Appendix A.8.27

Compensatory Habitat Management Plans

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Document Verification

Project title	N6 Galway City Ring Road
Document title	Updated Environmental Impact Assessment Report
Job number	233985-00
Document ref	Appendix A.8.27 Compensatory Habitat Management Plans
File reference	

Revision	**Date**	**Filename**			
Issue 1	26 July 2018	**Description**	Issued for 2018 EIAR		
			Prepared by	**Checked by**	**Approved by**
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Issue 2	28 March 2025	**Filename**			
		Description	Issued for 2025 RFI Response		
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		Filename			
		Description			
			Prepared by	**Checked by**	**Approved by**
		Name			
		Signature			

Issue Document Verification with Document ✓

Contents

Appendices

1. Introduction

This Compensatory Habitat Management Plan (hereafter referred to as "CHMP") describes the process for the compensation[1] of the following Annex I habitats, which were identified as having a significant residual impact as a result of the proposed N6 Galway City Ring Road (hereafter referred to as the "*proposed N6 GCRR*"):

- European dry heaths [4030] (Refer to Section 2)
- Semi-natural dry grasslands and scrubland facies on calcareous substrates(*Festuco-Brometalia*) (* important orchid sites) [6210] (Refer to Section 3)
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinioncaeruleae*) [6410] (Refer to Section 4)
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion,

Alnion incanae) [*91E0] (Refer to Section 5)

This Plan was originally prepared as part of the 2018 EIAR and was reviewed again in 2024 as part of the response to the request by ABP for further information in December 2023 where they requested Galway County Council to "Update the Environmental Impact Assessment Report" (EIAR) submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended). It has been reviewed and updated to take account of the 2019 Response to Request for Further Information and to take account of points raised from the Brief of Evidence presented to An Bord Pleanála (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated June 2021 and the findings of surveys and assessments undertaken in 2023 and 2024 to inform the updated EIAR and NIS to reflect recent source material and information where this is available.

Full details of the impact assessment and residual impacts are described in Chapter8, Biodiversity of the updated Environmental Impact Assessment Report (EIAR).

The measures outlined in this report will compensate for the significant residual effect on the above habitats by ensuring that there will be no net permanent loss ofthis habitat type as a consequence of the proposed N6 GCRR. In the interestsof clarity, the compensation proposed in this report does not representcompensation as defined by Article 6(4) of the Habitats Directive. All of the areas of the above habitats to be lost fall outside of designated areas for nature conservation.

The measures outlined in this report were developed following an extensive literature review (refer to Section 6 References. This literature review included peer-reviewed scientific research and other grey literature sources (e.g. guidance from government agencies) for the relevant habitat types under discussion in this report; i.e. dry heath, semi-natural dry calcareous grassland, *Molinia* meadow and alluvial woodland. These include examples of best practice for habitat creation, restoration and management for these target habitat types, as well as reviews of theeffectiveness of specific techniques recommended in this report. This report has only recommended the creation of habitat types where there is good scientific evidence that the habitat can be successfully created, and it therefore is based on the best scientific knowledge and evidence. This report has not made recommendationsfor creation of habitat types for which either there is no good scientific evidence that the habitat can be successfully created, or there is significant doubt around the effectiveness of the habitat creation techniques. Careful and detailed considerationhas gone into the nature of and site conditions at donor and receptor sites to ensurethat the proposals are realistic and have a high chance of succeeding. Tables detailing these donor and receptor sites are provided in Annex 2 of this Appendix. Updates to donor and receptor site areas and the inclusion of new receptor and donor sites have occurred

[1] *"Compensation describes measures taken to offset residual effects resulting in the loss of, or permanent damage to, ecological features despite mitigation"* (CIEEM, 2018).

since the 2018 EIAR. Labels which include “nD” correspond to new donor sites that were identified in the 2019 habitat surveys undertaken to inform the RFI response. In the case of some of these new sites, they are located within the boundaries of donor sites previously identified in the 2018 EIAR; however, they comprise a reduced extent/area and as such have been assigned the “nD” code to reflect the change. According to the results of the 2019 and 2023 habitat surveys, some donor sites identified in the 2018 EIAR are no longer present and as such have been omitted in this CHMP. Labels which include “nR” correspond to new receptor sites that were identified following a meeting with the Department of Culture Heritage and the Gaeltacht (DHCG) on 9 March 2020 in order to identify the 4 hectares most suited as translocation sites for dry heath habitat due to the risk of peat erosion. The reduced receptor site area for the dry heath habitat translocation will ensure that these sites are completely covered with translocated turves, rather than a combination of peat turves and peat soil, thereby reducing the risk of peat erosion.

The CHMP is a working document and will be finalised by the Contractor followingappointment and prior to commencing works on site, including the preparation of site-specific method statements. This CHMP will be implemented by the Contractorunder the advice and supervision of the Project Ecologist (employed by the Employer) and/or the Ecological Clerk of Works (ECoW) (employed by theContractor). The results of any monitoring will be used to inform the long-term ecological mitigation programme and any necessary timely corrective action. Construction, monitoring and any required corrective action, will be Galway County Council’s (GCC) responsibility as outlined in the Schedule of Environmental Commitments. During operation, GCC will engage the services of a suitable contractor to monitor the ecological mitigation measures for the lifetime of the Project. The finalisation of the CHMP by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS.

1.1 Guidance

This CHMP has been prepared with regard to the following guidance documents, as relevant:

- *Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report* (European Commission et al., 2017)
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (European Commission et al., 2017)
- *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, Directorate-General for Environment, 2013)
- *Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial,Freshwater and Coastal, 2nd Edition* (Chartered Institute of Ecology andEnvironmental Management, 2016)
- *Guidelines for Ecological Report Writing* (Chartered Institute of Ecology andEnvironmental Management, 2017)
- *Guidelines for Ecological Impact Assessment in the UK and Ireland version 1.*2 (Chartered Institute of Ecology andEnvironmental Management, 2018)
- *Wildlife and Traffic: A European Handbook for Identifying Conflicts andDesigning Solutions (Iuell et al., 2003)*
- *Habitat Translocation A Best Practice Guide* (Anderson, 2003)
- *A Habitats Translocation Policy for Britain* (Joint Nature ConservationCommittee, 2003)
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (Environmental Protection Agency 2022)
- *Guidelines on the Information to be contained in Environmental ImpactStatements* (Environmental Protection Agency, 2002)
- *Guidelines on the Information to be Contained in Environmental ImpactAssessment Report* (Environmental Protection Agency, Draft August 2017)

- *Advice Notes on Current Practice in the Preparation of Environmental ImpactStatements* (Environmental Protection Agency, 2003)
- *Advice notes for Preparing Environmental Impact Statements* (EnvironmentalProtection Agency, Draft September 2015)
- *Guidelines for a national survey and conservation assessment of uplandvegetation and habitats in Ireland Version 2.0* (Perrin et al., 2014)
- *The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78* (O'Neill et al., 2013)
- *Lowland Calcareous Grassland Creation and Management in LandRegeneration* (Ashwood, 2014)
- *The Lowland Grassland Management Handbook 2nd Edition* (Crofts &Jefferson, 1999);
- *Our Trees A Guide to Growing Ireland's Native Trees in Celebration of a New*Millennium (The People's Millennium Forests, 2000)
- *Management Guidelines for Ireland's Native Woodlands* (Cross & Collins,2017)
- *Results of a Monitoring Survey of Old Sessile Oak Woods and Alluvial Forests.* (O'Neill & Barron, 2013)
- *The monitoring and assessment of four EU Habitats Directive Annex I woodland habitats. Irish Wildlife Manuals, No. 146* (National Parks and Wildlife Service, 2023)
- *National Survey of Native Woodlands 2003-2008* (Perrin et al., 2008a and b)
- *A Guide to Landscape Treatments for National Road Schemes in Ireland* (National Roads Authority, 2006)

2. European dry heaths [4030]

2.1 Introduction

The proposed N6 GCRR will result in the permanent loss of c.3.18ha of the Annex I habitat European dry heaths [4030] (hereafter referred to as "*4030"*), of which 1.42ha of this habitat occurs in a mosaic with the Annex I habitat Northern Atlantic wet heaths with *Erica tetralix* [4010], the Annex I habitat *Molinia* meadows [6410] and the Annex I habitat Blanket bog (active) [*7130]. It is proposed to compensate for this loss by re-creating c.4.10ha of 4030 habitat. This area of habitat creation represents c.129% of the loss of the 4030 habitat and its mosaics. This represents 72% of the total combined losses of:

- the Annex I habitat European dry heath 4030 (*i.e.* c.1.76ha)
- the Annex I habitat Northern Atlantic wet heaths with *Erica tetralix* [4010] (*i.e.* c.2.54ha in total., of which c.1.60ha is due to direct impacts, while c.0.94ha are due to indirect impacts)
- The Annex I habitat Blanket bog (active) [*7130] (i.e. c.0.01ha)
- lands containing a mosaic of the 4030, 4010, *7310 and 6410 habitats (*i.e.* c.1.42ha)

Although the habitat creation proposed does not reduce the residual impact associated with the loss of 4010, *7130, or the mosaics of 4010/4030, 4010/4030/6410 and 4010/4030/7130, it will fully compensate for the loss of 1.76ha of 4030.

The results of the literature review carried out as part of the CHMP confirm that dry heath is a habitat that can and has been successfully translocated and recreated. The literature review confirmed that heathland restoration and creation has been researched and practiced for over 45 years. Heathland restoration or translocation has been undertaken for a range of development types including pipelines, roads, windfarms, forestry sites post-felling and restoration post-burning damage. The approach to dry heath habitat creation and translocation for the proposed N6 GCRR is evidence based and is founded on tried and tested known techniques and methodologies.

Particular examples which were drawn from, and which are of direct relevance to the proposals for this proposed N6 GCRR, are listed below:

- Parker, D.M. (1995). Habitat Creation – a Critical Guide. English Nature Science No. 21. English Nature. This publication describes two case studies from Dorset; the Ferndown Bypass and the Gallows (Duck) Hill in Wareham. The Ferndown Bypass used heath soils to re-create heathland vegetation on roadside verges of the new bypass. The heathland soil was stripped following cutting of vegetation, stored for 18 months and then spread on roadside verges. A nurse mix was used to stabilise the soil. Monitoring for +3 years and +5 years indicated that a heathland sward had become established. In the Gallows (Duck) Hill, soils from a wet heath donor site were translocated to a site with nutrient-poor, waterlogged soil and heather brashings were used. The publication reports that some success was achieved at this site. The Ferndown Bypass in particular is directly comparable to what is being proposed for the proposed N6 GCRR, being the same development type and having used the same primary method for habitat creation i.e. translocation of heath soils.

- Allison, M. and Ausden, M. (2004). Successful use of topsoil removal and soil amelioration to create heathland vegetation. Biological Conservation 120: 221–228. This study in Kent, compared the effectiveness of topsoil removal on improved agricultural grass fields in creating suitable soil conditions for establishment of heathland vegetation. The experiment examined topsoil removal combined with various treatments, including the addition of heathland clippings. The results demonstrated that it was possible to successfully create heathland vegetation on species-poor grassland using topsoil removal and addition of heathland clippings. The methods used have similarities with what is proposed for the proposed N6 GCRR. The experiment found that the vegetation that established on areas involving topsoil removal and addition of heathland clippings comprised a species-rich mix of ericaceous dwarf-shrubs including *Calluna vulgaris* and *Erica cinerea*; two of the target dominant species for the dry heath receptor sites for this proposed N6 GCRR.

- Pywell, R., Meek, W., Webb, N., Putwain, P. & Bullock, J. (2011). Longterm heathland restoration on former grassland: The results of a 17-year experiment. Biological Conservation 144, 1602-1609. This long-term largescale experiment examined the effectiveness of five techniques for restoring heathland on improved agricultural grassland and found that the most successful methods were soil stripping followed by the incorporation of heathland topsoil and soil stripping followed by the translocation of large heathland turves. The results from this study supports the techniques being proposed for the proposed N6 GCRR.

- The Corrib Onshore Pipeline case study. Ecologist Jenny Neff CEcol CEnv FCIEEM (consultant ecological adviser to Vermilion E&P Ireland Ltd - formerly to Shell E & P Ireland Ltd), provided details and experience of peatland habitat translocation and restoration during the construction of the Corrib Gas Project, in particular the reinstatement of the Corrib Onshore Pipeline element of the project. For this project the peatland habitat in question was blanket bog rather than heath, however, directly relevant and applicable techniques used were drawn from to inform the proposals for the proposed N6 GCRR. Figures illustrating the process of peatland habitat translocation can be found in Annex 1 to this appendix.

- Duddigan, S., Hales-Henao, A., Bruce, M., Diaz, A. and Tibbet, M. (2024) Restored lowland heathlands store substantially less carbon than undisturbed lowland heath. *Nature Communications Earth and Environment,* 5(15); Tibbett, M., Gil-Martinez, M., Fraser, T., Green, I.D., Duddigan, S., De Oliveira, V.H., Raulund-Rasmussen, K., Sizmur, T. and Diaz, A. (2019) Long-term acidification of pH neutral grasslands affects soil biodiversity, fertility and function in a heathland restoration. *Catena,* 180, 401-415. This long-term experiment examined the effectiveness of soil acidification on agricultural pasture on the Isle of Purbeck in heathland restoration. It was found that soil acidification with elemental sulfur resulted in a shift in soil biotic and abiotic features and in the vegetation community to similar to that

typical of a heathland/acid grassland habitat. While c.*vulgaris* was successfully established at the site (one of the target dominant species for the dry heath receptor sites for this proposed N6 GCRR), the vegetation community was dominated by more intermediate species (i.e. those which can occur in both mesotrophic and acid grasslands) than those characteristic of acid/calcifugous grassland and heathlands. Despite the similarities in biotic and abiotic conditions between natural and restored heathland, restored heath in this site was found to contain less than half the soil carbon content (and stock) than the natural heathland. It was found that in particular, top soil removal as a restoration technique resulted in significant reduction in soil carbon content. However, restoring or recreation of heathland can result in net carbon gain depending on the existing habitat and soil conditions (Anderson, 2024). For example, acid grassland to heath restoration can capture twice the amount of carbon as the acid grassland (Quin *et al.,* 2015).

- Butterworth, T., Baker, J. and Hoskin, R. (2019) *Biodiversity net gain. Good practice principles for development. Part B: Case studies. CIRIA*. This publication describes a case studies from Dorset of relevance to dry heath habitat creation: Major road maintenance on the A338 (Bournemouth Spur Road). The A33 road maintenance project involved the removal of pine, scrub, bracken, rhododendron and gaultheria to allow heath vegetation reestablishment. The establishment of heath habitat on roadside verges was carried out through the removal of nutrient rich topsoil and reseeding using heather brash and a grass seed mix, supporting the use of these techniques for this proposed N6 GCRR.

- Davis, J., Lewis, S. and Putwain, P. (2015) '"Robust" interventions: The re-creation of dry heathland and habitat for a nationally threatened butterfly at Prees Heath Common Reserve, Shropshire', *Proceedings of the 11th National Heathland Conference*, Sunningdale Park, Berkshire, March 2015. This study created dry heath habitat on former arable land through the use of deep ploughing, chemical acidification and heath vegetation establishment through heather brash and grass seed spreading from nearby donor sites. After a seven-year period *Calluna vulgaris* cover had become more extensive (up to 52% in some areas), with greater success occurring in areas with an existing heather seed bank. This is a more recent project supporting the use of heather brash and grass seed spreading from donor sites in order to establish the target vegetation communities for this proposed N6 GCRR.

- Symes N.C. and Day J. (2003) A practical guide to the restoration and management of lowland heathland. The RSPB, Sandy. This publication describes a number of case studies of heathland habitat restoration and creation, supporting the use of a number of different techniques for the CHMP for this proposed N6 GCRR in a context-dependent manner.

  - Habitat restoration was carried out at Arne nature reserve using pine felling, soil stripping, invasive species removal and cattle grazing, resulting in the successful reversion of vegetation succession and reduction of soil nutrient status leading to successful establishment of pioneer heath communities over a 10-year period.

  - A cattle grazing regime was used to diversify sward structure and suppress scrub and bracken at Ashdown Forest, successfully creating a heathland and acid grassland mosaic.

  - Different bracken management techniques were used at Cannock Chase Country Park: spraying with herbicide, litter stripping and spreading of heather brash, tillage of bracken litter mat following herbicide application and cutting and baling of bracken. Herbicide application followed by cultivation was the most effective management tool to control bracken.

  - Turf stripping was used at Albury heath to remove wavy hair-grass and facilitate heather regeneration from the existing seedbank. It was found that deeper soil scraping/removal resulted in better heather regeneration as grass dominates regeneration from shallower soil removal.

The only relevant example of wet heath translocation/creation that the literature review revealed was a published study by lead author John Box (Box et al, 2011). In this study an area of wet heath was translocated to an engineered receptor cell fed by combination of groundwater springs and direct precipitation. The unique circumstances of this study are different to the circumstances of the proposed N6 GCRR in important ways. The receptor side was located on a clay seam and had groundwater springs which fed a supply of water to the translocated habitat. The receptor site was also engineered and actively managed to ensure the water levels were controlled to the required levels. Monitoring results indicated that the experimental translocation was successful for a period of 7 years when the hydrological regime of the

receptor site was actively managed. However, when active management ceased, the receptor site became drier and species were lost. Given the complex hydrological conditions that support wet heath ecosystems, and the local context in which wet heath occurs (i.e. sunken pockets on shallow soils within granite bowls), it is not deemed feasible to successfully translocate or recreate wet heath habitat. Furthermore, ten of the heath receptor sites are located on MDA sites and at an elevated level it will not be possible to create appropriate hydrological conditions for wet heath habitat. Any attempts to create wet heath habitat would require significant engineering interventions and long-term active management to maintain a viable area of wet heath habitat.

Separate to the areas of 4030 habitat to be created as a compensatory measure, thereare areas of 4030 habitat located within the Assessment Boundary that will be retained and fenced off for the duration of construction. These areas will notbe directly impacted by the proposed N6 GCRR. These areas are presentedin Figures 8.38.1 to 8.38.15 of the updated EIAR. These areas will not be available touse as donor sites for the purposes of creation of compensatory 4030 habitat.

The steps followed for the 4030 habitat compensation process are:

- Identification and selection of suitable compensatory habitat receptor sites for4030 habitat (Refer to Sections 2.2 to 2.5)
- Pre-compensatory site preparation works at both the donor and receptor sites,including (Refer to Sections 2.5.2 and 2.5.3):
  - the provision of site specific method statements within Finalised EcologySite Management Plans (Refer to Section 2.5.2.1)
  - erection of temporary fencing
  - soil analysis test
  - surface vegetation management and removal
  - topsoil stripping
  - soil acidity amelioration techniques
- Implementation of a combination of compensatory measures as dependent on the characteristics of the receptor sites (Refer to Section 2.5.3). These measuresinclude:
  - the translocation of turves and suitable soil from donor to receptor sites
  - harvesting and spread of heather clippings at the donor site
- Short-term and long-term management of receptor sites following the implementation of compensatory measures (Refer to Section 2.6)
- Monitoring of receptor sites to be carried out pre-compensation, during and post-compensation by a suitably qualified and experienced ecologist[2] in order to ensure that any potential issues are identified at an early stage and addressedthrough adaptive management measures. (Refer to Section 2.7)

2.2 Description of Annex I habitat 4030

In Ireland the Annex I habitat 4030 usually occurs on well-drained mineral soils orshallow peats (*i.e.* typically less than c.50cm deep) on sloping ground and is dominated by ericaceous dwarf shrubs such as *Calluna vulgaris*, *Erica cinerea*, *Ulex gallii* and *Vaccinium myrtillus*. There are six Dry heath vegetation communities, which correspond to 4030 habitat. Five of these six plant communities consist of only a limited cover of peat-forming species, with the exception of the plant community DH4 *Calluna vulgaris – Sphagnum*

[2] Throughout this document where it is clear the role of the ecologist is attached to the constructionstage, the role is referred to as the "Project Ecologist and/or EcOW". However where the role for an ecologist being referred to may involve a role beyond the contractor's contract (i.e. during the operation and maintenance of the proposed N6 GCRR), the role is referred to as "a suitably qualified and experienced ecologist".

capillifolium.There is only one Dry heath vegetation community that will be affected as a consequence of the proposed N6 GCRR, *i.e.* DH1. In Ireland this community is characterised by the presence of *Ulex gallii*, generally accompanied by *Erica cinerea* or *Calluna vulgaris* and is typically found in coastal areas (Perrin*et al.*, 2014). Dry heath habitat is commonly found in a mosaic of different vegetation types present on rock slopes (Perrin *et al.*, 2014). Burning of Dry heathis sometimes used as a management tool to produce a heathland with a variety of heather growth stages. However, currently in Ireland most heath fires are intentionally started to encourage grass growth for livestock (Perrin *et al.*, 2014).

2.3 Description of 4030 Donor Sites

There are 49 relatively very small, isolated polygons of Annex I habitat 4030 whichwill be removed to facilitate the construction of the proposed N6 GCRR (see Figure 1 to Figure 4 for locations). All of these areas are located west of the River Corrib and outside of any designated areas for nature conservation. These sites were classified as Annex I habitat due to the presence of a sufficient number of positive indicator species (after Perrin *et al.*, 2014). Two of these donor sites (*i.e.* 4030.nD61 and 4030.nD63 see Figure 4) form a mosaic with 4010; however the dominant habitat present is 4030.

The Annex I habitat European dry heaths [4030] is present in each 4030 donor site. The following additional habitats are also present in some of the 4030 donor sites (see Annex 2 of this Appendix for more specific details per donor site):

- Dry meadows and grassy verges (GS2)
- Dry-humid acid grassland (GS3)
- Wet grassland (GS4)
- Wet heath (HH3)
- Dense bracken (HD1)
- Scrub (WS1)
- Exposed siliceous rock (ER1)
- Stone walls and other stonework (BL1)

Full descriptions of these 49 polygons (*i.e.* 4030 donor sites) of habitat to be lost are provided below and are grouped into six geographically distinct areas.

2.3.1 An Baile Nua - Ch. 0+000 to Ch. 0+750

There are nine donor sites within this area, 4030.D1 to 4030.D9, and 4030.nD48 and 4030.nD49 consisting of c.0.37ha (see Figure 1 for locations). Botanical and other relevant environmental data (as per the 4030 structure and function condition assessment described in Perrin *et al.*, 2014) was collected at two relevés located c.102m west of the nearest area of 4030 habitat to be lost and c.25m south-east of the nearest area of 4030 habitat to be lost on the 10 September 2014 and 3 September 2015 respectively. Data collected at these relevés is considered to be representative of the habitat to belost in this general location. A total of three (at one relevé) and five (in the other relevé) of the eight positive indicator species of this Annex I habitat were present (*i.e. Arctostaphylos uva-ursi*, *Calluna vulgaris*, *Daboecia cantabrica*, *Erica cinerea* and *Ulex gallii*). The percentage cover of these positive indicator species present was greater than 50%, while the percentage cover of dwarf shrub species atone relevé was greater than 50%. Only two bryophyte species were present at one relevé (*i.e. Rhytidiadelphus squarrosus* and *Hypnum cupressiforme*), while none were present in the other. No negative indicator species were present at either relevé; however *Pteridium aquilinum* was present in both. There was evidence of senescent *Calluna vulgaris* in one of the relevés; however this was less than 50% and there were no signs of burning in the local vicinity of each relevé. The depth ofpeat at each relevé varied from c.20-50cm at one to c.0-5cm at the other. The latter of which had a higher associated percentage cover of bare soil and rock compared to the former. No surface water was noted in either relevé. The median height of the field layer at each relevé differed (*i.e.* c.60cm and 40cm), as did the dwarf shrub layer (*i.e.* c.40cm and 35cm) and the ground layer (*i.e.* c.5cm and 0cm). One of the relevés passed all 14 criteria of the structure and function condition assessment,while the other failed on six of the 14 criteria, *i.e.* failing on number of

bryophytesor non-crustose lichen species present (≥3); percentage cover of non-native speciesin relevé taken and within habitat only (<1%); percentage cover of *Pteridium aquilinum* (<10%); and, cover of disturbed ground in relevé taken and within habitat only (<10%) (Perrin *et al.*, 2014). Refer to relevé codes EC05 R1 and R336-NFMRR2 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

Ten additional relevés were carried out within the areas of 4030 to be lost in this section in 2019. These relevés were carried out to provide additional support and aid the verification of the baseline habitat classifications as part of the response to items 3a and 3b of the 2019 RFI Response. Between two (at two relevés) and five (in one relevé) of the eight positive indicator species of this Annex I habitat were present in the additional 2019 relevés (*i.e. Calluna vulgaris*, *Daboecia cantabrica*, *Erica cinerea, Ulex gallii* and *Vaccinium myrtillus*). Four of the ten relevés from 2019 had ≥3 bryophyte species present (species recorded include *Thuidium tamariscinum, Rhytidiadelphus squarrosus, Pseudoscleropodium purum, Pleurozium schreberi, Lophocolea bidentata, Kindbergia praelonga, Hypnum jutlandicum, Fissidens taxifolius, Didymodon vinealis, Didymodon insulanus, Dicranum scoparium, Calliergonella cuspidate* and *Bryum capillare*). The six remaining relevés failed the structure and function condition assessment on the criterion of the number of bryophytes or non-crustose lichen species present. The negative indicator species *Rumex acetosella* was recorded in a single relevé, however, the percentage cover was less than 1%. Three relevés failed the structure and function condition assessment on the criterion of percentage cover of *Pteridium aquilinum* (i.e. greater than 10%). The median height of the shrub layer varied between 29 cm and 120 cm. Evidence of mature Calluna vulgaris was recorded when it occurred in eight of the ten relevés. The percentage cover of bare ground was < 10% in all relevés and no surface water was recorded. One of the relevés passed all 14 criteria of the structure and function condition assessment. Other relevés recorded in this area failed on between one and four of the 14 criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); percentage cover of positive indicator species (≥50%); proportion of dwarf shrub cover composed of Myrica gale, Salix repens, Ulex gallii collectively <50%; percentage cover of *Pteridium aquilinum* (<10%); and cover of scattered native trees and scrub <20% (Perrin *et al.*, 2014).

Refer to Appendices A.8. 1 and A.8.19 of the updated EIAR for more detail. Refer to relevé codes 336_R1, 338_R1, 2394_R1, 2396_R1, 2638_R1, 2397_R1, 2391_R1, 361_R2, 2403_R1 and 614_R1 presented in Appendix A.8.19 of the updated EIAR for associated species lists and data.

2.3.2 Na Foraí Maola Thiar -Ch. 0+850 to Ch. 1+100

There are three donor sites within this area, 4030.D10 to 4030.D12, consisting of c.0.07ha (see Figure 1 for locations). Botanical and other relevant environmental data(as per the 4030 structure and function condition assessment described in Perrin *et al*., 2014) was collected at two relevés located within two areas of 4030 habitat to be lost on 3 September 2015 and 7 September 2015 respectively. Data collected atthese relevés is considered to be representative of the habitat to be lost in this general location. Severe encroachment from *Pteridium aquilinum* was noted at onerelevé. A total of four of the eight positive indicator species were within each relevé(*i.e. Erica cinerea*, *Daboecia cantabrica*, *Calluna vulgaris* and *Ulex gallii*). The percentage cover of positive indicator species present was greater than 50%, whilethe percentage cover of dwarf shrub species at one relevé was greater than 50%. Two bryophyte species and one lichen species were present at one relevé (*i.e. Hypnum jutlandicum*, *Scleropodium purum* and *Cladonia* sp.), while two were recorded in the other (*i.e. Hylocomium splendens* and *Hypnum jutlandicum*). No negative species were present at either relevé and non-native species were only recorded in one relevé at very low abundance level. *Pteridium aquilinum* was present in both relevés with percentage covers greater than 10%. There wasevidence of senescent *Calluna vulgaris* in one of the relevés; however this was lessthan 50% and there were no signs of burning in the local vicinity of each relevé. The depth of peat at each relevé varied from c.10cm at one to c.5cm at the other. No bare soil was present at either relevé; however a very small percentage of bare rock was noted at one. No surface water was noted in either relevé. The median height of the field layer at each relevé differed (*i.e.* c.50cm and 60cm), as did the ground layer (*i.e.* c.8cm and 15cm), while the median height of the dwarf shrub layer was the same for both (*i.e.* c.45cm). One of the relevés passed on 13 of the 14 criteria of the structure and function condition assessment, while the other passedon 10 of the 14 criteria (Perrin *et al.*, 2014), *i.e.* failing on percentage cover of *Pteridium aquilinum* (<10%); number of bryophytes or non-crustose lichen speciespresent (≥3); percentage cover of dwarf shrub cover (<50%); and, cover of disturbed ground in relevé taken. Refer to relevé codes R336-NFMR R1 and R336-NFMR R2 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

One additional relevé (2407_R1) was carried out in 2019 within the area of 4030 habitat to be lost. Four of the eight positive indicator species of this Annex I habitat were present in the additional 2019 relevé (*i.e. Calluna vulgaris*, *Daboecia cantabrica*, *Erica cinerea* and *Ulex gallii*). No bryophyte species were recorded, and the percentage cover of *Pteridium aquilinum* was greater than 10%. Evidence of mature *Calluna vulgaris* was recorded within the relevé. The relevé failed the structure and function condition assessment on two of the criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); and percentage cover of *Pteridium aquilinum* (<10%) (Perrin *et al.*, 2014). Refer to Appendices A.8.01 and A.8.19 of the EIA Report for more detail on the methodology and associated species list and respectively.

2.3.3 Na Foraí Maola Thoir - Ch. 1+150 to Ch. 1+500

There are thirteen donor sites within this area, 4030.D13, 4030.D15 to 4030.D18, 4030.n50 and 4030.nD52 to 4030.nD57 consisting of c.0.34ha. See Figure 2 for locations. Botanical and other relevant environmental data (as per the 4030 structure and function condition assessment described in Perrin *et al.*, 2014) was collected at two relevés located c. 122m south-east of the nearest area of 4030 habitat to be lost and within very close proximity to an area of4030 habitat to be lost on the 8 September 2014 and the 7 September 2015 respectively. Data collected at these relevés is considered to be representative of thehabitat to be lost in this general location. A total of four (at one relevé) and three (in the second relevé) of the eight positive indicator species of this Annex I habitatwere present (*i.e. Calluna vulgaris*, *Ulex gallii*, *Daboecia cantabrica* and *Erica cinerea*). The percentage cover of positive indicator species was greater than 50% at both relevés, while the percentage cover of dwarf shrub species at one relevé was greater than 50%. Four bryophyte species were present at one relevé (*i.e. Hypnum jutlandicum* and *Rhytidiadelphus squarrosus*), while two were recorded in another(*i.e. Hypnum jutlandicum* and *Pseudoscleropodium purum*). No negative or non- native species were present in either relevé. *Pteridium aquilinum* was present in only one relevé with a percentage cover less than 10%. There was evidence of senescent *Calluna vulgaris* in one of the relevés; however this was less than 50% and there was no signs of burning in the local vicinity of each relevé. The depth ofpeat was very low at both relevés (*i.e.* 4cm and 10cm). No bare soil was present ineither relevé. The percentage cover of bare rock and litter was less than 10% at both relevés. No surface water was noted in either relevé. The median height of the dwarfshrub layer at each relevé differed (*i.e.* c.40cm and 25cm), as did the ground layer(*i.e.* c.15cm and 5cm), while the median height of the field layer was the same for both (*i.e.* c.30cm). One of the relevés passed on all of the 14 criteria of the structure and function condition assessment (Perrin *et al.*, 2014), while the other passed on 13 of the 14 criteria, *i.e.* failing on percentage cover of dwarf shrub cover (<50%).Refer to relevé codes EC12 R1 and EC12 R3 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

Ten additional relevés were carried out in 2019 within the area of 4030 habitat to be lost in this section. Of these ten relevés, seven had two or more of the positive indicator species for 4030. The indicator species recorded in this area were *Calluna vulgaris, Daboecia cantabrica, Erica cinerea* and *Ulex galii.* Eight of the relevés had three or more bryophyte and/or crustose lichen species recorded (bryophyte species recorded are *Aulacomnium palustre, Dicranum scoparium, Diplophyllum albicans, Frullania dilatata, Hylocomium splendens, Hypnum cupressiforme s.s., Hypnum jutlandicum, Kindbergia praelonga, Mnium hornum, Plagiomnium undulatum, Pseudoscleropodium purum, Pseudotaxiphyllum elegans, Rhytidiadelphus squarrosus, Sphagnum capillifolium, Sphagnum capillifolium subsp rubellum, Sphagnum cuspidatum, Sphagnum papillosum, Sphagnum subnitens* and *Thuidium tamariscinum. Cladonia* lichens such as *Cladonia cf. subcervicornis* and *Cladonia portentosa* were also recorded). Evidence of mature *Calluna vulgaris* was recorded within nine of the ten relevés. Four of the relevés failed the structure and function condition assessment on the criterion of percentage cover dwarf shrub composed of *Ulex gallii* and one relevé failed the structure and function condition assessment on the criterion of percentage cover of *Pteridium aquilinum* (<10%) (Perrin *et al.,* 2014). No weedy negative indicator species were recorded in any of the relevés, and all relevés have <10% cover of disturbed ground or bare soil. Two of the relevés passed all 14 criteria of the structure and function condition assessment. Other relevés recorded in this area failed on between one and three of the 14 criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); percentage cover of positive indicator species (≥50%); proportion of dwarf shrub cover composed of *Myrica gale, Salix repens, Ulex gallii* collectively <50%; percentage cover of *Pteridium aquilinum* (<10%); and cover of scattered native trees and scrub <20% (Perrin *et al.*, 2014).

