



Fassaroe Historic Unlicensed Landfill Remediation

Screening for Appropriate Assessment and Natura Impact Statement

May 2018



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1 INTRODUCTION

This Natura Impact Statement (NIS) provides information in support of an Appropriate Assessment (AA) of the proposed remediation of 5 No. historic unlicensed landfill sites at Fassaroe, Bray, Co. Wicklow. These 5 No. sites are identified as Sites Nos. 1, 2, 3A, 3B and 3C. These sites were historically quarried areas which were subsequently used for landfill purposes by Wicklow County Council. The remediation measures proposed comprise the provision of a gas management system as well as a capping of the landfill sites to standards suitable for accommodating future development on the zoned lands surrounding the landfills, including the provision of open space / recreation on the sites of the landfills themselves.

This NIS assesses whether the proposed landfill remediation at Fassaroe, alone or in combination with other plans and projects, is likely to have significant effects on a European Site(s) in view of best scientific knowledge and the conservation objectives of the site(s). European Sites are those identified as sites of European Community importance designated as Special Areas of Conservation under the Habitats Directive (92/43/EEC) or as Special Protection Areas under the Birds Directive (79/409/ECC as codified by Directive 2009/147/EC).

1.1 LEGISLATIVE CONTEXT

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, better known as "The Habitats Directive", provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC) as codified by Directive 2009/147/EC.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to have a significant effect on or to adversely affect the integrity of European Sites. Article 6(3) establishes the requirement for Appropriate Assessment (AA):-

Any plan or project not directly connected with or necessary to the management of the [European] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

Article 6(4) states:-

If, in spite of a negative assessment of the implications for the [European] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

1.2 METHODOLOGY

1.2.1 Guidance Followed

Both EU and national guidance exists in relation to Member States fulfilling their requirements under the EU Habitats Directive, with particular reference to Article 6(3) and 6(4) of that Directive. The methodology followed in relation to this AA has had regard to the following guidance:-

- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Department of Environment, Heritage and Local Government, (DoEHLG, 2010);
- Communication from the Commission on the Precautionary Principle. Office for Official Publications of the European Communities, Luxembourg, (EC, 2000a);
- Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (known as MN2000), Office for Official Publications of the European Communities, Luxembourg, (EC, 2000b);
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Brussels (EC, 2001);
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission. Office for Official Publications of the European Communities, Luxembourg, (EC, 2007);
- Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities, Luxembourg (EC, 2006);
- Article 6 of the Habitats Directive: Rulings of the European Court of Justice (EC, 2014); and
- Interpretation Manual of European Union Habitats. Version EUR 28. European Commission (EC, 2013).

1.3 STAGES OF APPROPRIATE ASSESSMENT

Stage 1: Screening / Test of Significance

This process identifies whether the proposed development is directly connected to or necessary for the management of a European Site(s) and identifies whether the development is likely to have significant impacts upon a European Site(s) either alone or in combination with other projects or plans.

The output from this stage is a determination for each European Site(s) of not significant, significant, potentially significant, or uncertain effects. The latter three determinations will cause that site to be brought forward to Stage 2.

Stage 2: Appropriate Assessment

This stage considers the impact of the proposed development on the integrity of a European Site(s), either alone or in combination with other projects or plans, with respect to (1) the site's conservation objectives; and (2) the site's structure and function and its overall integrity. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts is undertaken.

The output from this stage is a Natura Impact Statement (NIS). This document must include sufficient information for the Competent Authority to carry out the appropriate assessment. If the assessment is negative, i.e., adverse effects on the integrity of a site cannot be excluded, then the process must consider alternatives (Stage 3) or proceed to Stage 4.

Stage 3: Assessment of Alternatives

This process examines alternative ways of achieving the objectives of the project that avoid adverse impacts on the integrity of the European Site. This assessment may be carried out concurrently with Stage 2 in order to find the most appropriate solution. If no alternatives exist or all alternatives would result in negative impacts to the integrity of the European sites then the process either moves to Stage 4 or the project is abandoned.

