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)

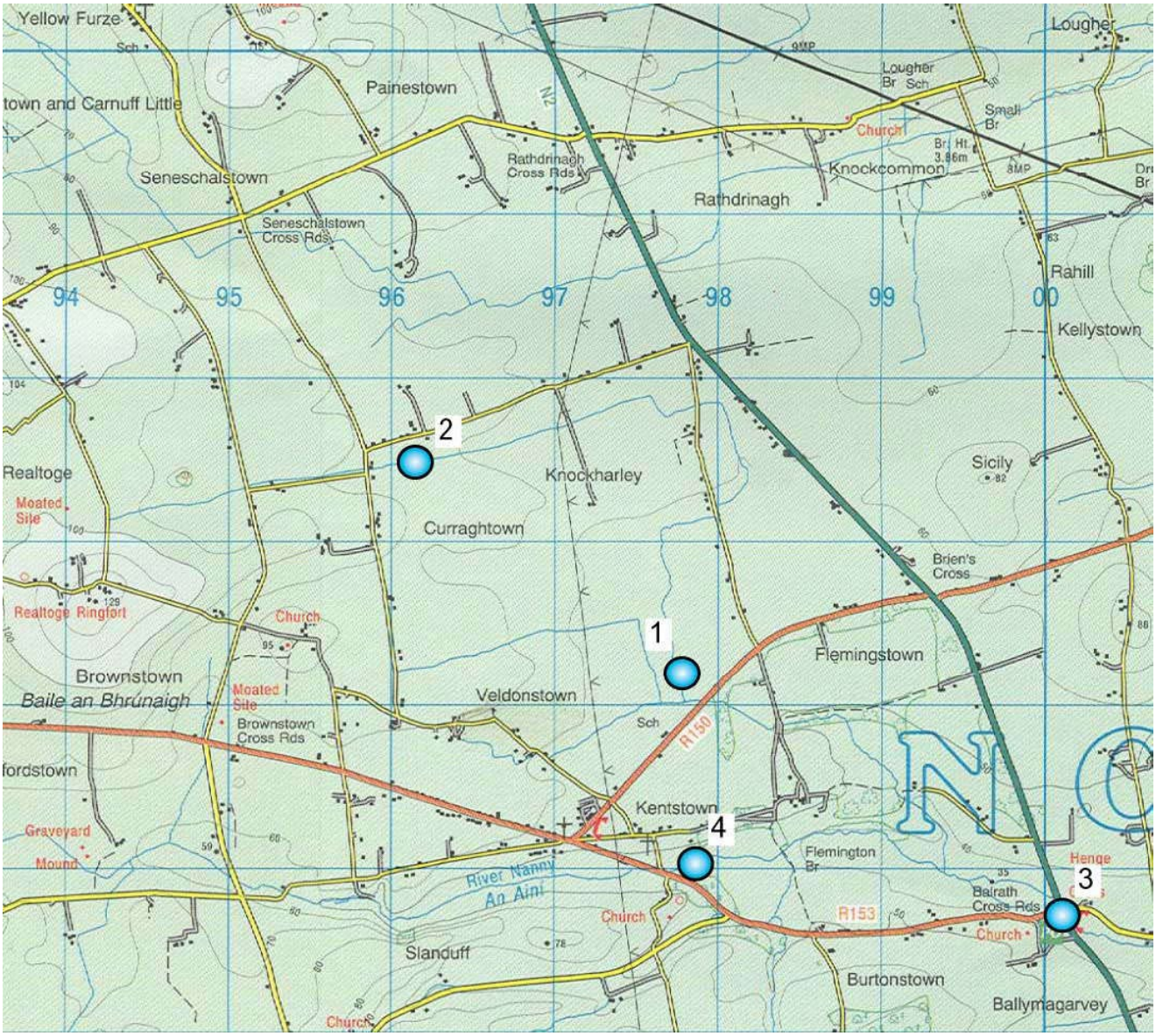


Plate 10-1: Biological Monitoring Locations at Knockharley - 2016

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.