Refer to Appendix A.8.1 of the updated EIAR for more detail on the methodology. Refer to relevé codes 739_R1, 2700_R1, 734_R3, 2417_R1, 736_R4, 2414_R1, 2414_R2, 764_R2, 767_R2 and 2418_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species lists and data.

2.3.4 Troscaigh Thiar - Ch. 2+000 to Ch. 2+400

There are 12 donor sites within this area, 4030.D20 to 4030.D22, 4030.D24, 4030.D27, 4030.D31, 4030.nD58 and 4030.nD59 consisting of c.0.21ha. See Figure 2 for locations. Botanical and other relevant environmental data(as per the 4030 structure and function condition assessment described in Perrin *et al.*, 2014) was collected at one relevé located c.172m west of the nearest area of 4030 habitat to be lost on the 4 September 2014. Data collected at these relevés is considered to be representative of the habitat to be lost in this general location. A total of three of the eight positive indicator species of this Annex I habitat were present (*i.e. Ulex gallii*, *Calluna vulgaris* and *Erica cinerea*). The percentage coverof these positive indicator species was greater than 50%, as was the percentage cover of dwarf shrub cover. One bryophyte species was present (*i.e. Pseudoscleropodium purum*). No negative species, non-native species, *Pteridium aquilinum* or *Juncus effusus* were present. There was evidence of senescent *Callunavulgaris* and *Ulex gallii* and this was greater than 50%; however there were no signsof burning in the local vicinity of the relevé. The depth of peat was less than 10cm.No bare soil or rock was present. No surface water was noted. The median height of the field layer, dwarf shrub layer and ground layer was c.40cm, 50cm and 3cm respectively. It passed on 11 of the 14 criteria of the structure and function conditionassessment, *i.e.* number of bryophytes or non-crustose lichen species present (≥3);percentage cover of dwarf shrub cover (<50%); and, percentage cover of senescent *Calluna vulgaris* cover (<50%) (Perrin *et al.*, 2014). Refer to relevé code EC13 R1 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

Six additional relevés were carried out in 2019 within the area of 4030 habitat to be lost in this section. Five of the six relevés contained two or more positive indicator species (i.e. *Calluna vulgaris, Erica cinerea* and *Ulex gallii*) and four of the six relevés contained 3 or more bryophyte and/or crustose lichen species. Bryophyte species recorded include *Calliergonella cuspidata, Hylocomium splendens, Hypnum jutlandicum, Pleurozium schreberi, Pseudoscleropodium purum, Racomitrium fasciculare, Rhytidiadelphus squarrosus, Sphagnum denticulatum, Sphagnum fallax s. fallax, Sphagnum palustre* and *Thuidium tamariscinum.* The percentage cover of positive indicator species was greater than 50% in all relevés recorded and there was evidence of mature or senescing *Calluna vulgaris* in all relevés. The percentage cover of *Pteridium aquilinum* was less than 10% and weedy negative indicator species were absent of remained below 1% cover in all relevés. All relevés also have <10% cover of disturbed ground or bare soil. Two of the relevés failed the structure and function condition assessment on the criterion of percentage cover dwarf shrub composed of *Ulex gallii.* One of the relevés passed all 14 criteria of the structure and function condition assessment. Other relevés recorded in this area failed on between one and two of the 14 criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); percentage cover of positive indicator species (≥50%); and proportion of dwarf shrub cover composed of *Myrica gale, Salix repens, Ulex gallii* collectively <50% (Perrin *et al.*, 2014).

Refer to Appendix A.8.1 of the updated EIAR for more detail on the methodology. Refer to relevé codes 2623_R1, 2622_R1, 2612_R1, 2611_R1, 2618_R2 and 2617_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species lists and data.

2.3.5 Ballard East - Ch. 3+450 to Ch. 4+050

There are nine donor sites within this area, 4030.D32 to 4030.D38, and 4030.nD60, consisting of c.0.13ha. See Figure 3 for locations. Botanical and other relevant environmental data (as per the 4030 structureand function condition assessment described in Perrin *et al.*, 2014) was collected attwo relevés located c.240m north-east of the nearest area of 4030 habitat to be lostand c.21m west of the nearest area of 4030 habitat to be lost on the 4 September 2014 and the 9 September 2015 respectively. Data collected at these relevés is considered to be representative of the habitat to be lost in this general location. Boththese relevés were located within a mosaic of habitats which included Acid grassland (GS3), Dry siliceous rock (ER1) and Wet grassland (GS4) (as defined inFossitt 2000). A total of four (at one relevé) and two (in the second relevé) of the eight positive indicator species of this Annex I habitat were present (*i.e. Calluna vulgaris*, *Erica cinerea*, *Ulex gallii*, *Daboecia cantabrica* and *Arctostaphylos uva-ursi*). The percentage cover of these positive indicator species was greater than 60% at both relevés, while the percentage cover of dwarf shrubs was great than 25% at one of the relevés. Five bryophyte species were present at one relevé, while two were present at

the other (*i.e. Hylocomium* sp., *Sphagnum papillosum*, *Hylocomiumsplendens*, *Hypnum jutlandicum*, *Dicranum scoparium* and *Pleurozia purpurea*). No negative indicator species, non-native species or *Pteridium aquilinum* were present at either relevé. There was evidence of senescent *Calluna vulgaris* at both the relevés; however at very low percentage cover. The depth of peat varied at both relevés (*i.e.* c.5c and 10cm). There was no bare soil or rock present at either relevé.No surface water was noted. The median height of the field layer at each relevé differed (*i.e.* c.50cm to 35cm), as did the median height of the dwarf shrub layer (*i.e.* c.40cm and 30cm) and ground layer (*i.e.* c.8cm and 5cm). Both relevés passedon all 14 criteria of the structure and function condition assessment (Perrin *et al.*, 2014). Refer to relevé codes EC18 R3 and EC18 R7 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

Seven additional relevés were carried out in 2019 within the area of 4030 habitat to be lost in this section. Between two and three of the eight positive indicator species for 4030 were recorded in all relevés (i.e. *Calluna vulgaris, Daboecia cantabrica, Erica cinerea* and *Ulex gallii*). Five of the seven relevés recorded three or more bryophyte species present. Species recorded include *Hylocomium splendens, Hypnum jutlandicum, Hypnum resupinatum, Pseudoscleropodium purum, Radula complanata, Rhytidiadelphus squarrosus, Rhytidiadelphus triquetrus* and *Thuidium tamariscinum.* No negative indicator species were recorded and the percentage cover of *Pteridium aquilinum* was less than 10% in all relevés recorded. There was evidence of senescent *Calluna vulgaris* at six of the seven relevés. All relevés also have <10% cover of disturbed ground or bare soil. One relevé failed the structure and function condition assessment on the criterion of percentage cover dwarf shrub composed of *Ulex gallii.* Two of the relevés passed all 14 criteria of the structure and function condition assessment. Other relevés recorded in this area failed on between one and two of the 14 criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); percentage cover of positive indicator species (≥50%); proportion of dwarf shrub cover composed of *Myrica gale, Salix repens, Ulex gallii* collectively <50%; percentage cover of *Pteridium aquilinum* (<10%); percentage cover of *Juncus effusus* (<10%); and cover of scattered native trees and scrub (<20%) (Perrin *et al.*, 2014).

Refer to Appendix A.8.1 of the updated EIAR for more detail on the methodology. Refer to relevé codes 2433_R1, 2432_R1, 2435_R1, 2436_R1, 2431_R1, 2434_R1 and 1065_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species lists and data.

2.3.6 Area near the Ballymoneen Road - Ch. 4+750 to Ch.5+100

There are seven donor sites within this area, 4030.D40, 4030.D42, 4030.D43, and 4030.nD61 to 4030.nD64, consisting of c.0.99 ha. See Figure 4 for locations. Two of these sites form a mosaic with 4010 habitat. Botanical and other relevant environmental data as per the 4030 structure and function condition assessment described in Perrin *et al.*, 2014) was collected at one relevé located c.600m north-east of the nearest area of 4030 habitat to be lost on the 28 September 2014. Data collected at this relevé is considered to be representative of the habitat to be lost in this general location. A total of two of thepositive indicator species were present (*i.e. Calluna vulgaris* and *Erica cinerea*). The percentage cover of these positive indicator species was less than 50% at the relevé, as was the percentage cover of dwarf shrubs. Six bryophyte species were present at the relevé (*i.e. Hylocomium* sp., *Sphagnum papillosum*, *Hylocomium splendens*, *Hypnum jutlandicum*, *Dicranum scoparium* and *Pleuroziapurpurea*). No negative indicator species or *Pteridium aquilinum* were present, however non-native species were. There was evidence of senescent *Calluna vulgaris* at the relevé; however at very low percentage cover. Bare ground and rock were noted; however the low percentage cover of disturbed bare ground was relatively low. No surface water was noted. The median heights of the field layer and dwarf shrub layer were c.15cm, while the mean height of the ground layer was c.3cm. The relevé passed on 11 of the 14 criteria of the structure and functioncondition assessment (Perrin *et al.*, 2014). Refer to relevé code EC20 R4 presentedin Appendix A.8.19 of the EIA Report for an associated species list.

Seven additional relevés were carried out in 2019 within the area of 4030 habitat to be lost in this section. All seven relevés had between two and four of the eight positive indicator species for the 4030 habitat (*i.e. Calluna vulgaris, Daboecia cantabrica, Erica cinerea* and *Ulex gallii*). However, the percentage cover of these positive indicator species was less than 50% in two of the relevés. Only two of the relevés recorded three bryophyte species (species recorded included *Hypnum jutlandicum, Sphagnum papillosum* and *Sphagnum subnitens*). No negative indicator species were recorded and the percentage cover of *Pteridium aquilinum* was less than 10% in all relevés recorded. There was evidence of senescent *Calluna vulgaris* at five of the seven relevés. All relevés also have <10% cover of disturbed ground or bare soil. One of the relevés recorded in this area passed all 14 criteria of the structure and function condition assessment. Relevés

recorded failed on between one and three of the 14 criteria, *i.e.* failing on number of bryophytesor non-crustose lichen species present (≥3); percentage cover of positive indicator species (≥50%); and cover of scattered native trees and scrub (<20%) (Perrin *et al.*, 2014).

Refer to Appendix A.8.1 of the updated EIAR for more detail on the methodology. Refer to relevé codes 1188_R1, 1187_R2, 5073_R1, 5890_R6, 5890_R3, 1203_R1 and 1198_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species lists.

2.4 Description of Other Peatland Donor Sites

There are 17 isolated polygons of Annex I habitat 4010 (Northern Atlantic wet heaths with *Erica tetralix*), two polygons of a mosaic of Annex I habitats 4010/4030/*7130 (Northern Atlantic wet heaths/Dry heaths/Blanket bog (active)), 1 polygon of a mosaic of 4010/4030/6410 (Northern Atlantic wet heaths/Dry heaths/*Molinia* meadows) and one isolated polygon of Annex I habitat *7130 (Blanket bog (active)) which will be removed to facilitate the construction of the proposed N6 GCRR (see Figures 1 to 6 for locations) and which contain soils/peat which will be suitable for use at 4030 receptor sites. All of these areas arelocated west of the River Corrib between Ch. 0+900 to Ch. 7+800 and outside of any designated areas for nature conservation. These sites were classified as Annex I habitat due to the presence of a sufficient number of positive indicator species (after Perrin *et al.*, 2014) and range in area from c.0.004ha to c.0.64ha.

Three of these sites form a mosaic with three other Annex I habitats (*i.e.* with 4030 dry heath, 6410 Molinia meadows and blanket bog [*7130]); however the dominant habitat present is 4010 wet heath (see Figures 1 and 3 for locations). The *7130 blanket bog site forms a mosaic with dry heath (see Figure 2 for location). These three 4010 dominated mosaic donor sites are located: c.85m and 90m west of 4030.nR22 on Figure 1; and directly south of 4030.R11 on Figure 3. The *7130 dominated mosaic donor site comprises an area of 0.01 ha and is located directly adjacent to 4030 donor sites 4030.nD54, 4030.D16 and 4030.D17 on Figure 2. In the case of some of the areas of 4010, the following additional habitats are also present (see Annex 2 of this Appendix for more specific details per donor site):

- Wet grassland (GS4)
- Dry heath (HH1)
- Dense bracken (HD1)
- Poor fen and flush (PF2)
- Scrub (WS1)
- Exposed siliceous rock (ER1)

2.5 Methodology for Compensatory Habitat Creation

2.5.1 Selection of Receptor Sites

The identification and selection of compensatory habitat receptor sites, where 4030 habitat will be created, was based on a desk study conducted in July 2017 and site visits conducted during the period of 2014 to 2017 as part of the environmental surveys undertaken to inform the Environmental Impact Assessment for the proposed N6 GCRR. Subsequent surveys were undertaken at the donor and receptor sites in 2019 and 2023 to provide additional support and aid the verification of the baseline habitat classifications, and to identify any subsequent changes in habitats present (Refer to Appendix A.8.1 of the updated EIAR for more detail). These sites were selected, in consultation with the design team, as suitable receptor sites based on a review of the following:

- Site data collected as part of habitat surveys undertaken in 2014, 2015, 2017, 2019 and 2023 at the locations of the 50 4030 donor sites, and the 22 other peatland donor sites, and at the 17 receptor sites. Detailed relevéswere carried out within 60 of these donor sites and in close proximity (*i.e.* c.472m- 25m) to the other 12 donor sites within the same habitat type. Relevé information collected in these areas is considered to be representative and comparable to the sites themselves. The following information was collected:

- the percentage cover of positive indicator plant species present
- depth of peat (cm)
- median vegetation height (cm)
- presence of soil, rock, surface water features and plant litter
- other botanical and environmental factors considered as part of condition assessment criteria for this habitat type (after Perrin *et al.* 2014)

- Hydrological and hydrogeological data collected to inform the environmentalstudies for the proposed N6 GCRR
- Soils and Geology data collected to inform the environmental studies for theproposed N6 GCRR

Other information relied upon as part of the selection process included the following information sources:

- Ordnance Survey of Ireland mapping and aerial photography available fromwww.osi.ie
- Online data available on European sites as held by the National Parks andWildlife Service (NPWS) from www.npws.ie
- Online data available from the National Biodiversity Data Centre mappingservice (http://maps.biodiversityireland.ie/#/Map)
- Information on land-use zoning from the online mapping of the Department ofthe Environment, Community and Local Governmenthttp://www.myplan.ie/en/index.html
- Information on water quality in the area available from www.epa.ie
- Information on soils, geology and hydrogeology in the area available from www.gsi.ie
- Information on the location, nature and design of the Project supplied by the design team
- Information on the status of EU protected habitats in Ireland (National Parks &Wildlife Service, 2013)

A total of 17 compensatory habitat receptor sites for the creation of 4030 were selected (see Figure 1 to 5 for locations). A full description of the baseline conditionsat these sites is provided below. These receptor sites are located within the Assessment Boundary[3], adjacent or in close proximity to the footprint of the proposed N6 GCRR. Based on a review of information collected (from thesources described above and with reference to guidance provided in Section 1.1), these receptor sites were considered suitable for the following reasons:

- The likely presence of suitable soil pH, structure, fertility and sub-soil type necessary for the establishment of Dry heath
- Presence of other physical characteristics at the receptor site necessary for the establishment of 4030 such as suitable geology and/or hydrological features (*i.e.*undulating micro topography with rocky outcrop features, on well-drained mineral soils or shallow peats)
- Presence of similar plant species composition within or in close proximity to the receptor site to that being compensated for at the donor site (*i.e.* at five of the receptor sites, nRS.2, nRS.22, RS.10, RS.11, and RS.7, there is 4030 and/or 4010 habitats locateddirectly adjacent)
- Relatively short distance between some donor and receptor sites, where possible

[3] The extents of the lands to be compulsory acquired for the construction and operation of the proposed N6 GCRR is referred to as the Assessment Boundary.

- Total area of the receptor sites (*i.e.* 4.08ha) in the context of the total area to be lost of 4030 habitat (*i.e.* 1.76ha)[4], wet heath [4010] (*i.e.* c.2.54ha). blanket bog [*7130] (i.e. 0.01ha); and, lands containing a mosaic of these two habitats (*i.e.* c.1.42ha)
- Existing or future access to the site that will facilitate machinery, required for the proposed compensatory measures or management activities, entering or exiting the site

2.5.1.1 Receptor Site 4030.R1 - Ch. 0+000 to Ch. 0+100

This receptor site consisting of c.0.09ha was surveyed on the 3 September 2015 and two habitat types (as defined by Fossitt 2000) were identified within its boundaries, i.e. Wet grassland (GS4) and Dense bracken (HD1). See Figure 1 for location. The Wet grassland was described as rank with ruderals and disturbance indicators. The habitats present at this receptor site were confirmed in subsequent surveys in 2019 and 2023. This area has also been identified as a Material Deposition Area[5] (*i.e.* DA01) (refer to Figures 7.301 to 7.302 and Chapter 7, Construction Activities, Chapter 9, Soils and Geology and Chapter 11, Hydrology of the updated EIAR for further details.

2.5.1.2 Receptor Site 4030.nR2 – Ch. 0+200 to Ch. 0+350

This receptor site consisting of c.0.12ha was surveyed on the 3 September 2015 and four habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Dense bracken (HD1), Scrub (WS1), Recolonising bare ground (ED3) and a relatively small patch of Dry siliceous heath (HH1).The Dense bracken and Scrub were also found in a mosaicwithin the site and lands immediately adjacent. Additional habitats were identified at this receptor site following the 2019 habitat surveys. Wet grassland (GS4), Dry meadows and grassy verges (GS2) and Exposed siliceous rock (ER1) were identified occurring in the receptor site, with Recolonising bare ground (ED3) no longer being present. The northern boundary of the site borders the donor site 4030.nD48. See Figure 1 for location.

2.5.1.3 Receptor Site 4030.R3 – Ch. 0+350 to Ch. 0+400

This receptor site consisting of c.0.25ha was surveyed on the 3 September 2015 and three habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Dense bracken (HD1), Scrub (WS1) and Exposed siliceous rock (ER1). The Dense bracken, Scrub and Exposed siliceous rock were found in a mosaic. Following the 2019 habitat surveys, Wet grassland (GS4) habitat, was also identified at this site, in a mosaic with Dense bracken and Scrub. See Figure 1 for location. This site is also a Material Deposition Area (*i.e.*DA03).

2.5.1.4 Receptor Site 4030.nR4 – Ch. 0+450 to 0+550

This receptor site consisting of c. 0.19ha was surveyed on 10 September 2014 andfour habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Dense bracken (HD1), Scrub (WS1), Acid grassland (GS3) and Wet grassland (GS4). Both the dense bracken and the scrub and the Wet grassland and Acid grassland were found in mosaics. Habitat surveys in 2023 found that Wet grassland (GS4) was no longer present at this receptor site. See Figure 1 for location.

[4] "*Replacement ratios of compensatory habitat greater than one-to-one are frequently appropriate because of the uncertainty inherent in compensation, particularly in cases which require ecological restoration, habitat creation or translocation of species or habitats. The scientific basis for deriving appropriate ratios is not exact and will vary depending on the habitat or species concerned. Increased replacement ratios can also help take account of the time lag in delivering compensation and regaining the same maturity, complexity and diversity of habitats and the full complement of associated species.*" (CIEEM, 2018).

[5] These are areas within the proposed development boundary where excavated material suitable for reuse will be deposited, areas where lands have been severed, areas within slip road embankments, localised depressions around attenuation and infiltration ponds, and areas within Lackagh Quarry with slope stability concerns of the existing quarry walls.

2.5.1.5 Receptor Site 4030.nR22 – Ch.0+900 to Ch. 1+000

This receptor site consisting of c.0.42ha was surveyed in 2023 and four habitat types(as defined in Fossitt 2000) was identified occurring as a mosaic within its boundaries, *i.e.* Dense bracken (HD1), Scrub (WS1), Acid grassland (GS3) and Wet grassland (GS4) (see Annex 2 of this appendix). See Figure 1 for location.

2.5.1.6 Receptor Site 4030.R7 –Ch. 1+250 to Ch. 1+350

This receptor site consisting of c.0.55ha was surveyed on 9 September 2014, and two habitat types (as per Fossitt 2000) were identified, *i.e.* a mosaic of Dense bracken (HD1) and Scrub (WS1). Additional habitats were identified at this receptor site following the 2019 habitat surveys. Dense bracken (HD1), Scrub (WS1), Acid grassland (GS3), Dry meadows and grassy verges (GS2), Wet grassland (GS4), Drainage ditches (FW4), Poor fen and flush (PF2) and Dry siliceous heath (HH1) were all identified in mosaics at this site (see Annex 2 of this appendix for details). Dry siliceous heath (HH1) habitat at this receptor site corresponds to the habitat 4030, and is also the donor site nD52 (see Section 2.3.3 above). See Figure 2 for location.

2.5.1.7 Receptor Site 4030.nR8 and 4030.nR9 – Ch. 1+350 to Ch.1+500

These two receptor sites, which are separated by a proposed drain, were surveyed in September 2014, August 2015 and September 2015 and five habitat types (as perFossitt 2000) were identified, *i.e.* Acid grassland (GS3), Wet grassland (GS4), Scrub (WS1), Treeline (WL2) and Dense bracken (HD1). Additional habitats were identified at this receptor site following the 2023 habitat surveys. Dry meadows and grassy verges (GS2), Drainage ditches (FW4) and Poor fen and flush (PF2) were all identified in mosaics at this site (see Annex 2 of this appendix for details). The 4030 donor site 4030.nD55 lies directly northeast of receptor site 4030.R8. Receptor 4030.R8 consists of 0.06ha and 4030.R9 consists of 0.08ha. See Figure 2 for location. Thesesites are also a Material Deposition Area (*i.e.* DA05).

2.5.1.8 Receptor Site 4030.R10 – Ch. 1+650 to Ch. 1+950

This receptor site consisting of c.0.48ha was surveyed in September 2014 and fivehabitat types (as per Fossitt 2000) were identified, *i.e.* Dense bracken (HD1), Scrub(WS1), Wet grassland (GS4), Acid grassland (GS3) and a very small area of wet heath (HH3), which corresponds with habitat 4010. This area of 4010 forms part ofa larger 4010 (other peatland) donor site (*i.e.* 4010.D6). Additional habitats were identified at this receptor site following the 2019 habitat surveys. Dry calcareous and neutral grassland (GS1), Exposed siliceous rock (ER1) and Stone walls and other stonework (BL1) were all identified in mosaics at this site (see Annex 2 of this appendix for details). See Figure 3 for location. This is also a Material Deposition Area (*i.e.* DA06).

2.5.1.9 Receptor Site 4030. R11 –Ch. 2+900 to Ch. 3+050

This receptor site consisting of c.0.67ha was surveyed in September 2014 and fourhabitat types (as defined in Fossitt 2000) were identified within its boundaries. See Figure 3 for location. These included a mosaic of Acid grassland (GS3), Wet grassland (GS4), Scrub (WS1) and Dense bracken (HD1) and Wet grassland (GS4)and Scrub (WS1). These habitats were also identified in subsequent surveys in 2019 and 2023. The habitat 4010 was identified directly east of this site; this habitat falls within the Assessment Boundary however is proposed to beretained. This site is also a Material Deposition Area (*i.e.* DA08).

2.5.1.10 Receptor Site 4030.R12 – Ch. 3+200 to Ch. 3+350

This receptor site consisting of c.0.24ha was surveyed on the 9 September 2015 and two habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Wet grassland (GS4) and Improved agricultural grassland (GA1). These habitats were also identified in subsequent surveys in 2019 and 2023. See Figure 3 for location. This site is also a Material Deposition Area (*i.e.* DA09).

2.5.1.11 Receptor Site 4030.nR23 – Ch.3+250 to Ch. 3+350

This receptor site consisting of c.0.03ha was surveyed in 2023 and one habitat type(as defined in Fossitt 2000) was identified within its boundaries, *i.e.* Improved agricultural grassland (GA1). See Figure 3 for location.

2.5.1.12 Receptor Site 4030.R13 – Ch. 3+300 to Ch. 3+400

This receptor site consisting of c.0.07ha was surveyed on the 9 September 2015 and three habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Wet grassland (GS4), Acid grassland

(GS3) and spoil and bare ground (ED2). Additional habitats were identified at this receptor site following the 2019 habitat surveys. Scrub (WS1), Recolonising bare ground (ED3), Improved agricultural grassland (GA1) and Stone walls and other stonework (BL1) were all identified in mosaics at this site (see Annex 2 of this appendix for details). See Figure 3 for location.

2.5.1.13 Receptor Site 4030.nR15 and 4030.nR16 – Ch. 3+900 to Ch.4+100

These receptor sites, separated by a tributary of the Bearna Stream, were surveyedin September 2015 and two habitat types (as defined by Fossitt 2000) wereidentified within its boundaries, *i.e.* Wet grassland (GS4) and Acid grassland (GS3).Receptor 4030.R15 consists of 0.18ha and 4030.R16 consists of 0.30ha. Additional habitats were identified at this receptor site following the 2019 habitat surveys. Scrub (WS1), Dense bracken (HD1), Eroding/upland rivers (FW1), Drainage ditches (FW4) and Dry calcareous and neutral grassland (GS1) habitats were all identified in mosaics at this site (see Annex 2 of this appendix for details). See Figure 3 for locations. Both these sites are Material Deposition Areas (*i.e.* DA11 and DA12).

2.5.1.14 Receptor Site 4030.nR24 – Ch.5+600 to Ch. 5+650

This receptor site consisting of c.0.06ha was surveyed in 2023 and two habitat types (as defined in Fossitt 2000) was identified occurring as a mosaic within its boundaries, *i.e.* Improved agricultural grassland (GA1) and Stone walls and other stonework (BL1). See Figure 4 for location.

2.5.1.15 Receptor Site 4030.R19 –Ch. 5+850 to Ch. 6+050

This receptor site consisting of c.0.43ha was surveyed in August 2014 and four habitat types (as defined in Fossitt 2000) were identified within its boundaries, *i.e.*Scrub (WS1), Acid grassland (GS3), Wet grassland (GS4) and Improved agricultural grassland (GA1). Additional habitats were identified at this receptor site following the 2019 habitat surveys. Stone walls and other stonework (BL1), Dense bracken (HD1), Exposed siliceous rock (ER1) and Dry meadows and grassy verges (GS2) habitats were all identified in mosaics at this site (see Annex 2 of this appendix for details). See Figure 5 for location. This site is also a Material Deposition Area (*i.e.* DA15).

2.5.2 Pre-Compensatory Site Preparation Works

2.5.2.1 Ecology Site Management Plans

Prior to compensatory works commencing, Ecology Site Management Plans will be finalised by the Contractor in combination with the Project Ecologist and/or ECoW with reference to the construction programme, which may influence the timing and co-ordination of these works and the requirement for storage of soils and/or turves, and issued to the team involved in the compensatory works. The finalised plans will include site specific method statements outlining step-by-step actions (as per the pre-compensatory measures described in Section 2.5.2 and compensatory measures described in Section 2.5.3) for the Contractor to implementwithin a specified timescale, under the supervision and advice of the Project Ecologist and/or ECoW. It will also include a check-list of conditions (as per the monitoring criteria set out in Perrin *et al.*, 2014, as described in Section 2.7) to be assessed by a suitably qualified and experienced ecologist at the receptor sites during the pre-compensation, during and post-compensation monitoring. The finalisation of the Ecology Site Management Plans by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, as these plans are merely providing more site specific detail and methodological steps to the principles and proposals already outlined in this CHMP.

2.5.2.2 Non-native Invasive Plant Species and Biosecurity

As set out in the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the updated EIAR, a non-native invasive plant species survey willbe undertaken immediately in advance of works commencing to inform the finalisation of CEMP. The biosecurity measures outlined in the CEMP will be implemented at both the donor and receptor sites, where applicable, in order to avoid the accidental spread of potentially harmful plant or animal species betweensites. The CEMP also includes: measures that the Contractor will implement in order to avoid spreading invasive species during soil movement; measures to treat invasive plant species prior to construction/compensation works commencing; and,site hygiene measures to be implemented to prevent further spread of non-native invasive plant species.

2.5.2.3 *Temporary Fencing*

Where applicable, temporary fencing and associated signage will be erected at boththe donor and receptor sites for the duration of the construction. This will minimiseany potential disturbance to adjacent sensitive habitats and/or hydrological featureswithin both the donor and receptor sites from either encroachment into the habitat or damage. Sensitive habitats identified include: Annex I wet heath [4010]; and, a mosaic of 4030 and 4010 Annex I habitats (see Figure 8.22.1 to 8.22.15 and Figure 8.24.1 to 8.24.15 of the updated EIAR for location maps of these sensitive habitats).

2.5.2.4 *Material Deposition Areas*

In the case of the receptor sites that are also Material Deposition Areas (MDA), thefollowing measures will also be implemented to ensure the successful creation of 4030. The placement of a compatible layer of material, such as a granular materialwith a high permeability, on the slopes of the MDA, to allow water to freely drain and to provide slope and surface stability. On top of the granular layer, intact habitat turves may be placed (as described in Section 2.4.3). The root depth for some heathland plants may extend up to 500mm and therefore there may be interaction between the root zone of the dry heath habitat and the core of the MDA area. It can be confirmed that the pH of the top 400mm layer of the MDA material (where it directly underlies areas proposed for dry heath habitat creation) will be below 6.5. The habitat layer will include a minimum 100mm depth of translocated soil/peat depth and/or turves. Therefore, there will be a minimum of 500mm depth of material with a pH compatible with dry heath habitat. See Plate 1 below for an example illustration of granular layer of the side slope of a MDA in the context of where the intact turves would be placed and Plate 2 for a typical cross section of MDAs with dry heath. Details of MDA sites on top of which dry heath habitat will be created are outlined Table 1.