Stage 4: Assessment Where Adverse Impacts Remain

This stage includes the identification of compensatory measures where, in the context of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

1.4 FIELD SURVEY

Field surveys of the study area were carried out on 11th and 12th August 2015, 9th June and 27th June 2016 and 2nd May 2018 by RPS ecologists. Areas of ecological interest highlighted during the desktop assessment were investigated further during the walkover surveys. Habitats on site were classified in accordance with the Heritage Council publication '*A Guide to Habitats in Ireland*' (Fossitt, 2000) and mapped in accordance with the '*Best Practice Guidance for Habitat Survey and Mapping*' (Smith *et al.*, 2011). The classification is a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. The classification is hierarchical and operates at three levels, using codes to differentiate habitats based on the plant species present. Species recorded in this report are given both their Latin and common names, following the nomenclature as given in the '*New flora of the British Isles*' (Stace, 2010).

Protected species survey was carried out in accordance with the National Roads Authority publication '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*'.

An aquatic survey of the County Brook (in Ballyman Glen) was conducted by Aquens Ltd. in October 2015. The water quality assessment was undertaken using macroinvertebrate indicators. The sampling method adopted was that applied by the EPA in the national river monitoring program (McGarrigle *et. al.*, 2002).

1.5 CONSULTATION

Consultation was previously undertaken by RPS for a proposed planning application at Fassaroe which incorporated amongst other items, remediation proposals for 3 No. of the historic landfill sites also subject of this current Certificate of Authorisation Application. These were site Nos. 1, 2 and 3B. The responses received in respect of that more extensive development remain relevant to the current Certificate of Authorisation application which incorporates the same landfill remediation proposals (gas management and capping) as the previously proposed planning application.

Relevant responses from that consultation are detailed in **Table 1.1**.

Table 1.1: Summary of Relevant Aspects of Consultation Undertaken for Previously Proposed Development at Fassaroe (including the remediation of 3 No. landfill Sites)

| Consultee | Method of Consultation | Summary of Consultation |
|--------------------------------|------------------------|---|
| Inland Fisheries Ireland (IFI) | Email Correspondence | <p>Response email dated 14th October 2015 identified that the lands at Fassaroe are located in the catchment of the Glencullen / Cookstown River. The Dargle (an EU-Designated Salmonid System) and its tributaries support a nationally significant population of Sea trout (<i>Salmo trutta</i>) in addition to a significant and biologically valuable population of Atlantic salmon (<i>Salmo salar</i>, listed under Annex II and V of the EU Habitats Directive). In that case, the IFI advised that all proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of this system.</p> <p>Best practice should be implemented at all times in relation to any activities that may impact on surface water (stream and river) or riparian habitats. Comprehensive surface water management measures (GDSDS study recommendations) must be implemented at the construction and operational stage to prevent any pollution of local surface waters. On-site attenuation ponds may be required to allow for the settlement of fine/particulate materials out of potentially discharging surface waters during construction. Petrol/oil interception (and possibly hydrobrake controls) should be in place on primary surface water discharges to protect receiving freshwaters in terms of water quality. Only clean, uncontaminated water should discharge to local surface waters. The environmentally-sensitive design and implementation of surface water discharge structures would be required to ensure protection of ecological integrity at point of discharge.</p> <p>Watercourses should be maintained in their open natural state in order to prevent habitat loss, preserve and enhance biological diversity and aid in pollution detection. All proposed works must be designed and implemented in an environmentally sound and sustainable manner and should not impact negatively on the salmonid status of this system. Natural fish migration should be maintained by minimizing changes to the natural stream morphology and hydraulic conditions.</p> <p>In the case of the previously more extensive planning application development proposals at Fassaroe, the IFI advised that it is essential that local infrastructural capacity is available to cope with any increased surface and foul water generated by the proposed development in order to protect the ecological integrity of any receiving aquatic environment. This advice remains relevant to the current CoA application primarily in</p> |

