Construction of the proposed biological treatment facility will result in the loss of wet grassland (GS4) which provides cover and foraging habitat for local wildlife and is of Local Importance (Higher Value). Wet grassland (GS4) on site is limited in area and will result in a ***Permanent Slight Impact***.

Broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) has been planted on site for commercial timber production and will be felled when trees reach maturity or felled to facilitate the phased development of the site. Felling of areas of broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) will be undertaken over the phased 8 year construction phase (see Drawing No. LW14-821-01-P-0050-003, Table 10-16 below and Chapter 2 Proposed development for more information). Most tree felling will occur in the first phase; 7.5ha of deciduous woodland (WD1) will be felled, with no broadleaved/coniferous woodland (WD2) felled. During the following phases (years 3-8) 5ha of broadleaved/coniferous woodland (WD2) will be felled with no deciduous woodland (WD1) felled. During the construction phase a total of 12.5ha of trees will be felled; this accounts for 78.98% of woodland on site.

While woodland will be felled during the construction phase, 14.1ha of woodland will be restored and 29.3ha of native deciduous tree compensation planting will be undertaken as part of the proposed development (presented in Drawing Nos. LW14-821-01-P-0050-003).

With replanting taking into account, as well as the phased manner in which felling will take place, and the young age of the forestry, the impact on broadleaved/coniferous woodland (WD2) and deciduous woodland (WD1) is deemed to be a ***Short-Term Moderate Impact***. As woodland on site is for commercial timber production, felling and replanting will occur whether the proposed development goes ahead or not.

Table 10-16: Phased felling during construction phase

Phase	Ha	% Deciduous woodland plantation (WD1)	% Broadleaved/coniferous woodland plantation (WD2)
Year 0,1,2	7.5	100	0
Year 3-4	2.1	0	100
Year 5-6	1.7	0	100
Year 7-8	1.2	0	100
Total felled	**12.5**	**60**	**40**

A culvert will be installed within the Knockharley Stream, this will require temporary diversion of Knockharley Stream and instream works and will result in the disturbance of the habitat. The river is Eroding/Upland River (FW1) is of Local Importance (higher value) as it acts as a corridor for local wildlife and Otter use has been recorded. The impact on Eroding/Upland River (FW1) is deemed to be ***Permanent Slight Impact.***

No protected flora were identified within the site and therefore there will be no impact to protected flora as a result of the proposed development.

10.5.2.3 Water Quality

The Knockharley Stream is categorised as eroding/upland river (FW1) which runs along the site's northern boundary. Eroding/upland river (FW1) habitat is of Local Importance (Higher Value) as it provides a corridor for local wildlife and foraging habitat for animals such as otter. The Knockharley Stream is a 1st order stream. The wet width of the stream is approximately 2m with a very low flow recorded during monitoring surveys along with a moderate velocity. The substrate was observed to consist of cobble, gravel and fine gravel, and silt. The banks were covered with vegetation and trees overhanging the stream, and there was leaf litter on the stream bed. The stream is considered to be of low value for fish.

The surface drainage from the (current) permitted development leaves the property via a deep drainage channel located in the extreme south-east corner. An isolating weir facilitates diversion of the site drainage to the storm water pond in the event of a contamination incident. This would allow the polluted water to be retained on the property until the spill event is investigated and remediated. This provision can equally deal with third-party pollution events arising outside the site boundary. The storm water pond has sufficient capacity to dampen storm peaks and to maintain the current discharge characteristics from the landholding. The pond also allows for the settling of fines carried by the drainage waters. This is described in more detail in Section 2.2.8 of Chapter 2 Description of the Proposed Development in Volume 2 of this EIAR.

The existing landfill, surface water management system and leachate management system were designed in accordance with the Landfill Directive, the Landfill Design Manual, The Waste Management Act and with EPA guidance. The existing facility is licensed to operate under an IE licence issued by the EPA, all infrastructure design is approved for construction by the EPA via Specified Engineering Works submissions. Following construction, the infrastructure is subject to quality assurance and is validated by the EPA for operation.

The drainage of the proposed development at Knockharley Landfill will be compliant in the use of SuDS. Swales leading to an attenuation facility are proposed in the drainage of the development.

Appendix 12.2 of Volume 3 of this EIAR presents the proposed Surface Water Management Plan (SWMP) and provides further detail on the proposed drainage. The proposed drainage layout is shown in Drawing No. LW14-821-01-P-000-004 through 011 Site Layout Plan in Volume 4 of this EIAR and on Figure 12-6 Proposed Drainage Layout Chapter 12 Surface Water Quality and Drainage in Volume 2 of this EIAR.

During the construction period, prior to mitigation, the development has the potential to lead to impacts on surface water quality:

- during tree felling,
- installation of a culvert in the Knockharley Stream
- from personnel and traffic activities,
- increased surface water run-off from access tracks to facilitate forestry works and earthworks during construction,
- spoil heaps from the excavations construction of berms, and
- sanitary waste.

The potential for release of sediment and nutrients to surface water during the construction of the development has been considered. The existing and proposed surface water management systems will mitigate the potential release of sediment and nutrients to surface water from the proposed infrastructure (landfill, IBA, biological treatment facility, roads and hardstanding areas). The northern surface water management system will be constructed ahead of other elements of the development. There is potential for sediment and nutrient release in the absence of mitigation measures from areas outside of the northern and southern surface water management systems, i.e. construction of the screening berms, felling activities and during the construction of the northern surface water management infrastructure. The surface runoff impacts within the southern catchment will be minimal as a surface water attenuation pond is already in place and a proposed constructed wetland will also be but in place.

Without the implementation of mitigation measures, run-off contaminated with sediment and fuel from construction activities has the potential to enter the Knockharley stream. This could potentially result in a ***Short-Term Moderate-Significant Impact*** in terms of water quality and aquatic species.

10.5.2.4 Fauna

The mammal species recorded on the site are not of high conservation concern and they are likely to be common and widespread in the surrounding environment. The most abundant species recorded on the site was the Fox, which is an opportunistic forager and readily forages in disturbed environments. The proposed development site is used by a range of mammal species for foraging, however no mammal breeding sites were found on the site. A number of rabbit burrows were found at the site; however, no warren was found and certainly no evidence of breeding was found within the footprint of the proposed development.

The proposed location of the extension to leachate management facility is proximal to an area where badger evidence (latrine) was located, however no evidence of breeding was recorded (setts) and therefore no long-term impacts are predicted. There will ***Temporary Slight Impact*** on badger via disturbance, as badgers are likely to avoid this area.

Otter spraints were identified along the Knockharley stream in the north west of the site, however, no holts or couches were identified. A culvert is to be installed within the Knockharley stream and the stream is also proximity to felling works and to the northern limit of a proposed berm to the west of the site. These works will disturb otters as a result of noise and construction workers in the area which will have a ***Temporary Slight Impact*** on Otter. Construction works have the potential to lower water quality within the Knockharley Stream which may have an indirect impact on Otter via a reduction in its food source. However, previous surveys of Knockharley Stream contains have highlighted that the stream contains limited habitat for fish. Prior to the implementation of mitigation, the impact on Otter from a reduction of water quality is deemed to be ***Temporary Slight Impact***.

Hare were also observed in the western section of the site; however, no layups were identified and so ***Temporary Slight Impact*** to hare may occur during construction.

During a 2016 bat survey, bats were observed within northern central section of the proposed development site commuting/feeding within/along habitats previously deemed to be of high value to bats. Many of these hedgerows and treelines have or will be removed under the permitted Knockharley landfill. As part of this development, the removal of treelines and hedgerows will be limited and located in the areas of the proposed IBA facility, surface water attenuation lagoon, and biological treatment facility. Berms planted with native deciduous trees will also be constructed within the general area of hedgerow and treeline removal and are likely to be used by local bats for foraging and commuting. The loss of hedgerows and treelines is deemed to be a ***Medium-term Moderate Impact*** on bats.

Night time works will not be undertaken (except in the case of emergency works) and therefore, noise and light disturbance is not envisaged for wildlife including bats.

In terms of water quality, without the implementation of mitigation measures, run-off during construction of the proposed development will lead to water quality impacts to the Knockharley stream via run-off entering the stream. This could have an indirect impact on species such as Otter and the impact prior to mitigation ***Temporary Significant Impact***.

Potential Impacts on Birds

No Annex I birds of the EU Birds Directive were recorded on the site. Three *red-listed* species of conservation concern (Meadow Pipit, Herring Gull and Black-headed Gull) were recorded from the subject site. A flock of 200 Herring Gulls was recorded at T3 in January 2016. A total number of 80 were recorded along the same transect during the previous month surveys in December. Herring Gull were recorded along T2 and T3 during the same period in lower numbers. Meadow Pipit were recorded along four of the transects and are a local resident species likely to forage within site on occasion. Eight *Amber-listed* species of medium conservation were recorded on the site, however the majority of these occurred in low numbers or are nationally abundant in Ireland. A flock of 500 Lesser Black-backed gulls was recorded at T3. The number and abundance of species recorded on the site was entirely typical of the range of habitats present and all are likely to be widespread in the wider environment.

The construction phase of the project will have the highest potential impacts on bird species in terms of disturbance and loss of nesting habitat. As discussed in Section 10.5.2.2 Habitats and Fauna, the construction phase will be short-term and will take place in a phased manner, which will allow disturbed birds to relocate to alternative suitable habitats on and adjacent to the site. During the construction phase a limited amount of hedgerow and treelines will be removed; as will 12.5ha of (in a phased manner); commercial woodland that will be felled whether the proposed development goes ahead or not. Following the construction phase, woodland will be replanted plus additional compensation planting. Whilst felling and replanting will be phased, regrowth of trees will take some time to provide the same level of foraging and nesting habitat for birds. The impact is therefore deemed to be a ***Medium-Term Moderate Impact*** for birds.

Mitigation measures will ensure that direct mortalities of breeding birds are avoided through appropriate timing of treeline and hedgerow removal as well as tree felling outside of the bird nesting season (1st March – 31st August).

The Buzzard roosting site recorded in 2010 on the site is located outside of the footprint of the proposed development and will not be impacted by this project. Buzzards appear to be common on the site and do not appear to be impacted by the current levels of activity on the existing landfill site as evidenced by the observations of Buzzard in March 2015.

The constructed wetland provides nesting habitat for Coot and probably a range of other aquatic birds and this habitat will not be impacted by the proposed development.

Potential impacts on other species

No other species of high conservation concern were recorded on the site. The Common Frog is expected to be widespread on the site given the available wet habitats and any displaced Frogs will be able to move to alternative habitats elsewhere on the site.

Similarly, the terrestrial invertebrates recorded are highly mobile and displaced individuals will be able to relocate to other suitable habitats on the site. Impacts to these species will be temporary and imperceptible.

10.5.3 Operational Phase

10.5.3.1 Designated Conservation Sites

As previously mentioned in Section 10.5.2 there are only two direct links with pNHAs; Balrath Woods pNHA which contains no aquatic dependent flora or fauna and Laytown Dunes/Nanny Estuary pNHA which is located greater than 10km away from the site. No impact is envisaged on Balrath Woods pNHA. As Laytown Dunes/Nanny Estuary pNHA overlaps with River Nanny Estuary and Shore SPA (Site Code: 004158) which is located within 15km of the proposed development, a Stage 1 Appropriate Assessment Report and Stage 2 Natura Impact Statement accompanies this report and details the potential impacts on European Sites and proposed mitigation.

10.5.3.2 Habitats and Flora

During the operational phase, felled trees which are a mixture of deciduous (native and non-native) trees and non-native conifers will be replaced with native deciduous trees which are of higher ecological value to local wildlife. Replanting will occur in areas around the site including berms to the west and north east of the site which will provide cover and foraging habitat for fauna. Please see Drawing LW14-821-01-P-0050-003 for more details on replanting locations. The resulting woodland will be commercial forestry and will be felled in the future. Planting of deciduous woodland will result in ***Positive Medium-Term Moderate Impact*** on woodland habitat.

10.5.3.3 Water Quality

The operation of the facility to date has not had a negative impact on surface water quality. The southern and northern surface water management systems will direct surface water flows from the site to the attenuation ponds and wetlands prior to discharge to the Knockharley Stream. The pond will attenuate flows and allow suspended solids to settle. The outlet from the pond can be shut to prevent discharge to watercourse in the event of a suspected contamination incident. Automated monitors will be triggered to close if monitored water quality levels rise/fall above/below acceptable levels or trigger levels; isolating contaminated water. Water is discharged from the pond and through a constructed wetland for final polishing before discharge to the receiving watercourse. Therefore, the potential for sediment release to watercourses is low during the operational phase.

To mitigate the risk of IBA dust or hydrocarbons leaks from vehicles on roads surrounding the IBA facility contaminating the storm water, provision has been made in the design to install french drains adjacent to perimeter roads. During operations the outfall from this French drainage network will discharge to the leachate collection system. Post capping the outfall will be redirected to the holding pond via a petrol interceptor into the northern storm water management system.

Due to the insignificant increase in potential run-off from the site no impact is envisioned on the water quality of Knockharley Stream.

10.5.3.4 Fauna

During the operational phase, mammals are likely to continue to use the site and the new woodland created will provide habitat for cover and foraging. The increased activity to the north west of the site where the IBA facility is located may deter mammals from this area, however, resulting in a slight localised disturbance impact. However, as the woodland and landscaping matures this impact shall be reduced.

Mixed deciduous and coniferous trees felled will be replaced with native broadleaved trees which will be of higher ecological value to local wildlife. This woodland planting will provide cover and foraging habitat for local fauna. As these trees mature, they will also provide nesting habitat for birds.

This woodland will be commercial forestry and will therefore be felled in the future. Planting of deciduous woodland will have a ***Positive Short-Term Moderate impact*** on local fauna.

10.5.4 Decommissioning Phase

On cessation of waste acceptance at the landfill, a restoration and aftercare plan will be put in place (please see Chapter 2 Description of the Proposed Development in Volume 2 of this EIAR) and any structures not required as part of the restoration and aftercare plan will be removed. During the removal of structures and restoration works there may be local short-term disturbance to flora and fauna.

10.5.5 Cumulative Impacts

In terms of plans relevant to the study area, the Meath County Development Plan 2013 – 2019 sets out the policies for natural heritage which include:

- NH POL 1 – To protect, conserve and seek to enhance the County's Biodiversity

It is an objective of Meath County Council – NH OBJ 1 – To implement, in partnership with the Department of Arts, Heritage and the Gaeltacht, relevant stakeholders and the community, the objectives and actions of *Actions for Biodiversity 2011 – 2016 Ireland's National Biodiversity Plan* that relate to the remit and functions of Meath County Council and the County Meath Biodiversity Plan and any revisions thereof.

- NH POL 5 – To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, National Heritage Area or those proposed to be designated over the period of the plan, only where an assessment carried out to the satisfaction of the Meath County Council, in consultation with National Parks and Wildlife Service, indicates that it will have no significant adverse effect on the integrity of the site.
- NH POL 6 – To have regard to the views and guidance of the National Parks and Wildlife Service in respect of proposed development where there is a possibility that such development may have an impact on a designated European or National Site or a site proposed for such designation.

The related objectives to these policies are:

- NH OBJ 2: To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directive, and in accordance with the Department of Environment, Heritage and Local Government Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance documents, is carried out in respect of any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site's conservation objectives.
- NH OBJ 3: To protect and conserve the conservation value of candidate Special Areas of Conservation, Special Protection Areas, National Heritage Areas and proposed Natural Heritage Areas as identified by the Minister for the Department of Arts, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan.

The Draft County Meath Biodiversity Action Plan 2015-2020 aligns with the objectives in the Meath County Development Plan in terms of implementing the requirements of the Habitats Directive and protecting biodiversity. These plans, their objectives and policies will aid in protecting biodiversity and ensuring that cumulative effects on European Sites do not result in adversely affecting the integrity of European Sites.

Proposed and permitted developments, within the surrounding hinterlands, were also assessed. Townlands considered include:

- Kentstown
- Veldonstown
- Curraghtown
- Knockharley
- Flemingstown
- Tuiterath
- Rathdrinagh
- Painestown
- Seneschalstowen

Within the townland of Kentstown nineteen dwellings and nine dwelling extensions have been permitted in the last 5 years. The most notable developments within the area, during this time, include; a wastewater treatment plant and holding tanks at Kentstown Wastewater Treatment Plant (File no.: AA170635) by Irish water in 2017, and the construction of 8 no. dwellings in Kentstown by Athlumney Village Housing Ltd. Projects such as the development of 39 no. dwellings on Veldonstown Rd. by McAleer & Rushe Ltd. in 2017, have been noted as being appealed.

In the townland of Veldonstown planning permission was granted for four new dwellings and one extension during the previous five years. In the townland of Curraghtown planning permission was granted for six new dwellings and two extensions during the previous 5 years. Other permitted developments within Curraghtown were agricultural based, with the permission granted for three slatted shed and tanks, along with other works such as the erection of stables and a portal frame structure.

Within the Knockharley landfill site, a 3MW solar farm was permitted on the capped section of the landfill. This permitted development will include the installation of 3 no. transformers, ducting and underground electrical cabling and associated works (File no.: AA180145). Two residential properties and two extensions were permitted within the townland of Flemingstown over the past five years. Additional developments within the townland include permission to install two new football pitches and other associated works at Balrath Football Club.

One dwelling was permitted in the townland of Tuiterath over the previous 5 years. A private wastewater treatment system and percolation area was permitted within the townland in 2013. Within the townland of Painestown permissions for six new dwellings was granted along with three extensions. A number of agriculture and industry associated developments were also identified.

Agricultural bases developments included; the construction of a farm house, stables, storage shed, roofed horse walker and soiled water storage tank, along with construction of stables, a track room, storage shed and soiled water tank. The townland of Seneschalstown saw the permissions of the construction of residential properties and four extensions within the past 5 years.

The townland of Rathdrinagh saw the permission of the construction of 6 dwellings and the extension of three. Additional granted developments include the construction of cattle sheds with external slatted effluent collection area, milking parlour, bulk feed tank, slurry tank, concrete bunded silage area, and slatted shed extension, along with an agricultural field extension, also in the townland. A camp site, caravan park and static home development, and associated works, is also permitted.

There are a number of facilities within the surrounding hinterlands that operate under licences issued by the EPA:

- Kentstown Sow Unit (transferred to Marry Pig Farms Limited) is located approximately 4 km south of the Knockharley Landfill facility in Danestown. It is operated under an IE licence P0456-01 from the EPA. It is a piggery with approximately 4,000 pigs and employs 3 people. Planning permission was granted in January 2015 for the demolition and reconstruction of facility buildings

- There is a poultry farm in Gerrardstown, Garlow Cross, located approximately 3.5 km south west of the facility. The poultry farm produces eggs and currently has capacity for 40,000 layers and is licensed for 117,500 layer spaces. The facility is licensed by the EPA through IE licence P0917-01. The 2015 AER lists one employee.
- A poultry farm in Garballagh, Duleek rears c. 3,000 broilers per annum. It is operated under IE licence P0887-01. It is approximately 4 km west of the facility and employs one person.
  Dunbia operates a meat processing facility in Beauparc under IE licence P0811-02 the operation of slaughterhouses with a carcass production capacity greater than 50 tonnes per day. It has over 70 employees and is 3.5 km north of the facility.
- Cooksgrove Ltd., trading as Euro Farm Foods, operates as cattle slaughterhouse in Cooksgrove, Duleek. It has an IE licence P0822-01 with a throughput of 300 cattle a day. It has over 100 employees. The facility is approximately 8 km west of the Knockharley Landfill facility.
- Nurendale Ltd. trading as Panda Waste Services Ltd. owns and operates a large Materials Recovery Facility at Rathdrinagh Cross Roads, approximately 4 km north east of the facility on the N2 to Slane. It is operated under a licence from the EPA, W0140-04 and is licenced to accept up to 250,000 tonnes per annum of household, commercial and industrial waste, biowaste and biodegradable waste, and construction and demolition waste and the facility employs approximately 160 people. A licence review application for, *inter alia*, the acceptance and processing of incinerator bottom ash is at time of writing under consideration by the Agency.
- Advanced Environmental Solutions (AES) Ltd. owns and operates a waste transfer facility in Navan under IE licence no. W0131-02, approximately 10 km west of Knockharley Landfill. The licensed capacity of the facility is 95,000 tonnes per annum. The facility has approximately 15 employees.
- Perma Pigs Limited, is an operational pig farm located at Littlegrange, Drogheda, County Louth, is operated under license P0431-02.
- Irish Cement Limited, located at Platin Works, Platin, Drogheda, County Meath, is operated under license register number P0030-04.
- A poultry farm, located at Dowth, Slane, County Meath is operated under license P0951-01.
- Indaver Ireland Limited, operating at Carranstown, Duleek, Co. Meath, is licensed under register number: W0167-03.

Each of these facilities is licensed by the EPA and subject to monitoring as part of their licences. The current proposal for construction at the site is not likely to give rise to impacts on the Knockharley Stream following the implementation of best practice construction measures and so cumulative impacts with other projects is not likely to occur.

In addition, as it is not considered that any existing or future smaller-scale development – which mainly comprises one-off housing, and which are detailed in Appendix 1.9 of Volume 3 will, in combination with the proposed development, cause significant cumulative impacts, no consideration in this regard is undertaken in this EIAR.

10.6 Mitigation Measures

10.6.1 Construction Phase

During consultation with IFI it was stated that they were concerned by the potential for suspended solids, hydrocarbons and other deleterious matter generated by the proposed development to enter the Knockharley stream as well as the blocking of waters. These concerns have been mitigated via the mitigation measures outlined in Section 10.6.1.2 Water Quality below; especially in *Control of Sediment & Nutrient Loading and Spills.*

10.6.1.1 Fauna and Flora

- In terms of habitats, treelines and hedgerows will be retained where possible. Where retention is not possible vegetation clearance and tree felling will be carried out outside of the bird breeding season (the bird breeding season is between 1st March – 31st August).
- The proposed development will require the felling of some mature trees that may be suitable for temporary roosting bats during the spring/summer period. For mature trees noted in the area of the proposed IBA facility and the proposed biological treatment facility, tree-felling will not be undertaken in May, June, July and early August, in order to ensure that breeding populations of bats are protected. Therefore, it is recommended that tree felling of mature trees in these areas will be conducted during the period of September – October/early November as bats are capable of flight and can avoid being injured. Immediately prior to felling, the trees will be examined for the presence or absence of bats, and/or other bat activity. This survey will be carried out by a suitably qualified bat specialist and will include a visual inspection of the tree during daylight hours followed by a night time detector survey. Where an Autumn examination of a tree has shown that bats have not emerged or returned to a tree, it is safe to proceed with the felling of the tree the following day, once the appropriate tree-felling licence, if required, has been secured. In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should be de-limbed (i.e. all branches removed first) prior to cutting the truck. Day time temperatures of greater than $7^{0}C$ are favoured for felling to ensure that bats are active and can exit any potential trees being felled. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape (NRA, 2005).
- A pre-construction mammal survey will be undertaken at an appropriate time of the year prior to construction and felling commencing. The mammal survey are to reconfirm the findings of the studies for this EIAR prior to construction. Should any new Badger setts or Otter holts be discovered on areas proposed for development during construction works, the NPWS will be informed and Badger sett/ Otter breeding or resting site removal will take place under the advice and licensing/derogation regulations of the NPWS.
- Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species, roosting birds or active nocturnal bird species.
- During stream diversion and culverting, vegetation clearance will be kept to a minimum and in-stream sedimentation traps will be positioned prior to construction, and maintained for the duration. All diverted water /run-off will be sent to the onsite surface water attenuation lagoon to minimise sediment entering the stream, if required. Any in-stream works will be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI) and subject to Section 50 approval from the OPW. In consideration of fisheries resources downstream, works in watercourses will be carried out during the period July-September unless prior agreement has been reached with IFI.

Biosecurity (invasive species management)

- All equipment and all footwear/waders that will be placed within the water shall be steam-cleaned prior to arrival on site to prevent the spread of invasive species or disease entering the water and after use to prevent the spread to other catchments. This shall prevent the entrance of invasive species and disease into the stream

- Best practice biosecurity measures are required to prevent the spread of the crayfish plague in Ireland along with other invasive species. The crayfish plague disease can be carried on wet equipment so ALL equipment (clothing and fishing gear) that has been in freshwater must be treated with a disinfectant and then completely dried before moving to another area. This will avoid the accidental spread of the disease to other areas. See Crayfish Leaflet 3 in Appendix 10.4 Volume 3 of this EIAR (http://www.biodiversityireland.ie/wordpress/wp-content/uploads/Crayfish_leaflet.pdf).
- A Check – Dry – Clean approach shall be adopted for all site personnel.
- Check:
  - Check you are not unknowingly carrying any water, living organism (including plant fragments) on your equipment or clothing
  - Pay particular attention to those areas that retain water, remain damp or are hard to inspect
- Clean:
  - Clean equipment, footwear and clothes thoroughly after water-based activity
  - Pieces of plants, seeds and organisms that get caught up in, or attach themselves to your equipment must be thoroughly removed from all hidden corners, inside clothing and other surfaces
  - Where available, use pressure washers and hoses to wash equipment and clothing
  - Ensure washings and any water that has collected in equipment are left in the cleaning area. Alternatively, empty them onto land away from other watercourses and not into another watercourse, drain or ditch
- Dry:
  - All equipment and clothing should be dried thoroughly
  - Where possible, air dry for 48 hours in order to kill any aquatic organisms
  - In slightly moist conditions, some species can live for many days. New research from the Environment Agency has shown that a killer shrimp can survive in the moist fold of a wader for up to 15 days.

10.6.1.2 Water Quality

- Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined see Section 12.6, Chapter 2 Description of the Proposed Development in Volume 2 of this EIAR.
- The new attenuation pond will be put in place at the commencement of construction at the site. Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have a functioning drainage system in place.
- The existing southern attenuation pond together with the new northern attenuation pond will mitigate any increase in the rate of run-off. Erosion control measures and temporary stilling ponds, including the attenuation ponds will be regularly maintained during the construction phase.
- The 4-stage treatment train (swale – holding pond-attenuation pond– wetland/diffuse outflow) will retain and treat the discharges from the new surfaces as a result of the development and reduce any risk of flooding downstream.
- Where required, portaloos and/or containerised toilets will be used in combination with existing site welfare facilities and associated waste water management facilities to provide toilet facilities for site personnel during construction. Sanitary waste produced by portaloos/containerised toilets will be removed from site via a licenced waste disposal contractor.

Reducing Runoff

- Cognisance has been taken of the findings in Chapter 12 Surface Water Quality and Drainage and Chapter 11 Soils, Geology and Hydrogeology in Volume 2 of this EIAR in the location of the drainage system, including the new attenuation pond to ensure that these facilities are located in suitable areas.
- The conceptual site drainage has been designed to complement existing overland flow. The drainage design will be developed in full at the detailed design stage.

Flooding

- A modification will be installed across the stream in the form of a dam and culvert arrangement in order to channel extreme flows overbank into a wooded area. This will compensate for any loss in the 1 in 1000-year floodplain. This is described in more detail in Section 12.4.3. Chapter 12 Surface Water Quality and Drainage in Volume 2 of this EIAR.
- The proposed compensation flood culvert is designed to provide compensatory storage for the flood plan storage lost through constructing the northern surface water management system in a1:1000-year flood plain.
- Construction will not take place during extreme weather conditions.

Control of Sediment & Nutrient Loading

- The soil stability will also be assessed at site specific locations particularly at stockpile, screening berms and stream bank locations where earthworks are proposed. Best practices will be employed in the prevention of silt laden run-off from entering watercourses.
- Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations:
    a. All stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary.
    b. All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond.
    c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.
- Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.
- The developer will ensure that erosion control, namely silt-traps, silt fencing, stilling ponds and swales are regularly maintained during the construction phase.
- Standing water, which may arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations will be pumped into the site drainage system (including attenuation ponds), after which permanent in situ dewatering will be implemented during operations. As historically there is little evidence of high inflows, it is anticipated that pumped flows from excavations will be very low. Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations.
- The excavated subsoil material will be removed to form the screening berms.
- Swales will be shallow to minimize the disturbance to sub-soils. Temporary silt traps will also be provided at regular intervals in the swales.
- Cross-drainage pipes of 450mm minimum diameter will be provided to prevent a risk of clogging for conveying flows from agricultural drains and forestry drains across the access roads.
- Additional wheel washing facilities will be provided at the exit of the IBA facility. This will supplement the existing wheel wash which will be retained at the entrance to the site. The silt traps will be cleaned on a regular basis.
- Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines (34) and Forest Harvesting and Environmental Guidelines (36), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff.
- Trees will be felled away from watercourses where possible. Branches, logs or debris will not be allowed to accumulate in watercourses and will be removed as soon as possible.
- The rate of absorption of a felled site is decreased, and therefore rate of run-off, is expected to be slightly higher than that of a forested site, however it is expected to develop berms on the deforested areas as soon as weather condition allow following felling, followed by replanting. Thus, no significant increase in the rate of run-off is anticipated as a result of felling or risk of downstream flooding.

- There is an existing wheel wash at the entrance to the site which will be used during the construction period.
- A designated concrete wash-down area will be constructed at the temporary compound. Every concrete truck delivering concrete to the site will use this facility prior to leaving the site. A settlement pond will be provided to receive all run-off from the concrete wash down area.
- The outfall from the wetland will have vertical pipe drop energy dissipation structure within the wetland outlet chamber prior to discharge into the adjacent launching apron protection works. This design approach will mitigate the risk of suspended solids developing within the Knockharley stream downstream of the outfall.
- Rock armour will be used to provide bank protection works upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs.

Spills

- Detail of oil spill protection measures adjacent to a watercourse are outlined in Appendix 2.0 of Volume 3 of this EIAR which outlines the Proposed Construction Environmental Management Plan (CEMP).
- All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s). Emergency Silt Control and Spillage Response Procedures are contained within under Site Drainage Management Plan of the Construction Environmental Management Plan (CEMP).
- Refuelling of plant during construction will only be carried out at the existing designated refuelling station locations. Each station is fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team is in place on site. Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.
- Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.
- Appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. Adequate security will be provided to prevent spillage as a result of vandalism. A regular review of weather forecasts of heavy rainfall is required and a contingency plan will be prepared for before and after such events.
- A suitably qualified person will be appointed by the developer to ensure the effective implementation of the CEMP onsite. They will also ensure:
    a. regular monitoring of the drainage system and maintenance as required.
    b. Record keeping of the daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase.
    c. Water quality monitoring will continue to be carried out in accordance with the licence. (There will be one new monitoring point, at the discharge point from the new wetland.)
- If excessive suspended solids are noted, construction work will be stopped and remediation measures will be put in place immediately.
- Discharges from paved roads paved areas will be surrounded by filter drains with petrol interceptors installed at respective outlets upstream of the storm water management attenuation ponds or other.

10.6.2 Operational Phase

- Replacement tree planting and new tree planting will be comprised of native deciduous tree species (see Landscape Masterplan LW14-821-01-P-0050-012 for more information).
- Excessive additional lighting around the site will be avoided. Lighting will be kept to minimum safe levels to reduce disturbance to nocturnal mammals and birds. Directional lighting will be used to prevent light disturbance in the surrounding area.
- The surface water management system will mitigate any potential impacts on hydrology and surface water quality during the operational phase. Regular visual inspections and monitoring will be required in compliance with the IED licence.
- The conceptual drainage has been designed to operate effectively during the operational period. Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site. The attenuation ponds will be permanent features, and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.
- Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls.
- The mitigation measures applicable for spills during the construction phase are applicable during the operational phase. In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill. The haulage contractor will be required to have spill kits and training. There will be regular inspections and maintenance of leachate tankers to mitigate leaks. In the event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented.
- Surface water will be visually inspected as part of the operational site walkovers on a weekly basis. There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland. Routine surface water sampling is and will continue to be carried out in accordance with the licence which includes the submission of interpretive reports to the EPA for approval. Any incidents shall be notified to the EPA in accordance with the licence.

10.6.3 Decommissioning Phase

There will be a period of restoration and aftercare following cessation of waste acceptance activities at the facility. Decommissioning of the development will be subject to Agency approval under prevailing waste Licence condition. It is proposed to leave the surface water management system in situ and this will mitigate any potential impacts during decommissioning activities and in addition, temporary mitigation will be put in place to protect watercourses in areas outside of the in-situ water management system. These measures will be similar to those proposed during the construction stage such as silt-traps, silt fencing and stilling ponds.

10.7 Residual Impacts after Mitigation

A certain amount of permanent habitat loss will be associated with the footprint of the proposed development, however this will be small relative to the value of habitats available on the site.

With the application of the above mitigation measures which includes monitoring, there will be no significant residual impacts from this development are envisaged.

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ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 11 – LAND, SOILS & GEOLOGY

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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11 LAND, SOILS & GEOLOGY

11.1 Introduction

This chapter has been prepared to examine the potential impacts of the proposed development at Knockharley Landfill facility as outlined below in Section 11.2.1 on the land, soils and geology in the local environment. The effects of the proposed development are considered, having taken account of mitigation measures to reduce or eliminate any residual impacts on the surrounding land, soils, geology and hydrogeology. Land use is addressed in Chapter 13 Landscape and Visual Impact Assessment.

11.2 Methodology

11.2.1 Study Area

The existing Knockharley Landfill facility comprises an area of 135.2 hectares (333-acre site) and has been in operation since 2004. The landfill currently accepts residual household, commercial and industrial wastes together with construction/demolition wastes and incinerator bottom ash (IBA). The site boundary for the existing facility, along with the proposed layout is illustrated in Drawing No.'s LW14-821-01-P-0000-002 Existing Site Layout and LW14-821-01-P-0000-003 Proposed Site Layout in Volume 4 of this EIAR.

A detailed description of the proposed development is provided in Chapter 2 of this EIAR. The development will include intensification of the landfill within its existing permitted footprint, an IBA Facility, a second surface water attenuation pond, wetland and associated infrastructure, a leachate management facility, screening berms, tree felling, replanting and compensation planting, a biological treatment facility and ancillary infrastructure. The study area is defined as all areas within the proposed development footprint.

The current planning permission permits the development of approximately 25 hectares of landfill cells.

11.2.2 Relevant Guidance

The following guidelines were considered in the development of this chapter to identify relevant objectives relating to:

- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report [1]
- Guidelines on the information to be contained in Environmental Impact Statements [2]
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements [3]
- Revised Guidelines on the Information to be Contained in Environmental Impact Statements, September 2015 [4]
- Advice Notes for Preparing Environmental Impact Statements Draft September 2015 [5]
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft August 2017 [6]

An assessment of the soils, geology and hydrogeology aspects of the site was undertaken using the following sources of information:

- Geology in Environmental Impact Statements [7]
- Online landslide database [8]
- Online heritage database [9]
- Online Aggregate Potential Mapping database [10]
- GSI Public Data Viewer - www.spatial.dcenr.gov.ie [11]
- OSI Online Historic Maps www.maps.osi.ie/publicviewer/ [12]

- Geology of Meath, Sheet 13 [13]
- NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes [14]
- General Soil Map of Ireland [15]
- Groundwater Protection Scheme for County Meath (on GSI website) [16]
- EPA Envision Map Viewer [17]
- BS 8002:2015 - Code of practice for earth retaining structures [18]
- Control of Groundwater for Temporary Works (CIRIA Report R113) [19]
- Review of previous site investigation reports from 2015 & 2016 for the site:
    - OCM - Tier 3 Risk Assessment 2015
    - Priority Geotechnical – Geophysical Survey 2016
    - Priority Geotechnical – Interpretive Report 2017

11.2.3 Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter 5 of the EIAR.

Following consultation with the EPA on 29th August 2016, one of the key points raised was the requirement for a hydrogeological risk assessment to be completed as new cells are proposed.

FT consulted the Geological Survey of Ireland (GSI) with regards any potential impacts from the development, however, no response was received. FT has taken the points raised by the HSE, Irish Water and Meath County Council into account during the preparation of this chapter.

11.2.4 Desk Study

Prior to undertaking the site walkover and intrusive site investigations, a desk study was undertaken in order to help determine the baseline conditions within the study area and planning boundary to provide relevant background information.

The desk study included an assessment of the sources of information listed in Section 11.2.2.

11.2.5 Field Assessments

A site walkover was undertaken by FT in June 2016 with an intrusive geotechnical site investigation undertaken by Priority Geotechnical from 5th August to 18th September 2016. The scope of the geotechnical survey is summarised below with the information obtained referenced in this chapter:

- Advancement of 10 No. cable percussive boreholes to a maximum depth of 10m BGL;
- Advancement of 1 No. rotary core borehole to a maximum depth of 30m BGL;
- Installation of groundwater/ ground gas monitoring installations;
- Collection of samples for geotechnical testing; and
- Seismic Refraction Profiling, 2D Electrical Resistivity (ERT) surveying and Multi-Channel Analysis of Surface Wave (MASW) along pre-designated transects in the proposed cell development area to the north and east of the existing landfill.

11.2.6 Evaluation Criteria

During each phase (construction, operation, maintenance and decommissioning) of the proposed development, a number of activities will take place on site, some of which will have the potential to cause impacts on the geological regime at the site and the associated soils, geology and hydrogeology. These potential impacts are discussed in detail in Section 11.4.2.

11.3 Existing Environment

11.3.1 Site Description

The site currently comprises a licensed landfill facility where waste disposal and recovery activities are undertaken with waste acceptance commencing in December 2004. The licensed boundary of the licence facility is shown in red on LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR and the ownership boundary (of Knockharley Landfill Ltd.) is shown in blue. A detailed description of the existing development is outlined in Section 2.2 in Chapter 2 – Description of the Proposed Development of this EIAR.

The site is a mix of, constructed landfill and associated facilities with some woodland and wet grassland. Prior to development as a landfill, the land was used for agriculture and a network of field drains were installed to improve the land. The site is sloped with elevations ranging from 70 mOD in the north west to 55 mOD in the south east of the site.

11.3.2 Overburden Geology

The Teagasc online mapping for the site indicates that the soils underlying the site and the surrounding area mainly comprise poorly drained acidic mineral soils consisting of surface water gleys and groundwater gleys. Gley soils are derived from shale and sandstone parent material and are responsible for the poor drainage characteristics evident in this part of County Meath.

The GSI online Quaternary Geology mapping shows that the overburden consists of glacial till predominantly derived from the underlying Namurian shales and sandstones, with the southern part of the site being underlain by tills derived from Carboniferous limestone. Two narrow swathes of alluvium deposits are identified within the southern section of the site and along the northern boundary, with glacial till derived from the Limestone identified to the south of the site.

This locally thick and continuous till deposit thins in all directions away from the site as bedrock is noted at the surface approximately 1.2 km to the east and west of the site.

A review of historic site investigations pertinent to the development of the original landfill from 2001 has indicated that the glacial tills vary in thickness from 12 to 21.5 m across the site, with the thickest deposits being encountered to the west and thinnest to the east of the site.

The till comprises cobbles and boulders in a silty Clay matrix with minor sand content. The till has a low permeability in the range of 1 x 10^{-9} m/sec to 4.63 x 10^{-11} m/sec, determined by permeability testing conducted by K.T Cullen for the EIS submitted as part of the original landfill application in 2001.

This permeability range is further supported by testing completed by Priority Geotechnical in 2016. A total of 9 no. samples selected for testing returned permeability results in the range of 1 x 10^{-9} m/sec to 7 x 10^{-11} m/sec. The results indicate that the till has a low permeability which places the Knockharley deposit in the lower range of permeability values for Irish tills.

The development of the existing phases of the landfill has involved excavation into the glacial till. The excavated clays have been re-compacted to form the basal clay liner and have provided material for the various embankments located around the footprint of the site.

The Quaternary Geology of the site and its surrounds is presented in Figure 11.1.

11.3.3 Bedrock Geology

The site lies regionally within the south-eastern limb of a synclinal axis containing the Namurian aged Balrickard Formation. The dip of the rocks within the syncline are variable. The syncline is bounded to the east and west by two northwest-southeast trending faults.

Figure 11.2 shows the bedrock geology underlying the site as described in the "Geology *of Meath"* map (Sheet 13, GSI, 2001). The 1:100,000 scale bedrock map shows that the site is underlain by Carboniferous aged (Namurian) Balrickard Formation described by the GSI as '*coarse feldspathic micaceous sandstone with shale and argillaceous limestone and fossiliferous shale'*. The Balrickard Formation is underlain by similar strata to the north and south belonging to the Donore Formation and passes up into similar rocks of the Walshstown Formation to the northeast.

Bedrock recovered from the boreholes undertaken for the site investigation from 2000 and 2004 comprised fine grained light-coloured sandstone and darker coloured siltstone / mudstone. The elevation of the bedrock surface varies from 40 to 50 mOD, falling away towards the south, following the slope of the topography. The depth to bedrock encountered in the boreholes varies between about 12 m bgl towards the east of the site to about 21.5 m bgl towards the west of the site.

Similar geological characteristics were reported during the 2016 site investigation. Of the 9 no. boreholes advanced in the northern portion of the site, 1 no. borehole reported identifying slate / mudstone bedrock at 17.0m bgl. The geophysical survey indicated a variation in elevation across the bedrock profile from 45 – 60 mOD. The bedrock geology of the site and surrounding area is presented in Figure 11.2.

11.3.4 Geological Heritage

The GSI Online Irish Geological Heritage database indicates that the proposed development area is not located in an area of specific geological heritage interest. The nearest site of significant geological heritage features fields of megafluting, located approximately 800 m to the east of the site. This geological feature covers 115 km^2 area and forms part of the largest field of such features in Ireland.

11.3.5 Economic Geology

The GSI online Aggregate Potential Mapping database indicates that the site is located within an area of high potential for crushed rock aggregate. No other geological features of economic significance were noted within a 2-km radius of the site. The operational Duleek Quarry is located 5.1 km east of the site.

11.3.6 Site Investigations

As part of the initial planning application for the landfill, an intrusive investigation was undertaken in November 2000 by KT Cullen & Co. to confirm the geological succession underlying the site. The investigation comprised the excavation of 20 No. trial pits to a maximum depth of 4.7 m below ground level (bgl), 14 No. shallow shell and augur boreholes to maximum depths 10.0 m bgl and 8 No. deep rotary boreholes to a maximum depth of 30.0 m bgl.

Topsoil was encountered across the site to depths of approximately 1.0 m bgl overlying a low permeability boulder clay encountered across the site to depths ranging from 12.5 to 21.5 m bgl. This predominantly comprised a *Stiff gravelly silty Clay with frequent cobbles, minor sand content and limited sand lenses.*

Bedrock was encountered at eight locations and comprised interbedded siltstone / mudstone and fine-grained sandstones interbedded with siltstone / mudstone. Bedrock cores retrieved from the site investigation described the bedrock as *Fine-grained Light-coloured Sandstone and darker coloured Siltstone / Mudstone.* Where weathered rock head was encountered, the shallow fractures of clay filled to depth of approximately 1 m.

An additional site investigation was undertaken in August 2004 to facilitate the installation of a replacement deeper groundwater monitoring well for MWS16d and 19 No. shallow ground gas monitoring wells. The site investigation revealed low permeability boulder clay across the site to a maximum depth of 12.1 m bgl (MW16d) comprising *Stiff Gravelly Clay with frequent cobbles.*

This was underlain by bedrock comprising *Dark black weathered Siltstone / Mudstone* from 12.1 to 15.6 m bgl, with black Mudstone encountered to 30.0 m bgl.

Geotechnical Site Investigations were undertaken by Priority Geotechnical (PGL) in August and September 2016 to support both the design and planning application for the proposed development. The site investigation comprised the advancement of 1No. rotatory cored borehole (RC01) to 27.0 m bgl and 10 No. shallow shell and auger boreholes (BH01 – BH10) to a maximum depth of 15.0 m bgl.

The site investigation generally encountered overburden comprising *Firm to stiff slightly sandy gravelly Clay* to depths of between 6.0 to 15.0 m bgl in boreholes BH01, BH02 and BH03. Boreholes BH04 to BH10 encountered a *Dense clayey sandy Gravel* between 3.5m bgl to 7.1m bgl. A *Clayey / silty gravelly Sand* was encountered at RC01 from 7.0 to 17.0 m bgl. Bedrock was encountered at 17.0m bgl.

In conjunction with the intrusive site investigation outlined above Priority Geotechnical Ltd undertook a geophysical survey to identify overburden horizons present beneath the site and to confirm the depth to bedrock beneath overburden deposits. The geophysical survey comprised of continuous 2D Electrical Resistivity (ERT), Seismic Refraction Profiling and Multi-Channel Analysis of Surface Wave (MASW) along pre-designated transects in the proposed cell development area to the north of the existing landfill.

Resistivity values for the overburden were generally relatively low, typically ranging between 75 and 100ohm-m, increasing to a maximum of c. 150ohm-m. Resistivity values for the overburden deposits were generally very consistent across the site reflecting overburden to be a relatively homogenous material typical of Glacial Till (Sandy Gravelly CLAY) as encountered during the intrusive investigations.

Seismic velocities were seen to increase rapidly to >1000m/s, indicative of stiff overburden below 2.0m BGL. P-wave seismic velocities ranged from 2000 - 2600m/indicative of a very stiff material. From the findings of the geophysical surveys the thickness of Glacial Till deposits varied between 15 to 20 m but were generally around 17 m in thickness.

P-wave seismic velocity was used to delineate the Glacial Till / Bedrock boundary in areas where a resistivity contrast was not observed. Bedrock was identified by an increase in P-wave velocity to >2900 m/s indicative of fresh rock. The Glacial Till / Bedrock boundary was seen to range in elevation from 42 to 52 m OD across the site. The bedrock was interpreted to comprise a Shale / Mudstone material due to the low resistivity and observed seismic velocity.

The site investigations were generally consistent with the published GSI maps for the region. The site investigation factual report is provided in Appendix 11.1, Volume 3 of this EIAR.

11.3.7 Soil Laboratory Testing

Laboratory testing was scheduled by PGL on behalf of FT. Soil testing was carried out in accordance with BS1377 (1990) - *Methods of Test for Soils for Civil Engineering Purposes*. A total of 125 no. bulk disturbed samples (B), 109 no. small disturbed samples (D) and 9 no. undisturbed clay samples (U) were recovered from the exploratory holes.

11.3.8 Determination of Characteristic Geotechnical Parameters

Topsoil

Topsoil was encountered in eight of the nine exploratory holes to depths of between 0.2 and 0.4 m bgl.

Glacial Till

The Glacial Till Deposits encountered at the site were generally described as *Firm to very stiff slightly sandy gravelly CLAY with low to medium Cobble content*.

Table 11-1: Geotechnical Laboratory Testing

Geotechnical Tests				
Type	**N**	**Min**	**Max**	**Remarks**
Standard Penetration Test (N Value)	91	12	N>50	12 to 82 with refusals (N>50)
Natural Moisture Content	78	11%	34%	Typically, 11% to 18%. Elevated (>20%) in the upper 2.0m.
Atterberg Limits	31	PI8	PI21	Liquid Limit, LL 24% to 51% Plastic Limit, PL 15% to 3% Plasticity Index, PI 8 to 21 Material falls in the low to intermediate plasticity (CL – CI) CLAY range
Particle Size Distribution	47	-	-	Includes 29 No. hydrometer analysis on fine soils
Loss on Ignition	05	1.1%	2.5%	-
Moisture Condition Value (MCV)	20	0	6.5	-
Max dry density/moisture content relationship	14	9%/1.95 mg/m^3	14%/2.11 mg/m^3	-
Permeability in triaxial cell	09	7.26 x 10^{-10} ms^{-1}	1.12 x 10^{-10} ms^{-1}	Results are indicative of impermeable 'intact' Clay

The Glacial Till at the site is broadly described as a cohesive deposit, with a plasticity index of PI8 to PI21.

SPT N values were recorded during the site investigation, with N values of between 12 to refusal where N>50 indicating Stiff to Hard cohesive deposits. Based on SPT 'N' values the strength of this deposit is very high and as such, based on Figure 2 in BS8002:2015, the characteristic weight density of the Glacial Till has been taken as 21 kN/m^3.

Soil Classification

Atterberg classification testing was carried out on 31 no. samples of the Overburden Deposits. The results of the Atterberg testing at the site shows the Glacial Till deposits fall within the low and intermediate plasticity (CL – CI) CLAY range. The plasticity index of the samples ranged from 8 to 21%. At borehole BH09 and BH10 in the upper 1.5 m a high plasticity SILT was identified with moisture contents (w) of 34%.

Permeability Parameters

Determination of Permeability in a Triaxial Cell test was undertaken on 8 No. samples of Glacial Till collected during the site investigation.

Direct measurement of permeability (k) in hydraulic triaxial cell indicated values of 7.26 x 10^{-11} ms^{-1}to 1.12 x 10^{-10} ms^{-1}. This is indicative of impermeable 'intact' Clay deposit (CIRIA 1986).

Moisture Content

Recorded natural moisture content values (*w)* lay within the range 9% to 20% with the exception of shallow Silt Deposits encountered in BH09 and BH10 with a measured natural moisture content of 34%. Dry densities of 90% to 99% maximum dry density were achieved at natural moisture content.

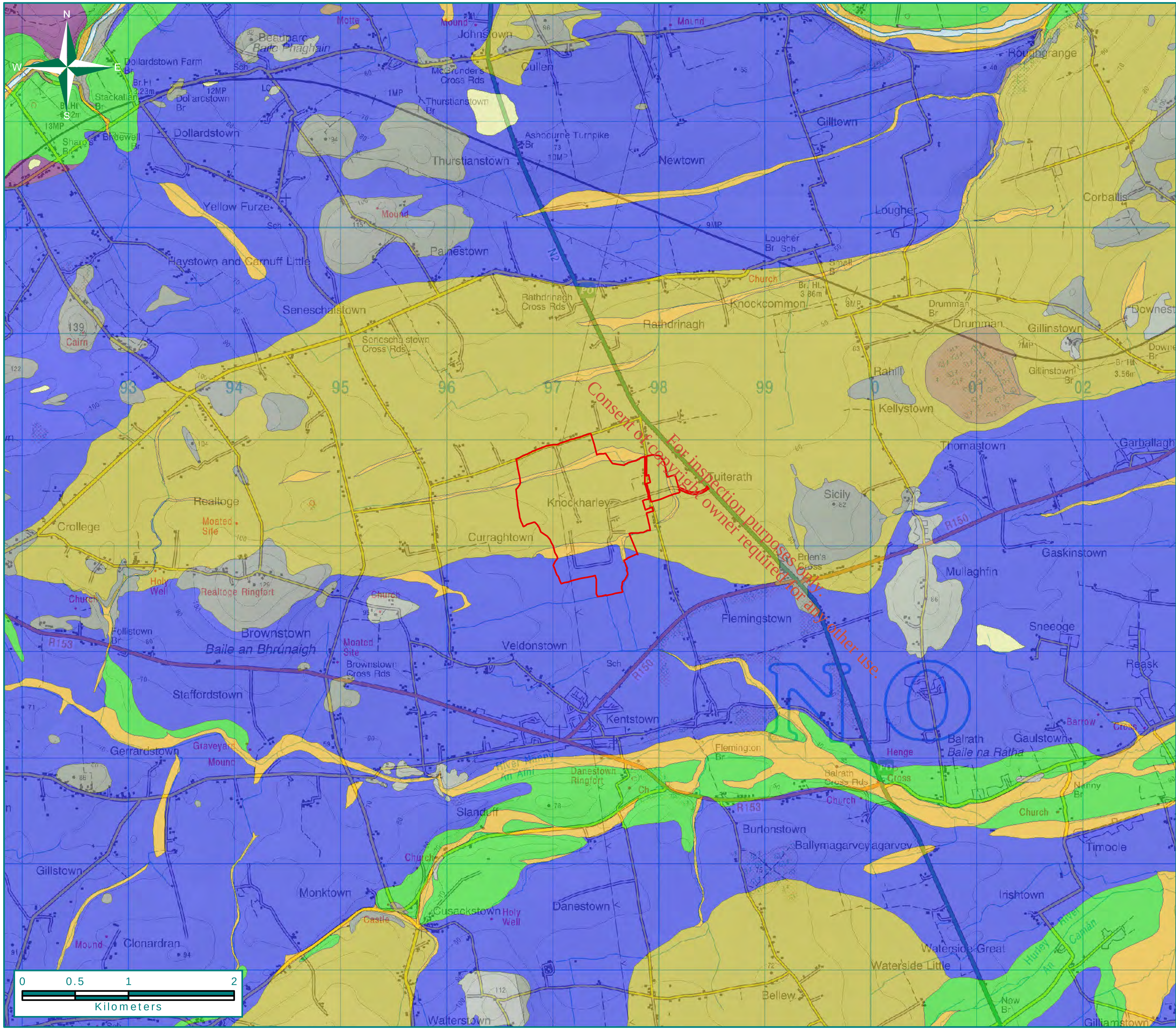
Optimum moisture contents ranged between 9% to 14%. Typically, natural moisture content was 'wet' of the optimum within the range omc+1% to omc+8%.

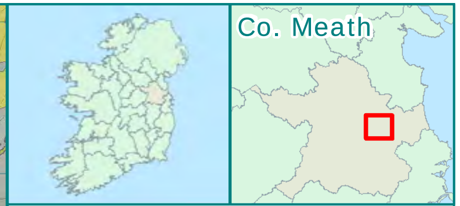
The moisture content data recorded during the site investigation indicated the glacial deposits at natural moisture content will require to be dried to bring them closer to optimum moisture content prior to reuse during the proposed development.

11.3.9 Soil Contamination

There are no known areas of soil contamination within the proposed development site. No evidence of soil contamination was noted during site walkovers. Historical OSI mapping for the site indicates no evidence of any industrial use for the site with the site comprising agricultural land. As such it is possible that minor fuel spills and leaks have occurred locally in the past.

There was a minor fuel spill on site in 2016 on grass directly adjacent to the bunded fuel storage area. The spill was identified immediately, and a clean-up was carried out with EPA approval.