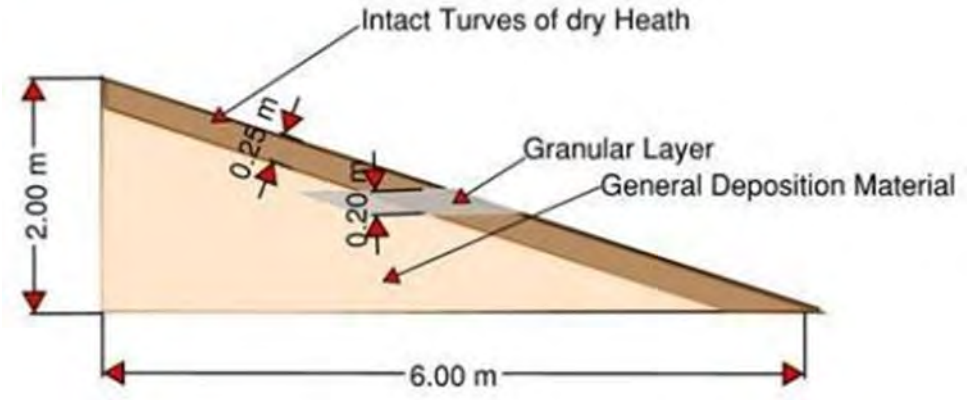

Plate 1 Example illustration of MDA side slope

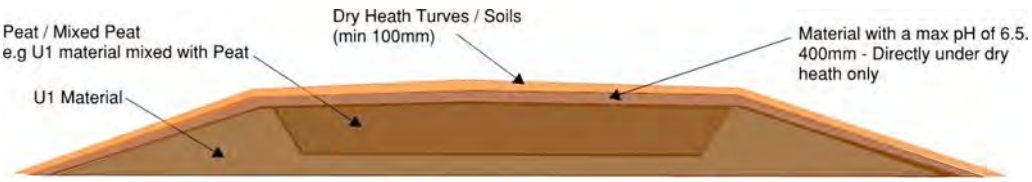

Plate 2 Example illustration of a typical cross section of MDA with Dry Heath

Table 1 Details of the MDA sites on top of which dry heath habitat will be created

MDA Reference Number	Dry Heath Receptor Site Reference Code	Material Proposed for Build-up of the MDA
DA01	4030.R1	Peat with U1 bunds
DA03	4030.R3	Peat with U1 bunds

MDA Reference Number	Dry Heath Receptor Site Reference Code	Material Proposed for Build-up of the MDA
DA05	4030.nR8 and 4030.nR9	U1 only (i.e. no peat) As noted in Appendix A.9.3 of the updated EIAR, there will be a restriction on the type of U1 material which may be placed in this MDA. This restriction is to prevent impact on local peatland habitat in this location by restricting the fill material to only that which is derived from native, or pH compatible, materials.
DA06	4030.R10	Peat with U1 bunds
DA08	4030.R11	Peat with U1 bunds
DA09	4030.R12	Peat with U1 bunds
DA11	4030.nR16	Peat with U1 bunds
DA12	4030.nR15	Peat with U1 bunds
DA15	4030.R19	Peat with U1 bunds

2.5.2.5 Soil Preparation at the Receptor Site

The soil preparation technique(s) outlined below will be implemented at the receptor sites either alone or in-combination, as decided upon on a site-by-site basisby the Contractor under the supervision and advice of the Project Ecologist and/orECoW. In most cases, it may be recommended that these techniques are implemented in-combination in order to increase the likelihood of success of 4030 habitat creation (Hawley *et al.*, 2008). Soil analysis tests to assess the pH and nutrient status of a receptor site will need to be carried out prior to the implementation of the stie specific method statements as these factors are essentialin determining which technique(s) should be employed at a site (Hawley *et al.*, 2008and Farrell, 2008).

Surface Vegetation Management and Removal Techniques

At some receptor sites, certain undesirable herbaceous species present (such as *Pteridium aquilinum*, *Molinia caerulea* and *Deschampsia* species) may outcompeteand therefore hinder the growth and establishment of the target ericaceous vegetation (Hawley *et al.*, 2008). At such receptor sites, it will be necessary to cut and remove these undesirable species, in-combination with the soil stripping method described below, in order to prepare the site prior to implementation of thecompensatory measures. It is important that all cut material is removed from the receptor site and not left on the ground as failure to do so may result in the accumulation of nutrients at the site, which would provide suitable conditions for more competitive species to grow rather than the desired ericaceous species. Failure to remove cut material may also result in the shading of the desirable seedlings (Hawley *et al.*, 2008). The methods employed to remove cut material will vary per site, as dependent on its size and topography. With regards to *Pteridium aquilinum*,it may be controlled by cutting and/or crushing the growing fronds, resulting in thegradual starvation of the rhizomes and death of the plant. Bracken cutting should be targeted at mature fronds, which should be cut twice a year, *i.e.* in mid-June and again six weeks later (Scottish Natural Heritage, 2018). At some receptor sites, it may be deemed necessary to use herbicides to control and/or eliminatethe presence of *Pteridium aquilinum*, especially in areas severely infested with thisspecies. Following treatment, the accumulated litter will need to be removed from the site (Hawley *et al.*, 2008).

Soil Acidity Amelioration Techniques

At receptor sites where the past land use was agricultural in nature, it is important that measures to manipulate the soil's acidity (*i.e.* adding sulphur to the soil to lowerpH) and nutrient status (*i.e.* soil stripping to remove nutrients) are employed in- combination in order to create suitable soil conditions. This is essential for the success of the re-creation of 4030 at these particular receptor sites where low pH and low nutrient soils are required (Hawley *et al.*, 2008 and Diaz *et al.*, 2008). At sites were the soil pH is high (as identified from the results of the soil analysis test),elemental sulphur may be added to the soil following initial vegetation clearance and topsoil removal to reduce the pH to suitable acidic conditions for 4030 re- creation (Davis *et al.,* 2015; Hawley *et al.*, 2008; Tibbett *et al.,* 2019). Considering the existing habitats at the receptor

sites(as described in section 3.1), it is considered unlikely that this will be required as the soil conditions at the vast majority of these sites are more than likely nutrient- poor.

Soil Stripping

Topsoil will need to be removed from receptor sites where the soil fertility has beenidentified as being unsuitably high for the re-creation of 4030 (*i.e.* at sites where the past land use was agricultural in nature). This action will reduce the presence ofnutrients (in particular phosphate) that result in high soil fertility and will in turn result in a reduction in competitive grasses, which may be present in the existing seed bank at the receptor site and would thrive in such high soil fertility.

The removal involves stripping the topsoil from the site up to a maximum depth of *c.*25cm (Diaz *et al.*, 2008 and Farrell, 2008). These works must be undertaken during dry weather conditions under the supervision of the Project Ecologist and/orEcoW. Ground compaction of the sub-soil by machinery will be avoided as it mayimpede the rates of establishment of desired species following implementation of the compensatory measures. Prior to translocation of turves and soil, it may be necessary to lightly cultivate the subsoil at the receptor site using a rotovator machine to relieve any compaction or surface capping (Pywell *et al.*, 1995). An uneven, non-compacted bed is desired for a higher rate of heathland vegetation establishment (Hawley *et al.*, 2008).

Surface and below-ground vegetation (trees and shrubs) removal techniques

At receptor sites where there are undesirable woody species, it may be necessary tocut them down to ground-level and spot-treat the remaining stumps with suitable herbicide (Hawley *et al.*, 2008). All associated vegetation will need to be removedfrom the receptor site.

2.5.3 Compensatory Measures

The three different compensatory measures described below outline how to re- create 4030 habitat within the 17 compensatory habitat receptor sites. More than likely these measures will be implemented in combination with one another, as to be determined on a site-by-site basis by the Contractor under the supervision and advice of the Project Ecologist and/or EcoW. The timing and duration of these works will depend on the progress of the construction of the proposed N6 GCRR, requirements for access and weather conditions. It should be noted that the process of habitat creation can take several years (Morris *et al.*, 2006 and Farrell, 2008) and that appropriate adaptive management of these sites (as outlinedin Sections 2.6 and 2.7) may be required to ensure success.

2.5.3.1 Translocation of Turves

Translocation of the heath habitat is considered to be the most successful restorationand re-creation treatment in the long-term as it results in the desired plant communities of the targeted habitat becoming quickly established (Pywell *et al.*, 2011) and the translocation of turves and soil/peat will be the principal method of habitat translocation for dry heath for the proposed N6 GCRR. Translocation involves the removal of intact turves (*i.e.* the vegetated sod- peat), soil and/or plant species from the impacted donor site to the new receptor orcompensation site (Iuell *et al.*, 2003). Following site preparation, intact turves of existing 4030 habitat (*i.e.* c.10-25cm in depth, depending on the depth of peat at the individual donor sites) will be carefully removed from the donor sites using a suitable excavator (*i.e.* with adequate capacity to carefully remove and translocate the intact turves) during dry weather conditions and moved to the receptor site. If necessary, specially designed digger buckets will be used for this purpose (as was successfully employed on the Corrib Onshore Pipeline project). Low ground pressure vehicles will be used for turve removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary, operating on bog mats. This will be carried out at the start of the vegetation growing season (i.e. spring) to encourage rapid establishment of plant growth prior to the winter season. Where it is possible to translocate turves from dry heath donor sites containing *Daboecia cantabrica*, all specimens of *Daboecia cantabrica* will be located in the centre of turves to ensure their successful translocation. Each turve will be placed at a distance from one another, as determined by the size of the receptor site. These gaps will be subsequently filled in with suitable soils from thedonor sites. The turves will need to be laid out at the receptor site in such a manneras to avoid excessive movement of the excavator, which could cause damage. Thismay be achieved by arranging the turves in such a manner as to avoid excessive movement on the turves and/or subsoil, which could result in soil compaction, in turn impeding the rates and/or success of establishment of desired species.

Following site preparation, which may include the stripping of topsoil, the turves will be incorporated into the bare substrate at the receptor site. This process will need to be undertaken slowly and carefully in order maintain the integrity of the intact turves, which will contain desirable species of this habitat type such as thoseoutlined in Section 2.2. Turves will be placed end to end with no gaps. Where necessary receptor sites will be protected from erosion, and vegetation regeneration will be encouraged through the use of geocoir (on flat surface) or geojute (on sloped areas) on areas of bare soil, pinned down with 0.5m steel pegs or similar. Where translocation direct from the donor site to the receptor site cannot take place (e.g. due to construction programme constraints and/or other project commitments), it will be necessary to store turves from the donor sites for later translocation to the receptor site at the appropriate time of year.

Where direct translocation of turves to receptor sites is not possible, they will be handled and stored based on documented best practice and proven case studies for peatland turve translocation. This includes ensuring that turves are as large in size and depth as possible (e.g. 3m x 1m and to a depth of 0.3m was successfully employed on the Corrib Onshore Pipeline project). During storage, turves must not be placed on top of each other in order to avoid any compaction of soil, as this would reduce the quality of the soil and would negativelyimpact on the success of the translocation. Furthermore, placing turves end to end (i.e. with no gaps) during storage will avoid edges drying out. If necessary using silt fencing or geotextile membranes along any vertical exposed edges of turves can be used to avoid edges drying out. Storage of turves will be on a flat surface placed on top of either a geotextile membrane, on bog mats or similar. The duration of storage must be as minimal as possible. Depending on the duration of storage and prevailing weather conditions, the intact turves may require periodic watering (with rainwater) at an appropriate level in order to ensure that the plants and seeds present do not dry out and die. Careful consideration will need to be given to how often and how much watering should beapplied to the turves, and they will be monitored for the duration of storage.

In the case of some of the dry heath receptor sites the nature of the ericaceous vegetation, shallow soils and outcropping granite, may make intact turve removal difficult. In these situations, trimming the ericaceous vegetation (and retaining this cut material for use as brash and a source of seed to assist in vegetation regeneration at the receptor sites) may assist in extracting intact turves. Where turves cannot be extracted intact in these areas then the scraw (mixture of soils, root stock, seed bank etc.) will still be valuable for use as soils to be translocated to the receptor sites.

The measures set out in the Sediment, Erosion and Pollution Control Plan (SEPCP) in the CEMP in Appendix A.7.5 of the updated EIAR will be implemented for effective sediment, erosion and pollution control for the construction phase of the proposed N6 GCRR.

2.5.3.2 Translocation of Suitable Soils/Peat

Following site preparation, the heathland soils/peat (including the topsoils with or without various associated suitable vegetative matter) of the donor sites of existing4030 habitat may be scraped up and transferred together to the receptor sites in a suitable excavator. The translocation of the topsoil in-combination with the translocation of intact turves should contain a sufficient seed bank of desirable plantspecies to encourage the establishment of the desired ericaceous species and allowthe receptor site to re-vegetate, creating the habitat type (Hawley *et al.*, 2008). A minimum 100m translocated soils/turve depth will be provided at each 4030 receptor site.

In some cases it may be necessary (e.g. due to construction programme constraints and/or other project commitments), to store the soil/peat from the donor sites for later translocation to the receptor site at the appropriate time of year. Storage of soils/peat from donor sites will occur in dedicated area(s) within construction compounds for the proposed N6 GCRR west of the River Corrib, on top of a geotextile layer, no higher than 1.5m to avoid compaction. The duration of storage must be as minimal as possible. Topsoil and subsoil must be stored separately and separate to any other topsoil or soil present on-site. In order to avoid soil compaction and soil smearing, it is recommended that: soil is handled during dry conditions and not when saturated; and, after placement the soil is decompacted by ripping by ripping, which will improve drainage, aeration and rooting establishment. It should be noted that stripping and disturbance of soils may encourage the release of nutrients and in turn alter the soil fertility and promote undesirable weed species (National Roads Authority, 2006); therefore measures outlined above under the heading of surface vegetation management and removal techniques may be required. Turves from donor sites will be ‘thatched’ on top of the stored soil/peat areas to seal and protect it for the duration of the storage period.

In addition to heathland soils/peat taken from the 4030 donor sites, any additionalsoils/peat required at the receptor sites may be sourced from the other peatland donor sites located within the Assessment Boundary (see Section 2.4 formore details). The requirement for these soils at the receptor sites will be determined on a site-by-site basis by the Contractor under the supervision and advice of the Project Ecologist and/or EcoW. The existing habitats at these donor sites are comprised of 4010 and mosaics of 4010/4030; therefore they will containsuitable soils (*i.e.* peat) for the re-creation of 4030. As with the turve translocation, low ground pressure vehicles will be used for soil removal, especially for wetter donor sites such as the 4010 and *7130 donor sites, and if necessary operating on bog mats. All wet peaty soils (e.g. this will be likely from the 4010 and *7130 donor sites) will be transported in sealed trucks to avoid loss of wet peat in transit.

The total area of 4030 donor sites is c.1.99ha, while the total area of all other peatland donor sites is c.1.98ha; therefore the overall area of peatland donor sites with suitable available soils for 4030 re-creation is c.3.97ha. Following a review of the depths of peat at sites located within or near to donor sites as recorded as part of ground investigation works, depths of peat recorded at relevés surveyed as part of habitat surveys, and knowledge regarding the habitat types of Dry heath and Wet heath, it is considered that sufficient soils for the creation of c.4.08ha of 4030 maybe sourced from within the proposed landtake for the proposed N6 GCRR while reducing the risk of peat erosion in translocation sites.

2.5.3.3 Harvesting and Spread of Heather Clippings

Clippings with seed capsules of the desired ericaceous species *Calluna vulgaris* and*Erica cinerea* may be harvested from within the 4030 donor sites and the other potential peatland donor sites located within the Assessment Boundary in autumn and winter time (Pywell *et al.*, 1995). These clippings must be spread on bare peat translocated from the donor sites (and not on the areas where intact turves have been translocated to). The amount of clippings spread is recommended to be twice the area they must cover (Diaz *et al.*, 2008). The depth of the harvested shoots applied to the substrate was found to have a critical effect on heather seedling germination and recruitment at the small scale (Pywell *et al.*, 1995). Similarly, seeds from mature plants of *Daboecia cantabrica* will be collected from the sites within the Assessment Boundary where it has been recorded, from August/September onwards (in a year prior to construction works commencing), during warm, dry conditions. Seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites. *Daboecia cantabrica* is typical of Connemara dry heath habitat and is therefore of local/regional value. Where it is possible to translocate turves from dry heath donor sites containing *Daboecia cantabrica*, all specimens of *Daboecia cantabrica* will be located in the centre of turves to ensure their successful translocation.

Where seeds are collected from donor sites prior to turves/soil being removed, they will be collected a minimum of one summer/autumn season prior to construction works commencing, during warm, dry conditions. Until such time as they are required to be planted at the receptor sites, seeds will be stored in suitable conditions to ensure their survival. These will be used for inclusion in the seed mix for planting later at the appropriate time of year at dry heath receptor sites. If necessary, additional dry heath native seed material will also be used from a reputable supplier such as http://www.wildflowers.ie/.

2.6 Management

Site specific details (*i.e.* with regards to whether or not the physical and/or chemicalcontrol of encroaching *Pteridium aquilinum* is required) on both the short-term andlong-term management of the newly created habitat will be outlined in the finalised Ecology Site Management Plan, as determined by the Project Ecologist and/or EcoW. Management of the newly created habitat is necessary for its success, as it will prevent the domination of the sward by undesirable species (*e.g. Pteridium aquilinum*), which have the ability to out compete the desired heath species.

Following the implementation of the chosen compensatory measure(s), a stock- proof protective fence will be erected to protect the receptor site from disturbance such as unwanted grazing and/or trampling. At sites where *Pteridium aquilinum* isencroaching on the newly created habitat, it may be necessary to cut it back two tothree times a year (Hawley *et al.*, 2008), as determined by a suitably qualified and experienced ecologist on a site-by-site basis. All cuttings will need to be removed from the site to avoid alterations to the existing soil conditions. It may be deemed necessary to use selective herbicides to eliminate the presence and

potential spread of *Pteridium aquilinum*, especially in areas severely infested with this species (Hawley *et al.*, 2008).

2.7 Monitoring

Monitoring of receptor sites will be carried out by a suitably qualified and experienced ecologist pre-compensation, during and post-compensation in order to:

- firstly, ensure that potential issues that may deter the success of the compensation are identified and addressed through adaptive management measures
- secondly, to determine the overall success of the habitat compensation process

Monitoring will be undertaken immediately after the turves are placed in the receptor sites, and will be undertaken every three weeks and after a heavy rainfall event until such time as the Dry heath is established, with an adaptive corrective plan put in place if evidence shows that it is not successful. Adaptive management measures will be targeted to address the specific issues identified by the monitoring and may be varied. For example they could include, translocation of additional turves and/or heather clippings to replace those that have failed. If, for example, grass species dominance is an issue identified during the monitoring process, removal of grass vegetation and the top layer of soil can be used to encourage re-establishment of heather seedlings, either from the existing seed bank or from additional heather clippings (Hitchcock, 2018). Adaptive management measures, implemented in response to monitoring results, will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, providing these measures either fall within the scope of proposals already provided for in this CHMP, or involve impacts of equal of lesser significance to those provided for in this CHMP and assessed in the updated EIAR and updated NIS.

The finalised Ecology Site Management Plans, which will be prepared on a site-by-site basis, will include a check-list of conditions to be assessed by a suitably qualified and experienced ecologist at the receptor sites during pre-compensation, during the compensation works, and as part of the post-compensation monitoring. Conditions assessed in both the short and long-term will be in reference to the monitoring criteria set out in Perrin *et al.*, 2014 for this Annex I habitat and will beused to determine the extent of successful 4030 establishment of the equivalent value of the areas being compensated for. These conditions include the following as a minimum:

- Information on vegetation composition, *i.e.* number of established and mature positive indicator species and bryophyte species present, proportions of shrub cover, cover ofnegative indicator species, non-native invasive plant species, scattered native trees and scrub, *Pteridium aquilinum* and *Juncus effusu*;
- Information on vegetation structure, *i.e.* senescent proportion of *Calluna vulgaris*, level of grazing, signs of burning and growth of *Calluna vulgaris*across the receptor site
- Information on physical structure*, i.e.* cover of disturbed ground

The intervals and duration for the pre- and during compensation works monitoringprogramme, will be decided upon by the Project Ecologist and/or ECoW and is likely to depend upon the speed of habitat establishment and stabilisation.

The post-construction monitoring programme will require annual monitoring, commencing on the year of habitat creation, for a minimum period of five years, with a review by a suitably qualified and experienced ecologist at the end of that period undertaken to determine whether the monitoring period needs to be extended further, if for example it is viewed that the habitat has not stabilised or become fully established by that time. Any extension to the monitoring period will need toconsider whether on-going monitoring should be at annual or longer intervals e.g. +3 years post-creation, +6 years post-creation etc. The results of all monitoring will be made available to the NPWS.

In a ‘worst-case’ scenario, it would take between 15 to 25 years for positive indicator species of the European dry heath [4030] compensatory habitat to establish and mature at receptor sites and reach an equivalent ecological value to the donor sites. This does not affect the conclusions set out in the updated EIAR on the residual impact on this habitat, *i.e.* that post-compensation the loss of 4030 will not be likely to result in a significant residual effect, at any geographic scale, over the long- term (*i.e.* >15-25 years).

The most significant time constraint, with respect to achieving the equivalent value of the areas of 4030 being lost, is the total number of years it will take for the positive indicator species of 4030 habitat, in particular *Calluna vulgaris*, to establish and mature at the receptor sites. The various compensatory measures outlined above can be implemented in isolation or in combination to create 4030 habitat. Whilst it is likely that a combination of compensatory measures will be undertaken at the receptor sites (*i.e.* the translocation of intact turves, soils and/or plant species and the spreading of mature clippings of *Calluna vulgaris* and *Erica cinerea*), a precautionary approach has been adopted and, as such, the number of years considered is establishment from seed rather than from the translocation of intact turves. In the case of the translocation of turves, the number of years required to achieve an equivalent value to that of the habitat being lost will be less when compared to the other compensatory measures, as the turves already contain established and mature positive 4030 indicator species.

There are three key stages in the developmental life cycle of the main species of 4030, *Calluna vulgaris*, i.e. pioneer, building and maturation. The pioneer stage (i.e. from the development and establishment of a seedling to when the plant has developed into a fully formed bush) typically lasts between five to six years. Following on from the pioneer stage is the building stage. This typically occurs when the plant is approximately 15 years old. The final stage is the mature phase, which typically occurs when the plant is approximately 25 years old (Webb, N.R., 1986). In the context of restoring 4030 habitat to a favourable condition, full recovery of a structurally diverse heathland may occur within 15 years after the management method of turf-stripping is complete (Shellswell *et al.*, 2016) and will occur within 25 years. This method involves the removal of undesirable vegetation and topsoil from the site and would result in conditions that are comparable to the translocation of soils as the plant species will be establishing from seed. In a study conducted in Denmark, it was noted that heathland habitat had successfully established, using the method of natural succession, 22 years after the cessation of farming at an acid grassland site and that the abundance of Calluna vulgaris notably increased the vegetation after ten years of cessation. This species however was not dominant after 22 years (Degn, 2001).

2.8 Conclusions

The measures outlined in this section will compensate for the significant residual effect on 4030 habitat by ensuring that there will be no net permanent loss of this habitat type as a consequence of the proposed N6 GCRR and a biodiversitygain for peatland habitats. A total area of c.4.08ha (c.129% of the combined losses of: 4030 and mosaics containing 4030) will be created as part of the proposedcompensatory works. The steps outlined in this section are presented below as a flow chart.

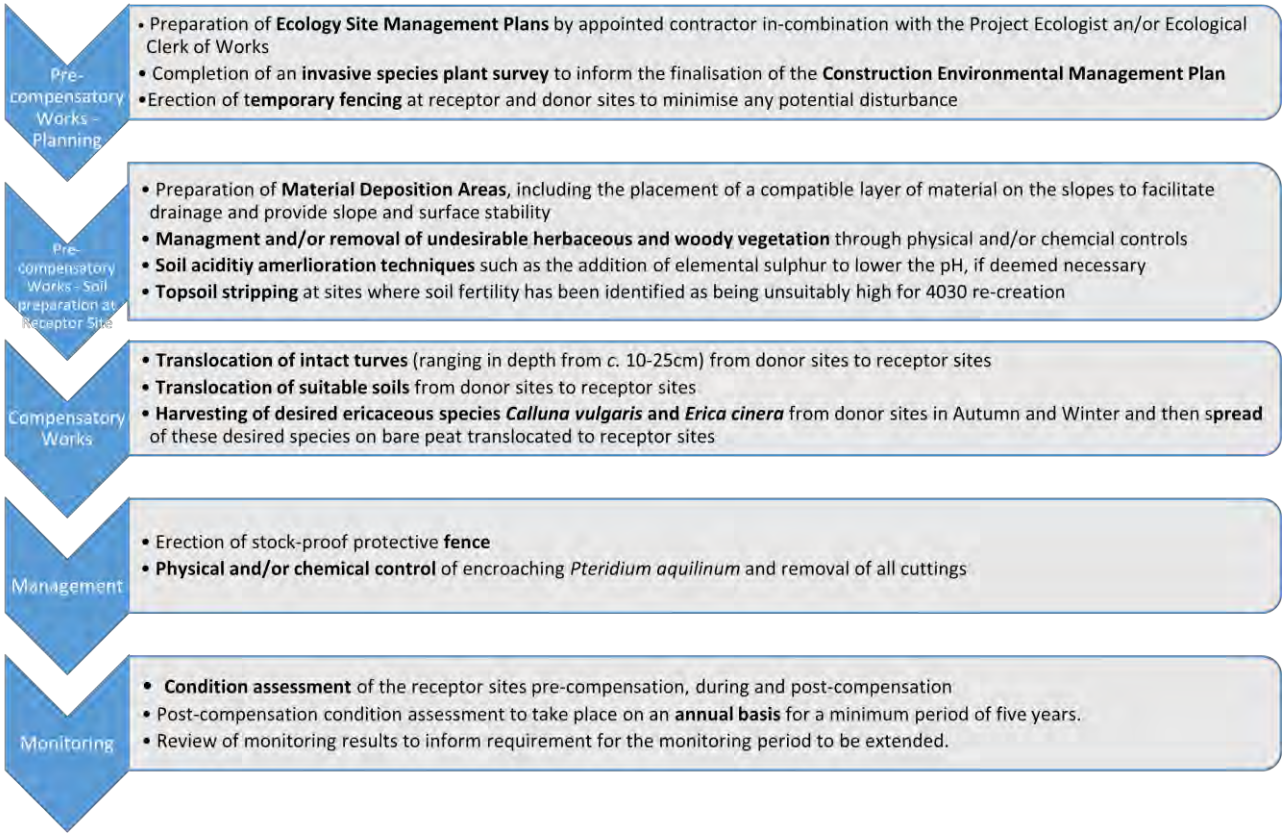

Plate 3 Flow chart of steps involved in the creation of 4030

3. Semi-natural dry grasslands and scrubland facies on calcareous substrates [6210]

3.1 Introduction

The proposed N6 GCRR will result in the permanent loss of c.0.25ha of Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] (hereafter referred to as 6210). It is proposed to compensate for this loss by re-creating c.7.98ha.

Separate to the areas of 6210 habitat to be created as a compensatory measure, there are areas of 6210 habitat located within the Assessment Boundary that will be retained and fenced off for the duration of construction. These areas will not be directly impacted by the proposed N6 GCRR. These areas are presented in Figures 8.38.1 to 8.38.15 of the updated EIAR. These areas will not be available to use as donor sites for the purposes of creation of compensatory 6210 habitat.

The steps followed for the 6210 habitat compensation process are:

- Identification and selection of suitable compensatory habitat receptor sites for 6210 habitat (Refer to Sections 3.2 to 3.5)
- Pre-compensatory works site preparation at both the donor sites and receptor sites, including: the provision of site specific method statements within the Finalised Ecology Site Management Plans; erection of temporary fencing; topsoil stripping; and, weed control (Refer to Section 3.5.2)
- Implementation of compensatory measures at the receptor sites, either alone orin-combination as dependent on the characteristics of the receptor sites. These measures include: the translocation of turves and soil from donor sites to the receptor sites; seeding from either seed collected at donor sites or bought nativeIrish seed mix; green-hay strewing; and/or, natural colonisation (Refer toSection 3.5.3)
- Short-term and long-term management of the receptor sites following theimplementation of compensatory measures (Refer to Section 3.6)
- Monitoring of the receptor sites to be carried out pre-compensation, during andpost-compensation by a suitably qualified and experienced ecologist in order toensure that potential issues are identified at an early stage and addressed throughadaptive management measures. (Refer to Section 3.7)

3.2 Description of Annex I habitat 6210

The vegetation community associated with the Annex I habitat Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] to be lost is *Briza media – Thymus polytrichus*. Thisis a species-rich sub-community of the grassland vegetation community *Cynosurus cristatus – Plantago lanceolata*. It contains a large number of constants, such as thegraminoid species *Carex flacca*, *Briza media*, *Anthoxanthum odoratum* and *Sesleria caerulea* with *Carex caryophyllea*, *Festuca* spp. and *Koeleria macrantha* and forb species *Thymus polytrichus*, *Linum catharticum*, *Galium verum*, *Lotus corniculatus*, *Campanula rotundifolia*, *Polygala vulgaris*, *Leucanthemum vulgare* and *Pilosella officinarum*. It is comprised of swards of calcareous grassland on shallow, well-drained soils of poor fertility (*i.e.* a mean organic content of 26.6%).In Ireland it is typically found in association with limestone pavement and eskers, occurring at middling altitudes often on sloping ground which improves drainage. The management of these swards usually involves light grazing regimes by cattle or horses (O'Neill *et al.*, 2013). The diversity of this habitat type is a result of a combination of mineral nutrient stress and grazing/cutting management conditions,which prevents a few rank species dominating the grassland (Ashwood, 2014

3.3 Description of 6210 Donor Sites

There are four sites of Annex I habitat 6210 which will be removed to facilitate the construction of the proposed N6 GCRR (see Figure 8 and Figure 9 for locations). All of these sites are located east of the River Corrib. These sites were classified as Annex I habitat due to the presence of a sufficient number of high quality positive/positive indicator species (after O'Neill *et al.*, 2013). Full descriptions of the five donor sites

of habitat to be lost are provided below. The following additional non-Annex I habitats are also present in some of the 6210 donor sites (see Annex 2 of this Appendix for more specific details per donor site):

- Dense bracken (HD1)
- Scrub (WS1)
- Ornamental/non-native shrub (WS3)
- Stone walls and other stonework (BL1)

3.3.1 Donor Site 6210.D1 - Ch. 11+750

Donor site 6210.D1 consists of c.0.09ha. See Figure 8 for location. Botanical andother relevant environmental data (as per the 6210 structure and function conditionassessment described in O'Neill *et al.*, 2013) was collected at a relevé within this area of 6210 habitat to be lost on the 27 July 2016. Data collected within this relevéwas considered to be representative of the habitat to be lost. On the day of the survey, it was noted that the habitat was being moderately grazed by horses. A totalof four of the 18 high quality indicator species of this Annex I habitat (*i.e. Anthyllisvulneraria*, *Linum catharticum*, *Briza media* and *Blackstonia perfoliata*) and three of the 17 positive indicator species were present (*i.e. Lotus corniculatus*, *Leontodon hispidus* and *Carex flacca*). No non-native species, negative indicator species or scrub species (or *Pteridium aquilinum*) were noted. The percentage cover of bare ground was c.15% with some bare soil, rock and litter present. No surface water was present. The median vegetation height for grass species was c.10cm, while the median vegetation height for forb species present was c.20cm. The area failed on three of the 11 criteria of the structure and function condition assessment, *i.e.* the presence of positive indicator species (≥7); the percentage cover of bare ground (<10%); and, signs of serious grazing or disturbance (<20m^3) (O'Neill *et al.*, 2013).Refer to relevé code LQ-N84 R1 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

3.3.2 Donor Site 6210.D3 – Ch. 12+100 c.282m east ofLackagh Quarry

Donor site 6210.D3 consists of c.0.1ha. See Figure 8 for location. Botanical and other relevant environmental data (as per the 6210 structure and function conditionassessment described in O'Neill *et al.*, 2013) was collected at a relevé on the 14 August 2014 located within this area of 6210 to be lost. Data collected at this relevéwas considered to be representative of the habitat to be lost. It was described as anarea of disturbed ground recolonised by 6210 vegetation. Only one of the 18 high quality indicator species (*i.e. Knautia arvensis*) and five of the 17 positive indicatorspecies were present (*i.e. Daucus carota*, *Carex flacca*, *Ctenidium molluscum*, *Helictotrichon pubescens* and *Lotus corniculatus*). Non-native species were noted with a percentage cover greater than 1%. No negative species were noted. The percentage cover of bare soil, rock and litter was noted to be c.3%. No surface water features were present; however it was noted that the drainage of the site appeared to be impeded with damp patches present. The median height of grass species present was c.35cm, while the median height of forb species was c.30cm.The area failed on three of the 11 criteria of the structure and function condition assessment, *i.e.* the presence of positive indicator species (≥7); the presence of high quality indicator species (≥2); and, cover of non-native species (<1%) (O'Neill *et al.*, 2013). Refer to relevé code LQ-N84 R2 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

3.3.3 Donor Site 6210.nD6 - Ch. 12+150 c.52m east of N84Headford Road

Donor site 6210.nD6 consists of c.0.03ha. See Figure 8 for location. Botanical andother relevant environmental data (as per the 6210 structure and function conditionassessment described in O'Neill *et al.*, 2013) was collected at a relevé on the 24 June 2019 located within the area of 6210 to be lost. Data collected atthis relevé was considered to be representative of the habitat to be lost. It was described as a slightly damp area of disturbed ground with species-rich grassland. A total of one of the 18 high quality indicator species of this Annex I habitat (*i.e. Briza media*) and six of the 17 positive indicator species (*i.e. Sesleria caerulea*, *Helictotrichon pubescens*, *Carex flacca*, *Daucus carota*, *Lotus corniculatus*, *Pilosella officinarum* and *Ctenidium molluscum*) were present. Two non-native species, *Cotoneaster horizolntalis* and *Chamaecyparis sp.,* were present (total percentage cover of 0.4%) and the total percentage cover of negative indicator species present was less than 20% (the total cover of negative indicator species was 0.5%). There was 5% litter cover present and no bare soil was present. No surface water features were present. The median height of grass

species present was c.30cm, while the median height of forbspecies was c.30cm. The area failed on 2 of the 11 criteria of the structure and function condition assessment, *i.e* the presence of positive indicator species (≥7); the presence of high quality indicator species (≥2) (O'Neill *et al.*, 2013). Refer to relevé code 4585_R1 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

3.3.4 Donor Site 6210.D4 - Ch. 12+150 c.52m east of N84Headford Road

Donor site 6210.D4 consists of c.0.02ha. See Figure 9 for location. Botanical andother relevant environmental data (as per the 6210 structure and function conditionassessment described in O'Neill *et al.*, 2013) was collected at a relevé on the 27 August 2014 located c.16.5m south of the area of 6210 to be lost. Data collected atthis relevé was considered to be representative of the habitat to be lost. It was described as a slightly damp area of disturbed ground with localised Exposed calcareous rock with species-rich grassland. A total of three of the 18 high quality indicator species of this Annex I habitat (*i.e.* Briza media, *Anthyllis vulneraria* and*Linum catharticum*) and seven of the 17 positive indicator species (*i.e. Sesleria caerulea*, *Helictotrichon pubescens*, *Carex flacca*, *Daucus carota*, *Lotus corniculatus*, *Pilosella officinarum* and *Ctenidium molluscum*) were present. No non-native species were present and the total percentage cover of negative indicatorspecies present was less than 20%. There was no litter present and the percentage cover of bare soil was less than 10%. No surface water features were present. The median height of grass species present was c.25cm, while the median height of forbspecies was c.25cm. The area passed on all 11 criteria of the structure and functioncondition assessment (O'Neill *et al.*, 2013). Refer to relevé code EC39 R11 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

An additional relevé was carried out in within the areas of 6210 to be lost in this area in 2019. Botanical and other relevant environmental data (as per the 6210 structure and function condition assessment described in O'Neill *et al.*, 2013) was collected at a relevé on the 24 June 2019 located within the area of 6210 to be lost. Data collected atthis relevé was considered to be representative of the habitat to be lost. A total of one of the 18 high quality indicator species of this Annex I habitat (*i.e. Anthyllis vulneraria*) and five of the 17 positive indicator species (*i.e. Carex flacca, Daucus carota, Lotus corniculatus, Pilosella officinarum* and *Sesleria caerulea*) were present. No non-native species were present. However, *Arrhenatherum elatius* occurred relatively abundantly (i.e. percentage cover of 25%), therefore the total percentage cover of negative indicator species present was greater than 20%. There was 5% litter cover present and 1% cover of bare soil was present. No surface water features were present. The median height of grass species present was c.40cm, while the median height of forb species was c.5cm. The area failed on 4 of the 11 criteria of the structure and function condition assessment, *i.e* the presence of positive indicator species (≥7); the presence of high quality indicator species (≥2); Cover of negative indicator species individually ≤10%; and the cover of negative indicator species collectively ≤20% (O'Neill *et al.*, 2013). Refer to Appendices A.8.1 and A.8.19 of the updated EIAR for more detail. Refer to relevé code 2096_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species list.