| Consultee | Method of Consultation | Summary of Consultation |
|--|------------------------|--|
| | | <p>respect of surface water runoff (which will increase due to the proposed landfill capping) and foul drainage from the remediated landfills. All discharges must be in compliance with the European Communities (Surface Water) Regulations 2009 and the European Communities (Groundwater) Regulations 2010.</p> <p>It is recommended that the “Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites” (http://www.fishingireland.net/environment/constructionanddevelopment.htm) be consulted when planning to undertake works on this site. The maintenance of habitat integrity (both in-stream and riparian) is essential in safeguarding the ecological value of this important urban natural resource. The specific details of any works directly affecting watercourses or riparian habitats in the area must first be submitted to IFI for assessment.</p> |
| <p>The Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht</p> | <p>Email</p> | <p>A response letter dated 26th November 2015 outlined the need to consider the following:</p> <ul style="list-style-type: none"> ▪ Cumulative and ex situ impacts; ▪ Potential impacts from water and wastewater provisions; ▪ Alien invasive species; and ▪ Complete project details need to be considered, including construction management plans. |

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2 STAGE 1: SCREENING FOR APPROPRIATE ASSESSMENT

2.1 INTRODUCTION

This screening process is an assessment of the European Sites that the proposed landfill remediation proposals could potentially affect. This process:-

- Identifies sites within a 15km radius of the proposed remediation works;
- Provides an outline summary of the proposed remediation works;
- Summarises what the possible effects on those European Sites could be; and
- Screens out European Sites that are unlikely to be affected.

2.2 SITE LOCATION AND DESCRIPTION OF THE PROJECT

The subject lands comprise of 5 No. historic unlicensed landfill sites which were previously operated by Wicklow County Council. They lie within the area of Fassaroe, Bray, Co. Wicklow which is designated for major new development area under the Draft Bray Municipal District Local Area Plan 2018. These overall lands are zoned primarily for residential development with recreation (open space), retail, employment and education uses also provided for.

The overall lands at Fassaroe (within which the landfill sites are located) are bounded by the N11 to the east, Ballyman Glen and the County Brook (Fassaroe Stream) to the north, the Cookstown River to the south and by agricultural land to the west. The general location of the sites is identified on **Figure 2.1** below. The existing edge of the built up area of Bray environs is located immediately to the east of the N11. Powerscourt Demesne is located c. 2km to the southwest. Dun Laoghaire Golf Club is located on elevated lands to the north west of the site, accessed from Ballyman Road.

The lands at Fassaroe are in general currently in agricultural use, including both the landfill sites (which have been capped with topsoil and returned to agricultural use in the past) and the areas surrounding them. There are a number of other notable activities within the general Fassaroe area. Roadstone quarry is located to the south-east of the area of the landfills. This quarry operates under licence from the EPA (Waste Licence Ref. W0269-01) for the operation of a soil recovery facility to backfill the quarry, which is anticipated to be completed in 6-7 years. There is a Greenstar Recycling centre located to the north-east of the landfill locations. This is a Materials Recovery and Transfer facility (MRF) operated by Starrus Eco Holdings Limited who are the named licensee on the Waste Licence (Ref. W0053-03). There are also a number of residential clusters in the areas surrounding the landfills; at Thornhill Road, adjacent to Greenstar in the north-east; along Kilbride Lane in the south-east; and along Berryfield Lane which runs east to west through the Fassaroe area (to the south of 4 No. of the landfill sites and to the north of one of the landfill sites) and connects to Ballyman Road in the west. There are a number of small businesses located within the residential clusters at Thornhill Road and Berryfield Lane. There is an existing 110kV ESB substation located on the southern side of Berryfield Lane to the south and east of the landfill sites.

Figure 2.2 below presents an aerial photograph of the general Fassaroe area with the general location of the landfill sites. **Figure 2.3** shows the locations and boundaries of the sites on a map.