Legend

- Site Boundary

Quaternary Geology

- Alluvium
- Fen peat
- Cutover raised peat
- Gravels derived from Lower Palaeozoic sandstones and shales
- Gravels derived from limestones
- Bedrock outcrop or subcrop
- Karstified bedrock outcrop or subcrop
- Lacustrine sediments
- Till derived from Lower Palaeozoic sanstones and shales
- Till derived from limestones
- Till derived from Namurian sandstones and shales
- Water

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Quaternary Geology
Figure No.	11.1
Rev.	A
Scale	1:50,000 @ A4

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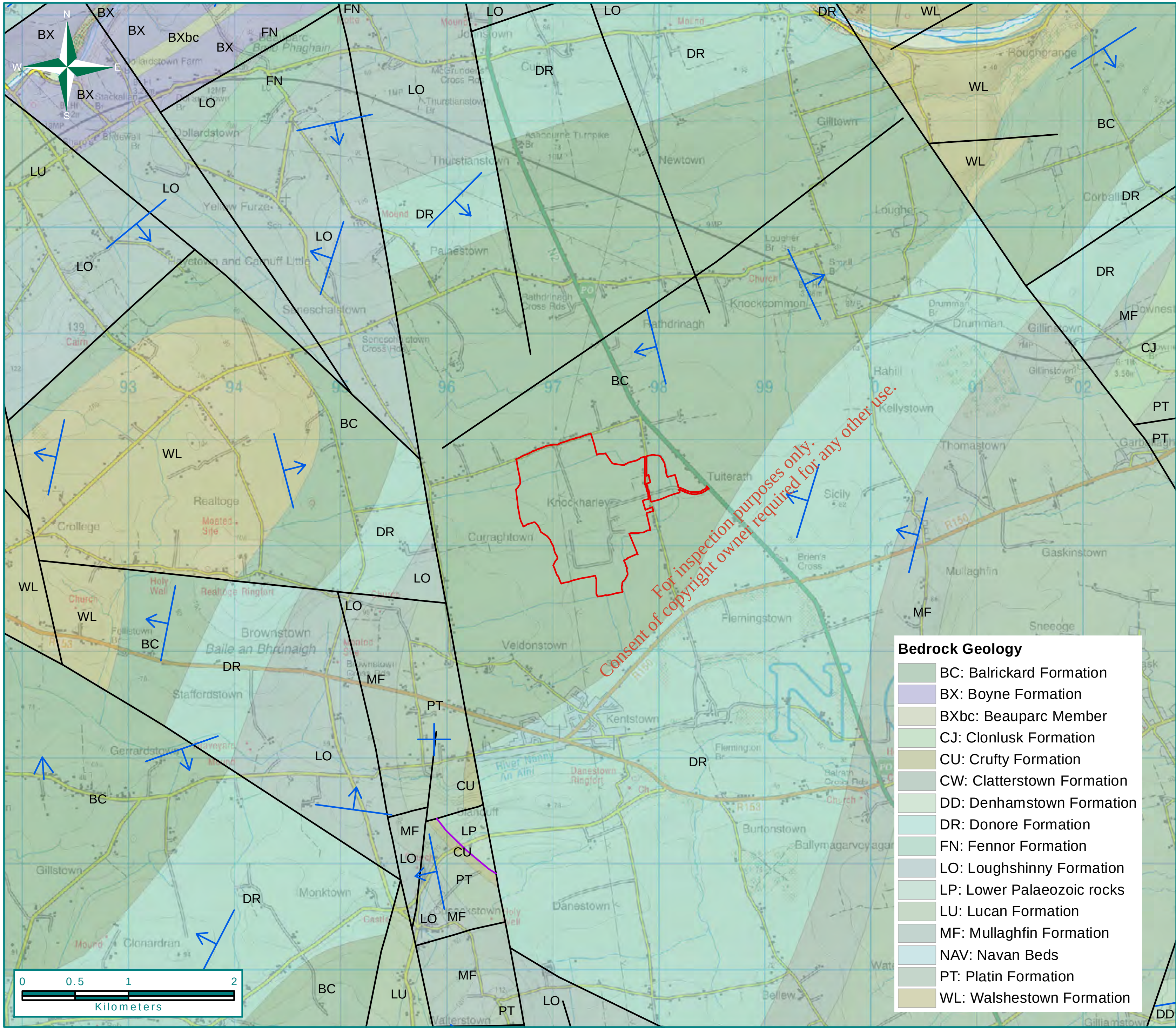

Bedrock Geology

- BC: Balrickard Formation
- BX: Boyne Formation
- BXbc: Beauparc Member
- CJ: Clonlusk Formation
- CU: Crufty Formation
- CW: Clatterstown Formation
- DD: Denhamstown Formation
- DR: Donore Formation
- FN: Fennor Formation
- LO: Loughshinny Formation
- LP: Lower Palaeozoic rocks
- LU: Lucan Formation
- MF: Mullaghfin Formation
- NAV: Navan Beds
- PT: Platin Formation
- WL: Walshestown Formation

Legend

- Site Boundary
- Dip of Bedding in Degrees
- Stratigraphical Linework
- Structural Linework

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Bedrock Geology
Figure No.	11.2
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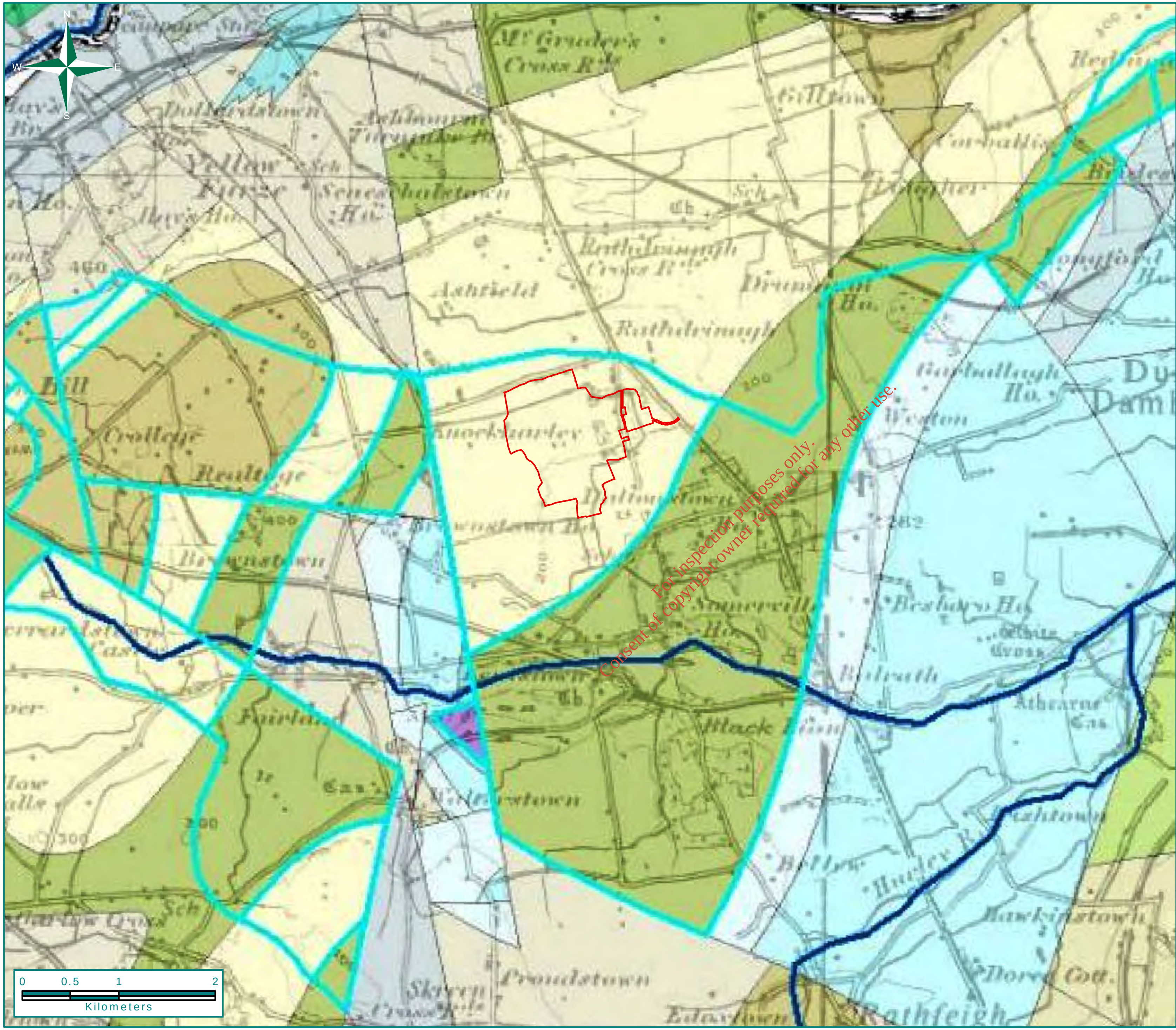

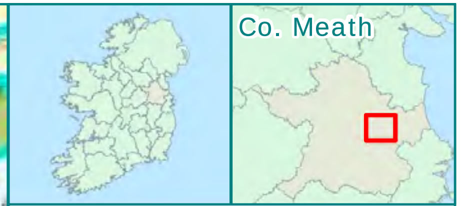

Legend

Site Boundary

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Realtage Groundwater Body
Figure No.	11.3
Rev.	A
Scale	1:55,000 @ A4

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11.3.10 Hydrogeology

Groundwater is an important natural resource, with increasing dependence on it as a drinking water supply source. The Knockharley Landfill site is located within one groundwater body – the Realtage Groundwater Body (GWB) as shown in Figure 11.3 above. This GWB is located in Co. Meath between Navan and Duleek. The area lies on the topographic boundary between the Boyne and Nanny River catchments.

The GSI classifications for the aquifers in the study area, including the principal aquifer characteristics are summarised in Table 11.2, and shown on Figure 11.4. All aquifers in the study area are bedrock aquifers; there are no gravel aquifers within the study area (i.e. a gravel deposit of greater than 1 km^2 with a saturated thickness of greater than 5 m).

Table 11-2: Summary of Aquifer Classifications & Characteristics

Aquifer Name	GSI Aquifer Classification	Groundwater Body	Transmissivity (m^2/day)
Balrickard Formation	Locally important aquifer, moderately productive only in local zones (LI)	Realtage GWB	1 – 10m^2/day

The bedrock aquifer lies within the underlying fine-grained siltstones and mudstones. The bedrock is confined or sealed by the low permeability of the overlying glacial tills (boulder clay). A pumping test undertaken during the site investigation in 2000 at MW16d confirmed these poor aquifer conditions returning less than 10 m^3/day. The aquifer classification for the site is shown in Figure 11.4.

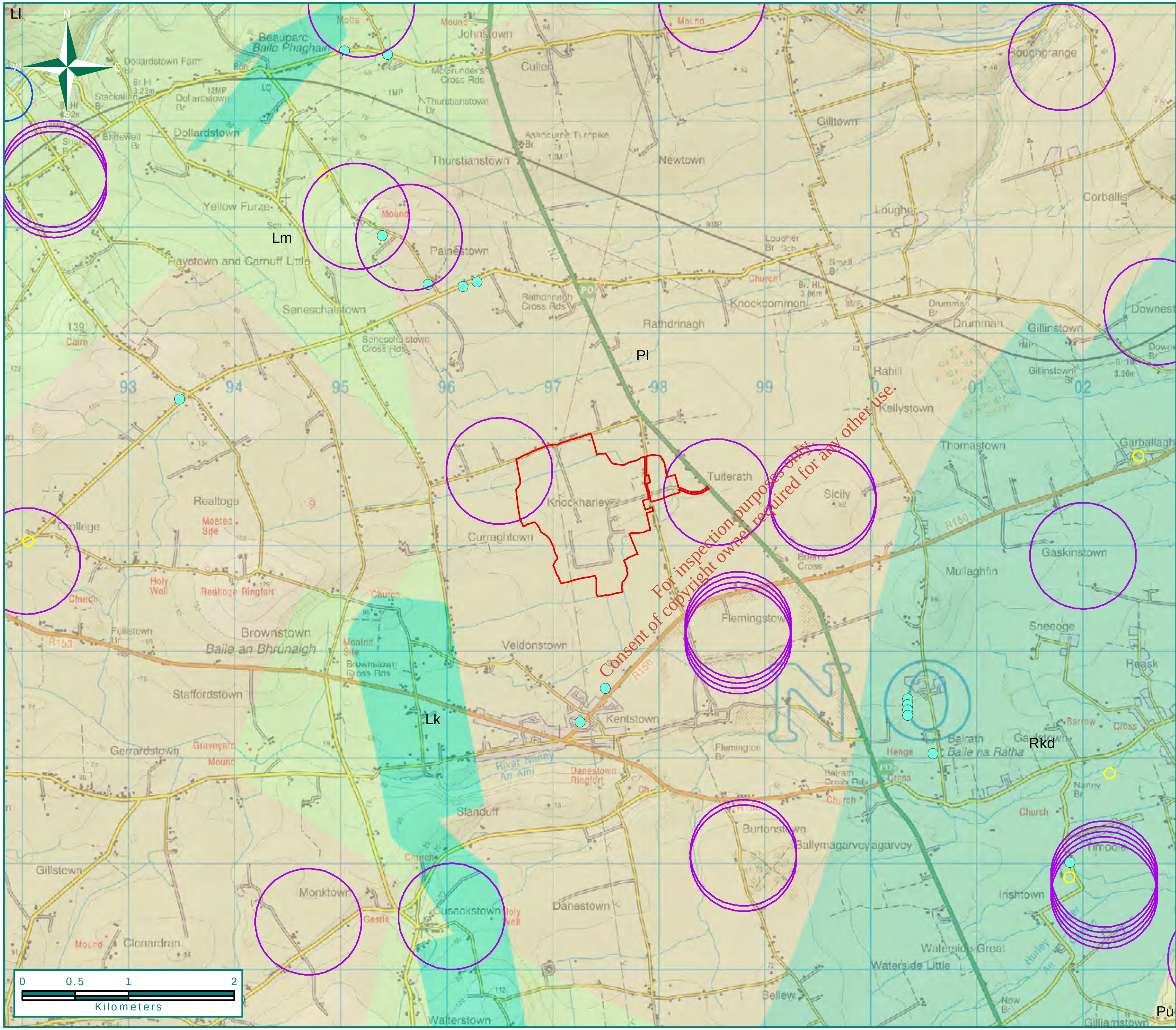
There are no groundwater-sourced drinking water protection areas within the study area. The closest drinking water protection area is the Slane Outer Protection Area located 5.75 km north of the site.

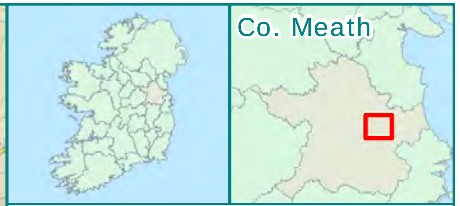
Figure 11.4 also shows the location of groundwater wells included in the GSI dataset. There may be other wells in the study area in additional to those included in the GSI dataset. The available details for these wells are summarised in Table 11.3.

Table 11.3: Abstraction Well Characteristics

BH/Spring	Yield class	Yield (m^3/d)	Use	Depth (m)	Distance from site (km)	Date
2927SWW063	Poor	27.3	-	29	0.3	1962
2925NWW033	Poor	11	-	25.9	0.9	1899
2925NWW027	Poor	32.7	-	18.3	2.1	1969
2925NWW030	Poor	32.7	-	18.6	1.4	1966
2925NWW058	Poor	-	-	-	4.2	1899
2925NWW046	Poor	21.8	Public Supply	24.4	2.9	1966

The GSI lists two wells within 1 km of the site boundary and a further seven wells within a 5 km radius of the site boundary, the majority of which are down-gradient. The well locations are presented in Figure 11.4. Both wells located within 2 km of the site are classified as having poor yields of between 11 – 29 m^3/day. The wells were drilled between 1899 and 1966 and vary in depth between 11 m and 32.7 m with poor yields of between 18 and 29 m^3/d. The known private wells are also identified in Figure 11.4. Mains water is generally available in the area, however, the GSI mapping does indicate that private groundwater wells for residents and farms are apparent.





Legend

Site Boundary

Aquifer Classification

- Lk: Locally Important Aquifer -
- Ll: Locally Important Aquifer - Bedrock Mod Productive Locally
- Lm: Locally Important Aquifer - Bedrock Generally Mod Productive
- Pl: Poor Aquifer Bedrock Generally Unproductive Except Locally
- Pu: Poor Aquifer Bedrock Generally Unproductive
- Rkd: Regionally Important Aquifer - Karstified (diffuse)
- GW Well (500m-1km Accuracy)
- GW Well (200m-500 Accuracy)
- GW Well (100m-200m Accuracy)
- GW Well (50m-100m Accuracy)
- GW Well (10m-50m Accuracy)

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Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Aquifer Classification
Figure No.	11.4
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11.3.11 Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The vulnerability of an aquifer to contamination is influenced by the leaching characteristics of the topsoil, the permeability and thickness of the subsoil, the presence of an unsaturated zone, the type of aquifer, and the amount and form of recharge (the hydrologic process where water moves downward from surface water to groundwater). Groundwater vulnerability is determined mainly according to the thickness and permeability of the subsoil that underlies the topsoil, as these properties strongly influence the travel times and attenuation processes of contaminants that could be released into the subsurface from below the topsoil. The type of recharge is also considered where indirect recharge (termed 'point recharge' in Ireland) can occur through swallow holes or sinking streams.

The GSI online groundwater data viewer classifies the site as *'Low Vulnerability'* due to the relatively thick cover of low permeability Glacial Till (boulder clay) in the area. The aquifer vulnerability of the site and surrounding area are shown in Figure 11.5.

A summary of the groundwater vulnerability for the site is presented in Table 11.4. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions highlighted based on the findings of the site investigations.

Table 11.4: Groundwater Vulnerability

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (Sand/gravel)	Moderate Permeability (e.g., Sandy soil)	Low Permeability (e.g., Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	> 3.0 m	3.0 - 10.0 m	3.0 - 5.0 m
Moderate (M)	Not applicable	>10.0 m	5.0 - 10.0 m
Low (L)	Not applicable	Not applicable	**>10 m**

The GSI's Response Matrix for Landfills combines the aquifer vulnerability, and the classification of the aquifer (Pl), to give a response for site suitability for landfills. Table 11.5 below details the response matrix for landfills under the GSI guidelines.

Table 11.5: GSI Guidelines – Response Matrix for Landfills

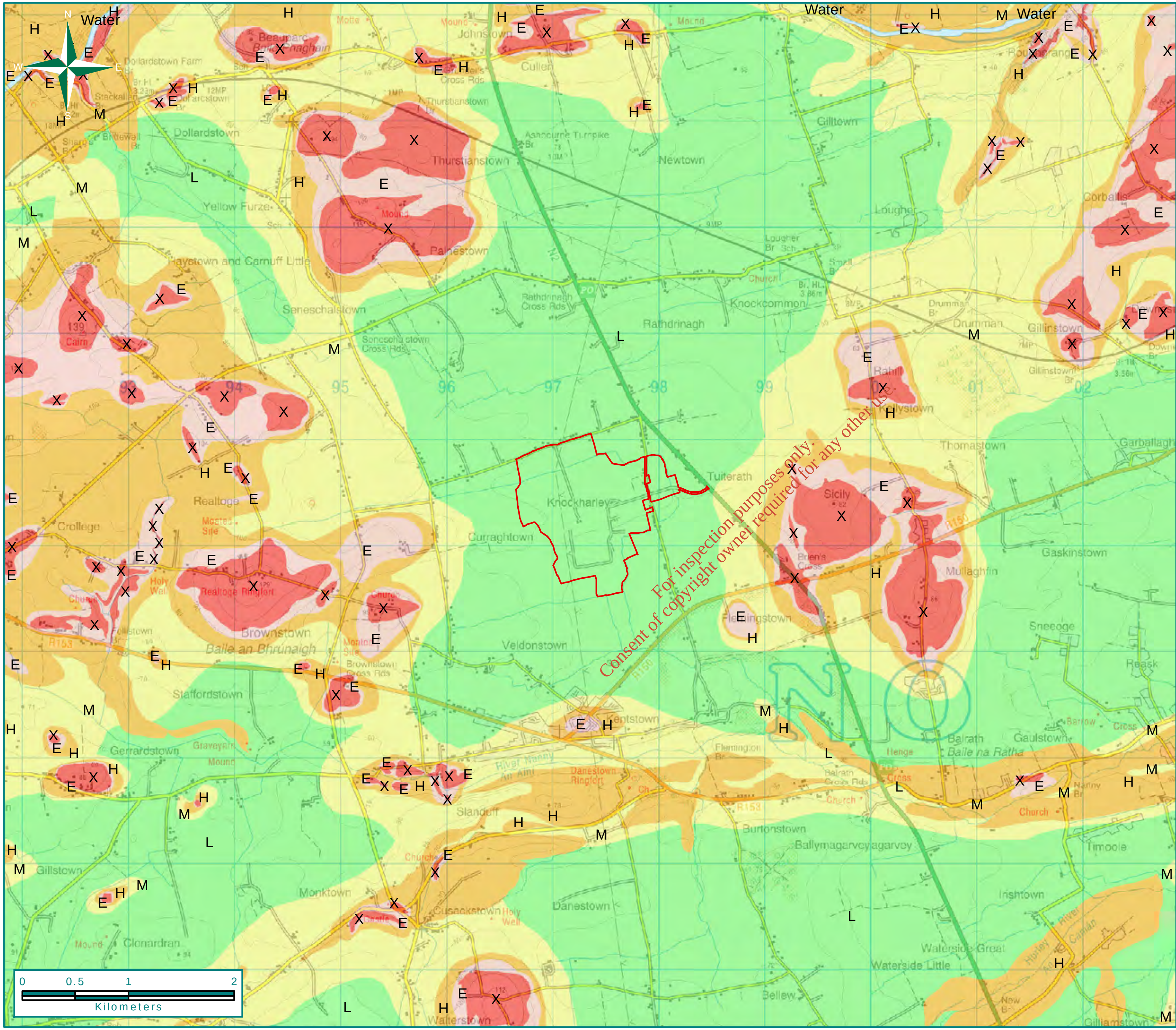
Vulnerability Rating	RESOURCE PROTECTION					
	Aquifer Category					
	Regionally Important (R)		Locally Important (L)		Poor Aquifers (P)	
	Rk	Rf / Rg	Lm/Lg	Ll	Pl	Pu
Extreme (E)	R4	R4	R3[2]	R2[2]	R2[1]	R2[1]
High (H)	R4	R4	R3[1]	R2[1]	R2[1]	R1
Moderate (M)	R4	R3[1]	R2[2]	R2[1]	R2[1]	R1
Low (L)	R4	R3[1]	R1	R1	**R1**	R1

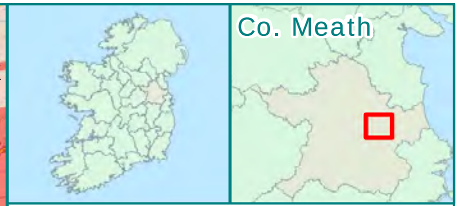
Thus, a resource protection response of R1 is adopted. That is, the landfill development is acceptable subject to guidance in the EPA Landfill Design Manual (CAREY, P et al., 2000) or (for R2[1] areas) to the following conditions of the waste licence:

a) attention to be given to the presence of high permeability zones, existing wells and future aquifer development

No high permeability zones of significance were encountered during the geotechnical site investigations from 2000 and 2016. Site investigations have confirmed thicknesses of >10m of low permeability Glacial Till deposits overlying bedrock at the site.

The existing groundwater wells on site are monitored on a regular basis in accordance with the IE licence. Furthermore, a new groundwater monitoring well has been installed as part of this development downgradient of the proposed IBA Facility and Leachate Facility and will be monitored on a quarterly basis in accordance with the IE licence. The low productivity of the bedrock aquifer excludes it from significant future development or abstractions.





Legend

Site Boundary

Groundwater Vulnerability

- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X (Rock Near Surface or Karst)

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Groundwater Vulnerability
Figure No.	11.5
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11.3.12 Water Framework Directive Status and Risk Assessment

The Water Framework Directive (WFD) (2000/60/EC) was adopted by the (then entitled) European Community in 2000. This Directive was transposed into Irish law from December 2003 by, *inter alia*, the European Communities (Water Policy) Regulations 2003, (S.I. No 722 of 2003) and subsequent amendments. The first cycle ran from 2009-2015. The Directive runs in 6-year cycles (2016-2021). A draft second cycle River Basin Management Plan was published for public consultation in August 2017 and the finalised second cycle River Basin Management Plan for Ireland 2018-2021 is in place. This plan includes measures for the projection of groundwaters.

The overriding purpose of the WFD is to achieve at least "good status" in all European waters and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The first cycle of river basin management planning, which covered the period 2009-2015, developed plans and associated programmes of measures on the basis of eight River Basin Districts (RBDs) within the island of Ireland. These plans set ambitious targets that envisaged that most water bodies would achieve good status by 2015.

This second cycle plan aims to build on the positive aspects of the first cycle and learn from those aspects which did not progress as well as expected which are summarised as three key learnings.

The proposed development site is underlain by the Realtage GWB (IE_EA_G_020) as presented in Figure 11.3. This groundwater body achieved "good status" during the later stages of the first round of assessments as updated in May 2015[1].

11.3.13 Groundwater Quality

Information obtained from the GSI Groundwater Data Viewer indicates that the groundwater in this region is expected to be soft to moderately hard with a calcium bicarbonate signature. However, monitoring of the deep boreholes on site revealed hardness (as $CaCO_3$) ranging from 250 – 382 mg/l, indicating moderately hard to hard water. Alkalinity (as $CaCO_3$) was classified as high, returning concentrations ranging from 177 to 304 mg/l. Additionally, given the presence of the underlying Balrickard Formation Aquifer, the groundwater is expected to be siliceous.

Groundwater monitoring was undertaken to establish baseline conditions for the site in 2000 prior to the acceptance of waste. Monitoring was undertaken in both shallow and deep boreholes across the site. The groundwater in the overburden is characterised by naturally elevated sodium, potassium and sulphate levels.

These, together with high manganese and low nitrate levels are indicative of reducing levels in the low permeability till. There are also some levels of cation exchange taking place, which again suggests slow groundwater movement and long resistance time.

The groundwater in the bedrock displays a similar natural groundwater signature to the overburden groundwater with elevated sodium, potassium and sulphate levels. The presence of a thick, low permeability till layer overlying the bedrock aquifer is reflected in the low total organic carbons, chloride and nitrate values. The elevated manganese levels again are a characteristic of the Namurian rock type with the reducing conditions encouraging the mobilisation of this metal in the groundwater regime.

11.3.14 Groundwater Monitoring

Groundwater quality and groundwater level monitoring has been undertaken in accordance with Schedule D of the EPA licence since 2003. In accordance with the licence, groundwater trigger levels (GTLs) were set for the site, and monitoring results are compared to those GTLs. In the event of adverse impact from the landfill activity on groundwater, it would be reflected by differences between up-gradient and down-gradient analytical results. Groundwater flows on the site from northwest to southeast. Groundwater wells MW1d, MW2d, MW3d and MW7d are located up-gradient of the landfill and MW5d, MW6d, MW16d and MW17d are located downgradient of the landfill. The locations of the monitoring wells are shown on Drawing No. LW14-821-01-P0050-001 in Volume 4 of this EIAR.

[1] EPA 2015 Water Quality in Ireland 2010 - 2012 https://www.epa.ie/pubs/reports/water/waterqua/wqr20102012/WFD_GWBStatus.xls

The groundwater monitoring laboratory results from 2011 – quarter 3 2018 are presented in Appendix 11.2, Volume 3 of this EIAR. These results have been compared to site GTL's and the overall threshold values (OTVs) from the European Communities Environmental Objectives (Groundwater) Regulations 2010 as appropriate.

Quarterly field parameters (pH, electrical conductivity, dissolved oxygen) have remained stable overall and within normal values for groundwater. The laboratory results have indicated that elevated ammoniacal nitrogen levels are present in almost all the wells. While occasionally they exceed the OTV for groundwater, the trigger level has never been exceeded. Given that the higher ammonia values are in up gradient wells (MW-1d and MW-7d) any such elevated levels are not associated with the landfill and are attributable to the naturally occurring reducing conditions. Chloride has remained stable and below trigger levels during the monitoring period.

Iron was above site trigger levels in 2012, 2013, 2014 across all wells on site and above site trigger levels at well MW2D in Q2 2015. However, it has remained below site trigger levels at all wells in the remainder of the period. Elevated iron levels can often occur due to groundwater movements through geological formations. Furthermore, sodium has remained stable and below site trigger levels.

Potassium had slight exceedance of at screening criteria at MW1d and MW3d on several occasions, but both are up-gradient of the landfill. The results were otherwise below the site trigger levels.

Total Oxidised Nitrogen and Total Organic Carbon have remained stable and low across all wells on site. Phenol results were below the laboratory limit of detection (LOD), while coliforms (faecal and total) results were variable for this period but have been detected historically at all wells on site.

For annual parameters, whilst variations were noted for metals, they have remained relatively stable and most results were recorded at low levels or below the laboratory LOD for the period. Results overall in up gradient and downgradient wells remained relatively stable. Pesticides overall have remained at low levels or below the laboratory LOD during the annual rounds 2011-2018.

Based on the results from 2011-2018, similar concentrations across all parameters tested were detected in both the up-gradient and down-gradient boreholes, therefore indicating that site activities are not impacting on the groundwater quality.

A new groundwater monitoring well was installed in August 2016, as part of the site investigation works (MW17d). It is located downgradient of the proposed IBA Facility. Quarterly monitoring of baseline conditions commenced in Q3 of 2017 and will be included in the amended licence for the site. To date, all parameters tested under the sample testing schedule have remained stable overall and within GTL's set for the site and OTV limits for groundwater quality.

A groundwater risk assessment was completed in February 2015 which assessed the landfill design and construction, including remedial measures, the type and age of the waste, the geological and hydrogeological conditions and any sensitive receptors.

This investigation concluded there was no evidence that the landfill has impacted on groundwater quality down gradient of the site and the engineered landfill liner and 10-20m of low permeability subsoil provide sufficient protection to ensure that the groundwater resource, albeit of limited value, is protected from future impacts.

11.3.15 Material Balance, Storage and Re-Use

The quantities of material to be excavated and utilised for the proposed Knockharley Landfill are presented below in Table 11.6.

Table 11-6: Proposed Excavation and Filling Volumes

Proposed Development	Development Stage	Cut Volume (m^3)
MSW Cells	Phase 5: Cell 17 - 20	285,897
	Phase 6: Cell 21 - 24	209,521
	Phase 7: cell 25 - 28	165,673
	Additional Cut for Cell Liner	122,871
IBA Facility	IBA Cells 29 - 33	153,316
	Additional Cut for Cell Liner	60,067
Biological Treatment Plant	Building Plan & Hardstanding Area	38,628
Leachate Plant	Lagoons & Leachate Holding Tanks	41,394
Surface Water Attenuation Pond & Holding Pond	Lower Pond 1 & Upper Pond 2	40,128
Wetlands	Low lying area below Lower Pond 1	7,980
	Total Cut Volume	**1,125,475**
Proposed Development	**Development Stage**	**Fill Volume (m^3)**
Screening Berms	10 m Eastern Berm	217,910
	6 m Eastern Berm	12,755
	Western Berm	513,107
	Total Fill Volume	**743,772**

The total quantity of soil to be excavated for the development of the proposed MSW landfill, IBA Facility, Attenuation Pond and Holding Pond, Biological Treatment Facility, Leachate Facility and ancillary services is estimated to be approximately 1,125,475 m^3.

The total quantity of overburden material required for the construction of the proposed screening berms is estimated to be approximately 743,772 m^3.

The estimated volume of available overburden material from the development of MSW Cells 17 - 28 and the IBA Facility is outlined in Table 11.7 over. Note, the quantity of suitable recoverable Clay material for lining is based on a 40% reduction of the recovered volume.

Table 11-7: Estimated Overburden & Boulder Clay Recovery

Development Phase	Cells	Overburden Volume (m³) above 4.0m bgl	Overburden Volume (m³) below 4.0m bgl	Volume (m³) suitable for use in lining
MSW Phase 5	17	35,102	45,148	18,059
	18	35,102	45,148	18,059
	19	35,102	45,148	18,059
	20	35,102	45,148	18,059
MSW Phase 6	21	35,107	26,050	10,420
	22	35,107	26,050	10,420
	23	35,107	26,050	10,420
	24	35,107	26,050	10,420
MSW Phase 7	25	35,113	15,084	6,033
	26	35,113	15,084	6,033
	27	35,113	15,084	6,033
	28	35,113	15,084	6,033
Total	17 – 28	421,288	345,125	138,050

Development Phase	Cells	Overburden Volume (m³) above 3.0m bgl	Overburden Volume (m³) below 3.0m bgl	Volume (m³) suitable for use in lining
IBA Facility	29	18,020.10	3,318	1,327
		18,020.10	3,318	1,327
	30	18,020.10	3,318	1,327
		18,020.10	3,318	1,327
	31	18,020.10	3,318	1,327
		18,020.10	3,318	1,327
	32	18,020.10	3,318	1,327
		18,020.10	3,318	1,327
		18,020.10	3,318	1,327
Total	29 – 32	144,161	26,546	10,618
Total	MSW + IBA	565,449	371,671	148,668

Engineered Clay Liner

As can be seen in Table 11.7, the quantity of suitable Boulder Clay material for the engineered clay liners, following a conservative 40% reduction factor for aggregate screening, returns a potential recoverable volume of 148,668 m^3. Preliminary calculations show approximately 153,375 m^3 of suitable Glacial Till will be required for the engineered clay liners at both MSW and IBA areas.

The above conservative estimate indicates a volume shortfall of 4,707 m^3 may arise during the recovery process. Therefore, a requirement to import the remaining Clay liner material to satisfy this shortfall may be needed. It should be noted that the re-use potential of the recovered Glacial Till will be subject to further in-situ testing before being placed in layers and compacted to 95% maximum dry density.

Capping

The quantity of overburden material required for capping the MSW and IBA cells is estimated to be approximately 148,850 m^3. Future permanent capping will continue on a phased basis during the development of the IBA and MSW cells where suitable capping material will be recovered.

Table 11.8 outlines the capping and clay liner requirements for the MSW Cells and IBA Facility.

Table 11-8: Proposed Capping and Clay Liner Requirements

Development Stage	Development Stage	Net Volume (m^3)
MSW Cells 17 - 28	Capping	94,789.80
	Engineered Clay Liner	105,322.00
IBA Facility	Capping	54,060.30
	Engineered Clay Liner	48,053.60

Stockpile Survey 2018

An updated topographical survey was completed in January 2018 of the existing overburden stockpile located in the north-western portion of the site. The results of the survey indicate approximately 20,886 m^3 of soil material remain available for use as capping or developing the screening berms.

Screening Berms

The proposed perimeter screening berms will be constructed using excavated overburden material from the proposed development areas.

Table 11.9 below summarises the overburden material balance available for developing the screening berms.

Table 11-9: Proposed Capping and Clay Liner Requirements

Development Stage	Net Volume (m^3)
MSW Cells 17 - 28	565,449
IBA Cells 29 - 32	
Biological Treatment Plant	128,130
Leachate Facility	
Surface Water Attenuation Pond and Holding Pond	
Wetlands	
2018 Stockpile Survey	20,886
Total	**714,465**

The overburden balance in Table 11.9 presents a total overburden volume of 714,465 m^3.

Of the recovered overburden material available, 148,850 m^3 will primarily be used as capping for the proposed MSW and IBA cells. Deducting the capping volume required, the quantity of overburden material available for developing the screening berms is estimated to be approximately 565,615 m^3.

Overall, the material balance indicates a shortfall of approximately 178,175 m^3 will be encountered when assessed against the proposed screening berm design. In view of the shortfall identified, FT has considered the following options with respect to berm construction:

- In the event of a need for future cell development, an opportunity is presented to place recovered overburden in the locations where a shortfall is identified;
- Reduce the scale of the western screening berm volume.

Phasing & Material Use:

Overburden to a maximum depth of 4.0 m bgl will be recovered from the excavation of the MSW & IBA areas and will be used for construction and landscaping the screening berms along the western and north-east boundaries of the site. Engineered Clay Liner material will be won from the underlying Glacial Till excavated from approximately 3m to 7.0m bgl during development of the MSW Cells and IBA areas to form the engineered clay liner for both developments.

The construction works phasing for the proposed landfill development will progress in sequence through 4 no. separate phases (Phase 1 to Phase 4) and will involve a combination of cutting and filling measures.

Each phase of material removal and the materials end-use is detailed below in Table 11.10. Note, phasing is assumed to proceed in 2-year intervals subsequent to planning approval.

All recovered overburden will be directed to the screening berms in a phased sequence referenced Berm A to Berm E. The screening berm layout and material phasing is illustrated Drawing LW14-821-01-P-0050-011, Volume 4 of this EIAR. Final berm heights may vary to below the maximum 10.0m level subject to volumes of surplus material recovered during the works.

Table 11-10: Construction Phasing Sequence

Construction Phase	Development Stage	Cut Volume (m^3)	Area of development (m^2)	Volume of Overburden (m^3)	Volume of Boulder Clay (m^3)	Material Re-Use	
						ECL Volume (m^3)	Screening Berms (m^3)
Phase 1 (Year: 0, 1 & 2)	MSW: Cell 19 & 20	160,500	17,551	70,204	90,296	36,118	70,204
	MSW: Cell 21 & 22	122,314	17,554	70,214	52,100	20,840	70,214
	MSW: Cell 28	50,197	8,778	35,113	15,084	6,033	35,113
	IBA: Cell 29 & 1/2 of 32	64,015	18,020	54,060	9,955	3,982	54,060
	Biological Treatment Plant	32,308	16,160	32,308	-		32,308
	Leachate Lagoon L3	9,314	4,657	9,314	-		9,314
	Leachate Treatment Yard	2,000	2,500	2,000			2,000
	Surface Water Attenuation Pond and Holding Pond	40,131	13,200	40,131	-		40,131
	Wetland	7,980		7,980			7,980
					Total Volume	**66,973**	**321,321**
Phase 2 (Year: 3 & 4)	MSW: Cell 24, 26 & 27	161,550	26,333	105,333	56,217	22,487	105,333
	MSW: Cell 17 & 18	160,500	17,551	70,204	90,296	36,118	70,204
					Total Volume	**58,605**	**175,537**
Phase 3 (Year: 5 & 6)	MSW: Cell 23 & 25	111,354	17,555	70,220	41,134	16,453	70,220
	IBA: Cell 30	42,677	12,013	36,040	6,636	2,655	36,040
					Total Volume	**19,108**	**106,260**
Phase 4 (Year: 7 & 8)	Leachate Lagoon L2 & L4	30,080	15,040	30,080	-	-	30,080
	IBA Cell 31, 1/2 of 32	64,015	18,020	54,060	9,955	3,982	54,060
					Total Volume	**3,982**	**84,140**

*Note: ECL - Engineered Clay Liner

11.4 Potential Impacts

The main characteristics of the proposed Knockharley Landfill development that could impact on soils, geology and hydrogeology in the absence of mitigation are:

1. Construction and operation of new dedicated cells for the acceptance and placement of non-hazardous incinerator bottom ash (IBA), until the cells are full.
2. Construction and operation of a biological treatment facility.
3. Expansion of the existing leachate management infrastructure comprising plant, storage tanks and lagoons, and associated ancillary equipment, for leachate treatment/conditioning prior to off-site treatment.
4. Development of screening berms along the western, southern and north-eastern flanks of the site to a maximum height of 10 m.
5. Development of a surface water attenuation pond, holding pond, compensatory flood plain and wetland and associated drainage infrastructure.
6. Overburden topsoil and subsoil excavation / reuse.
7. Temporary material storage areas.
8. Felling and re-planting of trees (as per normal commercial forestry lifecycle).
9. Relocation of an existing 20 kV ESB powerline to facilitate screening berm development.

The material balance will be managed by the creation of screening berms.

Mitigation measures to minimise these potential impacts are described in the following section.

11.4.1 Do Nothing Impact

If the proposed development were not constructed, it is likely that the facility will continue to operate as a landfill as permitted. The impact on the land, soils, geology and hydrogeology would remain largely unaltered as a result.

11.4.2 Impact Appraisal Methodology

The following elements of the development were examined to determine the potential impacts on the soils, geology and hydrogeology underlying the site:

- characterisation of the soils, geology and hydrogeology of the site
- evaluation of the risks and potential impacts of the proposed development

The following sections detail the potential impacts that have been identified from the appraisal methodology presented above. Appropriate mitigation measures are then proposed to avoid or adequately mitigate these impacts.

11.4.3 Assessment of Significance of Impact on the Receiving Environment

An impact rating has been developed for each of the phases of the proposed development based on the IGI Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013). In line with IGI Guidance the receiving environment (Geological Features) was first identified, then the importance of the geological features is rated (Table 11-10) followed by an estimation of the magnitude of the impact (Table 11-11). This determines the significance of the impact prior to application of mitigation measures as set out in Table 11.12.

Table 11.11: Importance Rating Site Attributes of Soils, Geology and Hydrogeology (NRA, 2008)

Importance	Criteria
Extremely High (Hydrogeology only)	Attribute has a high quality or value on an international scale.
Very High	• Attribute has a high quality, significance or value on a regional or national scale. • Degree or extent of soil/ groundwater contamination is significant on a national or regional scale. • Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale.
High	• Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. • Volume of peat and/or soft organic soil underlying the site is significant on a local scale.
Medium	• Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. • Volume of peat and/or soft organic soil underlying the site is moderate on a local scale.
Low	• Attribute has a low quality, significance or value on a local scale. • Degree or extent of soil contamination is minor on a local scale. • Volume of peat and/or soft organic soil underlying the site is small on a local scale.

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The rating criteria for soil, geological and hydrogeological impacts are defined as set out in Table 11.11.

Table 11.12: Estimation of Significance of Impact on Soils, Geological and Hydrogeology (TII/NRA, 2008)

Magnitude	Criterion
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity
Minor Beneficial	Results in minor improvement of attribute quality
Moderate Beneficial	Results in moderate improvement of attribute quality
Major Beneficial	Results in major improvement of attribute quality

The matrix in Table 11.12 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Tables 11.10 and 11.11.

Table 11.13: Ratings of Magnitude of Significant on Soils, Geology and Hydrogeology (NRA, 2008)

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High (Hydrogeology only)	Imperceptible	Significant/ Moderate	Profound/Significant	Profound
Very High	Imperceptible	Significant/ Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

11.4.4 Potential Impacts During Construction

The characteristics of the proposed development that could pose potential impacts to soils, geology and hydrogeology in the absence of mitigation are outlined in this Section. In general, the potential impacts on soils and geology typically associated with cell construction include slope stability, excavation of soils for the various proposed infrastructure, use of concrete for foundations, use and storage of fuels presenting a contamination risk and erosion of soils exposed during earthworks and tree felling/replanting.

11.4.4.1 Construction Impacts on Soils and Geology

The following on-site activities have been identified as the sources of potential risks to soils and geology from the development:

Forestry Felling

The forestry in Knockharley is commercial forestry and will be felled and replanted as per the normal commercial forestry cycle regardless of the proposed development.

The proposed development includes the development of screening berms of the northern and western boundaries of the site and to facilitate it, felling is required. The berms will be replanted.

Forestry felling, if not properly mitigated, could cause or contribute to ground condition instability due to ground vibration and ground loading from tree felling equipment. However, given the relatively flat topography of the proposed felling area and the absence of peat ground conditions, the potential impact of forestry felling on soils and geology is considered to be minimal. Appropriate specific mitigation measures will nonetheless be implemented in respect of forestry felling, to minimise any potential for impacts on geology, including best practice felling methodologies and monitoring.

Overburden Excavation

The potential impact to soils and geology is limited to the excavation and removal of topsoil and subsoil during the construction phase of the IBA Facility, northern Surface Water Management infrastructure, leachate management facility, biological treatment facility and ancillary infrastructure including roads, drainage, etc. The development of the IBA facility will involve a significant amount of excavation works comprising the removal of till material to a depth of approximately 7.0m BGL across an area of 57,829m^2 (excluding 'wedge' infill).

Direct impacts additional to the excavation of materials which may occur during the construction of the proposed development include:

- Soil erosion as a result of earthworks, excavations and temporary storage of excavated materials represents a potential source of impact. Control of both erosion and sediment entrainment in runoff will be a key undertaking for the duration of the project.
- Use of construction plant and associated use and storage of fuels and hydrocarbons with potential for spills or leaks could cause soil and groundwater contamination. Depending on the size of the spillage, unmitigated, a fuel spill has the potential to require intervention to remove contamination which includes the removal of soils to a disposal unit which is licenced for to accept this waste.
- Excavated soils can become exposed to erosion from wind and rain which, if unmitigated, this may lead to breakdown of the soils and in the case of excavated cohesive soils may lead to them changing from acceptable soils for re-use (e.g. engineered clay liner) to unacceptable soils which require use on screening berms or possibly disposal.

Clay barrier material will be won from underlying boulder clays excavated from the MSW and IBA cells. Boulders within the excavated clay will be removed via screening and engineered clay will be placed in layers and compacted to 95% maximum dry density.

Furthermore, the overburden will be excavated to varying depths in the areas for the ancillary facilities and their associated services such as the biological treatment facility, leachate treatment plant, leachate lagoons and surface water attenuation pond and holding pond. This will expose the underlying glacial till to erosion from storm water run-off at active areas of the site.

The movement and management of the excavated material will be a major operation with the excavated soils and till stored and reused for screening berms and landscaping onsite and as capping material. The material excavated on site should be sufficiently segregated and stockpiled for reuse.

Soil compaction may occur due to movement of construction and maintenance traffic. This will occur particularly within areas of topsoil which are highly compressible. This could lead to an increase in runoff and subsequently to an increase in erosion.

The magnitude of these potential impacts, prior to mitigation, is considered to be of moderate significance.

11.4.4.2 Construction Impacts on Hydrogeology

A significant proportion of the glacial till will be removed during the construction phase of the proposed development.

This may result in the exposure of the weathered bedrock to sources of contamination and may temporarily increase the vulnerability of the aquifer whether or not the rock is exposed. However, given that 10m - 15m of glacial till is present below the site the impact is unlikely to occur.

If the proposed IBA cells and ancillary infrastructure are not constructed and operated in accordance with the IE licence conditions', there is potential for groundwater contamination as a result of leachate contamination. The proposed development will be designed in accordance with EPA guidance, best practice and best available technique reference notes (BREF) and will be subject to EPA approval prior to construction and CQA and EPA approval of same post construction prior to operation. It is described in Chapter 2 of Volume 2 of this EIAR.

Dewatering may potentially be required during the construction stage if high groundwater is encountered during excavation. There will be no direct impacts on hydrogeology as a result.

Chemical pollution may occur in the absence of mitigation as a result of spillage or leakage of chemicals, runoff from vehicle washing facilities, unset concrete, storage of fuels or refuelling activities etc.

The construction works may impose hydrogeological impacts in the absence of mitigation by modifying the natural seepage of the soils, which may deprive ditches and streams of their natural supply of water which may lead to a reduced baseflow and reduced recharge to the bedrock aquifer.

The excavation into the glacial till will result in some local lowering of the shallow subsoil water table and the piezometric surface in the bedrock. However, these groundwater levels will revert to the pre-construction situation when there is no longer a requirement to manage the level of the shallow overburden water table within the footprint area.

The construction of additional drainage channels and other infrastructure may result in localised drawdown of the water table and, where gravel is used during construction, may also result in localised preferential drainage pathways. The changes in the drainage regime may also result in changes to the moisture content of the soils which may have implications for ecology (described in Chapter 10 Biodiversity), sediment transport, flooding and erosion (described in Chapter 12 Surface Water Quality and Drainage).

The magnitude of these potential impacts, prior to mitigation, is considered to be of slight significance.

11.4.5 Potential Indirect Impacts During Construction

Minor amounts of granular material may be required for the construction of the biological treatment facility, leachate treatment plant and construction & maintenance of new site tracks during operation which will place intermittent minor demand on local quarries. Concrete works required for the biological treatment facility and leachate treatment plant will typically require local excavations, drainage and suspended solids management for dig and concrete pours and into which structures will be built requiring placement of blinding, shutters, reinforcement and final concrete pour.

Dewatering may potentially be required during the construction stage if high groundwater is encountered during excavation. In the absence of mitigation, there could be an indirect impact on local stream levels of groundwater wells.

11.4.6 Potential Cumulative Impacts During Construction

The surrounding area predominantly comprises agricultural farmland with no other significant industries identified. Furthermore, given the resultant moderate / slight significant impact of the potential development, there would be no cumulative impact on the geology and hydrogeology of the site.

There may be indirect cumulative impacts in terms of demands placed on local quarries for aggregate and concrete required during the construction phase of the development.

As a result, the proposed development at Knockharley Landfill is not expected to contribute to any significant, negative cumulative effects with other existing or proposed developments in the vicinity. The effective implementation and efficacy of the mitigation measures will prevent a significant release of silt into the receiving watercourses and/or the avoidance of spills/leaks. In these circumstances, any effects on the receiving environment would be negligible.

11.4.7 Summary & Discussion of Potential Direct Impacts During Construction

The following construction stage potential impacts for the proposed development are summarised below:

Soils and Geology

- Possible contamination, by leakage and spillage of soil, may occur from mobile plant and associated equipment during the construction phase only, where soil is excavated and transported to another area. This may lead to contamination of surface water features with increased concentrations of suspended solids.
- Transfer of suspended solids in natural water courses leading to siltation of stream beds with subsequent implications for fauna and flora as well as increased flood risk.
- Movement of construction traffic or construction of temporary access roads may lead to compaction of the soil reducing soil permeability and rainfall infiltration. This could lead to an increase in run-off and a subsequent increase in erosion.

Hydrogeology

- During the construction stage there is potential for contamination of groundwater from spillages of fuels and lubricants from construction machinery.
- During the construction phase, there may be a requirement for dewatering of excavations. This may have an indirect effect on groundwater levels in the immediate area.

11.4.8 Potential Impacts during Operation

11.4.8.1 Potential Direct Impacts

Very few potential direct impacts are envisaged during the operational phase of the development. By virtue of the design standards required, and the operational conditions of the licence, the potential for an uncontrolled direct impact is unlikely. The potential impacts in the absence of mitigation are related to the risk of accidents which include:

- Control of leachate impact on the hydrogeology include leachate minimisation and leachate containment using the in-situ composite liner system.
- Some construction traffic will be necessary for maintenance plus normal operational traffic which could result in minor accidental leaks or spills of fuel/oil.
- Storage of fuels on site and refuelling of vehicles.
- Uncontrolled leachate breakouts from the waste body or holding ponds
- A spill during leachate transport off site.

11.4.8.2 Potential Cumulative Impacts

No cumulative impacts are envisaged during operation with respect to impacts on the surrounding geological and hydrogeological environment outside of the site boundary.

11.4.9 Potential Impacts during Decommissioning

The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

11.4.10 Summary of Potential Impacts

A summary of unmitigated potential impacts on soils, geology and hydrogeology due to the proposed development is provided in Table 11.13 over. The sensitivity of the environments is based on the perceived importance of the receptor on a local, national or international scale as discussed in Section 11.4.2.

Table 11-14: Summary of Potential Impact Significance on Soils, Geology and Hydrogeology

Activity	Potential Impact	Attribute	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Excavations for IBA cells, site roads, bio-plant, leachate plant surface water management infrastructure and sub-station construction. Tree felling and replanting	Removal of material, soil compaction, increased runoff causing erosion, and possible contamination.	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor aquifer.	Medium	Small Adverse	Moderate/ Slight
Construction of cells, lagoons, tanks and ponds	Slope failure	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer	Medium	Small Adverse	Moderate/ Slight
Construction of hardstanding areas and access roads.	Removal of material, soil compaction, increased runoff causing erosion, and possible contamination.	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible
Operation Phase					
Screening berms, IBA Facility, Trafficking	Erosion and sedimentation if not managed appropriately	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible
Leachate management	Groundwater contamination	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible

11.5 Mitigation Measures

The following section outlines appropriate mitigation measures to avoid or reduce the potential impact of the proposed development.

11.5.1 Mitigation by Design and Best Practice

With regard to the proposed development, detailed design best practice will be implemented as follows:

- The proposed waste infrastructure will be designed in accordance with best practice and subject to EPA approval prior to construction and subject to CQA and approval of such by EPA prior to operation (Refer Chapter 2 of Volume 2 of this EIAR).
- The works will be designed and checked by a geotechnical and civil engineer, suitably qualified and experienced in cell design, construction and operation.
- Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to evaluate risk levels for the construction, operation and maintenance of the works. Identified risks will be minimised by the application of principles of avoidance, prevention and protection. Information on residual risks will be recorded and relayed to appropriate parties
- A method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The surface water management infrastructure will be constructed in the northern catchment prior to any other construction works to mitigation potential impacts on hydrogeology.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.
- Historically groundwater has required drainage systems below the cell liner systems to intercept such groundwater as may be present. Typically groundwater from the Knockharley site has been present in sand lenses within the boulder clay and flow rates are historically very low. In the event such groundwater is encountered it will be pumped and directed to the existing attenuation ponds as is presently the case or to the proposed northern attenuation pond. Historic evidence shows that groundwater pumping has little if any influence on surrounding groundwater elevations.

11.5.2 Mitigation Measures During Construction

The following sections outline appropriate mitigation measures to avoid or reduce the potential impact of the proposed development.

11.5.2.1 Outline Construction Environmental Management Plan

The Outline Construction Environmental Management Plan (CEMP) to be adopted during the construction phase is provided in Appendix 2.0 of Volume 3 of this EIAR. The Outline CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development. The CEMP describes how the contractor for the main construction works will implement a site Environmental Management System (EMS) on this project to meet the specified contractual, regulatory and statutory requirements and environmental impact statement mitigation measures.

All site personnel will be required to be familiar with the environmental management plan's requirements as related to their role on site. The plan describes the project organisation, sets out the environmental procedures that will be adopted on site and outlines the key performance indicators for the site.

- The CEMP is a controlled document and will be reviewed and revised as necessary.
- A copy of the CEMP will be located at the site office.

- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the CEMP and its contents.

11.5.2.2 Excavation, Storage and Removal of Subsoils

The development will be constructed in a phased manner to reduce the potential impacts of the development on the soils and geology. Phased construction reduces the amount of clearing and soil excavation required at any one time.

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of soil excavation. Excavated overburden soils will be reused as far as possible. This will include:

- Use of suitable impermeable material for the engineered clay barrier.
- Constructing screening berms to mitigate nuisance and visual impacts on adjacent sensitive receptors.
- Facilitate final capping of the landfill cells and IBA cells

Some temporary stockpiles (not exceeding 2 m in height) of material may be necessary to facilitate capping works, however no permanent stockpiles of material will remain after construction and it is not proposed to remove waste soil or rock from site.

Although the removal of topsoil and vegetation exposes soil to erosion from surface water run-off at active areas at the site, practices are already in place to protect the soil from erosion. Drainage of surface water is incorporated into the site design. This will divert storm water runoff away from the working area. Storm water run-off is directed and will continue to be directed to the existing and proposed attenuation pond / holding pond and wetlands prior to discharge. Weekly measurements will continue to monitor the quality of the discharge. Chapter 12 'Surface Water Quality and Drainage' discusses surface water issues in more detail.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the exposed bedrock/aquifer, refueling of machinery and plant will only occur at designated refueling areas. Refueling will be conducted from refueling trucks with drip trays and spill kits available. A designated refueling area will be located at the site compound.

If dewatering of excavations is required, monitoring of groundwater supplies within an appropriate radius of the excavation will be carried out. If there is evidence of lowering of local water supplies, alternative arrangements will be made.

11.5.2.3 Control of Sediment & Nutrient Loading

The soil stability will also be assessed at site-specific locations particularly at stockpile, screening berms and stream bank locations where earthworks are proposed. Best practices will be employed in the prevention of silt laden run-off from entering watercourses.

Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations:

a. all stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary.
b. all open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond.
c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.

11.5.2.4 Attenuation Ponds & Screening Berms

Screening berms will be constructed on a phased basis concurrent with overburden recovery from cell excavation works. Prior to berm installation, top soil will be stripped back, formation compacted, and soils as may become available placed and compacted in layers. Layers will be overfilled and once berms are at the final height is reached will have side slopes profiled receive and allow subsequent placement of topsoil, seeding and tress as required.

The proposed development will require the construction of an additional surface water attenuation pond / holding pond north of the IBA facility to cater for the expected increase in run-off from this area and from the run-off from the northern end of the landfill.

To minimise erosion impacting storm water, storm drainage will be installed prior to bulk earth moves with silt fences and temporary settlement ponds placed around screening berms and pond banks until such time as a vegetation cover has become established. Further details of the surface water mitigation measures are discussed in Chapter 12.

Prior to earthworks taking place temporary haul roads will also be installed.

11.5.2.5 IBA Cells

Overburden will be removed and placed in screening berms. Clay barrier material will be won from underlying boulder clays excavated to form cells. Boulders within the excavated clay will be removed via screening and engineered clay will be placed in layers and compacted to 95% maximum dry density.

A ground water drainage system will be installed to accommodate prevailing site conditions upon which the engineered clay barrier will be installed and compacted to 95% maximum dry density.

11.5.2.6 Measures for Spills

Detail of oil spill protection measures adjacent to a watercourse are outlined in Appendix 2.0 of Volume 3 of this EIAR which outlines the proposed Outline CEMP.

Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site. Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.

All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s). Emergency Silt Control and Spillage Response Procedures are contained within the Outline CEMP.

11.5.2.7 Slope Stability

With regard to slope stability issues, detailed design best practice will be implemented as follows:

- The works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.
- A Outline CEMP accompanies this EIAR. Prior to construction the CEMP construction will be finalised, which will incorporate all measures set out in the Outline CEMP and other measures required on foot of conditions attached to any grant of permission.
- Identified risks will be minimised by the effective implementation of the measures identified in the EIAR and the Outline CEMP, which will be reviewed and finalised prior to commencement of construction.
- A method statement for each element of the works will be finalised prior to any element of the work being carried out. A draft of the methods is provided in the Outline CEMP and will be reviewed and finalised prior to commencement of construction.
- The CEMP for construction will place emphasis on the regular checking of equipment, temporary stockpiles, as well as drainage structures and their attenuation ability by suitably qualified and experienced staff.

- Excavation works will be monitored by suitably a qualified and experienced geotechnical personnel.
- The programming of the works (by the Contractor) will be such that earthworks are not scheduled to be carried out during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.

11.5.2.8 Mitigation Measures for Groundwater

Groundwater protection related to Intensification of MSW landfilling & IBA cells, stormwater attenuation and holding ponds, leachate management facility and biological facility are discussed below:

Cell Development

All cells, whether in the permitted landfill development or proposed IBA Facility, will require a composite lining in accordance with the Landfill Directive for non-hazardous cells. This requires a 2 mm HDPE barrier overlying a 1.0m clay barrier k= $1*10^{-9}$ m/s or equivalent. This requirement is also conditioned in the current IED licence for the facility.

Surface Water Lagoons

Surface water lagoon and the holding pond will be constructed using a similar lining system as the cells comprising a 2 mm HDPE barrier overlying a 1.0m clay barrier k $1*10^{-9}$ m/s or equivalent, albeit that lining systems may have additional cover systems using soil, concrete or other to facilitate maintenance and or safety criteria as required during detailed design.

Storage Systems

The section applies to all storage facilities (leachate lagoons, bunded containment associated with proprietary leachate treatments as may be required).

All above ground tanks for leachates or other treatment related products will be bunded to contain a minimum storage volume in accordance with Agency guidance[2] to be not less than the greater of:

- 110% capacity of the tank within the bunded area, or;
- 25% of the total volume of the substance stored within the bunded area.