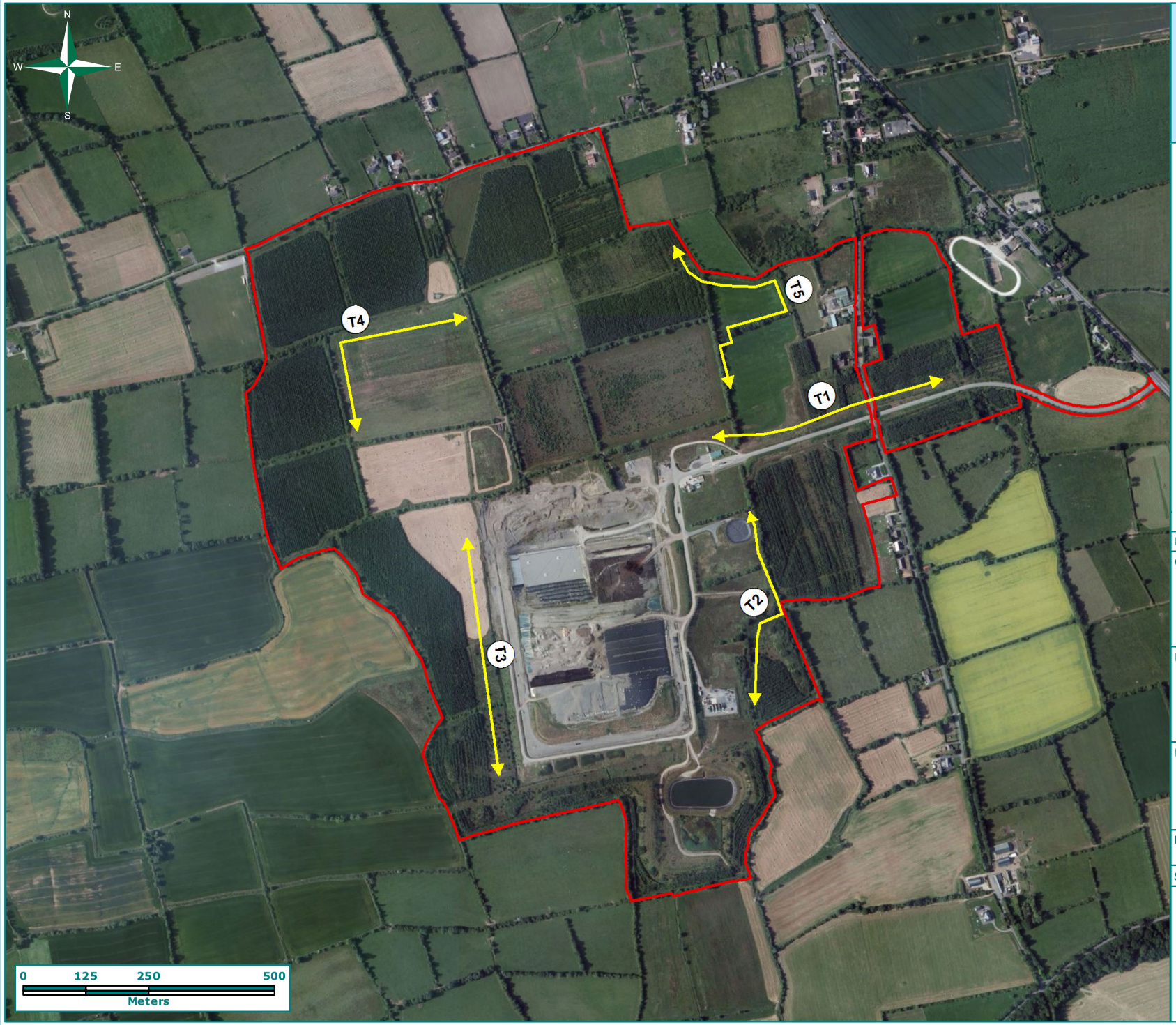
The survey was updated on the 26th of March 2015 with particular attention paid to areas proposed for new development.