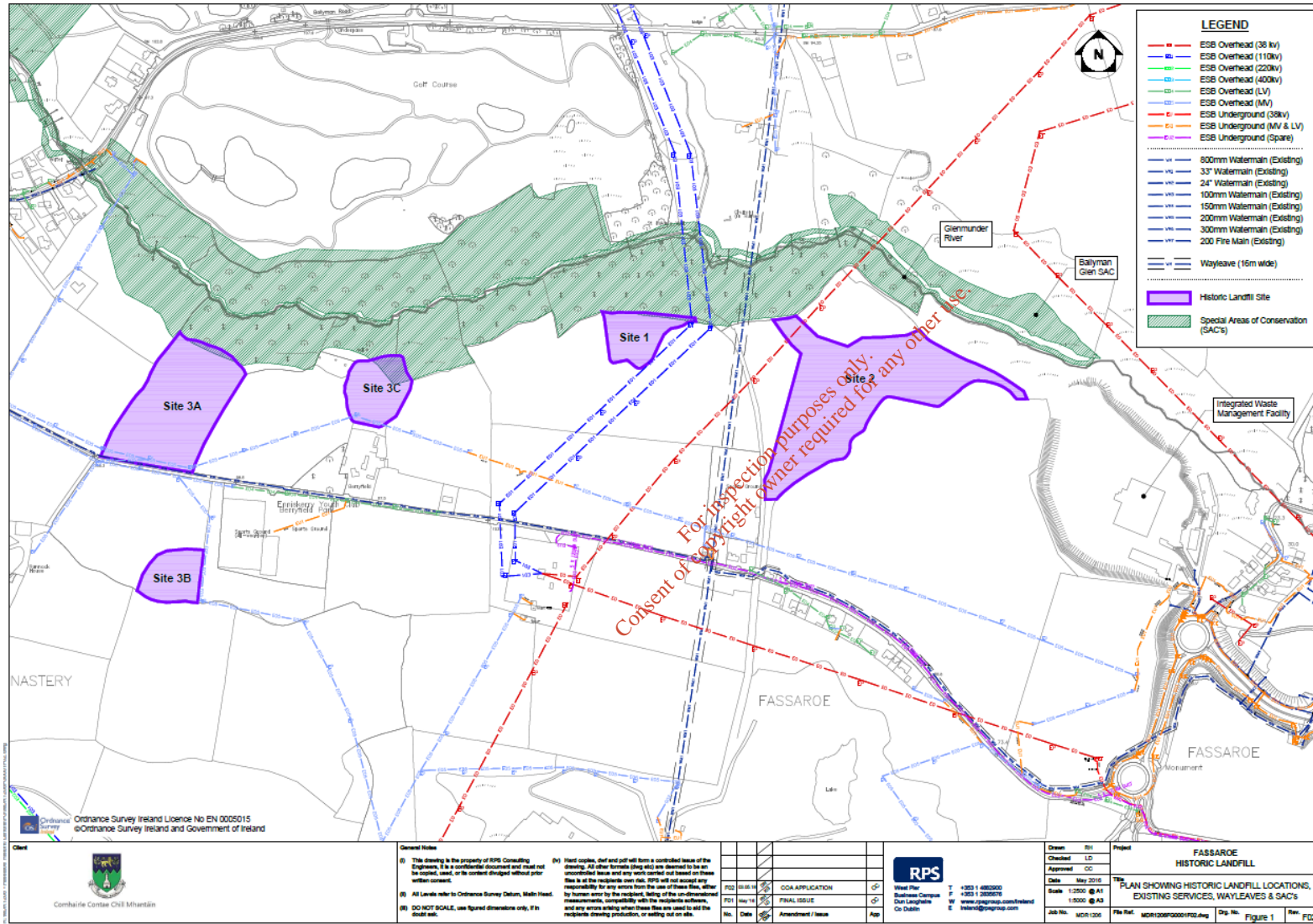
Figure 2.1: Site Location Map



Figure 2.2: Aerial Photo of Fassaroe Area with General Outline of Landfill Sites



Figure 2.3: Location of Historic Landfill on Fassaroe Lands



The general Fassaroe lands in the vicinity of the landfill sites rise steeply to the west from the N11. They also rise from Ballyman Glen in the north and from Cookstown River valley in the south. The highest point of the overall lands is just to the south of Berryfield Lane to the east of Site 3B from where the land falls north-eastwards and south-eastwards and falls to the west.