This is to facilitate containment of contents of one or more tanks in the event of a tank failure. All tanks will have covers to prevent rainfall ingress.

Below ground tanks will be surrounded with a 1.0m clay barrier k $1*10^{-9}$ m/s or equivalent.

Below ground lagoons (leachate, holding pond or attenuation pond) will be constructed using a composite lining system comprising a 2 mm HDPE barrier overlying a 1.0m clay barrier k $1*10^{-9}$ m/s or equivalent. All below ground lagoons will have floating covers to prevent rainfall ingress.

Refuelling During Construction

Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling will be carried out from these tanks or from delivery vehicles at a designated refuelling area. There will be a designated refuelling area at the site compound. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005);

- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction compound and in each item of plant to deal with any accidental spillage.

11.5.3 Mitigation Measures During Operation

Current measures employed at the site to control leachate impact on the hydrogeology include leachate minimisation and leachate containment using the in-situ composite landfill liner system. Therefore, the risk of leachate reaching the bedrock is considered negligible. Furthermore, groundwater monitoring undertaken at the site in accordance with the licence will continue to monitor measures for the protection of groundwater in the area.

Although the overburden water table will be depressed by drainage and/or pumping during cell construction, this is a temporary measure during construction. In the long-term, post closure, the piezometric level will be allowed to rise to natural levels which are likely to be above the cell base level. The groundwater monitoring programme, as set out in the licence, will continue to assess groundwater quality at the site.

The emergency response procedures in place under the licence also address possible spillages. Corrective Action Procedures on the site ensure that any non-compliance with the waste licence are investigated and corrected and that measures are put in place to remedy and prevent reoccurrence of the non-compliance.

To mitigate against possible contamination of the exposed bedrock / aquifer, refuelling of machinery and plant during operation of the facility will only occur offsite or in specially designated areas such as site compounds, using designated refuelling bowsers.

All temporary cuts / excavations will be carried out such that they are stable or adequately supported. Unstable temporary cuts / excavations will not be left unsupported.

Temporary cuts and excavations will be protected against the ingress of water or erosion. Temporary works will be such that they do not adversely interfere with any existing drainage channels.

11.5.4 Mitigation Measures during Decommissioning

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures in Section 11.5.2.

11.6 Residual Impacts

Residual impacts that are most likely to occur at the proposed facility during the construction phase are as follows:

- There will be a change in ground conditions at the site with the replacement of natural materials such as glacial deposits and bedrock by HDPE geocomposite liner or 1 mm fully welded LLDPE liner, sub-grade drainage stone, leachate collection pipework, ground ducting for water, telemetry and power, and surfacing materials (e.g. concrete, new access roads). This is a direct permanent change to the material composition of the site.

Residual impacts that are most likely to occur at the facility during the Operational phase are as follows:

- Changes in ground surfacing including areas of new hardstands (i.e. leachate plant and biological treatment) and tree felling will impact on the hydrology of the site and may result in increased runoff of rainwater and increased drainage discharge.
- The drainage infrastructure that will be emplaced as part of the proposed development will also change the sub-surface hydrology by replacing some manmade drainage systems with line interceptors and point discharges to buffered outfalls. Careful design of this drainage to mimic natural conditions will help to mitigate negative impacts of artificial drainage.

The residual significance of the effects of the proposed development on soils, geology and hydrogeology is expected to be low taking account of the effective implementation of the mitigation measures as outlined in Section 11.5.

The residual impact is summarised in Table 11.14, using the impact assessment methodology outlined above in Section 11.4.2 and taking account of mitigation measures in Section 11.5 of this document.

Table 11-15: Residual Geological Impact Significance for Sensitive Receptors

Activity	Potential Impact	Attribute	Importance	Before Mitigation		After Mitigation	
				Magnitude	Significance	Magnitude	Residual Significance
Construction Phase							
Excavations for landfill, ducting, hardstands, sub-station, treatment plant, leachate ponds, attenuation ponds.	Removal of material, soil compaction, increased runoff & sedimentation, contamination	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Small Adverse	Moderate/ Slight	Negligible	Imperceptible
Construction of landfill cells, storage lagoons and screening berms.	Slope failure	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer	Medium	Small Adverse	Moderate/ Slight	Negligible	Imperceptible
Construction of hardstanding and access roads.	Removal of material, soil compaction, increased runoff causing erosion, and possible contamination.	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible	Negligible	Imperceptible
Operation & Maintenance Phase							
Site access tracks, sub-station, treatment plant	Increase in rate of run-off, contamination	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible	Negligible	Imperceptible

Activity	Potential Impact	Attribute	Importance	Before Mitigation		After Mitigation	
				Magnitude	Significance	Magnitude	Residual Significance
Landfill screening berms and storage lagoons	Erosion and sedimentation	Soil, rock & aquifers. Low permeability, poorly drained soils. Poor Aquifer.	Medium	Negligible	Imperceptible	Negligible	Imperceptible

It can be observed from Table 11.14 that, following the implementation of mitigation measures, the residual impact significance to the receiving environment would be moderate/slight to imperceptible during the construction period and imperceptible in all respects assessed during the operation of the proposed landfill. Mitigation measures will be monitored throughout the construction and operational phases.

Mitigation systems will, where required, be in place before development works commence.

As a result of the mitigation measures being implemented, the proposed development is expected to have an imperceptible impact on the receiving environment.

The proposed development is not expected to contribute to any significant, negative cumulative effects of other existing developments in the vicinity. When the mitigation measures are implemented in full, any effects on the receiving environment will be imperceptible.

11.7 Conclusions

A study has been undertaken which has identified the principal impact of the construction of the proposed development. The following conclusions can be drawn, in relation to soils, geology and hydrogeology:

- A site walkover and intrusive investigation were undertaken on the site in order to assess the potential impacts on the soils, geology and hydrogeology.
- The site's geology typically consists of a thin layer of topsoil, glacial till overburden predominantly comprising cohesive gravelly clay (boulder clay) greater that 10m in thickness and overlying sandstone / siltstone bedrock.
- The proposed areas for development is located to the north and east of the current permitted landfill footprint including screening berms to the west.

Overall, the material balance has indicated a shortfall of approximately 178,175 m^3 will be encountered when assessed against the proposed screening berm design. In view of the shortfall identified, FT has considered the following options with respect to screening berm construction:

- In the event of a need for future development, an opportunity is presented to place recovered overburden in the locations where a shortfall has been identified.
- Reduce the scale of the western screening berm volume by 178,175 m^3.
- Import the remaining overburden material externally to meet the shortfall identified.

A number of potential impacts have been identified associated with the excavation of overburden on the site. The significance of these potential impacts is assessed as being of moderate/slight significance prior to mitigation.

Potential impacts from the proposed development on the underlying soils, geology and hydrogeology occur due to the removal of the overburden which exposes the underlying soil to erosion and to possible sources of contamination, both during and post construction. Individual assessments of these impacts have been conducted and are outlined separately within this EIAR.

Effective mitigation measures to deal with construction & operational impacts have already been implemented and are outlined above. Provided that these mitigation measures continue to be effectively implemented, as proposed, the residual risks to the soils, geology and hydrogeology associated with the construction, operation and decommissioning of the site are considered to be imperceptible.

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KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 12 – HYDROLOGY & SURFACE WATER QUALITY

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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12 HYDROLOGY & SURFACE WATER QUALITY

12.1 Introduction

This chapter describes and assesses the potential impacts of the proposed development at Knockharley Landfill on the surrounding hydrological environment and the water quality within the study area. The receiving environment and the characteristics of the proposed development for construction and operation are described. The potential impacts of the proposed development during the construction and operation phases are evaluated, and the mitigation measures for these potential impacts are presented. The chapter concludes with the predicted residual impacts of the proposed development.

12.1.1 Study Area

The proposed development comprises:

- The acceptance of up to 435,000 tonnes per annum of non-hazardous wastes, which will comprise up to 150,000 tonnes of incinerator bottom ash (IBA), as well as household, commercial and industrial wastes including residual fines, non-hazardous contaminated soils, construction and demolition (C&D) wastes and baled recyclables. In addition, the acceptance of up to 5,000 tonnes per annum of stable non-reactive hazardous waste is proposed.
- The acceptance and placement within the existing permitted landfill footprint of incoming wastes for recovery or disposal as appropriate; the increase in height of the landfill body from the current permitted post settlement final contour height of 74 mOD to a post settlement contour height of 85 mOD – the proposed height increase will apply from the active landfill phase at the time of permission grant. Permission is sought for the acceptance of waste until the cells are full.
- The construction and operation of a dedicated IBA facility. Permission is sought to store IBA until recovery outlets are identified. Permission is sought for trials to prepare IBA for recovery and removal off site. The IBA facility will consist of 5 no. cells which will be constructed in accordance with the requirements of the Landfill Directive 99/31/EC for non-hazardous wastes. A final post settlement contour height of 85 mOD is proposed. Permission is sought for operation of the IBA facility until the cells are full and subsequent aftercare activities as may be required are complete. The development includes additional perimeter (haul) roads and screening berms.

  The IBA facility will comprise 1 no. portal frame building 76 m x 76 m x 15.5 m to facilitate:

  - weathering
  - metals recovery trials
  - crushing and washing to facilitate recovery trials and processing

- The construction and operation of a building for:

  - The extraction and biological treatment of the organic fraction of MSW (otherwise known as MSW 'fines' material) and;
  - contingency storage of baled recyclables
  - contingency storage of baled MSW

  This facility shall comprise:

  - a processing building of 108 m in length, 50 m in width and up to 17 m in height, of portal frame construction with 13 no. vehicle roller shutter doors and 7 or more pedestrian access doors (subject to fire certification requirements)
  - internal storage bays as required
  - 12 no. concrete composting tunnels located within the processing building of c. 6 m in width, 25m in length and 5 m in height
  - a covered bio-filtration unit within the overall processing building footprint, with a stack of height of 20 m
  - access from the internal site road with a marshalling yard area with egress from the existing site road to the landfill gas compound

   - all other ancillary and associated works, including leachate storage in a below ground tank, bio-treatment system for sanitary wastewater drainage and fencing.

   Permission is sought for the continued use of this building post filling of the landfill cells onsite.

- The construction and operation of a leachate management facility comprising:
  - 3 no. additional floating cover leachate storage lagoons (L2, L3 and L4) of c. 5,000 m^2 each
  - 2 no. bunded above ground tanks for raw leachate from IBA cells (S1 and S2) approximately 25 m diameter 6.0 m high.
  - 3 no. bunded above ground tanks:
    - 1 no. tank (S3) for treated leachate from landfill leachate approximately 22m diameter 6.0m high.
    - 1 no, tank for treated leachate from IBA approximately 25 m diameter 6.0 m high (S4).
    - 1 no. tank for leachate concentrate 16 m diameter by 6.0 m high (S5).
  - Modular - typically containerised plant units (C1 through C6), on concrete slab of c. 1,000 m^2 and 1 no. elevated tank 5 m diameter 10 m high (T1) with provision for 2 no. additional low level (<5.0 m high) bunded storage tanks for dosing and other compounds (T2 and T3).
  - Loading area for 2 no. 25 tonne articulated tankers.

  Permission is sought for the continued operation of this plant post filling of the landfill cells to facilitate continued leachate management.

- Construction of screening berms along the western planning boundary to a maximum of 10 m in height, on the eastern boundary to a maximum height of 10 m and on the northern boundary, to a maximum height of 6 m, with a total berm footprint of c. 11.3 ha. Haul roads for construction will be in or immediately adjacent to berm footprint.

- Construction of surface management infrastructure, with discharge to the adjacent Knockharley Stream to the northern end of the landfilling footprint and the proposed IBA cell development. Key elements will comprise:

  - holding pond for surface water runoff
  - storm water attenuation lagoon to maintain green field surface water discharges to Knockharley stream and to facilitate suspended solids management
  - wetland
  - flood compensation culvert to provide equivalent 1:1000-year flood plain storage
  - permitted stream diversion around permitted development

- Felling of c. 12.5 ha of the existing commercial broadleaf/conifer mix plantations to facilitate:
  - construction of the screening berms along the western boundary and to the north of the proposed IBA area, and
  - development of Phase 7 Cells 27 and 26 and the new northern surface water attenuation pond.

  Replanting and new planting totalling (c.16.8 ha) will off-set loss of commercial forestry in the proposed development footprint at the following locations:
  - replanting over screening berms
  - new planting on the cap over cells 25, 26, 27 and 28 in what is currently the permitted development

- Relocation of an existing 20 kVa overhead ESB powerline that provides power to the existing landfill facility administration buildings, that will be impacted by the development of the screening berm to the east of the proposed IBA cell area.

- Construction of an additional ESB sub-station and new overhead ESB supply to the north-western corner of the currently permitted landfill footprint to facilitate power provision for pumps and other infrastructure.

- Construction of a new ESB sub-station adjacent to the proposed building for biological waste treatment and storage with ESB connection to adjacent 20 kVA power lines.
- Extension of existing below ground infrastructure (permitted development) and provision of additional below ground infrastructure. (Power, water, telemetry, leachate rising mains, drainage). Extension of the existing car park for the administration area.

The proposed development is described in greater detail in Chapter 2 of Volume 2 of this EIAR.

Knockharley Landfill is located 1.5 km to the north of Kentstown village in County Meath.

The site ownership boundary encloses an area of 135 ha. The permitted landfill footprint is located in the centre of this land holding and occupies 25 ha. The layout of the existing development and the layout of the proposed development is shown in Drawing No. LW14-821-01-P-0000-002 Existing Site Layout and Drawing No. LW14-821-01-P-0000-003 Proposed Site Layout in Volume 4 of this EIAR.

12.2 Methodology

The following sources of information were considered in this assessment:

- the design layout of the proposed development
- published literature
- a desk-based assessment of the surface water hydrology and water quality in the catchments relevant to the proposed development, including an assessment of the watercourses which will be intercepted by the layout of the proposed development and those which will receive surface water run-off from the proposed development
- a field assessment of the existing hydrological environment, to both verify desk-based assessment and record all significant hydrological features
- a study of existing water quality sampling to determine the existing water quality

12.2.1 Relevant Guidance

The EIAR has been prepared in accordance with Schedule 6 of the Planning and Development Regulations 2001, as amended, and Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment were also considered (the 2014 EIA Directive).

The following guidelines were considered in the development of this chapter to identify relevant objectives relating to hydrology and surface water quality:

- Guidance Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report, 2018 (1)
- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft 2017 (2)

Other reference documents used in the preparation of this section include the following:

- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, 2009 (3)
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses, 2016 (4)
- The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009 (5)

In addition to considering the relevant documents above the methodology for the baseline assessment has been devised with due consideration of the following:

- Meath County Development Plan 2013-2019 (6)
- Strategic Flood Risk Assessment, Variation 3 of Meath CDP 2013-2019, (7)
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a Framework for Community Action in the Field of Water Policy (8)
- Flood Mapping Website http://www.floodmaps.ie (9)
- OPW preliminary flood risk assessment (PFRA) indicative mapping website www.cfram.ie (10)
    - Fingal East Meath Flood Risk Assessment and Management Study http://fem.cfram.com/floodmaps.html
- Greater Dublin Strategic Drainage Study (GDSDS): Technical Documents of Regional Drainage Policies, March 2005 (11)
- Environmental Good Practice on Site - Construction Industry Research and Information Association (UK) (12)
- Best Practice Guide BPGCS005 Oil Storage Guidelines (13)
- Control of Water Pollution from Linear Construction Sites (C648) - Construction Industry Research and Information Association (UK) (14)
- Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) 2006 (UK) (15)
- Sustainable Construction Procurement. A Guide to Delivering Environmentally Responsible Projects (C571) 2001 (UK) (16)
- UK Pollution Prevention Guidelines (PPG):
    - PPG1: Understanding your environmental responsibilities – good environmental practice, 2013 (17)
    - GPPG: Above ground oil storage tanks, 2011 (18)
    - PPG3: Pollution Prevention Guidelines, 2006 (19)
    - GP4: Treatment and disposal of wastewater where is no connection to the public foul sewer, 2017 (20)
    - PPG5: Works and maintenance in or near water, 2017 (21)
    - PPG6: Working at construction and demolition sites, 2012 (22)
    - PPG7: The safe operation of refuelling facilities,2011 (23)
    - GPP8: Safe storage and disposal of used oils, 2017 (24)
    - GPP21: Pollution incident response plans, 2017 (25)
    - PPG22: Dealing with Spills, 2011 (26)
    - PPG26: Drums and intermediate bulk containers, 2011 (27)
- River Basin Management Plan for Ireland 2018-2021, 2017 (28)
- www.catchments.ie (29)
- Biological River Water Quality Data (30)
- Code of Best Forest Practice – Ireland, 2000 (31)
- Forestry and Water Quality Guidelines, 2000 (32)
- Forestry and Archaeological Guidelines, 2000 (33)
- Forest Harvesting and Environmental Guidelines, 2000 (34)

Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EC) was adopted by the (then entitled) European Community in 2000. This Directive was transposed into Irish law from December 2003 by, *inter alia*, the European Communities (Water Policy) Regulations 2003, (S.I. No 722 of 2003) and subsequent amendments. The first cycle ran from 2009-2015. The Directive runs in 6-year cycles (2016-2021). A draft second cycle River Basin Management Plan was published for public consultation in August 2017 and the finalised second cycle River Basin Management Plan for Ireland 2018-2021 is in place.

The overriding purpose of the WFD is to achieve at least "good status" in all European waters and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The first cycle of river basin management planning, which covered the period 2009-2015, developed plans and associated programmes of measures on the basis of eight River Basin Districts (RBDs) within the island of Ireland. These plans set ambitious targets that envisaged that most water bodies would achieve good status by 2015.

This second cycle plan aims to build on the positive aspects of the first cycle and learn from those aspects which did not progress as well as expected which are summarised as three key learnings.

Firstly, it has been concluded that a single River Basin structure rather than eight River Basin districts will facilitate efficient use of resources and ensure a coherent national approach to similar issues.

Secondly, the implementation structures have been amended in the 2018-2021 plan to ensure better governance and delivery.

Thirdly, the targets in the first cycle were not realistic, the 2018-2021 plan sets targets that are based on sound evidence and are ambitious yet achievable. Where evidence does not exist, it shall be further developed over the course of the second cycle.

Water Framework Directive Waterbody Status

The European Communities Environmental Objectives (Surface Water) Regulations 2009 (S.I. No. 272 of 2009), as amended in 2009, 2012, 2015 (S.I. No. 296 of 2009, S.I. No. 327 of 2012, S.I. No. 386 of 2015) give effect to the criteria and standards to be used for classifying surface waters in accordance with the WFD. There are five categories of surface water status: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'. The status is used to determine the degree of impact by human activities on water resources.

A surface water body must achieve both good ecological status and good chemical status before it can be considered to be of good status. The chemical status of a water body is assessed based on certain chemical pollutants. The ecological status is assessed based on Biotic Indices or Quality (Q) Values. The EPA scheme of Q Values and its relationship to WFD status is set out in Table 12.1.

Table 12-1: WFD Status and EPA Q Values

Q Value	WFD Status
Q5	High
Q4-5	High
Q4	Good
Q3-4	Moderate
Q3	Poor
Q2-3	Poor
Q2	Bad
Q1-2	Bad
Q1	Bad

In accordance with the regulations, waters classified as 'High' or 'Good' must not be allowed to deteriorate. Waters classified as less than good must be restored to at least good status within a prescribed timeframe.

The regulations also state that, for the purpose of classification, a status of less than good is assigned in the case of a water body where the environmental objectives for an associated protected area requiring special protection by virtue of obligations arising from specific national legislation for the protection of water, or for the conservation of habitats and species directly dependent on water, are not met.

Water Framework Directive Risk

A baseline risk assessment was completed of the water bodies within each River Basin District in 2005. This assessment involved using information on water pollution indicators, point and diffuse pollution sources, water abstraction and existing commercial activities. The risk assessment indicated whether the water body would meet the criteria for "good status" or would be considered "at risk" of not meeting the standards by 2015. This assessment provided the baseline information to prepare the first cycle River Basin Management Plan and Programme of Measures necessary to comply with the WFD standards. Following the completion of the first cycle, the status information shows that 55% of river water bodies achieved good or high status. The river basin characterisation process for the second cycle goes beyond the classification of status and assesses whether a water body is at risk of not meeting its objectives based on the review of such information such as water quality trends, catchment pressures and expert local knowledge. There are three categories of risk, 'not at risk', 'at risk' and review. Not at risk requires maintenance of the existing measures in place to maintain the satisfactory status. At risk waterbodies need new and often more targeted mitigation measures. Review waterbodies need more monitoring and assessment.

The following evidence-based prioritisation is proposed for this river basin planning cycle:

- Ensure full compliance with relevant EU legislation
- Prevent deterioration
- Meeting the objectives for designated protected areas
- Protect high status waters
- Implement targeted actions and pilot schemes in focus sub-catchments aimed at (i) targeting water bodies close to meeting their objective and (ii) addressing more complex issues which will build knowledge for the third cycle.

12.2.2 Consultation

The scope for this assessment has been informed by pre-application consultation with An Bord Pleanála, Meath County Council, prescribed bodies and other interested parties as summarised in Chapter 5 of Volume 2 of the EIAR.

This chapter considers the responses, regarding concerns relating to hydrology and surface water quality.

The comments expressed in particular by the Health Service Executive (HSE), Inland Fisheries Ireland (IFI), Irish Water, Office of Public Works (OPW) and An Taisce in written consultations received from them as part of the EIA process were considered in the preparation of this chapter.

12.2.3 Other Sources

Reference is also made to Chapter 2 Proposed Development, Chapter 10 Biodiversity and Chapter 11 Soils, Geology and Hydrogeology in Volume 2 of this EIAR. The drawings referenced in this chapter are included in Volume 4 of this EIAR.

12.2.4 Desk Study

The desk top study involved an examination of the hydrological aspects and water quality aspects of the following sources of information:

- current and historic ordnance survey Ireland mapping, and ortho-photography
- OPW indicative flood maps
- catchment flood risk assessment and management (CFRAM) studies maps
- study of existing surface water/drainage features in the
- review of the water framework directive online mapping and data (cycle 1 and cycle 2)[1]

[1]http://watermaps.wfdireland.ie/NsShare_Web/Viewer.aspx?Site=NsShare&ReloadKey=True and https://www.catchments.ie/maps/ and https://www.catchments.ie/data/#/?_k=7f514g

- review of the EPA online mapping[2]
- study of the proposed layout of the development
- liaison with geotechnical specialists for details on soil conditions on the site
- review of designated sites within 15km of the site
- study of planning documents for adjacent developments
- history of flooding and status of drainage in the neighbourhood
- review of consultation with interested bodies
- study of development plans
- review of baseline surface water monitoring results (2001-2003) and licence compliance monitoring results (2012-2017)

12.2.5 Field Assessment

Site walkover surveys took place on 27 July 2016 and 5 August 2016 to confirm the pattern of existing drainage on the site and to record any significant hydrological features. The site walkovers involved an initial review of available information gathered in the desk study phase followed by a site visit, findings of which are discussed in Section 12.3.5.

A permitted watercourse diversion to the north-western corner of the permitted development was deemed to be necessary to facilitate the construction of the permitted cells to ensure that the watercourse will run sufficiently clear of the construction works thus avoiding any impact on water quality in the stream.

There is an existing low point in the middle of 1:1000-year flood plain storage at the proposed location of the northern surface water attenuation pond. This area is covered in rushes but was dry at the time of the site visit. It is proposed to construct the surface water attenuation pond in the natural low-lying area, for both the permitted and proposed developments. This low-lying area provides flood plain storage during a 1:1000-year storm event. The flood plain footprint and proposed surface water attenuation pond is shown on Figure 12-6.

It is proposed to offset the lost storage by creating compensatory storage upstream of an existing and adjacent culvert within the Knockharley stream.

Water sampling is ongoing at the site in accordance with the existing licence and the sample results were examined to establish the existing water quality conditions.

The monitoring results are compared to the baseline results for the site, pre-development.

12.2.6 Evaluation Criteria

During each phase (construction, operation, maintenance and decommissioning[3]) of the proposed development, several activities will take place on site, some of which will have the potential to cause impacts on the hydrological regime at the site and the quality of surface water draining the site.

Assessment of Significance of Impact on the Receiving Environment

An impact rating has been developed for each of the phases of development. The sensitivity of the receiving environment was first identified. The sensitivity us understood as the sensitivity if the environmental receptor to change, including its capacity to accommodate the changes the project may bring about (1) Then the magnitude of the potential impact was estimated. The magnitude considers the characteristics of the change (timing, scale, size and duration of the impact) which would probably affect the target receptor as a result of the proposed project (1). The sensitivity rating, together with the magnitude of the potential impact, provides an overall rating of the significance of the impact prior to application of mitigation measures.

[2] http://gis.epa.ie/Envision

[3] There is a restoration and aftercare plan place in accordance with the licence and a fund has been established to accommodate aftercare costs including works and costs associated with decommissioning. The restoration and aftercare plan will be updated in accordance with the updated licence for the proposed development.

Sensitivity of Receptors

The sensitivity of an environmental receptor is based on its ability to absorb an impact without perceptible change. The hydrological environment is considered to be of low sensitivity due to the distance of the proposed development from the nearest environmentally designated sites, Laytown Dunes/Nanny Estuary proposed Natural Heritage Area (pNHA), Site Code 000554 and River Nanny Estuary and Shore Special Protection Area (SPA), Site Code 004158, which lie approximately 21 km by hydrological links to the west of the boundary of the proposed development at Knockharley Landfill site, at its nearest point. The WFD risk status of the receiving Flemingstown waterbody is "Review" (29), i.e. needing further investigation to assign the WFD risk status. The Flemingstown waterbody discharges to the Nanny Meath. The WFD risk status is "At Risk" (29) of deteriorating or being at less than good status in the future. The sensitivity of the water quality is considered to be low.

Assessment of Magnitude and Significance of Hydrological and Water Quality Impact

The assessment of the hydrological and water quality impacts examines the quality, significance, extent and context, probability and duration/frequency. A description of possible hydrological effects is presented in Table 12-2.

Table 12-3 gives examples of the criteria used to evaluate the significance if impacts.

Table 12-4 summarises the significant of the criteria.

Table 12-2: Description of Effects (2)

Quality of Effects	**Positive Effect** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem or be removing nuisances or improving amenities). **Neutral Effects** No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error. **Negative / Adverse Effects** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance.
Describing the Significance of Effects	**Imperceptible** An effect capable of measurement but without significant consequences. **Not Significant** An effect which causes noticeable changes in the character of the environment but without significant consequences. **Slight Effects** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities. **Moderate Effects** An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends. **Significant Effects** An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.

	Very Significant Effects An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment. **Profound Effects** An effect which obliterates sensitive characteristics.
Describing the Extent and Context of Effects	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect. **Context** Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions.
Describing the Probability of Effects	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented. **Unlikely Effects** The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects	**Momentary Effects** Effects lasting from seconds to minutes. **Brief Effects** Effects lasting less than a day. **Temporary Effects** Effects lasting less than a year. **Short-term Effects** Effects lasting one to seven years. **Medium-term Effects** Effects lasting seven to fifteen years. **Long-term Effects** Effects lasting fifteen to sixty years. **Permanent Effects** Effects lasting over sixty years. **Reversible Effects** Effects that can be undone, for example through remediation or restoration. **Frequency of Effects** Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).

Table 12-3: Criteria Associated with Significance of Effects

Significance	Criterion	Description and Example
Imperceptible	An effect capable of measurement but without significant consequences.	Temporary site works removed from watercourse carried out using appropriate surface water management practices.
Not Significant	An effect which causes noticeable changes on attribute but without significant consequences	No perceptible changes to the hydrology and water quality discharges to watercourse but no loss in quality, fishery productivity or biodiversity. No increase in flood risk. Example - change in surface runoff input to stream from diffuse source to point source or minor realignment of water course, maintenance works
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.	Detectable but non-material and transitory changes to the hydrology and water quality - measurable change in attribute, but of limited size and/or proportion. Example - remedial works to a watercourse requiring works within the channel carried out using appropriate surface water management practices.
Moderate effect	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.	Short to medium term changes to the hydrology and water quality loss in productivity of a fishery. Contribution of significant sediment and nutrient quantities in the receiving water, but insufficient to change its water quality status. Example – Earthworks carried out adjacent to or within a watercourse in the absence of appropriate working practices
Significant	An effect which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment.	Long term changes to the hydrology and water quality Examples - change in water quality status of river reach, loss of flood storage/increased flood risk, pollution of potable source of abstraction.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.	Long term changes to the hydrology and water quality Examples - change in water quality status of river reach, loss of flood storage/increased flood risk, pollution of potable source of abstraction. The extent of impact is greater than 'Significant impact'
Profound	An effect which obliterates sensitive characteristics.	Long term and irreversible change to the hydrology or water quality. Results in loss or extensive change to a water body or habitat.

Potential impacts are assessed as being of profound, very significant, significant, moderate, slight, not significant or imperceptible. Plate 12.1 is a typical classification of the significance of impacts.

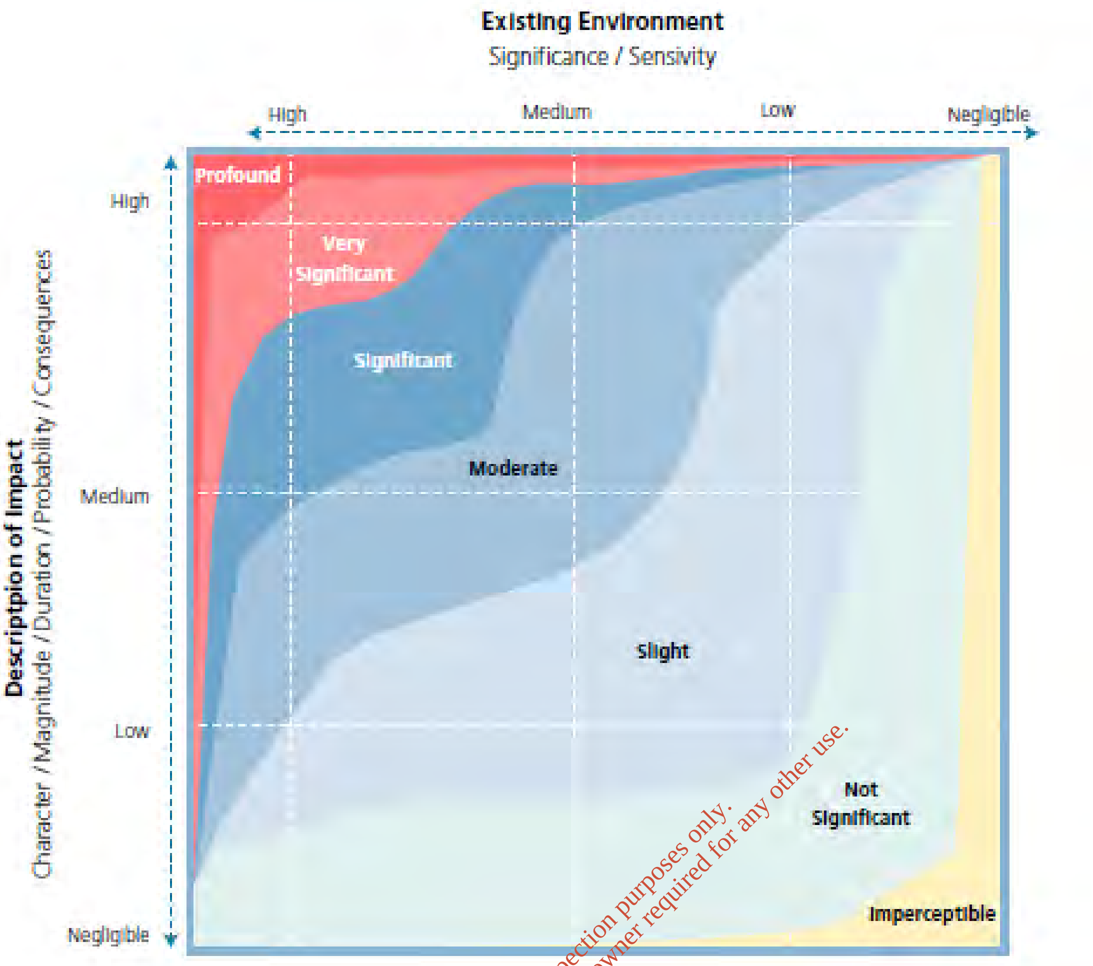


Plate 12-1: Chart showing typical classification of the significance of impacts (2)

A summary of unmitigated potential impacts and the associated significance rating due to the proposed development is provided in Table 12.11 in Section 12.6.6. The residual impacts following mitigation and the associated significance rating are provided in Table 12.14 in Section 12.7.

As part of the evaluation of the site for the proposed development, a flood risk identification and assessment was carried out as discussed in Section 12.5. Landfill development is considered 'Highly Vulnerable' development, as described in Table 3.1 of the guidelines produced by the Department of Environment, Heritage and Local Government (5). This type of development is not appropriate in a Flood Zone A or a Flood Zone B area (where there is a risk of flooding in a 1 in 100-year return period flood or a 1 in 1000-year return period flood) unless it passes a Justification Test (See Appendix 12.5 In Volume 3 of this EIAR). Any potential increase in surface water run-off due to the development in areas deemed to be already at risk of flooding will be examined as part of the impact evaluation in this chapter and mitigation measures will be proposed where required.

In all cases where required, a cumulative flood risk assessment will be undertaken.

12.3 Existing Environment

12.3.1 Site in Context

Prior to development as a landfill, the land was used for agriculture and a network of field drains were installed to improve the land.

A detailed description of the existing surface water regime is included in Appendix 12.6 Hydrological Study of Volume 3 of this EIAR.

The capacity of the existing surface water attenuation pond is described in Appendix 12.1 of Volume 3 of this EIAR.

Figure 12-1 shows the water body catchment map. The Knockharley or Flemingstown stream entering the site from the western boundary at Knockharley is a 1st order tributary of the River Nanny. The stream is not salmonid. It flows from the west in an easterly direction. The stream emerges from a 1.0 m diameter circular concrete culvert at the western boundary. The stream flows into an open channel just upstream of the location of a permitted culvert through a screening berm. The stream continues in an easterly direction and then runs along part of the eastern boundary of the site, continuing southwards to meet the River Nanny via the Knockharley or Flemingstown Stream, 2.89 km south of the site boundary. The existing surface water pond discharges to the Knockharley or Flemingstown Stream south of the wetland. A second tributary, the Kentstown Stream flows east along the southern licensed boundary before turning south and joining the Veldonstown Stream, just upstream of its confluence with the Knockharley or Flemingstown Stream.

The site is sloped with elevations ranging from 70 mOD in the north west to 55 mOD in the south east of the site. The site is a mix of, constructed landfill and associated facilities with some woodland and wet grassland.

The site has a water shed running east to west with natural outfalls to the south and north, this is shown in Figure 12-2.

The Geological Survey of Ireland (GSI) website (www.gsi.ie) provides information on subsoils and the underlying aquifer for the site. The overburden soil at the Knockharley Landfill site is mainly Shale and Sandstone Till with some Limestone Till to the south of the site. There is evidence of alluvium along the line of the existing stream to the north of the site and along the line of an old stream which was rerouted to facilitate the original landfill development to the south, as shown in Figure 11.1 in Chapter 11 Soils, Geology and Hydrogeology in Volume 2 of this EIAR. Alluvium can be an indicator of historic flooding.

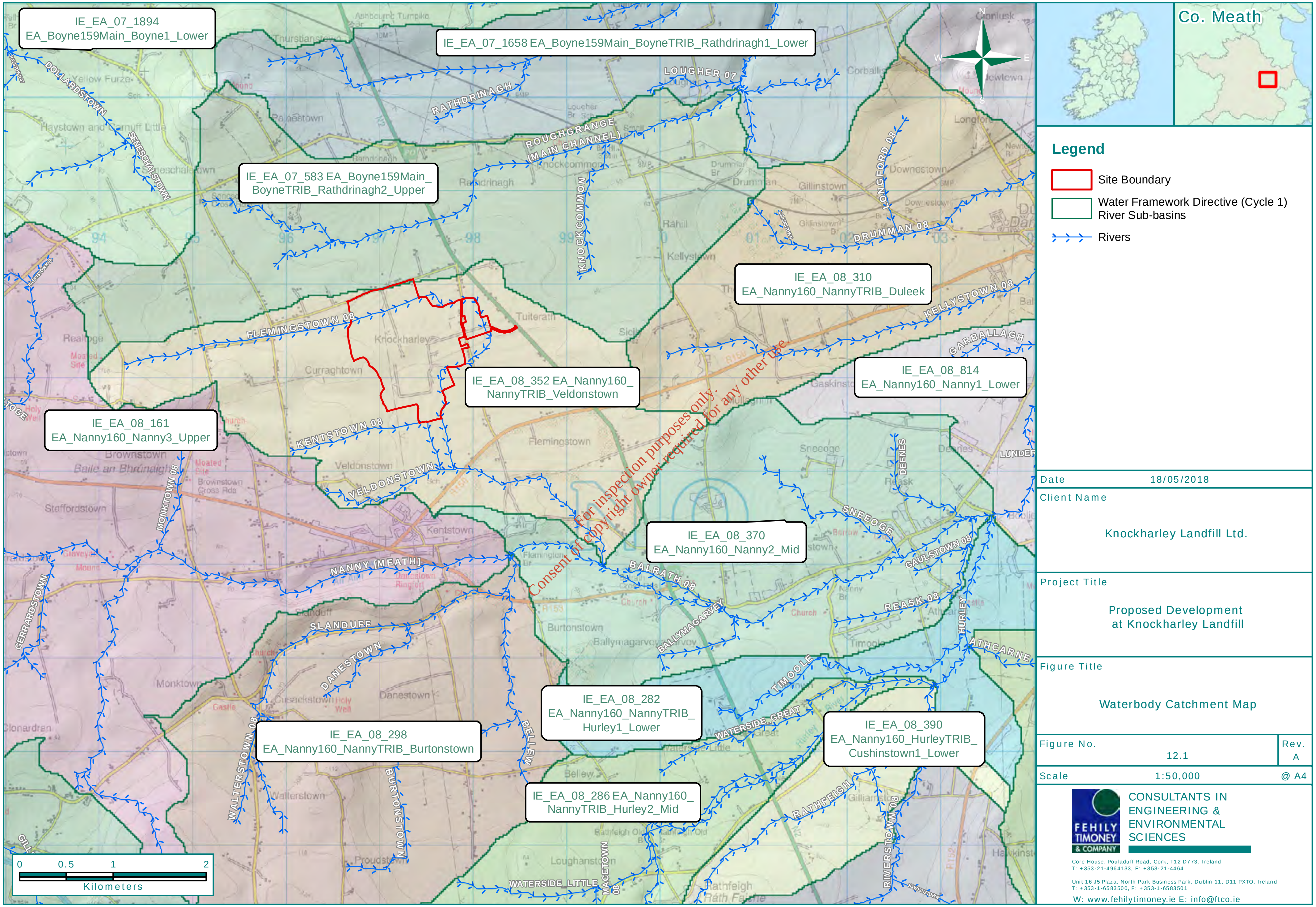
The aquifer is classed as *Low Vulnerability*, as shown in Figure 11.5 in Chapter 11 Soils, Geology and Hydrogeology of Volume 2 of this EIAR and is therefore at a low risk of contamination from activities taking place at the ground surface. Chapter 11 of Volume 2 of this EIAR advises the groundwater is most susceptible to contamination during excavation of cells. However, given that significant overburden will remain in place this risk was considered to be low.

As discussed in Section 12.2.5, the drainage from the proposed development is at a distance of approximately 21 km by hydrological links to any environmentally protected areas. These environmentally designated areas are discussed further in Chapter 10 Biodiversity of Volume 2 of this EIAR.

There are no other sites which are designated for environmental protection within 15 km downstream which would be categorised as sensitive receptors with hydrological links to the proposed development site.

The hydrological features within the site are shown in Figure 12.2 and described in Section 12.3.6.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig12-1_WaterbodyCatchmentMap_A4.mxd



Legend

- Site Boundary
- Water Framework Directive (Cycle 1) River Sub-basins
- Rivers

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Waterbody Catchment Map
Figure No.	12.1
Rev.	A
Scale	1:50,000 @ A4

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12.3.2 General Description of the Catchment

The average annual rainfall (1981 – 2010) in the area of the proposed development is 929 mm[1].

The proposed development site lies within Hydrometric Area HA 08 known as the Catchment of Nanny-Delvin of the Irish River Network and is under the new single River Basin Management Plan for Ireland which is the responsibility of the Water Policy Advisory Committee. The Midlands and Eastern Water and Environment Committee will have responsibility for regional delivery and implementation. The site is situated within the waterbody catchment as defined by the EU Water Framework Directive (WFD - 2000/60/EC) (8), and as shown in Figure 12.1. Waterbody Catchment Map[4]. The risk status and water quality of riverbodies are taken from www,catchments.ie.

Under cycle 2, the relevant:

- Catchment is Nanny-Delvin IE_EA_08_352
- Sub catchment is Nanny Meath SC 010,
- Riverbody is Flemingstown 08_010

Under cycle 1, the relevant:

- River Waterbody is Veldonstown IE_EA_08_352EA_Nanny160_NannyTRIB_Veldonstown.

The river body associated with the proposed development is described in more detail below.

The WFD risk status of the Flemingstown riverbody is "review". The water quality is high.

The northern boundary of the landholding within the site boundary is on the boundary of a second waterbody catchment:

- under Cycle 2 the Boyne SC_10 and the riverbody Roughgrange (Main Channel) 010, and
- under Cycle 1, the river body IE_EA_07_583EA_Boyne159Main_BoyneTRIB_Rathdrinagh2_Upper.

The WFD risk status of the Roughgrange riverbody is "review" and the risk score is subject to review (meaning further investigation is required to assign status as "at risk" or "not at risk". The river water quality status is unassigned.

Veldonstown IE_EA_08_352 Waterbody (cycle 1)

The Knockharley or Flemingstown stream entering the site from the western boundary at Knockharley is a 1st order tributary of the River Nanny. The River Nanny rises to the east of Navan in County Meath and flows in an easterly direction to the Nanny Estuary (status unassigned) at Laytown.

The entire area of the site drains to the tributary of the River Nanny as illustrated in Figure 12.1. The surface water run-off within this catchment drains generally in a south easterly direction to this tributary.

The Veldonstown sub-catchment of the River Nanny has an area of 10.75 km^2 up to where it joins the River Nanny in Balrath.

12.3.3 Existing Flooding in the Area

The national flood hazard mapping website, www.floodmaps.ie (9), indicates a number of historical flooding events in the vicinity of the site as can be seen on Figure 12.3 OPW Flood Maps.

[4] Cycle 1 mapping is used from www.watermaps.wfd.ie as it provides more information on stream order than cycle 2 mapping from catchments.ie.

A copy of the flood map report which summarises all flood events within 2.5 km of the Knockharley site is available in Appendix 12.4 Attenuation Pond Design of Volume 3 of this EIAR. Of the five flood incidents listed, none of these occurred on the Knockharley Stream up to its confluence with the River Nanny. One of the flood incidents occurred approximately 0.75 km downstream of the confluence at Balrath Cross Roads, with events recorded in 2007 and 2009. Photographs are provided on the website for both incidents showing flooded lands adjacent to the River Nanny from Balrath downstream to Duleek.

Minutes of the Area Engineer's meeting in 2005 listed flood events including at Balrath Cross Roads on N2/R153 as follows– *Some of the arches of the Nanny Road Bridge are blocked and bridge does not have the capacity for volume of water. N2 flood January 2005. Flood occurs 1 to 2 times a year* (Flood Id = 696).

There are no areas defined as 'benefitting lands'[5] in the OPW flood hazard mapping website indicated at the Knockharley site or on lands adjacent to the stream up to its confluence with the River Nanny.

Although there are no recorded flood events along the route of the Knockharley Stream, there is evidence of alluvium along the banks of the stream as discussed in Section 12.3.1. which would suggest that the stream may have overtopped its banks historically.

The OPW has produced indicative flood mapping to assist in a preliminary flood risk assessment (PFRA) on its website www.cframs.ie (10). These maps were produced by the OPW from several sources. The indicative flood mapping indicates Flood Zone A areas i.e. an area with a probability of flooding in a 1 in 100-year flood, as shown in Figure 12.3. OPW Flood Data Map, outside the site boundary coinciding with the stream to the north east of the site and downstream of the site to the south of the wetland area along the course of the stream.

An area with a 1 in 1000 probability of a flood event occurring, or a 0.1% annual exceedance probability (AEP), i.e. a Flood Zone B area, is also shown in Figure 12.3 of this EIAR in the footprint where further development is proposed. However, the surface water from lands draining towards this area has been diverted as part of earlier planning applications. A hydrological study prepared by FT (see Volume 2 Chapter 12 Surface Water Appendix 12-6 of this EIAR) found:

- The current course of the Knockharley Stream can cater for a 1 in 100-year flood event without overtopping the river bank.
- The 1 in 1000-year flood will exceed the Knockharley stream banks in the vicinity of the proposed development area.
- The current footprint of the landfill development avoids flood Zone A areas.
- The proposed development provides compensatory flood zone storage in the event of a 1 in 1000-year flood event.

The site-specific areas where possible pluvial flooding has been identified are presented in Figures 12.3 and 12.7. The process for developing the pluvial flood extent maps was based on 'dropping' various depths and intensities of rainfall over a range of durations and modelling how that rainfall would flow over the land and, pond in low-lying areas. The areas are either:

- part of the existing development on site
- coincide with the location of the proposed surface water attenuation pond and holding pond at the low point of the site.

Therefore, this proposed development will not be affected by a pluvial flood risk.

More detailed mapping is available from the Fingal East Meath Flood Risk and Management Study (FEMFRAMS) which indicates a Flood Zone B area i.e. an area with a probability of flooding in a 1 in 1,000-year flood. This area is indicated in and adjacent to the permitted landfill area, where further development is proposed, however, the surface water from lands draining towards this area has been diverted as part of earlier planning applications.

[5] A dataset prepared by the Office of Public Works identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage.

A hydrological study was prepared for the Knockharley site by FT in 2011 and it was found that the current course of the Knockharley Stream can cater for a 1 in 100-year extreme event without overbank flooding and that the current footprint of the landfill development avoids flood risk areas for that event.

In the flood risk assessment prepared for this proposed development, a HECRAS river model (See Appendix 12.6 Hydrological Study of Volume 3 of this EIAR) was run to determine the flood level for the 1 in 1,000-year extreme event and thus estimate the potential storage lost in the indicative area shown to be a Flood Zone B area in the Flood Risk Assessment (FEMFRAMS) study, (see Appendix 12.5 Flood Risk Assessment of Volume 3 of this EIAR).

The Meath County Development Plan (CDP) 2013 - 2019 (6) sets out the county's policies and objectives with regard to flooding as outlined below. The policies and objectives relating to water quality are referenced in Section 12.3.4.

It is the policy of Meath County Council:

WS POL 29 *To have regard to the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoEHLG/OPW, 2009) through the use of the sequential approach and application of the Justification Tests for Development Management and Development Plans, during the period of this Plan.*

WS POL 30 *To have regard to the findings and recommendations of the current Strategic Flood Risk Assessment prepared as part of the County Development Plan review. See Appendix 6.*

WS POL 31 *To ensure that all developments have regard to the surface water management policies in the Greater Dublin Strategic Drainage Study (GDSDS). Compliance with the recommendations contained in Technical Guidance Document, Volume 2, Chapter 4 of the Greater Dublin Strategic Drainage Study shall be required in all instances.*

WS POL 32 *To ensure that a flood risk assessment is carried out for any development proposal, where flood risk may be an issue in accordance with the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DoECLG/OPW, 2009). This assessment shall be appropriate to the scale and nature of risk to the potential development.*

WS POL 33 *To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the OPW are responsible, and the Council will, retain a strip of 10 metres on either side of such channel where required, to facilitate access thereto.*

WS POL 34 *To consult, where necessary, with Inland Fisheries Ireland, the National Parks and Wildlife Service and other relevant agencies in the construction of flood alleviation measures in County Meath.*

WS POL 35 *To ensure that flood risk management is incorporated into the preparation of Local Area Plans and Town Development Plans in accordance with 'The Planning System and Flood Risk Management - Guidelines for Planning Authorities (2009)'.*

WS POL 36 *To have regard to the recommendations of the Fingal East Meath Flood Risk Assessment and Management Study, the Eastern, North West and Neagh Bann Catchment Flood Risk Assessment and Management Study when finalised and approved.*

It is an objective of Meath County Council:

WS OBJ 11 *To undertake a review of the 'Strategic Flood Risk Assessment for County Meath' following the publication of the flood mapping which is being produced as part of the Catchment Flood Risk Assessment and Management (CFRAM) Studies.*

WS OBJ 12 *To design flood relief measures to ensure appropriate protection for alluvial woodland (i.e. a qualifying interest) along the Boyne.*

WS OBJ 13 *To design flood relief measures to protect the conservation objectives of Natura 2000 sites and to avoid indirect impacts of conflict with other qualifying interests or Natura 2000 sites.*

WS OBJ 14 *To promote positive flood relief measures that can enhance habitats in the Boyne floodplain such as swales, constructed wetland basins etc.*

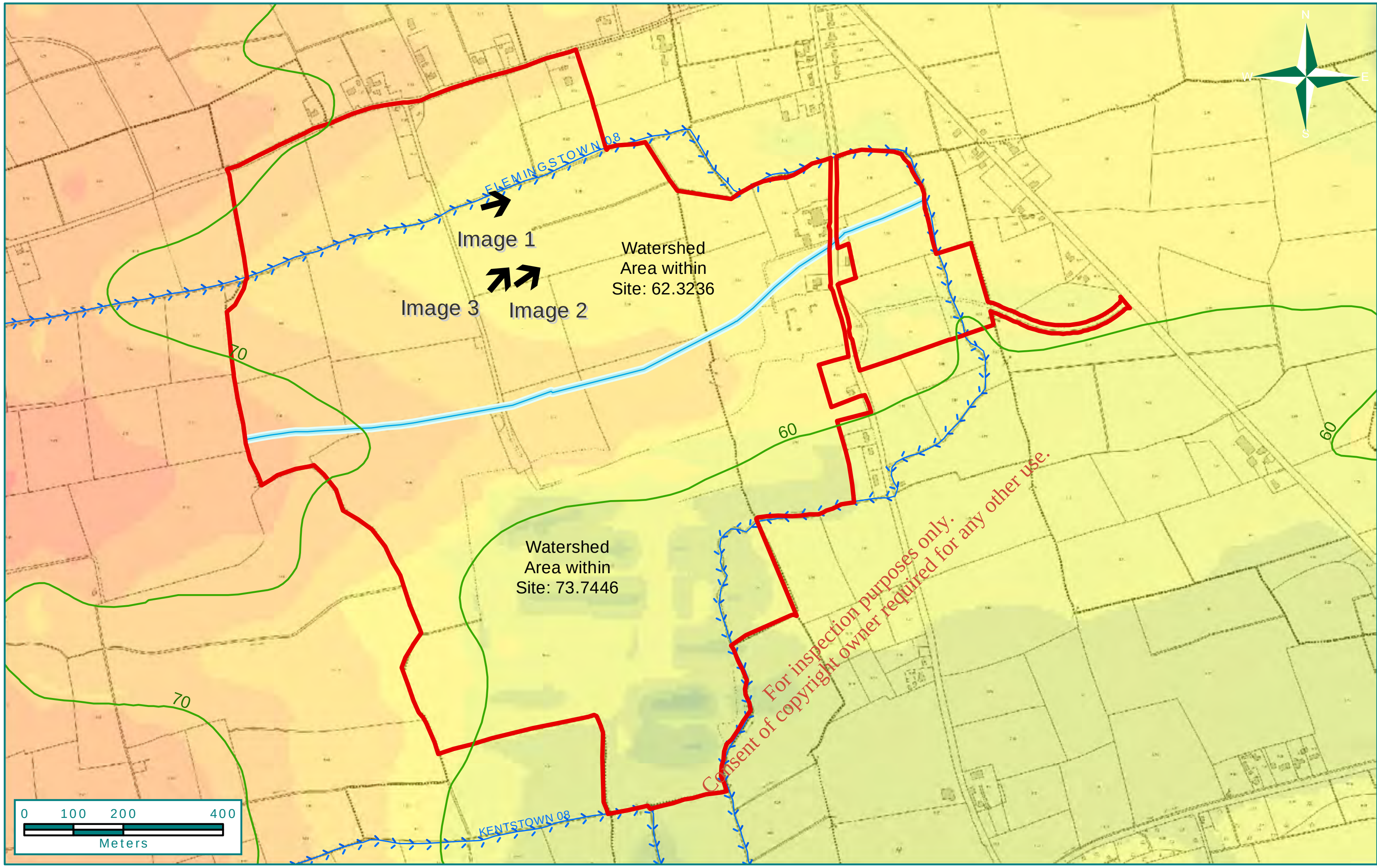
WS OBJ 15 *To seek to ensure that construction works are designed so as not to result in surface water runoff into cSAC or SPAs either directly or indirectly via a watercourse.*

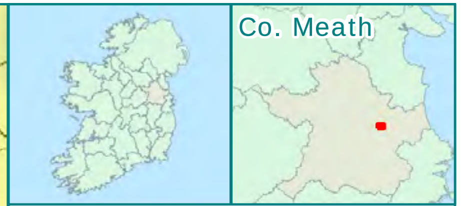
A Strategic Flood Risk Assessment (SFRA) was prepared for County Meath for the Meath CDP 2013-2019. Flood Zone mapping was prepared as part of this SFRA, indicating Flood Zones A (1% Annual exceedance probability, (AEP)) and Flood Zones B (0.1% AEP) in the vicinity of the urban settlements in County Meath.

The SFRA concludes that Flood Risk Management policies should be implemented from the CDP. The flood forecasting and warning system was recommended for the Nanny River and Delvin River.

A study of the Flood Zones indicated in the SFRA, shows the proposed development site is outside the scope of the settlements assessed as part of this SFRA and as such will not be part of the proposed flood forecasting and warning system.

Even if included at a later stage, the proposed development has provision for attenuation to ensure runoff does not exceed green field runoff flow rates and the proposed development will reduce flood storage volumes in or immediately adjacent to the proposed development.