3.4 Description of Other Dry Calcareous and NeutralGrassland Donor Sites

There are 37 polygons of the habitat type Dry calcareous and neutral grassland (GS1) classified as being of local importance higher value, which will be removedto facilitate the construction of the proposed N6 GCRR (see Figures 7 to 11 for locations) and which contain soils which will be suitable for use at 6210 receptorsites. In the case of some of these areas of GS1, the following additional habitats are also present (see Annex I of this Appendix for more detail):

- Dry meadows and grassy verges (GS2)
- Dense bracken (HD1)
- Hedgerow (WL1)
- Treeline (WL2)
- Scrub (WS1)
- Spoil and bare ground (ED2)
- Recolonising bare ground (ED3)

Five of these polygons also overlap partially or entirely with receptor sites; 6210.R1 and 6210.R2 (Figure 7), and 6210.R5 (Figure 8). Of these 6210.R1 is located partially within the boundaries of the Lough Corrib Special Area of Conservation (SAC). All other sites lie outside of any designated areas for nature conservation. All of these areas are located east of the River Corrib between Ch. 9+400 to Ch. 17+150 and range in area from c.0.002hato c.1.54ha. See Chapter 8, Biodiversity of the updated EIAR for further details on this habitat type.

3.5 Methodology for Compensatory Habitat Creation

3.5.1 Selection of Receptor Site

The identification and selection of the compensatory habitat receptor sites, where 6210 habitat will be created, was based on a desk study conducted in June 2017 andMarch 2018 and site visits conducted on various dates from 27 July 2015 to 10 October 2017 as part of the surveys undertaken to inform the environmental studiesfor the proposed N6 GCRR. Subsequent surveys were undertaken at the donor and receptor sites in 2019 and 2023 to provide additional support and aid the verification of the baseline habitat classifications, and to identify any subsequent changes in habitats present (Refer to Appendix A.8.1 of the updated EIAR for more detail). These sites were selected, in consultation with the design team, as suitable receptor sites based on a review of the following:

- Site data collected as part of habitat surveys undertaken between 2014 and 2016, and in 2019 and 2023 at the location of four donor sites and in 2015, 2016, 2017, 2019 and 2023 at the location of receptor sites.

Detailed relevés were carried out within all four donor sites between 2014 and 2019 and the following information was collected:

  - the percentage cover of high quality, positive and/or negative indicatorplant species present
  - presence of soil, rock and surface water
  - other botanical and environmental factors considered as part of condition assessment criteria for this habitat type (after O'Neill *et al.*2013)

- Hydrological data collected to inform the environmental studies for theproposed N6 GCRR
- Soils and Geology data collected to inform the environmental studies for theproposed N6 GCRR
- Information on current and past land-use activities undertaken at the receptor sites, which may have influenced the condition of the topsoil

Other information relied upon as part of the selection process included the following information sources:

- Ordnance Survey of Ireland mapping and aerial photography available fromwww.osi.ie
- Online data available on European sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie
- Online data available from the National Biodiversity Data Centre mapping service (http://maps.biodiversityireland.ie/#/Map)
- Information on land-use zoning from the online mapping of the Departmentof the Environment, Community and Local Government http://www.myplan.ie/en/index.html
- Information on water quality in the area available from www.epa.ie
- Information on soils, geology and hydrogeology in the area available fromwww.gsi.ie
- Information on the location, nature and design of the proposed N6 GCRR supplied by the design team
- Information on the status of EU protected habitats in Ireland (National Parks& Wildlife Service, 2013)

Six compensatory habitat receptor sites for the creation of 6210 were selected (see Figure 7 to Figure 11 for locations). A full description of the baseline conditions at thesesites is provided below. These receptor sites

are located within the Assessment Boundary, adjacent or in close proximity to the footprint of the proposed N6 GCRR. Based on a review of information collected (from thesources described above and with reference to guidance provided in Section 1.1), these receptor sites were considered suitable for the following reasons:

- Presence of physical characteristics at the receptor site necessary for the establishment of calcareous grassland such as suitable topography and geology
- Presence of similar plant species composition within or in close proximity to the receptor site to that being compensated for at the donor site (*i.e.* the nearestarea of 6210 habitat is located c.20m north of one of the receptor site)
- Relatively short distance between donor and receptor sites (*i.e.* the shortest distance between a donor site to a receptor site is between 6210.D3, which is located c.103m to the south-east of 6210R.7) (See Figure 6 to Figure 7 for locations)
- Total combined area of the receptor sites (*i.e.* c.7.98ha) in the context of the total area of 6210 to be lost (*i.e.* c.0.25ha) (*i.e.* c.3,192% of the area of 6210 lostwill be compensated for)[6]
- Existing or future access to the site that will facilitate machinery, required for the proposed compensatory measures or management activities, entering or exiting the site

3.5.1.1 Receptor Site 6210.R1 – Ch. 9+400 to Ch. 9+550

This receptor site consisting of c.0.83ha was surveyed on the 10 September 2015 and 1 June 2016 and two habitat types (as defined by Fossitt 2000) were identifiedwithin its boundaries. The site was dominated by Dry calcareous and neutral grassland (GS1). There was also a small area of Exposed calcareous rock (ER2), located in the north-eastern corner of the eastern field. It is partially located withinLough Corrib SAC and is also partially located within a GS1 donor site. Additional habitats were identified at this receptor site following the 2019 habitat surveys. Stone walls and other stonework (BL1) and Treeline (WL2) habitats were identified in a mosaic with Dry calcareous and neutral grassland (GS1) at this site (see Annex 2 of this appendix for details). See Figure 7 for location. The existing pollution control measures are sufficient to eliminate the risk of suspended solids to the River Corrib with respect to topsoil stripping or turve translocation in the creation of the 6210 habitat.

A portion of this receptor site consisting of c.9.4% of the total area lies within the air quality Zone of Influence (ZoI) for nitrogen deposition. Therefore, it may not be possible to achieve the creation of a calcareous grassland habitat that is of Annex I quality within the ZoI (i.e. within 20m of the proposed GCRR). This area has been excluded from the total calculated area of 6210 habitat to be created in this CHMP, and from the area cited in the updated EIAR, due to the uncertainty in creation of a species-rich calcareous grassland that is of Annex quality within the air quality ZoI. The area of this receptor site that lies outside of the air quality ZoI consists of *c.* 0.75ha. However, the full receptor site (i.e. *c*. 0.83 ha) is included within the CHMP with the objective of creating a species-rich grassland habitat and achieving Annex I status.

3.5.1.2 Receptor Site 6210.R2 –Ch. 9+550 to Ch. 9+700

This receptor site consisting of c.0.98ha was surveyed on the 10 September 2015 and one habitat type (as defined by Fossitt 2000) was identified within its boundaries, *i.e.* Dry calcareous and neutral grassland (GS1). On the day of the survey, it was noted that this field, and surrounding fields, were heavily grazed by horses. It is located c.25m east of Lough Corrib SAC and is within a GS1 donor site. The habitat classification of this site was confirmed in subsequent habitat surveys. See Figure 7 for location.

[6] "*Replacement ratios of compensatory habitat greater than one-to-one are frequently appropriate because of the uncertainty inherent in compensation, particularly in cases which require ecological restoration, habitat creation or translocation of species or habitats. The scientific basis for deriving appropriate ratios is not exact and will vary depending on the habitat or species concerned. Increased replacement ratios can also help take account of the time lag in delivering compensation and regaining the same maturity, complexity and diversity of habitats and the full complement of associated species*." (CIEEM, 2018).

3.5.1.3 Receptor Site 6210.R5 –Lackagh Quarry between Ch.11+250 to Ch. 11+500

This receptor site consisting of c.2.44ha was surveyed on 3 September 2015, 27 July 2016 and 10 October 2017 and five habitat types (as defined by Fossitt 2000) were identified within its boundaries. These included: other artificial lakes and ponds (FL8); Dry calcareous and neutral grassland (GS1); Dry meadows and grassyverges (GS2); Spoil and bare ground (ED2); and, Buildings and artificial surfaces (BL3). Additional habitats were identified at this receptor site following the 2019 habitat surveys. Recolonising bare ground (ED3) and Scrub (WS1) habitats were identified in mosaics with other habitats at this site (see Annex 2 of this appendix for details). It partially overlaps with a GS1 donor site. This site is also a Material Deposition Area (*i.e.* DA24). See Figure 8 for location.

3.5.1.4 6210.R6 –Lackagh Quarry between Ch. 11+450 to Ch.11+600

This receptor site consisting of c.0.48ha was surveyed on 3 September 2015, 27 July 2016 and 10 October 2017 and three habitat types (as defined by Fossitt 2000)were identified within its boundaries. These included: Recolonising bare ground (ED3); Spoil and bare ground (ED2); and, Dry calcareous and neutral grassland (GS1). The habitat classification of this site was confirmed in subsequent habitat surveys. It partially overlaps with a GS1 donor site. This site is also a Material Deposition Area (*i.e.* DA25). See Figure **8** for location.

3.5.1.5 6210.R7 –Lackagh Quarry between Ch. 11+850 to Ch.12+000

This receptor site consisting of c.0.49ha was surveyed on the 3 September 2015 and one habitat type (as defined by Fossitt 2000) was identified within its boundaries, *i.e.* Dry calcareous and neutral grassland (GS1). The habitat classification of this site was confirmed in subsequent habitat surveys. See Figure 8 for location.

3.5.1.6 6210.R8 –Lackagh Quarry between Ch. 11+400 to Ch. 11+750

This receptor site consisting of c.2.83ha was surveyed on the 27 September 2023, and three habitat types (as defined by Fossitt 2000) was identified within its boundaries, *i.e.* Spoil and bare ground (ED2), Recolonising bare ground (ED3) and Scrub (WS1). See Figure 8 for location. This site is also a Material Deposition Area (DA28).

3.5.1.7 6210.nR9 – Doughiska between Ch. 11+400 to Ch. 11+750

This receptor site consisting of c.0.44ha was surveyed on the 29 August 2023, and three habitat types (as defined by Fossitt 2000) were identified within its boundaries, *i.e.* Scrub (WS1), Dry calcareous and neutral grassland (GS1) and Dense bracken (HD1). See Figure 11 for location. This receptor site was originally recorded as the Annex I habitat Calcareous grassland [6210] when it was first surveyed in 2014, and was partially to be retained as part of the 2018 EIAR, but was no longer of Annex quality when it was resurveyed in 2019 and 2023 due to scrub and bracken encroachment. It is directly adjacent to the GS1 soil donor site GS1.D28.

This receptor site is surrounded on all sides by major roads of the proposed N6 GCRR and lies entirely within the air quality Zone of Influence (ZoI) for nitrogen deposition. Therefore, it may not be possible to achieve the creation of a calcareous grassland habitat that is of Annex I quality within this receptor site. This area has been excluded from the total calculated area of 6210 habitat to be created in this CHMP, and from the area cited in the updated EIAR, due to the uncertainty in creation of a species-rich calcareous grassland that is of Annex quality within the air quality ZoI. However, the receptor site is included within the CHMP with the objective of creating a species-rich grassland habitat and achieving Annex I status.

3.5.2 Pre-Compensatory Works Site Preparation

3.5.2.1 Ecology Site Management Plans

Prior to compensatory works commencing, Ecology Site Management Plans specific will be finalised by the Contractor in combination with the Project Ecologist and/or ECoW with reference to the construction programme, which mayinfluence the timing and co-ordination of these works and the requirement for storage of soils and/or turves, and issued to the team involved in the compensatoryworks. The finalised plans will include a site specific method statement outlining step-by-step actions (as per the pre-compensatory

measures described in Section 352 and compensatory measures described in Section 3.5.3) for the Contractor toimplement within a specified timescale, under the supervision and advice of the Project Ecologist and/or ECoW. It will also include a check-list of conditions (as per the monitoring criteria set out in O'Neill *et al.* 2013 and condition assessmentsset out in Ashwood 2014, as described in Section 3.7) to be assessed by the ProjectEcologist and/or ECoW at the receptor site during the pre-compensation, during and post-compensation monitoring. The finalisation of the Ecology Site Management Plans by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, as these plans are merely providing more site specific detail and methodological steps to the principles and proposals already outlined in this CHMP

3.5.2.2 Non-native Invasive Plant Species and Biosecurity

As set out in the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the updated EIAR, a non-native invasive plant species survey will be undertaken immediately in advance of works commencing to inform the finalisation of CEMP. The biosecurity measures outlined in the CEMP will be implemented at both the donor and receptor sites, where applicable, in order to avoid the accidental spread of potentially harmful plant or animal species betweensites. The CEMP also includes: measures that the Contractor will implement in order to avoid spreading invasive species during soil movement; measures to treat non-native invasive plant species prior to construction/compensation works commencing; and, site hygiene measures to be implemented to prevent further spread of non-native invasive plant species

3.5.2.3 Temporary Fencing

Where applicable, temporary fencing and associated signage will be erected at boththe donor and receptor sites for the duration of the construction. This will minimiseany potential disturbance to adjacent sensitive habitats and/or hydrological featureswithin both the donor and receptor sites from either encroachment into the habitat or damage.

3.5.2.4 Material Deposition Areas

In the case of the receptor sites that are also Material Deposition Areas (MDA), thefollowing measures will also be implemented to ensure the successful creation of 6210. This will include the placement of suitable soils on top of the MDA to allowwater to freely drain and to provide a suitable substrate for the habitat to establish upon (via measures described in Section 3.5.3). The mixed peat and U1 material used to construct the base of the Material Deposition Areas (MDAs) in Lackagh Quarry will be separated from the Calcareous grassland habitat layer on top by a 350mm depth, free draining material contained within a filter separator layer (e.g. geotextile), above and below to prevent the migration of fines sediment therefore ensuring the functionality of the layer. This drainage layer will prevent any interaction between the calcareous grassland substrate and the mixed peat layer and, therefore, the use of peat material will not have any effect on the creation of Calcareous grassland habitat on these MDAs. Once the MDA area has been created, including placement of the free draining material contained within a filter separator layer (e.g. geotextile), above and below to, the calcareous grassland habitat will be created on top of this layer. Due to the proposed management requirements of 6210 (outlined in Section 3.6 below), the side-slopes of the MDAs will not be used to create this habitat type.

3.5.2.5 Stripping of Unsuitable Topsoil

Soil fertility, in particular the presence of major plant nutrients nitrogen, potassiumand phosphorus, is one of the main factors in determining the likely establishment and success of a newly created semi-natural grassland. It is recommended that at receptor sites where the previous land-use was agricultural in nature and as such soil fertility is likely to be high, the topsoil is removed (Crofts & Jefferson, 1994). This involves stripping the topsoil of the site to a maximum depth of c.30cm. Thistopsoil may contain a seed bank of highly competitive plant species that are undesirable in the context of Dry calcareous grasslands creation or other existing surrounding semi-natural habitats. These works should be undertaken during dry weather conditions under the supervision of the Project Ecologist and/or ECoW. Prior to translocation of turves and soil from the donor sites, it may be necessary tolightly cultivate the subsoil at the receptor site using a rotovator machine to relieveany compaction or surface capping.

3.5.2.6 Weed Control

It is possible that undesirable plant species, dormant in the soil of the receptor site,may become disturbed during the site preparation process and as a result start to germinate and establish as seedlings. Appropriate measures (e.g. sowing a pioneer/nurse crop; spot treatments with herbicides and/or, cutting or pulling undesirable plants prior to flowering; see also Section 3.5.2.6 below) will need to be undertaken to control such species, which could potentially outcompete and inhibit the germination and establishment of the desired species required for the creation of 6210. If there is a significant time period between site clearance at the receptor site and when the compensatory habitat will be created, these appropriate measures may include at the receptor site: sowing a pioneer/nurse crop; spot treatments with herbicides and, cutting or pulling undesirable plants in June beforeflowering (Crofts & Jefferson, 1994).

3.5.3 Compensatory Measures

The five different compensatory measures described below outline how 6210 habitat will be created within the compensatory habitat receptor site. These measures will be implemented either in-combination or alone, as determined by theContractor under the supervision and advice of the Project Ecologist and/or ECoW.The timing and duration of these works will depend on the progress of theconstruction of the proposed N6 GCRR, requirements for access and weather conditions. It should be noted that for whichever compensatory measure or combination of measures adopted, the process of grassland establishment and the development of stable vegetative communities can take several years and that appropriate management of these sites (as outlined in Section 3.6) is essential to ensure success (Ashwood, 2014 and Crofts & Jefferson, 1999).

3.5.3.1 Translocation of Turves

Translocation involves the removal of turves, soil and/or plant species from the impacted donor site to the new receptor or compensation site (Iuell *et al.*, 2003). Following site preparation, intact turves of existing 6210 habitat (*i.e.* c.25cm-30cmin depth as dependent on conditions at donor site) will be carefully removed from the chosen donor site using a suitable excavator (*i.e.* with adequate capacity to carefully remove and translocate the intact turves) during dry weather conditions and moved to the receptor site. Following site preparation, which will include the stripping of topsoil to a maximum depth of c.10cm, the turves will be incorporatedinto the bare substrate at the receptor site. This process will need to be undertaken slowly and carefully in order maintain the integrity of the intact turves, which willcontain desirable species of this habitat type such as those outlined in O'Neill *et al*(2013). The turves will need to be laid out at the receptor site in such as manner asto avoid excessive movement of the excavator, which could cause damage. Small "*plugs*" of impacted turves from the donor sites may also be translocated and incorporated into the receptor site. The general close proximity of the donor sites to the receptor site will help facilitate this translocation method.

In the case where receptor sites are also MDAs, the habitat layer, in the case of turve translocation, would be a maximum depth of c.250mm - 300mm in depth as dependent on conditions at donor site, and in the case of translocated soil substrates would be a maximum depth of c.100mm - 250mm. Below this will be the a 350mm depth free draining material layer contained within a filter separator layer (e.g. geotextile) above and below. The root zone for calcareous grassland habitat typically does not extend further than 100 - 200mm and therefore the roots of colonising and established plants in the 6210 receptor sites will not extend through the calcareous grassland habitat substrate layer (max 100 - 300mm deep) and below that the 350mm free draining layer, into the mixed peat and U1 material layer within the MDA. Therefore, there will be complete separation between the calcareous grassland habitat and any peat.

Where translocation direct from the donor site to the receptor site cannot take place,it will be necessary to store turves from the donor sites for later translocation to thereceptor site at the appropriate time of year. During storage, turves must not be placed on top of each other in order to avoid any compaction of soil, as this wouldreduce the quality of the soil and would negatively impact on the success of the translocation. The duration of storage must be as minimal as possible. Depending on the duration of storage and prevailing weather conditions, the intact turves mayrequire periodic watering at an appropriate level in order to ensure that the plants and seeds present do not dry out and die. Careful consideration must be given to how often and how much watering will need to be applied to the turves. Where there will be a time delay between removing turves from donor sites, site preparation works at the receptor sites and placing turves at receptor sites, it is recommended that a pioneer/nurse seed mix is planted at the receptor site, if site clearance has taken place in the receptor site, in order to stabilise the soil substrate (Ashwood, 2014).

3.5.3.2 Translocation of Suitable Soils

Following site preparation, both the soils (including the topsoil) and the vegetationof the donor sites of existing 6210 habitat may be scraped up and transferred together to the receptor site in a suitable excavator. The topsoil of the donor sites should contain a sufficient seed bank of desirable plant species to allow the receptorsite to re-vegetate naturally, creating the habitat type. In some cases it may be necessary (*e.g.* due to the project schedule and/or other project commitments), to store the soil from the donor sites for later translocation to the receptor site at the appropriate time of year.

The duration of storage must be as minimal as possible. Topsoil and subsoil must be stored separately and separate to any other topsoil or soil present on-site. In orderto avoid soil compaction and soil smearing, it is recommended that: soil is handledduring dry conditions and not when saturated; and, after placement the soil is decompacted by ripping, which will improve drainage, aeration and rooting establishment. It should be noted that stripping and disturbance of soils may encourage the release of nutrients and in turn alter the soil fertility and promote undesirable weed species (National Roads Authority, 2006); therefore weed control measures outlined in Section 3.2.4 may be required.

In addition to soils taken from the 6210 donor sites, any additional soils required atthe receptor sites may be sourced from the other Dry calcareous and neutral grasslands (GS1) donor sites located within the Assessment Boundary (see Section 3.4 for more details). The requirement for these soils at the receptor sites will be determined on a site-by-site basis by the Contractor, the Project Ecologist and/or ECoW. The existing habitats at these donor sites are comprised of Dry calcareous and neutral grassland (GS1) classified as being of local importance higher value; therefore they will contain suitable neutral to calcareous soils for there-creation of 6210.

The total area of 6210 donor sites is c.0.25ha, while the total area of all other Dry calcareous and neutral grassland donor sites is c.11.80ha; therefore the overall areaof donor sites with suitable available soils for 6210 re-creation is c.12.05ha.

Following a review of the depths of topsoil at sites located within or near to donorsites as recorded as part of ground investigation works and knowledge regarding this habitat type, it is considered that sufficient soils for the creation of c.7.98ha of 6210 may be sourced from within the proposed landtake for the proposed N6 GCRR.

3.5.3.3 Seeding

It is recommended that seeds of desirable plant species from the local donor sites are collected directly from plants once mature (*i.e.* from August/September onwards) during warm, dry conditions, stored in suitable conditions to ensure theirsurvival and then planted as seed mix at the compensatory receptor site. This is thepreferred method of seeding as it will ensure that no foreign seeds are present in theplanted seed mix and will in turn help to protect the integrity of the local genetic population of plants of this habitat type (Ashwood, 2014 and Crofts & Jefferson, 1999). It may be carried out by hand or by seed collection machines as dependent on the size of the donor site (National Roads Authority, 2006). To determine first whether it is an appropriate time to harvest the seeds at a particular donor siteand secondly that the seeds themselves have developed properly, it may be necessary to check a sample selection first. This will involve: assessing the seed's colour, which typically may be brown when mature; examining whether or not they crack under pressure; and/or, determining whether or not the cotyledon is present. During collection, seeds may be stored in paper or cloth bags or open tubs to avoid exposure to direct sunlight (NBDC, 2016). In some cases it may be necessary (*e.g.*due to the project schedule and/or other project commitments), to store seeds from the donor sites for planting later at the appropriate time of year. Prior to storage and sowing, seeds must be air dried (at c.18°C) and then cleaned using a sieve to remove any dust and the chaff of the seed. The dry seeds can be placed into an air-tight container with dry silica sachets and placed in a refrigerator at a low temperature (NBDC, 2016). If it is necessary to store seeds for a longer period of time, then they may be frozen (at a recommended temperature of c.-18°C). This can only occur for orthodox species (i.e. species where seed longevity can be increased in a predictable manner by

reducing seed moisture content) when seeds have undergone the drying process (De Vitis *et al.,* 2020).

Where seed collection from the donor sites is not possible, local native seed mixesmay be bought at "*Irish Wildflower Showcase*"[7] (or similar supplier of native seedstock), which is a reputable supplier of local native seed mixes. Specific seed mixes,containing only the desirable plant species indicative of 6210 habitat and suited to the climate and main soil conditions of the receptor site, can be made up to order tohelp ensure the successful creation of this habitat type.

To yield best results, it is recommended that seeds are sown in August or September(*i.e.* late summer to early autumn) as it will allow the plants sufficient time tobecome established during the winter ready for vigorous growth the following spring (National Roads Authority, 2006). Seed sowing can be undertaken either byhand or using agricultural machinery such as slot, seeders and seed drills where applicable (Crofts & Jefferson, 1999). Where possible, the soil should be rolled following seeding to improve the likelihood of germination taking place by maximising the seed surface contact with the soil (National Roads Authority, 2006).

3.5.3.4 Hay-strewing

Hay-strewing is an alternative method to translocation and/or natural colonisation.It involves, following site preparation of the receptor site, spreading freshly cut hay,which contains seeds from the donor sites, over the receptor site to be colonised (Ashwood, 2014 and Crofts & Jefferson, 1999). In order to yield best results, it is necessary for the hay to be cut at the donor site after the target plant species have flowered and while the seeds are still attached (*i.e.* August/September), but at the point of dispersal (National Roads Authority, 2006). Once cut and collected, the hay will need to be spread loosely and quickly (*i.e.* within 24 hours) to prevent anyspoiling or loss of the seeds (National Roads Authority, 2006). It is then left for a period of three weeks until seeds have fallen. It will need to be turned once if possible during this period. The hay will then need to be removed to prevent smothering of seedlings and to shake out any remaining attached seeds (Crofts & Jefferson, 1999).

3.5.3.5 Natural Colonisation

During surveys undertaken in July 2014, an area of 6210 Annex I habitat was identified c.20m north of one of the receptor sites and as such it is possible that natural colonisation of the receptor site would occur if colonisation gaps are provided for. This process may however take a number of years before establishment of desired species occurs (Crofts & Jefferson, 1999). This measure should only be implemented in-combination with a selection of or all of thecompensatory measures outlined above.

3.6 Management

Site specific details on both the short-term and long-term management of the newlycreated habitat will be outlined in the finalised Ecology Site Management Plan, as determined by the Project Ecologist and/or ECoW. Management of the newly created habitat is necessary for its success, as it will prevent the domination of the sward by undesirable rank species (e.g. *Rubus fruticosus* L.), which have the abilityto outcompete the desired species, and will help to maintain a high species richness.

Following the implementation of the chosen compensatory measure(s), a stock- proof protective fence will be erected to protect the receptor site from disturbance such as unwanted grazing and/or trampling. This will give the newly created habitatsufficient time to establish and stabilise, which typically takes between three to fiveyears (Ashwood, 2014). Established grasslands develop "*rootmats*" which allow the grassland to withstand trampling by animals (Crofts & Jefferson, 1994). Mowing will be required at a newly created grassland site; however depending on the compensatory measure implemented, mowing may or may not be required in the first year of the created habitat, *e.g.* in cases where turves have been translocatedon to bare substrate cutting will not be required (Ashwood, 2014).

While mowing dates and frequency of cutting will be assessed on an on-site basis,as it will be influenced by the rate of plant species growth, it will more than likely take place once a year from mid-June to July after

[7] Irish Wildflower Showcase website: http://www.wildflowers.ie/

the grasses have set seed. Mowing must consider the potential for ground nesting birds to be present (Ashwood, 2014 and Croft & Jefferson, 1994). All cuttings will need to be removed from the site to avoid nutrient enrichment of the sward and the shading of young seedlings (Ashwood, 2014 and Croft & Jefferson, 1994). The cut must be set high (*i.e.* above 4cm from ground level) to avoid scalping the turves, which could potentially result in the exposure of bare ground and in turn the encouragement of weed invasion. Mowing will need to ideally be undertaken during dry conditions to avoid compacting and potentially damaging the soil structure (National Roads Authority, 2006).

The potential for significant impacts to arise from the creation of a small area of 6210 within the Lough Corrib SAC (*i.e.* at receptor site 6210.R1) has been considered and assessed as part of the updated NIS. The mitigation measures outlined in the updated NIS and detailed in the CEMP in Appendix A.7.5 of the updated EIAR will ensure no adverse effects on European site integrity willarrive from the implementation of the proposed N6 GCRR, including the proposal for creation of 6210.R1.

3.7 Monitoring

Monitoring of receptor sites will be carried out by a suitably qualified and experienced ecologist pre-compensation, during and post-compensation in order to

- Firstly, ensure that potential issues that may deter the success of thecompensation are identified at an early stage and addressed through adaptive management measures
- secondly to determine the overall success of the habitat compensation process.

Adaptive management measures will be targeted to address the specific issues identified by the monitoring and may be varied. For example they could include, translocation of additional turves to replace those that have failed, and/or additionalseeding where this is deemed necessary to improve vegetation cover/presence. Adaptive management measures, implemented in response to monitoring results, will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, providing these measures either fall within the scope of proposals already provided for in this CHMP, or involve impacts of equal of lesser significance to those provided for in this CHMP and assessed in the updated EIAR and updated NIS.