2.3 GENERAL DESCRIPTION OF REMEDIATION PROPOSALS

2.3.1 Landfill Capping

As noted above, the Fassaroe area (including, and in the vicinity of, the landfill sites) is zoned for future development including residential, open space and recreation, education, retail and employment. In this regard, the remediation proposals for the landfills at Fassaroe need to address both environmental risk associated with the landfills and also potential risk to human health in order to ensure appropriate safety standards for potential future development at the lands. Accordingly, significant site investigations were undertaken at the site in order to prepare an Environmental Risk Assessment (ERA), which in turn has been used to inform the development of appropriate landfill remediation proposals. Elevated levels of ammonia and heavy metals, in up-gradient and down-gradient boreholes, indicate groundwater quality beneath all sites has been impacted by the historic landfilling of waste at Fassaroe.

In order to address potential risks to water receptors, the environment in general and human health (for existing and potential future users and residents of the area), the remediation measures required for the landfill sites primarily include:-

- The use of a capping system on the landfills;
- The provision of Virtual Gas Curtain and Gas Monitoring / Management measures; and
- Excavation and disposal of some limited areas of the landfill bodies to accommodate the route of necessary future infrastructure to serve development in the area (a proposed road connecting from the N11 to Ballyman Road).

2.3.1.1 Slope Stabilisation

Slope failures and potentially unstable slopes have been recorded along the northern boundary of landfill site No. 2 above Ballyman Glen. Anecdotal evidence also suggests that landfill Site Nos. 3a and 3c have previously suffered slope failures/slips on their northern boundaries along the Glen and SAC. The presence of rock drains on the surface may be an indication of previous remediation works.

Slope stabilisation measures will be required in these unstable slope areas. The detailed slope stabilisation measure options will be specified on the basis of the slope profile and available land take at each location with the objective of minimising incursion on the Glen. These works will generally require excavation of the slip material to allow reconstruction from below the slip surface. The lower slopes of the land fill where the failures have occurred may need to be reconstructed to a shallower gradient which will likely extend the toe of the slope further into the Glen (and SAC) than the toe of the existing waste profile. Depending on the specific slope profile, a steeper reinforced earth slope may also be constructed at mid slope (further away from the Glen) to further minimise incursion into the Glen. A combination of these measures in response to the specific profile at each location of the slope failures will allow upper part of the slope of the capped landfill to be constructed with new acceptable fill at a shallower gradient.

2.3.2 Summary of Works within and adjacent to Ballyman Glen

While the substantive elements of the proposed remediation works described above do not extend into Ballyman Glen, there are a number of localised areas in which works are required adjacent to and within Ballyman Glen SAC. These include the following:-

- Edge of Landfill Remediation Measures adjacent to and within Ballyman Glen SAC; and
- Localised structural stabilisation works at northern boundary of Landfill Nos. 2, 3a and 3c adjacent to and within Ballyman Glen SAC.

2.4 IDENTIFICATION OF RELEVANT EUROPEAN SITES AND COMPILATION OF INFORMATION ON THEIR QUALIFYING INTERESTS

The EU Habitats Directive contains a list of habitats (Annex I) and species (Annex II) for which SACs must be established by Member States. Similarly, the EU Birds Directive contains lists of important bird species (Annex I) and other migratory bird species for which SPAs must be established. Those that are known to occur at a site are referred to as 'qualifying interests' and are listed in the Natura 2000 forms which are lodged with the EU Commission by each Member State. A 'qualifying interest' is one of the factors (such as the species or habitat that is present) for which the site merits designation. The National Parks and Wildlife Service (NPWS) is responsible for the designation of SACs and SPAs in Ireland.

Figure 2.4 and **Table 2.1** identify the European sites that are within a 15km radius of the proposed remediation works. The use of a 15 km radius from the proposed works is in line with current best practice and guidance (DoEHLG, 2010) and considered appropriate to the nature and scale of the proposed remediation works. There are 10 SACs and 4 SPAs within 15km of the proposed site. The approximate distance from the location of the landfill sites and potential Surface Water (SW) and Ground Water (GW) connectivity to the European sites is provided in **Table 2.1**. A brief description of each European Site is also provided below based on the Site Synopses, which have been obtained from the NPWS website [www.npws.ie].