Legend

- Site Boundary
- Rivers
- 10m Contours
- Indicative Watershed Boundary within Site
- Field Survey Photograph Locations

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Hydrological Features Map
Figure No.	12.2
Rev.	A
Scale	1:12,500 @ A4

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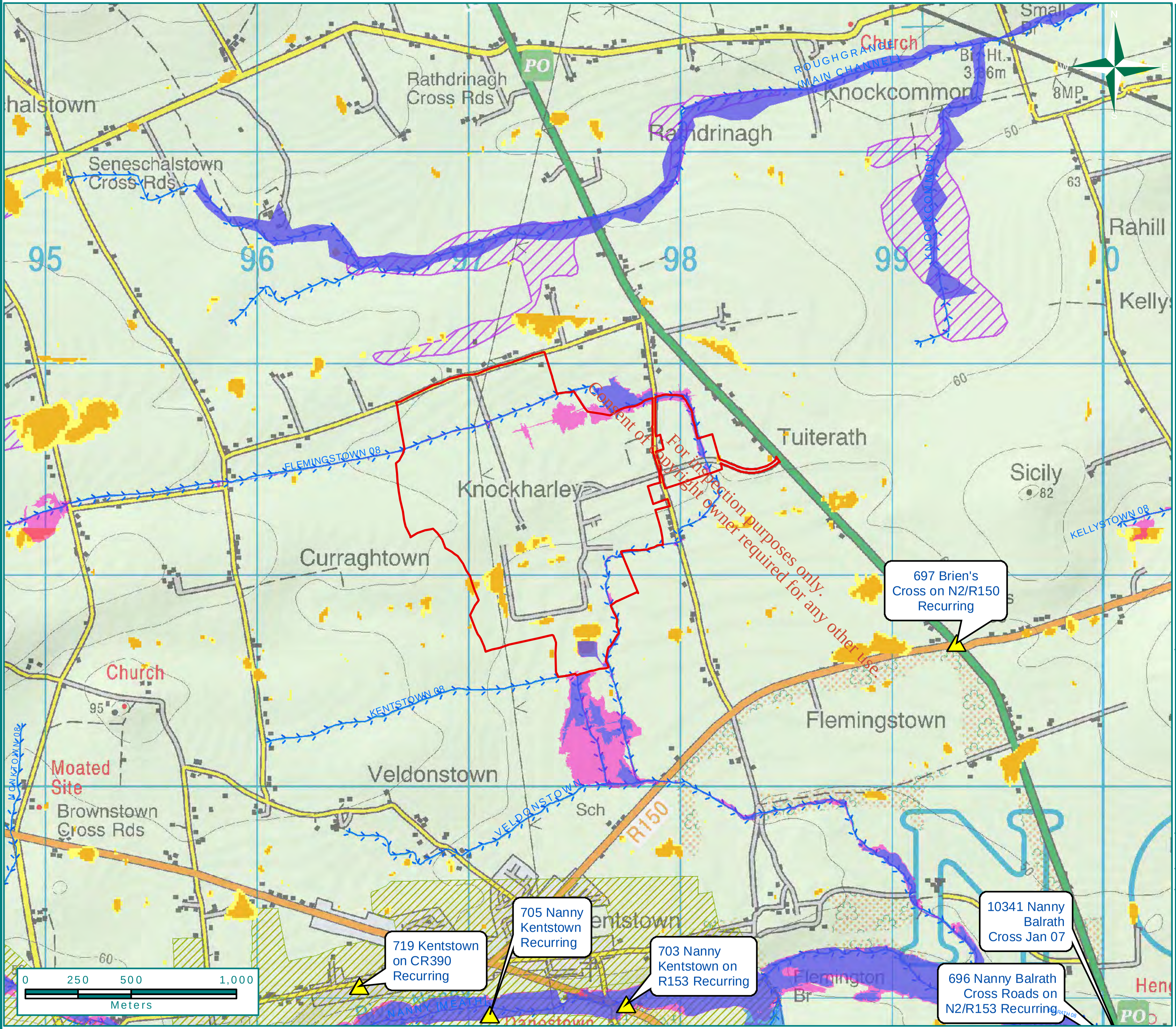
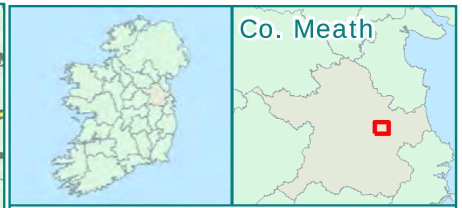
Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig12-3_1000 Year OPW Flood Map_A4.mxd





Legend

- Site Boundary

Preliminary Flood Risk Assessment/Catchment Flood Risk Assessment and Management Studies

- Flood Zone A (PFRA/CFRAMS: 1% AEP Fluvial Flood Extent)
- Flood Zone B (PFRA/CFRAMS: 0.1% AEP Fluvial Flood Extent)
- PFRA/CFRAMS: 1% AEP Pluvial Flood
- PFRA/CFRAMS: 0.1% AEP Pluvial Flood
- Drainage Districts
- Benefiting Lands
- Rivers
- OPW Historic Flood Points

NOTE: The maps on Preliminary Flood Risk Assessme (PFRA) provide only an indication of areas that may be prone to flooding. They are not necessarily locally accurate, and should not be used as the sole basis for defining the flood zones nor for making decisions on planning applications.

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	OPW Flood Information Map
Figure No.	12.3
Rev.	A
Scale	1:25,000 @ A4

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12.3.4 Existing Water Quality

County Development Plans

Knockharley Landfill is located County Meath. A review of the Meath County Development Plan 2013 – 2019 was carried out to determine their specific objectives in relation to water quality. The policies and objectives relating to flooding are referenced in Section 12.3.4.

Meath County Development Plan 2013 -2019

The Meath County Development Plan 2013-2019 lays down specific policies in relation to water quality as follows:

WS POL 2 To protect and develop, in a sustainable manner, the existing groundwater sources and aquifers in the county and to control development in a manner consistent with the proper management of these resources.

WS POL 17 To ensure that all new developments have access to or are provided with satisfactory drainage systems in the interests of public health and to avoid the pollution of ground and surface waters.

WS POL 19 To protect groundwater resources having regard to the County Meath Groundwater Protection Plan.

WS POL 20 To ensure through the implementation of the River Basin Management Plans[6] and their associated programmes of measures, and any other associated legislation, the protection and improvement of all drinking water, surface water and ground waters throughout the county.

WS POL 21 To work, in co-operation with relevant organisations and major stakeholders to ensure a co-ordinated approach to the protection and improvement of the county's water resources.

WS POL 22 To continue efforts to improve water quality under the Local Government (Water Pollution) Act 1977, as amended and by implementing the measures outlined under the Nitrates Directive (91/676/EEC) and complying with the requirements of the Surface Water Legislation Environment Objectives (Surface Waters) Regulations 2009 and other relevant regulations.

WS POL 23 To promote public awareness of water quality issues and the measures required to protect both surface water and ground water bodies.

WS POL 24 To manage groundwater resources particularly having regard to the abstraction and recharge rates of ground-waterbodies.

WS POL 25 To protect, maintain and improve the natural character of the watercourses and rivers in the county Meath.

WS POL 26 To seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the County.

WS POL 27 To ensure that proposed septic tanks and proprietary treatment systems, or other waste water treatment and storage systems, and associated percolation areas where required as part of a development, comply with the recommendations of the Environmental Protection Agency and that they are employed only where site conditions are appropriate.

NH POL 21 To protect the recreational, educational and amenity potential of navigational and non-navigational waterways within the County, towpaths and adjacent wetlands.

The Meath County Development Plan 2013-2019 lays down specific objectives in relation to surface water run-off as follows:

WS OBJ 9 To promote compliance with environmental standards and objectives established for bodies of surface water, by the European Communities (Surface Waters) Regulations 2009.

WS OBJ 10 To develop groundwater protection schemes in line with the recommendations contained within the DoEHLG/GSI/EPA publication 'Groundwater Protection Schemes, 1999' or any revised or replacement publication.

[6] The draft River Basin Management Plan for Ireland 2018 to 2021 replaces the eight separate RBD Plans.

WS OBJ 16 To incorporate and promote the use of Sustainable Urban Drainage Systems within County Council Developments and other infrastructural projects as required in the Greater Dublin Regional Code of Practice for Drainage Works.

WS OBJ 17 To require the use of Sustainable Urban Drainage Systems in accordance with the Greater Dublin Regional Code of Practice for Drainage Works for new developments (including extensions).

WS OBJ 18 To ensure that all new developments comply with Section 3.12 of the Greater Dublin Regional Code of Practice for Drainage Works V6 which sets out the requirements for new developments to allow for Climate Change.

WFD Status and Risk Assessment

As discussed in Section 12.2.1.1 there is a status and risk for river waterbodies. The information is available on catchments.ie. The status and risk for waterbody (IE_EA_08_352) draining the site are discussed below.

Water Framework Directive Monitoring Data

A water quality monitoring programme was established by the Environmental Protection Agency (EPA) under the WFD to determine the status of the waterbodies, as discussed above. Chemical and biological/ecological quality of surface waters is monitored at numerous locations throughout the country. The monitoring stations near the site are shown on Figure 12.4.

There is one monitoring point downstream of the landfill on the River Nanny, east of Balrath and a second point which is upstream of the confluence of the tributaries draining the site with the River Nanny. The results of the monitoring at this location is included in Table 12.4 and they are discussed below.

Biological Water Quality

The EPA scheme of Biotic Indices or Quality (Q) Values was developed to determine the status of organic pollution in Irish rivers by assessing the occurrence of macroinvertebrate taxa of varying sensitivity to pollution.

The Q values measured most recently (30) at the monitoring stations near the site are outlined below. The locations of theses monitoring locations with respect to the landfill facility are shown in Figure 12.4.

Table 12-4: EPA Measured Q Values

Station No.	Station Name	River Sub Basin	Co-ordinates (X,Y) IG	2005	2008	2010	2014
RS 08N010110	East Br Kentstown	NANNY (MEATH)_010 EA_08N010110	N 264966.67 E 297681.67	2-3	2-3	3	3
RS 08N010280	Br d/s Nanny Br	NANNY (MEATH)_010 EA_08N010280_	N 265150.87 E 302748.86	4	4	3-4	3

A Q value of 3 or 2-3 represents 'Poor' water quality status under the WFD. It also indicates that the waterbody is "moderately polluted" and in an "unsatisfactory condition[7]"

A Q value of 3 represents 'Poor' water quality status under the water framework directive. It also indicates that the waterbody is "moderately polluted" and in an "unsatisfactory condition".

A Q value rating of 3-4 represents 'Moderate' water quality status under the water framework directive. It also indicates that the waterbody is "slightly polluted" and in an "unsatisfactory condition".

A Q value rating of 4 represents 'Good' water quality status under the water framework directive. It also indicates that the waterbody is "unpolluted" and in a "satisfactory condition".

The Q values since 2010 have been the same both up and downstream of the confluence of the Knockharley or Flemingstown Stream with the River Nanny. Whilst the most recent results in 2014, represent 'Poor' water quality status under the water framework directive, because the upstream and downstream observations are similar, poor quality status arises from influences external to and upstream of the existing and proposed development.

Chemical Water Quality

Various parameters are analysed from the water samples taken as part of the WFD monitoring programme. The parameters measured at the monitoring stations near the site are outlined below and shown in Table 12.5.

The table shows the mean values recorded during a monitoring programme (2009-2016) (35) for the following locations. The count indicates the number of samples taken over the period for each parameter.

- 08N01-0110 East Br Kentstown
- 08N01-0280 Br d/s Nanny Br

The monitoring results are compared to the environmental quality standards as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended in 2012, 2015 (S.I. No. 272 of 2009, S.I. No. 327 of 2012, S.I. No. 386 of 2015).

[7] "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses. EPA website.

Table 12-5: WFD Monitoring Results 2009-2016

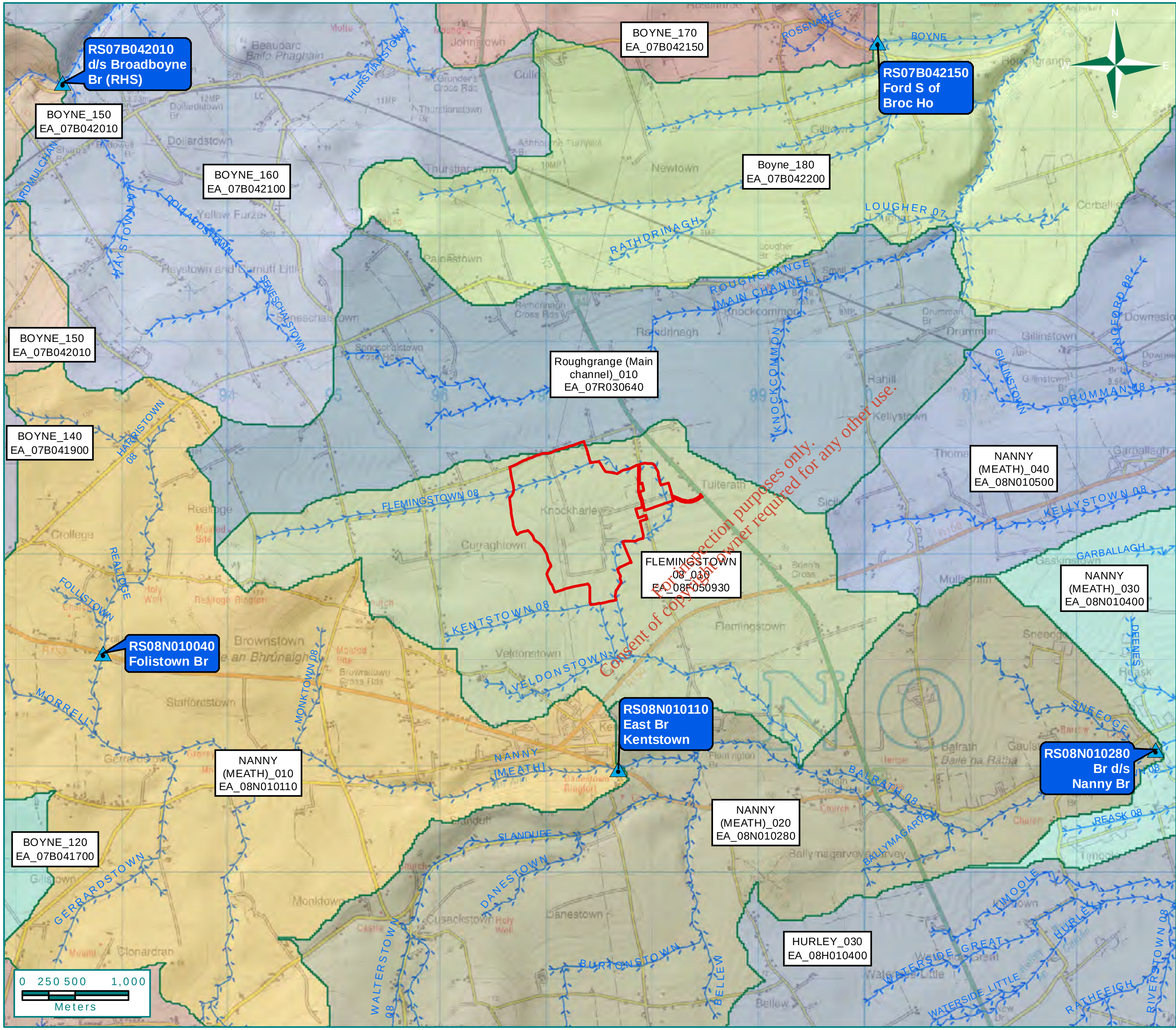
Row Labels	Unit	Count	Minimum	Average	Maximum	Environmental Quality Standard
08N01-0110						
Alkalinity-total (as CaCO3)	mg/l	28	224	318.61	370	
Ammonia-Total (as N)	mg/l	43	0.03	0.30	1.416	0.14 (95%ile good status)
BOD - 5 days (Total)	mg/l	47	0.50	2.25	7.8	2.6 (95%ile good status)
Chloride	mg/l	28	20	25.71	44.3	
Conductivity @20°C	µS/cm	4	569.84	616.42	684.71	
Conductivity @25°C	µS/cm	30	521	720.90	787	
Dissolved Oxygen	mg/l	90	6.66	48.71	104	
Dissolved Oxygen %	%	4	64.50	84.20	93.6	
Nitrite (as N)	mg/l	29	0.01	0.05	0.124	
ortho-Phosphate (as P) - unspecified	mg/l	43	0.01	0.12	0.301	0.075 (95%ile good status)
pH	pH units	42	7.77	8.09	8.6	>6<9
Temperature	°C	33	3.30	9.88	14.9	
Total Hardness (as CaCO3)	mg/l	28	244	369.70	456	
Total Nitrogen	mg/l	4	2.53	3.10	3.46	
Total Oxidised Nitrogen (as N)	mg/l	28	1.76	3	4.62	
True Colour	PtCo Units	25	6.00	19	66	
08N01-0280						
Alkalinity-total (as CaCO3)	mg/l	27	224	321.07	370	
Ammonia-Total (as N)	mg/l	29	0.01	0.05	0.114	0.14 (95%ile good status)
BOD - 5 days (Total)	mg/l	33	0.50	1.19	3.09	2.6 (95%ile good status)
Chloride	mg/l	27	18.30	26.76	50.6	
Conductivity @20°C	µS/cm	4	555.36	614.61	672.95	
Conductivity @25°C	µS/cm	29	512	713.62	771	
Dissolved Oxygen	mg/l	62	7.60	50.63	130	
Dissolved Oxygen %	%	4	81.40	89.90	94.8	
Nitrite (as N)	mg/l	28	0.00	0.03	0.078	
ortho-Phosphate (as P) - unspecified	mg/l	29	0.03	0.09	0.155	0.075 (95%ile good status)

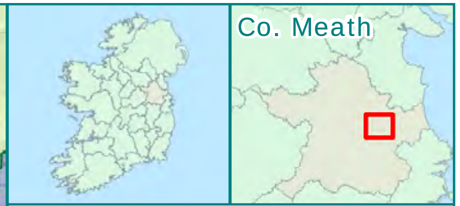
Row Labels	Unit	Count	Minimum	Average	Maximum	Environmental Quality Standard
pH	pH units	29	7.87	8.18	8.49	>6<9
Temperature	°C	32	3.30	10.17	16.6	
Total Hardness (as CaCO3)	mg/l	27	248	374.23	473	
Total Oxidised Nitrogen (as N)	mg/l	28	1.48	2.98	4.56	
True Colour	PtCo Units	24	5.00	18.89	88	

EQS - European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended

The parameters measured, as shown in Table 12.5 are in some instances above the thresholds of the environmental quality standards.

Whilst the most recent results in 2014, represent ‘Poor’ water quality status under the water framework directive, (see also Figure 12-4 Q Values) because the upstream and downstream observations are similar, poor quality status arises from influences external to and upstream of the existing and proposed development.





Legend

Site Boundary

EPA Monitoring Stations

Operational

Water Framework Directive Cycle 2 Revision

River Sub-basins

Rivers

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Water Quality Monitoring
Figure No.	12.4
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Scale	1:50,000 @ A4

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Licence Compliance Monitoring Data

Surface water quality is currently monitored on a quarterly basis at 8 locations at Knockharley Landfill set out under licence condition D.1 of the existing Industrial Emissions (IE) Licence, W0146-02. The locations are shown in Table 12.6 below and in Drawing No. LW14-821-01-P-050-001 Existing Monitoring Locations in Volume 4 of this EIAR.

Table 12-6: IE Licence Surface Water Monitoring Locations

Monitoring Location	Easting	Northing	Stream	Description
SW1	296706	267600	Knockharley/Flemingstown St.	Upstream
SW2	297464	267862	Knockharley/Flemingstown St.	Upstream
SW3	298087	267634	Knockharley/Flemingstown St.	Upstream
SW5	297764	267116	Knockharley/Flemingstown St.	Upstream
SW6	297663	266562	Knockharley/Flemingstown St.	Downstream
SW7	297510	266525	Kentstown St.	Downstream
SW8	297916	266029	Knockharley/Flemingstown St.	Downstream (and d/s of confluence of Kentstown and Knk/Flem St.)
SW9	297587	266621	Outlet from wetland	Discharge from the surface water wetland (into Knockharley/Flemingstown St.)

The monitoring programme, carried out at the facility since 2001 before waste was accepted, established baseline water quality and identified seasonal variations. The seasonal variation is thought to be associated with local agriculture practices and individual wastewater treatment systems in the area surrounding the facility. Baseline surface water quality results are shown in Table 12.7 for comparative purposes.

Surface water samples are analysed each quarter for a range of parameters as specified in Schedule D of the licence. Surface water results over the last 5-year period were assessed and compared to the baseline and are discussed in following paragraphs.

Table 12-7: Baseline Surface Water Quality

Parameter	Units	SW1	SW2	SW3	SW5	SW6	SW7	SW8
pH	pH Units	7.94-8.20	7.7-8.44	7.75-7.98	7.61-8.07	7.76-8.06	7.42-8.37	7.63-8.02
Electrical Conductivity	mS/cm	0.613-0.730	0.653-0.682	0.593-0.688	0.549-0.726	0.625-0.698	0.590-0.694	0.662-0.720
Ammoniacal Nitrogen	mg/l	<0.2-0.6	<0.2	<0.2-1.1	<0.2-0.5	<0.2-0.5	<0.2-1.7	<0.2-0.4
Dissolved Oxygen	mg/l	5.3-9.4	4.7-8.9	5.1-8.6	4.4-8.4	5.0-8.9	5.0-8.7	4.6-8.5
Chloride	mg/l	21-31	23-56	29-36	29-35	28-33	24-36	30-54

Parameter	Units	SW1	SW2	SW3	SW5	SW6	SW7	SW8
Total Suspended Solids	mg/l	<10-48	<10-46	<10-34	<10	<10-11	<10-10	<10-15
BOD	mg/l	<2-2	<2-12	<2-5	<2-4	<2-3	<2-3	<2-3
COD	mg/l	<15-41	<15-25	<15-46	<15-43	<15-41	<15-29	<15-31
Potassium	mg/l	9	2.6	10.8	11.6	11.8	17.6	2.4
Sodium	mg/l	13.5	8.1	13	14	15	9.8	15
Total Oxidised Nitrogen	mg/l	4.1	7.9	5.4	5.1	5.3	3.7	4.3
Calcium	mg/l	95.44	99.93	77.87	74.7	72.58	99.99	93.66
Cadmium	µg/l	3.5	3.5	3.5	3.5	<0.4	<0.4	<0.4
Chromium	µg/l	4	4	3	4	<1	<1	<1
Copper	µg/l	10	8	8	9	6	6	<5
Iron	µg/l	75	47	112	132	123	38	55
Lead	µg/l	<5	<5	<5	<5	<5	<5	<5
Magnesium	mg/l	6.48	4.44	5.38	5.3	5.23	8.89	6.73
Manganese	µg/l	11	10	10	9	5	6	4
Mercury	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/l	25	24	29	29	30	30	29
Zinc	µg/l	<5	<5	<5	<5	<5	<5	<5
Total Alkalinity as CaCo3	mg/l	300	220	200	90	250	270	250
Total Phosphorous	mg/l	0.44	0.09	0.34	0.56	0.54	0.54	0.32

The following is a discussion of surface water quality as monitored in compliance with the licence in the period 2012 to 2017. The results of surface water monitoring at SW2 and S2W6 over the last 5 years are averaged in Table 12.8. The full set of monitoring results for all monitoring locations are presented in Appendix 12.3.

Table 12-8: Averages of Surface Water Monitoring Results at SW2 & SW6 2013- Q3 2018

Parameters	Units	Average SW2	Average SW6
Ammoniacal Nitrogen	mg/l	0.12	0.10
BOD	mg/l	2.09	4.59
Cadmium	µg/l	0.40	0.18
Calcium	mg/l	115.33	119.45
Chloride	mg/l	21.69	19.25
COD	mg/l	14.68	18.91
Dissolved Oxygen	mg/l	9.00	8.40
Electrical Conductivity (lab)	mS/cm	0.60	0.77
Iron	mg/l	0.24	0.18
Lead	µg/l	1.82	2.15
Magnesium	mg/l	8.90	16.95
Manganese	µg/l	97.00	38.50
Mercury	µg/l	0.26	0.26
Orthophosphate	mg/l	1.00	1.00
pH	pH units	7.98	7.47
Sodium	mg/l	15.43	14.18
Sulphate	mg/l	21.65	246.30
Temperature	mg/l	7.73	8.75
TON	mg/l	0.62	0.37
Total Chromium	µg/l	1.01	1.06
Total Phosphorous	mg/l	0.35	0.21
Total Suspended Solids	mg/l	7.00	8.59
Zinc	mg/l	0.01	0.01

In accordance with licence condition 8.8.1, a continuous monitoring programme is in place at the surface water pond (SW pond) and at the discharge point from the wetland (SW9). There is a trigger level of 20 mg/l for Total Organic Carbon (TOC). If this limit is recorded the outlet to the pond is shut. Electrical Conductivity, pH and TOC are measured continuously at the inlet to the pond.

Ammoniacal Nitrogen

The parameter ammoniacal nitrogen is indicative of organic pollution from sources such as leachate, wastewater or agriculture. Ammoniacal Nitrogen levels overall across site have remained relatively stable in the period. There is no baseline for SW9 as it is the outfall from the proposed development. The outfall SW9 from the facility wetland is located upstream and immediately adjacent to SW6 on the Knockharley/Flemingstown Stream (see Drawing No. LW14-821-01-P-050-001 Existing Monitoring Points) in Volume 4 of this EIAR. There has been no exceedance of the baseline level of ammoniacal nitrogen at SW6 in the past 5 years. The level of ammoniacal nitrogen at SW9 the outfall, was recorded once in 2014 above the EQS of ≤0.140 mg/l (95%ile) (S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009), however at that event, the result for SW6 was similar but was below the baseline. The trendline for ammoniacal N at SW6 and SW9 in the period 2013 to 2018 is flat. These results indicate no impact from the existing development.

Electrical Conductivity

Electrical Conductivity at monitoring locations upstream of the landfill (SW1, SW2, SW3 and SW5) have remained relatively stable but display an upward trend at all locations over the period and the results are generally within the baseline range.

Results for Electrical Conductivity at SW7 and SW8 are broadly stable. Electrical Conductivity results at locations SW6 and SW9 are similar and display a slight upward trend of 0.1 mS/cm in the 5-year period. Electrical Conductivity levels at SW6 were outside the baseline range on occasion in 2015 and in 2016, and on three occasions in 2017 and 2018. The trend in Electrical Conductivity results is upwards at all locations SW1-SW9 over the 5-year period and all locations show results outside the baseline range. The trends displayed at SW6 and SW9 are normal in the context of the upstream results.

Total Suspended Solids

Total suspended solids levels have remained below the surface water discharge limit of 35 mg/l at SW9, as set in the licence with the exception of the Q2 sampling event in 2017 but this was attributed to sampler error due to very low flow.

pH

pH levels are relatively stable across all monitoring locations. Overall trends in pH levels have remained within the baseline range and have been relatively stable over the monitoring period.

Dissolved Oxygen

Dissolved Oxygen levels were broadly similar upstream and downstream of the facility and are within typical ranges for surface waters.

BOD

The levels of BOD recorded at all locations are usually below the laboratory limit of detection and are usually within the baseline level. The results show BOD above the baseline and limit of detection at a number of locations around the site both up and downstream of the facility. The levels of BOD at SW9 were above the EQS on five occasions in the 5-year period but the results are lower than those detected at other locations and the 5 year trend is downwards.

The levels of BOD were above the baseline on two occasions in May 2016 and May 2017 at SW6, however in both instances, the BOD at SW9 was lower than that recorded at SW6 indicating the result was not attributable to the facility.

Chemical Oxygen Demand (COD)

Levels of COD in the past 5 years have generally been recorded within the baseline range. There were 5 no. exceedances of the baseline at upstream locations and one exceedance at SW6 in 2013. Chemical Oxygen Demand exhibits a decreasing trend at all locations in the period.

Chloride

Chloride levels downstream of the facility at SW6 and SW8 have been recorded within the baseline range. The 5-year trend at SW9 and SW6 (discharge to stream) is downwards. At locations upstream, SW1-SW5, the trends are downwards except for SW5. The chloride results are generally within the baseline range, exhibiting higher levels upstream at SW1 and SW3 on two occasions and downstream at SW7 on two occasions.

Given that elevated readings were observed upstream of SW6 and at SW7 which is not influenced by the facility it is likely that external sources are responsible for chloride outside the baseline range.

Annual Parameters

Metals; cadmium, copper, chromium, lead, mercury, zinc have overall remained at low stable levels and have not shown increasing trends in the period. Levels are below the EQS limits and baseline levels.

Iron has been detected at above the baseline range at monitoring locations both upstream and downstream of the landfill. In general, there is no increase in levels of iron at downstream locations than recorded at upstream locations.

Magnesium levels have been recorded above baseline ranges for the period at all monitoring locations.

Levels of Total Phosphorus have been recorded above baseline ranges at a number of monitoring stations periodically throughout 2013-2018 but is within the baseline range at SW6. Levels of Total Phosphorous at SW6 and SW9 have been consistently similar or lower than those upstream.

The results indicate good surface water quality overall at the monitoring locations, with no impact from the landfill development.

The existing groundwater quality is assessed in Chapter 11 Soils, Geology and Hydrogeology in Volume 2 of this EIAR.

12.3.5 Internal Site Drainage

A site walkover survey took place on 27 July 2016 and 5 August 2016, to confirm the pattern of existing drainage on the site and to record any significant hydrological features on the proposed development site.

Whilst site observations showed reeds to be present adjacent to drains and poorly graded pasture which may be subject to localised waterlogging, the ground underfoot was firm and there was no evidence of flooding.

Surface water run-off drains over land and via a network of forestry and man-made drainage ditches to tributary streams of the River Nanny.

Figure 12-2 shows the approximate location of the water shed bisecting the site and also shows photographs taken during the 5th August 2016 survey.

Runoff from the permitted facility developed as of 2017 drains via an operating drainage system from the landfill facility and is directed towards the southern storm water attenuation pond and afterwards to a constructed wetland before it is discharged to the Knockharley/Flemingstown Stream.

A site walkover was conducted in November 2018 to confirm that the pattern of existing features and drainage on the site remained as per the 2016 survey.

12.3.5.1 Existing Surface Water Management

The surface drainage from the (current) permitted development south of the watershed leaves the property via a deep drainage channel located in the extreme south-east corner. An isolating weir facilitates diversion of the site drainage to the storm water pond in the event of a contamination incident. This would allow the polluted water to be retained on the property until the spill event is investigated and remediated. This provision can equally deal with third-party pollution events arising outside the site boundary. The storm water pond has sufficient capacity to dampen storm peaks and to maintain the current discharge characteristics from the landholding. The pond also allows for the settling of fines carried by the drainage waters. This is described in more detail in Section 2.2.8 of Chapter 2 in Volume 2 of this EIAR.

12.3.5.2 Access to OPW Maintainable Channels

There are no OPW maintainable channels within the site boundary. OPW maintainable channels in the vicinity of the site are shown in Figure 12-5.

12.3.6 Existing Facilities On-site

12.3.6.1 Water Supply

There is an existing water supply at the site.

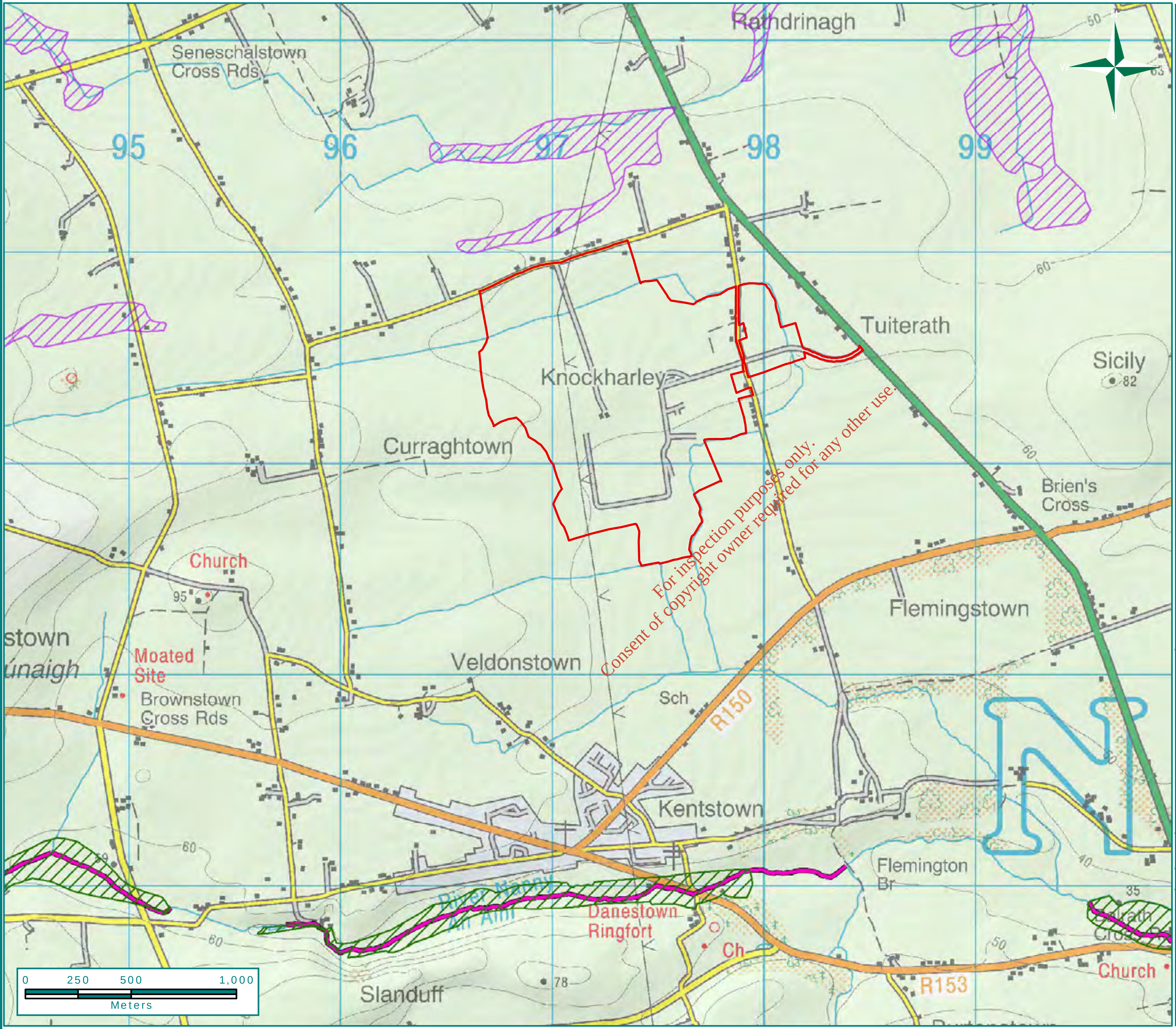
Water is required for the existing wheel wash facility and for dust suppression.

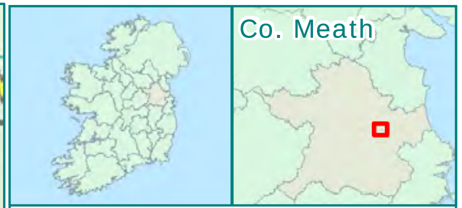
Water will be used during existing and proposed site operations for dust suppression, the additional volumes required will not be significant as it is proposed to reuse water from the attenuation ponds where appropriate.

12.3.6.2 Sanitary Waste Management

There are existing sanitary facilities at the site which will serve to provide for operations personnel. The existing sanitary facilities are located within the administration building and are conveyed to a proprietary wastewater treatment system on site.

Temporary site accommodation will be required during construction works including temporary storage of sanitary waste prior to transfer of sanitary waste off site by a permitted waste collector.





Legend

- Site Boundary
- OPW Benefited Land V3 - Jan 16

Drainage District

- DD - Benefited Land V2 - May 16
- DD - Channels V2 - May 16

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	OPW Maintainable Channels Map
Figure No.	12.5
Rev.	A
Scale	1:25,000 @ A4

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12.4 Proposed Development

The proposed development is described in detail in Chapter 2 of Volume 2 of this EIAR. The existing landfill, surface water management system and leachate management system were designed in accordance with the Landfill Directive, The Waste Management Act and with EPA guidance. The existing facility is licensed to operate by the EPA and under that licence, all infrastructure design is approved for construction by the EPA under Specified Engineering Works submissions. Following construction, the infrastructure is subject to quality assurance and is validated by the EPA for operation. The preliminary design of proposed IBA facility, biological treatment facility, leachate management facility and ancillary infrastructure is in accordance with the Landfill Directive and associated guidance as per Section 12.2.1. The existing and proposed development has been designed to prevent negative impacts on hydrology and surface water.

The proposed drainage layout is shown in Drawing No. LW14-821-01-P-000-004 through 011 Site Layout Plan in Volume 4 of this EIAR and on Figure 12-6 Proposed Drainage Layout in this chapter.

An existing storm water outfall exists on the southern boundary and it is proposed to develop an additional storm water outfall on the northern boundary.

A four-stage treatment train (swale – holding pond- suspended solids settlement and attenuation – within the northern attenuation pond–wetland) will cater for infrastructure in the northern watershed, that is the permitted landfill area runoff and proposed IBA facility runoff. Drainage from the proposed biological treatment facility and leachate management facility will be directed to the existing southern attenuation pond.

The drainage of the proposed development at Knockharley Landfill will be compliant in the use of SuDS. Swales leading to an attenuation facility are proposed in the drainage of the development. Appendix 12.2 of Volume 3 of this EIAR presents the proposed Surface Water Management Plan (SWMP) and provides further detail on the proposed drainage.

A temporary site compound will be provided by the contractor for future construction works with waste from canteen and sanitary facilities being discharged to a temporary holding tank for removal off site to a waste water facility.

The existing and proposed surface water management outfall were previously described in Chapter 2 of Volume 2 of this EIAR.

12.4.1 Screening Berms and Temporary Stock Pile Areas

During the construction period, excavated material will be used to create the screening bunds as shown Drawing No. LW14-821-01-P-0000-003 Proposed Site Layout Plan in Volume 4 of this EIAR. Surplus materials will be used for the final cap construction. Earthworks associated with berm locations and temporary stockpile areas are presented on Drawing No. LW14-821-01-P-0050-011 Cut/Fill Phasing Plan in Volume 4 of this EIAR.

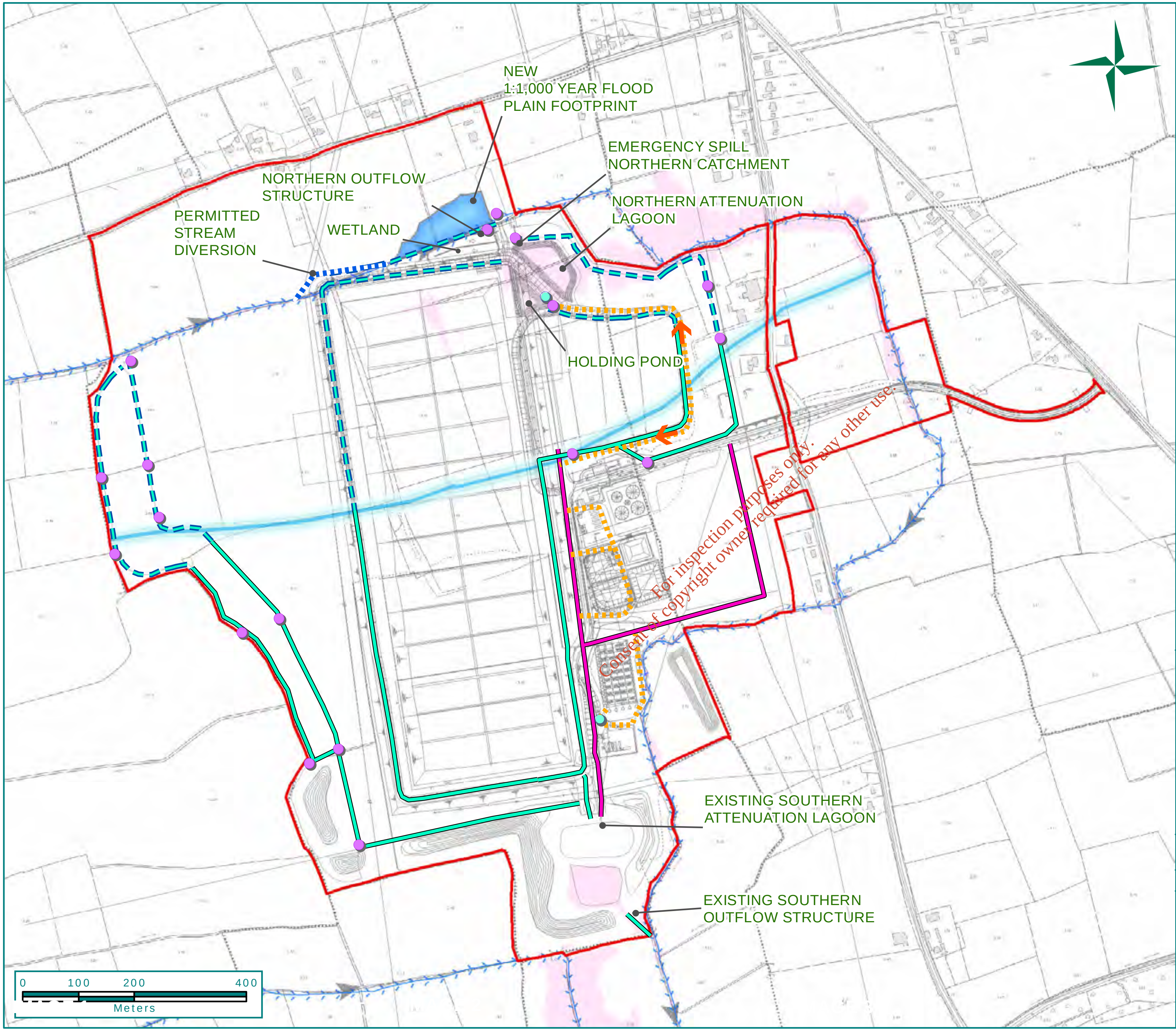
During the construction period, spoil heaps from the excavations will be stored temporarily. All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt run-off, where necessary. The permanent site drainage system will be put in place prior to excavation, therefore the discharge routes from any temporary stockpiling within that area will be via the site drainage system as detailed in the planning drawings. A minimum buffer of 10 m will be provided between temporary stockpiles and the nearest watercourse. No spoil stockpiles will be left on site after construction is completed.

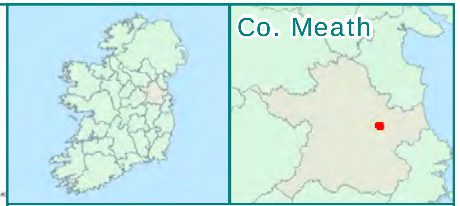
The construction of screening berms will require removal of trees prior to berm placement and reinstatement of trees once berms are constructed.

Prior to removal of trees and installation of haul roads, swales and silt fences will be placed around the perimeter of the proposed works areas to intercept storm water runoff and to pass same to *in situ* drains / watercourses via temporary suspended solids management ponds.

Figure 12-6 shows the proposed primary surface water swale, trunk main layouts and temporary stilling ponds. Construction of cell and cap areas will be subject to prior approval from the Agency in accordance with prevailing IED licence conditions for the facility. Cell, berm and cap construction will be phased.

Swales will be used to drain the reinstated sections to a mixture of temporary and permanent suspended solids management areas. Silt fencing will be erected to further protect streams, where required. The temporary stilling ponds will remain in place until the reinstated areas have attained satisfactory re-vegetation.





Legend

- Site Boundary
- Rivers & Streams
- Indicative Watershed Boundary within Site

Proposed Drainage Layout

- Below Ground Storm - Existing
- Below Ground Storm - Proposed
- Surface Water Swale Northern Outfall - Proposed
- Surface Water Swale Southern Outfall
- Permitted Stream Diversion
- 1:1000 Year Flood Plain Footprint
- New 1:1000 Year Flood Plain Footprint
- Petrol Interceptor
- Suspended Solids Management Ponds

Date	24/07/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Proposed Drainage Layout
Figure No.	12.6
Rev.	A
Scale	1:9,500 @ A4

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12.4.2 Southern Catchment

This section describes the proposed surface water infrastructure required to accommodate surface water runoff from the catchment areas south of the watershed divide as shown in Figure 12.2. Figures presented below are referenced from Appendix 12.1 of Volume 3 of this EIAR. This southern surface water management outfall has an existing surface water attenuation pond and wetland discharging into the Knockharley stream.

The discharge from the surface water pond is controlled by a slam shut valve that prevents surface water discharging if continuous monitoring of TOC indicates potential contamination of the surface water. The live storage volume of the pond is 4,253 m^3, (theoretical requirement 3,758 m^3). The 1:20 discharge capacity from the existing attenuation pond to the receiving watercourse (via the wetland) is 0.188 m^3/s.

It is proposed to direct additional surface water runoff from the proposed leachate and biological treatment facilities into the southern storm water management system via the in-situ 225 mm to 750 mm trunk main. Surface runoff from these developments will be intercepted by an in-situ petrol interceptor prior to discharge into the existing southern storm water management system.

The development area is 73.74 ha of which buildings and hard standings (from permitted and proposed developments) comprise 16.39 ha.

The greenfield discharge flow rate for the 73.74 ha catchment area is 284.5 l /s and the 1:20 year live attenuation storage[8] requirement is 4,245m^3.

The live attenuation storage of the in-situ constructed southern storm water attenuation pond is 4,253 m^3. The dead storage is 7,197 m^3. On-site in-situ provision therefore exceeds design requirements.

The existing outfall structure between attenuation pond and wetland will require the pipe outfall diameter to be increased from 225 mm to 358 mm to throttle flows to the greenfield discharge flow rates of 284 l/s. At present the discharge rate is lower than the greenfield rate.

Appendix 12.1 Southern Attenuation Pond Calc Set of Volume 3 of this EIAR shows that the existing southern attenuation pond has adequate capacity to accommodate existing increased runoff from the proposed development.

12.4.3 Northern Catchment

Surface water runoff from all roads and hard standings north of the watershed divide including runoff from the proposed IBA facility and permitted landfill will be diverted to the proposed northern surface water management system. The water will drain via landfill perimeter swales and baffled chute inlets into the northern storm water attenuation pond. The drainage pipework will vary from 225 mm diameter up to 750 mm diameter. Water from the IBA facility will drain via a holding pond prior to discharge via a baffled chute inlet to the northern storm water attenuation pond. The pipework will discharge via a Class 1 bypass proprietary oil/water separator into a holding pond and thereafter into the new northern attenuation pond. From there, the surface water will discharge via a wetland to the Knockharley stream on the northern boundary. Figure 12-9 is an artist's impression of the proposed infrastructure. The function of the holding pond will be to provide a containment facility in case contaminated surface water from either the permitted development or proposed IBA facility enters the storm water system. The function of the surface water attenuation pond will be to attenuate discharges from the pond to greenfield discharge rates and to facilitate suspended solids management.

The additional surface water management infrastructure required to accommodate runoff in the northern watershed from the permitted landfill development and proposed IBA facility and will require the construction of:

- A holding pond to isolate, if necessary, contaminated storm runoff with:
    - o continuous monitoring of pH, TOC, conductivity and turbidity
    - o automated valve set within rectangular weir to isolate flows

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[8] A procedure to compute an attenuation pond size based on procedure suggested by Greater Dublin Strategic Drainage Study Regional Policy, Volume 2 Appendix E, Criteria 2, Pages E13-E15

  - pump sump to facilitate pumping of contaminated storm runoff to leachate management facility
  - emergency spill to pass extreme events into the surface water attenuation pond
- a surface water attenuation pond to maintain greenfield runoff rates and to allow settlement of suspended solids:
  - emergency spill and baffled chute to pass water from runoff exceeding 1:100-year extreme events to Knockharley stream
  - floating outlet discharge to wetland to control storm runoff flow rates at or below green field discharge rates
- a wetland to receive attenuated storm flows from the surface water attenuation pond to polish suspended solids to < 35 mg/l and to discharge to Knockharley stream
- a flood compensation culvert across the Knockharley stream sized to facilitate:
  - conveyance of 1:100-year storm events with no impact on upstream water levels
  - compensation storage of flows for 1:1000-year flood event
  - emergency spill in case the compensation culvert becomes blocked
- permitted stream diversion around north-west corner of permitted landfill development
- supporting infrastructure to accommodate monitoring and power.

The sizing of the surface water management infrastructure and detailed of associated structures are presented Appendix 2.4 Northern Storm Water Management of Volume 3 of this EIAR.

The development area is 66.19 ha of which buildings and cells and roads comprise a factored area of 17.45 ha. The greenfield discharge flow rate for the 66.19 ha catchment area is 255 l /s and the 1:20 year live attenuation storage[9] requirement is 3,672 m^3.

The live attenuation storage of the in-situ constructed northern storm water attenuation pond will be 4,698 m^3. The dead storage will be 4,969 m^3. On-site *in situ* provision therefore exceeds design requirements.

During IBA operations potentially contaminated surface runoff will be collected via filter (French) drains with discharges into IBA Facility leachate collection system. The function of the holding pond will be to provide a containment facility in case IBA dust or other contaminants enters the storm water system.

Once IBA cell related operations cease, all runoff will be directed to the Holding Pond and thence to the Storm Water Attenuation pond.

The perimeter swales will have an approximate depth 600 mm with a bottom width of 1,000 mm and side slopes of 1 in 3.

Outflows from the storm water pond will enter the wetland via a floating weir or similar and will be discharged thereafter into the receiving Knockharley stream via a piped outfall with rip rap or similar lining protection. The attenuation pond will also have an emergency spill capable of passing a 1:100-year discharge into the receiving watercourse via a baffled chute.

The pond will be designed to accommodate a suspended solid loading of 2,500 mg/l and deliver an outflow containing less than 25 mg/l (current licence emission limit values require < 35 mg/l). The receiving wetlands will provide additional polishing once wetland vegetation is established.

The proposed storm water management infrastructure is in a 1:1000-year flood plain, accordingly flood compensation provision will be required to offset that lost by placing the proposed northern storm water attenuation management infrastructure in the natural low point of the site.

The operation of the existing pond and the proposed new pond are described in more detail in the Surface Water Management Plan in Appendix 12.2 of Volume 3 of this EIAR.

[9] A procedure to compute an attenuation pond size based on procedure suggested by Greater Dublin Strategic Drainage Study Regional Policy, Volume 2 Appendix E, Criteria 2, Pages E13-E15

Measures following consultation with IFI to protect watercourses and waterbodies on site, are provided under the following:

- A Construction Environmental Management plan in Appendix 2-0 in Volume 3 of the EIAR
- A Surface Water Management Plan IN Appendix 12-2 Volume 3 of the EIAR

Tree-felling will be required to facilitate the proposed new development, albeit that the trees to be felled are commercial forestry and will be harvested in the future. The existing forestry drains will be re-located where required and surface water flows re-diverted as necessary.

12.4.3.1 Proposed Flood Mitigation Measures

The flood risk identification and drainage assessment prepared for this development presented in Appendix 12.5 of Volume 3 of this EIAR, informed the preferred site drainage design for the proposed development.

The establishment of the proposed surface water attenuation pond in the 1:1000-year flood plain required that supplemental flood storage be provided to offset flood storage lost as a result of the works impacting the historic flood plain area.

The recommended action is to place a culvert in the existing water course designed to:

- pass 1:100-year storm runoff flows with no increase in water levels, and
- throttle 1:1000-year storm runoff to provide storage equivalent to the lost 1:1000-year flood plain volume.

The proposed design solution requires construction of a 1500 mm diameter culvert, length approximately 43 m within an embankment across the Knockharley stream at an existing culvert location (see Drawing Nos. LW14-821-01-P-500-001-003 through 005 Surface Water Management Infrastructure details in Volume 4 of this EIAR). Throttling of 1:1000-year storm events will be provided by an eccentric orifice or similar approximate diameter 825 mm (subject to detailed design).

The embankment top level will be approximately 2.15 m above existing ground level and will have an emergency spill to accommodate unforeseen culvert blockages.

The protection works upstream and downstream of the embankment will also accommodate outflows from the northern attenuation storm water pond via the wetland, and emergency spills > 1:100-year storm events from the storm water attenuation pond.

The outline Habitat and Species Management Plan within the CEMP will also define protocols following consultation with the IFI prior to construction in relation to Aquatic Ecology.

The proposed development requiring works within or adjacent to the stream will involve:

- the diversion of a watercourse for c. 171 m to the north of the site. This reach of the watercourse is not fisheries sensitive. (This work is part of permitted development albeit that Section 50 outstanding).
- Construction of a c. 43 m culvert within the Knockharley stream
- Construction of an embankment c. 55 m toe width across the stream with upstream and downstream launching apron protection works to house the culvert and provide access across the stream.
- Inlets to the Knockharley stream from wetland outfall and emergency attenuation pond spill outfall.

The outfall from the emergency spill will be via a baffled chute structure which will dissipate energy prior to discharge onto the embankment launching apron. In the unlikely event of an emergency spill occurring, the baffled chute structure is considered to be the most robust solution in mitigating the potential risk of increased suspended solids loading during an emergency spill. The baffles negating the need for a stilling basin which might get blocked.

The baffles will however be recessed into the stream bed and in the event of larger flows developing, i.e. in excess of design provision, the structure will be designed to accommodate downstream scour erosion up to 1.0 m depth.

The preliminary size of the flood compensation culvert was estimated as part of the flood risk assessment. A summary of the preliminary culvert sizing is provided in Table 12.12. The culvert was sized to convey a 1 in 100-year flood with a 20% allowance for Climate Change and to throttle flows to provide upstream compensation storage for 1:1000-year storm events. Details of supporting documentation is provided under the following:

- Flood Risk Assessment in Appendix 12-5 in Volume 3 of the EIAR
- Hydrology Report in Appendix 12-6 of Volume 3 of the EIAR

A summary of the key hydraulic design parameters is presented in Table 12-9 over and the culvert sizing is presented in Table 12-10.

Table 12-9: Summary of key hydraulic design parameters

Attenuation Ponds			
	Southern Pond	Northern Pond	Unit
Development Area	73.74	66.19	ha
Pond live storage requirement for 1 in 20 year flow	4,160	3,672	m^3
Live volume of storage provided	4,253	4,698	m^3
Outflow pipe diameter for 20 year flow	358	300	mm
Outflow pipe discharge for 20 year flow	0	0	l/s
1 in 100 year spill required for 1 in 100 year event or greater	3.66	3.24	m^3/s
Spill design capacity for 1 in 100 year flow or greater	3.71	3.29	m^3/s
Flooding & Culvert Analysis- Northern Catchment			
The flood component of the design flow that needs to be accommodated in upstream storage is any flow in excess of the 1:100, 1.83m^3/s flow, and equal to or less than the 1:1000 flood event (i.e. 2.43 m^3/s). This will be achieved by installing an orifice in the conpensation flood culvert which will restrict flows in high flow events, but allow flow to pass unimpeeded for lower flow events (up to the 1 in 100 year event).			
	Pre Development	Post Development	Unit
Flood plain storage, 1 in 1000 year	7,677	7,977	m^3
Upstream top water level in 1 in 100 year storm event	59.39	59.41	mOD
Upstream top water level in 1 in 1000 year storm event	59.56	60.5	mOD
Existing Top of bank level	59.62		mOD
Upstream Culvert Invert	-	58.457	mOD
Downstream Culvert Invert	-	58.089	mOD
1 in 100 year flood flow rate	1.83		m^3/s
1 in 1000 year flood flow rate	2.43		m^3/s
Culvert Diameter	-	1.5	m
[1]Orifice provision at entrance to culvert	-	0.825	m
Culvert length	-	43	m
Culvert Slope	-	0.009	or a 1 in 117 gradient
Flow through orifice	-	1.86	m^3/s
Upstream head on culvert in 1 in 100 year event	-	0.108	m
Upstream head on culvert in 1 in 1000 year event	-	0.278	m

1 Orifice shape and design subject to detailed design

Table 12-10: Summary of Preliminary Culvert Sizing

Culvert Reference	Form	Size (m)Pipe diameter	Length (m)	Invert Level U/S (Streambed Level)	Invert Level D/S (Streambed Level)	Culvert Slope (1:X)
Culvert at chainage 4814	Pipe	0.9	68	58.457	58.089	185

Reference	Form	Average Size Width (m) x height (m)	Length (m)	Invert Level U/S (Streambed Level)	Invert Level D/S (Streambed Level)	Slope (1:X)
Stream Diversion	Rectangular Channel	3.1 x 1.5	171	60.55	59.524	167

All natural watercourses which have to be traversed during site development works and/or for access road construction works will be effectively bridged using 600 mm diameter culvert with upstream and downstream stone protection works or similar prior to commencement.

A permanent crossing will be provided across the Flemingstown stream to facilitate an access road and is illustrated in Drawing No. LW14-821-01- P-0500-000 Proposed Storm Water Management Southern Outfall in Volume 4 of this EIAR.

A Section 50 application will be required to obtain the consent of the OPW for:

- stream diversion
- the flood culvert within embankment and stream crossing
- outfall from the wetland
- emergency overflow weir outfall from the northern Surface Water Attenuation Pond
- temporary crossing(s) associated with forestry works and construction works

A description of the works associated with the proposed Section 50 application is presented under respective headings below. The primary risks to receiving waters will be increased suspended solids loadings during construction, during operations and in the aftercare period.

Preliminary design has been informed by consultation with IFI and OPW. However prior to work commencing, detailed design will be reviewed with IFI and OPW to make sure the design criteria adopted accommodate prevailing site conditions.

12.4.4 Stream Diversion

A stream diversion, see Drawing No. LW14-821-01- P-0500-001 Proposed Storm Water Management Southern Outfall in Volume 4 is proposed to facilitate construction of the permitted development. This will require a new stream channel to be constructed. This diversion is permitted under the existing planning permission for the landfill development, but the diversion has not been required to date as the landfill cells have not yet been constructed in that area. The potential impacts and mitigation measures are included in this chapter.

To mitigate the risk of elevated suspended solids occurring, excavation works and connection to the live channels will take place during summer. Whilst there is a risk of elevated suspended solids occurring when water is passed initially through the channel, this risk will be mitigated by allowing the channel to stabilise and to vegetate following excavation prior to letting diverted stream flows enter. Water will be allowed to enter the diversion channel during low flow conditions.

If works are carried out during low flow conditions, the proposed channel is allowed to stabilise with a vegetative cover, and if flows into the channel are initiated during low flow conditions the impact associated with elevated suspended solids will be “not significant”.

12.4.5 Flood Culvert and Stream Crossing

The flood culvert is designed to throttle 1:1000-year storm events and to cause localised upstream flooding, see Drawing No. LW14-821-01- P-0500-001 Proposed Storm Water Management Southern Outfall in Volume 4 of this EIAR.

The proposed culvert cross section area is similar to the existing channel section so long-term use will not change velocities outside the normal range and will not increase the risk of suspend solids as flows pass through the proposed culvert. The culvert will also have upstream and downstream protection to allow any eddies initiated by changes section / velocity to be contained within a rip rap stone protection lining.