The finalised Ecology Site Management Plans, which will be prepared on an on- site basis, will include a check-list of conditions to be assessed by a suitably qualified and experienced ecologist at the receptor site during the pre-compensation,during, and post-compensation monitoring. Conditions assessed in both the short and long-term will include as a minimum (after O'Neill *et al.*, 2013 and Ashwood,2014):

- Information on vegetation composition, *i.e.* number of (high quality) positive indicator species, cover of negative indicator species and non- native invasive plant species, cover of scrub, bracken and heath.
- Information on vegetation structure, *i.e.* height of vegetation, ratio of forb to graminoid species and level of grazing and disturbance.
- Information on physical structure and extent of 6210 establishment*, i.e.*cover of bare ground and litter and presence of bald patches.

In order to achieve the equivalent value of the areas of the Annex I Semi-natural dry grasslands and scrubland facies on calcareous substrates [6210] being lost, the habitat that will be created at the compensatory receptor sites must correspond to 6210 respectively and, therefore, contain sufficient established and mature positive indicator species of those Annex I habitat types (as per Martin et al., 2018).

The intervals and duration for the pre- and during compensation monitoring programme, will be decided upon by the Project Ecologist and/or ECoW and is likely to depend upon the speed of habitat establishment and stabilisation.

6210 may take between three to five years after initial habitat creation to become established (Ashwood, 2014). The post-construction monitoring programme will require annual monitoring, commencing on the year of habitat creation, for a minimum period of five years, with a review by a suitably qualified and experiencedecologist at the end of that period undertaken to determine whether the monitoringperiod needs to be extended further, if for example it is viewed that the habitat hasnot stabilised or become fully

established by that time. Any extension to the monitoring period will need to consider whether on-going monitoring should be atannual or longer intervals e.g. +3 years post-creation, +6 years post-creation etc.

The results of all monitoring will be made available to the NPWS.

In a 'worst case' scenario, it will take between approximately 10 to 20 years for the 6210 compensatory habitat to establish and mature at the receptor sites and reach an equivalent ecological value to the respective donor sites. This does not affect the conclusions set out in the updated EIAR on the residual impact on these habitats, i.e. that post-compensation the loss of 6210 will not result in a significant residual effect, at any geographic scale, over the long-term (i.e. >10- 20 years).

The most significant time constraint, with respect to achieving this requirement, is the total number of years it will take for the positive indicator species of this Annex I habitat to establish and mature at the receptor sites. As detailed above, the various compensatory measures can be implemented in isolation or in combination to create 6210 habitat. Whilst it is likely that a combination of compensatory measures will be undertaken at the receptor sites (*i.e.* translocation of intact turves/suitable soils, seeding, hay-strewing, and/or natural colonisation[8]), a precautionary approach has been adopted and, as such, the number of years provided is from seed rather than the translocation of intact turves. In the case of the translocation of turves, the number of years required to achieve an equivalent value to that of the habitat being lost will be less when compared to other compensatory measures, as the turves already contain established and mature positive indicator species of these Annex I habitats.

The number of years required for a species-rich grassland to establish and mature, (e.g. a calcareous grassland), varies in published literature. The establishment of calcareous grassland typically takes between three to five years and, following the implementation of site preparation and appropriate management, a relatively species-rich grassland community will develop in between five to ten years (Ashwood, 2014). In a study on the restoration of species-rich calcareous grassland in The Netherlands, it was found that after 20 years the number of indicative grassland species stabilised at the site (Willems & van Nieuwstadt, 1996). In another study based in the United Kingdom, it was found that under the appropriate management practices of nutrient-stripping, the re-creation of a species- rich grassland occurred in less than 10 years (Walker *et al.*, 2004).

3.8 Conclusions

The measures outlined in this section will compensate for the significant residual effect on 6210 habitat by ensuring that there will be no net permanent loss of this habitat type as a consequence of the proposed N6 GCRR. A total area of c.7.98ha (*i.e.* c.3,192% of the area of 6210 lost) will be created as part of the proposed compensatory works. The steps outlined in this section are presented below as a flow chart. The steps outlined in this section are presented below as a flow chart.

[8] It is noted that the compensatory measure of natural colonisation may take a number of years before desired species established (Croft, A. & Jefferson R. G. (eds)(1999*) The Lowland Grassland Management Handbook,* 2nd Edition.) and as such it was recommended that it is only implemented in-combination with a selection of or all other compensatory measures.

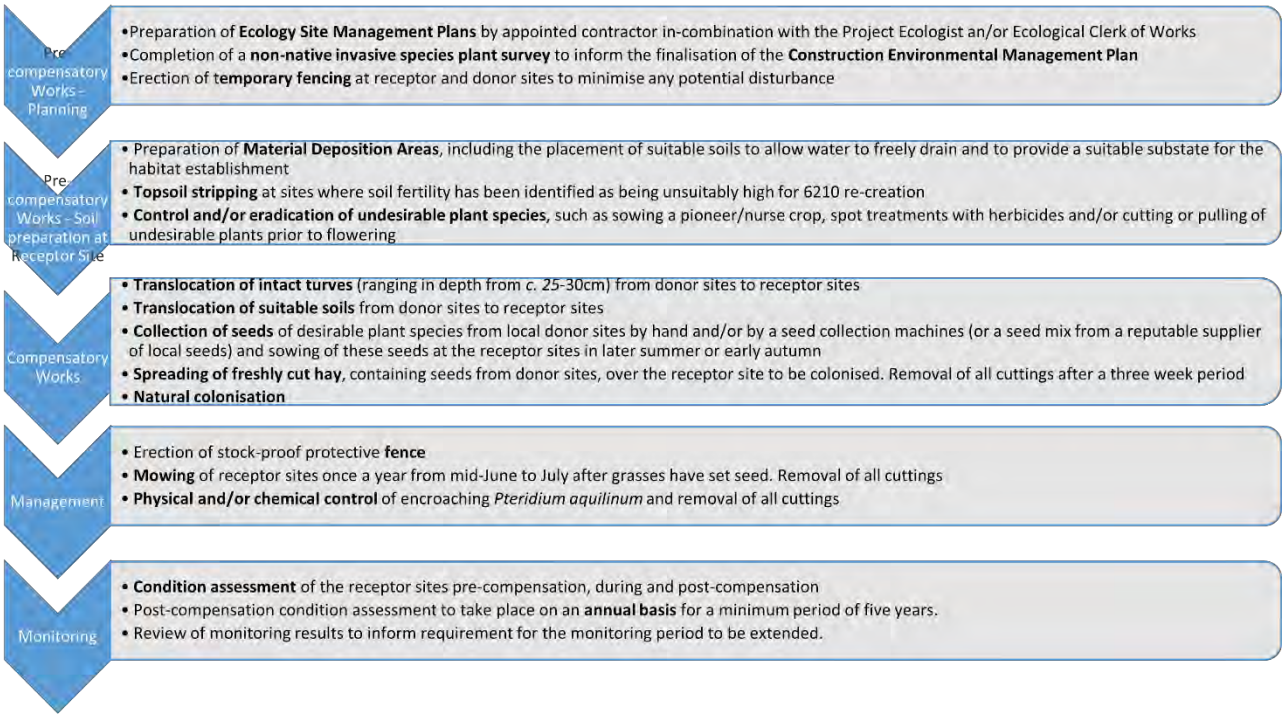

Plate 4 Flow cart of steps involved in the creation of 6210

4. *Molinia* meadows on calcareous, peaty or claye-silt-laden soils (*Molinion caeruleae*) [6410]

4.1 Introduction

The proposed N6 GCRR will result in the permanent loss of c.0.29ha of theAnnex I habitat *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] (hereafter referred to as 6410), of which 0.01ha is due to indirect impacts. It is proposed to compensate for this loss by re-creating c.0.49ha. This is c.170% of the loss of 6410 (*i.e.* 0.29ha).

Separate to the areas of 6410 habitat to be created as a compensatory measure, thereare areas of 6410 habitat located within the Assessment Boundary that will be retained and fenced off for the duration of construction. These areas will notbe directly impacted by the proposed N6 GCRR. These areas are presented in Figures 8.38.1 to 8.38.15 of the updated EIAR. These areas will not be available to use as donor sites for the purposes of creation of compensatory 6410 habitat.

The steps followed for the 6410 habitat compensation process are:

- Identification and selection of a suitable compensatory habitat receptor site for6410 habitat (Refer to Section 4.2to 4.4)
- Pre-compensatory works site preparation at both the donor sites and receptorsite, including (Refer to Section 4.4.2):
  - the provision of site specific method statements within FinalisedEcology Site Management Plans
  - erection of temporary fencing; topsoil stripping
  - weed control

- Implementation of compensatory measures, either alone or in-combination as dependent on the characteristics of the receptor site. These measures include: the translocation of turves and soil from donor sites to the receptor site; seedingfrom either seed collected at donor sites or bought native Irish seed mix; application of freshly cut material; and/or, natural colonisation (Refer to Section 4.4.3)
- Short-term and long-term management of the receptor site following the implementation of compensatory measures (Refer to Section 4.5)
- Monitoring of the receptor site to be carried out pre-compensation, during and post-compensation by a suitably qualified and experienced ecologist in order toensure that potential issues are identified at an early stage and addressed throughadaptive management measures (Refer to Section 4.6).

4.2 Description of Annex I habitat 6410

The 6410 habitat area to be lost corresponds with the *Molinia caerulea – Potentillaerecta* vegetation community (after O'Neill *et al.*, 2013). In Ireland, this vegetationcommunity is relatively species-poor and is usually found on wet, very infertile andacidic basin peats and peaty gleys. It is dominated by *Molinia caerulea*, which is typically found growing in large tussocks. *Potentilla erecta* is also abundant. Other frequent species present include *Juncus acutiflorus*, *Agrostis stolonifera*, *Anthoxanthum odoratum* and *Holcus lanatus*, which form a fairly tall, rank sward,and *Succisa pratensis* and *Filipendula ulmaria*. The management of these swards usually involves grazing by cattle at a low intensity. The main threats are consideredto be improvement, abandonment and afforestation (O'Neill *et al.*, 2013).

4.3 Description of Potential 6410 Donor Site

There is one site of the Annex I habitat 6410 which will be removed to facilitate theconstruction of the proposed N6 GCRR (see Figure 7 for location). This site is located c.300m south-west of Ballindooley Lough and lies outside of any designated areas for nature conservation. This donor site was classified as Annex Ihabitat due to the presence of a sufficient number of high quality positive/positive indicator species (after O'Neill *et al.*, 2013). This site does not contain any other habitats. Full description of this donor site of habitat to be lost is provided below.

4.3.1 Donor Site 6410.nD2 – Ch. 12+250 to Ch. 12+400

Donor site 6410.nD2 consists of c.0.28ha. See Figure 9 for location. Botanical andother relevant environmental data (as per the 6410 structure and function conditionassessment described in O'Neill *et al.*, 2013) was collected at six relevés, two of which were located within the site and the other four between c.200m to 825m north-east of the area of 6410 habitat to be lost in July 2014 and November 2017. Data collected within these relevé was considered to be representative of the habitat to be lost. At three of these relevés one high quality indicator species of this AnnexI habitat was present (*i.e. Juncus conglomeratus* and *Cirsium dissectum*). A total offive (at two relevés), six (at the second relevé), seven (at third) and eight (at the fourth and fifth relevés) positive indicator species were present (*i.e. Moliniacaerulea*, *Filipendula ulmaria*, *Potentilla erecta*, *Carex panacea*, *Carex flacca*, *Carex nigra*, *Juncus articulatus*, *Mentha aquatica*, *Ranunculus flammula, Succisa pratensis* and *Galium palustre*). No non-native species, negative indicator species or *Polytrichum* species (or *Pteridium aquilinum*) were noted in any of the relevés. At four of the six relevés the following additional condition information was recorded. Scrub cover greater than 5% was only noted in one relevé. No bare soil or rock was present in three of the four relevés, while peat was present in one of therelevés at a low percentage cover. The percentage cover of bare ground was c.15%with some bare soil, rock and litter present. No surface water was present. The median vegetation height for grass species at three of the relevés differed (*i.e.* c.40cm at two relevés and c.5cm and 20cm at the other two respectively). Each of the four relevés where condition information was recorded passed a varying numberof the 12 criteria of the structure and function condition assessment (O'Neill *et al.*,2013), *i.e.* nine out of 12 for two relevés and 10 out of 12 for other two relevés, *i.e.*failing on presence of positive indicator species (≥7); presence of high quality indicator species (≥1); percentage cover of scrub, bracken and heath cover (≤5%) forb to graminoid ration (40-90% forb); and, percentage cover of sward between 10-80cm in height (≥30%). Refer to relevé codes EC39 R6, EC39 R7, EC39 R8, EC39 R10, EC39 R14 and EC39 R15 presented in Appendix A.8.19 of the updated EIAR for an associated species list.

4.4 Methodology for Compensatory Habitat Creation

4.4.1 Selection of Receptor Site

The identification and selection of the compensatory habitat receptor site, where 6410 habitat will be created, was based on a desk study conducted in September 2017 and a site visit conducted in September 2014 and November 2017 as part of the surveys undertaken to inform the environmental studies for the proposed N6 GCRR. This site was selected, in consultation with the design team, as a suitable receptor site based on a review of the following:

- Site data collected as part of habitat surveys undertaken in July 2014 at the donor site and in September 2014 and November 2017 at the receptor site. Detailed relevés were carried out within and in close proximity (*i.e.* c.200m- 825m) to the donor site within the same habitat type. Relevé information collected in these areas is considered to be representative and comparable to thesites themselves. Subsequent surveys were undertaken at the donor and receptor sites in 2019 and 2023 to provide additional support and aid the verification of the baseline habitat classifications, and to identify any subsequent changes in habitats present (Refer to Appendix A.8.1 of the updated EIAR for more detail). The following information was collected:
  - the percentage cover of high quality, positive and/or negative indicatorplant species present
  - presence of soil, rock and surface water
  - other botanical and environmental factors considered as part of condition assessment criteria for this habitat type (after O'Neill *et al.* 2013)
- Hydrological and hydrogeological data collected to inform the environmental studies for the proposed N6 GCRR
- Soils and Geology data collected to inform the environmental studies for the proposed N6 GCRR

Other information relied upon as part of the selection process included the following information sources:

- Ordnance Survey of Ireland mapping and aerial photography available fromwww.osi.ie
- Online data available on European sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie
- Online data available from the National Biodiversity Data Centre mapping service (http://maps.biodiversityireland.ie/#/Map)
- Information on land-use zoning from the online mapping of the Departmentof the Environment, Community and Local Government http://www.myplan.ie/en/index.html
- Information on water quality in the area available from www.epa.ie
- Information on soils and geology in the area available from www.gsi.ie
- Information on the location, nature and design of the proposed N6 GCRR supplied by the design team
- Information on the status of EU protected habitats in Ireland (National Parks& Wildlife Service, 2013)

Based on a review of information collected (from the sources described above andwith reference to guidance provided in Section 1.1), one compensatory habitat receptor site for the creation of 6410 was selected. It is located in Na Foraí Maola Thoir at Ch. 0+800 to Ch. 0+950 within the Assessment Boundary, adjacent or in close proximity to the footprint of the proposed N6 GCRR (see Figure 2 for location). This receptor site was surveyed on the 9 September 2014 and 3 November 2017 and five habitat types (as defined in Fossitt, 2000) wereidentified within and directly adjacent to its boundaries. These included: a mosaic of Dense bracken (HD1), Scrub (WS1), Acid grassland (GS3) and Wet grassland (GS4) and Wet grassland, Broadleaved woodland (WD1) and Building and artificialsurfaces (BL3) alone. These results were confirmed in subsequent surveys in 2019 and 2023. It was located directly adjacent to an area of 6410 habitat; this habitat falls within the Assessment Boundary however is proposed to be retained.

This site was considered to be a suitable receptor site for 6410 habitat compensationfor the following reasons:

- Presence of physical characteristics at the receptor site necessary for the establishment of *Molinia* meadow habitat such as suitable topography, geologyand/or hydrological features (*i.e.* an undulating topography on granite bedrockand peaty soils within a poorly productive groundwater body)
- Presence of similar plant species composition within or in close proximity to the receptor site to that being compensated for at the donor site (*i.e.* the nearestarea of 6410 habitat is located directly adjacent to the receptor site)
- Total area of the receptor site (*i.e.* c.0.49ha) in the context of the total area of 6410 to be lost (*i.e.* c.0.29ha) (*i.e.* c.170% of the area of 6410 lost will be compensated for)[9]
- Existing or future access to the site that will facilitate machinery, required for the proposed compensatory measures or management activities, entering or exiting the site

4.4.2 Pre-Compensatory Works Site Preparation

4.4.2.1 Ecology Site Management Plans

Prior to compensatory works commencing, Ecology Site Management Plans specific to the contract programme will be finalised by the Contractor in combination with the Project Ecologist and/or ECoW, with reference to the construction programme, which may influence the timing and co-ordination of these works and the requirement for storage of soils and/or turves, and issued to theteam involved in the compensatory works. The finalised plans will include site specific method statements outlining step-by-step actions (as per the pre- compensatory measures described in Section 4.4.2 and compensatory measures described in Section 4.4.3) for the Contractor to implement within a specified timescale, under the supervision and advice of the Project Ecologist and/or ECoW.It will also include a check-list of conditions (as per the monitoring criteria set outin O'Neill *et al.* 2013 and as described in Section 4.6) to be assessed by a suitablyqualified and experienced ecologist at the receptor site during the pre-compensation, during and post-compensation monitoring. The finalisation of the Ecology Site Management Plans by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, as these plans are merely providing more site specific detail and methodological steps to the principles and proposals already outlined in this CHMP.

4.4.2.2 Non-native Invasive Plant Species and Biosecurity

As set out in the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the updated EIAR, a non-native invasive plant species survey will be undertaken immediately in advance of works commencing to inform the finalisation of CEMP. The biosecurity measures outlined in the CEMP will be implemented at both the donor and receptor sites, where applicable, in order to avoid the accidental spread of potentially harmful plant or animal species betweensites. The CEMP also includes: measures that the Contractor will implement in order to avoid spreading invasive species during soil movement; measures to treat invasive plant species prior to construction/compensation works commencing; and,site hygiene measures to be implemented to prevent further spread of non-native invasive plant species.

4.4.2.3 Temporary Fencing

Where applicable, temporary fencing and associated signage will be erected at boththe donor and receptor sites for the duration of the construction. This will minimiseany potential disturbance to adjacent sensitive habitats and/or hydrological featureswithin both the donor and receptor sites from either encroachment into the habitat or damage.

[9] "Replacement ratios of compensatory habitat greater than one-to-one are frequently appropriate because of the uncertainty inherent in compensation, particularly in cases which require ecological restoration, habitat creation or translocation of species or habitats. The scientific basis for deriving appropriate ratios is not exact and will vary depending on the habitat or species concerned. Increased replacement ratios can also help take account of the time lag in delivering compensation and regaining the same maturity, complexity and diversity of habitats and the full complement of associated species.." (CIEEM, 2018).

4.4.2.4 Soil Preparation at the Receptor Site

The soil preparation technique(s) outlined below will be implemented at the receptor site either alone or in-combination, as decided upon on an on-site by the Contractor in combination with the Project Ecologist and/or ECoW. It is recommended that the soil fertility at the receptor site is determined prior to the implementation of the site specific method statements as this will influence which technique(s) are employed at a site. It is recommended that a combination of these measures are implemented in order to increase the likelihood of success of 6410 habitat creation (Klimkowska *et al.*, 2007). A reduction in soil fertility (*i.e.* in particular reduced levels of phosphorus) is an essential part in the restoration and creation of semi-natural wet grasslands of high nature value (Tallowin & Smith, 2001).

Surface Vegetation Management and Removal Techniques

At the receptor site, it may be necessary to cut and remove certain undesirable species (suchas *Pteridium aquilinum* and *Rubus fruticosus* L.), in-combination with the soil stripping method described in Section 3.2.3.2 below, in order to prepare the site prior to implementation of the compensatory measures. It may be deemed necessary to use herbicides to control and/or eliminate the presence of *Pteridium aquilinum*, especially in areas severely infested with this species. Following treatment, the accumulated litter should be removed from the receptor site.

Stripping of Unsuitable Topsoil

The stripping of unsuitable topsoil is one of the most effective techniques to reducethe soil fertility of a receptor site and to remove highly competitive undesirable species that may be present in the seed bank (Tallowin & Smith, 2001 and Klimkowska *et al.*, 2007). Studies have shown that the greater the depth of topsoilremoval (*i.e.* c.15-20cm) at the receptor the increased likelihood of success due toa reduction in soil fertility and in some cases prolonged water stagnation and associated anoxic conditions, which would be detrimental to undesirable species (Klimkowska *et al.*, 2007).

The topsoil removal will involve stripping the topsoil of the site to a maximum depth of c.25cm. These works must be undertaken during dry weather conditions under the supervision of the Project Ecologist and/or ECoW. Ground compaction of the sub-soil by machinery will be avoided as it may impede the rates of establishment of desired species following implementation of the compensatory measures.

4.4.3 Compensatory Measures

The five different compensatory measures described below outline how 6410 habitat will be created within the compensatory habitat receptor site. More than likely these measures will be implemented in-combination with one another, as to be determined by the Contractor under the supervision and advice of the Project Ecologist and/or ECoW. The timing and duration of these works will depend on theprogress of the construction of the proposed N6 GCRR requirements for access and weather conditions. It should be noted that the process of habitat restoration and creation can take several years and that appropriate management of these sitesis essential to ensure success (Crofts & Jefferson, 1999). However suitable hydrological/hydrogeological conditions necessary for the creation of 6410 (*i.e.* wet, waterlogged soil conditions) were identified at the receptor site during surveysundertaken in September 2014 and October 2017, as reflected by the existing habitats of wet grassland, located within the receptor site, and 6410 located directly adjacent to the receptor site. This should ensure that the proposals have a high chance of succeeding.

4.4.3.1 Translocation of Turves

Translocation involves the removal of turves, soil and/or plant species from the impacted donor site to the new receptor or compensation site (Iuell *et al.*, 2003). Following site preparation, intact turves of existing 6410 habitat (*i.e.* c.25cm-30cmin depth as dependent on conditions at donor site) will be carefully removed from the chosen donor site using a suitable excavator (*i.e.* with adequate capacity to carefully remove and translocate the intact turves) during dry weather conditions and moved to the receptor site (located in Na Foraí Maola Thiar). Following site preparation, which will include the stripping of topsoil to a maximum depth of c.25-30cm, as dependent on the conditions at the donor site, the turves will be incorporated into the bare substrate at the receptor site. This process must be undertaken slowly and carefully in order maintain the integrity of the intact turves,which will contain desirable species of this habitat type such as those outlined in Section 2.2 and Section 2.3 (after O'Neill *et al* (2013). The turves must be laid outat the receptor site in such a manner as to avoid excessive movement of the excavator, which could cause damage. Ground compaction

of the soil must be avoided as it may impede the rates of establishment of desired species following implementation of the compensatory measures. Small "*plugs*" of impacted turves from the donor site may also be translocated and incorporated into the receptor site.Due to the wetness of soils associated with 6410 habitat, it is recommended that, where possible, they are translocated immediately from the donor site to the receptor site as failure to do so may reduce the likelihood of successful 6410 creation. In the event of this not being possible, the duration of storage must be as minimal as possible. During storage, turves must not be placed on top of each otherin order to avoid any compaction of soil, as this would reduce the quality of the soiland would negatively impact on the success of the translocation. Sengl *et al*., (2017) compared the use of sod transplantation, natural colonisation and hay transfer, and seed addition in two restoration projects that served as habitat compensation measures for the loss of species rich grasslands. It was found that sod transplantation was the most successful method (i.e. produced a vegetation community most similar to the reference site), followed by hay transfer and natural colonisation. Seed addition resulted in a homogenous, species poor sward (Sengl *et al.,* 2017).

4.4.3.2 Translocation of Suitable Soils

Following site preparation, both the soils (including the topsoil) and the vegetationof the donor site of existing 6410 habitat may be scraped up and transferred togetherto the receptor site in a suitable excavator. The topsoil of the donor site is likely tocontain a sufficient seed bank of desirable plant species to allow the receptor site tore-vegetate naturally, creating the habitat type. Likewise, any intact vegetation present is likely to be comprised of a number of 6410 target species. Due to the wetness of soils associated with 6410 habitat, it is recommended that, where possible, they are translocated immediately from the donor site to the receptor site as failure to do so may reduce the likelihood of successful 6410 creation. In the event of this not being possible, the duration of storage should be as minimal as possible. It is anticipated that all soils required for the creation of 6410 will be sourced from the 6410 donor site.

4.4.3.3 Seeding

It is recommended that seeds of desirable plant species from the local donor site, and any other available site comprised of 6410 habitat, are collected directly from the plant once mature (*i.e.* from August/September onwards) during warm, dry conditions, stored in suitable conditions to ensure their survival and then planted asseed mix at the compensatory receptor site. The timing of seed collection will needto be considered as part of the construction programme. This is the preferred methodof seeding as it will ensure that no foreign seeds are present in the planted seed mixand will in turn help to protect the integrity of the local genetic population of plantsof this habitat type (Crofts & Jefferson, 1999). It may be carried out by hand or byseed collection machines as dependent on the size of the donor site (National RoadsAuthority, 2006). To determine first if whether or not it is an appropriate time to harvest the seeds at a particular donor site and secondly that the seeds themselves have developed properly, it may be necessary to check a sample selection first. Thiswill involve: assessing the seed's colour, which typically may be brown when mature; examining whether or not they crack under pressure; and/or, determining whether or not the cotyledon is present. During collection, seeds may be stored in paper or cloth bags or open tubs to avoid exposure to direct sunlight (NBDC, 2016).In some cases it may be necessary (*e.g.* due to the project schedule and/or other project commitments), to store seeds from the donor sites for planting later at the appropriate time of year. Prior to storage and sowing, seeds should be air dried (at c.18°C) and then cleaned using a sieve to remove any dust and the chaff of the seed. The dry seeds can be placed into an air-tight container with dry silica sachets and placed in a refrigerator at a low temperature (NBDC, 2016). If it is necessary to store seeds for a longer period of time, then they may be frozen (at a recommended temperature of c. -18°C). This can only occur for orthodox species (i.e. species where seed longevity can be increased in a predictable manner by reducing seed moisture content) when seeds have undergone the drying process (De Vitis *et al.,* 2020).

Where seed collection from the donor sites is not possible, local native seed mixesmay be bought at "*Irish Wildflower Showcase*"[10] (or similar supplier of native seedstock), which is a reputable supplier of local native seed mixes. Specific seed mixes,containing only the desirable plant species indicative of 6410 habitat and suited to the climate and main soil conditions of the receptor site, can be made up to order tohelp ensure the successful creation of this habitat type.

To yield best results, it is recommended that seeds are sown in late summer to earlyautumn as it will allow the plants sufficient time to become established during the winter ready for vigorous growth the following spring (National Roads Authority, 2006). Seed sowing can be undertaken either by hand or using agricultural machinery such as slot, seeders and seed drills where applicable (Crofts & Jefferson, 1999). Where possible, the soil should be rolled following seeding as thiswill improve the likelihood of germination taking place by maximising the seed surface contact with the soil (National Roads Authority, 2006).

4.4.3.4 Application of Freshly Cut Plant Material

Following site preparation of the receptor site, freshly cut plant material, which contains seeds from desirable species present at the donor site, may be spread overthe receptor site to be colonised (Crofts & Jefferson, 1999). In order to yield best results, it is necessary for the material to be cut at the donor site after the target plantspecies have flowered and while the seeds are still attached (*i.e.*August/September), but at the point of dispersal (National Roads Authority, 2006).Once cut and collected, the material will be spread loosely and quickly (*i.e.* within24 hours) to prevent any spoiling or loss of the seeds (National Roads Authority, 2006). It is then left for a period of three weeks until seeds have fallen. It should beturned once if possible during this period. The hay will then be removed to prevent smothering of seedlings and to shake out any remaining attached seeds (Crofts & Jefferson, 1999).

4.4.3.5 Natural Colonisation

During the survey undertaken in September 2014, an area of 6410 Annex I habitatwas identified directly adjacent to the receptor site and as such it is possible that natural colonisation of the receptor site may occur where colonisation gaps are provided for. This process may however take a number of years before the establishment of desired species occurs (Crofts & Jefferson, 1999). This measure should only be implemented in-combination with a selection of, or all of, the compensatory measures outlined above.

4.5 Management

Site specific details on both the short-term and long-term management of the newlycreated habitat will be outlined in the finalised Ecology Site Management Plans, asdetermined by the Project Ecologist and/or ECoW. Management of the newly created habitat is necessary for its success, as it will prevent the domination of the sward by undesirable rank species (e.g. *Pteridium aquilinum* and *Rubus fruticosus*L.), which have the ability to outcompete the desired species, and will help to maintain a high species richness.

Following the implementation of the chosen compensatory measure(s), a stock- proof protective fence will be erected to protect the receptor site from disturbance such as unwanted grazing and/or trampling. This will give the newly created habitatsufficient time to establish and stabilise. Regular mowing will be required at a newly created grassland site (Klimkowska *et al.*, 2007).

While mowing dates and frequency of cutting will be assessed on an on-site basis,as it will be influenced by the rate of plant species growth, it will more than likely take place once a year from mid-June to July after the grasses have set seed. Timingof mowing should consider the potential for ground nesting birds to be present (Croft & Jefferson, 1994). All cuttings should be removed from the site to avoid nutrient enrichment of the sward and the shading of young seedlings (Croft & Jefferson, 1994). The cut should be set high (*i.e.* above 4cm from ground level) to avoid scalping the turves, which could potentially result in the exposure of bare ground and in turn the encouragement of weed invasion. Mowing should ideally beundertaken during dry conditions to avoid compacting and potentially damaging the soil structure (National Roads Authority, 2006).

[10] Irish Wildflower Showcase website: http://www.wildflowers.ie/

4.6 Monitoring

Monitoring of the receptor site will be carried out by a suitably qualified and experienced ecologist pre-compensation, during and post-compensation in order to:

- firstly, ensure that potential issues that may deter the success of the compensation are identified at an early stage and addressed through adaptive management measures
- secondly, to determine the overall success of the habitat compensation.

Adaptive management measures will be targeted to address the specific issuesidentified by the monitoring and may be varied, For example they could include, translocation of additional turves to replace those that have failed, and/or additional seeding where this is deemed necessary to improve vegetation cover/presence.

Adaptive management measures, implemented in response to monitoring results, will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, providing these measures either fall within the scope of proposals already provided for in this CHMP, or involve impacts of equal of lesser significance to those provided for in this CHMP and assessed in the updated EIAR and updated NIS.

The finalised Ecology Site Management Plans, which will be prepared on an on- site basis, will include a check-list of conditions to be assessed by a suitably qualified and experienced ecologist at the receptor site pre-compensation, during the compensation works, and as part of the post-compensation monitoring. Conditions assessed in both the short and long-term will be in reference to the monitoring criteria set out in O'Neill *et al.*, 2013 for this Annex I habitat and will be used to determine the extent of successful 6410 establishment. These conditionsinclude the following as a minimum:

- Information on vegetation composition, *i.e.* number of high quality and positive indicator species present; percentage cover of negative indicator species, non-native, scrub species and *Pteridium aquilinum* present
- Information on vegetation structure, *i.e.* height of vegetation and forb to graminoid ration
- Information on physical structure, *i.e.* cover of bare ground and litter and evidence of grazing and/or disturbed ground

In order to achieve the equivalent value of the area of the Annex I *Molinia* meadows on calcareous, peaty or clayey-silt- laden soils (*Molinion caeruleae*) [6410] being lost, the habitat that will be created at the compensatory receptor site must correspond to 6410 and, therefore, contain sufficient established and mature positive indicator species of those Annex I habitat types (as per Martin *et al.*, 2018).

The intervals and duration for the pre- and during compensation monitoring programme, will be decided upon by the Project Ecologist and/or ECoW and is likely to depend upon the speed of habitat establishment and stabilisation.

The post-construction monitoring programme will require annual monitoring, commencing on the year of habitat creation, for a minimum period of five years, with a review by a suitably qualified and experienced ecologist at the end of that period undertaken to determine whether the monitoring period needs to be extended further, if for example it is viewed that the habitat has not stabilised or become fullyestablished by that time. Any extension to the monitoring period will need to consider whether on-going monitoring should be at annual or longer intervals e.g.

+3 years post-creation, +6 years post-creation etc.

The results of all monitoring will be made available to the NPWS.