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

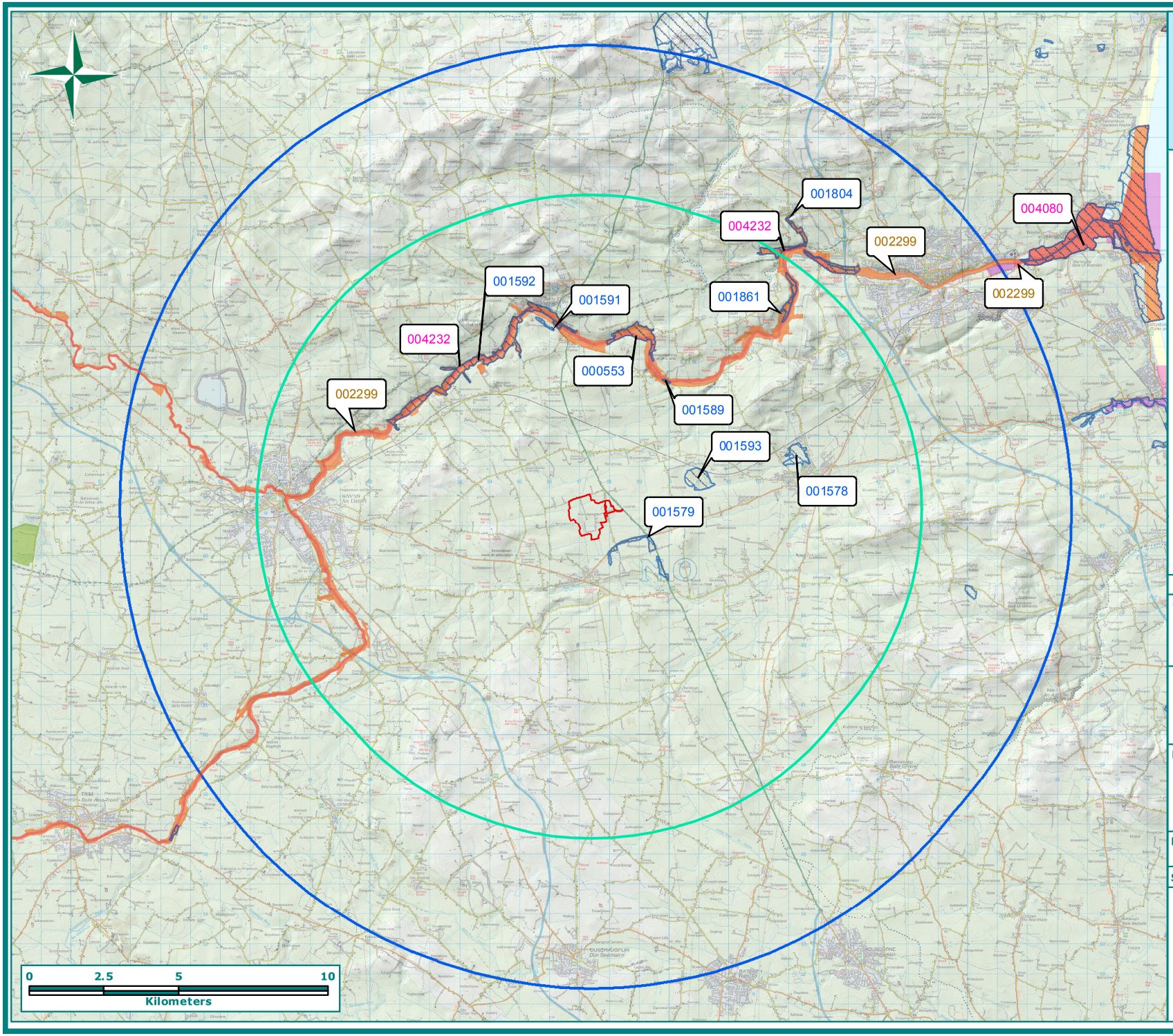
Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
River Boyne and River Blackwater cSAC	002299	River lamprey (*Lampetra fluviatilis*) [1099] Salmon (*Salmo salar*) [1106] Otter (*Lutra lutra*) [1355] Alkaline fens [7230] Alluvial forests with *Alnus glutinosa* and *Fraxinus 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

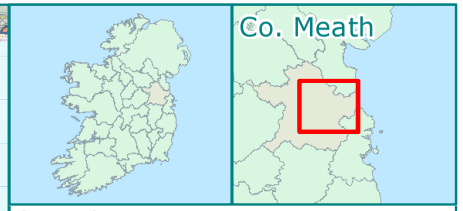
Site Name	Site Code	Features of Interest	Summary Description	Distance to Development
			Some of the grassland areas along the Boyne and Blackwater are used by a nationally important winter flock of Whooper Swan (*Cygnus Cygnus*). Several Red Data Book plants occur within the site, with *Pyrola rotundifolia, 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.	**Rev.**
10.2	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