The primary impact will occur during construction. To mitigate the risk of suspended solids impacting downstream flows construction works will be carried out during low flow periods, excavation in the channel will be kept to a minimum (culvert invert will be coincident with existing channel invert), and downstream settling ponds will be installed to either accept diverted flows or facilitate settlement of suspended solids as may develop during works to the bed and side slopes.

If works are carried out during low flow conditions; the culvert invert is the same as the channel invert; and diversions and or through flows are directed into an on-stream stilling basin as proposed; the risk of elevated suspended solids will be 'not significant.'

The culvert will also have a spill to:

- accommodate storm events exceeding 1:1000-year storm events, and
- accommodate blockages as pay occur in the culvert.

In the event of a spill occurring to pass flows > 1:1000-year events there will be an imperceptible impact on downstream suspended solids as the embankment will be flooded both upstream and downstream such that the downstream channel will act as a stilling basin and it will dissipate any energy developing as flows overtop the spill.

In the event that a spill occurs owing to the culvert becoming blocked, the spill will have a stilling basin and down-stream protection to dissipate any energy developing as flows overtop the spill.

12.4.6 Wetland Outfall

Storm water flow from the proposed storm water attenuation lagoon is designed to pass at a constant greenfield discharge rate with suspended solids < 25 mg/l (waste license requires < 35 mg/l) into the proposed wetland. The wetland is designed to further polish suspended solids before discharging green field flow rates into the Flemingstown stream, see Drawing No. LW14-821-01- P-0500-001 Proposed Storm Water Management Southern Outfall in Volume 4 of this EIAR.

The wetland outlet structure is designed to discharge flows over a weir and to dissipate energy within a vertical stilling basin prior to discharging outflow to the stream into a rip rap stone protected outfall structure. An emergency spill will also be incorporated within the wetland outfall structure in case the outfall pipe becomes blocked.

The structure is designed to discharge storm flows into the stream with negligible energy so as to negate the need for stilling basins within the watercourse. Rip rap stone protection will be provided at the outfall mitigate the risk of suspended solids being generated owing to localised turbulence.

12.4.7 Emergency Overflow Weir Storm Water Attenuation Lagoon

The storm water attenuation lagoon has been designed to attenuate 1:20-year storm event runoff. The overflow spill capacity is designed to accommodate a 1:100-year storm event, see Drawing No. LW14-821-01- P-0500-001 Proposed Storm Water Management Southern Outfall in Volume 4 of this EIAR.

Energy dissipation will be effected by a baffled chute structure. In the event of a storm event flood causing a spill the water will flow over the weir, pass through a culvert and enter the watercourse via the baffled chute. The chute is designed to facilitate energy dissipation within the chute. In the event that energy remains, a localised stilling basin will be provided within the rip rap stone protection at the base of the chute.

Energy dissipation will mitigate the risk of suspended solids being generated.

12.4.8 Temporary Crossing

Whilst there is an option to access lands to the north of the stream from adjoining lands, a worst-case scenario from a hydrology perspective, has been assumed. A worst case also assumes that existing crossings will not be used in case they are damaged.

To facilitate cutting, removal and replanting of trees in lands to the north of the stream, forestry equipment will need to cross the stream.

Temporary works will require installation of a precast pipe culvert min diameter 600 mm and backfill using washed granular fill and removal of same thereafter. The site access will be placed adjacent to the proposed permanent culvert to facilitate construction of the permanent works.

12.5 Flood Risk Identification and Assessment

Section 12.3.3 discusses the existing flood risk. Sections 12.4.2 and 12.4.3 describe the proposed changes to the surface water management system in the southern catchment and the proposed surface water management in the northern catchment.

12.5.1 Overview of Storm Water Management Infrastructure.

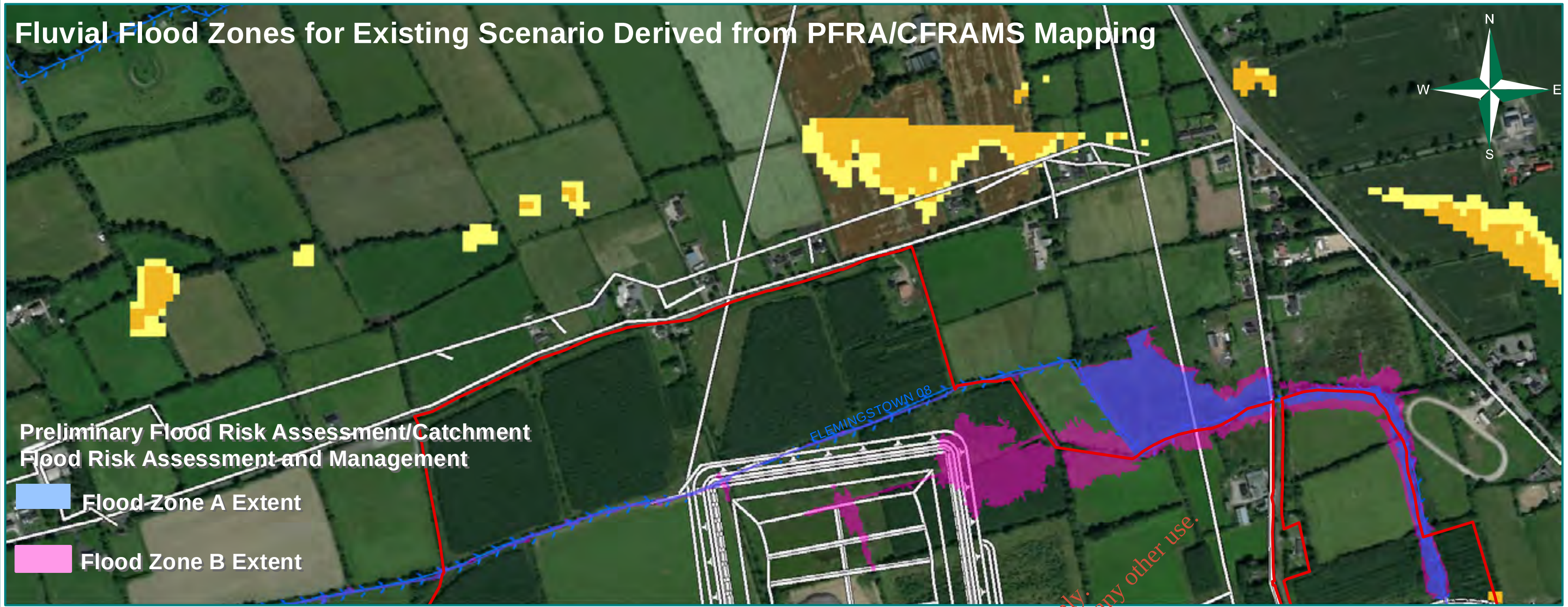
Section 12.3 and 12.4 of this chapter discuss the existing and proposed storm water management infrastructure,

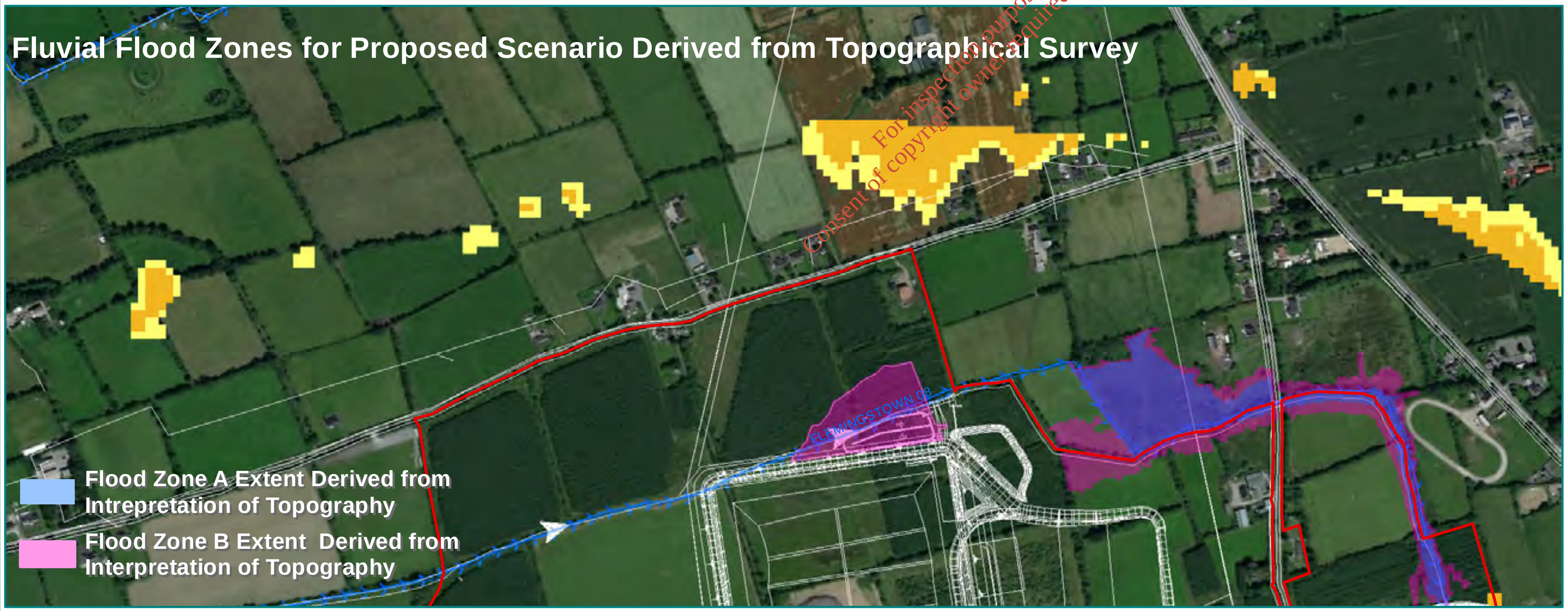
Figure 12.7 shows the 1:1000-year flood plain within the facility boundary and shows the proposed northern storm water attenuation pond will be located over an existing 1000-year flood plain storage.

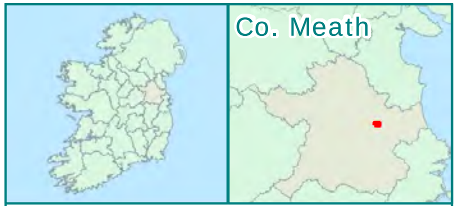
Figure 12-8 shows the catchment area upstream of the flood plain/proposed flood compensation culvert.

A Justification Test was carried out and is included in Appendix 12.5 of Volume 3 of this EIAR, following which a concept design was developed to provide storage offset that lost by placing a portion of the permitted and proposed developments within a 1000-year flood plain.

Figure 12.9 below illustrates the northern storm water management concept layout and location of compensatory flood provision.







Legend

- Site Boundary
- Site Layout
- PFRA/CFRAMS: 1% AEP Pluvial Flood Extent
- PFRA/CFRAMS: 0.1% AEP Pluvial Flood Extent
- Rivers

NOTE: The maps on Preliminary Flood Risk Assessme (PFRA) provide only an indication of areas that may be prone to flooding. They are not necessarily locally accurate, and should not be used as the sole basis for defining the flood zones nor for making decisions on planning applications.

Date	18/05/2018	
Client Name	Knockharley Landfill Ltd.	
Project Title	Proposed Development at Knockharley Landfill	
Figure Title	Site Specific Flood Risk Assessment - Existing Scenarion and Proposed Scenario Flood Zones	
Figure No.	12.7	Rev. A
Scale	1:10,000	@ A4

0 250 500 1,000
Meters

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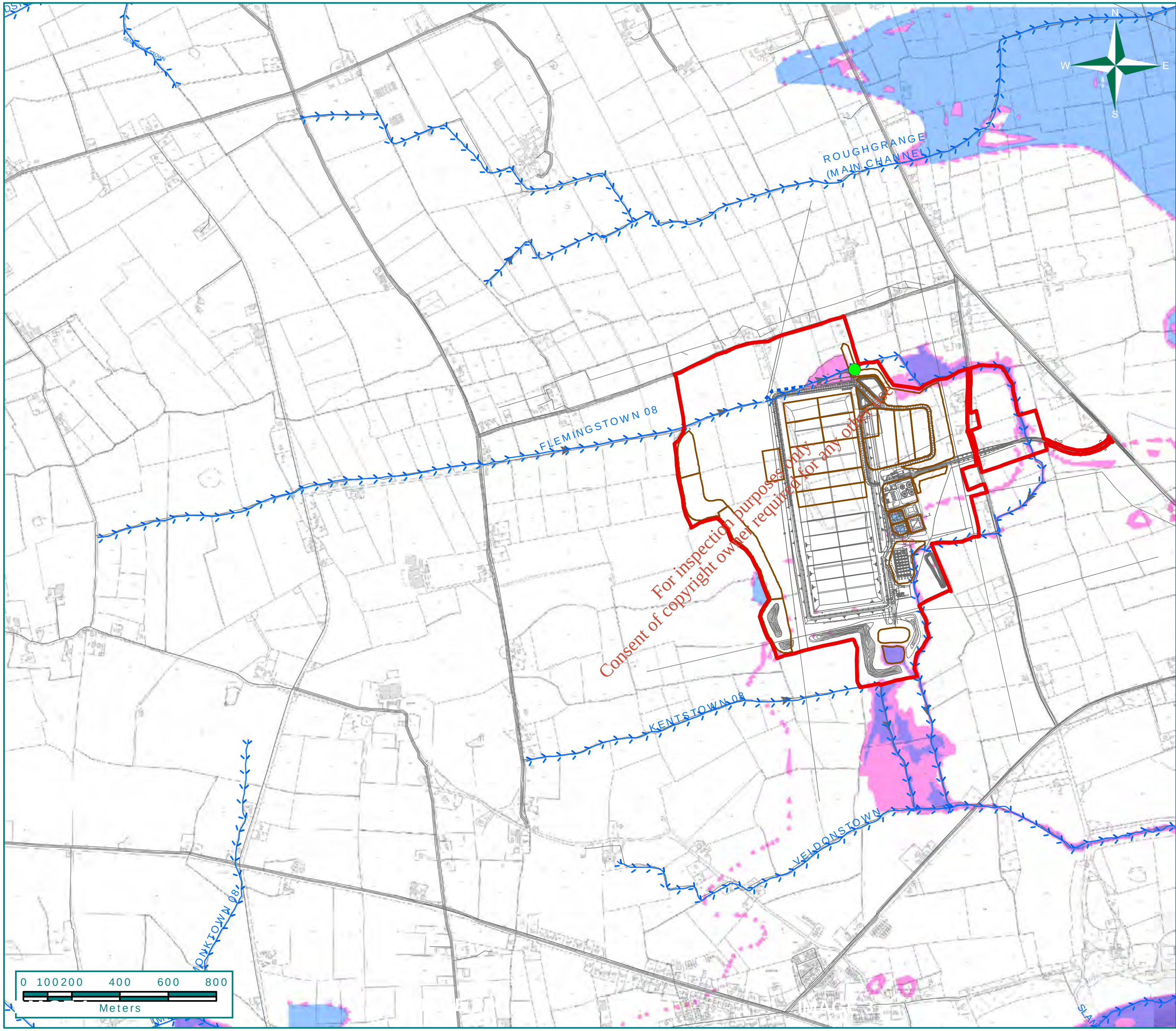
Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig12-8_Catchment Upstream of the Proposed Flood Compensation Culvert_A4.mxd



Legend

- Proposed Flood Compensation Culvert
- Site Boundary
- Flood Zone A Extent Derived from Intrepretation of Topography
- Flood Zone B Extent Derived from Interpretation of Topography
- Rivers

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Catchment Upstream of the Proposed Flood Compensation Culvert
Figure No.	12.8
Rev.	A
Scale	1:22,000 @ A4

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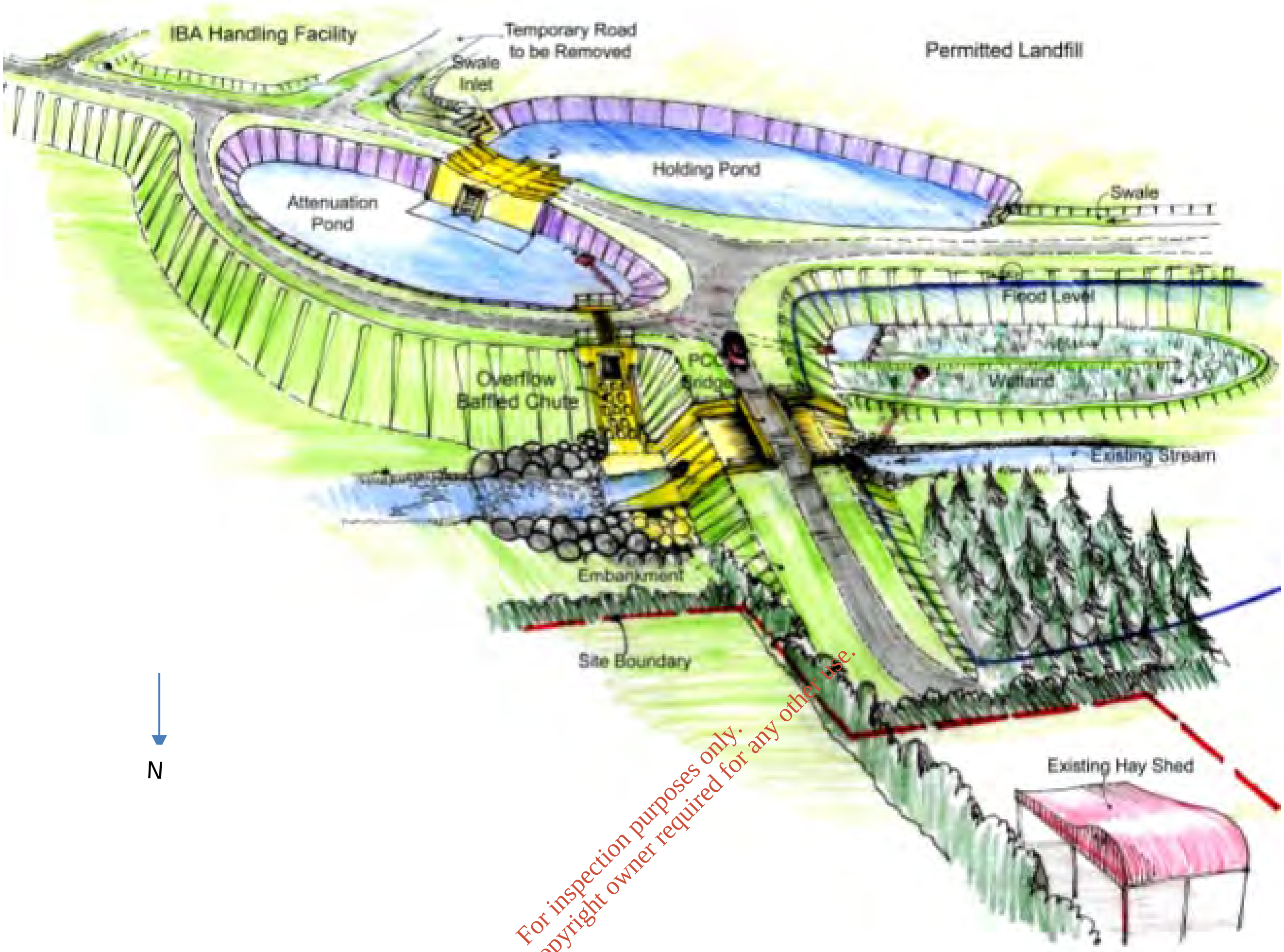

Figure 12-9: Artist Impression of Northern Storm Water Management and Flood Area

12.5.2 Offset Flood Provision

Details of volumes and flow rates quoted in the following sections can be found in Appendices 12.4 and 12.5 of Volume 3 of this EIAR.

As discussed in Section 12.3.3, the indicative flood mapping from the OPW shows an area at the north-east corner of the proposed development to be within a Flood Zone B area i.e. an area at risk of flooding in a 1 in 1000-year return period flood. Overland flows were diverted following construction of the existing permitted development and therefore flows are less likely to collect in this area, however a potential loss in floodplain storage remains.

The 1 in 1000-year flood level area was determined to be 59.56 m OD at the Flood Zone B location of the floodplain identified in the FEMFRAM[10] study. The permitted landfill footprint and proposed storm water management infrastructure will impinge on the Flood Zone B footprint that would otherwise provide *in-situ* storage approximately equal to 7,977 m^3 for 1:1000-year flood events.

It is proposed to provide equivalent compensatory storage by constructing a small culverted embankment which will be designed to throttle 1:1000-year flows and to let 1:100-year flows pass with minimal impact on upstream levels.

[10] http://fem.cfram.com/hydrology.html

A flood risk assessment prepared for the proposed development used a HECRAS river model simulation, referred to in Section 12.3.3, to determine flood levels for the 1 in 1000-year extreme event for alternate culvert diameters and the resulting upstream storage volume was compared to the potential storage lost in the indicative area shown to be a Flood Zone B area in the FEMFRAM study.

The design criteria for the flood compensation area is set out in Appendix 12.4 of Volume 3 of this EIAR.

The perimeter road on the northern boundary will also be higher than the 1:1000-year storm event predicted elevation to protect the landfill facility against flooding.

The proposed compensation culvert will accommodate a 1 in 100-year flood flow with a 20% allowance for Climate Change.

The surface water run-off from the landfill and the IBA facility will be controlled in an attenuation pond, with the outflow limited to greenfield rates before final discharge back into the stream via a wetland.

12.5.3 Conclusion of Flood Risk Identification and Assessment

There are no areas within the proposed development identified by the OPW as ‘benefitting lands’[11].

There is no area of the proposed development within the indicative 1 in 100-year floodplain area (Flood Zone A) as identified by the OPW in their CFRAM/PFRA mapping. FEMFRAM Study mapping indicates a Flood Zone B (1 in 1000-year flooding) in both the existing permitted and proposed development areas. A modification to the stream to the north of the proposed development will divert flows over and above the 1 in 100-year return period flows into an offset floodplain area, within the wooded area on the northern boundary of the permitted landfill footprint. A compensation culvert will throttle flows to provide for the lost storage that would otherwise have been provided in the historic flood plain arising from 1 in 1000-year flood event. There is no flood risk to any infrastructure within the proposed or permitted development during a flood event albeit that flooding may occur within the footprint of the site boundary, this will not however compromise the integrity of the proposed or permitted developments.

There will be no appreciable obstruction to flood flows as a result of the proposed development. Any stream crossings will be conveyed in culverts, sized to take the 1 in 100-year flood flow with a 20% allowance for Climate Change.

Because of the proposed development, an overall increase in run-off volume of 4.6% may occur. It will however be attenuated within the Veldonstown catchment and there will be no flood risk due to the development downstream in River Nanny catchment.

The estimated increase in run-off will also reduce over time as vegetation is re-established on the site. The estimated increase is considered to be of ‘not significant’. The potential for an increase in flood risk due to the proposed development is therefore of ‘imperceptible’ due to the small percentage increase in run-off volume contributing to the catchment because of the proposed development.

12.6 Potential Impacts

The potential impacts on the hydrological regime at the site and the surface water quality of waters draining the site are assessed in the following sections for the activities associated with each phase (construction, operation, maintenance and decommissioning) of the proposed development at Knockharley Landfill. The potential impacts are assessed in accordance with the evaluation criteria outlined in Section 12.2.6. The drainage of the proposed development is then considered, taking account of mitigation measures to reduce or eliminate any residual impacts.

[11] A dataset prepared by the Office of Public Works identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage.

An impact rating has been developed for each of the phases of development. In Section 12.2.6 the sensitivity of the receiving environment was first identified. Then the magnitude of the potential impact was estimated. The sensitivity rating, together with the magnitude of the potential impact, provides an overall rating of the significance of the impact prior to application of mitigation measures. The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. This is shown in Table 12.13. The residual impacts following mitigation and the associated significance rating is also provided in Table 12.14. The evaluation criteria covered the direct impacts and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project.

The potential impacts in relation to an increase in flooding, cumulative flood risk with neighbouring developments, as well as specific impacts during the various phases of the proposed development are outlined below.

There is an existing landfill with ancillary infrastructure in operation on site with a surface water management system. There has been no significant impact on hydrology or water quality as a result of the existing development. The proposed development has been designed to take account of the risks that it could pose to the environment and mitigation measures have been incorporated into the design.

12.6.1 Do Nothing Impact

If the proposed development does not proceed, it is likely that the land will continue to be used for landfill with areas left as poorly drained pasture and forestry. In areas where conifer forestry plantations are present, deforestation and reforestation will continue to occur into the future. The impact on hydrology and surface water quality would remain largely unaltered as a result.

Modifying the existing landfill facility will avoid the need for a similar development elsewhere on alternative lands where the other constraints and limitations would have to be managed, as opposed to making modifications to the existing site/landfill, where the associated works to accommodate such will be minimal as much of the associated works are in place and functioning efficiently.

12.6.2 Potential Impacts during Construction

In the absence of mitigation measures, the following potential impacts on hydrology and surface water during construction have been identified:

- Increased run-off
- Flooding
- Sediment loading
- Nutrient loading
- Spills

12.6.2.1 Increased Surface Water Run-off

The surface runoff impacts within the southern catchment will be minimal as a surface water attenuation pond is already in place. The proposed development in the northern catchment will also only result in a minor increase in surface runoff volumes prior to and during construction of the northern surface water management infrastructure. It is proposed to construct the surface water management infrastructure prior to other construction works. Once the attenuation pond and supporting infrastructure are constructed with a dedicated outlet to the Knockharley stream, surface water runoff into the receiving waters will revert to green field flow rates.

Increased impermeable surfaces associated with roof, pavements, capped areas and pond areas of the development will however increase surface runoff volumes which will contribute to the increased flow volumes shown in Table 12-11.

The potential impact of an increase in surface water runoff is greater flows in the receiving water bodies. This can cause erosion and scour around water channel structures and siltation in areas where the water velocities reduce, allowing for the waters suspended solid load to be deposited.

Increased surface runoff has the potential to also increase the peak in river water level, which could result in an increased flood risk if the increase is significant.

The percentage increase in surface water runoff volumes presented in Table 12.11 reflects percentage volume increases in the Veldonstown catchment from both the northern and southern catchments areas within the facility footprint during construction and during operations assuming attenuation is provided, and green field discharge rates are maintained.

Table 12-11: Summary of Estimated Increase in Surface Water Run-off Volumes

Catchment	% Increase Construction Note 2	% Increase Operation Note 3
Veldonstown - IE_EA_08_352 catchment Note 1	4.60%	4.69%

Note 1 1:100-year Runoff Flow Rate at Outfall of Veldonstown Catchment is 7.42 m^3/s and this has been used as a datum over a respective period assumes as being required to discharge increased runoff at greenfield discharge rate

Note 2 1:100 volume assume to be 1,106 m^3 taking a period of 54 minutes to be discharged from attenuation pond

Note 3 1:100 volume assumed to be 376 m^3 taking a period of 18 minutes to be discharged from the attenuation pond

Table 12.11 and Table 12.12 show the estimated change in runoff volumes corresponding to a 1-in-100 year, 30-minute duration storm at Knockharley Landfill.

Table 12-12: Overview of Runoff Impacts (Existing, Construction, Operation and Post Decommissioning)

Catchment	Scenario	Run-off [1,3,4]	Change in Runoff Entering Attenuation Ponds	Change in Runoff Entering Downstream Watercourse[6]	Runoff Volume[10]	Change in Runoff Volume	Time to Discharge into Knockharley Stream [8,9,11]	Time to Discharge Veldonstown [7]	Impact
		m^3/s	m^3/s	m^3/s	m^3	m^3	mins	mins	
Change in run-off from Entire Development Area[5]	Existing	1.816	0.000	0	3,268	0	0	75	Low[12]
	During Construction	2.025	0.209		3,645	376	18		
	During Operation	2.430	0.614		4,374	1,106	54		
	Decommissioning[2]	1.816	0.000		3,268	0	0		

Notes:

1 Impervious area, factored by runoff coefficient for each surface type.

2 Extent of decommissioning subject to Agency approval. Assumed impervious area not greater than the existing predevelopment area at decommissioning stage.

3 Runoff estimated by the Modified Rational Method, Q = 2.78 x (Rainfall Intensity) x (Contributing Impervious Area).

4 In estimating the runoff, a rainfall intensity for 1 in 100 year return period storm of 30 min. duration supplied by Met Éireann with a factor of 1.1 was applied to allow for climate change in accordance with GDSDS, 30.8mm applied.

5 Catchment Area within site boundary, 139.89 ha.

6 Runoff flows are attenuated in ponds, and discharged at a controlled rate, not exceeding the greenfield runoff rate.

7 Assuming a 1m/s velocity along the modelled 4.5 km reach of stream, gives an approximate time of concentration of 1hr 15m for the Veldonstown stream catchment.

8 The greenfield discharge rate for the "Southern" outfall is $0.351 m^3/s$, and $0.329 m^3/s$ from the "Northern" outfall.

9 Taking an average discharge of $0.34 m^3/s$, the additional runoff volume will be discharged in less time than the TOC.

10 Runoff Volume from 30min storm with return period of 1 in 100 years.

11 Time to discharge additional volume into Knockharley watercourse.

12 Impact is low on the hydrological regime as the time to discharge the additional volume is less that the time of concentration and therefore the discharge of additional volume from the site will have no impact on the peak flow levels in the stream downstream of the Veldonstown catchment.

The estimated increase in run-off will reduce over time as vegetation is re-established on the site. The estimated increases are considered to be not significant.

12.6.2.2 Flooding

The following comprises a list of sources in the absence of mitigation which could result in flooding at the site:

- Small diameter / shallow cross-drains could lead to blockages and consequent flooding and concentration of flows.
- The removal of vegetated material could lead to an increase in the rate of run-off from those areas. This increase in the rate of run-off could lead to a minor increase in flooding downstream.
- Stream flows could be impeded due to inappropriate design of stream crossings and watercourse diversions.
- Flows from the new drainage system could be impeded, should blockages occur in the existing drains.
- Open bodies of water and saturated ground present a risk to the safety of site personnel. Hazards of this type include the stream running through the site and other potentially wet areas following extreme rainfall events (Waterlogged ground was observed during the site walkover. See also Hydrological Features in Figure 12.2).
- The construction of new infrastructure has the potential to obstruct existing overland flow.
- Infrastructure proposed in boggy, poorly drained areas, could lead to an increase in flooding elsewhere.
- The increase in impermeable areas in the proposed new development areas could lead to an increase in flooding downstream.
- The relocation of the 1 in 1,000-year floodplain.

The potential impacts of flooding include, damage to the site's operational infrastructure, a risk to the health, safety and wellbeing of site staff, and a negative impact on the receiving environment, including pollution of watercourse.

Relocating the 1:1000-year floodplain as part of the proposed flood compensation area will have an impact on the flood extent, however, it will have little if any impact on fish, wild life or other as may be present.

12.6.2.3 Sediment & Nutrient Loading

Construction activities on site have the potential to cause soil disturbance. Rain can result in potential run-off of soil particles (sediment) to watercourses causing soil erosion and consequent sediment release into the receiving watercourses.

There is a potential impact on surface water quality from an increase in sediment concentration in watercourses during the construction phase. Sedimentation is the deposition of fine sediment either within the gravel or directly on the substrate surface of an aquatic system. Problems arise when high sedimentation rates smother coarser particles with fine ones. This can reduce oxygen levels either through a decline in through flow rates or, in the case of organic particulates, by their own use of oxygen (36).

The potential sources of sediment to surface water which may arise during tree felling and construction activities in the absence of mitigation measures include:

- Release of sediment during the stream diversion and culverting works.
- Increased sediment loading of streams from personnel and traffic activities.
    - Run-off from access tracks to facilitate forestry works and earthworks during construction

- o Temporary haul roads passing close to watercourses could allow the migration of silt laden run-off into watercourses; crushing of stone in haul roads by heavy vehicles, creates fines and consequent oozing of soluble material in very wet weather out from the roads and into the drainage network.
- Inappropriate site management of excavations could lead to loss of suspended solids to surface waters.
- Spoil heaps from the excavations will be stored temporarily and could lead to an increase in silt-laden run-off draining off site.
- Inappropriate management of berm construction could result in the loss of suspended solids to surface waters.

Other potential sources of nutrients or contaminants in surface water run-off during construction include:

- Wet concrete operations
- Sanitary waste
- Tree felling

As discussed in Section 12.4, the potential for release of sediment and nutrients to surface water during the construction and operation of the development was considered during the preliminary design and will form an integral part of detailed design. The existing and proposed surface water management systems will mitigate the potential release of sediment and nutrients to surface water from the proposed infrastructure (landfill, IBA, biological treatment facility, roads and hardstanding areas). The northern surface water management system will be constructed ahead of other elements of the development. There is potential for sediment and nutrient release in the absence of mitigation measures from areas outside of the northern and southern surface water management systems, i.e. construction of the screening berms, felling activities and during the construction of the northern surface water management infrastructure.

12.6.2.4 Spills

A spillage of diesel or hydraulic fluid during the construction period has the potential to impact on surface water quality in the absence of mitigation measures. These spills have the potential to contaminate surface water which will in-turn impact the water quality and the eco-systems which interact with the catchments surface water.

The potential sources of spills in the absence of mitigation during the construction period include:

- Refuelling activities
- Leak during plant operations
- Leak from storage tanks

12.6.2.5 Potential Cumulative Impacts

The increase in the rate of surface water run-off due to the increase in impermeability in the proposed new development areas within the waterbody catchment, could lead to a low cumulative risk of flooding downstream.

To mitigate the risk of cumulative downstream impacts, programming has been structured such that prior to any bulk earthworks works commencing in the northern sub catchment within the facility boundary, the northern storm water management system will be installed.

There are a number of facilities within the surrounding hinterlands that operate under licences issued by the EPA:

- Kentstown Sow Unit (transferred to Marry Pig Farms Limited) is located approximately 4 km south of the Knockharley Landfill facility in Danestown. It is operated under an IE licence P0456-01 from the EPA. It is a piggery with approximately 4,000 pigs and employs 3 people. Planning permission was granted in January 2015 for the demolition and reconstruction of facility buildings
- There is a poultry farm in Gerrardstown, Garlow Cross, located approximately 3.5 km south west of the facility. The poultry farm produces eggs and currently has capacity for 40,000 layers and is licensed for 117,500 layer spaces. The facility is licensed by the EPA through IE licence P0917-01. The 2015 AER lists one employee.
- A poultry farm in Garballagh, Duleek rears c. 3,000 broilers per annum. It is operated under IE licence P0887-01. It is approximately 4 km west of the facility and employs one person.

  Dunbia operates a meat processing facility in Beauparc under IE licence P0811-02 the operation of slaughterhouses with a carcass production capacity greater than 50 tonnes per day. It has over 70 employees and is 3.5 km north of the facility.
- Cooksgrove Ltd., trading as Euro Farm Foods, operates as cattle slaughterhouse in Cooksgrove, Duleek. It has an IE licence P0822-01 with a throughput of 300 cattle a day. It has over 100 employees. The facility is approximately 8 km west of the Knockharley Landfill facility.
- Nurendale Ltd. trading as Panda Waste Services Ltd. owns and operates a large Materials Recovery Facility at Rathdrinagh Cross Roads, approximately 4 km north east of the facility on the N2 to Slane. It is operated under a licence from the EPA, W0140-04 and is licenced to accept up to 250,000 tonnes per annum of household, commercial and industrial waste, biowaste and biodegradable waste, and construction and demolition waste and the facility employs approximately 160 people. A licence review application for, *inter alia*, the acceptance and processing of incinerator bottom ash is at time of writing under consideration by the Agency.
- Advanced Environmental Solutions (AES) Ltd. owns and operates a waste transfer facility in Navan under IE licence no. W0131-02, approximately 10 km west of Knockharley Landfill. The licensed capacity of the facility is 95,000 tonnes per annum. The facility has approximately 15 employees.
- Perma Pigs Limited, is an operational pig farm located at Littlegrange, Drogheda, County Louth, approximately 9 km north east of Knockharley Landfill. Perma Pigs Limited operates under EPA licence P0431-02. It is a piggery with No. 9,868 stock at the farm according to 2017 AER and is licensed to house 11,490 pigs, ranging from dry sows to weaners. The 2017 AER lists 5 no. employees.
- Irish Cement Limited, located at Platin Works, Platin, Drogheda, County Meath operates a cement production which includes a limestone quarry under the EPA licence register number P0030-05. The facility is approximately 10 km north east of Knockharley Landfill. Irish Cement EPA licence allows for the acceptance of alternative fuel which include meat and bone meal (40,000 tonnes per annum), chipped tyres (30,000 tonnes per annum) and solid recovered fuel (90,000 tonnes per annum). The 2016 AER lists 103 no. employees. Irish Cement Limited has submitted a licence review application to the EPA (P0030-06) to allow for the further replacement of fossil fuels with alternative fuels and the use of alternative raw materials (600,000 tonnes of waste per annum) at their Cement Works in Platin, Co. Meath.
- A poultry farm, located at Dowth, Slane, County Meath, approximately 7 km north east of Knockharley Landfill. The poultry farm produces eggs and currently has capacity for No. 78,000 birds (broilers) at the farm. The facility is licensed by the EPA - IE licence P0951-01. The 2016 AER lists one employee.
- Indaver Ireland Limited operate a waste incineration plant at Carranstown, Duleek, Co. Meath under EPA IE licence no. W0167-03. The plant is approximately 10 km north east of Knockharley Landfill. It is licensed to accept up to 235,000 per annum of household, commercial and industrial waste, sewage and industrial waste, aqueous waste and construction and demolition waste and hazardous waste and the facility employs approximately thirty-nine people.

Each of these facilities is licensed by the EPA and subject to monitoring as part of their licences. The current proposal for construction at the site is not likely to give rise to impacts on the Knockharley Stream following the implementation of best practice construction measures and so cumulative impacts with other projects is not likely to occur.

No future development of scale with the potential to impact on hydrology or surface water quality has been identified in the vicinity of the development location based on an assessment of these information sources and thus no further consideration in this regard is undertaken.

12.6.3 Potential Impacts During Operation and Maintenance

12.6.3.1 Uncontrolled release of leachate

The IBA facility will be designed, constructed and operated in accordance with the Landfill Directive, relevant EPA guidance and the licence. Leachate will be contained within the IBA cell area and pumped via leachate pipework to an appropriately designed leachate management facility. This is described in Chapter 2 of Volume 2 of this EIAR. By virtue of the design standards required, and the operational conditions of the licence, the potential for an uncontrolled release of leachate from the cells or leachate management infrastructure is unlikely.

There is potential for leachate breakouts from the waste body. The facility is, and will continue to be, operated in accordance with the conditions of the licence and regular inspections of the waste body take place. In the unlikely event of a leachate breakout, the leachate will be captured in the surface water management system and directed to the northern holding pond or southern attenuation pond.

12.6.3.2 Increased Surface Water Run-off

Table 12.10 summarises the hydrological impacts on the Veldonstown catchment for the 1:100 30 min duration storm with a 10% allowance for climate change shows:

- There will be no increase in flow rate discharging into the Knockharley stream from the proposed development owing to the proposed storm water attenuation pond maintaining flows at or below green field discharge rates.
- There will be a 4.69 % increase in discharge volumes primarily due to the change in land use resulting in an increase in impermeable ground conditions. This discharge volume is not significant.
- There will be no flood impact at the outfall of the Veldonstown catchment, because the time required to discharge the increased volume is less than the time of concentration associated with developing peak flows in the Veldonstown catchment, i.e. the downstream water body is able to accommodate the increased volume discharges at the greenfield discharge rate.

12.6.3.3 Flooding

During the operation and maintenance phase the attenuation ponds, the wetlands, and the flood compensation will be in place and therefore the risk of flooding at the proposed development or within the catchment is not likely.

12.6.3.4 Sediment & Nutrient Loading

The operation of the facility to date has not had a negative impact on surface water quality. The proposed development will incorporate the same level of mitigation by design and management to prevent uncontrolled releases to watercourses.

The southern and northern surface water management system will direct surface water flows from the site to the attenuation ponds and wetlands prior to discharge to the Knockharley Stream. The pond will attenuate flows and allow suspended solids to settle. The outlet from the pond can be shut to prevent discharge to the watercourse in the event of a suspected contamination incident. Water is discharged from the pond and through a constructed wetland for final polishing before discharge to the receiving watercourse. Therefore, the potential for sediment release to watercourses is low during the operational phase.

To mitigate the risk of IBA dust or hydrocarbons leaks from vehicles on roads surrounding the IBA facility contaminating the storm water, provision has been made in the design to install French drains adjacent to perimeter roads and to direct runoff from same during operations into IBA handling area and thence into the leachate collection system. There will be no risk of contaminated water entering the surface water attenuation lagoon.

During operations, the outfall from this french drainage network will discharge to the leachate collection system. Post capping, the outfall will be redirected to the holding pond via a petrol interceptor into the northern storm water management system.

12.6.3.5 Spills

The licence to operate the facility includes conditions on bunds, pipeline integrity and regular assessments of such. It is unlikely, therefore, that a spill from an on-site storage tank could be released into the environment.

In the absence of mitigation measures, there is potential for contamination of surface water from uncontrolled leaks from operational vehicles or spills during re-fuelling.

There is potential for a spill from a leachate tanker during the transport of leachate off site, both on-site and off-site.

In the unlikely event of a spill on a site road, the spill would be captured in the drainage system with subsequent management. If the spill occurred off-road or outside the facility, the maximum volume of leachate discharged to the environment would be 20 m^3.

12.6.3.6 Emergency

In the event of a fire, there is a potential for an indirect impact on surface water from the contaminated firewater. All contaminated firewater will be directed to the surface water management system and from there can be redirected to leachate storage.

12.6.3.7 Potential Cumulative Impacts

In summary the permitted and proposed developments during operations and following capping/closure (assuming these are considered to be operational activities) will not increase the flow rate of runoff entering the catchment downstream of the facility and whilst the volume of surface water runoff will increase it will not increase the risk of downstream flooding.

The hydrological impacts on the downstream receiving Veldonstown and River Nanny catchments are considered to be not significant because:

- the attenuation capacity provided by the surface water attenuation ponds will maintain flow rates below green field discharge rates (albeit that volumes may increase),
- the suspended solid loadings will most likely be lower than prevailing conditions with no engineering controls, and
- the Veldonstown catchment has sufficient attenuation capacity to negate the impacts of increased volumetric flows arising from the Knockharley permitted and proposed developments.

Given that there are no significant developments within the Veldonstown catchment area, other than farm land and residential properties, the potential cumulative impacts on hydrology and water quality are therefore considered to be imperceptible.

Given that discharges will not increase the flood risk within or downstream of the Veldonstown catchment, it is therefore not expected that other developments as maybe located at significant distances from the proposed development and/or drain into tributaries outside of the catchment of the River Nanny will have any significant potential cumulative hydrological impacts resulting from with the proposed development, i.e. not significant.

12.6.4 Potential Impacts Post Decommissioning

Decommissioning work is defined in the restoration and aftercare plan for the facility, which is a requirement under Condition 4 of IED Waste Licence W0146-02 and which is subject to Agency approval in relation to technical, emission limit values and financial provisions.

Surface water infrastructure associated with the permitted and proposed developments will remain in place. Decommissioning as may be required will be mainly be associated with buildings, paved areas and tanks eventually pumps and landfill gas management infrastructure. These areas will also be connected to the storm water management systems on the northern and southern outfalls. Such emissions as may develop during decommissioning works are likely to be significantly lower than those experienced during operations and installed drainage infrastructure will have sufficient capacity to accommodate suspended solid and other contaminant loadings. In the absence of specific mitigation measures during decommissioning there is potential for impact on surface water where activities take place outside of the permanent surface water management system.

Assuming hard surfaces and buildings will be removed, discharges will be similar to existing conditions which shows a reduction in discharge volumes. Accordingly, the impact on receiving waters is considered to be not significant.

12.6.5 Potential Impacts of Flooding

The flood risk identification, assessment and Justification Test is included in Appendix 12.5 of Volume 3 of this EIAR which discusses the potential impacts from flooding.

12.6.6 Cumulative Impacts

12.6.7 Summary of Unmitigated Impacts on Hydrology and Surface Water Quality from the Proposed Development on Sensitive Receptors

Plat2 12.-1 illustrates the classification approach adopted when determining the significance of impact on the receiving waterbodies.

A summary of unmitigated potential impacts due to the proposed development is provided in Table 12.13. In each case the receptor is the River Nanny.

Table 12-13: Summary of Potential Hydrological and Surface Water Quality Impact Significance on Sensitive Receptors

Activity	Potential Impact	Receptor	Significance Assessment Prior to Mitigation		
			Magnitude of impact	Sensitivity Existing Environment	Determining Significance
Construction Phase					
Hardstanding Areas, IBA facility, screening berms, lagoons and attenuation pond	increase in rate of run-off	River Nanny	negligible	low	Not significant (negative)
Screening berms, excavation and construction of cells, tree felling, stream diversion, culverting, trafficking.	erosion and sedimentation	River Nanny	medium	low	Slight (negative)
Tree felling, concrete works, excavation, wet concrete works, spoil heaps, berms	nutrient loading	River Nanny	low	low	Slight (negative)
Construction of new infrastructure causing blockages of drains, re-location of the 1 in 1000-year floodplain	flooding	River Nanny	negligible	negligible	Not significant (negative)
Section 50 works					
Stream diversion	erosion and sedimentation	River Nanny	low	low	Slight (negative)
Flood culvert and stream crossing	erosion and sedimentation	River Nanny	low	low	Slight (negative)
Wetland outfall	erosion and sedimentation	River Nanny	low	low	Slight (negative)
Emergency overflow weir	erosion and sedimentation	River Nanny	low	low	Slight (negative)
Temporary crossing	erosion and sedimentation	River Nanny	low	low	Slight (negative)
Operation & Maintenance					
Impermeable areas	increase in rate of run-off	River Nanny	low	low	Slight (negative)
Screening berms and IBA facility, trafficking	erosion and sedimentation	River Nanny	low	low	Slight (negative)
IBA facility, leachate management and spoil heaps.	nutrient loading	River Nanny	low	low	Slight (negative)
Heavy rainfall event	flooding	River Nanny	negligible	negligible	not significant (negative)

Activity	Potential Impact	Receptor	Significance Assessment Prior to Mitigation		
			Magnitude of impact	Sensitivity Existing Environment	Determining Significance
Decommissioning					
Trafficking and construction plant	Erosion and sedimentation	River Nanny	low	low	slight (negative)
Demolition works to remove concrete hardstands	Nutrient loading	River Nanny	low	low	slight (negative)

Some activities during the construction, operation, maintenance and decommissioning of the proposed development, if unmitigated, could have a slight negative impact on receiving watercourses.

As discussed, the risk of an increase in flooding is of negligible significance due to maintenance of greenfield discharge rates, the small percentage increase in run-off volumes contributing to the catchment and the attenuation capacity within the catchment to absorb increased flow volumes.

Decommissioning will be subject to prevailing IED Waste Licence W0146-02 Condition 4 Restoration and aftercare which also requires a Final Validation Report to be submitted to the Agency.

12.7 Mitigation Measures

During the iterative design process for the proposed development, cognisance was taken of the locations of existing watercourses and a 10 m buffer was applied to distance the watercourses from proposed infrastructure. A minimum buffer of 10 m from watercourses has been adopted for the proposed works.

The drainage system for the proposed development has been designed to mitigate potential impacts on hydrology and surface water quality and is described in detail in Section 12.4 and the drainage layout is shown in Drawing Nos. LW14-821-01- P-0000-003 through 0011 in Volume 4 and in Appendix 12.2 Surface water Management Plan in Volume 3 of this EIAR. A four-stage treatment train (swale – holding pond- attenuation – wetland will mitigate the potential impacts of increased run-off and sediment loading on watercourses from the proposed development. The residual impacts following mitigation and the associated significance rating is also provided in Table 12.14. Leachate and surface water will continue to be managed in accordance with the IE licence for the facility. The design of the proposed leachate and surface water management infrastructure will be subject to EPA approval prior to construction.

12.7.1 Proposed Mitigation Measures for the Construction Stage of the Proposed Development

Proposed drainage measures to reduce and protect the receiving waters from the potential impacts during the construction of the proposed development are as outlined above in Section 12.6. These include measures to prevent runoff erosion from vulnerable areas and consequent sediment release into the nearby watercourses to which the proposed development site discharges. The mitigation measures proposed to reduce potential direct and indirect impacts are outlined below and they are also included in the:

- Construction Environmental Management plan (Appendix 2-0 in Volume 3 of the EIAR
- Surface Water Management Plan in Appendix 12-2 of Volume 3 of the EIAR

These documents demonstrate the strong commitment that has been provided in the EIAR to ensure suitable measures will be put in place at all times to prevent the release of sediment to drainage waters, associated with construction areas, and subsequent migration to adjacent watercourses.

During the previously permitted stream diversion and proposed culverting, in-stream sedimentation traps will be positioned prior to construction and maintained for the duration. All diverted water /run-off can be sent to the onsite surface water attenuation lagoon to minimise sediment entering the stream, if required. Any in-stream works will be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI) and subject to Section 50 approval from the OPW. In consideration of fisheries resources downstream, works in watercourses will be carried out during the period July-September unless prior agreement has been reached with IFI.

As discussed, the new attenuation pond will be put in place at the commencement of construction at the site. Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have a functioning drainage system in place.

The existing southern attenuation pond together with the new northern attenuation pond will mitigate any increase in the rate of run-off. Erosion control measures and temporary stilling ponds, including the attenuation ponds will be regularly maintained during the construction phase.

The 4-stage treatment train (swale – holding pond-attenuation pond– wetland/diffuse outflow) will retain and treat the discharges from the new surfaces as a result of the development and reduce any risk of flooding downstream.

Mitigation Measures for Reducing Runoff

- Cognisance has been taken of the findings in Chapter 10 Biodiversity and Chapter 11 Soils, Geology and Hydrogeology in Volume 2 of this EIAR in the location of the drainage system, including the new attenuation pond to ensure that these facilities are located in suitable areas.

- The conceptual site drainage (see section 12.4.3 and Figure 12-6) has been designed to complement existing overland flow.

Mitigation Measures for Flooding

- A modification will be installed across the stream in the form of a dam and culvert arrangement in order to channel extreme overbank flows into a wooded area. This will compensate for any loss in the 1 in 1000-year floodplain. This is described in more detail in Section 12.4.3.
- The proposed compensation flood culvert is designed to provide compensatory storage for the flood plan storage lost through constructing the northern surface water management system and permitted cell development in a 1:1000-year flood plain.
- Construction will not take during extreme weather conditions when channel water levels / flows will be high.

Mitigation Measures for Control of Sediment & Nutrient Loading

The overburden soils have a high clay content and do not readily disperse following rainfall. To mitigate surface water runoff having elevated suspended solids at stockpile, screening berms and stream bank locations where earthworks are proposed, best practices will be employed in the prevention of silt laden run-off from entering watercourses as follows:

- Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations:
  a. All stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary.
  b. All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond.
  c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.
- Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.
- The developer will ensure that erosion control, namely silt-traps, silt fencing, stilling ponds and swales are regularly maintained during the construction phase.
- Standing water, which may arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations will be pumped into the site drainage system (including attenuation ponds), after which permanent *in situ* dewatering will be implemented during operations. As historically there is little evidence of high inflows, it is anticipated that pumped flows from excavations will be very low. Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations.
- The excavated subsoil material will be removed to form the screening berms.
- Swales will be shallow to minimize the disturbance to sub-soils. Temporary silt traps will also be provided at regular intervals in the swales.
- Cross-drainage pipes of 450mm minimum diameter will be provided to prevent a risk of clogging for conveying flows from agricultural drains and forestry drains across the access roads.
- Additional wheel washing facilities will be provided at the exit of the IBA facility. This will supplement the existing wheel wash which will be retained at the entrance to the site. The silt traps will be cleaned on a regular basis.
- Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines (32) and Forest Harvesting and Environmental Guidelines (34), to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff.
- Trees will be felled away from watercourses where possible. Branches, logs or debris will not be allowed to accumulate in watercourses and will be removed as soon as possible.
- The rate of absorption of a felled site is reduced, and therefore rate of run-off is expected to be slightly higher than that of a forested site, however it is proposed to develop berms on the deforested areas as soon as weather conditions allow following felling, followed by replanting.

Thus, no significant increase in the rate of run-off is anticipated as a result of felling or risk of downstream flooding as set out in the flood risk assessment presented in Appendix 12.5, Volume 3.

- There is an existing wheel wash at the entrance to the site which will be used during the construction period.
- A designated concrete wash-down area will be constructed at the temporary compound. Every concrete truck delivering concrete to the site will use this facility prior to leaving the site. A settlement pond will be provided to receive all run-off from the concrete wash down area.
- The outfall from the wetland will have vertical pipe drop energy dissipation structure within the wetland outlet chamber prior to discharge into the adjacent launching apron protection works. This design approach will mitigate the risk of suspended solids developing within the Knockharley stream downstream of the outfall.
- Rock armour will be used to provide bank protection works upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs.

Mitigation Measures for Spills

- Detail of oil spill protection measures adjacent to a watercourse are outlined in Appendix 2.0 of Volume 3 of this EIAR which details the Proposed CEMP Plan.
- All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s). Emergency Silt Control and Spillage Response Procedures are contained within under Site Drainage Management Plan of the Construction Environmental Management Plan (CEMP).
- Refuelling of plant during construction will only be carried out at the existing designated refuelling station locations. Each station is fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team is in place on site. Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site. Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.
- Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.
- Appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. Adequate security will be provided to prevent spillage as a result of vandalism. A regular review of weather forecasts of heavy rainfall is required, and a contingency plan will be prepared for before and after such events.
- A suitably qualified person will be appointed by the developer to ensure the effective implementation of the CEMP onsite. They will also ensure:
    a. regular monitoring of the drainage system and maintenance as required.
    b. Record keeping of the daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase.
    c. Water quality monitoring will continue to be carried out in accordance with the licence. (There will be one new monitoring point, at the discharge point from the new wetland.)
- If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.
- Discharges from paved roads paved areas will be surrounded by filter drains with petrol interceptors installed at respective outlets upstream of the storm water management attenuation ponds or other.

12.7.2 Proposed Mitigation Measures for the Operation Stage of the Proposed Development

The surface water management system will mitigate any potential impacts on hydrology and surface water quality during the operational phase. Regular visual inspections and monitoring will be required in compliance with the IED licence.

The conceptual drainage has been designed to operate effectively during the operational period. Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site. The attenuation ponds will be permanent features and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.

Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls.

The mitigation measures applicable for spills during the construction phase are applicable during the operational phase. In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill. The haulage contractor will be required to have spill kits and training. There will be regular inspections and maintenance of leachate tankers to mitigate leaks. In the unlikely event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented.

Surface water will be visually inspected as part of the operational site walkovers on a weekly basis. There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland. Routine surface water sampling is and will continue to be carried out in accordance with the licence which includes the submission of interpretive reports to the EPA for approval. Any incidents shall be notified to the EPA in accordance with the licence.

12.7.3 Proposed Mitigation Measures for Decommissioning of the Development

There will be a period of restoration and aftercare following cessation of waste acceptance activities at the facility. Decommissioning of the development will be subject to Agency approval under prevailing waste licence condition. It is proposed to leave the surface water management system *in situ* and this will mitigate any potential impacts during decommissioning activities and in addition, temporary mitigation will be put in place to protect watercourses in areas outside of the in-situ water management system. These measures will be similar to those proposed during the construction stage such as silt-traps, silt fencing and stilling ponds.

12.8 Residual Impacts

The residual significance of the effects of the proposed development on downstream receptors is expected to be low taking account of the implementation and efficacy of the mitigation measures as outlined in Section 12.6 and 12.7.

Mitigation will be provided to protect the water quality by preventing any silt laden run-off or contaminated storm runoff reaching the downstream watercourses. Table 12.14 shows all Residual Impacts are negligible and therefore will not impact the objectives of the EU Water Framework Directive.

Table 12.14 indicates that, following the implementation of mitigation measures, the residual risk to the receiving watercourses will be negligible during the construction period and negligible during the operation of the proposed development. Implementation and efficacy of the mitigation measures will be monitored throughout the construction and operation phases.

In the unlikely event of a SCADA or other failure impacting the northern attenuation pond continuous monitoring infrastructure, the proposed wetland will further reduce the risk of contamination in the receiving watercourses.

The existing development has not had a negative impact on surface water quality in the environment. The proposed system is very similar to the existing and thus as a result of the surface water management measures to be applied, the proposed development is expected to have a negligible impact on the receiving environment.

The consultation responses received as outlined in Chapter 5 of Volume 2 of this EIAR have been addressed and suitable mitigation has been incorporated into the drainage design for the proposed development at Knockharley Landfill.

The proposed development at Knockharley Landfill is not expected to contribute to any significant, negative cumulative effects with other existing or proposed developments in the immediate vicinity or within downstream waters. The effective implementation and efficacy of mitigation measures will prevent a significant release of silt into the receiving watercourses and/or will avoid spills/ leaks or uncontrolled releases. In these circumstances, any effects on the receiving aquatic environment will be negligible.