In a 'worst case' scenario, it will take between approximately 10 to 20 years for the 6410 compensatory habitat to establish and mature at the respective receptor site and reach an equivalent ecological value to the respective donor sites. This does not affect the conclusions set out in the updated EIAR on the residual impact on these habitats, *i.e.* that post-compensation the loss of 6410 will not result in a significant residual effect, at any geographic scale, over the long-term (*i.e.* >10- 20 years).

The most significant time constraint, with respect to achieving this requirement, is the total number of years it will take for the positive indicator species of this Annex I habitat to establish and mature at the receptor sites. As detailed above, the various compensatory measures can be implemented in isolation or in combination to create 6410 habitat. Whilst it is likely that a combination of compensatory measures will be undertaken at the receptor sites (*i.e.* translocation of intact turves/suitable soils, seeding, application of freshly cut plant material and/or natural colonisation[11]), a precautionary approach has been adopted and, as such, the number of years provided is from seed rather than the translocation of intact turves. In the case of the translocation of turves, the number of years required to achieve an equivalent value to that of the habitat being lost will be less when compared to other compensatory measures, as the turves already contain established and mature positive indicator species of these Annex I habitats.

4.7 Conclusions

The measures outlined in this section will compensate for the significant residual effect on 6410 habitat by ensuring that there will be no net permanent loss of this habitat type as a consequence of the proposed N6 GCRR. A total area of c.0.49ha (*i.e.* c.170% of the area of 6410 lost) will be created as part of the proposed compensatory works. The steps outlined in this section are presented below as a flow chart.

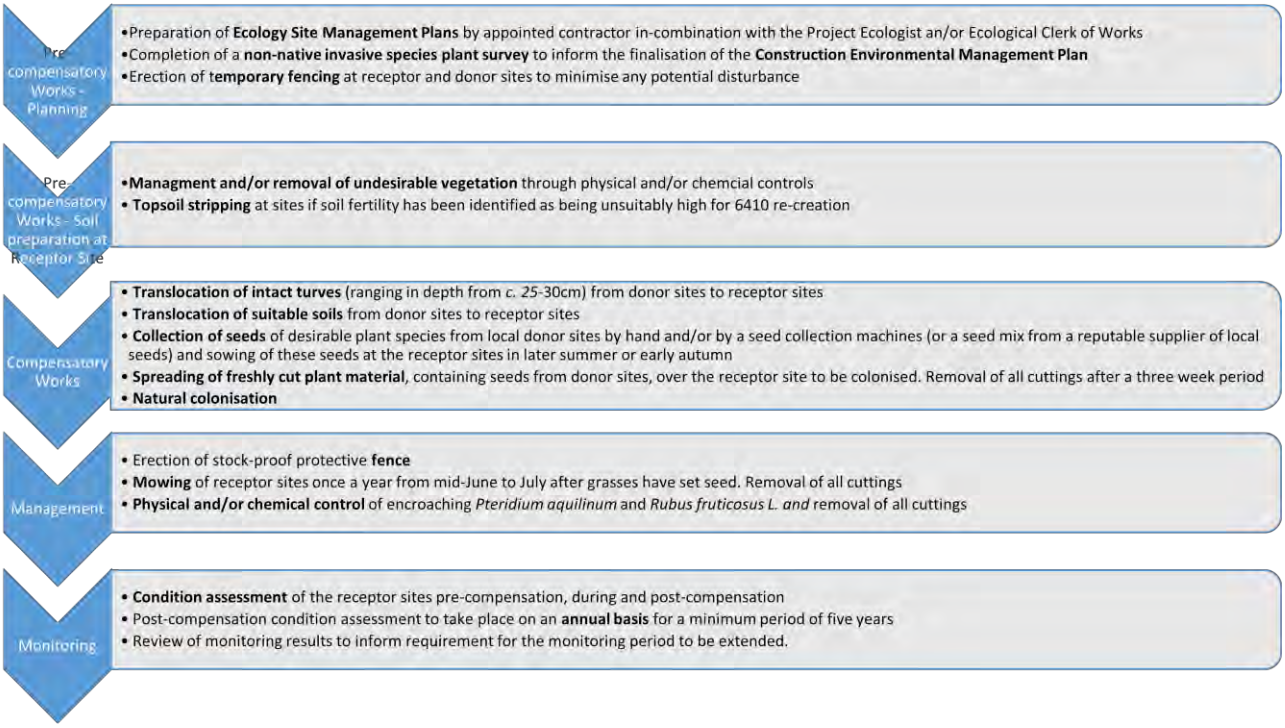

Plate 5 Flow chart of steps involved in the creation of 6410

[11] It is noted that the compensatory measure of natural colonisation may take a number of years before desired species established (Croft, A. & Jefferson R. G. (eds) (1999) *The Lowland Grassland Management Handbook*, 2nd Edition.) and as such it was recommended that it is only implemented in-combination with a selection of or all other compensatory measures.

5. Alnus glutinousa and Fraxinus excelsior (Alno-Padion, Alnion incanae) [*91E0]

5.1 Introduction

The proposed N6 GCRR will result in the permanent loss of c.0.14ha of thepriority Annex I habitat Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*) [*91E0] (hereafter referred to as *91E0). This habitat does not fall within the Lough Corrib SAC. It is proposed to compensate for this loss by re-creating c.0.17ha. This is c.121% of the loss of *91E0 (*i.e.* 0.14ha).

The steps followed for the *91E0 habitat compensation process are:

- Identification and selection of a suitable compensatory habitat receptor site for *91E0 habitat (Refer to Section 5.2 to 5.4)
- Pre-compensatory works site preparation at both the donor site and receptorsite, including: the provision of site specific method statements within Finalised Ecology Site Management Plans; erection of temporary fencing; topsoil stripping; and, weed control (Refer to Section 5.4.2)
- Implementation of compensatory measures, either alone or in-combinationwith one another, as dependent on the characteristics of the receptor site. These measures include (Refer to Section 5.4.3):
  - the translocation of soil from the donor site to the receptor site
  - seed collection and sowing
  - tree planting
  - growing trees from cuttings
- Short-term and long-term management of the receptor site following theimplementation of compensatory measures (Refer to Section 5.5)
- Monitoring of the receptor site to be carried out pre-compensation, during andpost-compensation by a suitably qualified and experienced ecologist in order to ensure that potential issues are identified at an early stage and addressed through adaptive management measures (Refer to Section 5.6)

5.2 Description of Annex I Habitat *91E0

The vegetation type with the priority Annex I habitat Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*) [*91E0] to be lostis *Salix cinerea – Equisetum fluviatile*. In Ireland this vegetation type is comprisedof willow-dominated wet woodland stands of waterlogged, regularly inundated or permanently submerged ground. Soils present are typically base-rich, organic and highly fertile. The stands are strongly dominated by *Salix cinerea*. *Fraxinus excelsior* and *Alnus glutinosa* are frequent, but typically provide little cover. The field layer is dominated by *Rubus fruticosus*, *Hedera helix* and *Filipendula ulmaria*.Other frequent species include *Carex remota*, *Dryopteris dilatata*, *Agrostis stolonifera*, *Mentha aquatica*, *Phalaris arundinacea*, *Galium palustre* and *Angelicasylvestris*. *Equisetum fluviatile* and *Cardamine pratensis* are occasionally present. Bryophyte cover is typically low, with most frequent species being *Calliergonellacuspidata*, *Kindbergia praelonga*, *Isothecium myosuroides* and *Brachythecium rutabulum*. *Calliergon cordifolium* occurs occasionally around small pools (Perrin*et al.*, 2008a & Perrin *et al.*, 2008b). Threats to this vegetation type include changesto hydrological regimes, overgrazing by livestock, woodland clearance and invasion by non-native species.

5.3 Description of Potential *91E0 Donor Site

There is one site of Annex I habitat *91E0 subject to permanent habitat loss as a consequence of the proposed N6 GCRR (see Figure 7 for location). The donor site of *91E0 habitat were considered to be Annex I habitat due to thepresence of a sufficient number of high quality positive/positive indicator species (after Perrin *et al.*, 2008a & Perrin *et al.*, 2008b). No other habitats were present at the potential donor site. Full descriptions of the donor site of habitat to be lost is provided below.

5.3.1 Donor Site *91E0.nD4 - Ch. 9+800 to Ch. 9+900

Donor site *91E0.nD4 consists of c.0.14ha. See Figure 7 for location. This donor site lies outside of but adjacent to Lough Corrib SAC. Botanical data was collectedwithin this site on the 1 June 2016. It was described as a small patch of *Salix cinerea* wet woodland (WN6-3c *Alnus glutinosa – Filipendula ulmaria* group, *Salix cinerea – Equisetum fluviatile* vegetation type), which corresponded with the Residual alluvial forest [*91E0] priority Annex I habitat type. The woodland was dominatedby *Salix cinerea* subsp. *oleifolia*, with *Fraxinus excelsior*, *Agrostis stolonifera*, *Rubus fruticosus* agg., *Filipendula ulmaria* and *Eurhynchium striatum* recorded frequently. Other species present included: *Juncus effusus*, *Hedera helix*, *Lythrum salicaria*, *Galium palustre*, *Geranium robertianum*, *Crataegus monogyna*, *Prunus spinosa*, *Galium aparine*, *Rumex sanguineus*, *Equisetum fluviatile*, *Epilobium hirsutum*, *Corylus avellana*, *Ranunculus repens* and the moss species *Calliergonella cuspidatum*, *Eurhynchium striatum*, *Kindbergia praelonga* and *Thamnobryum alopecurum*.

Two relevés were carried out in within the area of *91E0 to be lost in this site on 4 and 5 July 2019. Refer to Appendices A.8.1 and A.8.19 of the EIAR for more detail. The area was described as a damp woodland area with peat soils. A total of 12 positive indicator species of this Annex I habitat were present: 3 tree species (i.e. *Crataegus monogyna, Fraxinus excelsior* and *Salix cinerea*), 5 herb species (*i.e. Agrostis stolonifera, Filipendula ulmaria, Galium palustre, Rumex sanguineus* and *Urtica dioica*), and four moss species (i.e. *Calliergonella cuspidata, Kindbergia praelonga, Ulota bruchii* and *Ulota crispa*). One non-native species was present (*Acer pseudoplatanus,* less than 1% cover). Refer to relevé code 3297a_R2 & 3297_R1 presented in Appendix A.8.19 of the updated EIAR for the associated species list.

5.4 Methodology Compensatory Habitat Creation

5.4.1 Selection of Receptor Site

The identification and selection of the compensatory habitat receptor site, where *91E0 habitat will be created, was based on a desk study conducted in June 2017 and site visits conducted in 2014 to 2017 as part of the surveys undertaken to informthe environmental studies for the proposed N6 GCRR. This site was selected, in consultation with the design team, as a suitable receptor site based on areview of the following:

- Site data collected as part of habitat surveys undertaken in 2016 at the donor site and in 2015 at the receptor site. The following information was collected: the percentage cover of high quality, positive and/or negative indicator plant species present; presence of soil, rock and surface water; and, other botanical and environmental factors considered as part of condition assessment criteria for this habitat type (after Perrin *et al.*, 2008a & Perrin *et al.*, 2008b). Subsequent surveys were undertaken at the donor and receptor sites in 2019 and 2023 to provide additional support and aid the verification of the baseline habitat classifications, and to identify any subsequent changes in habitats present (Refer to Appendix A.8.1 of the updated EIA for more detail).
- Hydrological data collected to inform the environmental studies for the proposed N6 GCRR
- Soils and Geology data collected to inform the environmental studies for the proposed N6 GCRR

Other information relied upon as part of the selection process included the following information sources:

- Ordnance Survey of Ireland mapping and aerial photography available fromwww.osi.ie
- Online data available on European sites as held by the National Parks andWildlife Service (NPWS) from www.npws.ie

- Online data available from the National Biodiversity Data Centre mappingservice (http://maps.biodiversityireland.ie/#/Map)
- Information on land-use zoning from the online mapping of the Department ofthe Environment, Community and Local Governmenthttp://www.myplan.ie/en/index.html
- Information on water quality in the area available from www.epa.ie
- Information on soils and geology in the area available from www.gsi.ie
- Information on the location, nature and design of the proposed N6 GCRR suppliedby the design team
- Information on the status of EU protected habitats in Ireland (National Parks &Wildlife Service, 2013)

Based on a review of information collected (from the sources described above andwith reference to guidance provided in Section 1.1), one compensatory habitat receptor site for the creation of *91E0 was selected. It is located directly south-eastof, and partially overlapping with the donor site *91E0.nD4 within the Assessment Boundary, adjacent or in close proximity to the footprint of the proposed N6 GCRR (see Figure 7 for location). This receptor site lies outside of but adjacent to Lough Corrib SAC.

This receptor site was surveyed on the 10 September 2015 and October 2017. Only one habitat type (as defined in Fossitt, 2000) was identified within and directly adjacent to its boundaries, *i.e.* Wet grassland (GS4). Wet willow-alder-ash woodland (WN6, which corresponds to the Annex I habitat *91E0) occurs in the area of overlap with donor site *91E0.nD4. These results were confirmed in subsequent surveys. It was considered to be a suitable receptor site for *91E0 habitat compensation for the following reasons:

- Presence of physical characteristics at the receptor site necessary for the establishment of Residual alluvial forest such as suitable topography, geology and/or hydrological features (*i.e.* waterlogged, base-rich, organic and highly fertile soils which are regularly inundated or permanently submerged by water)
- Presence of similar plant species composition within or in close proximity to the receptor site to that being compensated for at the donor site (*i.e.* the nearestarea of *91E0 habitat is located immediately north of the receptor site)
- Short distance between donor and receptor sites (*i.e.* the donor site is located directly adjacent to the receptor site)
- Total area of the receptor site (*i.e.* c.0.17ha) in the context of the total area of Residual alluvial forest to be lost (*i.e.* c.0.14ha) (*i.e.* c.121% of the area of *91E0 lost will be compensated for)[12]
- Existing or future access to the site that will facilitate machinery, required for the proposed compensatory measures or management activities, entering or exiting the site

This site is located within the same flooding regime as the adjacent donor site *91E0.nD4 (*i.e.* Flood Zone A and Flood Zone B, see Figure 11.4.107 of the updated EIAR for location of this flooding zone). The geographical location of the receptorsite within this flood regime is important for the establishment of ground conditions suitable for the creation of *91E0 at the site (*i.e.* waterlogged soils that are regularly inundated or permanently submerged). This flooding regime will not be impacted by the proposed N6 GCRR.

The vegetation type with the priority Annex I habitat Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*) [*91E0] to be lostis *Salix cinerea – Equisetum fluviatile*. In Ireland this vegetation type is comprisedof willow-dominated wet woodland stands of waterlogged, regularly inundated or permanently submerged ground. Soils present are typically base-rich, organic and highly fertile. The stands are strongly dominated by *Salix cinerea*. *Fraxinus excelsior* and *Alnus glutinosa* are frequent, but typically provide little cover. The field layer is dominated by *Rubus fruticosus*, *Hedera helix* and *Filipendula*

[12] "*Replacement ratios of compensatory habitat greater than one-to-one are frequently appropriate because of the uncertainty inherent in compensation, particularly in cases which require ecological restoration, habitat creation or translocation of species or habitats. The scientific basis for deriving appropriate ratios is not exact and will vary depending on the habitat or species concerned. Increased replacement ratios can also help take account of the time lag in delivering compensation and regaining the same maturity, complexity and diversity of habitats and the full complement of associated species.*" (CIEEM, 2018).

ulmaria.Other frequent species include *Carex remota*, *Dryopteris dilatata*, *Agrostis stolonifera*, *Mentha aquatica*, *Phalaris arundinacea*, *Galium palustre* and *Angelicasylvestris*. *Equisetum fluviatile* and *Cardamine pratensis* are occasionally present. Bryophyte cover is typically low, with most frequent species being *Calliergonella cuspidata*, *Kindbergia praelonga*, *Isothecium myosuroides* and *Brachytheciumrutabulum*. *Calliergon cordifolium* occurs occasionally around small pools (Perrin*et al.*, 2008a & Perrin *et al.*, 2008b). Threats to this vegetation type include changesto hydrological regimes, overgrazing by livestock, woodland clearance and invasion by non-native species.

5.4.2 Pre-Compensatory Works Site Preparation

5.4.2.1 Ecology Site Management Plans

Prior to compensatory works commencing, Ecology Site Management Plans will be finalised by the Contractor in combination with the Project Ecologist and ECoWwith reference to the construction programme, which may influence the timing andco-ordination of these works and the requirement for storage of soils, and issued tothe team involved in the compensatory works. The finalised plans will include site specific method statements outlining step-by-step actions (as per the pre- compensatory measures described in Section 5.4.2and compensatory measures described in Section 5.4.3) for the Contractor to implement within a specified timescale, under the supervision and advice of the Project Ecologist and/or ECoW.It will also include a check-list of conditions (as per the monitoring criteria set outin Perrin *et al.*, 2008a & Perrin *et al.*, 2008b and as described in Section 5.6) to beassessed by a suitably qualified and experienced ecologist at the receptor site duringthe pre-compensation, during and post-compensation monitoring. The finalisationof the Ecology Site Management Plans by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, as these plans are merely providing more site specific detail and methodological steps to the principles and proposals already outlined in this CHMP.

5.4.2.2 Non-native Invasive Plant Species and Biosecurity

As set out in the Construction Environmental Management Plan (CEMP) in Appendix A.7.5 of the updated EIAR, a non-native invasive plant species survey will be undertaken immediately in advance of works commencing to inform the finalisation of CEMP. The biosecurity measures outlined in the CEMP will be implemented at both the donor and receptor sites, where applicable, in order to avoid the accidental spread of potentially harmful plant or animal species betweensites. The CEMP also includes: measures that the Contractor will implement in order to avoid spreading invasive species during soil movement; measures to treat invasive plant species prior to construction/compensation works commencing; and,site hygiene measures to be implemented to prevent further spread of non-native invasive plant species.

5.4.2.3 Temporary Fencing

Where applicable, temporary fencing and associated signage will be erected at boththe donor and receptor sites for the duration of the construction. This will minimiseany potential disturbance to adjacent sensitive habitats within both the donor and receptor sites from either encroachment into the habitat or damage. Both the receptor and donor site lie outside of but adjacent to the Lough Corrib SAC and therefore any temporary fencing will need to be installed in a manner that is sensitive to and does not impact on the adjacent Lough Corrib SAC.

5.4.2.4 Stripping of Topsoil

Depending on the condition of the receptor site during construction, it may be necessary to remove its topsoil in the event that the site has been improvedconsiderably and as a consequence contains a seed bank of highly competitive plantspecies that are undesirable in context of *91E0 creation or other existing surrounding semi-natural habitats. This would involve stripping the topsoil of the site to a maximum depth of c.5-10cm. These works must be undertaken during dryweather conditions under the supervision of the Project Ecologist and/or ECoW. Considering the current condition of the receptor site, it is not anticipated that this measure will be required.

5.4.2.5 Weed Control

It is possible that undesirable plant species, dormant in the soil of the receptor site,may become disturbed during the site preparation process and as a result start to germinate and establish as seedlings. Appropriate measures should be undertaken to control such species, which could potentially outcompete and inhibit the germination and establishment of the desired species required for the creation of

*91E0. If there is a significant time period between site clearance at the receptor site and when the compensatory habitat will be created, measures may include at the receptor site: sowing a pioneer/nurse crop; spot treatments with herbicides and,cutting or pulling undesirable plants in June before flowering.

5.4.3 Compensatory Measures

The five different compensatory measures described below outline how *91E0 habitat will be created within the compensatory habitat receptor site. These measures will be implemented either in-combination with one another or alone, asdetermined by the Contractor under the supervision and advice of the Project Ecologist and/or ECoW. The timing and duration of these works will depend on theprogress of the construction of the proposed N6 GCRR, requirements for access and weather conditions. It should be noted that for whichever compensatory measure or combination of measures adopted, the process of woodland creation, and the establishment of a typical structural diversity of a woodland, can take several years before it reaches a natural state (Forestry Commission, 1999). It is recommended that a combination of measures are implemented in order to ensure the successful establishment of *91E0. The compensatory measure of translocating trees from the donor site to the receptor site may be considered by the Project Ecologist and/or ECoW prior to works commencing; however considering current ground conditions and the composition and structure of the donor site, it is likely that this measure would not be feasible.

5.4.3.1 Translocation of Suitable Soils

Following site preparation, both the soils (including the topsoil) and the herbaceousvegetation of the donor site (where practical) of existing *91E0 habitat may be scraped up and transferred together to the receptor site in a suitable excavator. Thetopsoil of the donor site should contain a sufficient seed bank of desirable plant species to allow the receptor site to re-vegetate naturally, creating the habitat type.In some cases it may be necessary (*e.g.* due to the project schedule and/or other project commitments), to store the soil from the donor site for later translocation to the receptor site at the appropriate time of year.

The duration of storage must be as minimal as possible. Topsoil and subsoil must be stored separately and separate to any other topsoil or soil present on-site. In orderto avoid soil compaction and soil smearing, it is recommended that: soil is handledduring dry conditions and not when saturated; and, after placement the soil is decompacted by ripping, which will improve drainage, aeration and rooting establishment (National Roads Authority, 2006).

Considering the condition of the receptor site (*i.e.* an unimproved, wet grassland field), it is not anticipated that the translocation of suitable soils will be required; however in the event that this is required, suitable soils for the creation of *91E0 may be sourced from within the Assessment Boundary.

5.4.3.2 Site Preparation of Suitable Soil for Seed Sowing andTree Planting

The soil at the receptor site will have to be prepared accordingly to make it suitablefor seed sowing and tree planting. This will involve: digging over the soil to a minimum depth of c.25cm, removing larger stones and any roots of undesirable species; and creating growing beds (c.1m wide and flat-topped) by raising the soil slightly (no more than c.10cm) above the ground level. The surface of the bed should be firm and fine. Any weeds must be removed prior to the sowing of seeds or planting of trees (The People’s Millennium Forest, 2000).

5.4.3.3 Tree Seed Collection and Sowing

It is recommended that seeds of desirable tree species from the local donor site arecollected directly from the plant once mature during warm, dry conditions, stored in suitable conditions to ensure their survival and then planted at the compensatoryreceptor site. This is the preferred method of seeding as it will ensure that no foreignseeds are present in the planted seed mix and will in turn help to protect the integrityof the local genetic population of plants of this habitat type (DAFM, 2015). The construction programme will need to factor in this requirement to ensure that seed is collected prior to site clearance.

Tree seeds will need to be: collected from a group of nearby trees (*i.e.* where cross-pollination and fertilisation are likely to have occurred); placed in Hessian or meshbags; and, stored in suitable containers in a cool, dark place on a temporary basis. Specifics details on how seeds from different tree species, indicative of the *91E0 habitat, should be collected and sown are available in *Our Trees A Guide to Growing Ireland's Native Trees in Celebration of a New Millennium* (The People'sMillennium Forest, 2000), *e.g.* seeds from *Alnus glutinosa* (present in their cones) should be shaken out immediately prior to sowing. Seeds may be sown in differentways, depending on the species (*i.e.* seed dibbing or broadcasting, followed by rolling).

Ideally, seeds should be sown directly into the ground immediately after collection;however this may not be possible (*e.g.* due to the project schedule and/or other project commitments) and as such they may have to be stored on a long-term basis(*i.e.* for more than a few weeks). It is important that the seeds are stored appropriately in order to ensure they still remain viable. This process will involve:extracting the seeds; cleaning and drying them; placing them in a polythene bag; and, sealing firmly to ensure no air is present. They should then be stored in a refrigerator at a temperature of c.2-3°C. They may be stored for several years andstill remain viable. Prior to sowing, these seeds will have to be first stratified (*i.e.* undergo a process of pre-treatment to simulate natural conditions that a seed must go through before germinating) prior to sowing. The methods involved in stratification will vary depending on the species. Stratified seeds should then be sown in February. Prior to sowing seeds, they should be checked for signs of germination (*i.e.* the seeds will appear swollen and the tip of the radicle will be evident). If germination has commenced, the seeds should be sown within a day ortwo. Seeds sown straight-away will stratify naturally in the ground (The People's Millennium Forest, 2000). A small mesh wire netting or fabric may be placed overthe seeds to provide protection from birds.

Where seed collection from the donor site is not possible, local native seeds may be bought at "*Irish Wildflower Showcase*"[13] (or similar supplier of native seed stock), which is a reputable supplier of local native seed mixes. Specific seed mixes,containing only the desirable plant species indicative of *91E0 habitat and suited to the climate and main soil conditions of the receptor site, can be made up to order to help ensure the successful creation of this habitat type.

5.4.3.4 Tree Planting

As an alternative to (or in-combination with) sowing seeds at the receptor site, collected seeds may be first grown at a nursery and then at a later stage planted at the receptor site. This will involve sowing a few seeds into compost filled pots. Thedepth seeds are sown at will depend on the species. The pots should be kept sheltered, at a suitable temperature and watered regularly. Once the seeds have germinated, they should be kept watered and weeded carefully. Following a periodof growth of a few months, it may be necessary to move the seedling/tree to a newlarger pot or prepared bed, as they'll require more space and depth for their roots. Seedlings should be planted at an appropriate planting depth, which is indicated bythe colour difference present at the base of a seedling. Seedlings should be checkedfor mildew and aphid infestation regularly (Forestry Commission, 1999). Alternatively young local native trees of the desirable species for *91E0 creation may be bought and planted at the receptor site.

When planting the young trees, it is important to make sure the tiny root hairs are not damaged and/or do not dry out. Trees are planted between October to March; however not during heavy frost. The tree should be placed in the prepared soil at the appropriate depth. Roots should be carefully spread out when planting to ensurethey are not damaged. For older trees that have been growing in pots, they may be moved carefully into the ground with their roots and soil intact. Trees should be transplanted before the age of four as after this period the likelihood of their successdecreases significantly. Following planting all young trees should be watered immediately. Mulch may be placed around the base of a planted tree in order to deter the growth of other competitive species and to conserve moisture (The People's Millennium Forest, 2000).

[13] Irish Wildflower Showcase website: http://www.wildflowers.ie/

5.4.3.5 Growing Trees from Cuttings

In the case of some tree species, such as *Salix spp.*, the easiest way to propagate large numbers is to grow them from cuttings. These cuttings will need to be taken in autumn or winter from a young branch with one or two years growth. A cutting is taken with a straight cut just below a bud at its base and will need to be between

c.15-24cm in length with at least three buds on it, while a slanted cut is made at thetop of the branch. The flat end of the cutting is then placed in the soil to a depth of

c.half or two thirds of the branch and immediately watered (The People's Millennium Forest, 2000). They should be taken ideally from the donor site, or alternatively from another area of suitable tree species located in close proximity tothe receptor site. If necessary, the cuttings may be stored or "*heeled in*" damp coarsesand before "*pegging them out*" at the receptor site (Coillte, 2009).

5.5 Management

Site specific details on both the short-term and long-term management of the newlycreated habitat will be outlined in the finalised Ecology Site Management Plans, asdetermined by the Project Ecologist and/or ECoW. Management of the newly created habitat is necessary for its success, as it will prevent the invasion of undesirable rank species (such as non-native invasive species *Cornus sericea* and *Impatiens glandulifera*), which have the ability to outcompete the desired species, and will help to maintain a high species richness (Cross & Collins, 2017). If it is identified, during the monitoring of the receptor site, that the desired ground flora for *91E0 is not establishing, then it may be necessary to plant seedlings of these desirable species within the receptor site.

Following the implementation of the chosen compensatory measure(s), fencing may have to be erected around the periphery of the site to exclude unwanted grazers(*i.e.* deer, rabbit and /or hares) from entering the site and causing direct damage to the emerging trees and shrubs. Uncontrolled grazing at this site may negatively impact on the establishment of trees. The type of fencing erected will depend on the species of grazer to be excluded from the site. If any fences become damaged, it should be replaced accordingly. Depending on the type of fencing erected, it may be decided that tree guards and/or mulch mats are used to protect the planted trees from grazing and/or other competing plant species (The People's Millennium Forest, 2000). If non-native trees are present, which are considered to be of no ecological benefit, it may be necessary to remove them manually using a chainsaw to avoid any damage to the site.

The donor site lies outside of but adjacent to the Lough Corrib SAC and thereforeany fencing will need to be installed in a manner that is sensitive to and does not impact on the adjacent Lough Corrib SAC. The potential for significant impacts to arise from the creation of a small area of *91E0 adjacent to Lough Corrib SAC (i.e. works at donor site *91E0.D3 and receptor site *91E0.R1) has been considered and assessed as part of the updated NIS. The mitigation measures outlined in the updated NIS and detailed in the CEMP will ensure no adverse effects on European site integrity will arrive from the implementation of the proposed N6 GCRR, including the proposal for creation of *91E0.R1.

5.6 Monitoring

Monitoring of the receptor site will be carried out by a suitably qualified and experienced ecologist pre-compensation, during and post-compensation in order to:

- firstly, ensure that potential issues that may deter the success of the compensation are identified at an early stage and addressed through adaptive management measures
- secondly, to determine the overall success of the habitat compensation process

Adaptive management measures will be targeted to address the specific issues identified by the monitoring and may be varied. For example they could include, additional seeding and/or planting, either from seed or cuttings, where this is deemed necessary to improve vegetation cover/presence. Adaptive management measures, implemented in response to monitoring results, will not affect therobustness and adequacy of the information presented here and relied upon in the updated EIAR and updated NIS, providing these measures either fall within the scope of proposals already provided for in this CHMP, or involve impacts of equal of lessersignificance to those provided for in this CHMP and assessed in the updated EIAR and updated NIS.

The finalised Ecology Site Management Plans, which will be prepared on an on- site basis, will include a check-list of conditions to be assessed by suitably qualifiedand experienced ecologist at the receptor site pre-compensation, during the compensation works, and as part of the post-compensation monitoring. Conditions assessed in both the short and long-term will be in reference to the monitoring criteria set out in Perrin *et al.*, 2008a & Perrin *et al.*, 2008b for this Annex I habitatand will be used to determine the extent of successful *91E0 establishment. Theseconditions include the following as a minimum:

- Information on vegetation community, *i.e.* percentage cover of positive indicator species (including target tree species and other woody species, herbs and ferns and mosses and liverworts), percentage cover of bryophytes,percentage cover of negative indicator species
- Information on vegetation/woodland structure, *i.e.* evidence of regeneration, grazing pressure, number of saplings present, presence of deadwood and evidence of impacting activities
- In the very unlikely event that there is a change in hydrology at the receptorsite (*i.e.* a change in the flooding regime), it may be necessary to block manmade drains within the receptor site and monitor water table levels within the site, as the condition of *91E0 habitat at the site will be intrinsically linked to the site's hydrology (Coillte, 2009)

In order to achieve the equivalent value of the areas of the priority Annex I habitat Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*) [*91E0] being lost, the habitat at the compensatory receptor site must correspond to *91E0 and, therefore, contain sufficient established and mature positive indicator species of this priority Annex I habitat type (as per Perrin *et al.*, 2008a).

The intervals and duration for the pre- and during compensation monitoring programme, will be decided upon by the Project Ecologist and/or ECoW and is likely to depend upon the speed of habitat establishment and stabilisation.

The post-construction monitoring programme will require annual monitoring, commencing on the year of habitat creation, for a minimum period of five years, with a review by a suitably qualified and experienced ecologist at the end of that period undertaken to determine whether the monitoring period needs to be extended further, if for example it is viewed that the habitat has not stabilised or become fullyestablished by that time. Any extension to the monitoring period will need to consider whether on-going monitoring should be at annual or longer intervals e.g. +3 years post-creation, +6 years post-creation etc.

The results of all monitoring will be made available to the NPWS.

In a worst-case scenario it may take between 30 to 50 years for the *91E0 compensatory habitat at receptor site to establish and mature and reach an equivalent ecological value to the donor site. This does not affect the conclusions set out in the updated EIAR on the residual impact on this habitat, *i.e.* that post-compensation the loss of *91E0 will not likely to result in a significant residual effect, at any geographic scale, over the long-term (*i.e.* >50 years).