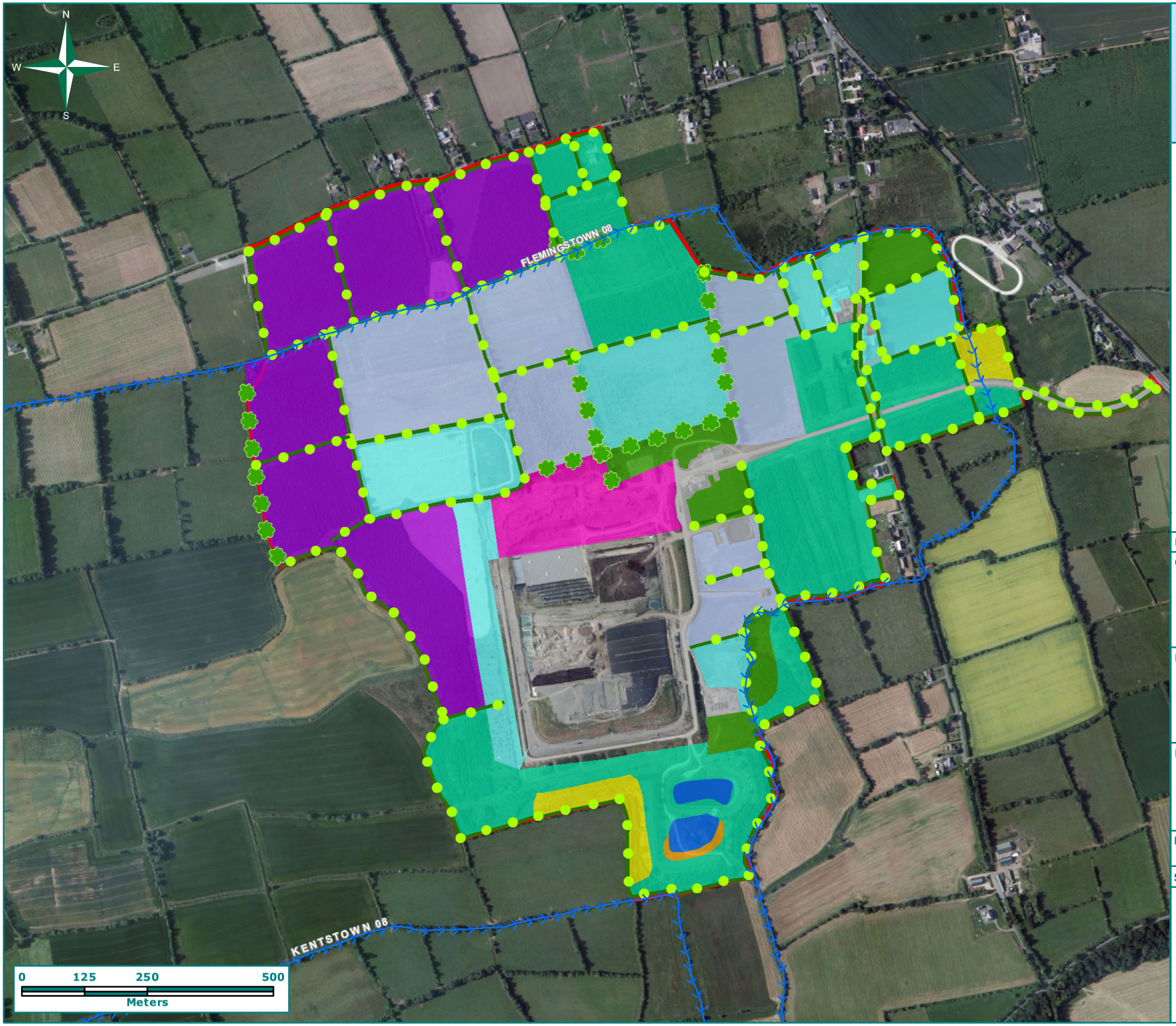
A total of 11 dominant habitats were recorded on the site during the habitat survey (Fossitt, 2000) conducted in 2010 (FT, 2010) and ground truthed in 2015 and 2016. These are listed below, together with their Fossitt (2000) habitat codes:

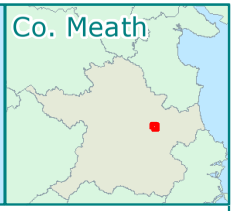
- Hedgerow (WL1)
- Treeline (WL2)
- Scrub (WS1)
- Immature Woodland (WS2)
- Improved Agricultural Grassland (GA1)
- Mosaic of Improved Agricultural Grassland and Wet Grassland (GA1/GS4)
- Wet Grassland (GS4)
- Artificial Lakes or ponds (FL8)
- Eroding/Upland River (FW1)
- Reed and Large Sedge Swamps (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.