Table 12-14: Residual Hydrological and Water Quality Impact Significance for Sensitive Receptors

Activity	Potential Impact	Receptor	Sensitivity Existing Environment	Before Mitigation		After Mitigation	
				Magnitude	Determining Significance	Magnitude	Determining Residual Significance
Construction Works							
Hardstanding Areas, IBA facility, screening berms, lagoons and attenuation pond	increase in rate of run-off	River Nanny	low	negligible	Not significant	negligible	not significant
screening berms, excavation and construction of cells, tree felling, stream diversion, culverting, trafficking.	erosion and sedimentation	River Nanny	low	medium	Slight	negligible	not significant
Tree felling, concrete works, excavation, wet concrete works, spoil heaps, berms	Nutrient loading	River Nanny	low	low	Slight	negligible	not significant
Construction of new infrastructure causing blockages of drains, re-location of the 1 in 1000-year floodplain.	flooding	River Nanny	negligible	negligible	Not significant	negligible	not significant
Section 50 Works							
Stream diversion	erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant
Flood culvert and stream crossing	erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant
Wetland outfall	erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant
Emergency overflow weir	erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant
Temporary crossing	erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant

Activity	Potential Impact	Receptor	Sensitivity	Before Mitigation		After Mitigation	
				Magnitude of impact	Determining Significance	Magnitude of impact	Determining Residual Significance
Operation & Maintenance							
Impermeable areas	increase in rate of run-off	River Nanny	low	low	Slight	negligible	not significant
Screening berms and IBA facility, trafficking	erosion and sedimentation	River Nanny	low	low	Slight	negligible	not significant
IBA facility, leachate management and spoil heaps.	nutrient loading	River Nanny	low	low	slight	negligible	not significant
Heavy rainfall event	flooding	River Nanny	negligible	negligible	not significant	negligible	Imperceptible
Decommissioning							
Trafficking and construction plant	Erosion and sedimentation	River Nanny	low	low	slight	negligible	not significant
Demolition works to remove concrete hardstands	Nutrient loading	River Nanny	low	low	slight	negligible	not significant

12.9 Conclusion

The impact of proposed development at Knockharley Landfill the receiving environment in terms of hydrology and surface water quality will be 'Not Significant' to 'Imperceptible'.

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ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 13 – LANDSCAPE & VISUAL IMPACT ASSESSMENT

NOVEMBER 2018

Knockharley Landfill Ltd.

Kentstown, Navan,Co.Meath

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13 LANDSCAPE & VISUAL IMPACT

13.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) describes the existing landscape in the viciniity of the proposed development location and the visual character of the local landscape. This chapter addresses the likely significant landscape and visual effects of the proposed development at Knockharley Landfill, County Meath.

13.1.1 Proposed Development

The existing landfill facility operates under an Industrial Emission (IE) licence (Licence No: W0146-02) from the Environmental Protection Agency (EPA) which permits the disposal of up to 200,000 tonnes per annum. Pursuant to planning reference PL17.220331, An Bord Pleanála in granting permission for this site placed a management condition (Condition 3 of the governing permission) on the site restricting disposal at the facility to 132,000 tonnes per annum until December 2010, thereafter reducing to 88,000 tonnes per annum for disposal. Permission is now sought for further development from An Bord Pleanála by the applicant. A detailed description of the proposed development is set out in Chapter 2 Description of Development in Volume 2 of this EIAR.

13.1.2 Landscape and Visual Assessment Overview Proposed

This assessment provides a description of the existing landscape context and of the proposed development in that context and identifies any significant landscape and visual effects. Effects are considered with regard to vulnerability of the landscape to change, and to the location of visual receptors relative to the proposed development. The assessment adopts the following structure:

Section 13.2 Assessment Methodology

Section 13.3 Existing Environment

Section 13.4 Description of the Proposed Development

Section 13.5 Mitigation Measures

Section 13.6 Landscape and Visual Effects

Section 13.7 Conclusion

13.2 Assessment Methodology

13.2.1 Landscape and Visual Impact Assessment (LVIA) Study Area

The Study Area for this Landscape and Visual Impact Assessment extends to 20 km from the site boundary of the proposed development. All desktop studies, site visits, baseline mapping, Zone of Theoretical Visibility (ZTV) maps and Viewshed Reference Points (VRPs) informing the assessment extend to the full study Area. For the purposes of Cumulative Assessment, other relevant developments beyond the 20 km radius Study Area are also considered.

Reference to the site in this chapter is to the proposed development area at Knockharley Landfill that lies at the center of the Study Area.

13.2.2 Definition of Landscape

This Assessment adopts the definition of landscape presented in the European Landscape Convention, and as such the term 'landscape' refers equally to areas of rural countryside and urban – built up –areas.

The European Landscape Convention, adopted in 2000, defines landscape as follows:

> *"An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe 2000)*

13.2.3 Relevant Guidance and Legislation

The landscape and visual impact assessment has had regard to the following guidance reference material:

- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report, EC, 2018
- Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports EPA, 2017.
- Landscape and Landscape Assessment, Consultation Draft of Guidelines for Planning Authorities, Department of Environment and Local Government, 2000.
- Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, The Landscape Institute, 2013.
- Advice Note 01/11 – Photography & Photomontage in Landscape and Visual Impact Assessment, The Landscape Institute, 2011.
- Meath County Development Plan 2013-2019

13.2.4 Methodology Overview

The landscape and visual impact assessment includes a review of the site and study area in terms of characterising the receiving environment. The existing landscape character was evaluated using criteria such as landform, land cover and land use, features of interest and focal points, designations and views and prospects as well as the scale of the receiving visual environmental, quality of the environment and amenity and the valued aspects integral to how the character is experienced or perceived.

The landscape of the area is described in terms of its existing character, landscape values and the landscape's sensitivity to change. The assessment considers the sensitivity of views and the degree of change that may arise as a result of the proposed development and also the sensitivity of receptors.

In this assessment, the term 'receptors' means viewers within the general environment as well as residential properties. Although the study area extends to 20 km, given the landform and land use within the vicinity of the site the assessment has generally focused on the 5 km zone around the site area.

The methodology used for the landscape assessment entailed the following:

- A desktop study of the site in relation to its overall context locally, regionally and nationally including a review of landscape planning context, including the County Development Plan, landscape character types, designated landscape and protected views.
- Visiting the site and its environs to assess the following:
  - Quality and type of view in the area;
  - The extent of the visual envelope, i.e. the potential area of visibility of the site in the surrounding landscape; and
  - The character and quality of the surrounding landscape in relation to the position of the proposed development.
- Preparation and review of Zone of Theoretical Visibility (ZTV) maps, including cumulative visibility.
- Undertaking Route Screening Assessment.
- Preparation of representative Viewshed Reference Point (VRPs)/Photomontages.
- Assessment of potential likely significant landscape and visual effects, including cumulative effects.

13.2.5 Baseline Landscape and Visual Information

An initial desktop study was undertaken to identify the relevant policies and guidelines, nationally and locally to be considered in the assessment.

13.2.6 Existing Landscape Assessment

The landscape character, values and sensitivity of the area in the vicinity of the proposed development location is outlined in accordance with the Department of Environment and Local Government Guidelines - *Landscape and Landscape Assessment, Consultation Draft of Guidelines for Planning Authorities, 2000*. In these guidelines landscape character, values and sensitivity are defined as:

- **Landscape character** can be established for an area where there is visual distinctiveness and identity through a continuity of similar characteristics. This description outlines 'what is physically on the land surface', resulting from geology, soils, hydrology, topography, vegetation and land-use.
- **Landscape values** can be described as the environment or cultural benefits that are derived from various landscape resources. These resources may include physical and visual components.
- **Landscape sensitivity** can be described as the extent to which a landscape can accommodate change without unacceptable loss of existing character or interference with values.

The baseline condition in relation to the landscape character of the area of the proposed development was assessed by means of a desk-based study to assess the available information in relation to the sensitive landscapes in the area of the proposed development, the current presence of sensitive visual receptors in the area and the presence of sites of cultural significance in the vicinity of the proposed development.

Once the baseline assessment had been carried out, an assessment of both the positive and negative impacts of the proposed development on the surrounding area in terms of the visual impact was undertaken. These impacts are presented in this section, as well as the mitigation measures proposed, if appropriate, to mitigate any negative impacts.

The data and publications used to compile the baseline assessment are listed below:

- Meath County Council County Development Plan (CDP) 2013 -2019
- Kentstown Written Statement (as per Variation No. 2 of CDP 2013 – 2019)
- Regional Planning Guidelines for the Greater Dublin Area 2010 - 2022

The proposed development site was visited by personnel from Fehily Timoney and Company in March 2015 and February 2018. A site walkover and windscreen survey of the surrounding area was undertaken. The purpose of the site walkover and the windscreen survey was to assist in the characterisation of the landscape in the local and broader context, in addition to identifying sensitive receptors.

13.2.7 Visual Impact Assessment

The landscape impact assessment describes the likely nature and scale of changes to individual landscape elements and characteristics, and the consequential effect on landscape character.

Existing trends of change in the landscape are taken into account. The potential landscape impact is assessed based on the landscape sensitivity and on the scale or magnitude of landscape effects.
The sensitivity of the landscape resource is a function of its land use, landscape patterns and scale, visual enclosure and distribution of visual receptors and the value placed on the landscape.

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics.

Landscape Value and Sensitivity is classified using the following criteria:

Table 13-1: Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use.
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically, this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the proposal site boundary that may have an effect on the landscape character of the area.

Table 13-2: Magnitude of Landscape Impacts

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix.

Table 13-3: Landscape Impact Significance Matrix

	Sensitivity of Receptor				
Scale / Magnitude	*Very High*	*High*	*Medium*	*Low*	*Negligible*
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial - moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial - moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible

**Light grey shading indicates a level of impact that is considered to be 'significant' in EIA terms*

13.2.8 Visual Sensitivity

Unlike landscape sensitivity, visual sensitivity has an anthropocentric basis. Visual sensitivity is a two-sided analysis of receptor susceptibility (people or groups of people) versus the value of the view on offer at a particular location.

To assess the susceptibility of viewers and the amenity value of views, the assessors use a range of criteria and provide a four-point weighting scale to indicate how strongly the viewer/view is associated with each of the criterion. Susceptibility criteria is extracted directly from the IEMA *Guidelines for Landscape and Visual Assessment* (2013), whilst the value criteria relate to various aspects of a view that might typically be related to high amenity including, but not limited to, scenic designations. These are set out below:

1. **Susceptibility of receptor group to changes in view**. This is one of the most important criteria to consider in determining overall visual sensitivity because it is the single category dealing with viewer susceptibility. In accordance with the IEMA *Guidelines for Landscape and Visual Assessment* (2013) visual receptors most susceptible to changes in views and visual amenity are:

    - *Residents at home;*
    - *People, whether residents or visitors, who are engaged in outdoor recreation, including use of public rights of way, whose attention or interest is likely to be focussed on the landscape and on particular views;*
    - *Visitors to heritage assets, or to other attractions, where views of the surroundings are an important contributor to the experience;*
    - *Communities where views contribute to the landscape setting enjoyed by residents in the area; and*
    - *Travellers on road rail or other transport routes where such travel involves recognised scenic routes and awareness of views is likely to be heightened.*

Visual receptors that are less susceptible to changes in views and visual amenity include:

- *People engaged in outdoor sport or recreation, which does not involve or depend upon appreciation of views of the landscape; and;*
- *People at their place of work whose attention may be focussed on their work or activity, not their surroundings and where the setting is not important to the quality of working life.*

2. **Recognised scenic value of the view** (County Development Plan designations, guidebooks, touring maps, postcards etc). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Development Plans, at least, a public consultation process is required;

3. **Views from within highly sensitive landscape areas**. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated with the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;

4. **Intensity of use, popularity**. Whilst not reflective of the amenity value of a view, this criterion relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;

5. **Provision of elevated panoramic views**. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas.

6. **Sense of remoteness and/or tranquillity**. Remote and tranquil viewing locations are more likely to heighten the amenity value of a view and have a lower intensity of development in comparison to dynamic viewing locations such as a busy street scene, for example;

7. **Degree of perceived naturalness**. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by obvious human interventions;

8. **Presence of striking or noteworthy features**. A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;

9. **Historical, cultural or spiritual value**. Such attributes may be evident or sensed at certain viewing locations that attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;

10. **Rarity or uniqueness of the view**. This might include the noteworthy representativeness of a certain landscape type and considers whether other similar views might be afforded in the local or the national context;

11. **Integrity of the landscape character in view**. This criterion considers the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;

12. **Sense of place**. This criterion considers whether there is special sense of wholeness and harmony at the viewing location; and

13. **Sense of awe**. This criterion considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations where highly susceptible receptors or receptor groups are present, and which are deemed to satisfy many of the view value criteria above are likely to be judged to have a high visual sensitivity and vice versa.

13.2.9 Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence of the proposal and its effect on visual amenity.

Visual presence is a somewhat quantitative measure relating to how noticeable or visually dominant the proposal is within a particular view. This is based on a number of aspects beyond simply scale in relation to distance. Some of these include the extent of the view as well as its complexity and the degree of existing contextual movement experienced. The backdrop against which the development is presented and its relationship with other focal points or prominent features within the view is also considered. Visual presence is essentially a measure of the relative visual dominance of the proposal within the available vista and is expressed as such i.e. minimal, sub-dominant, co-dominant, dominant, highly dominant.

It should be noted that as a result of this two-sided analysis, a high order visual presence can be moderated by a low level of effect on visual amenity and vice versa.

The magnitude of visual impacts is classified in the following table:

Table 13-4: Magnitude Value and Sensitivity

Criteria	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual disorder or disharmony is also generated, strongly reducing the visual amenity of the scene
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual disorder or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual disorder or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene

13.2.10 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the significance matrix in Table 13.5 over.

Table 13-5: Visual Impact Significance Matrix

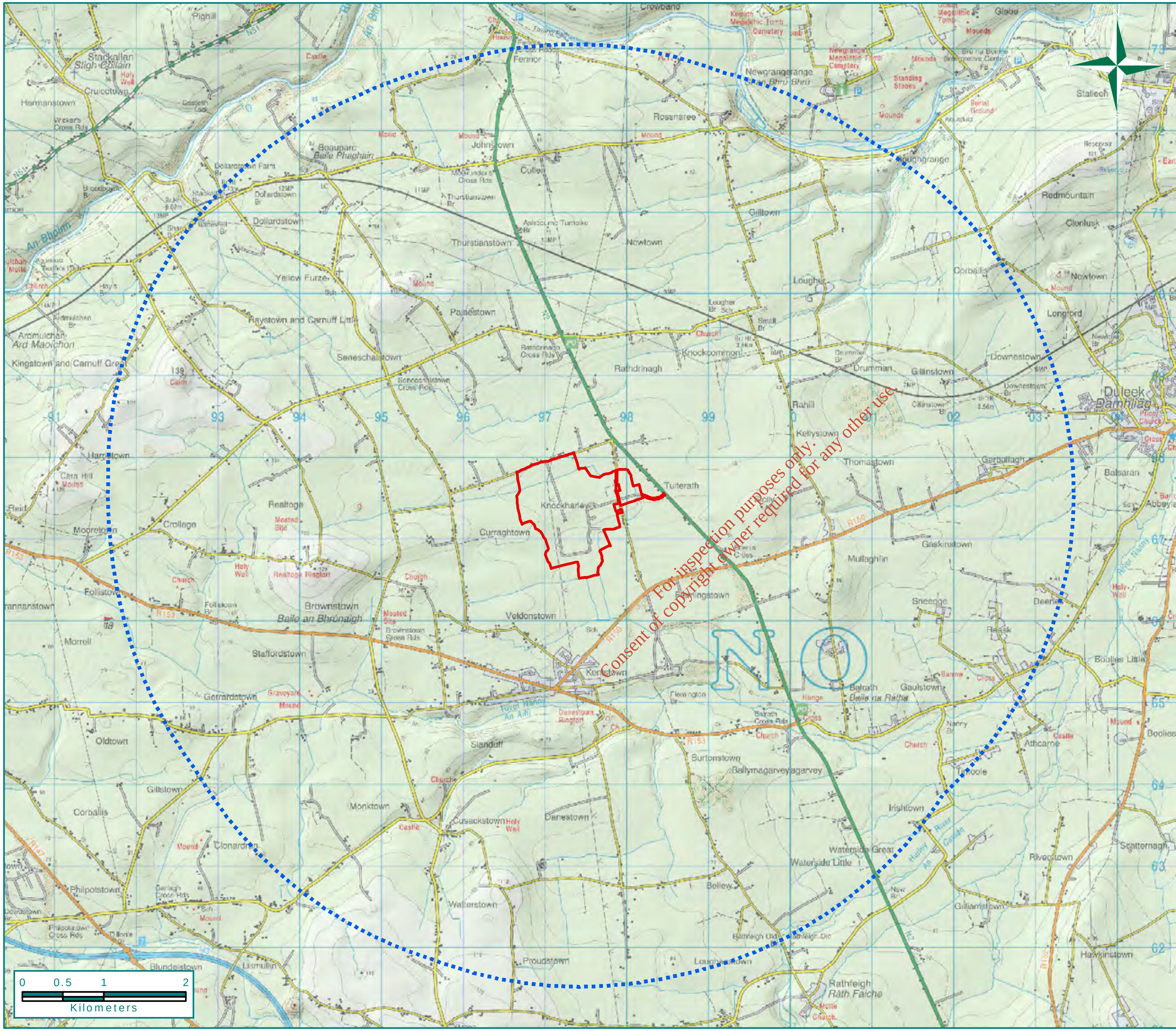
	Sensitivity of Receptor				
Scale / Magnitude	*Very High*	*High*	*Medium*	*Low*	*Negligible*
Very High	Profound	Profound-substantial	Substantial	Moderate	Slight
High	Profound-substantial	Substantial	Substantial - moderate	Moderate-slight	Slight-imperceptible
Medium	Substantial	Substantial - moderate	Moderate	Slight	Imperceptible
Low	Moderate	Moderate-slight	Slight	Slight-imperceptible	Imperceptible
Negligible	Slight	Slight-imperceptible	Imperceptible	Imperceptible	Imperceptible

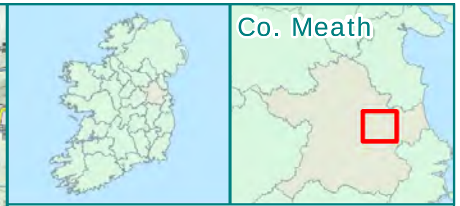
**Light grey shading indicates a level of impact that is considered to be 'significant' in EIA terms*
**Note: The significance matrices provided above at table 14.3 and table 14.5 provide an indicative framework from which the significance of impact is derived. The significance judgement is ultimately determined by the assessor using professional judgement. Due to nuances within the constituent sensitivity and magnitude judgements, this may be up to one category higher or lower than indicated by the matrix.*

It should be noted that short term impacts on the visual landscape due to temporary tree felling are not considered in this assessment. The mitigated scenario will only consider the final phase when all tree felling has been carried out and proposed forestry planting has been completed and trees are fully grown.

13.3 Existing Environment

The proposed development site is in a western lowland area of County Meath. The site location and the associated 5km study area is identified in Figure 13.1 herein.





Legend

- Site Boundary
- 5km Distance from Site Boundary

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Site Location Map Indicating 5km Distance from Site Boundary
Figure No.	13.1
Rev.	A
Scale	1:65,000 @ A4

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13.3.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the proposal will be assessed. This also includes reference to any relevant landscape character appraisals and the current landscape policy context (both are generally contained within County Development Plan).

The landfill site itself is generally characterised by the field network pattern of the wider landscape setting into which the landfill cells and associated infrastructure and facilities have been placed. While this has necessitated the removal of part of the hedgerow landscape infrastructure, significant sections of it remain on the site and additional structure planting has been undertaken since the commencement of landfill operations, particularly along the boundaries to provide screening and a suitable buffer between the site and residences associated with the local road network.

A general description of the landscape context of the proposed development site and wider study area is provided below. Additional descriptions of the landscape as viewed from each of the selected viewpoints are provided under the detailed assessments later.

13.3.1.1 Landform and Drainage

The central study area (5 km radius) contains the proposed development site. The site is contained in a generally flat and gently undulating terrain, between the River Boyne to the north and the River Nanny to the South. The River Boyne and the River Nanny are the principal watercourses within the study area. The general topography of the area is low-lying. The landfill site is located within the catchment area of the River Nanny which flows west to east some 1.5 km to the south. The site is sloped with elevations ranging from 70 mOD in the north west to 55 mOD in the south east of the site. The site is a mix of constructed landfill and associated facilities with some woodland and wet grassland.

The Knockharley or Flemingstown stream entering the site from the western boundary at Knockharley is a 1st order tributary of the River Nanny. The stream flows from the west in an easterly direction. A second tributary, the Kentstown Stream flows east along the southern licensed boundary before turning south and joining the Veldonstown Stream, just upstream of its confluence with the Knockharley or Flemingstown Stream.

13.3.1.2 Land Use and Land Cover

The existing Knockharley Landfill site comprises 135.2 hectares (333-acre site) with the existing landfill footprint positioned near the centre of the landholding, aligned approximately north-south through the centre of the site.

Within the site boundary are also located:

- a complex of buildings comprising of an administration building, two weighbridges, inspection slab, quarantine slab, machinery/maintenance garage, car parking and other facilities. These are located within the administration area to the east of the landfill cells.
- a leachate storage lagoon located to the south of the administrative buildings
- a surface water attenuation pond situated to the south of the landfill
- a landfill gas compound located to the south east of the landfill footprint
- access road and internal site roads and underground and over ground services

The vast majority of the 5 km radius study area is farmed landscape consisting of fields of crops and pastures. There are small blocks of broad-leaved forest throughout the study area. The agricultural land is a patchwork of medium to large sized fields divided by hedgerows, which are mainly used for tillage and crop production and some animal grazing. Intensive pig farming and other agricultural industries are also present in the wider vicinity of the landfill. Within the flat lowland landscape, the local road network is characterised by a broadly spaced rectilinear pattern with dwellings hugging the roadside.

Although there are numerous settlements within the study area, the only one that noticeably contributes to urban land cover in a broader context is Kentstown village which is located c. 900 m south of the proposed development site.

According to the CORINE 2012 landcover dataset (and terminology used therein), land cover near the proposed development primarily comprises a dump[1] (132), non-irrigated lands (211), pastures (231), broad-leaved forest (311) and discontinuous urban fabric (112). A map of this 2012 CORINE land cover dataset, is included in Figure 6.4.

The land use zoning mapping for County Meath as set out in the Meath County Development Plan identifies the lands within the vicinity of the site as unzoned white lands.

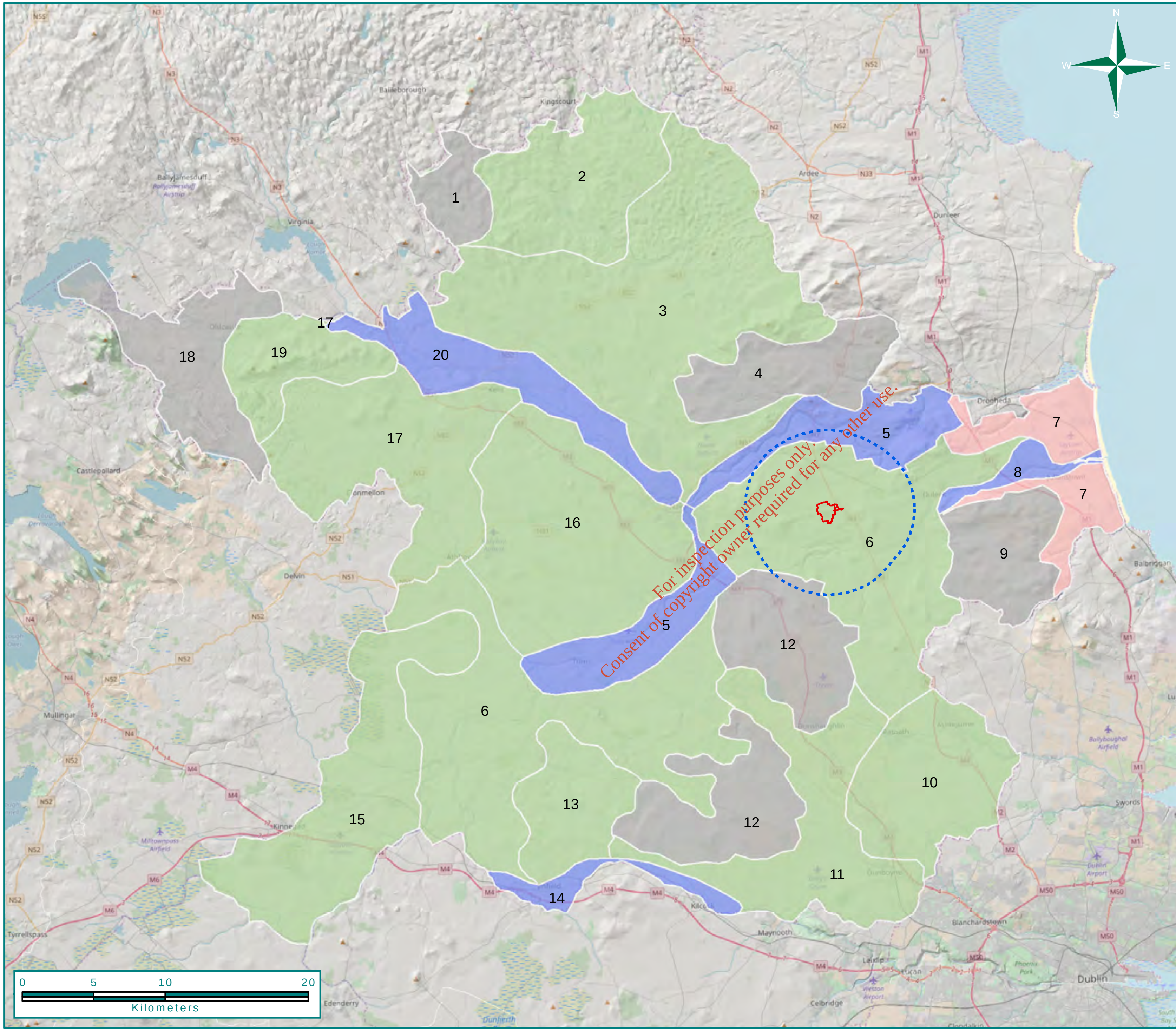
The facility is located in a rural area in the townlands of Kentstown and Tuiterath, Co. Meath, approximately 1.5 km north of Kentstown village. The village of Slane is located 7 km north of the site, the town of Duleek is located 7 km to the east and the town of Navan is 10 km to the west. The N2 national primary route runs in a northwest-southeast direction east of the site, with a dedicated access road to the site off the N2. The access road from the N2 to the administration area is approximately 900 m running east to west. This is the only access point to the site for customers and construction vehicles.

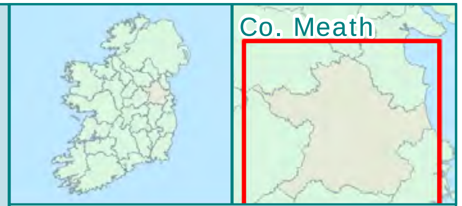
A local road county road CR384 traverses the eastern portion of the site in a north-south direction. This road also runs directly adjacent to the northern boundary of the site for a distance of approximately 400m.

13.3.1.3 Landscape Policy Context and Designations

A Landscape Character Assessment was prepared for County Meath in 2007 and this is incorporated into the County Development Plan 2013–2019 as Appendix 7. The Landscape Character Assessment identifies four generic Landscape Character Types (LCT's) for the county including; Hills and Upland Areas; Lowland Areas; River Corridors and Estuaries and; Coastal Areas. The site is fully contained within the 'Lowland Landscape' Type as identified in Figure 13.2 overleaf.

[1] Knockharley landfill





Legend

Site Boundary

5km Distance from Site Boundary

Meath County Development Plan 2013 - 2019 Landscape Character Areas

Lowland Landscape

River Corridors & Estuaries

Hills & Upland Areas

Coastal Landscape

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Landscape Character Types and Landscape Character Areas
Figure No.	13.2
Rev.	A
Scale	1:371,510 @ A4

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These LCTs are sub-divided into 20 geographically specific landscape character areas (LCAs) with the sensitivity of the LCA's being defined as "*its overall resilience to sustain its character in the face of change and its ability to recover from loss or damage to its components*".

The Landscape Character Assessment identifies the proposed development location as being located within LCA 6 – Central Lowlands, which is of the "Lowland Areas" LCT.

LCA 6 is described as follows:

> *"The landscape character around settlements tends to be a well-managed patchwork of small pastoral fields, dense hedgerows and small areas of broadleaved woodland particularly in the Kildalkey environs where there are estate landscapes with large mature parkland trees. The landscape is predominantly rolling pastureland, although the landscape surrounding Castlerickard has greater diversity than elsewhere in the lowlands with estate landscape, large conifer plantations, and birch woodland around the Boyne river corridor.*
>
> *In more remote areas, away from settlements, single-track roads wind through less well-managed farmland with rough pasture, overgrown hedgerows and less woodland. Farmland is a variety of scales with square – rectangular fields divided by hedgerows, which are usually clipped to eye-level adjacent to road corridors but are less well managed away from roads. The agricultural landscape comprises a series of small farms rather than few large ones. Views within this area are generally limited by the complex topography and mature vegetation except at the tops of drumlins where panoramic views are available particularly of the Hill of Tara uplands and Skryne Church."*

A number of recommendations are outlined in relation to LCA 6 including among them, the recommendation to "*maintain the visual quality of the landscape by avoiding development that would adversely affect short range views between drumlins*".

The potential capacity of the LCA to accommodate various type of development is presented –while no reference is made to landfill or waste facility type development, the most relevant comparator is considered to be "agricultural buildings", given the similar structural form that the proposed IBA facility building and the biological treatment facility building will take. It is identified that "*large agricultural buildings would be a change of character*" and "*overall the potential capacity to accommodate such development is medium.*"

Neighbouring Areas

Other LCAs beyond the Central Lowlands are:

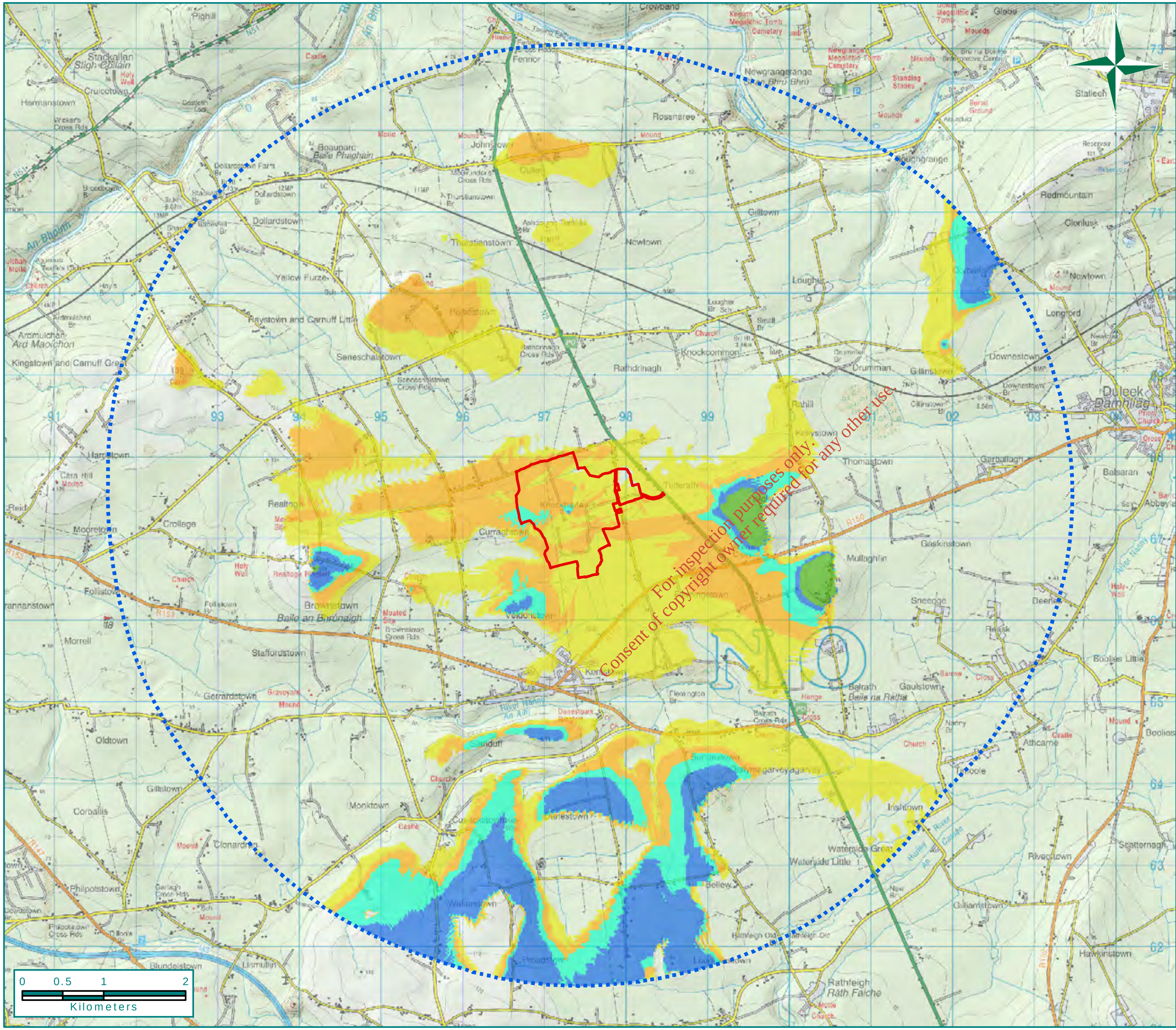
- Tara Skyrne Hills – located approximately 6 km to the south (Hills and Upland Areas LCT)
- Bellewstown Hills – located approximately 8 km to the east (Hills and Upland Areas LCT)
- Boyne Valley – located approximately 7 km to the north (River Corridor and Estuaries LCT)

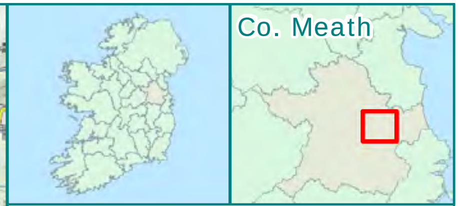
Given their distance from the proposed development location, no visual impacts will be realised at these LCAs and they are not considered further.

13.3.2 Visual Baseline

The visual baseline for this landfill development establishes both the nature of visibility within the study area and the important receptor locations from which the development might be viewed.

Only those parts of the study area that potentially afford views of the proposed development are of interest to this part of the assessment. Therefore, the first part of the visual baseline is establishing a 'Zone of Theoretical Visibility' (ZTV), which is presented in the ZTV map Figure 13.3 herein. This visibility is described as 'potential' or 'theoretical' because ZTV maps are computer generated outputs based on a 'bare-ground' terrain model and take no account of screening by the likes of vegetation and buildings. In flat landscapes, such as this, vegetation screening is usually the main determinant of visibility. Thus, the ZTV maps are more useful for determining where the development will definitely not be visible from rather than where they will be visible from.





Legend

- Site Boundary
- 5km Distance from Site Boundary

Zone of Theoretical Zisibility - % of Landfill Site Potentially Visible

- 20%
- 40%
- 60%
- 80%
- 100%

Zone of Theoretical Visibility calculation based on the following paramters:
- observer height 1.5m
- landfill height 85m
- calculated to a radius of 5km from site boundary

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Zone of Theoretical Visibility (ZTV) within 5km Radius of Site Boundary
Figure No.	13.3
Rev.	A
Scale	1:65,000 @ A4

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The following key points should be noted from the ZTV mapping (Figure 13.3):

- The study area is flat and comprises lowlands.
- Fairly comprehensive theoretical visibility occurs within the nearest 1 km of the proposed development within the lowland context of the central study are.
- The landfill site is indiscernible within the wider landscape.

Visual Envelope

The visual envelope is the extent of potential visibility of the site to or from a specific area or feature. The visual envelope for the proposed development will be defined by views from:

- the local CR384 road to the east, south west, west and north of the development site
- the R150 regional road directly south of the development site

The approximate zone of visual influence derived from site visit assessment is in Figure 13.3.

13.3.3 Visual Receptors

13.3.3.1 Centres of Population and Houses

The largest settlements within proximity to the study area are Drogheda at the eastern periphery of the study area and Navan approximately 10 km to the west of the site. These settlements both have populations in excess of 30,000. According to the ZTV map, views of the proposed development will not be afforded from Drogheda or Navan given the substantial screening afforded by the intervening terrain.

The largest settlement within the study area is Kentstown with a population of 1,179 persons. There is potential intervisibility of the site from Kentstown due to the low land topography, intervening vegetation and structures. In the immediate flat landscape which surrounds the proposed development dwellings tend to be located immediately adjacent to the dispersed road network. This is reflective of the fact that the landscape within the area surrounding the site has a low population density according to the 2016 census results.

13.3.3.2 Transport Routes

The most heavily trafficked route within the study area is the N2 national primary road that runs from Dublin to the border of Northern Ireland at Moy Bridge neat Aughnacloy, Co. Tyrone. The N2 directly abuts the planning boundary for the site to the east (because the planning boundary include a 900 m access road to the administration area) . The existing site entrance enjoys a direct vehicular access onto the N2 which is facilitated by a ghost island junction. There is a network of county roads in the vicinity of the site which provide access to the village of Kentstown approximately 1.5 km to the south of the site. The local road network includes the CR384 to the north, local country road to the east and R150 to the south.

13.3.3.3 Amenity and Heritage Locations

This category of receptor is dominated by outdoor recreation features such as way-marked walking routes, lakes, canals and mountain tops. The study area however comprises lowlands. Within the study area there is a UNESCO World Heritage site, Brú na Bóinne, an important tourist attraction. The proposed development is located c.5.3 km from the Brú na Bóinne information centre. In 2013, 'The Boyne Valley Drive', a driving route encompassing 22 no. historic sites throughout County Meath and County Louth was launched in conjunction with Fáilte Ireland, Meath County Council and Louth County Council with a promotional programme aimed at the overseas market. The Boyne Valley is considered by Fáilte Ireland to be one of a number of priority destinations in Ireland. The Boyne Valley Drive presents several attractions and amenities to tourists and visitors. The Boyne Valley Drive traverses the Study Area for the purposes of this Chapter of the EIAR.

13.3.3.4 View of Recognised Scenic Value

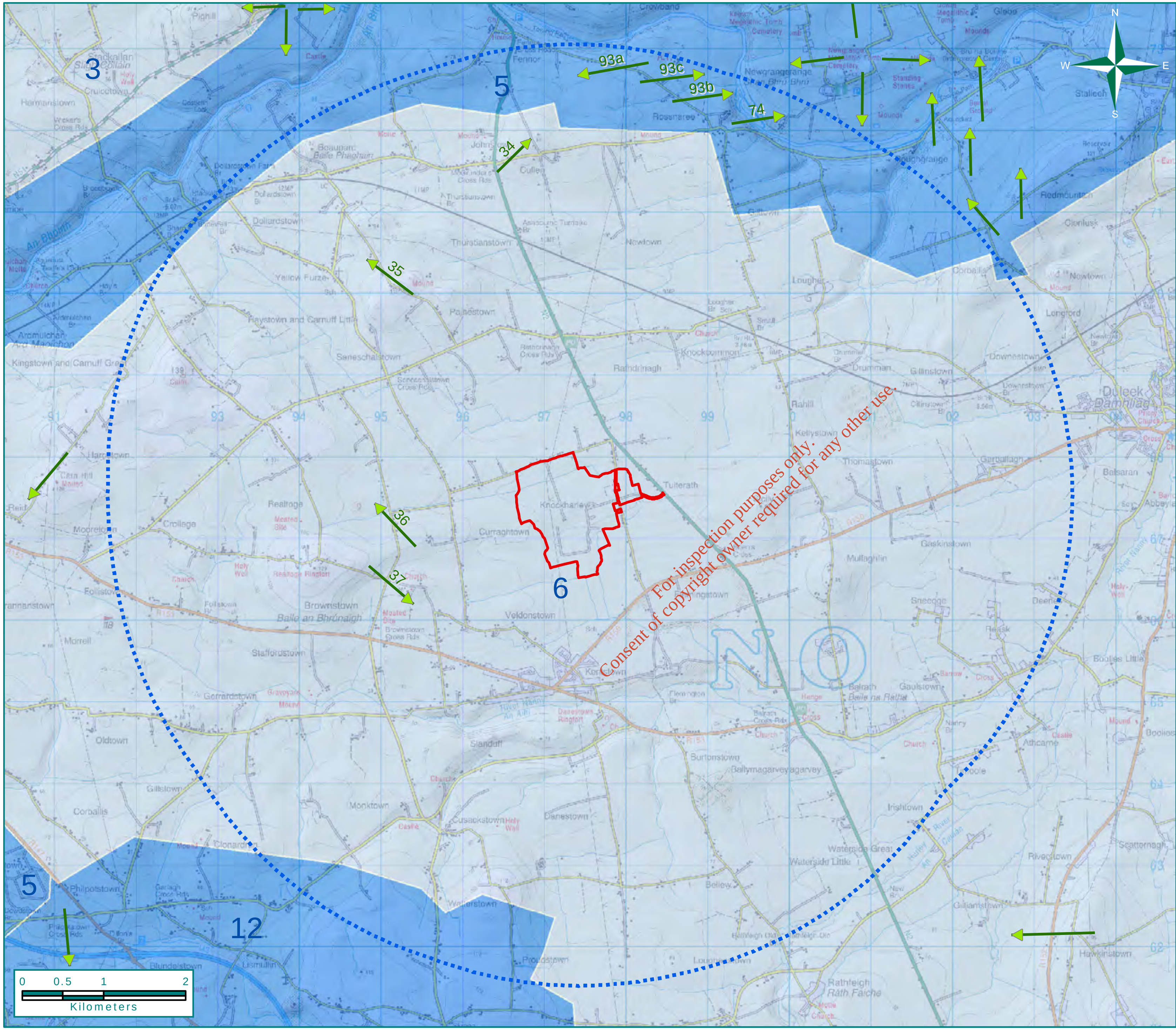
There are 8 no. protected views within 5 km of the proposed development location, classified as per Appendix 12 of the Meath County Development Plan 2013-2019. These protected views are identified in the table.

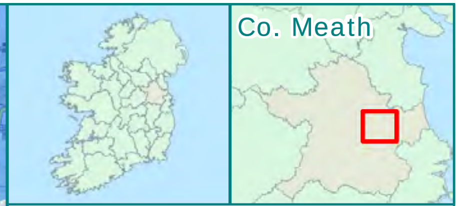
Table 13-6: Protected Views within 5km of the proposed development location *

View No.	Location	Direction	Description	Significance
34	N2 between Slane and Balrath at McGrunder's Cross Roads	North East	View of Boyne Valley with open view of Knowth and Newgrange. Mixed composition of working landscape. Slane visible on left (west). Roads, power lined and housing visible.	International
35	Country Road between Beaupark and Painestown	North West	View to northwest across settled landscape with settlements and infrastructure(powerline, windfarm, roads visible). Many large woodland lots.	Regional
36	County road to north of Brownstown Cross Roads on R153 I	North West	View to north west across working landscape with visual agricultural structures.	Local
37	County road to north of Brownstown Cross Roads on R153 II	South East	View to south east across working landscape with visual agricultural structures.	Local
74	Boyne valley from Rosnaree House	East	Boyne valley from Rosnaree House	National
93a	Local Road L16002, 1.2km east of Fenner Cross Roads	North East	View towards the Core Area of the World Heritage Site.	Regional
93b	Local Road L16002, 0.7km west of Rossnaree	East	View towards the Core Area of the World Heritage Site.	Regional
93c	Local road L16002, 1.65km east of Fennor Cross Roads	East	View towards the Core Area of the World Heritage Site.	Regional

* as per Appendix 12 of the CDP 2013 - 2019

The proposed development location is not within the visual envelope of any of these views, as shown in Figure 13.4.





Legend

Site Boundary

5km Distance from Site Boundary

Views & Prospects

Meath County Development Plan 2013 - 2019
Landscape Character Assesment

Landscape Sensitivity

High

Moderate

Date	18/05/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	Landscape Sensitivity and Views and Prospects
Figure No.	13.4
Rev.	A
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13.3.3.5 Identification of Viewshed Reference Points as a Basis for Assessment.

The results of the ZTV analysis provide a basis for the selection of Viewshed Reference Points (VRP's), which are the locations used to study the landscape and visual impact of the proposed development in detail. The assessment of visual impact involves identifying viewpoints within the visual envelope that are representative within the receiving environment. These viewpoints were selected based on physical inspection of the view. The selected viewpoints are surveyed to ascertain the condition of the existing view (characteristics, features, positive and negative qualities, etc.) and the associated sensitivity of the viewpoint (based on the extent and location type – residential, public road, amenity, etc.). With the aid of representative images, the degree of change to be experienced at that location is assessed.

13.4 Potential Impacts

13.4.1 Potential Impact of the Proposed Development

The following criteria outline the manner in which potential impacts on landscape character and visual impact can occur in the context of the proposed development:

- The design language associated with the proposed development;
- The scale and form of the development; and
- The form of the proposed boundary berms.

13.4.2 Potential Landscape Impacts

The proposed development will continue the emerging trend within Knockharley Landfill landholding – a landscape changing in character from former agricultural land to a large-scale waste management facility with associated light industrial and ancillary buildings. The existing landfill is located within the proposed development boundary. The proposed development will therefore appear within the landscape as a contiguous development.

However the proposed final landfill height will be higher than the existing landfill height, resulting in an increase in the overall height of the facility at this location. The main landscape impacts associated with the proposed development will be the removal of existing woodland boundary planting and the construction of soil berms along boundaries to the north of the site. Construction of screening berms along the western planning boundary is to a maximum of 11 m in height, on the eastern boundary, to a maximum height of 10 m and on the northern boundary, to a maximum height of 6 m, with a total berm footprint of c. 11.3 ha. The proposed development comprises a number of tall structures such as the landfill, the IBA facility, the leachate storage tanks, and the biological treatment facility. The landfill has a proposed height of 85 m AOD (25 m AGL) and the biological treatment facility external wall has a maximum height up to 14.12 m (70.8 m AOD) and a stack of 20 m (76.6 m AOD).

While these activities will bring a sense of change and disruption to parts of the site, the sequential restoration proposals will ensure that tree cover will prevail once again in the medium to long term providing a natural woodland backdrop in views from the local road network. The site has displayed a high success rate for woodland establishment to date and this provides a sound basis for the current proposed restoration plan.

The introduction of the relatively large scale industrial style buildings onto the site which could change the perception of the local rural setting is mitigated by the careful placement of the buildings such that they will be significantly screened in views from vantage points to the south and east of the site by a combination of existing vegetation cover and their placement at a low point on the site. The buildings will not therefore become a significant feature in views along from the local road network, from local residences to the east of the site or from Kentstown primary school to the south of the site.

Direct and permanent change will occur locally where the proposed development will be physically located. Bearing in mind the existing permitted development within site has already altered the landscape character of the site. The proposed development will not result in significant changes in the size, elevation or landscape character and will continue to alter the landscape character in a same degree as before.

The highest direct landscape effects will arise from changes to landform and existing vegetation on the site. The significance of change is considered to be Moderate.

The proposed development is located in a mainly flat landscape and therefore even relatively low vegetation can provide screening to receptors. Outside the development site, recognisable changes to the landscape character will be limited and localised due to the flat nature of the overall study area and significant intervening vegetation, which will prevent the full recognition of the scale of the changes to landform within the land holding. Moderate landscape effects are therefore extremely localised and beyond the site impacts are therefor considered to be slight.

13.4.3 Potential Visual Impacts

To determine the visual impact of the proposed development, a number of viewpoints were selected for detailed assessment. These viewpoints relate to the visual envelope of the site. The viewpoints are listed in Table 13.7 herein with an indication of their location and distance from the site.

Furthermore, a series of photomontages of the development have been prepared based on the visual envelope at these viewpoints. These photomontages are utilised as a visual aid when assessing the impact at these viewpoints and the general impact of the proposed facility is presented and described in terms of these photomontages in the following section.

All of the photographs were taken in GPS recorded locations. The proposed structures have been modelled in AutoCAD and 3D Studio MAX. The GPS camera position is used to place viewpoints which are then rendered. The image is transferred into Adobe Photoshop using known existing place markers.

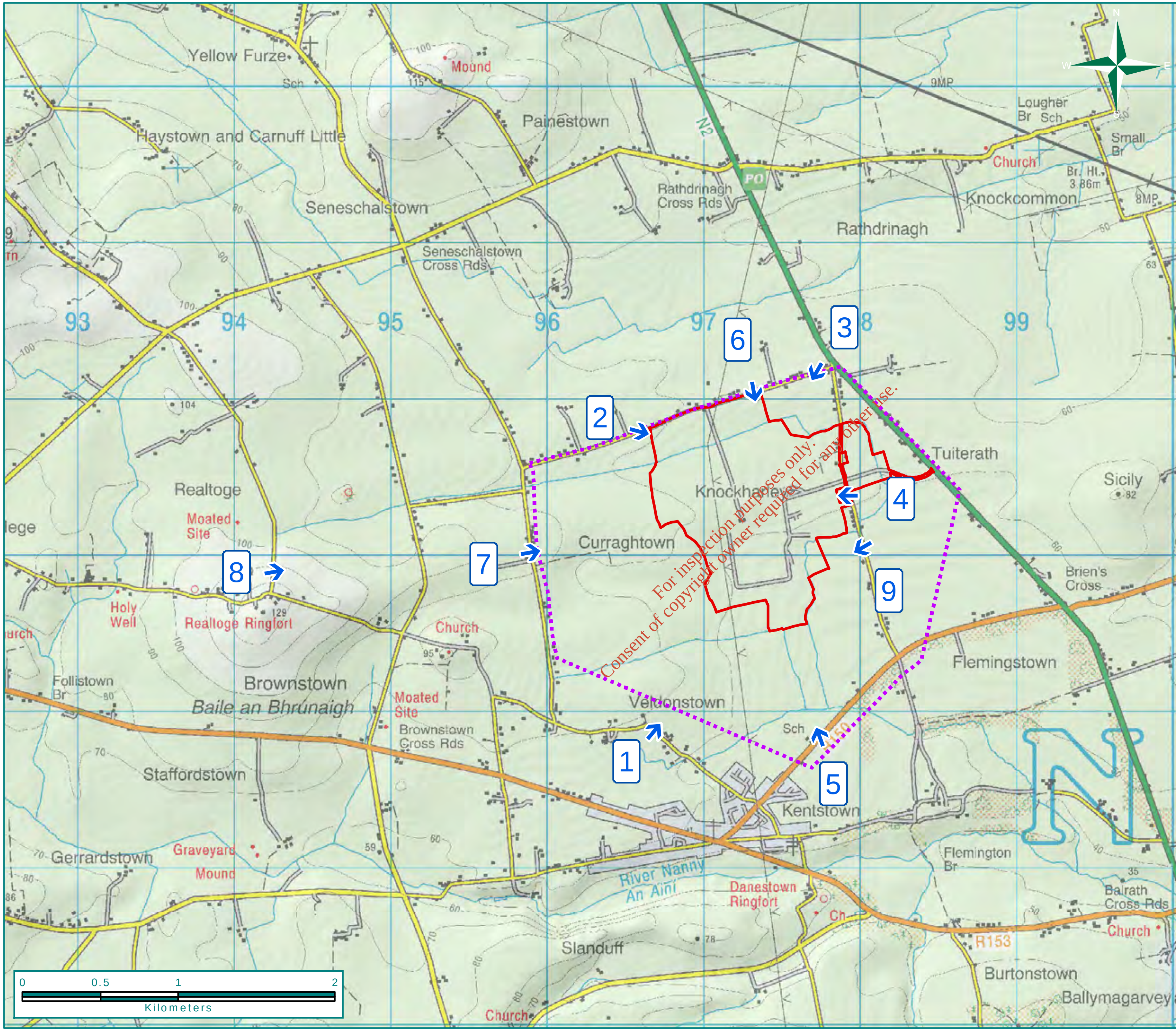
Table 13-7: Viewpoint Locations

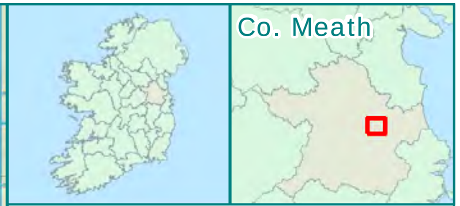
Viewpoint No.	Location	Viewpoint Type	Grid Reference	Approximate Distance from Site Boundary
1	Local Road to the South	Roadside	696616, 765891	870m
2	CR384 Roadside North West of Site	Roadside/Amenity	696520, 767809	70m/Adjacent
3	CR384 Roadside North East of Site	Roadside	697653, 768191	387m
4	CR384 Roadside East of Site	Roadside/Residential	697856, 767398	26m/Adjacent
5	Kentstown Primary School	School	697675, 765856	134m
6	CR384 Roadside North of Site	Roadside	697252, 768063	Adjacent
7	Local County Road Network West of Site	Roadside/Residential	695828, 767037	845m
8	Country Road Network West of the Site	Roadside	694186, 766913	2.4km
9	Country Road Immediately East of the Site	Roadside	697947, 767068	130m

The proposed development is located in a mainly flat landscape and therefore even relatively low vegetation can provide screening to receptors. The above outlined 9 no. photomontages from representative viewpoints have been prepared illustrating the nature of visibility of the proposed development at various distances, contexts and elevations. While most viewpoints have been informed by the ZTV and the identified surrounding area of identified visibility, some additional viewpoints have been prepared to address concerns raised through the public consultation process, as outlined in Chapter 5 of this EIAR.

Visibility from heritage receptors such as Brú Na Bóinne, the Hill of Tara, the Hill of Slane is considered to be nil because the distance from the proposed development is more than 5km and due to other developments in the line of sight. The site is not visible from high points identified in the ZTV at 5 km from the proposed site.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig13-5_Photomontage viewpoint locations_A4.mxd





Legend

- Site Boundary
- Zone of Visual Influence (derived from site visit assessment)
- View Point Location

VP	Angle	X Co-ord	Y Co-ord
1	North-east	696616	765891
2	South-east	696520	767809
3	South-west	697653	768191
4	West	697856	767398
5	North	697675	765856
6	South	697252	768063
7	East	695828	767037
8	East	694186	766913
9	South-west	697947	767068

Date 29/05/2018

Client Name

Knockharley Landfill Ltd.

Project Title

Proposed Development at Knockharley Landfill

Figure Title

Photomontage Viewpoints

Figure No. 13.5

Rev. A

Scale 1:33,970 @ A4

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Viewpoint 1

ITM 696616,765891
Direction of the view- North-East

The existing and proposed view from this location is shown in Figure VP1 overleaf.

Description of View

Viewpoint 1 is from a location on a local road coming from Kentstown towards the north. This photomontage is representative of the views from the settlement of Kentstown and road users.

Existing View

The view is taken from a location at 870 m from the site boundary, at a slightly lower elevation. A large field of pastures bounded by a vegetated treeline is visible. None of the existing facilities are discernible from this view due to the distance, topography and the screening of the existing treeline.

Proposed View and Mitigation

The existing vegetation near the viewpoint is deemed to screen completely the proposed development and therefore, the existing rural character of the view will be kept intact. Mitigation will therefore not be required towards this location.

VIA Result

The viewpoint sensitivity is considered to be High due to number of residents living in the settlement of Kentstown. The visual magnitude of the proposed development is Negligible because it is barely discernible from this view. Therefore, the significance of the visual impact from this location will be Slight and no adverse changes expected.

VIEWPOINT 1		
Proposed Development at Knockharley Landfill		
Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 1	
Filed : LW14/821/01/LW1482101-FigureVP1		

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Viewpoint 2

ITM 696520,767809
Direction of the view- South-East

The existing and proposed view from this location is shown in Figure VP2 overleaf.

Description of View

Viewpoint 2 is from an adjacent location in the local road CR384 northwest of the site. This photomontage is representative of the road receptors.