The most significant time constraint, with respect to achieving this requirement, is the number of years it will take for the target tree species and other woody species to establish and mature at the receptor site. The time required for the non-woody vascular species and non-vascular bryophyte species to establish and mature will be significantly less when compared to woody species, in particular the tree species. The number of years for each of the woody species to establish and mature is provided in Table 2 below. Whilst a combination of both tree seed sowing and tree sapling planting will be undertaken at the receptor site, a precautionary approach has been adopted and, as such, the number of years considered is taken from seed sowing rather than a planted tree sapling. In the case of the latter, a planted tree sapling is likely to reach maturation in less years.

Table 2 Indicative number of years for each of the target tree species and other woody species to establish and reach maturation

Plant Species	Indicative Number of Years until Establishment and Maturation
Target Species	
Alnus glutinosa	Initial growth of this species is typically rapid. It usually reaches its ultimate height, and therefore maturation, in 20-50 years, usually attaining its full development by 30-40 years (Royal Horticultural Society, 2019 and Council for Forest Research and Development, 2004).
Fraxinus excelsior	Initial growth of this species is typically rapid. This species typically reaches its ultimate height, and therefore maturation, in 20-50 years. It's level of annual growth peaks around 20 years (Royal Horticultural Society, 2019 and Council for Forest Research and Development, 2002).
Salix cinerea	The sub-species of this species, Salix cinerea subsp. oleifolia[14], typically reaches its ultimate height, and therefore maturation, in 5-10 years (Royal Horticultural Society, 2019).
Salix spp.	As above for Salix cinerea.
Other Woody species	
Betula pubescens	This species typically reaches its ultimate height, and therefore maturation, in 20-50 years (Royal Horticultural Society, 2019).
Crataegus monogyna	This species typically reaches its ultimate height, and therefore maturation, in 20-50 years (Royal Horticultural Society, 2019).
Solanum dulcamara	This species is likely to reach maturity in 10-20 years.
Viburnum opulus	This species typically reaches its ultimate height, and therefore maturation, in 10-20 years (Royal Horticultural Society, 2019).

5.7 Conclusions

The measures outlined in this section will compensate for the significant residual effect on *91E0 habitat by ensuring that there will be no net permanent loss of thishabitat type as a consequence of the proposed N6 GCRR. A total area of c.0.17ha (*i.e.* c.121% of the area of *91E0 lost will be compensated for) will be created as part of the proposed compensatory works. The steps outlined in this section are presented below as a flow chart.

[14] This subspecies is comparable to *Salix cinerea* and other *Salix* species in terms of its life cycle and indictive number of years to maturation.

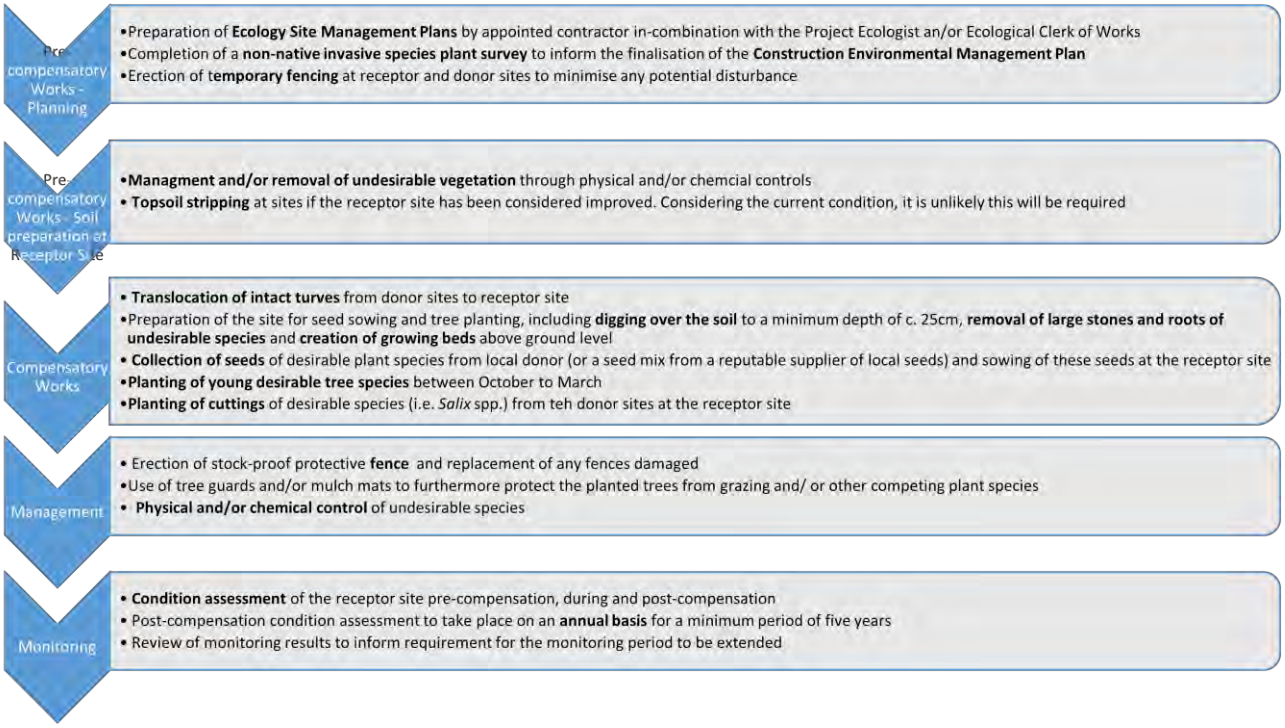

Plate 6 Flow chart of steps involved in the creation of *91E0

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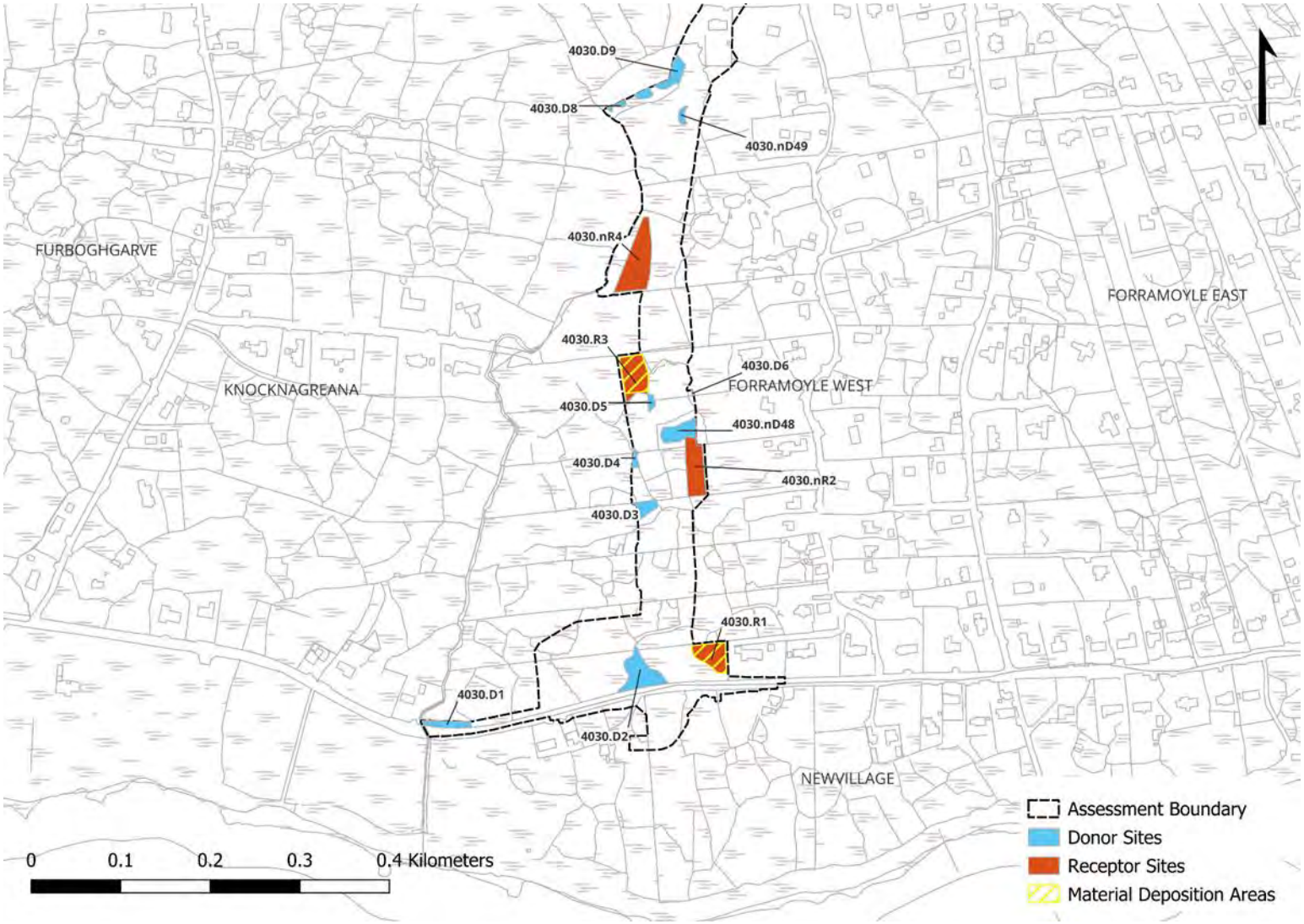
Figures 1 to 11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FORRAMOYLE WEST
4030.D5
4030.nD48
4030.D4
4030.nR2
4030.D3
4030.R1
4030.D1
4030.D2
NEWVILLAGE
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0.2
0.3
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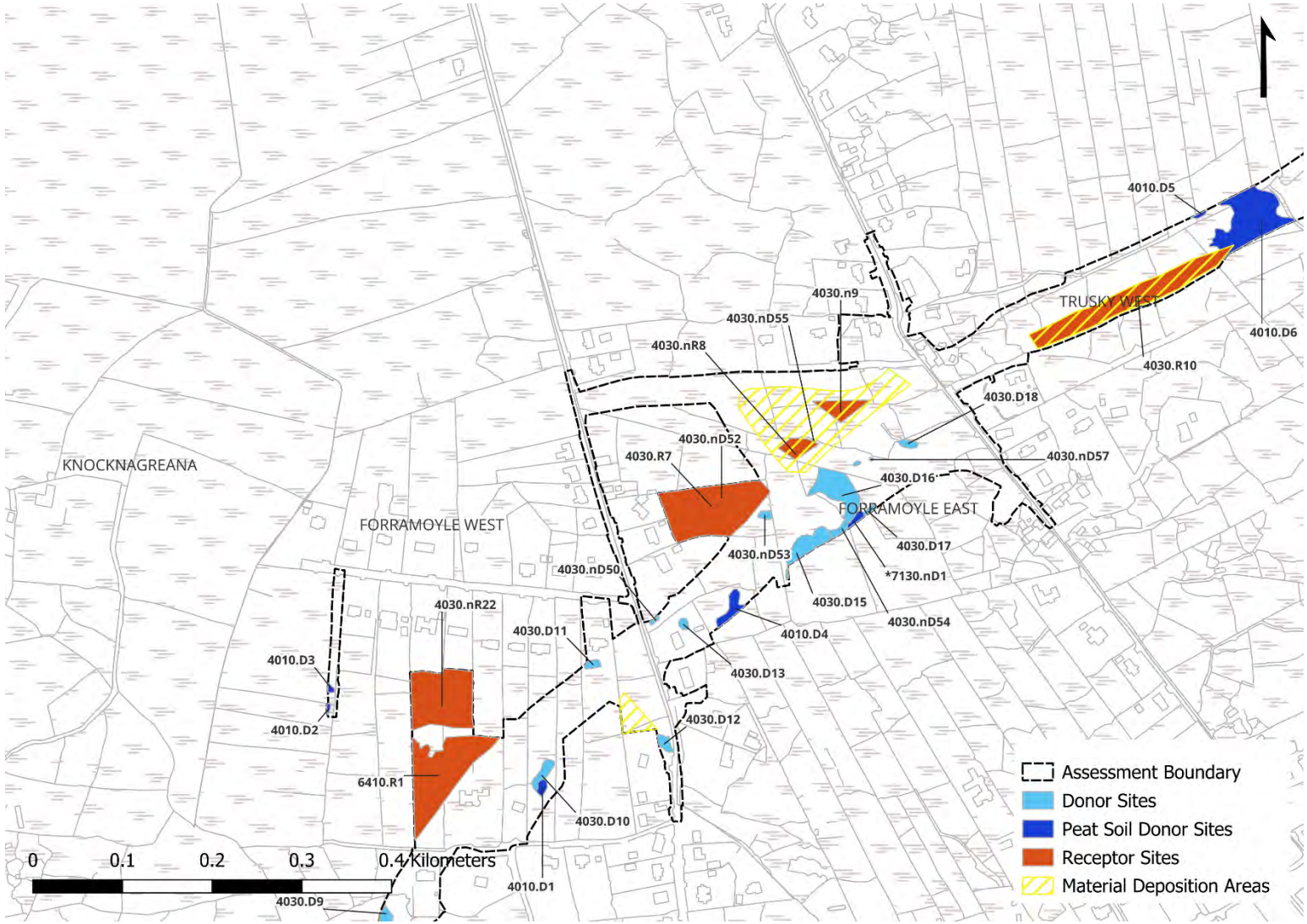
Assessment Boundary
Donor Sites
Receptor Sites
Material Deposition Areas

Figure 1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4030.nR8
TRUSKY WEST
4010.D6
4030.R10
4030.D18
4030.nD52
4030.R7
4030.nD57
4030.D16
KNOCKNAGREANA
FORRAMOYLE WEST
FORRAMOYLE EAST
4030.D17
4030.nD53
4030.nD50
*7130.nD1
4030.D15
4030.nR22
4030.nD54
4030.D11
4010.D4
4010.D3
4030.D13
4030.D12
4010.D2
6410.R1
4030.D10
4010.D1
4030.D9
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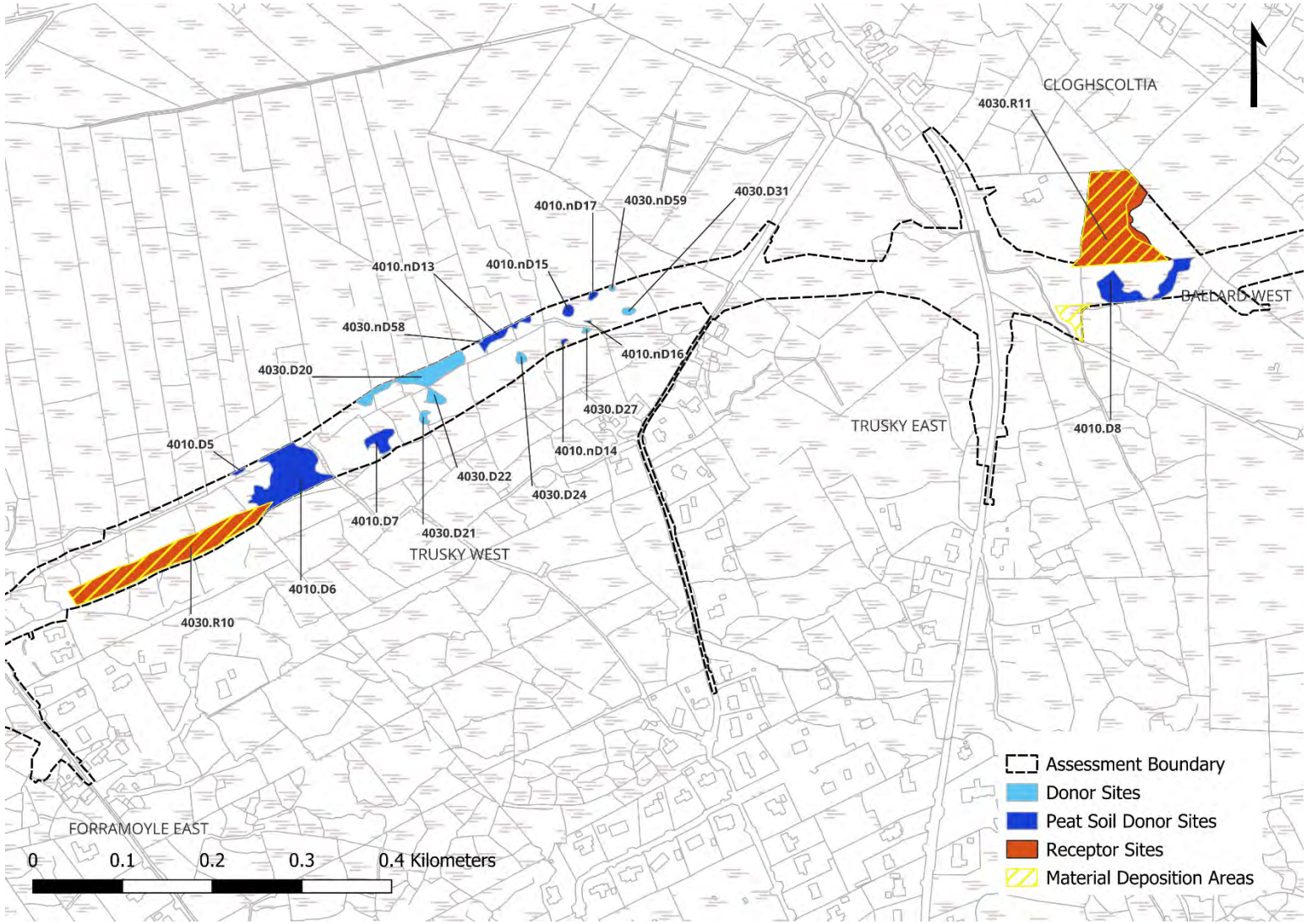
0.2
0.3
0.4 Kilometers
Assessment Boundary
Donor Sites
Peat Soil Donor Sites
Receptor Sites
Material Deposition Areas

Figure 2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4030.nD59
4010.nD17
4010.nD15
4010.nD13
BALLARD WEST
4030.nD58
4010.nD16
4030.D20
4030.D27
TRUSKY EAST
4010.D8
4010.D5
4010.nD14
4030.D22
4030.D24
4010.D7
4030.D21
TRUSKY WEST
4010.D6
4030.R10
FORRAMOYLE EAST
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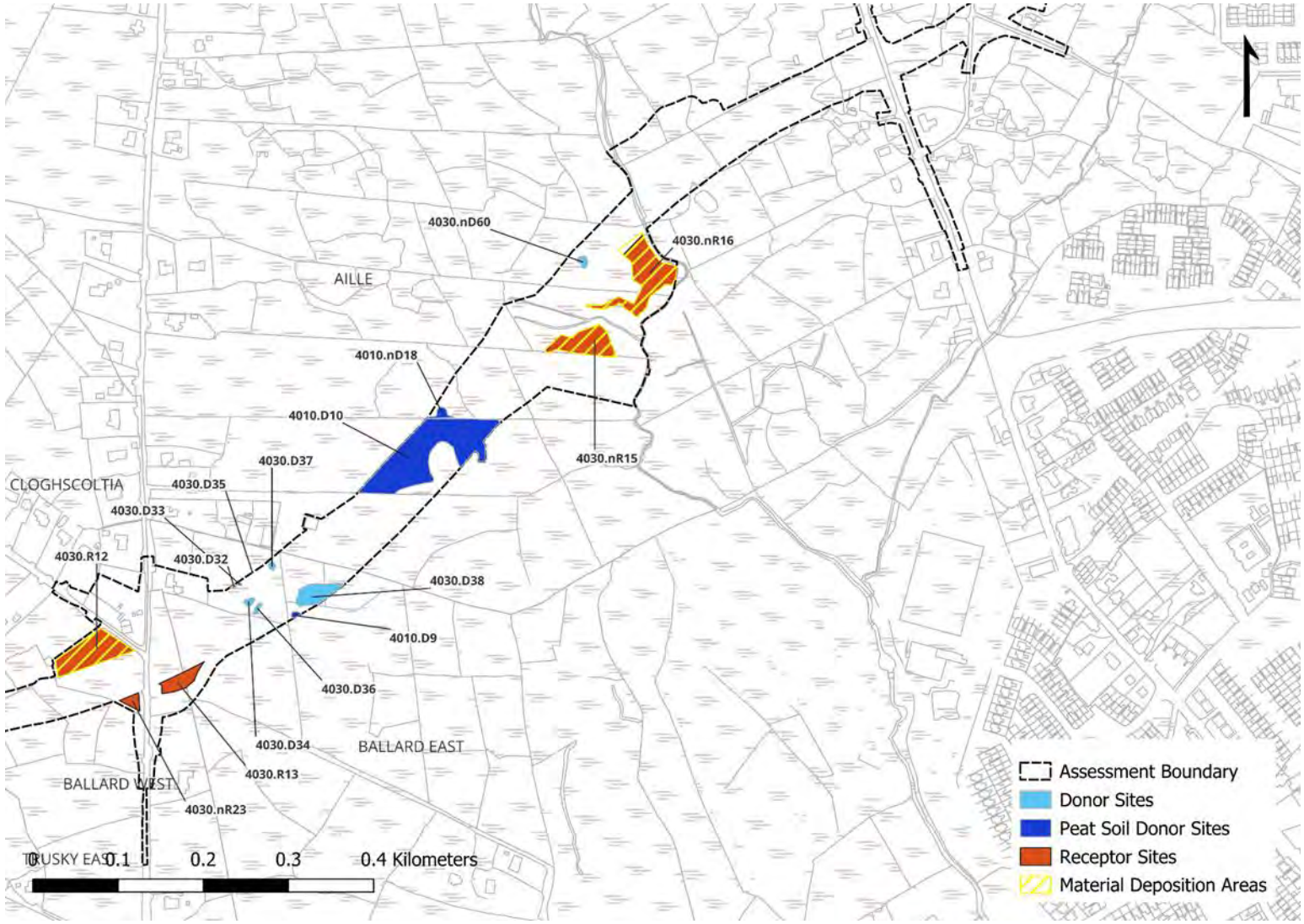
0.2
0.3
0.4 Kilometers
Assessment Boundary
Donor Sites
Peat Soil Donor Sites
Receptor Sites
Material Deposition Areas

Figure 3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4030.nR16
AILLE
4010.nD18
4010.D10
4030.nR15
4030.D37
CLOGHSCOLTIA
4030.D35
4030.D33
4030.R12
4030.D32
4030.D38
4010.D9
4030.D36
4030.D34
BALLARD EAST
4030.R13
BALLARD WEST
4030.nR23
TURUSKY EAST
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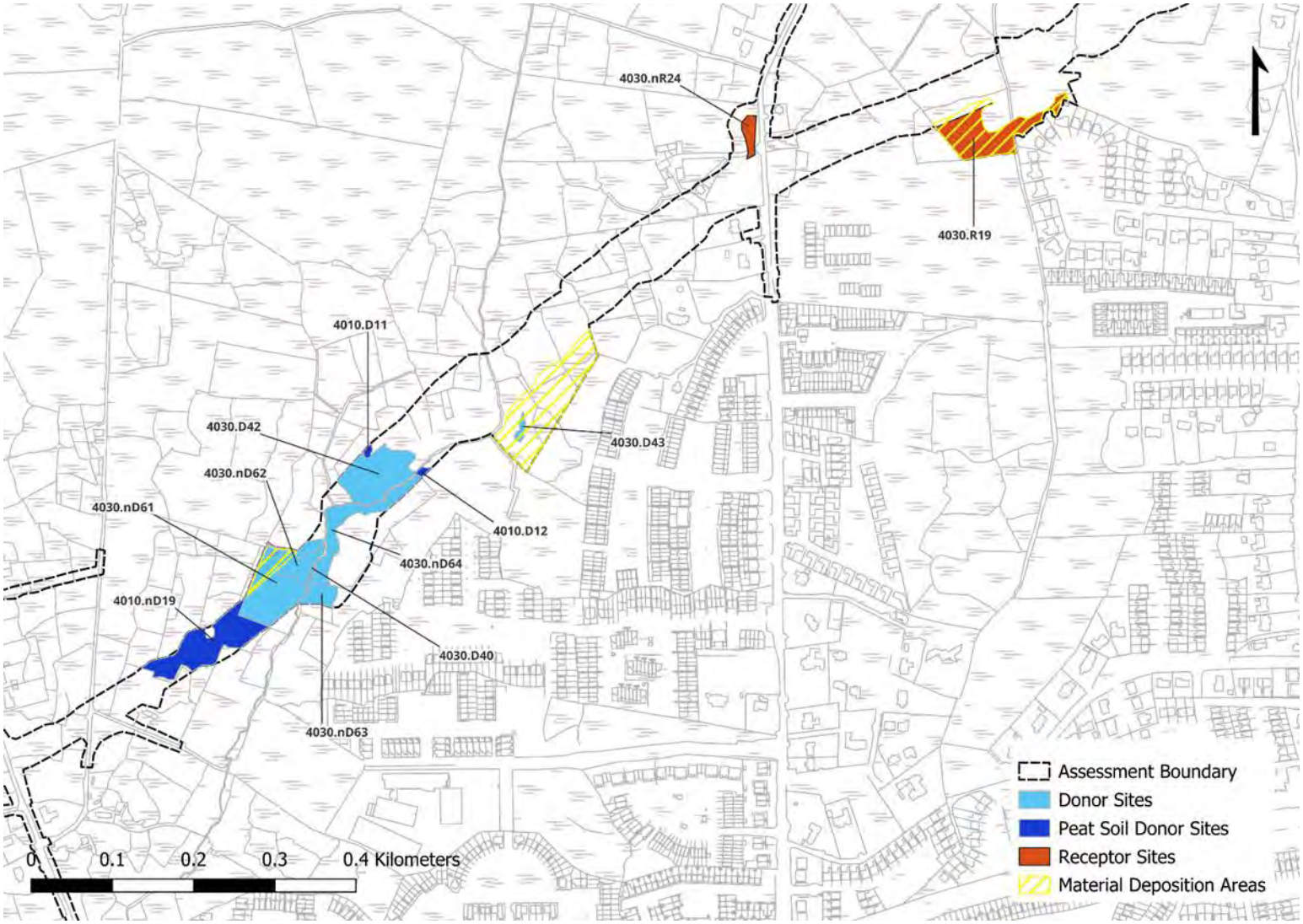
0.4 Kilometers
Assessment Boundary
Donor Sites
Peat Soil Donor Sites
Receptor Sites
Material Deposition Areas

Figure 4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4030.nD64
4030.D40
4030.nD63
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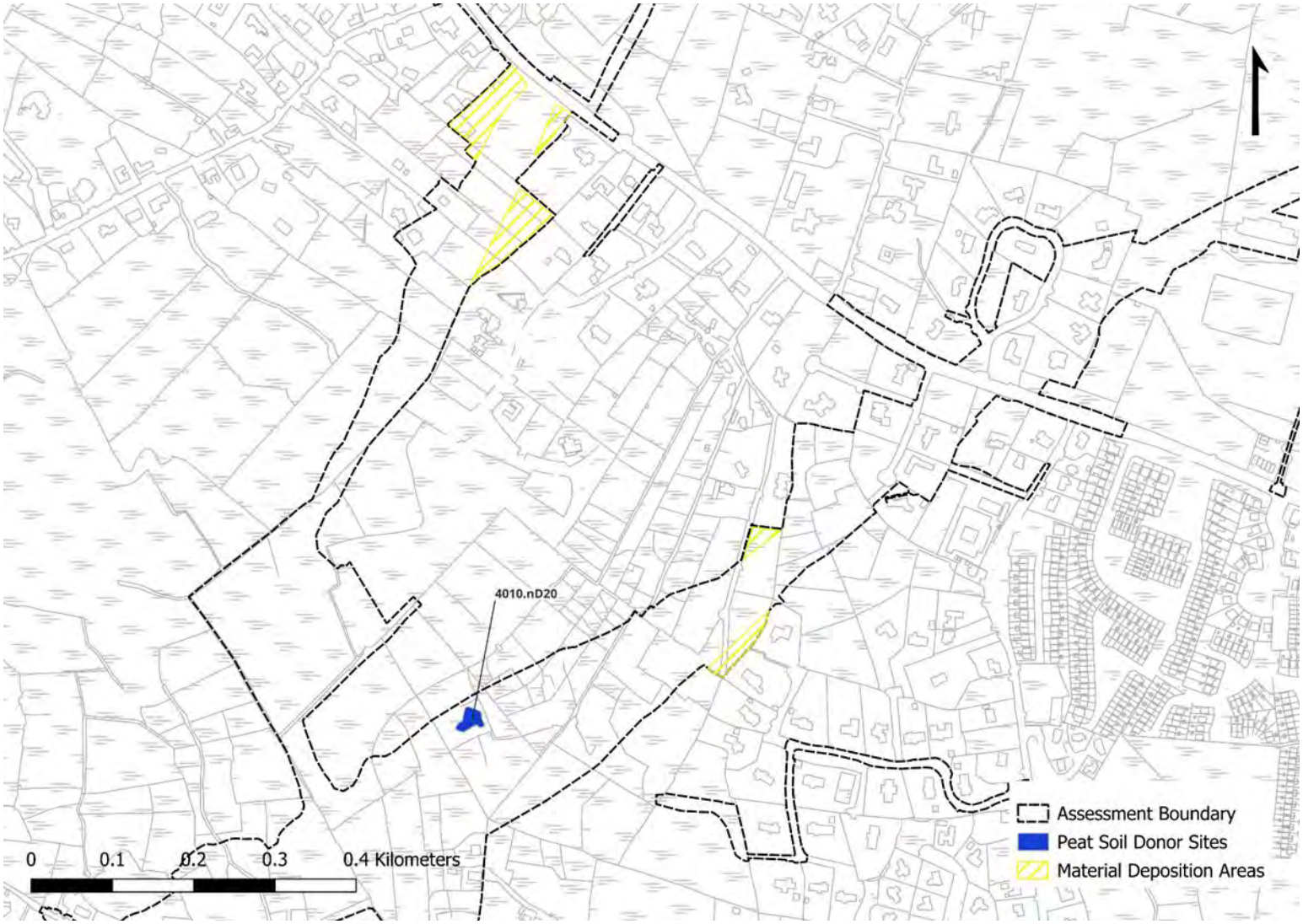
0.4 Kilometers
Assessment Boundary
Donor Sites
Peat Soil Donor Sites
Receptor Sites
Material Deposition Areas

Figure 5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0.2
0.3
0.4 Kilometers
Assessment Boundary
Peat Soil Donor Sites
Material Deposition Areas

Figure 6


COOLANILLAUN
*91E0.nD4
*91E0.R1
GS1.D3
GS1.D2
GS1.D1
6210.R2
6210.R1
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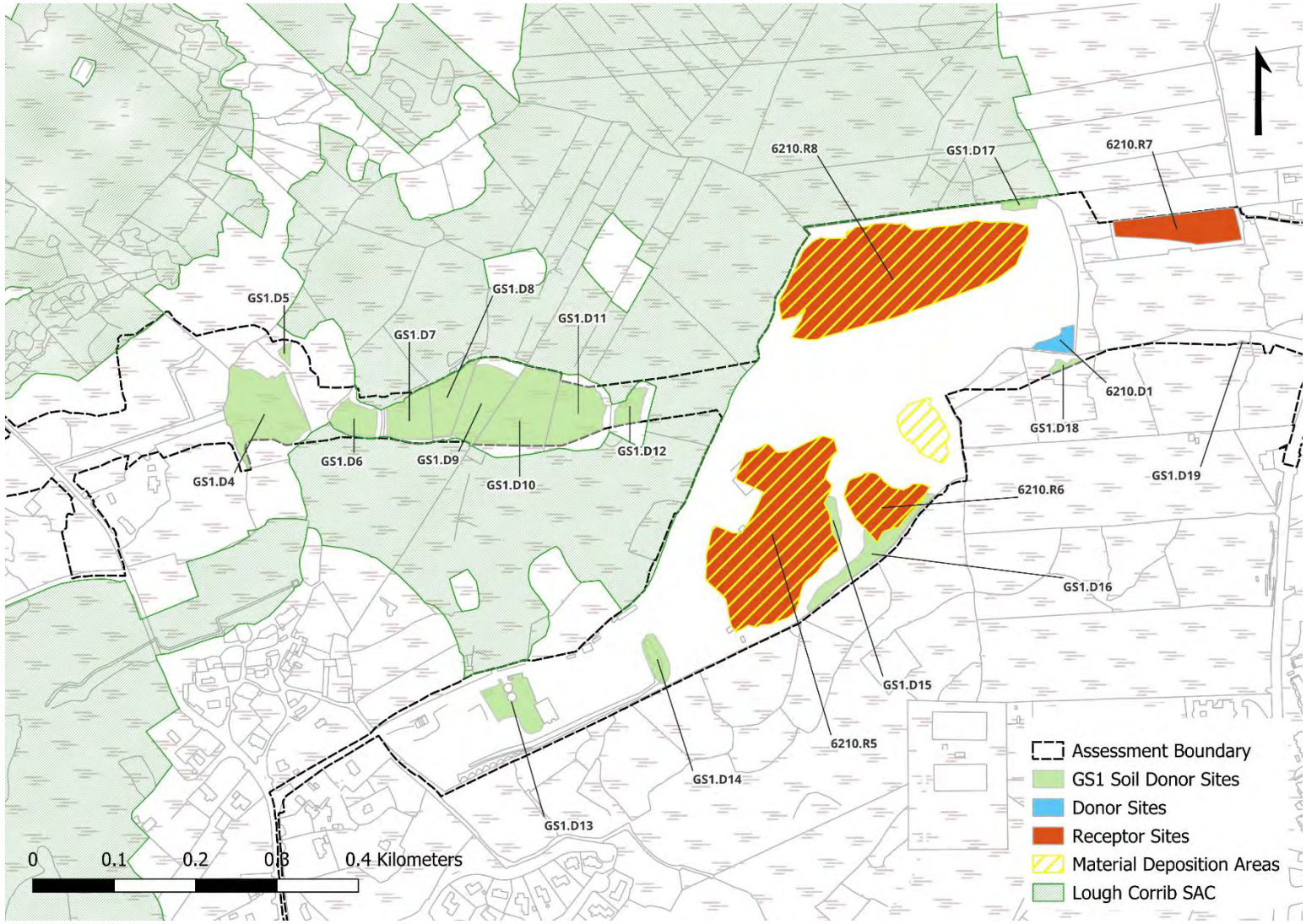
0.1
0.2
0.3
0.4 Kilometers
Assessment Boundary
GS1 Soil Donor Sites
Donor Sites
Receptor Sites
Lough Corrib SAC