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

Results of 2015 survey

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

Results of 2016 bat survey

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.

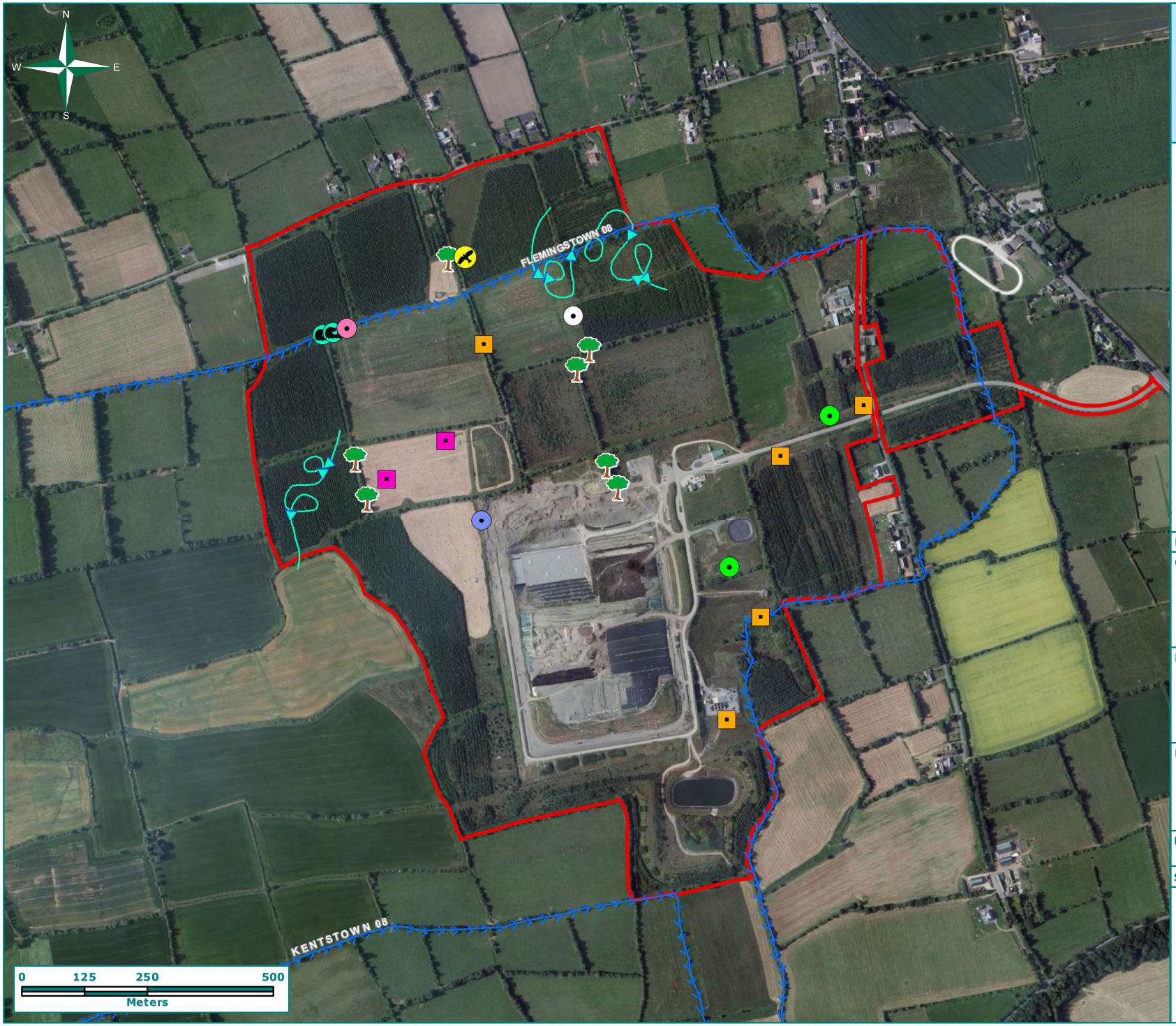
The Common Frog is protected by the Wildlife Act (1976 and Amendment 2000). Common Frog is also listed as a species of International Importance in the Irish Red Data Book (Whilde, 1993) and as species of community interest under Annex V of the EU Habitats Directive. Common frog is still present on site in suitable habitat as frog spawn was identified in Otter prey remains during the site visit in March 2015.