Existing View

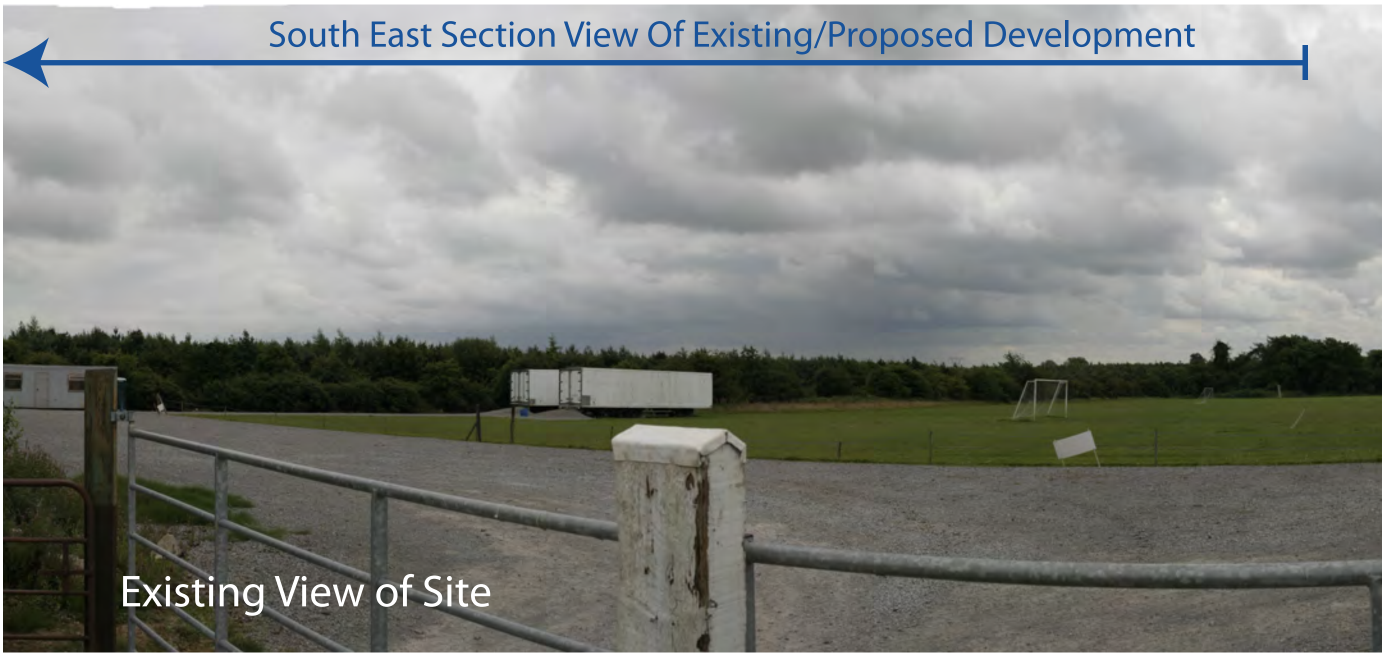
This is a close view towards the site, taken from the adjacent local road towards the south east. Two large containers and a football pitch are visible with the commercial forestry within the development site visible behind.

Proposed View and Mitigation

The proposed development will not be visible from this view due to the topography and the existing vegetation of forest planting. Providing that the new planting areas remain the same as the current ones, additional mitigation will not be required towards this location.

VIA Result

The viewpoint sensitivity is considered to be Low as there are no susceptible receptors and there are no features or recorded routes that recognise the value of the view. The visual magnitude of the proposed development is Negligible because it is barely discernible from this location. Therefore, the significance of the visual impact from this location will be Imperceptible.



VIEWPOINT 2		
Proposed Development at Knockharley Landfill		
Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 2	
Filed : LW14/821/01/LW1482101-FigureVP2		

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Viewpoint 3

ITM 697653,768191
Direction of the view- South-West

The existing and proposed view from this location is shown in Figure VP3 overleaf.

Description of View

Viewpoint 3 is from a location in the local road CR384, 387 m northeast of the site. This photomontage is representative of the road receptors and residential receptors.

Existing View

This is a close view towards the site, taken from the adjacent local road towards the south west. The existing facilities are not visible from this perspective.

Proposed View and Mitigation

The proposed IBA facility and the permitted landfill will be visible from this view, as is shown in the photomontage. This view will be mitigated with the proposed screening berms with new replanting between VP3 and the permitted landfill (see planning drawing LW14-821-01-P-0000-003).

VIA Result

The viewpoint sensitivity is considered to be Low as there are no susceptible receptors and there are no features or recorded routes that recognise the value of the view. The visual magnitude of the proposed development is Low. Therefore, the visual significance from this viewpoint would be Slight-Imperceptible. With the proposed screening berms with new replanting, the visual significance will be Slight-Imperceptible.

VIEWPOINT 3

**Proposed Development at
Knockharley Landfill**

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Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions: A	
Date of Issue - March 2018	**FIGURE VP 3**	
Filed : LW14/821/01/LW1482101-FigureVP3		

VIEWPOINT 3 WITH MITIGATION

Proposed Development at Knockharley Landfill

Drawn: SK	Checked: CC	Approved: BG
Revision A - Issue for Planning	Previous Revisions: A	
Date of Issue - March 2018	FIGURE VP 3m	
Filed : LW14/821/01/LW1482101-FigureVP3		

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Viewpoint 4

ITM 697856,767398
Direction of the view- West

The existing and proposed view from this location is shown in Figure VP4 overleaf.

Description of View

Viewpoint 4 is from a location adjacent to the eastern boundary of the site, in the local road CR384. This photomontage is representative of the road receptors and residents of this area.

Existing View

This is a close view towards the site, taken from the adjacent local road towards the west. A residential building adjacent to the road is in foreground. The rest of the view is comprised by a rural setting. The existing facilities are not visible from this perspective due to vegetation screening. The landfill is fully capped at this viewpoint.

Proposed View and Mitigation

The proposed development will not be visible from this view due to the existing vegetation as shown in the photomontage provided. Once fully grown, this planting will maintain the existing screening and will fully screen the development.

VIA Result

The viewpoint sensitivity is considered to be Medium as there are a number of residents in the area. The visual magnitude of the proposed development is Negligible as the proposed will be barely visible in the available vista while the forested area is maintained as proposed. The visual significance from this viewpoint would be Imperceptible.

VIEWPOINT 4

Proposed Development at
Knockharley Landfill

Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 4	
Filed : LW14/821/01/LW1482101-FigureVP4		

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Viewpoint 5

ITM 697675,765856
Direction of the view- North

The existing and proposed view from this location is shown in Figure VP5 overleaf.

Description of View

Viewpoint 5 is from the Kentstown Primary School, at 134 m south of the boundary of the proposed development. This photomontage is representative of the views from this school and for the residents of this area.

Existing View

This is a view from the south of site, taken from the adjacent local road towards the west. A residential building adjacent to the road is in foreground. The rest of the view is comprised by a rural setting of field patterns and hedgerows. The existing landfill is visible in the background, however it is the portion of the landfill that is currently fully capped and restored to grassland.

Proposed View and Mitigation

The proposed development will not be visible from this location, beyond the existing view of the landfill.

VIA Result

The viewpoint sensitivity is considered to be High as there is a group of susceptible receptors (school users and residents). The visual magnitude of the proposed development is Negligible. The visual significance from this viewpoint would be Imperceptible.

VIEWPOINT 5			
Proposed Development at Knockharley Landfill			
Drawn: SK	Checked: CC	Approved: BG	
Revision B - Issue for Planning		Previous Revisions A	
Date of Issue - March 2018		FIGURE VP 5	
Filed : LW14/821/01/LW1482101-FigureVP5			

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Viewpoint 6

ITM 697252,768063
Direction of the view- South

The existing and proposed view from this location is shown in Figure VP6 overleaf.

Description of View

Viewpoint 6 is from a location adjacent to the northern boundary of the site, in the local road CR384. This photomontage is representative of the road receptors and residents.

Existing View

This is a view from the north of site, taken from one of the gates of the site towards the south. The gate and fence of the existing facility is visible in the foreground and the landfill in the distance is screened by the vegetated row behind the fence.

Proposed View and Mitigation

The landfill, IBA facility and berm would be visible from this location as they will rise the horizon of the view, but the existing vegetation and proposed compensatory planting will screen them.

VIA Result

The viewpoint sensitivity is considered to be Low as there are no susceptible receptors and there are no features or recorded routes that recognise the value of the view. The visual magnitude of the proposed development is Low as the proposal will not have a marked effect in the available vista. The visual significance from this viewpoint would be Low. As the proposed forestry restoration planting develops, the landfill will be fully screened by the vegetation which blends into the wider rural setting of the view. Post-screening the visual significance will be Slight-Imperceptible

VIEWPOINT 6

Proposed Development at Knockharley Landfill

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Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions: A	
Date of Issue - March 2018	**FIGURE VP 6**	
Filed : LW14/821/01/LW1482101-FigureVP6		

VIEWPOINT 6 WITH MITIGATION

Proposed Development at Knockharley Landfill

Drawn: SK	Checked: CC	Approved: BG
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Date of Issue - March 2018		**FIGURE VP 6m**
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Viewpoint 7

ITM 695828,767037
Direction of the view- East

The existing and proposed view from this location is shown in Figure VP7 overleaf.

Description of View

Viewpoint 7 is from a location on the local road from Kentstown towards the north. This photomontage is representative of the views from the settlement of Kentstown and road users.

Existing View

The view is taken from location at 845 m west from the site boundary. The elevation of this location is similar to the proposed site and the view illustrate the flat topography of the neighbouring area. The view is comprised by a rural setting of agricultural fields and hedgerows. None of the existing facilities are discernible from this view due to the distance and the screening elements.

Proposed View and Mitigation

The proposed development is visible from this view (construction of screening berms) but due to the distance, further mitigation is not deemed to be required. All proposed screening berms shall be replanted to replace that felled for the construction of the berms.

VIA Result

The viewpoint sensitivity is considered to be High due to number of residents. The visual magnitude of the proposed development is Negligible because it is barely discernible from this view. Therefore, the significance of the visual impact from this location will be Imperceptible. and no adverse changes expected if the forestry restoration is replanted as proposed.

VIEWPOINT 7		
Proposed Development at Knockharley Landfill		
Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 7	
Filed : LW14/821/01/LW1482101-FigureVP7		

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Viewpoint 8

ITM 695828,767037
Direction of the view- East

The existing and proposed view from this location is shown in Figure VP8 overleaf.

Description of View

Viewpoint 8 is from a location in a Country road 2.4 km west from the site boundary at an elevated location. This photomontage is representative of the views for the road users.

Existing View

The view illustrates an agricultural field and surrounding hedgerows with a limited visibility to further distances due to the vegetation. None of the existing facilities are discernible from this view due to the distance and the screening elements that are close to the viewpoint location.

Proposed View and Mitigation

The proposed development is not visible from this view and mitigation is not required. Felling of trees to facilitate construction of screening berms is proposed on this boundary. The berms will be replanted as commercial forestry.

VIA Result

The viewpoint sensitivity is considered to be Low as the only visual receptors are road users of this Country road. The visual magnitude of the proposed development is Negligible because it is barely discernible from this view. Therefore, the significance of the visual impact from this location will be Imperceptible.

VIEWPOINT 8		
Proposed Development at Knockharley Landfill		
Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 8	
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Viewpoint 9

ITM 697947,767068
Direction of the view- South-West

The existing and proposed view from this location is shown in Figure VP9 overleaf.

Description of View

Viewpoint 9 is from a location in a Country road immediately east from the site boundary. This photomontage is representative of the views for the road users and residents in the vicinity.

Existing View

The view illustrates an agricultural field and surrounding hedgerows with a limited visibility to further distances due to the vegetation. The visibility of the existing facilities is limited due to the distance and the screening elements but the existing restored landfill is just visible along the hedge/treeline and existing screening berm.

Proposed View and Mitigation

The proposed development will add the biological treatment facility in the left hand side of the view and the higher parts of the building will be visible from this location. The rest of the development will remain as existing. Enhancement of the existing planting on top of the berm will contribute to fully screen the proposed biological treatment plant facility building.

VIA Result

The viewpoint sensitivity is considered to be Low as the only visual receptors are road users of this Country road. The visual magnitude of the proposed development is Medium as the proposed building will introduce a moderate intrusion element in the available vista. Therefore, the significance of the visual impact from this location will be Slight. When the additional planting to an existing berm gets higher than the treatment plant, upper areas of the proposed facilities will be screened and the impact will be Imperceptible.

Existing View of Site

Photomontage View of Proposed Development

VIEWPOINT 9

Proposed Development at
Knockharley Landfill

Drawn: SK	Checked: CC	Approved: BG
Revision B - Issue for Planning	Previous Revisions A	
Date of Issue - March 2018	FIGURE VP 9	
Filed : LW14/821/01/LW1482101-FigureVP9		

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Existing View Of Site

Photomontage View of Proposed Development With Mitigation

VIEWPOINT 9 WITH MITIGATION

Proposed Development at Knockharley Landfill

Drawn: SK	Checked: CC	Approved: BG
Revision A - Issue for Planning	Previous Revisions: A	
Date of Issue - March 2018	FIGURE VP 9m	
Filed : LW14/821/01/LW1482101-FigureVP9		

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The summary of the visual significance post-mitigation at each of the viewpoints is shown in the table below.

Table 13-8: Visual Significance in the viewpoints

Viewpoint No.	Visual Significance Post-mitigation
1	Imperceptible
2	Imperceptible
3	Slight-Imperceptible with proposed forestry restoration
4	Imperceptible
5	Imperceptible
6	Imperceptible with proposed forestry restoration
7	Imperceptible
8	Imperceptible
9	Imperceptible with proposed additional planting on an existing berm.

13.5 Cumulative Impact

A solar farm of 3MW of photovoltaic panels has been granted permission by Meath County Council over an area of 3.87Ha in the existing landfill (Plan. Ref. AA180145). The cumulative visual impact of the proposed development in conjunction with the solar farm is addressed here.

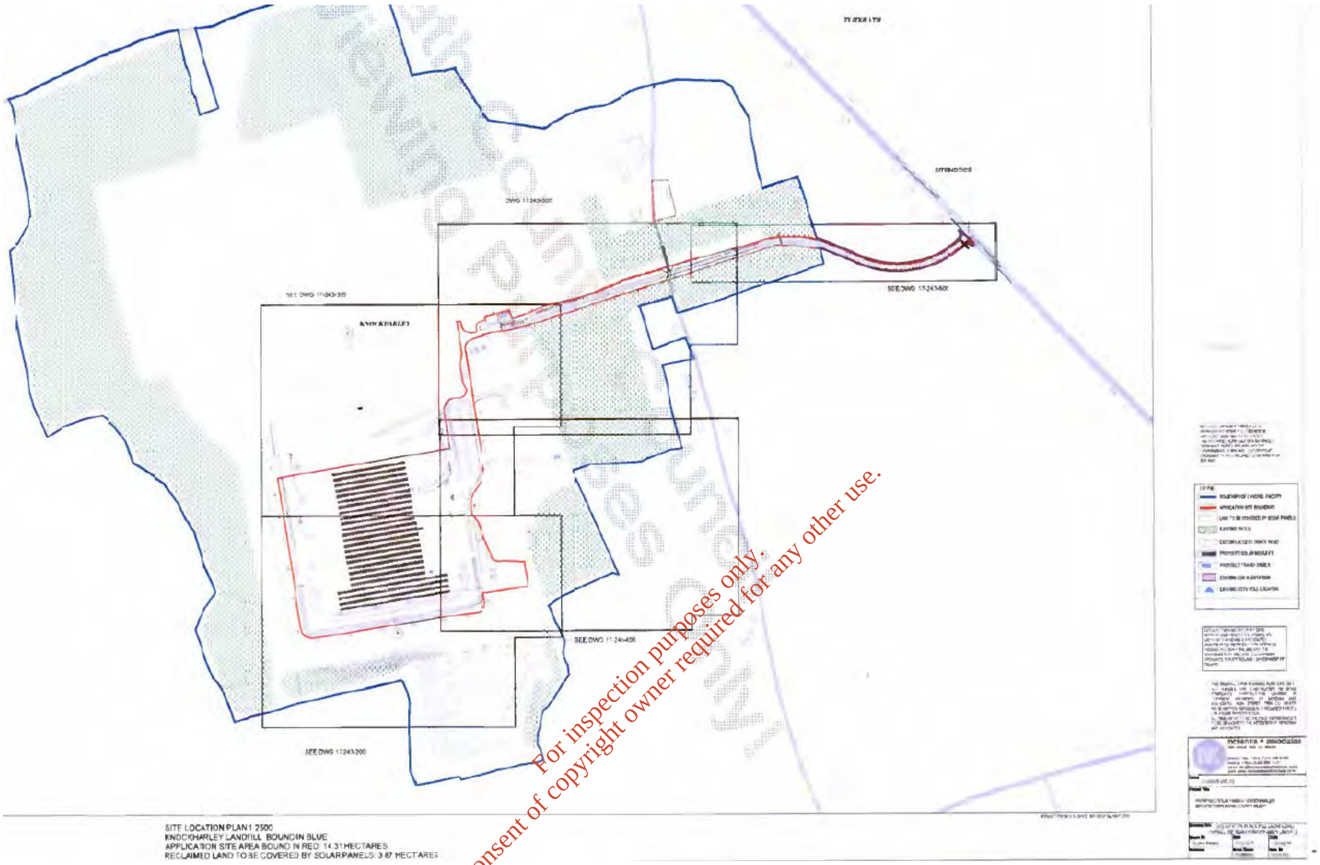

Plate 1: Location of the permitted solar farm (Plan. Ref. AA180145).

According to the LVIA from this planning application, 'the visual impact is limited by a small area of visual influence from the south-east and south'. The cumulative impact with the proposed development will affect the visual receptors at the south-east and south of the development. The mitigation proposed would screen the development and the solar farm in viewpoints VP9 but there is potential visibility of the panels from VP5. From this viewpoint, the cumulative visual significance of the proposed development in combination with the solar farm would be Slight-Imperceptible.

13.6 Mitigation Measures

13.6.1 Requirement for Mitigation

Given the rural location of the proposed development, it is considered that the structural elements of the proposed development i.e. 2 no. shed type structures are, in their form and nature and potential for visual impact, similar to large scale agricultural developments.

To this end, Chapter 11 "Development Management Standards and Guidelines" of the Meath CDP 2013 – 2019 states that:

> "*The design, scale, siting and layout of agricultural buildings should respect, and where possible, enhance the rural environment. In visually sensitive areas, the Council will seek to group together and site buildings in an appropriate manner, and require the use of harmonious external materials to minimise obtrusion on the landscape. The use of dark coloured cladding, notably dark browns, greys, greens and reds are most suitable for farm buildings, and roof areas should be darker than walls.*"

The structural elements of the proposed development are considered to adhere to these requirements through employing mushroom coloured (RAL 1006020) cladding for the building construction.

13.6.2 Proposed Mitigation Measures

Avoidance and reduction mitigation measures integral to design of the development are the primary means of mitigation proposed. These measures include:

- The biological treatment facility is positioned in a naturally low area of the site to improve screening by the existing vegetation;
- Maintenance of existing screening berms and planting to the south.
- Replanting of forestry felled to facilitate construction of screening berms on the western and north eastern boundary
- Enhancement of the planting on top of the existing berm on the eastern boundary;
- The filled landfill cells 27 and 28 will provide screening for landfilling activities south of those cells;
- The filled IBA cell 29 will provide screening for IBA facility activities west of that point; and
- Careful selection of colour finishes for elevations of the proposed buildings in adherence with the Development Management Standards and Guidelines of the Meath CDP 2013 – 2019 will provide additional visual impact mitigation.

A landscape Plan has been prepared to show the forestry planting and the berms proposed in the site. This is shown in the Planning Drawing LW14-821-01-P-0050-012 in Volume 4 of this EIAR. Trees planted in the proposed berms will offer screening to the facilities that reach higher elevations and heights above the ground level.

The proposed mitigation measures will screen the views towards the following viewpoints: VP3, VP6, and VP9. The mitigated views has been assessed individually from each viewpoint at a time when landscaping is at maturity.

13.7 Residual Impacts after Mitigation

As the assessment of potential impacts undertaken in Section 13.4 considers impacts with the implementation of mitigation measures, impacts as identified therein are considered residual impacts.

13.8 Monitoring

The proposed woodland screen planting will involve a maintenance and management programme to ensure successful establishment and development.

The maintenance and management programme will include provision for weed control and the replacement of any plant failures on an annual basis for the first 3-5 years. In the longer term (15-20 years) the trees will be sequentially thinned to promote the development of a healthy and self-sustaining mature woodland.

13.9 Conclusion & Summary

13.9.1 Landscape Character

While the development proposal for the existing facility will incur some changes on the site, these will not significantly affect the character of the wider landscape setting given the inherent capacity of this 'Low Central Landscape' to absorb development of this nature. This is principally facilitated by the extent of mature hedgerow and woodland cover that prevails and the general absence of significant vantage points that facilitate views across the site and its environs.

More locally, the proposed changes will be more evident but the changes will not be significantly intrusive or significantly alter the character of the locality as perceived by local residents and users of the local road network including motorists, cyclists and pedestrians.

13.9.2 Visual Impact

At the macro level, views of the proposed development site are constrained by a combination of extensive existing hedgerow and woodland vegetation and the nature of the gently rolling topography in which there are relatively few vantage points. From those locations that do facilitate views towards the site, distance tends to have a significantly diminishing effect. In addition, the nature of the proposed landfill is such that it integrates well in the local environment aided by the sequential grass seeding and greening up of the finished profile as the filling operations progress.

In distant views the proposed biological treatment facility is well integrated by virtue of its low position on the site and the nature of the screening provided by the landfill cells themselves as well as the adjacent existing screen vegetation. In conjunction with the permitted solar farm, the highest visual impact would be Slight-Imperceptible from viewpoints 3 and 6.

13.10 References

Department of Environment and Local Government - Landscape and Landscape Assessment, Consultation Draft of Guidelines for Planning Authorities, June, 2000.

The Landscape Institute – Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, 2013.

The Landscape Institute – Advice Note 01/11 – Photography & Photomontage in Landscape and Visual Impact Assessment,2011.

Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report, EC, 2018

Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports EPA, 2017.

Meath County Development Plan 2013-2019

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 14 – ACHAEOLOGY, ARCHITECTURE AND CULTURAL HERITAGE

NOVEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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14 CULTURAL HERITAGE

This chapter has been prepared by Dermot Nelis Archaeology.

14.1 Introduction

This chapter assesses the impacts, if any, of the proposed development at the facility on the archaeological, historical and cultural environment in the vicinity of the site. This section will also propose mitigation measures to safeguard any monuments, features or finds of antiquity if required.

The objectives of this section are to:

- identify all known features of archaeological, architectural and cultural heritage importance in the vicinity of the proposed development
- determine any potential impacts of the proposed development on the archaeological, architectural and cultural heritage resource
- identify measures to mitigate any potential impacts of the development on the archaeological, architectural and cultural heritage resource.

14.2 Study Area

There is no professional standard for defining the extent of a study area when assessing potential impacts on archaeological, architectural or cultural heritage remains. A study area of 1 km has been imposed around the proposed development to assess the presence of statutorily protected archaeological remains. A 1 km study area is an industry agreed approach for assessing potential impacts on archaeological remains and is accepted by National Monuments Service as providing an adequate assessment of any impacts that may occur on archaeological features. This involved mapping all Recorded Monuments within 1 km of the facility and assessing their potential to be impacted on as a result of the proposed development.

In addition, a study area of 1 km has been imposed around the proposed development area to record the presence of Protected Structures or any additional statutorily protected archaeological, architectural or cultural heritage features recorded in the *Meath County Development Plan 2013 – 2019* or the National Inventory of Architectural Heritage.

In relation to the potential visual impacts arising from the proposed development on important archaeological sites such as Bru na Boinne, the Hill of Tara, the Hill of Slane, and other archaeological sites, Chapter 13: Landscape deals with the potential visual impacts arising from the proposed development.

The key objectives of this report are to assess, as far as is reasonably possible from existing records, the potential impacts of the proposed development on the archaeological, architectural and cultural heritage resource. The following key issues are addressed:

- Direct and indirect impacts of construction activities on recorded and unrecorded archaeological, architectural and cultural heritage features
- Direct and indirect impacts of the operation of the proposed development on recorded and unrecorded archaeological, architectural and cultural heritage features
- Residual impacts of the proposed development on recorded and unrecorded archaeological, architectural and cultural heritage features.

14.3 Methodology

The study involved detailed interrogation of the archaeological and historical background of the proposed development area and its surrounding landscape. This included information from the:

- Record of Monuments and Places (RMP) of County Meath
- Topographical Files of the National Museum of Ireland
- Meath County Council's *Meath County Development Plan 2013 – 2019*
- National Inventory of Architectural Heritage, cartographic and documentary records and aerial photographs
- Environmental Protection Agency's *Guidelines on the Information to be Contained in Environmental Impact Statements* (2002). Environmental Protection Agency (EPA). 2002. Guidelines on the Information to be Contained in Environmental Impact Statements.
- EPA. 2003. Advice Notes on Current Practice (in the preparation of Environmental Impact Statements).
- EPA. 2017. Guidelines on the Information to be Contained in Environmental Impact Assessment Reports- Draft.

An impact assessment and mitigation strategy has been prepared. The impact assessment is undertaken to outline potential adverse impacts the proposed development may have on the archaeological, architectural or cultural heritage resource, while the mitigation strategy is designed to avoid, reduce or offset such adverse impacts.

Research has been undertaken in two phases. The first phase comprised a paper and digital survey of archaeological, historical and cartographic sources. The second phase involved a field inspection of the proposed development area.

14.3.1 Data Sources

The following sources were examined, and a list of sites and areas of archaeological, architectural and cultural heritage potential was compiled:

Record of Monuments and Places of County Meath - This is a list of archaeological sites known to the National Monuments Service. Back-up files of the Sites and Monuments Record (SMR) provide details of documentary sources and field inspections where these have taken place. There are no sites recorded on the RMP within the proposed development area or the 1 km study area.

Topographical Files of the National Museum of Ireland – This is the archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts, but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information in the discovery of sites of archaeological significance.

The **Meath County Development Plan** (2013 - 2019) contains Policies and Objectives on the preservation and management of archaeological, architectural and cultural heritage features. It was consulted to obtain information on sites within the proposed development area and the 1 km study area.

National Inventory of Architectural Heritage (NIAH) - This is a section within the Department of Arts, Heritage and the Gaeltacht (DoAHG). The work of NIAH involves identifying and recording the architectural heritage of Ireland from 1700 to the present day. The NIAH website also contains a non-statutory register of historic gardens and designed landscapes, and this was assessed to look for the presence of any such locations within the proposed development area and the 1 km study area.

Cartographic sources - These are important in tracing land-use development within the proposed development area, as well as providing important topographical information on sites and areas of archaeological potential. Cartographic analysis of relevant maps has been made to identify any topographical anomalies that may no longer remain within the landscape.

Documentary sources were consulted to gain background information on the historical and archaeological landscape surrounding the proposed development area.

Aerial photographs of Ordnance Survey Ireland and Bing aerial photography - This coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its potential to contain previously unidentified archaeological remains.

14.3.2 Field Inspections

Field inspection is necessary to determine the extent, character and condition of archaeological, architectural and cultural heritage remains, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

The areas walked correspond to the areas of development as identified in in Chapter 2 of this EIAR and comprise the IBA facility, the biological treatment plant area, the leachate plant area, the surface water lagoon location, areas of potential tree felling and locations for screening berm development.

In addition, land surrounding these areas, but which does not form part of the proposed development, was also visually assessed in an attempt to gain information on the wider landscape. Further information in relation to the field inspection undertaken is included in Appendix 14.1 of Volume 3 of this EIAR.

14.4 Existing Environment

14.4.1 Archaeological and Historical Background

There are no Recorded Monuments within the proposed development area or the 1 km study area (www.archaeology.ie). The closest Recorded Monument (RMP ME026-030) is located approximately 1.3 km west of the landfill site boundary and takes the form of a possible ringfort (Figure 14-1).

Reference to Summary Accounts of Archaeological Excavations in Ireland (www.excavations.ie) has shown that seven fieldwork projects have been carried out in Knockharley townland, the location of the proposed development. All fieldwork programmes were directly associated with the development of the Knockharley landfill site and were required by Condition 2(b) of planning permission PL17.220331, as approved by An Bord Pleanála, which relates to the ongoing site development. Condition 8.11 of the facility Industrial Emissions (IE) licence also requires the undertaking of archaeological assessment prior to development works onsite.

Of the seven projects, only one failed to reveal features or artefacts of archaeological significance. Of the remaining, fieldwork revealed evidence of a possible below-ground circular enclosure, a burnt mound or fulacht fiadh, a number of pits, linear spreads, deposits of burnt stone, a deer pit and a well. In addition, fieldwork carried out in 2016 within the landfill site and immediately west of the proposed lined cell revealed a possible truncated fulacht fiadh or burnt spread with associated pit features, four closely related pit features with burnt stone and clay and a small linear feature with a pit which was also filled with burnt stone and clay.

All of these features have been located within the immediate environment of the proposed development, and as such, they confirm the landscape surrounding the development area to have the potential to contain previously unrecorded archaeological remains.

No fieldwork projects are recorded as having been carried out in Flemingstown townland.

Information on artefact finds and excavations from County Meath is recorded by the National Museum of Ireland. There was no record of any finds from within Knockharley or Flemingstown townlands noted in the Topographical Files. Finds recorded from townlands in the wider vicinity of the proposed development area include a polished stone axehead, a stone axe, a bronze vessel and an ogham stone.

Reference to cartographic sources failed to identify any archaeological or architectural features within the proposed development area. A townland and parish boundary forms the majority of the northern boundary of the landfill site, and also part of the north-eastern boundary.

A townland boundary is recorded along all of the western and southern borders of the site. A townland boundary will be truncated by construction of the lined cell.

Five small presumably vernacular structures are recorded in the extreme northern end of the development area on cartographic sources but outside the land take required for construction of the landscaping berms or stream diversion. A well is also noted in this general area on the First Edition 1:2,500 Ordnance Survey map, but this feature is again outside all areas of proposed land take.

There was no evidence of any archaeological, architectural or cultural heritage features recorded on aerial photographs within the proposed development area or the surrounding landscape.

No archaeological, architectural or cultural heritage features were revealed within the proposed development area or the surrounding landscape as a result of carrying out the walkover survey.

Detailed information on the archaeological and historical background of the landscape surrounding the proposed development area, as well as a summary of previous fieldwork undertaken and the cartographical analysis carried out, is provided in Appendix 14.1.

14.4.2 Record of Monuments and Places (RMP)

There are no Recorded Monuments within the proposed development area or the 1 km study area. There are 13 Recorded Monuments located within 2 km of the landfill site boundary (Figure 14-1). The closest Recorded Monument (RMP ME026-030) is located approximately 1.3 km west of the landfill site boundary and takes the form of a possible ringfort.

Table 14-1: RMP sites within 2 km of Proposed Development Area

RMP No.:	ME026-013
Townland:	Brownstown
Classification:	Enclosure
Distance from proposed development area:	*c.* 2 km
Description:	Sub-circular area defined by a fosse (dimensions 40 m east/west x 36 m north/south). The fosse is almost obliterated on the east side. Original entrance may have been there. The monument is set within a large tree-ring.
Reference:	www.archaeology.ie
RMP No.:	ME026-014 and 026-014001
Townland:	Brownstown
Classification:	Church and graveyard
Distance from proposed development area:	*c.* 1.7 km
Description:	Located towards the top of the north east-facing slope of a hill. A church at Brun is listed in the ecclesiastical taxation (1302-06) of Pope Nicholas IV. At the Suppression in 1540 the rectory, or office of parish priest, with 20 acres was vested in St. Mary's Cistercian abbey in Dublin, and Edward Dowdall of Broniston was a witness at an inquiry. According to Ussher (1622) the church and chancel were ruined.

	Dopping's Visitation (1682-85) states the parish church of St. Michael at Brownstown was unrepaired since 1641 and that it was not enclosed. In 1640 the parish of Brownstown, consisting of the townlands of Brownstown and Realtoge, amounted to almost 700 acres and was the property of Nicholas Dowdall. A large stone house at Brownstown is the only item recorded on the Down Survey (1656-58) parish map and its terrier or commentary. The grass-covered foundations of an east/west building (internal dimensions 13.35 m east/west x 5.75 m north/south) with possible doorways towards the west end of the north and south walls is within a neglected sub-rectangular graveyard (dimensions *c.* 40 m north/south x *c.* 40 m east/west). The graveyard has a small number of headstones dating from 1786 to 1934. Cogan (1862-70) records that the chancel arch stood 20 feet (*c.* 6 m) from the east end of the church and that there was a tomb of Catherine Plunkett, daughter of Mathew Plunkett, baron of Louth, which would date to *c.* 1700. This tomb has not been identified however.
Reference:	www.archaeology.ie
RMP No.:	ME026-030
Townland:	Realtoge
Classification:	Ringfort- unclassified
Distance from proposed development area:	*c.* 1.3 km
Description:	This possible ringfort was identified on Lidar.
Reference:	www.archaeology.ie
RMP No.:	ME032-005
Townland:	Kentstown
Classification:	Font- present location
Distance from proposed development area:	*c.* 1.5 km
Description:	The font from Timloole church (RMP ME032-013) was moved to the Roman Catholic church at Kentstown, *c.* 5km to the west, shortly after the Catholic church was built. The limestone octagonal font with chamfered under-panels and a circular flat-bottomed basin (internal diameter 0.48 m; depth 0.24 m) is resting on an octagonal sandstone base. The English inscription in Roman letters running on all the sides below the rim reads: THIS / FANT / STONE WAS / BWYLDE / D BY ROBA / RE HOLI /WOD AN / DNI. 1597 / HE BEYN / GE RROCT /OR.
Reference:	www.archaeology.ie
RMP No.:	ME032-006, ME032-006001 and ME032-006002
Townland:	Kentstown
Classification:	Church, graveyard and tomb
Distance from proposed	*c.* 1.4 km

development area:	
Description:	Located at the southern edge of a level landscape and at the crest of a south-facing slope down to the west/east Nanny River, which is *c*. 150 m distant. The church of the "*vill de Kent*" is listed in the ecclesiastical taxation (1302-06) of Pope Nicholas. Ussher (1622) describes the church as ruined and the chancel as indifferently repaired. Dopping (1682-85) says the church was unrepaired since 1641 and it was not enclosed. The present Church of Ireland church was built *c*. 1750 when it became the head of Union with the parishes of Danestown and Ballymagarvey. It is within a sub-rectangular graveyard (RMP ME032-006001), measuring *c*. 55 m north/south x *c*. 38 m east/west at north and *c*. 45 m east/west at south, defined by masonry walls, but there is no evidence of an earlier structure. The mid-14th century effigy of Sir Thomas de Tuite (RMP ME032-006001) carved in low relief with a Latin inscription in gothic lettering along the long sides is displayed in the present church.
Reference:	www.archaeology.ie
RMP No.:	ME032-007
Townland:	Danestown
Classification:	Ringfort
Distance from proposed development area:	*c*. 1.8 km
Description:	Raised oval area defined by the remains of an earthen bank measuring 41 m east north east/west south west x 34 m north west/south east, with an external fosse and outer bank (maximum external diameter 82 m east north east/ west south west). There is an entrance and causeway at the south west.
Reference:	www.archaeology.ie
RMP No.:	ME032-008, ME032-008001 and ME032-008002
Townland:	Danestown
Classification:	Church, graveyard and font
Distance from proposed development area:	*c*. 1.95 km
Description:	Located on a slight rise of a south-facing slope near the west head of a small west/east valley. The parish church of Danestown (RMP ME032-008) is within a sub-rectangular graveyard (RMP ME032-008001) measuring *c*. 65 m north east/south west x *c*. 30 m north west/south east at north east to *c*. 48 m north east/south west at south west. It is defined by a stone-faced earthen bank *c*. 4-5 m wide. The inscriptions of many of the headstones have been published. Three pieces of window sill are used as grave-markers, and the head of an ogee-headed window and pieces of window tracery are in the graveyard. Inside the entrance on the north side of the graveyard is part of a font (RMP ME032-008002).
Reference:	www.archaeology.ie
RMP No.:	ME032-063003

Townland:	Burtonstown
Classification:	Ring-ditch
Distance from proposed development area:	*c.* 2 km
Description:	No further information is supplied in the National Monument's Service database.
Reference:	www.archaeology.ie

14.4.3 National Monuments

The Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs maintains a database on a county basis of National Monuments in State Care (www.archaeology.ie). The term National Monument is defined in Section 2 of the National Monuments Act (1930) as a monument, or the remains of a monument:

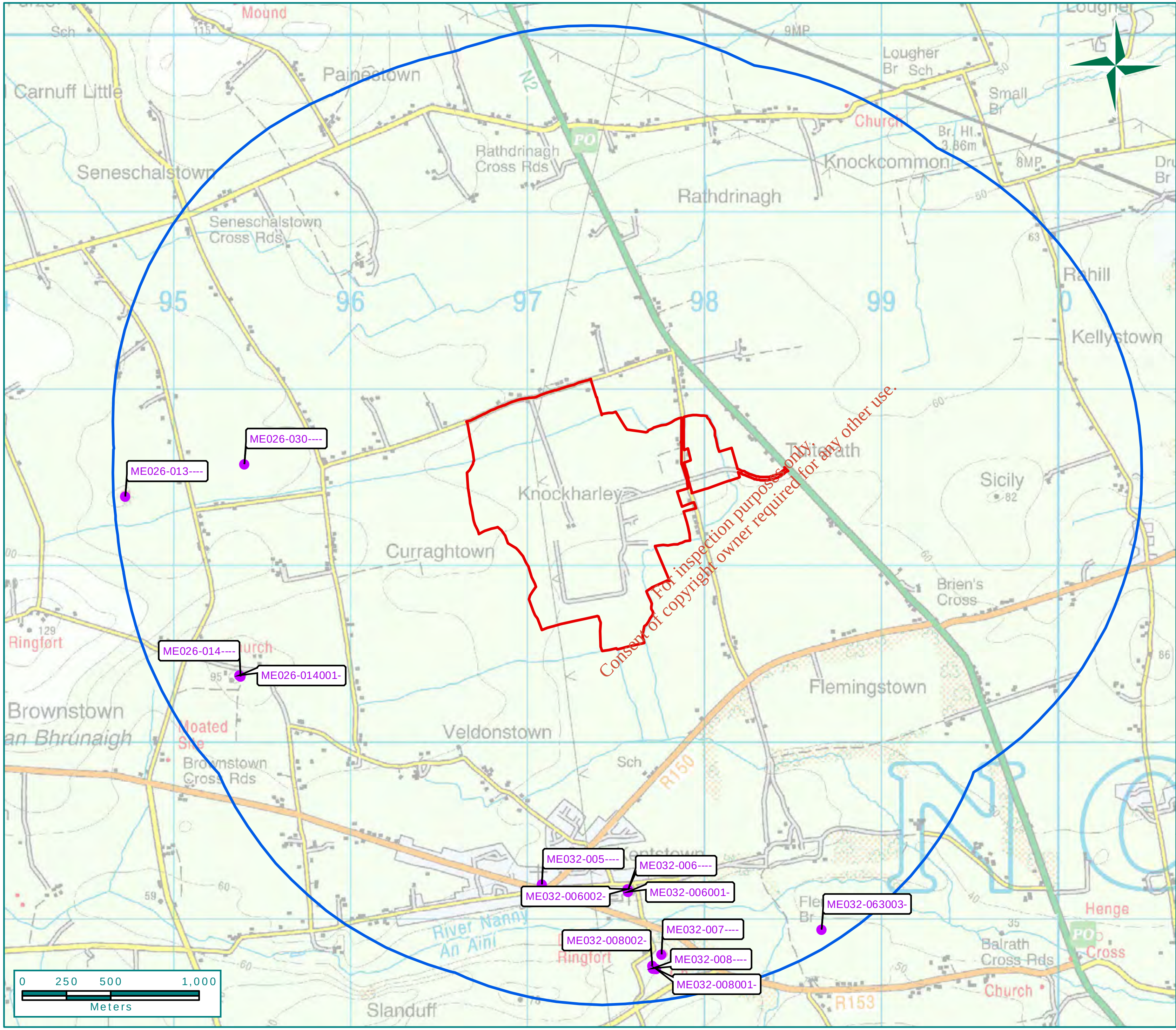
"the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto" (National Monuments Act, Section 2. 1930).

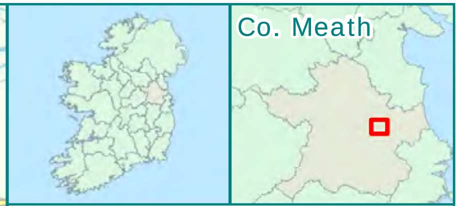
There are no National Monuments in State Care within the proposed development area or the 1 km study area.

There are no sites with Preservation Orders or Temporary Preservation Orders within the proposed development area or the 1 km study area.

There are no World Heritage Sites or Candidate World Heritage Sites within the proposed development area or the 1 km study area.

Map: R:\Map Production\2014\LW14\821\01\Workspace\MXD\EIS\LW14-821-01_Fig14-1_RMPsWithin2km_A4.mxd





Legend

- Site Boundary
- 2km from Site Boundary
- Record of Monuments and Places (RMP)

Date	03/10/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	RMPs within 2km of the Proposed Development
Figure No.	14.1
Rev.	A
Scale	1:30,000 @ A4

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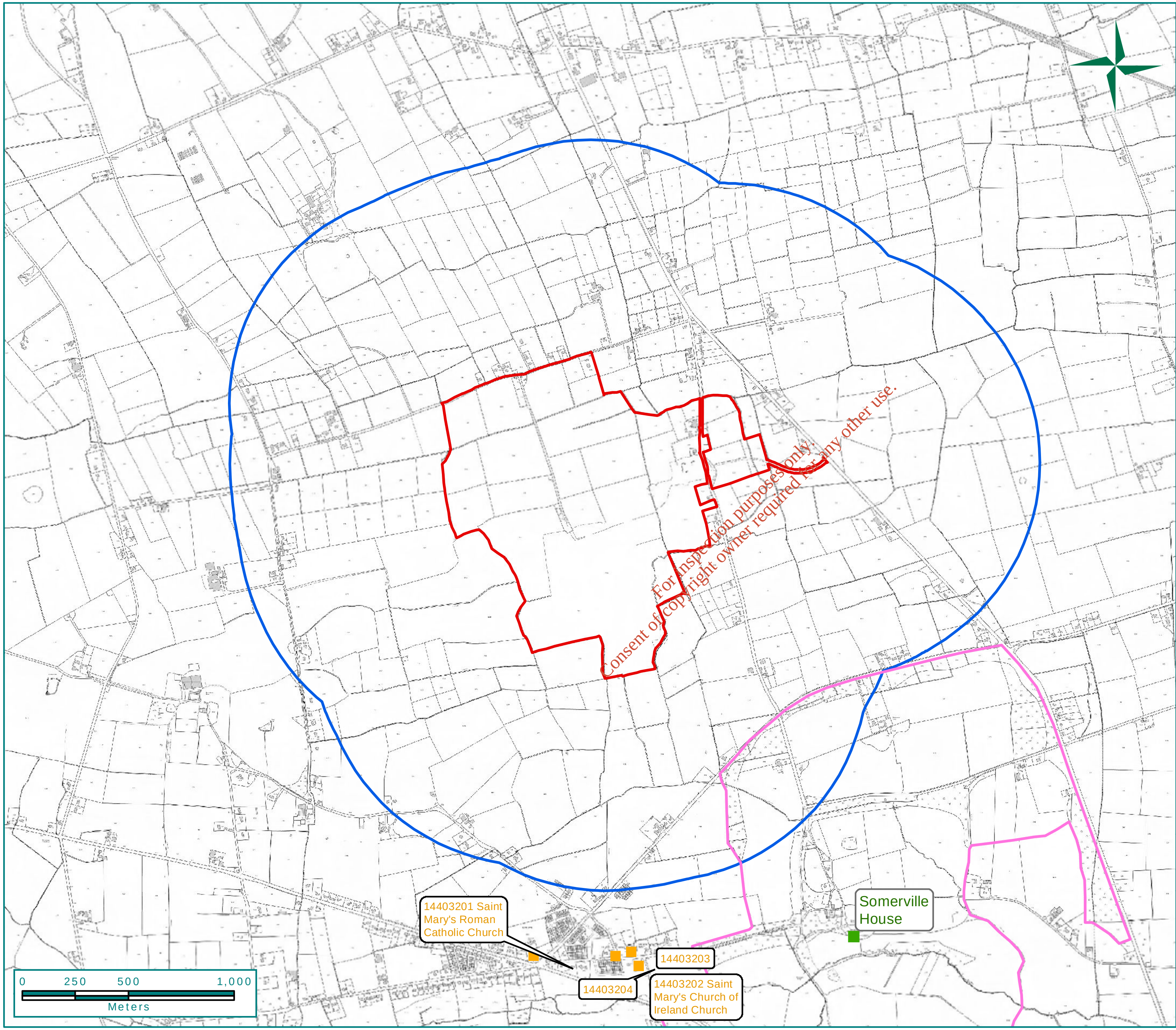

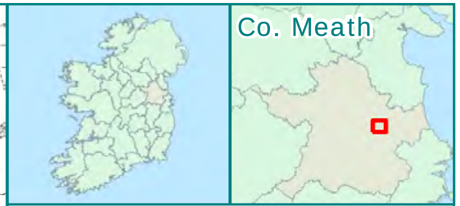

Legend

- Site Boundary
- 1km from Site Boundary
- Somerville Demesne
- National Inventory of Architectural Heritage (NIAH)
- NIAH Gardens (Unofficial)

Date	03/10/2018
Client Name	Knockharley Landfill Ltd.
Project Title	Proposed Development at Knockharley Landfill
Figure Title	NIAH Gardens & Architectural Conservation Areas within 1km of the Proposed Development
Figure No.	14.2
Rev.	A
Scale	1:25,000 @ A4

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14.4.4 Meath County Development Plan 2013 - 2019

Appendix 11 of the Meath County Development Plan (2013, 548 – 555) contains a list of *National Monuments in State Care* and the *Register of Historic Monuments*. There are no National Monuments in State Care or Registered Historic Monuments within the proposed development area or the 1 km study area.

14.4.5 Protected Structures

Appendix 8 of the Meath County Development Plan (2013, 393 - 520) contains the *Record of Protected Structures*. There are no Protected Structures within the proposed development area or the 1 km study area.

14.4.6 Architectural Conservation Areas

Appendix 9 of the Meath County Development Plan (2013, 522 - 540) contains a list of *Architectural Conservation Areas*. There are no Architectural Conservation Areas within the proposed development area. There is one Architectural Conservation Area partially within the 1 km study area.

Table 14-2: Architectural Conservation Areas within 1 km of the Proposed development area

Name	Townland	Distance
Somerville Demesne	Flemingstown	*c.* 600 m at its nearest point south east of the landfill site boundary

14.4.7 National Inventory of Architectural Heritage (NIAH)

NIAH (www.buildingsofireland.ie) maintains a non-statutory register of buildings, structures *etc*. recorded on a county basis.

There are no entries recorded on the NIAH building survey within the proposed development area or the 1 km study area.

NIAH also maintains a non-statutory register of historic gardens and designed landscapes recorded on a county basis. There are no such features within the proposed development area. There is one such feature partially within the 1 km study area.

Table 14-3: NIAH Historic Gardens and Designed Landscapes within 1 km of the Proposed Development

Name	Townland	Site Status	Distance
Somerville House	Flemingstown	Main features substantially present - peripheral features unrecognisable	*c.* 600 m at its nearest point south east of the landfill site boundary

14.5 Summary of Key Possible Impacts

Elements of the proposed development with the potential to impact on archaeological, architectural or cultural heritage remains in the vicinity of the proposed development are the IBA facility, the biological treatment facility, the leachate plant area, the surface water lagoon location, areas of potential tree felling and locations for screening berm development.

Development of these facilities will involve the mechanical excavation of all topsoil and overburden down to and through geologically deposited strata at their identified locations, followed by construction activities including, inter alia, the placement of concrete hardstanding, the installation of drainage infrastructure and the erection of buildings and other structures.

As a result of carrying out this assessment, the following potential archaeological, architectural and cultural heritage direct, indirect, construction, operational and residual impacts have been assessed:

14.5.1 Construction Phase Impacts: Direct and/or Indirect

- There are no Recorded Monuments, Protected Structures, Architectural Conservation Areas, NIAH structures or NIAH historic gardens or designed landscapes within the proposed development area. As a result, there will be no direct or indirect construction impact on the recorded archaeological, architectural or cultural heritage resource.
- Fieldwork previously carried out for the phased development of the Knockharley landfill site has revealed substantial archaeological remains within the immediate vicinity of the proposed development area. As such, it is considered there is a potential direct construction impact on previously unrecorded archaeological remains of unknown significance.

14.5.2 Operational Phase Impacts: Direct and/or Indirect

- There will be no direct or indirect operational impact on the archaeological, architectural or cultural heritage resource.
- There is one Architectural Conservation Area partially within the 1 km study area, and it is located approximately 600 m at its nearest point south east of the landfill site boundary. It is confirmed there will be no operational impact on this Architectural Conservation Area.
- There is one NIAH historic garden or designed landscape partially within the 1 km study area, and it is located approximately 600 m at its nearest point south east of the landfill site boundary. It is confirmed there will be no operational impact on this non-statutorily protected landscape feature.

14.6 Mitigation Measures

14.6.1 Construction Mitigation Measures

- Due to fieldwork previously carried out for the phased development of the Knockharley landfill site revealing substantial archaeological remains within the immediate vicinity of the proposed development area, it is proposed that a programme of pre-development licensed geophysical surveying will be carried out in all suitable areas of land take.
- It is proposed that a programme of pre-development test trenching will be carried out after the geophysical survey has been completed and within all areas of proposed land take. Test trenching will take in to account the results of the geophysical survey and will be carried out under licence to the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland. Further archaeological mitigation measures, which may include preservation in situ or preservation by record, may be made pending the results of the test trenching programme, and in agreement with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland.

14.6.2 Operational Mitigation Measures

- There will be no direct or indirect operational impact on the archaeological, architectural or cultural heritage resource. As such there are no operational mitigation measures required.

14.7 Residual Impacts after Mitigation

There will be no residual impacts on archaeological, architectural or cultural heritage remains after mitigation measures have taken place.

14.8 Monitoring

With the exception of the mitigation measures recommended in Section 15.6 above, there are no future monitoring requirements.

Table 14-4: Summary of Impacts

Potential Impact	Significance	Proposed Mitigation	Residual Impact
Potential direct construction impact on previously unrecorded archaeological remains	Unknown	Licensed geophysical survey and licensed test trenching. Further mitigation measures, which may include preservation in situ or preservation by record, may be implemented pending the results of the test trenching programme	None are envisaged.

14.9 Conclusion & Summary

There are no Recorded Monuments, Protected Structures, Architectural Conservation Areas, NIAH structures or NIAH historic gardens or designed landscapes within the proposed development area. As a result, there will be no direct or indirect construction impact on the recorded archaeological, architectural or cultural heritage resource.

Fieldwork previously carried out for the phased development of the Knockharley landfill site has revealed substantial archaeological remains within the immediate vicinity of the proposed development area. As such, it is considered there is a potential direct construction impact on previously unrecorded archaeological remains of unknown significance. There will be no direct or indirect operational impact on the archaeological, architectural or cultural heritage resource.

There is one Architectural Conservation Area partially within the 1 km study area, and it is located approximately 600 m at its nearest point south east of the landfill site boundary. It is confirmed there will be no operational impact on this Architectural Conservation Area. There is one NIAH historic garden or designed landscape partially within the 1 km study area, and it is located approximately 600 m at its nearest point south east of the landfill site boundary (see Figure 14-2). It is confirmed there will be no operational impact on this non-statutorily protected landscape feature.

Due to fieldwork previously carried out for the phased development of the Knockharley landfill site revealing substantial archaeological remains within the immediate vicinity of the proposed development area, it is proposed that a programme of pre-development licensed geophysical survey will be carried out in all suitable areas of land take.

It is proposed that a programme of pre-development test trenching will be carried out after the geophysical survey has been completed and within all areas of proposed land take. Test trenching will take in to account the results of the geophysical survey and will be carried out under Licence to the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland. Further archaeological mitigation measures, which may include preservation in situ or preservation by record, may be implemented pending the results of the test trenching programme, and in agreement with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland.

There will be no residual impacts on archaeological, architectural or cultural heritage remains after mitigation measures have taken place.

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ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 15 – MATERIAL ASSETS

SEPTEMBER 2018

Knockharley Landfill Ltd.
Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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TABLE 15-1: RELEVANT MATERIAL ASSETS 1

15 MATERIAL ASSETS

15.1 Introduction

This section examines existing material assets in the area of the proposed development. It predicts the impacts that may occur on these assets and the measures proposed to mitigate these effects. Consideration is given to both the construction and operational phases of the development.

15.2 Study Area

This assessment is based on material assets which have the potential to be directly impacted by the proposed development and therefore are those that occur within the immediate vicinity of the proposed development location.

15.3 Methodology

A desk-top study was undertaken to outline the material assets in the existing environment. In order to assess the impacts of the proposed development on material assets, a review of the proposed development to identify potential impacts on material assets was undertaken and the significance of these impacts assessed.

15.4 Existing Environment

The EPA in their *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft* (2017) and as per Directive 2014/52/EU states that "Material assets can now be taken to mean built services and infrastructure".

Together with the EC document, *Guidance Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report* (2018), the following are determined to be material assets, see Table 15.1.

Table 15-1: Relevant Material Assets

Material Assets in this chapter	Material Assets in other chapters
• Utilities (water supplies, sewage, power systems etc.) • Non-renewable resources (e.g. minerals, soils) • Renewable resources (hydraulic head, wind exposure) • Buildings and Other Structures	• Roads (Refer Chapters 6 and 8 of this EIAR) • Traffic (Refer to Chapter 8 of this EIAR)

Buildings and other structures within the planning boundary are addressed in Chapter 2 - Description of the Development of Volume 2 of this EIAR. Land use is discussed in Chapter 6 – Population and Human Health in Volume 2 of this EIAR. Vibration is addressed in Chapter 9 – Noise and Vibration in Volume 2 of this EIAR.

This chapter will therefore focus on remaining material assets not addressed elsewhere in this EIAR, i.e. utilities, buildings and other structures outside the planning boundary, non-renewable resources and renewable resources.

15.4.1 Utilities Infrastructure

Utilities infrastructure is necessary to ensure that power (electricity / gas), water and amenity services, such as telecommunications and sewer collection, are provided to communities in a reliable consistent manner. Due to a community's dependency on such sources, any disruption to a utility supply can have a negative impact.

A number of utility services are located within the site area. Existing overhead power lines (see Drawing No, LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR), are present at the following locations:

- 220 kVA running north south and adjacent to the western boundary of the landfill footprint
- 20 kVA running north south on the eastern boundary parallel to the existing local road with spurs to:
  - An ESB substation exporting power from the landfill gas compound to a 20kVA line
  - An ESB substation importing power to the administration building

The 20 kV line provides electricity to the local community as well as supplying the existing landfill site.

There is an existing Bord Gais gas pipeline running west to east through the south of the site just south of the existing landfill footprint and north of the existing surface water attenuation pond.

The existing gas and power lines are shown in Drawing No.'s LW14-821-01-P-0000-002 Existing Site Layout in Volume 4 of this EIAR.

Telecommunications are provided to the local community and also service the main administration buildings onsite. A source of potable water for use in the canteen, welfare facilities and for general site cleaning is sourced from the mains supply. This water source also provides water to a fire hydrant onsite.

There is no foul sewer service in the area. All foul effluent generated from administration welfare facilities is collected onsite and passed through a Bio-Cycle treatment unit. Any effluent from this unit is discharged to the leachate lagoon and is tankered offsite for further treatment in a wastewater treatment plant.

The Meath County Development Plan 2013-2019 states that "*Kentstown Village is currently served by Kentstown waste water treatment plant. This plant has been designed to cater for a design capacity of 600 population equivalent (PE) and there is currently limited capacity available. There are no immediate plans to upgrade the waste water treatment plant. The public water supply in Kentstown is served by the East Meath Water Supply Scheme. There is a total capacity to cater for 500 PE. There is currently limited capacity available*".

15.4.2 Buildings and Other Structures

The entire development site and a number of immediate surrounding agricultural fields are owned by the applicant; Knockharley Landfill Ltd. Access is via a dedicated entrance off the N2 national primary route. Buildings and other structures within the planning boundary are discussed in Chapter 2 -Description of the Development in Volume 2 of this EIAR.

A number of dwellings adjacent to the development site boundary are also owned by the applicant, Knockharley Landfill Ltd. All dwellings owned by the applicant are shown within the blue ownership boundary on Drawing No. LW14-821-01-P0000-002 Existing Site Layout in Volume 4 of this EIAR and all other dwellings and structures near the boundary of the facility are shown.

15.4.3 Non- Renewable Resources

While there are a number of sources of quarries and pits in the wider surrounding area, the site itself is not a source of minerals or aggregates. The geology of the site consists of gley topsoil derived from shale and sandstone parent material and the topsoil is underlain by glacial till commonly referred to as boulder clay.