Figure 7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GS1.D11
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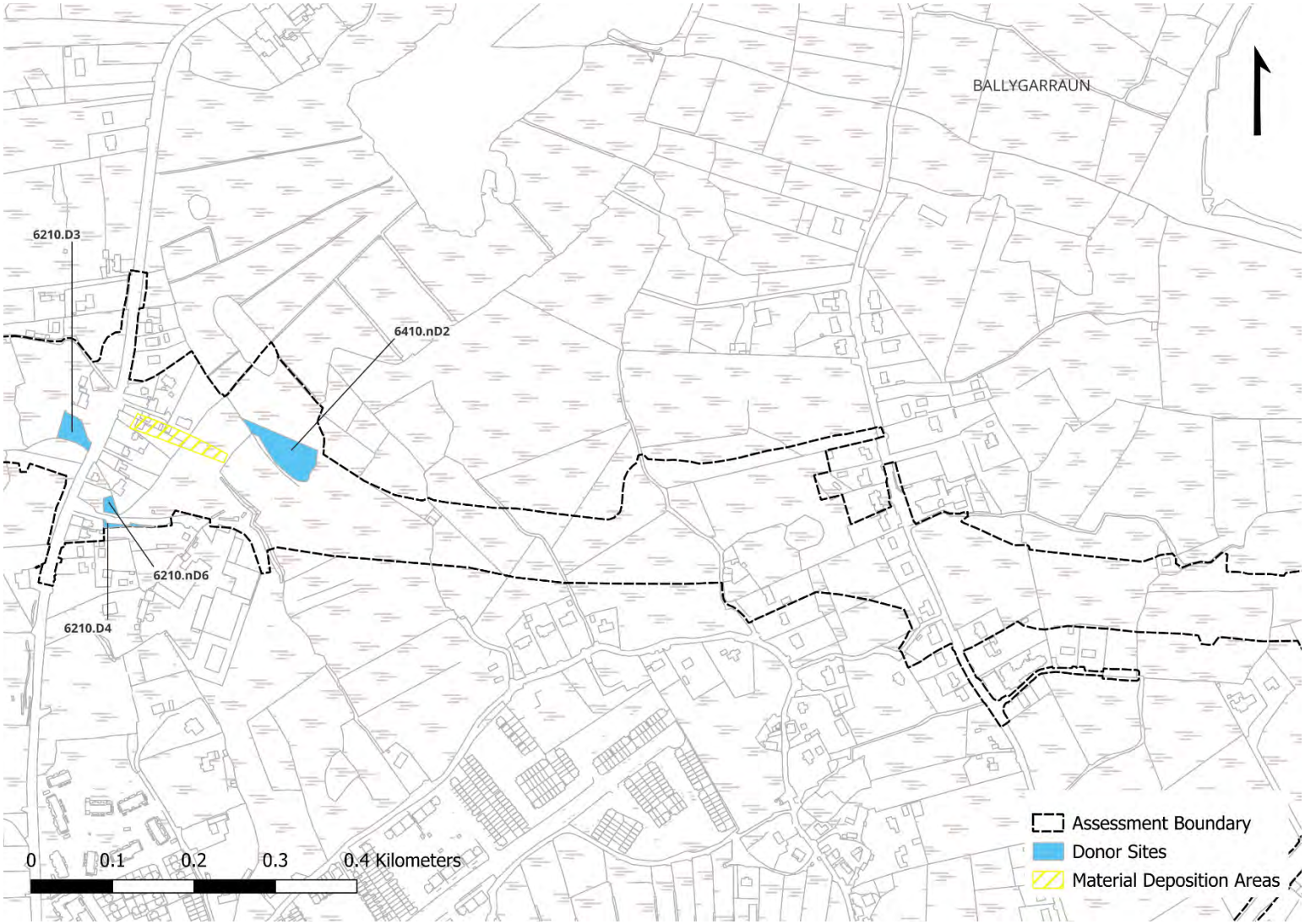
GS1.D18
GS1.D19
GS1.D6
GS1.D9
GS1.D12
GS1.D4
GS1.D10
6210.R6
GS1.D16
GS1.D15
6210.R5
GS1.D14
GS1.D13
0
0.1
0.2
0.3
0.4 Kilometers
Assessment Boundary
GS1 Soil Donor Sites
Donor Sites
Receptor Sites
Material Deposition Areas
Lough Corrib SAC

Figure 8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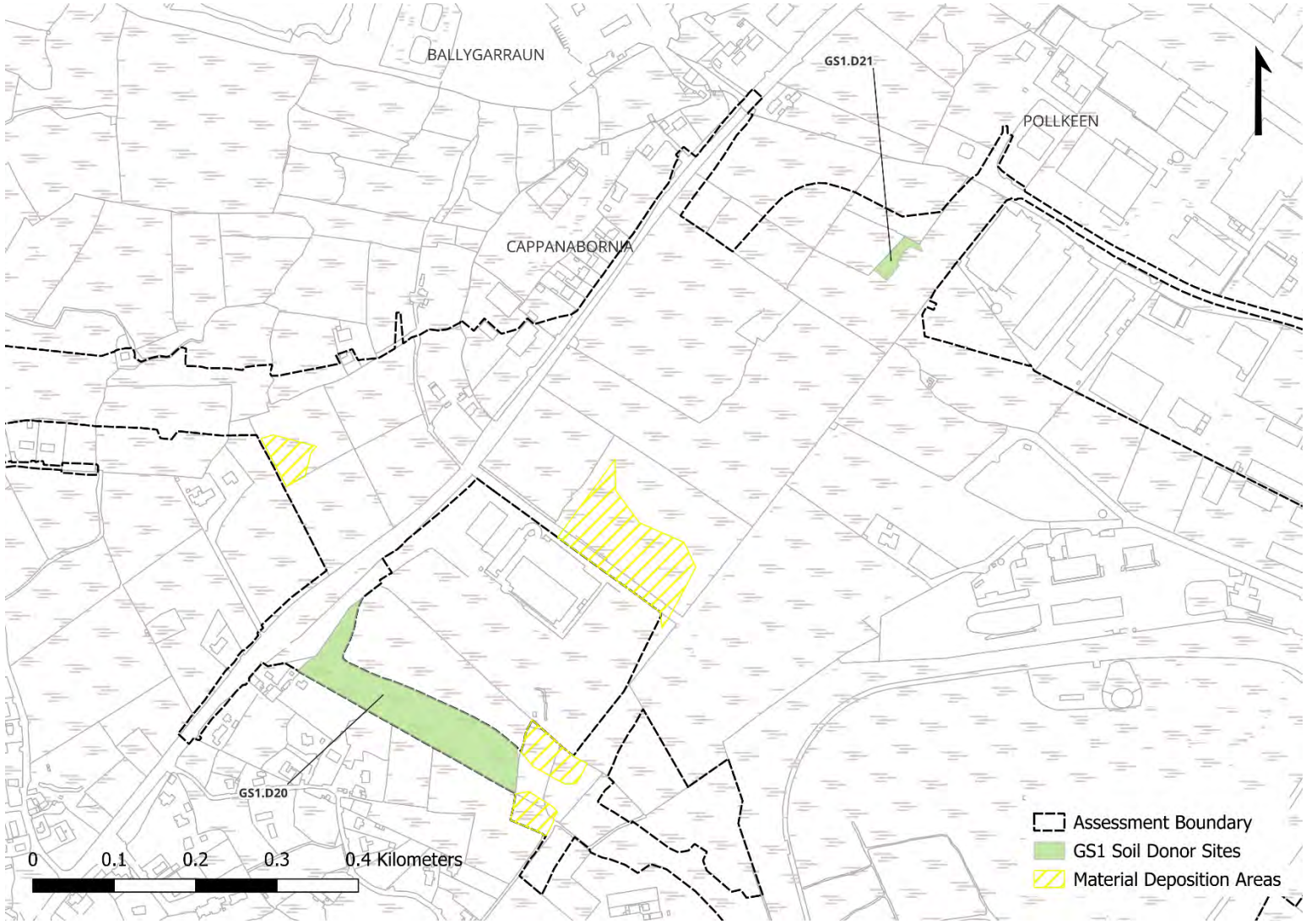
0.2
0.3
0.4 Kilometers
Assessment Boundary
Donor Sites
Material Deposition Areas

Figure 9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CAPPANABORNIA
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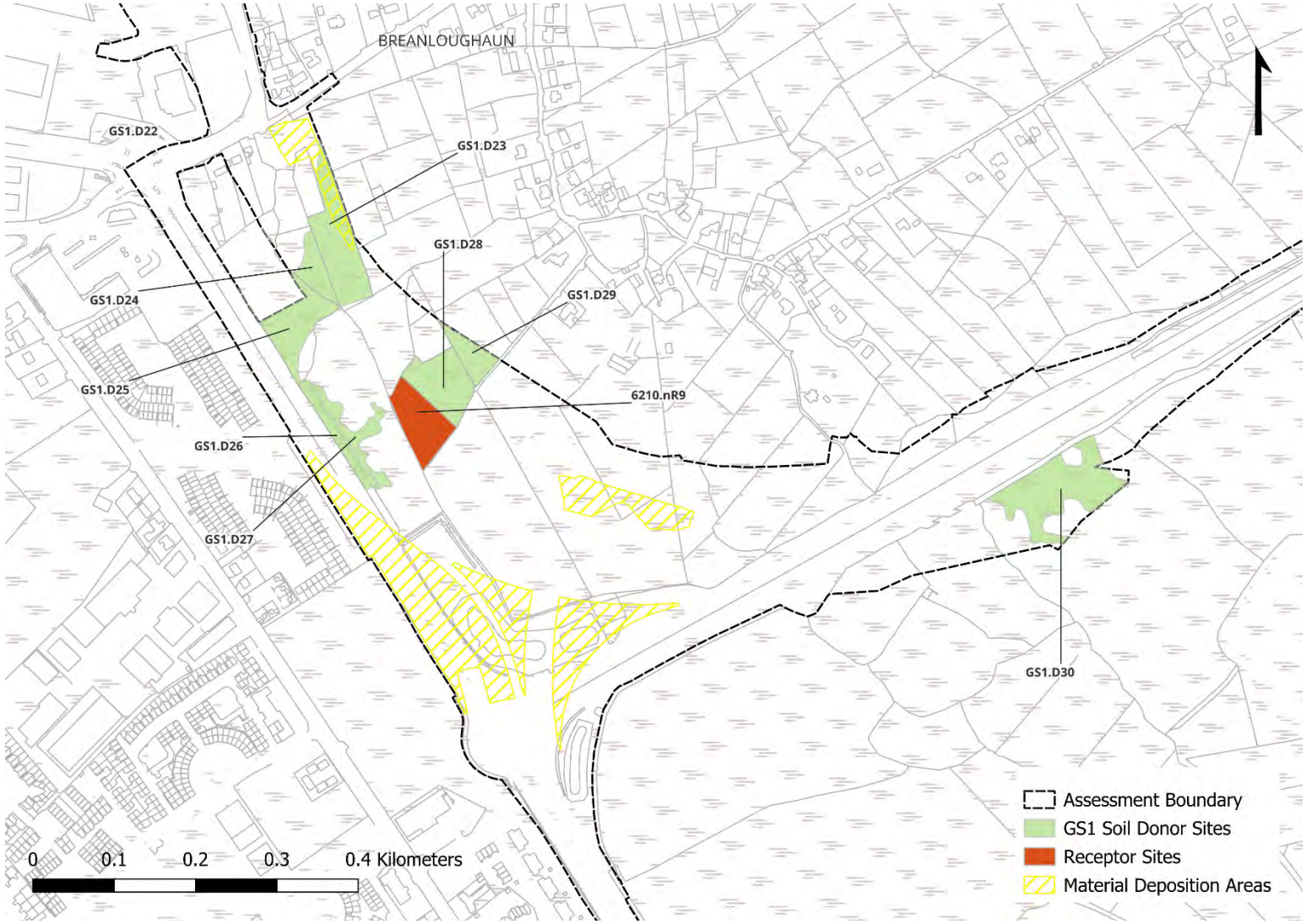
Assessment Boundary
GS1 Soil Donor Sites
Material Deposition Areas

Figure 10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GS1.D28
GS1.D24
GS1.D29
GS1.D25
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GS1.D26
GS1.D27
GS1.D30
0
0.1
0.2
0.3
0.4 Kilometers
Assessment Boundary
GS1 Soil Donor Sites
Receptor Sites
Material Deposition Areas

Figure 11

Annex 1

Photographs and Description of Peatland Habitat Translocation for the Corrib Pipeline

A.1 Annex 1 - Photographs and Description of Peatland Habitat Translocation for the Corrib Pipeline

A.1.1 Area of Heavily eroded Blanket Bog (tunnel launch compound)

1. Bespoke bucket used to lift surface vegetation turves (3m x 1m x 0.3 deep)

Sequence

2a. Lifting turve

2b. Transfer bucket + turve to back of low impact truck

2c. Transport to peat storage area

2d. Lift bucket + truve off back of truck and place on turve storage area

3a. Peat storage area (aerial)

3b. One of the peat storage areas – with turves growing on top and on sloping sides (after 1 year)

4. Reinstatement

Effectively reverse the process, lifting turves from the storage areas with turving bucket but used large multiforked bespoke ‘bucket’ to lift them from back of truck and placed carefully into position. Three turves placed together to form matrix of 3 x 3m and the interstices filled with stored peat up to the level of the replaced turves.

4a. To show forked bucket

4b. Placement

4c. The end result. Bare peat interstices were planted with *Eriophorum angustifolium* plantlets (64,000 in total) and seeded with locally collected ericaceous seed.

4d. Working edge visible, also newly created wetland (in peat) Sruwaddacon Bay in the background

B. Pipeline Wayleave Turving in ± Intact Blanket Bog

i. Used bespoke bucket: 2m x 1m x 0.5 deep

ii. Then transferred from the 'lifting' machine's bucket to the machine placing turves on bogmats in the adjacent storage area – required excellent driver coordination and care

iii. Turve storage on bogmats (on RHS of sheet piled haul road and trench section on left)

iv. Turves after lifting

v. Exposed edges firmly wrapped in silt fencing to prevent drying and erosion while in storage

C. Landfall Valve Installation Location

i. Use of Geocoir with vegetation establishing on Landfall Valve Instiallion

ii. Use of Geojute with vegetation establishing on Landfall Valve Instiallion side slopes

Annex 2

Details of Donor and Receptor Sites in Respect of Losses and Creation of Annex I habitat outside of European Sites

A.2 Details of Donor and Receptor Sites in Respect of Losses and Creation of Annex I habiat outside of European Sites

Details of donor and receptor sites, required for the purposes of creating Annex I habitat, including areas and habitat types present in each are described below in Table 3 and Table 4 respectively.

The location of each donor and receptor site and its corresponding approximate area has been determined by the habitat data presented in Chapter 8 Biodiversity of the updated EIAR. Donor sites were selected based on the presence of the targeted Annex I habitat as outlined in this Annex (*i.e.* 4010, 4030, 6210, 6410, *7130 and *91E0) and receptor sites were selected based on criteria presented in the Compensatory Habitat Management Plan.

Table 3 Details of Donor Sites - areas and habitat types present

Label [15] [16]	Dominant habitat [17] present	Mosaic of habitats present (where applicable)	Annex I habitat present[16] [17]	Total approximate area (ha) of donor site	Relevé Reference Code [18]
4010.D1	HH3	HH3	4010	0.0153	2406_R1
4010.D2	HH3	HH3/HH1/WS1/ER1	4010/4030/*7130	0.0038	-
4010.D3	HH3	HH3/HH1/WS1/ER1	4010/4030/*7130	0.0056	-
4010.D4	HH3	HH3	4010	0.0476	735_R1
4010.D5	HH3	HH3	4010	0.0061	-
4010.D6	HH3	HH3	4010	0.3504	848_R1
4010.D7	HH3	HH3	4010	0.0539	EC14_R4, 2621_R1
4010.D8	HH3	HH3/GS4/HH1	4010/4030/6410	0.1725	-
4010.D9	HH3	HH3/WS1/GS4	4010	0.0057	2424_R1
4010.D10	HH3	HH3/HD1/WS1	4010	0.6420	EC18_R4, 1131_R1, 1131_R2
4010.D11	HH3	HH3	4010	0.0121	1199_R1

[15] The labels referred to in this table correspond to the location of donor sites presented in Figures 1-11 included in this appendix. Labels which include "*nD*" correspond to new donor sites that were identified in the 2019 and 2023 habitat. In the case of some of these new sites, they are located within the boundaries of donor sites previously identified in the updated EIAR; however, they comprise a reduced extent/area and as such have been assigned the "nD" code to reflect the change. According tothe results of the 2019 and 2023 habitat surveys, some donor sites identified in the updated EIAR are no longer present and as such have been omitted in this CHMP.

[16] Annex I habitat codes presented in this Appendix correspond to the following Annex I habitats: Northern Atlantic wet heaths with *Erica tetralix* [4010], European dry heaths [4030], Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) [6210], *Molinia* meadows on calcareous, peaty or clayey- silt-laden soils (*Molinion caeruleae*) [6410], blanket bogs (*if active bog) [*7130] and Alluvial forests with *Alnusglutinosa* and Fraxinus *excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)* [*91E0].

[17] The habitat classification codes presented in this table are as per those defined in The Heritage Council's A Guide to Habitats in Ireland (Fossitt, 2000).

[18] Refer to relevé codes presented in Appendix A.8.19 of the updated EIAR for the associated species lists.

Label [15] [16]	Dominant habitat [17] present	Mosaic of habitats present (where applicable)	Annex I habitat present[16] [17]	Total approximate area (ha) of donor site	Relevé Reference Code [18]
4010.D12	HH3	HH3/WS1	4010	0.0126	5884_R1
4010.nD13	HH3	PF2/HH3	4010	0.0420	875_R1
4010.nD14	HH3	HH3/GS4/WS1	4010	0.0040	2613_R1
4010.nD15	HH3	HH3	4010	0.0144	2614_R1
4010.nD16	HH3	HH3	4010	0.0017	2615_R1
4010.nD17	HH3	HH3	4010	0.0078	2616_R1
4010.nD18	HH3	HH3	4010	0.0173	1094_R1
4010.nD19	HH3	HD1/WS1/HH3/BL1	4010	0.1218	1188_R1
4010.nD20	HH3	HH3	4010	0.0636	1655_R1
4030.D1	HH1	HH1	4030	0.0361	336_R1
4030.D2	HH1	HH1	4030	0.1220	338_R1
4030.D3	HH1	HH1/HD1/BL1	4030	0.0334	2394_R1
4030.D4	HH1	HH1/BL1	4030	0.0106	2396_R1
4030.nD48	HH1	HD1/GS2/HH1/ER1	4030	0.0724	2638_R1
4030.D5	HH1	HH1/WS1/HD1	4030	0.0113	2397_R1
4030.D6	HH1	HH1/HD1	4030	0.0064	2391_R1
4030.nD49	HH1	HH1	4030	0.0122	361_R2
4030.D8	HH1	HH1/HD1	4030	0.0092	2403_R1
4030.D9	HH3	HH3/HH1/HD1	4030	0.0150	614_R1
4030.D9	HH3	HH3/HH1/HD1/BL1	4030	0.0473	614_R1
4030.D10	HH1	HH1/HD1	4030	0.0337	2407_R1
4030.D11	HH1	HH1	4030	0.0139	R336-NFMR R2
4030.D12	HH1	HH1	4030	0.0212	R336-NFMR R1
4030.nD50	HH1	HH1/ER1	4030	0.0049	739_R1
4030.D13	HH1	HH1	4030	0.0113	2700_R1
4030.nD52	HH1	HH1/GS3	4030	0.0091	-
4030.nD53	HH1	HH1/GS3/BL1	4030	0.0121	734_R3
4030.D15	HH1	HH1/GS3	4030	0.0951	2417_R2, 2417_R1
4030.nD54	HH1	HH1/GS3	4030	0.0187	736_R4

Label [15] [16]	Dominant habitat [17] present	Mosaic of habitats present (where applicable)	Annex I habitat present[16] [17]	Total approximate area (ha) of donor site	Relevé Reference Code [18]
4030.D16	HH1	HH1/HD1	4030	0.1627	2414_R2, 2414_R1
4030.D17	HH1	HH1/GS4/WS1	4030	0.0076	764_R2, 764_R1
4030.nD55	HH1	HH1	4030	0.0021	767_R2
4030.nD56	HH1	HH1	4030	0.0029	-
4030.nD57	HH1	HH1	4030	0.0012	-
4030.D18	HH1	HH1	4030	0.0152	2418_R1
4030.D21	HH1	HH1/WS1	4030	0.0126	2623_R1
4030.D22	HH1	HH1	4030	0.0263	2622_R1
4030.D20	HH1	HH1/WS1	4030	0.1539	-
4030.nD58	HH1	HH1/WS1	4030	0.0016	-
4030.D24	HH1	HH1	4030	0.0121	2612_R1
4030.D27	HH1	HH1/BL1	4030	0.0046	2611_R1
4030.nD59	HH1	HH1	4030	0.0037	2618_R2
4030.D31	HH1	HH1/GS4	4030	0.0101	2617_R1
4030.D32	HH1	HH1	4030	0.0018	2433_R1
4030.D33	HH1	HH1	4030	0.0011	2432_R1
4030.D34	HH1	HH1	4030	0.0084	2435_R1
4030.D36	HH1	HH1/WS1	4030	0.0065	2436_R1
4030.D35	HH1	HH1	4030	0.0001	2431_R1
4030.D37	HH1	HH1/WS1	4030	0.0061	2434_R1
4030.D38	WS1	WS1/HH1	4030	0.0932	-
4030.nD60	HH1	HH1	4030	0.0114	1065_R1
4030.nD61	HD1	HD1/HH1/HH3/BL1	4030/4010	0.1239	1188_R3
4030.nD62	HH1	HH1/GS4/BL1	4030	0.1319	1187_R1, 1187_R2
4030.D40	HH1	HH1	4030	0.0071	5073_R1
4030.nD63	HH1/HH3	HH1/HH3	4030/4010	0.0962	5890_R6
4030.nD64	HH1	HH1/WS1/HD1/ER1/HH3	4030	0.2542	5890_R3, 5890_R5, 5890_R4, 5890_R2,

Label [15] [16]	Dominant habitat [17] present	Mosaic of habitats present (where applicable)	Annex I habitat present[16] [17]	Total approximate area (ha) of donor site	Relevé Reference Code [18]
					5890_R1, 5890_R7
4030.D42	HH1	HH1/WS1	4030	0.4251	1203_R1, 1198_R1
4030.D43	WS1	HH1/WS1	4030	0.0249	-
6210.D1	GS1	GS1	6210	0.0932	LQ-N84 R1
6210.D3	GS1	GS1/WS1	6210	0.1039	LQ-N84 R2
6210.nD6	GS1	GS1	6210	0.0288	4585_R1
6210.D4	GS1	GS1/WS3/WS1/HD1/BL1	6210	0.0186	2096_R1
6410.nD2	GS4	GS4	6410	0.0723	-
*7130.nD1	PB3	PB3/HH1	*7130/4030	0.0143	743_R1
*91E0.nD4	WN6	WN6	*91E0	0.1408	3297a_R2, 3297_R1
GS1.D1	GS1	GS1/BL1	-	0.6800	RC-LQ R1, 4401_R1, 4401_R2, 4401_R4, 4401_R5, 4401_R3
GS1.D2	GS1	GS1/BL1	-	1.5337	4402_R2, 4245_R2, 4245_R1
GS1.D3	GS1	GS1/BL1	-	0.4450	4402_R1
GS1.D4	GS1	GS1/WL1	-	0.7515	-
GS1.D5	GS1	GS1/WS1	-	0.0259	-
GS1.D6	GS1	GS1	-	0.1873	1843_R1
GS1.D7	GS1	GS1/WL1	-	0.2888	1841_R1
GS1.D8	GS1	GS1/WL1	-	0.3015	4613_R1
GS1.D9	GS1	GS1/WL1	-	0.4052	4612_R1
GS1.D10	GS1	GS1/WL1	-	0.6257	4611_R1
GS1.D11	GS1	GS1/WL1	-	0.4129	4610_R1
GS1.D12	GS1	GS1	-	0.1190	4608_R1
GS1.D13	GS1	GS1/WL1	-	0.2874	5403_R1
GS1.D14	GS1	GS1/WL2/WS1	-	0.1260	5407_R1
GS1.D15	GS1	GS1	-	0.0937	-

Label [15] [16]	Dominant habitat [17] present	Mosaic of habitats present (where applicable)	Annex I habitat present[16] [17]	Total approximate area (ha) of donor site	Relevé Reference Code [18]
GS1.D16	GS1	GS1	-	0.4429	5391_R1
GS1.D17	GS1	GS1	-	0.0543	-
GS1.D18	GS1	GS1	-	0.0321	-
GS1.D19	GS1	GS1	-	0.0030	4956_R1
GS1.D20	GS1	GS1/WS1/ED2/ED3/WL1	-	1.5430	2325_R2, 2325_R1, 2325_R3
GS1.D21	GS1	GS1/WS1/WL1/BL1	-	0.1011	-
GS1.D22	GS1	GS1	-	0.0024	-
GS1.D23	GS1	GS1/ED3/ED2/WL1	-	0.6738	127_R3, 127_R2, 127_R1
GS1.D24	GS1	GS1/WS1/WL1	-	0.2040	5061_R1
GS1.D25	GS1	GS1/ED3/ED2/WL1	-	0.4471	5062_R4, 5062_R1, 5062_R2, 5062_R3
GS1.D26	GS1	GS1/WS1/GS2	-	0.2068	-
GS1.D27	GS1	GS1/GS2	-	0.2382	EC56 R8
GS1.D28	GS1	WS1/GS1/HD1/BL1	-	0.4824	114_R1, 114_R2
GS1.D29	GS1	GS1/BL1	-	0.2048	118_R1
GS1.D30	GS1	GS1/WS1	-	0.8831	137_R2, 137_R1

Table 4 Details of Receptor Sites - areas and habitat types present and clarification on

Label [19]	Mosaics of habitats [20] present	Annex I habitat present (and corresponding donor site label [21]	Total approximate area (ha) of receptor site	Relevé Reference Code [22]
4030.R1	HD1/WS1 GS4/HD1	-	0.09	-
4030.nR2	HD1/WS1/GS4 HD1	-	0.12	-
4030.R3	HD1/WS1/GS4 HD1/WS1/ER1	-	0.12	-
4030.nR4	GS3/WS1/HD1 GS3/WS1	-	0.43	-
4030.R7	HD1/WS1/GS3/GS2/GS4/FW4 GS4/PF2 HH1/GS3 HD1/WS1 HD1/WS1/GS3/PF2 WS1 BL1	4030 (i.e. 4030.nD52)	0.55	734_R1, 734_R2
4030.nR8	HD1/WS1 GS4/PF2/GS3/WS1/FW4	4030 (i.e. 4030.nD55)	0.06	-
4030.nR9	GS3/GS2/GS4/WS1 GS4/GS2/FW4/WS1/HD1	-	0.08	-
4030.R10	HD1/WS1/ER1/GS1/BL1 HD1/GS4/ER1/GS3 WS1 GS1 WS1/HD1/GS3 HH3 BL1	4010 (i.e. 4010.D6)	0.48	825_R2, 827_R2
4030.R11	WS1/HD1/GS4/GS3 GS4 WS1	-	0.65	468_R1
4030.R12	GS4 GA1	-	0.24	-
4030.R13	GS4/WS1/BL1 ED2/ED3/GA1 GS4/GS3 WS1	-	0.07	-

[19] The labels referred to in this table correspond to the location of receptor sites presented in Figures 1-11 included in this appendix. Labels which include "nR" correspond to new receptor sites that were identified in the 2019 and 2023 habitat surveys. In the case of some of these new sites, they are located within the boundaries of donor sites previously identified in the updated EIAR; however, they comprise a reduced extent/area and as such have been assigned the "nR" code to reflect the change.

[20] The habitat classification codes presented in this table are as per those defined in The Heritage Council's *A Guide to Habitats in Ireland* (Fossitt, 2000).

[21] There are four receptor sites which overlap with donor sites containing Annex I habitat.

[22] Refer to relevé codes presented in Appendix A.8.19 of the updated EIAR for the associated species lists.

Label [19]	Mosaics of habitats [20] present	Annex I habitat present (and corresponding donor site label [21]	Total approximate area (ha) of receptor site	Relevé Reference Code [22]
4030.nR15	GS4/GS1/FW4/FW1 HD1/WS1	-	0.18	-
4030.nR16	GS4/GS1/FW4/FW1 GS3/HD1/WS1	-	0.30	-
4030.R19	WS1/GA1/GS4/ER1 WS1 GA1/GS3/GS4 GS2/WS1 WS1/HD1	-	0.43	1303_R1
4030.nR22	HD1/WS1/GS3/GS4 GS4	-	0.42	-
4030.nR23	GA1	-	0.03	-
4030.nR24	GA1 BL3	-	0.06	-
6210.R1	GS1 WL2/GS1/BL1	-	0.83	RC-LQ R1, 4619_R1, 4400_R1, 4400_R2, 4400_R3, 4401_R5, 4401_R1, 4401_R2, 4401_R3, 4401_R4, 4401_R5
6210.R2	GS1	-	0.98	4245_R2, 4245_R1
6210.R5	ED2/ED3/WS1 ED3 GS1 FL8 BL3 ED3/GS1/GS2 ED2/ED3 WS1/GS1	-	2.44	-
6210.R6	ED2/ED3 ED3 GS1	-	0.48	-
6210.R7	GS1	-	0.49	-
6210.R8	ED2/ED3/WS1 WS1	-	2.84	-
6410.R1	HD1/WS1/GS3/GS4 GS4 WD1 Residential BL1	-	0.49	609_R1

Label [19]	Mosaics of habitats [20] present	Annex I habitat present (and corresponding donor site label [21]	Total approximate area (ha) of receptor site	Relevé Reference Code [22]
*91E0.R1	GS4 WN6	*91E0 (i.e. *91E0.nD4)	0.17	RC-LQ R3, 4275_R6, 3962_R1, 3962_R2, 3962_R3, 3962_R4, 4275_R1, 4275_R2, 4275_R3, 4275_R4, 4275_R5