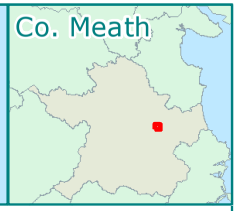
Table 10-15: Other species recorded on the site

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).





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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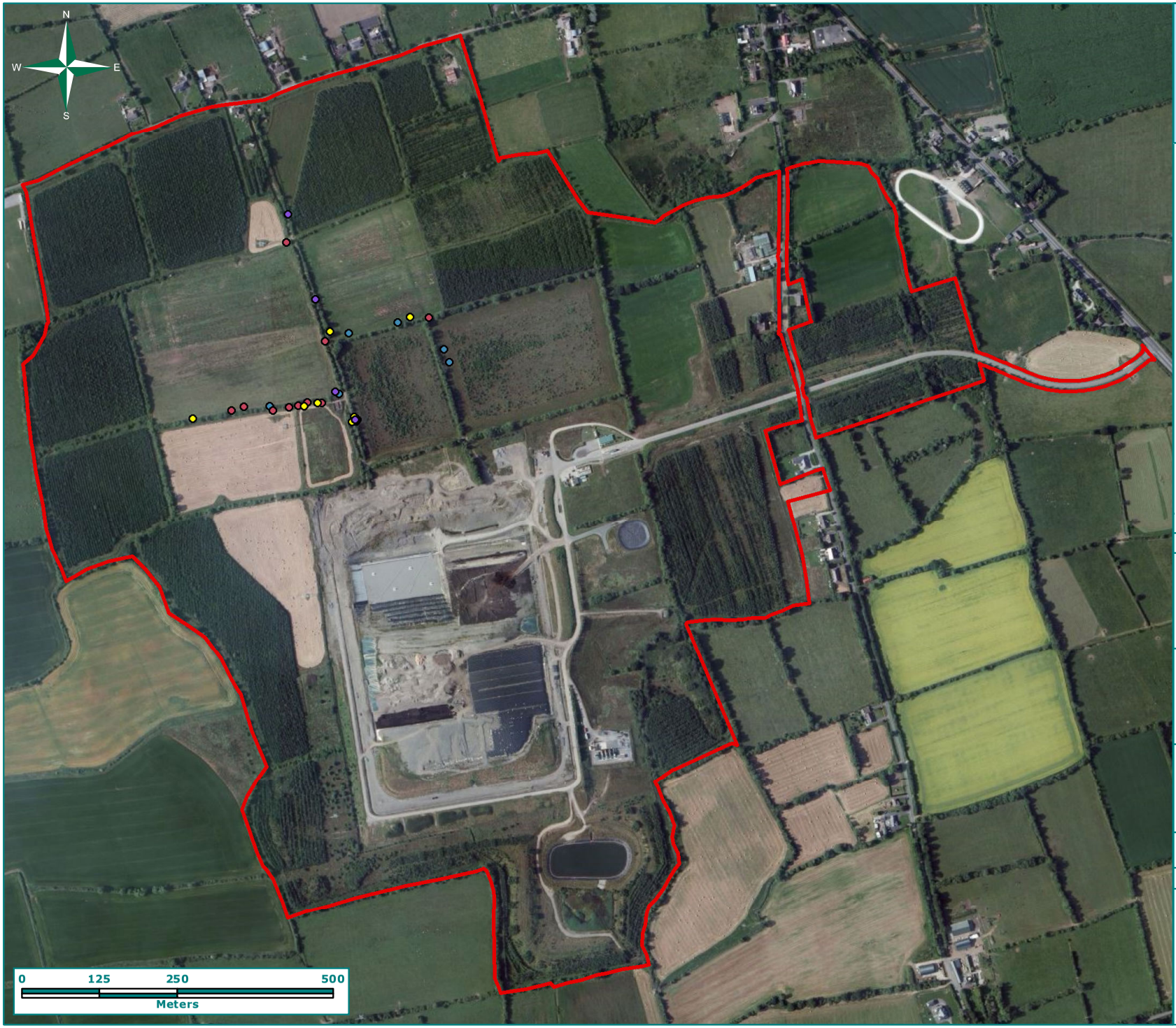

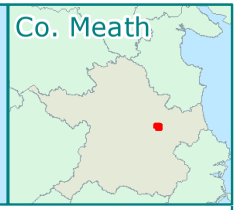

Legend

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 7^0C 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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