Excavated material has been reused onsite to form the landfill liner or construct internal berms and access roads. As described in Chapter 2 – Description of the Development in Volume 2 of this EIAR, excavated soils won from the construction of the IBA[1] facility, as well as future cells constructed in the currently permitted landfill area, will be used in the construction of the screening berms installed along the western, northern and eastern flanks of the site.

Fossil fuel use at the site in 2017 was 426 m^3 of light fuel oil, while 4,180 m^3 of water and 170 MWh of electricity was used.

15.4.4 Renewable Resources

The existing site itself is a renewable energy source. There is a landfill gas utilisation plant on site, which has been operational since the mid 2000's. Landfill gas engines in the utilisation plant allow the landfill gas produced onsite to be utilised in the production of renewable electricity for export to the national grid. In 2017, renewable electricity output from the gas engines was 18,872 MWh.

There is 37.7 ha of existing commercial forestry on site. The extent of the existing forestry is shown on Drawing No. LW14-821-01-P0050-003 Existing Forestation, Proposed Felling and Compensatory Planting in Volume 4 of this EIAR.

There is planning permission for a solar farm development on the capped area of the landfill but there is no infrastructure in place currently.

15.5 Summary of Key Possible Impacts

15.5.1 Utilities Infrastructure: Direct & Indirect

Construction Phase Impacts (Direct & Indirect)

There are no potential direct or indirect impacts on wastewater during the construction phase as chemical toilet systems will be provided within the construction compound, thus not requiring sewer connection. Mobile telecoms shall be also utilised.

There are potential slight, direct impacts in the absence of mitigation measures on power lines during construction on site. There is a 220 kV ESB line running across the site along the western flank of the landfill. Construction activities will take place near the power lines and in the absence of appropriate controls, could directly damage a power line, potentially creating a temporary power cut to the site and the local community.

There will be a direct, slight impact on power supply to the landfill administration buildings and potentially within the wider locality for a short period of time resulting from the relocation of the existing 20 kV ESB lines that run along the eastern boundary of the site, to facilitate berm construction directly to the east of the IBA facility and during connection of the two proposed ESB sub-stations. The key energy resource on site during construction will be diesel and the use of electricity will only increase marginally.

Similarly, unmitigated excavation activity near the Bord Gais pipeline onsite has the potential to interrupt gas transmission through the pipeline.

Operational Phase Impacts (Direct & Indirect)

Direct impacts on utilities resulting from the operational phase of the proposed development will be slight. Power supply will be provided through the dedicated ESB sub-stations onsite.

Electricity consumption associated with the proposed development activities will increase compared to the current consumption. Based on other similar composting plants, it is estimated that the electricity usage will be approximately 1,000 MWh. There will also be an increased demand for electricity for the management of leachate from the proposed development. This is estimated at 450 MWh based on the current electricity usage at the site.

---
[1] IBA Incinerator Bottom Ash

The total electricity consumption will be slightly greater than the average large business requirement and approximately half of an industrial facility's annual requirement. The impact on non-renewable resources will be slight.

An indirect impact is envisaged at wastewater treatment plants in the wider region, resulting from the increased volumes of leachate produced onsite and tankered offsite.

However, with onsite pre-treatment the contaminant loading will be reduced, thus increasing the range of potential facilities that may accept this leachate and reducing the 'loading' at facilities where it is currently accepted and may be accepted in the future.

15.5.2 Buildings and Other Structures: Direct & Indirect

Construction Phase Impacts (Direct and/or Indirect)

There will be no direct or indirect impacts on buildings and other structures that are not owned by the applicant, nor will there be any direct or indirect impacts on ownership and access to lands during the construction phase of the proposed development as the applicant has full ownership of the site area.

Operational Phase Impacts (Direct and/or Indirect)

For the same reason as outlined above, there will be no direct or indirect impacts on buildings and other structures not owned by the applicant or to ownership and access to lands during the operational phase of the proposed development.

However, there is a perception that values of properties owned by others will be depressed by the proximity to a landfill.

The view expressed in the ABP Inspector's Report (planning permission reference 01/5006, An Bord Pleanála reference PL17.125891) with regard to the potential for property devaluation at Knockharley was that it was:

"likely that with strict environmental controls in place and the visual integration of the site within the surrounding landscape that perceived disamenities and corresponding property devaluation would be of a short-term nature only".

This is reiterated in the ABP Inspectors Report for the 2006 planning application (planning permission reference NA/ 60336, An Bord Pleanála Reference PL 17.220331) where the inspector repeats the previous reports conclusion that:

"*perceived disamenities and corresponding property devaluation would be of a short-term nature only*" and that "*In the context of the permitted landfill and the location of the proposed extension, it is considered that the inclusion of the triangular shaped area to the north west will have no significant impact on the value of the properties owned by Faulkner & Doonan to the east of the site.*"

It was accepted in the An Bord Pleanála report for the original planning application that tonnage-based community levy would have a positive effect on property values (planning report July 2002, An Bord Pleanála reference PL17.125891).

There is no evidence that property prices in this part of County Meath are underperforming compared with other similar parts of the country.

The proposed development is located within the existing landfill site boundary, which is predominantly set back from the local road network. There will be no additional land loss by the proposed development. As the proposed development is located on an existing landfill site, impacts on property values are not predicted.

15.5.3 Non-renewable Resources: Direct & Indirect

Construction Phase Impacts (Direct and/or Indirect)

The construction of the proposed development will directly utilise non-renewable resources in the form of concrete, aggregates and other construction materials. However, resources will be minimised as far as possible and used efficiently onsite. As far as possible, sustainable resources will also be sourced from local sources. The proposed screening berms will be constructed from site won material.

The structural elements of the proposed development can be considered moderate sized development and therefore the use of virgin resources will not be significant. Water as a non-renewable resource will be used during the construction phase but the impact on supply from the construction phase will be negligible.

As identified, excavated soils will be utilised onsite in capping, temporary cover and particularly berm construction, thus maximising resource use.

Diesel fuel consumption during the construction phase is estimated at 212,000 litres. Diesel usage during construction, in the context of regional or national diesel consumption, will be negligible (0.009% of national diesel use for road transport[2]).

Operational Phase Impacts (Direct and/or Indirect)

The rationale in relation to the development of the IBA cells is outlined in Chapter 2 – Description of the Development in Volume 2 of the EIAR, which identifies the scope for potential future winning of the IBA material placed within the cells. In the event of markets for the re-use of IBA material developing in the future, this would constitute a sustainable use of resources and minimise the use of virgin materials in projects to which this re-use may be applied e.g. road construction projects. This would realise an indirect, positive impact on non-renewable resources.

Diesel consumption per year assuming the average plant consumes on average 50 l/day average 275 days will be 151,250 l annually. In the context of regional or national diesel consumption, the impact is negligible (0.006% of national diesel use for road transport).

15.5.4 Renewable Resources: Direct & Indirect

Construction Phase Impacts (Direct and/or Indirect)

There will be a short term direct loss of renewable resources on site from the proposed felling of 12.5 ha of commercial forestry in order to facilitate construction of the screening berms and some other infrastructure on site. The felling will be carried out in phases over a 5 year period. The berms will be replanted in commercial forestry, and where it is not possible to replant due to infrastructure development, compensatory planting is proposed. The areas of replanting and compensatory planting are shown on Drawing No. LW14-821-01-P0050-003 Existing Forestation, Proposed Felling and Compensatory Planting in Volume 4 of this EIAR. As the forestry is commercial, the felling and replanting cycle would take place regardless of the proposed development.

Operational Phase Impacts (Direct and/or Indirect)

The proposed development seeks to increase the volume of waste for landfilling, but a significant portion of waste to be placed within the currently permitted cells will not display a high landfill gas generation potential. There will be no landfill gas generation potential associated with IBA material, given its nature.

However, it is expected that landfill gas generation will increase slightly in the short term, resulting in its capture within the existing landfill gas collection network, directly and positively resulting in increased generation of renewable electricity at the Knockharley Landfill site.

[2] CSO 2016 – 2,385 ktoe diesel used in road transport

15.6 Mitigation Measures

15.6.1 Construction Phase Mitigation Measures

Given that the impacts arising from the relocation of the power lines on site during the construction phase will be temporary and slight, no specific mitigation measures are proposed, other than those typically undertaken by ESB Networks in such an event, which will include prior notification of impacts to end users, as well as all health and safety precautions.

The contractor will be required to take measures in accordance with the ESB Code of Practice on Avoiding Danger from Overhead Electricity Lines.

Mitigation measures to be applied to prevent potential for impact on the Bord Gais pipeline centre on appropriate method statements by Contractors and clear delineation of the route on site.

Insofar as possible, non-renewable resources associated with construction will be sourced locally in order to minimise transportation distances and impacts on climate change.

It is not expected that there will be an interruption to public utilities. The proposed re-routing of the 20 kv overhead line will be undertaken in consultation with the relevant utility infrastructure supplier and will comply with their requirements and all relevant codes of practice.

No mitigation measures are required in relation to buildings, other structures, ownership and access.

The total area of commercial forestry replanting and compensation planting proposed is 41 ha. The existing area is 37.7 ha. The compensatory planting will mitigate the loss of commercial forestry in areas of the site which will not be suitable for replanting.

15.6.2 Operational Phase Mitigation Measures

Following the completion of the construction phase and associated mitigation measures, there will be no further mitigation measures required with respect to the operational phase.

15.7 Residual Impacts after Mitigation

There will be no residual impacts on the infrastructural material assets of the study area.

While non-renewable resources, fossil fuels and water are required onsite during the construction and operational phases and will have a negligible residual depletion impact, it is not considered that there will be any further residual impacts associated with the infrastructural material assets of the location assessed in this section.

15.8 Monitoring

During the construction phase, all utility services will be marked and monitored to ensure there is no disturbance or disruption to the services.

No monitoring is required for the material assets assessed in this section during the operational phase.

15.9 Conclusion & Summary

The proposed development is located on an existing landfill site, therefore impacts on property values are not predicted. Perceived disamenities and corresponding property devaluation, if any, would be of a short-term nature only.

A number of utility services are identified onsite. The contractor will be required to take measures in accordance with the ESB Code of Practice on Avoiding Danger from Overhead Electricity Lines.

Where electrical utilities are required to be connected with, and re-routed, this will be undertaken in consultation with the relevant utility infrastructure supplier and will comply with their requirements.

The applicant has full ownership of the site area and access road in which the proposed development is located. Therefore, there will be no impacts on buildings and structures outside the ownership boundary or on ownership and access to lands from this proposed development.

The use of non-renewable resources as part the proposed development will be minimised as far as possible through efficient use of resources and the use of sustainable resources, where possible. In fact, the proposed development can benefit from the use of non-renewable resources through maximising the re-use of excavated material, particularly in berm construction, as well as in the potential future use of IBA material accepted at the facility, in off-site application, should a market for these applications develop.

15.10 References

EPA, Guidelines on Information to be Contained in Environmental Impact Assessment Reports (2018), EC, Guidance Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (2018).

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

KNOCKHARLEY LANDFILL LTD.

ENVIRONMENTAL IMPACT ASSESEMNT REPORT (EIAR) FOR THE PROPOSED DEVELOPMENT AT KNOCKHARLEY LANDFILL

VOLUME 2 – MAIN EIAR

CHAPTER 16 – SCHEDULE OF ENVIRONMENTAL COMMITMENTS

NOVEMBER 2018

Knockharley Landfill Ltd.

Kentstown, Navan,Co.Meath

FEHILY TIMONEY & COMPANY

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1 SCHEDULE OF ENVIRONMENTAL COMITTMENTS

1.1 Introduction

This document summarises the mitigation measures (environmental commitments) in the Environmental Impact Assessment Report for the proposed development.

Population & Health

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Population & Health	
N/A	6.6.1	Population No mitigation measures are proposed in relation to population, given the lack of significant direct construction and operational phase effects resulting from the proposed development. Appropriate mitigation measures for potential significant indirect effects on population and settlements associated with traffic, noise and air emissions are identified in full in their respective chapters of this EIAR, and are summarised hereunder for ease of reading.	N/A
N/A	6.6.2	Land Use No mitigation measures are proposed in relation to land use, given the lack of significant direct and indirect effects on land-use beyond the proposed development boundary.	N/A
N/A	6.6.3	Socio-Economics, Employment and Economic Activity No mitigation measures are proposed in relation to local employment and economic activity as the proposed development is considered as having positive, direct and indirect effects during the construction and operational phases.	N/A
N/A	6.6.5	Human Health No further mitigation measures are required beyond those set out in Chapters 7 Air and Climate, 9 Noise and 12 Hydrology and Surface Water Quality in Volume 2 of this EIAR.	N/A
N/A	6.8	Monitoring associated with potential significant indirect effects from noise, air emissions and surface water quality is proposed in respective sections of this EIAR.	N/A

Air Quality & Climate

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Air Quality & Climate			
1	7.5.1.1	All vehicles will comply with the onsite speed limit. The speed limit will be reduced appropriately on internal haul routes in extremely dusty environments	Construction
2	7.5.1.1	Stockpiles will be sprayed during periods of dry weather in order to suppress dust migration from the site	Construction
3	7.5.1.1	The earthen berms will be replanted in forestry immediately following construction in order to establish vegetated cover to prevent windblown erosion and associated dust emissions.	Construction
4	7.5.1.1	A water bowser will be available to spray work areas, especially during periods of infill activities coinciding with dry periods of weather, in order to suppress dust migration from the site.	Construction
5	7.5.1.1	The earthworks foreman will inspect internal haul roads as part of his daily supervision of the site.	Construction
6	7.5.1.1	The developer in association with the contractor will develop and implement a dust control plan. This plan will address aspects such as excavations, filling activities & temporary stockpiling. The plan will be prepared prior to any construction activities and will be established and maintained through the construction period.	Construction
7	7.5.1.1	Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust shall be regularly watered, as appropriate, during dry and/or windy conditions.	Construction
8	7.5.1.1	Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary. Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting, or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.	Construction
9	7.5.1.1	Vehicles exiting the site will use the wheel wash at the administration area to mitigate track out onto the public road.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
10	7.5.1.1	All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions	Construction
11	7.5.1.2	No mitigation measures are proposed in relation to vehicle emissions, as the predicted vehicle emissions associated with the proposed development are within the relevant air quality guidelines.	Construction
12	7.5.2.1	The existing access road from the N2 to the administration area is surface sealed as are other internal roadways where required. The IBA facility haul roads will be surfaced to mitigate dust.	Operation
13	7.5.2.1	Speed limits are in place on site to mitigate dust nuisance.	Operation
14	7.5.2.1	The access roads and internal site roads will be sprayed during periods of dry weather to suppress dust migration from the site.	Operation
15	7.5.2.1	All HGVs leaving the site are and will be required to pass through the wheel wash.	Operation
16	7.5.2.1	A water bowser and road sweeper will be used daily to control dust nuisance.	Operation
17	7.5.2.1	All IBA handled at the facility will be handled at an appropriate moisture content to prevent dust emissions	Operation
18	7.5.2.1	Waste including IBA will be hauled in covered trucks to prevent windblown dust.	Operation
19	7.5.2.1	All waste disposed of in the landfill is covered daily.	Operation
20	7.5.2.1	A monitoring programme at the site will continue to measure dust and PM_{10} in accordance with the IE licence for the facility	Operation
21	7.5.2.1	A biofilter will remove dust emissions generated from the biological waste treatment building and therefore preventing any release of dust to the atmosphere.	Operation
22	7.5.2.1	All waste handling at the biological waste treatment facility including handling of finished product will be carried out indoors under negative air pressure and the building will be fit with fast action roller shutter doors.	Operation
23	7.5.2.2	No mitigation measures are proposed in relation to landfill gas plant onsite, as the landfill gas plant is within the relevant air quality guidelines.	Operation
N/A	7.5.2.3	No mitigation measures are proposed in relation to the vehicle emissions onsite, as the predicted emissions are within the relevant are quality guidelines.	N/A

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
24	7.5.2.4	Scrutiny and screening of waste intake to prevent particularly odorous material being accepted at the landfill for disposal. Regular patrols of the site will be undertaken to identify any odour problems and any complaints received will be promptly investigated.	Operation
25	7.5.2.4	The immediate compaction of the waste within a small controlled area will minimise the available area for odours to escape from the daily tipping area. Additionally, operating procedures at the facility will require immediate landfilling of waste once tipped or ejected from trailers.	Operation
26	7.5.2.4	The primary odour control measure is the use of daily cover in accordance with the provisions of the licence. Daily cover comprises a minimum of 150 mm of soil-like material covered with a 100 mm deep layer of woodchip, the microbial population on the latter being a well-documented medium used to treat odorous compounds in bio-filters. Before being covered the waste is compacted.	Operation
27	7.5.2.4	Leachate is removed regularly by a licensed waste contractor thus minimising the potential for odours which can form as a result of leachate stagnating and becoming anaerobic. The leachate lagoon is covered and exhaust fumes from the vacuum tankers are vented through carbon filters. Any additional leachate tanks and lagoons will be property enclosed and maintained at all times.	Operation
28	7.5.2.4	A mobile fog spray system is present on site and is used as required.	Operation
29	7.5.2.4	Long term odour control will be achieved via the active landfill gas extraction system, which collects landfill gas under negative pressure, reducing the potential for odours to be released in an uncontrolled manner. This is a requirement of the existing licence and any future licence. The design of the landfill gas extraction system is subject to EPA approval. The design of the system will mitigate uncontrolled landfill gas.	Operation
30	7.5.2.4	Daily checks of the landfill gas field and combustion plant shall be undertaken to ensure optimum operation. Monitoring of internal and external landfill gas wells is carried out in accordance with the licence.	Operation
31	7.5.2.4	The use of odour assessments and VOC surface emission surveys in accordance with the licence and the EPA guidance documents to determine any issues that may have a potential impact and implementation of mitigation measures.	Operation
32	7.5.2.4	The existing gas extraction system will comprise of horizontal sacrificial gas extraction pipework in the waste disposal cells (to facilitate extraction, under negative pressure,	Design

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		of landfill gas, as may be required in cells designated for the placement of non-stabilised waste)	
33	7.5.2.4	The existing gas extraction system will comprise a network of vertical landfill gas extraction wells (constructed progressively with the development of the landfill, at 50 metre lateral and longitudinal centres. Additionally, vertical wells shall be drilled into the waste as required and determined by surveys of fugitive emissions, in order to minimise or eliminate landfill gas migration. The additional drilled wells shall be installed between the constructed main gas extraction wells, so as to reduce the distances between the individual wells and to increase the capture rate of landfill gas. Where appropriate, sacrificial vertical "pin" or "spike" wells will also be installed. It shall be ensured that the vertical gas wells are sealed at surface with bentonite as required in order to minimise the ingress of oxygen and the potential for migration of landfill gas.)	Design
34	7.5.2.4	All vertical and horizontal landfill gas extraction wells shall be connected to the gas collection pipe network which shall consist of a 355 mm ring main around the landfill footprint and 180 mm branches laid across the landfill surface. Each individual landfill gas well, as well as each individual branch shall, prior the point of connection into the next higher collection level (i.e. well-branch connections and branch-ring main connections) be equipped with shut-off valves, in order to enable flow restriction or isolation of individual wells or branches.	Design
35	7.5.2.4	To continuously remove condensate from the landfill gas extraction network and therefore avoid uncontrolled flow restriction and pulsating, the ring main shall be connected to the gas flaring and utilisation plant via condensate knockout pots. The condensate accumulating in these pots shall be removed by pneumatic/electric pumps and piped back into the leachate riser pipes, from where it can drain to the cell base and be removed with the leachate.	Design
36	7.5.2.4	The landfill gas collected in the landfill gas extraction and collection network shall, after passing through the condensate knockout pots, be flared off in an enclosed flare or utilised in landfill gas combustion engines with electricity generation, as appropriate. Contingency arrangements are currently in place in accordance with the licence to avoid gas venting in the case of plant failures.	Design
37	7.5.2.4	Operational procedure for the operation of landfill gas flares addresses the operational requirements to optimise the combustion rates and maintain compliance with emission limits and monitoring requirements. Any significant downtime of landfill gas flares or other utilisation equipment shall be logged by Bioverda Power Systems (landfill gas plant operator). Should significant downtime of landfill gas flares or other utilisation	Design

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		equipment occur and cause potential for environmental pollution, the Environmental Protection Agency shall be notified.	
N/A	7.5.2.5	No specific mitigation measures are proposed in relation to climate.	N/A
38	7.6.1	Monitoring of landfill gas, dust, odour and PM_{10} monitoring will continue in compliance with the IE licence for the site.	Operation
39	7.6.1	Landfill gas perimeter monitoring wells will be installed 12 months prior to waste acceptance at 50 m centres outside the landfill body. In-waste wells will be installed during and following landfilling.	Operation
40	7.6.1	Stack emissions monitoring will continue in compliance with the licence.	Operation
41	7.6.1	Monitoring of bioaerosols will be included in the new monitoring regime. New monitoring points relevant to the proposed development will be included in future monitoring.	Operation
42	7.6.1	A continuous monitoring system under SCADA control will monitor the operation of the air control system at the biological waste treatment facility. Any deviations in key design parameters will be detected and appropriate preventative maintenance will be undertaken to minimise air emissions.	Operation

Roads, Traffic & Transport

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Roads, Traffic & Transportation			
43	8.6	No mitigation measures are required to facilitate the proposed development, save for a commitment to adhere to the existing HGV routing arrangements.	Construction & Operation
44	8.6	The traffic management plan, included with the outline CEMP in Appendix 2.0 in Volume 3 will be followed during the construction phase.	Construction

Noise & Vibration

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Noise & Vibration			
45	9.7.1	The noise impact for construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise.	Construction
46	9.7.1	The construction works on-site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out in Appendix 2.0 outline Construction Environmental Management Plan (CEMP) in Volume 3 of this EIAR.	
47	9.7.1	A site representative responsible for matters relating to noise should be appointed	
48	9.7.1	Noise monitoring at noise sensitive locations should be performed during critical periods	
49	9.7.1	The hours of construction activity will be limited to avoid unsociable hours. Construction operations shall be restricted to between 07:30 hours and 18:30 hours Monday to Saturday in accordance with the IE licence, unless specifically agreed otherwise.	Construction & Operation
50	9.7.1	Avoid unnecessary revving of engines and switch off equipment when not required.	Construction & Operation
51	9.7.1	Keep internal haul routes well maintained and avoid steep gradients.	Construction & Operation
52	9.7.1	Select equipment conforming to international standards on noise and vibration.	Construction & Operation
53	9.7.1	Select equipment with quiet and low vibration emissions, and ensure equipment is regularly maintained ensuring it operates in an efficient manner. If possible, all mechanical plant will be fitted with effective exhaust silencers.	Construction & Operation
54	9.7.1	Compressors will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.	Construction & Operation
55	9.7.1	Locate equipment as far away as noise sensitive receivers as possible within constraints of the site.	Construction & Operation

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
56	9.7.2	Where reasonably practicable planning of Berm A and B construction phase to take account of potential short-term noise impacts, including starting closest to receptor and building away to mitigate potential ongoing berm construction noise impact.	Construction
57	9.7.2	Where reasonably practicable orientate plant to minimise the noise impact on nearby receptors where practicable	Operation
58	9.7.2	Where reasonably practicable erect temporary noise barriers where practicable to provide acoustic screening	Operation
59	9.7.2	Where reasonably practicable ensure that noisy plant and equipment are not used for long periods of time and at inappropriate times	Operation
60	9.7.2	Where reasonably practicable works will be phased and on-time reduced to lower the noise impact.	Operation
61	9.7.2	Carrying out regular monitoring of noise levels as per requirements of the licence. Carry out additional monitoring during critical periods	Operation
62	9.7.2	Investigate and record noise complaints and take action to mitigate where levels are above the licence limit as is the case as part of the current operations at Knockharley landfill.	Operation
63	9.7.2	The programme for construction and filling of cells was developed to minimise noise impacts were practicable. Cells 27, 28 and 29 will be filled in a manner that minimises the noise impact by starting closest to receptors and moving away so that the filled cells will also be used as berms to minimise the noise impact on nearby receptors.	Construction & Operation
64	9.9	Monitoring of noise levels on site will be a requirement of the IE licence for the site. These limits will be applied from the commencement of waste acceptance during the operational phase of the development.	Operation
65	9.9	Noise monitoring will be undertaken during in accordance with the Site's IED licence conditions.	Construction & Operation

Biodiversity

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Biodiversity	
66	10.6.1.1	Treelines and hedgerows will be retained where possible.	Construction
67	10.6.1.1	Where retention is not possible vegetation clearance and tree felling will be carried out outside of the bird breeding season (1st March – 31st August).	Construction
68	10.6.1.1	Tree-felling will not be undertaken in May, June, July and early August, in order to ensure that breeding populations of bats are protected. Therefore, it is recommended that tree felling of mature trees in these areas will be conducted during the period of September – October/early.	Construction
69	10.6.1.1	The following measures should be undertaken to protect bats during tree felling: • The tree should be de-limbed (i.e. all branches removed first) prior to cutting the truck. • Day time temperatures of greater than 7^{0}C are favoured for felling to ensure that bats are active and can exit any potential trees being felled. • The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist. • A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape.	Construction
70	10.6.1.1	Immediately prior to felling, the trees will be examined for the presence or absence of bats, and/or other bat activity. This survey will be carried out by a suitably qualified bat specialist and will include a visual inspection of the tree during daylight hours followed by a night time detector survey. Where an examination of a tree has shown that bats have not emerged or returned to a tree, it is safe to proceed with the felling of the tree the following day.	Construction
71	10.6.1.1	In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active.	Construction
72	10.6.1.1	A pre-construction mammal survey will be undertaken at an appropriate time of the year prior to construction and felling commencing. Should any new Badger setts or	Pre-Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Otter holts be discovered on areas proposed for development during construction works, the NPWS will be informed and Badger sett/ Otter breeding or resting site removal will take place under the advice and licensing/derogation regulations of the NPWS.	
73	10.6.1.1	Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species, roosting birds or active nocturnal bird species.	Construction
74	10.6.1.1	During stream diversion and culverting, vegetation clearance will be kept to a minimum and in-stream sedimentation traps will be positioned prior to construction, and maintained for the duration. All diverted water /run-off will be sent to the onsite surface water attenuation lagoon to minimise sediment entering the stream, if required.	Construction
75	10.6.1.1	Any in-stream works will be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI) and subject to Section 50 approval from the OPW.	Pre-Construction
76	10.6.1.1	In consideration of fisheries resources downstream, works in watercourses will be carried out during the period July-September unless prior agreement has been reached with IFI.	Construction
78	10.6.1.1	All equipment and all footwear/waders that will be placed within watercourses shall be steam-cleaned prior to arrival on site to prevent the spread of invasive species or disease entering the water and after use to prevent the spread to other catchments.	Construction
79	10.6.1.1	Best practice biosecurity measures are required to prevent the spread of the crayfish plague in Ireland along with other invasive species. The crayfish plague disease can be carried on wet equipment so ALL equipment to be used within or adjected to watercourses (clothing, fishing gear etc.) that has been in freshwater must be treated with a disinfectant and then completely dried before moving to another area.	Construction
80	10.6.1.1	A Check – Dry – Clean approach shall be adopted for all site personnel working within or directly adjacent to watercourses. • Check – Check you are not unknowingly carrying any water, living organism (including plant fragments) on your equipment or clothing – Pay particular attention to those areas that retain water, remain damp or are hard to inspect	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		• Clean – Clean equipment, footwear and clothes thoroughly after water-based activity – Pieces of plants, seeds and organisms that get caught up in, or attach themselves to your equipment must be thoroughly removed from all hidden corners, inside clothing and other surfaces – Where available, use pressure washers and hoses to wash equipment and clothing – Ensure washings and any water that has collected in equipment are left in the cleaning area. Alternatively, empty them onto land away from other watercourses and not into another watercourse, drain or ditch • Dry – All equipment and clothing should be dried thoroughly – Where possible, air dry for 48 hours in order to kill any aquatic organisms – In slightly moist conditions, some species can live for many days. New research from the Environment Agency has shown that a killer shrimp can survive in the moist fold of a wader for up to 15 days.	
81	10.6.1.2	The new attenuation pond will be put in place at the commencement of construction at the site.	Construction
82	10.6.1.2	Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have a functioning drainage system in place.	Construction
83	10.6.1.2	Erosion control measures and temporary stilling ponds, including the attenuation ponds will be regularly maintained during the construction phase.	Construction
84	10.6.1.2	The 4-stage treatment train (swale – holding pond-attenuation pond– wetland/diffuse outflow) will retain and treat the discharges from the new surfaces as a result of the development and reduce any risk of flooding downstream.	Construction
85	10.6.1.2	Where required, portaloos and/or containerised toilets will be used in combination with existing site welfare facilities and associated waste water management facilities to provide toilet facilities for site personnel during construction.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Sanitary waste produced by portaloos/containerised toilets will be removed from site via a licenced waste disposal contractor.	
86	10.6.1.2	A modification will be installed across the stream in the form of a dam and culvert arrangement in order to channel extreme flows overbank into a wooded area. This will compensate for any loss in the 1 in 1000-year floodplain.	Design & Construction
87	10.6.1.2	Construction will not take place during extreme weather conditions.	Construction
88	10.6.1.2	The soil stability will be assessed at site specific locations particularly at stockpile, screening berms and stream bank locations where earthworks are proposed. Best practices will be employed in the prevention of silt laden run-off from entering watercourses.	Construction
89	10.6.1.2	Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations: a. All stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary. b. All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond. c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.	Construction
90	10.6.1.2	Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.	Construction
91	10.6.1.2	The developer will ensure that erosion control, namely silt-traps, silt fencing, stilling ponds and swales are regularly maintained during the construction phase.	Construction
92	10.6.1.2	Standing water in excavations will be pumped into the site drainage system (including attenuation ponds), after which permanent insitu dewatering will be implemented during operations.	Construction
93	10.6.1.2	Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
94	10.6.1.2	Swales will be shallow to minimize the disturbance to sub-soils. Temporary silt traps will also be provided at regular intervals in the swales.	Construction
95	10.6.1.2	Cross-drainage pipes of 450mm minimum diameter will be provided to prevent a risk of clogging for conveying flows from agricultural drains and forestry drains across the access roads.	Construction
96	10.6.1.2	Additional wheel washing facilities will be provided at the exit of the IBA facility. This will supplement the existing wheel wash which will be retained at the entrance to the site. The silt traps will be cleaned on a regular basis.	Operational
97	10.6.1.2	Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines and Forest Harvesting and Environmental Guidelines, to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff. Trees will be felled away from watercourses where possible. Branches, logs or debris will not be allowed to accumulate in watercourses and will be removed as soon as possible.	Construction
98	10.6.1.2	The rate of absorption of a felled site is reduced, and therefore rate of run-off is expected to be slightly higher than that of a forested site, however it is proposed to develop berms on the deforested areas as soon as weather conditions allow following felling, followed by replanting. Thus, no significant increase in the rate of run-off is anticipated as a result of felling or risk of downstream flooding as set out in the flood risk assessment presented in Appendix 12.5, Volume 3.	Construction
99	10.6.1.2	There is an existing wheel wash at the entrance to the site which will be used during the construction period.	Construction
100	10.6.1.2	A designated concrete wash-down area will be constructed at the temporary compound. Every concrete truck delivering concrete to the site will use this facility prior to leaving the site. A settlement pond will be provided to receive all run-off from the concrete wash down area.	Construction
101	10.6.1.2	The outfall from the wetland will have vertical pipe drop energy dissipation structure within the wetland outlet chamber prior to discharge into the adjacent launching apron protection works. This design approach will mitigate the risk of suspended solids developing within the Knockharley stream downstream of the outfall.	Design & Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
102	10.6.1.2	Rock armour will be used to provide bank protection works upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs.	Design & Construction
103	10.6.1.2	All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s).	Construction & Operational
104	10.6.1.2	Emergency Silt Control and Spillage Response Procedures are contained within under Site Drainage Management Plan of the CEMP.	Construction
105	10.6.1.2	Refuelling of plant during construction will only be carried out at the existing designated refuelling station locations. Each station is fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team is in place on site.	Construction
106	10.6.1.2	Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site.	Construction & Operation
107	10.6.1.2	Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.	Construction & Operation
108	10.6.1.2	Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity	Construction & Operation
709	10.6.1.2	Appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.	Construction & Operation
110	10.6.1.2	Adequate security will be provided to prevent spillage as a result of vandalism.	Construction & Operation
111	10.6.1.2	A regular review of weather forecasts of heavy rainfall is required and a contingency plan will be prepared for before and after such events.	Construction
112	10.6.1.2	A suitably qualified person will be appointed by the developer to ensure the effective implementation of the CEMP onsite. They will also ensure: a. regular monitoring of the drainage system and maintenance as required.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		b. Record keeping of the daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase. c. Water quality monitoring will continue to be carried out in accordance with the licence. (There will be one new monitoring point, at the discharge point from the new wetland.)	
113	10.6.1.2	If excessive suspended solids are noted, construction work will be stopped and remediation measures will be put in place immediately.	Construction
114	10.6.1.2	Discharges from paved roads paved areas will be surrounded by filter drains with petrol interceptors installed at respective outlets upstream of the storm water management attenuation ponds or other.	All
115	10.6.2	Replacement tree planting and new tree planting will be comprised of native deciduous tree species (see Landscape Masterplan LW14-821-01-P-0050-012 for more information).	Construction
116	10.6.2	Excessive additional lighting around the site will be avoided. Lighting will be kept to minimum safe levels to reduce disturbance to nocturnal mammals and birds. Directional lighting will be used to prevent light disturbance in the surrounding area.	All
117	10.6.2	Regular visual inspections and monitoring of the surface water management system will be required in compliance with the IED licence	Operational
118	10.6.2	Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls.	Operational
119	10.6.2	In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill.	Operational
120	10.6.2	Leachate haulage contractors will be required to have spill kits and training.	Operational
121	10.6.2	There will be regular inspections and maintenance of leachate tankers to mitigate leaks.	Operational
122	10.6.2	In the event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented.	Operational

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
123	10.6.2	There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland	Operational
124	10.6.2	Routine surface water sampling is and will continue to be carried out in accordance with the license which includes the submission of interpretive reports to the EPA for approval. Any incidents shall be notified to the EPA in accordance with the license.	Operational
125	10.6.3	There will be a period of restoration and aftercare following cessation of waste acceptance activities at the facility. Decommissioning of the development will be subject to Agency approval under prevailing waste Licence condition. It is proposed to leave the surface water management system in situ and this will mitigate any potential impacts during decommissioning activities and in addition, temporary mitigation will be put in place to protect watercourses in areas outside of the in-situ water management system. These measures will be similar to those proposed during the construction stage such as silt-traps, silt fencing and stilling ponds.	Decommissioning & Aftercare

Land, Soils & Geology

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Land, Soils & Geology	
126	11.5.1	The proposed waste infrastructure will be designed in accordance with best practice and subject to EPA approval prior to construction and subject to CQA and approval of such by EPA prior to operation.	Design
127	11.5.1	The works will be designed and checked by a geotechnical and civil engineer, suitably qualified and experienced in cell design, construction and operation.	Design & Construction
128	11.5.1	Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to evaluate risk levels for the construction, operation and maintenance of the works. Identified risks will be minimised by the application of principles of avoidance, prevention and protection. Information on residual risks will be recorded and relayed to appropriate parties	Design & Construction
129	11.5.1	A method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.	Construction
130	11.5.1	Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.	Construction
131	11.5.1	The surface water management infrastructure will be constructed in the northern catchment prior to any other construction works to mitigation potential impacts on hydrogeology.	Construction
132	11.5.1	The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.	Construction
133	11.5.2.1	The proposed Construction Environmental Management Plan (CEMP) to be adopted during the construction phase is provided in Appendix 2.0 of Volume 3 of this EIAR. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development. The CEMP describes how the contractor for the main construction works will implement a site Environmental Management System (EMS) on this project to meet	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		the specified contractual, regulatory and statutory requirements and environmental impact statement mitigation measures.	
134	11.5.2.1	All site personnel will be required to be familiar with the CEMP requirements as related to their role on site.	Construction
135	11.5.2.1	The CEMP is a controlled document and will be reviewed and revised as necessary.	Construction
136	11.5.2.1	A copy of the CEMP will be located at the site office.	Construction
137	11.5.2.1	All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the CEMP and its contents.	Construction
138	11.5.2.2	The development will be constructed in a phased manner to reduce the potential impacts of the development on the soils and geology; this reduces the amount of clearing and soil excavation required at any one time.	Construction
139	11.5.2.2	One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of soil excavation	Design
140	11.5.2.2	Excavated overburden soils will be reused as far as possible. This will include: • Use of suitable impermeable material for the engineered clay barrier. • Constructing screening berms to mitigate nuisance and visual impacts on adjacent sensitive receptors. • Facilitate final capping of the landfill cells and IBA cells	Construction
114	11.5.2.2	Some temporary stockpiles (not exceeding 2 m in height) of material may be necessary to facilitate capping works, however no permanent stockpiles of material will remain after construction and it is not proposed to remove waste soil or rock from site.	Construction & Operation
142	11.5.2.2	Existing practices are already in place to protect the soil from erosion.	Operation
143	11.5.2.2	Drainage of surface water is incorporated into the site design. This will divert storm water runoff away from the working area. Storm water run-off is directed and will continue to be directed to the existing and proposed attenuation pond / holding pond and wetlands prior to discharge.	All

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
144	11.5.2.2	Weekly measurements will continue to monitor the quality of surface water discharge.	Construction & Operation
145	11.5.2.2	All excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events.	Construction
146	11.5.2.2 & 11.5.4	Refueling of machinery and plant will only occur at designated refueling areas. Refueling will be conducted from refueling trucks with drip trays and spill kits available. A designated refueling area will be located at the site compound.	All
147	11.5.2.3	The soil stability will be assessed at site-specific locations particularly at stockpile, screening berms and stream bank locations where earthworks are proposed. Best practices will be employed in the prevention of silt laden run-off from entering watercourses.	Construction
148	11.5.2.4	Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations: a. all stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary. b. all open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond. c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.	Construction
149	11.5.2.4	Screening berms will be constructed on a phased basis concurrent with overburden recovery from cell excavation works. Prior to berm installation, top soil will be stripped back, formation compacted, and soils as may become available placed and compacted in layers. Layers will be overfilled and once berms are at the final height is reached will have side slopes profiled receive and allow subsequent placement of topsoil, seeding and tress as required.	Construction
150	11.5.2.4	The proposed development will require the construction of an additional surface water attenuation pond / holding pond north of the IBA facility.	All
151	11.5.2.4	Storm drainage will be installed prior to bulk earth moves with silt fences and temporary settlement ponds placed around screening berms and pond banks until such time as a vegetation cover has become established.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
152	11.5.2.4	Prior to earthworks taking place temporary haul roads will also be installed.	Construction
153	11.5.2.5	Overburden will be removed from IBA cells and placed in screening berms.	Construction
154	11.5.2.5	Clay barrier material will be won from underlying boulder clays excavated to form IBA cells.	Construction
155	11.5.2.5	In the IBA cells, boulders within the excavated clay will be removed via screening and engineered clay will be placed in layers and compacted to 95% maximum dry density.	Construction
156	11.5.2.5	For the IBA cells, a ground water drainage system will be installed to accommodate prevailing site conditions upon which the engineered clay barrier will be installed and compacted to 95% maximum dry density.	Construction
157	11.5.2.6	Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.	Construction & Operation
158	11.5.2.6 & 11.5.4	Any diesel or fuel oils stored at the temporary site compounds will be bunded.	All
159	11.5.2.6 & 11.5.4	The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.	All
160	11.5.2.6 & 11.5.4	All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s).	All
161	11.5.2.6	Emergency Silt Control and Spillage Response Procedures are contained within the Draft CEMP.	Construction
162	11.5.2.7	The works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.	Design & Construction
163	11.5.2.7	Prior to construction the CEMP construction will be finalised, which will incorporate all measures set out in the Draft CEMP and other measures required on foot of conditions attached to any grant of permission.	Construction
164	11.5.2.7	A method statement for each element of the works will be finalised prior to any element of the work being carried out. A draft of the methods is provided in the Draft CEMP and will be reviewed and finalised prior to commencement of construction.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
165	11.5.2.7	The CEMP for construction will place emphasis on the regular checking of equipment, temporary stockpiles, as well as drainage structures and their attenuation ability by suitably qualified and experienced staff.	Construction
166	11.5.2.7	Excavation works will be monitored by suitably a qualified and experienced geotechnical personnel.	Construction
167	11.5.2.7	The programming of the works (by the Contractor) will be such that earthworks are not scheduled to be carried out during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.	Construction
168	11.5.2.8	All cells, whether in the permitted landfill development or proposed IBA Facility, will require a composite lining in accordance with the Landfill Directive for non-hazardous cells. This requires a 2 mm HDPE barrier overlying a 1.0m clay barrier k= $1*10^{-9}$ m/s or equivalent. This requirement is also conditioned in the current IED licence for the facility.	Design & Construction
169	11.5.2.8	Surface water lagoon and the holding pond will be constructed using a similar lining system as the cells comprising a 2 mm HDPE barrier overlying a 1.0m clay barrier k $1*10^{-9}$ m/s or equivalent, albeit that lining systems may have additional cover systems using soil, concrete or other to facilitate maintenance and or safety criteria as required during detailed design.	Design & Construction
170	11.5.2.8	All above ground tanks for leachates or other treatment related products will be bunded to contain a minimum storage volume in accordance with Agency guidance[1] to be not less than the greater of: • 110% capacity of the tank within the bunded area, or • 25% of the total volume of the substance stored within the bunded area.	Construction
171	11.5.2.8	All tanks will have covers to prevent rainfall ingress.	Design & Construction
172	11.5.2.8	Below ground tanks will be surrounded with a 1.0m clay barrier k $1*10^{-9}$ m/s or equivalent.	Design & Construction
173	11.5.2.8	Below ground lagoons (leachate, holding pond or attenuation pond) will be constructed using a composite lining system comprising a 2 mm HDPE barrier overlying a 1.0m clay	Design & Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		barrier k $1*10^{-9}$ m/s or equivalent. All below ground lagoons will have floating covers to prevent rainfall ingress.	
174	11.5.2.8	Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled.	Construction
175	11.5.2.8	There will be a designated refuelling area at the site compound.	Construction
176	11.5.2.8	Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005).	Construction
177	11.5.2.8	Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.	Construction
178	11.5.2.8	Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.	Construction
179	11.5.2.8	Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction compound and in each item of plant to deal with any accidental spillage.	Construction
180	11.5.3	In the event that groundwater is required to be drained below the cell liner, it will be pumped and directed to the existing attenuation ponds as is presently the case or to the proposed northern attenuation pond.	Operation
181	11.5.3	Leachate minimisation and leachate containment using the in-situ composite landfill liner system will continue to occur.	Operation
182	11.5.3	Groundwater monitoring will continue to be undertaken at the site in accordance with the waste licence.	Operation
183	11.5.3	Post closure, the groundwater monitoring programme, as set out in the licence, will continue to assess groundwater quality at the site.	Aftercare
184	11.5.3	The emergency response procedures in place under the licence also address possible spillages. Corrective Action Procedures on the site ensure that any non-compliance with the waste licence are investigated and corrected and that measures are put in place to remedy and prevent reoccurrence of the non-compliance.	Operation

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
185	11.5.3	To mitigate against possible contamination of the exposed bedrock / aquifer, refuelling of machinery and plant during operation of the facility will only occur offsite or in specially designated areas such as site compounds, using designated refuelling bowsers.	Operation
186	11.5.3	All temporary cuts / excavations will be carried out such that they are stable or adequately supported. Unstable temporary cuts / excavations will not be left unsupported. Temporary cuts and excavations will be protected against the ingress of water or erosion. Temporary works will be such that they do not adversely interfere with any existing drainage channels.	Operation
187	11.6	Mitigation measures will be monitored throughout the construction and operational phases.	
188	11.6	Mitigation will be provided to protect the water quality by preventing any silt laden run-off or contaminated storm runoff reaching the downstream watercourses.	
189	11.6	Mitigation systems will, where required, be in place before development works commence.	

Hydrology and Surface Water Quality

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Hydrology and Surface Water Quality			
190	12.7	A minimum buffer of 10 m from watercourses has been adopted for the proposed works.	Design
191	12.7	The drainage system for the proposed development has been designed to mitigate potential impacts on hydrology and surface water quality and is described in detail in Section 12.4 and the drainage layout is shown in Drawing Nos. LW14-821-01- P-0000-003 through 0011 in Volume 4 and in Appendix 12.2 Surface water Management Plan in Volume 3 of this EIAR.	Design
192	12.7.1	A Surface Water Management Plan has been included in Appendix 12-2 of Volume 3 of the EIAR.	Construction
193	12.7.1	A Construction Environmental Management plan (CEMP) has been included in Appendix 2-0 in Volume 3 of the EIAR.	Construction
194	12.7.1	During the stream diversion and culverting, in-stream sedimentation traps will be positioned prior to construction, and maintained for the duration.	Construction
195	12.7.1	All diverted water /run-off can be sent to the onsite surface water attenuation lagoon to minimise sediment entering the stream, if required.	Construction
196	12.7.1	Any in-stream works will be undertaken in consultation with the Planning Authority and Inland Fisheries Ireland (IFI) and subject to Section 50 approval from the OPW.	Construction
197	12.7.1	In consideration of fisheries resources downstream, works in watercourses will be carried out during the period July-September unless prior agreement has been reached with IFI.	Construction
198	12.7.1	As discussed, the new attenuation pond will be put in place at the commencement of construction at the site.	Construction
199	12.7.1	Site drainage, including silt traps and stilling ponds, will be put in place in parallel with or ahead of construction, such that excavation for new infrastructure will have a functioning drainage system in place.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
200	12.7.1	Erosion control measures and temporary stilling ponds, including the attenuation ponds will be regularly maintained during the construction phase.	Construction
201	12.7.1	The 4-stage treatment train (swale – holding pond-attenuation pond– wetland/diffuse outflow) will retain and treat the discharges from the new surfaces as a result of the development and reduce any risk of flooding downstream.	Construction
202	12.7.1	The conceptual site drainage (see section 12.4.3 and Figure 12-6) has been designed to complement existing overland flow.	Design
203	12.7.1	A modification will be installed across the stream in the form of a dam and culvert arrangement in order to channel extreme overbank flows into a wooded area. This will compensate for any loss in the 1 in 1000-year floodplain. This is described in more detail in Section 12.4.3.	Construction
204	12.7.1	The proposed compensation flood culvert is designed to provide compensatory storage for the flood plan storage lost through constructing the northern surface water management system and permitted cell development in a 1:1000-year flood plain.	Construction
205	12.7.1	Construction will not take during extreme weather conditions when channel water levels / flows will be high.	Construction
206	12.7.1	Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where access roads pass close to watercourses during construction. Silt fencing will be used to mitigate any contamination of streams with silt at the flowing locations: a. All stockpile material will be bunded adequately and/or surrounded by silt fences and protected from heavy rainfall to reduce silt run-off, where necessary. b. All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed attenuation pond. c. along the banks of any streams at the location of the proposed tree felling to provide additional protection to the watercourses in this area.	Construction
207	12.7.1	Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.	Construction
208	12.7.1	The developer will ensure that erosion control, namely silt-traps, silt fencing, stilling ponds and swales are regularly maintained during the construction phase.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
209	12.7.1	Standing water, which may arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. The excavations will be pumped into the site drainage system (including attenuation ponds), after which permanent *in situ* dewatering will be implemented during operations. As historically there is little evidence of high inflows, it is anticipated that pumped flows from excavations will be very low. Bio-degradable silt bags (or equivalent approved) will be used during dewatering of excavations.	Construction
210	12.7.1	The excavated subsoil material will be removed to form the screening berms.	Construction
211	12.7.1	Swales will be shallow to minimize the disturbance to sub-soils. Temporary silt traps will also be provided at regular intervals in the swales.	Construction
212	12.7.1	Cross-drainage pipes of 450mm minimum diameter will be provided to prevent a risk of clogging for conveying flows from agricultural drains and forestry drains across the access roads.	Construction
213	12.7.1	Additional wheel washing facilities will be provided at the exit of the IBA facility. This will supplement the existing wheel wash which will be retained at the entrance to the site. The silt traps will be cleaned on a regular basis.	Construction
214	12.7.1	Tree felling will be undertaken in accordance the felling licence and the specifications set out in the Forest Service Guidelines and Forest Harvesting and Environmental Guidelines, to ensure a tree clearance method that reduces the potential for sediment and nutrient runoff.	
215	12.7.1	Trees will be felled away from watercourses where possible. Branches, logs or debris will not be allowed to accumulate in watercourses and will be removed as soon as possible.	Construction
216	12.7.1	The rate of absorption of a felled site is reduced, and therefore rate of run-off is expected to be slightly higher than that of a forested site, however it is proposed to develop berms on the deforested areas as soon as weather conditions allow following felling, followed by replanting. Thus, no significant increase in the rate of run-off is anticipated as a result of felling or risk of downstream flooding as set out in the flood risk assessment presented in Appendix 12.5, Volume 3.	Construction
217	12.7.1	There is an existing wheel wash at the entrance to the site which will be used during the construction period.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
218	12.7.1	A designated concrete wash-down area will be constructed at the temporary compound. Every concrete truck delivering concrete to the site will use this facility prior to leaving the site. A settlement pond will be provided to receive all run-off from the concrete wash down area.	Construction
219	12.7.1	The outfall from the wetland will have vertical pipe drop energy dissipation structure within the wetland outlet chamber prior to discharge into the adjacent launching apron protection works. This design approach will mitigate the risk of suspended solids developing within the Knockharley stream downstream of the outfall.	Construction
220	12.7.1	Rock armour will be used to provide bank protection works upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs.	Construction
221	12.7.1	All personnel currently working on site are trained in pollution incident control response and this will be a requirement of the construction contract(s). Emergency Silt Control and Spillage Response Procedures are contained within under Site Drainage Management Plan of the Construction Environmental Management Plan (CEMP).	Construction
222	12.7.1	Refuelling of plant during construction will only be carried out at the existing designated refuelling station locations. Each station is fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team is in place on site.	Construction
223	12.7.1	Only emergency breakdown maintenance will be carried out on site and appropriate containment facilities will be provided to ensure that any spills from breakdown maintenance vehicles are contained and removed off site.	Construction
224	12.7.1	Drip trays and spill kits will be kept available on site, to ensure that any spills from the vehicle are contained and removed off site.	Construction
225	12.7.1	Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.	Construction
226	12.7.1	Appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.	Construction
227	12.7.1	Adequate security will be provided to prevent spillage as a result of vandalism.	Construction

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
228	12.7.1	A regular review of weather forecasts of heavy rainfall is required and a contingency plan will be prepared for before and after such events.	Construction
229	12.7.1	A suitably qualified person will be appointed by the developer to ensure the effective implementation of the CEMP onsite. They will also ensure: a. regular monitoring of the drainage system and maintenance as required. b. Record keeping of the daily visual examinations of watercourses which receive flows from the proposed development, during and for an agreed period after the construction phase. c. Water quality monitoring will continue to be carried out in accordance with the licence. (There will be one new monitoring point, at the discharge point from the new wetland.)	Construction
230	12.7.1	If excessive suspended solids are noted, construction work will be stopped and remediation measures will be put in place immediately.	Construction
231	12.7.1	Discharges from paved roads paved areas will be surrounded by filter drains with petrol interceptors installed at respective outlets upstream of the storm water management attenuation ponds or other.	Construction
232	12.7.2	The surface water management system will mitigate any potential impacts on hydrology and surface water quality during the operational phase.	Operation
233	12.7.2	Regular visual inspections and monitoring of the surface water drainage system will be required in compliance with the IED licence.	
234	12.7.2	The conceptual drainage has been designed to operate effectively during the operational period.	Design
235	12.7.2	Surface water run-off will discharge to the drainage swales during rain events. During the operation period the swales will have vegetated and will serve to further attenuate flows and reduce the amount of sediment discharging from the site.	Operation
236	12.7.2	The attenuation ponds will be permanent features and will continue to be effective in filtering the run-off from the site should any accidental release of silt combine with the surface water run-off during operational activities.	Operation

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
237	12.7.2	Surface water runoff from the IBA facility perimeter road will be directed to the IBA weathering area leachate collection system to avoid dust contamination of drainage outfalls.	Operation
238	12.7.2	The mitigation measures applicable for spills during the construction phase are applicable during the operational phase.	Operation
239	12.7.2	In the event of a leachate spill from a tanker, spill kits are kept on site and site staff are trained in the management of a spill. The haulage contractor will be required to have spill kits and training.	Operation
240	12.7.2	There will be regular inspections and maintenance of leachate tankers to mitigate leaks.	Operation
241	12.7.2	In the unlikely event of an unforeseen road traffic accident resulting in a leachate spill adjacent to a watercourse, Meath County Council and Inland Fisheries shall be contacted and spill protection measures will be implemented	Operation
242	12.7.2	Surface water will be visually inspected as part of the operational site walkovers on a weekly basis.	Operation
243	12.7.2	There will be continuous monitoring of surface water quality at the outfall from the surface water attenuation ponds to the wetland.	Operation
244	12.7.2	Routine surface water sampling is and will continue to be carried out in accordance with the licence which includes the submission of interpretive reports to the EPA for approval.	Operation
245	12.7.2	Any incidents shall be notified to the EPA in accordance with the licence.	Operation
246	12.7.3	Decommissioning of the development will be subject to Agency approval under prevailing waste licence condition.	Decommissioning
247	12.7.3	It is proposed to leave the surface water management system in situ and this will mitigate any potential impacts during decommissioning activities and in addition, temporary mitigation will be put in place to protect watercourses in areas outside of the in-situ water management system.	Decommissioning
248	12.7.3	Measures employed during the decommissioning phase will be similar to those proposed during the construction stage such as silt-traps, silt fencing and stilling ponds.	Decommissioning
249	12.8	Mitigation will be provided to protect the water quality by preventing any silt laden run-off or contaminated storm runoff reaching the downstream watercourses.	All

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
250	12.8	Implementation and efficacy of the mitigation measures will be monitored throughout the construction and operation phases.	All

Landscape & Visual Impact

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Landscape & Visual Impact			
251	13.6.2	The biological treatment facility is positioned in a naturally low area of the site to improve screening by the existing vegetation.	Design
252	13.6.2	Maintenance of screening berms and planting.	Operational
253	13.6.2	Enhancement of the existing planting on top of the berm.	Construction
254	13.6.2	The filled landfill cells 27 and 28 will provide screening for landfilling activities south of those cells.	Design
255	13.6.2	The filled IBA cell 29 will provide screening for IBA facility activities west of that point	Design
256	13.6.2	Careful selection of colour finishes for elevations of the proposed buildings in adherence with the Development Management Standards and Guidelines of the Meath CDP 2013 – 2019 will provide additional visual impact mitigation.	Design
257	13.6.2	A landscape Plan has been prepared to show the forestry planting and the berms proposed in the site. This is shown in the Planning Drawing LW14-821-01-P-0050-012 in Volume 4 of this EIAR. Trees planted in the proposed berms will offer screening to the facilities that reach higher elevations and heights above the ground level.	Design
258	13.7	The proposed woodland screen planting will involve a maintenance and management programme to ensure successful establishment and development.	Construction & Operation
259	13.7	The maintenance and management programme will include provision for weed control and the replacement of any plant failures on an annual basis for the first 3-5 years. In the longer term (15-20 years) the trees will be sequentially thinned to promote the development of a healthy and self-sustaining mature woodland.	Operation

Cultural Heritage

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
		Cultural Heritage	
260	14.6.1	It is proposed that a programme of pre-development licensed geophysical surveying will be carried out in all suitable areas of land take.	Pre-construction
261	14.6.1	It is proposed that a programme of pre-development test trenching will be carried out after the geophysical survey has been completed and within all areas of proposed land take. Test trenching will take in to account the results of the geophysical survey and will be carried out under licence to the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland. Further archaeological mitigation measures, which may include preservation in situ or preservation by record, may be made pending the results of the test trenching programme, and in agreement with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs and the National Museum of Ireland.	Pre-construction

Material Assets

Mitigation No.	EIAR Section Reference	Description of Mitigation Measure / Environmental Commitments	Stage of Impact i.e. Construction or Operation
Material Assets			
262	15.6.1	During relocation of the power lines measures typically undertaken by ESB Networks, which will include prior notification of impacts to end users, as well as all health and safety precautions will be put in place.	Construction
263	15.6.1	The contractor will be required to take measures in accordance with the ESB Code of Practice on Avoiding Danger from Overhead Electricity Lines.	Construction
264	15.6.1	Mitigation measures to be applied to prevent potential for impact on the Bord Gais pipeline centre on appropriate method statements by Contractors and clear delineation of the route on site.	Construction
265	15.6.1	Insofar as possible, non-renewable resources associated with construction will be sourced locally in order to minimise transportation distances and impacts on climate change.	Construction
266	15.8	During the construction phase, all utility services will be marked and monitored to ensure there is no disturbance or disruption to the services.	Construction & Operation