Table 2.1: Designated Sites within 15km of the Study Area

| Designated Area | Designation and Site Code | Qualifying Interests | Approximate Distance from Boundary of the Closest Landfill Site and SW and GW Connectivity |
|-------------------|---------------------------|---|---|
| Ballyman Glen | SAC (000713) | Annex I Habitats Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220] Alkaline fens [7230] | Within and directly adjacent |
| Knocksink Woods | SAC (000725) | Annex I Habitats Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220] Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) [91E0] | 550m south-west. No Connectivity. |
| Bray Head | SAC (000714) | Annex I Habitats Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] European dry heaths [4030] | 2.9km east, indirectly connected via County Brook (Fassaroe Stream) which flows into the River Dargle and then into Killiney Bay. |
| Glen of the Downs | SAC (000719) | Annex I Habitats Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0] | 6.1km south. No Connectivity. |
| Glenasmole Valley | SAC (001209) | Annex I Habitats Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220] | 13.3km north-west. No Connectivity. |
| Wicklow Mountains | SAC (002122) | Annex I Habitats Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3130] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with <i>Erica tetralix</i> [4010] | 5.2km west. No Connectivity. |

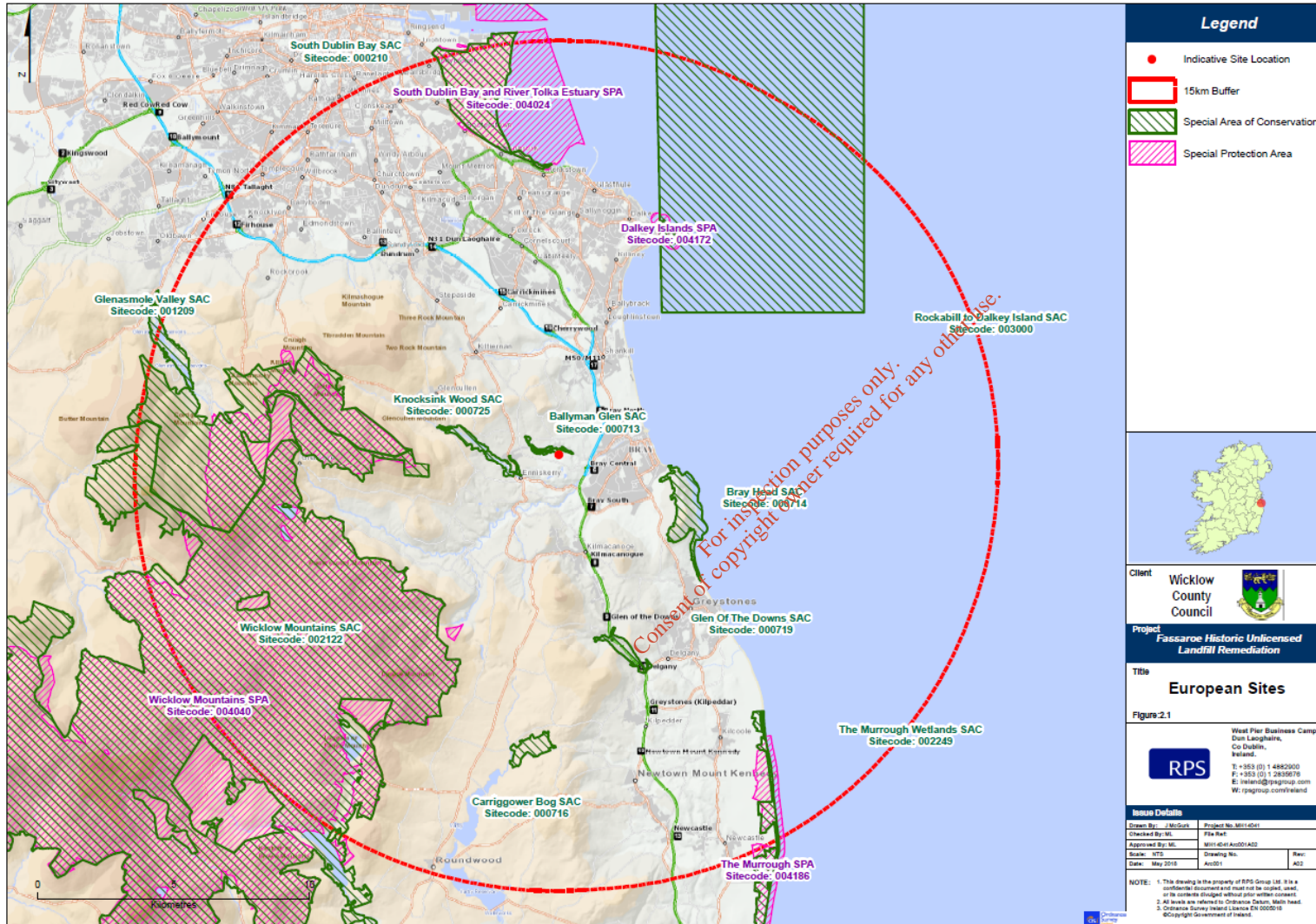
| Designated Area | Designation and Site Code | Qualifying Interests | Approximate Distance from Boundary of the Closest Landfill Site and SW and GW Connectivity |
|-----------------------------|---------------------------|---|--|
| | | <p>European dry heaths [4030] Alpine and Boreal heaths [4060] Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bogs (* if active bog) [7130] Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110] Calcareous rocky slopes with chasmophytic vegetation [8210] Siliceous rocky slopes with chasmophytic vegetation [8220] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] Annex II Species Lutra lutra (Otter) [1355]</p> | |
| Carriggower Bog | SAC (000716) | <p>Annex I Habitats Transition mires and quaking bogs [7140]</p> | 9.6km south. No Connectivity. |
| The Murrough Wetlands | SAC (002249) | <p>Annex I Habitats Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] Alkaline fens [7230]</p> | 11.3km south-east. No Connectivity |
| South Dublin Bay | SAC (000210) | <p>Annex I Habitats Mudflats and sandflats not covered by seawater at low tide [1140]</p> | 10.5km north. Remote and tenuous connectivity via the Irish Sea. |
| Rockabill to Dalkey Islands | SAC (003000) | <p>Annex I Habitats Reefs [1170]</p> | 6.2km north-east. Remote and tenuous connectivity via the Irish Sea. |

| Designated Area | Designation and Site Code | Qualifying Interests | Approximate Distance from Boundary of the Closest Landfill Site and SW and GW Connectivity |
|--|---------------------------|---|--|
| | | Annex II Species <i>Phocoena phocoena</i> (Harbour Porpoise) [1351] | |
| Wicklow Mountains | SPA (004040) | Merlin (<i>Falco columbarius</i>) [A098] Peregrine (<i>Falco peregrinus</i>) [A103] | 5.2km west. No Connectivity. |
| South Dublin Bay & River Tolka Estuary | SPA (004024) | Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046] Oystercatcher (<i>Haematopus ostralegus</i>) [A130] Ringed Plover (<i>Charadrius hiaticula</i>) [A137] Grey Plover (<i>Pluvialis squatarola</i>) [A141] Knot (<i>Calidris canutus</i>) [A143] Sanderling (<i>Calidris alba</i>) [A144] Dunlin (<i>Calidris alpina</i>) [A149] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157] Redshank (<i>Tringa totanus</i>) [A162] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Roseate Tern (<i>Sterna dougallii</i>) [A192] Common Tern (<i>Sterna hirundo</i>) [A193] Arctic Tern (<i>Sterna paradisaea</i>) [A194] Wetland and Waterbirds [A999] | 10.25km north. Remote and tenuous connectivity via the Irish Sea. |
| Dalkey Islands | SPA (004172) | Roseate Tern (<i>Sterna dougallii</i>) [A192] Common Tern (<i>Sterna hirundo</i>) [A193] Arctic Tern (<i>Sterna paradisaea</i>) [A194] | 8.4km north-east- Remote and tenuous connectivity via the Irish Sea. |
| The Murrough | SPA (004186) | Red-throated Diver (<i>Gavia stellata</i>) [A001] Greylag Goose (<i>Anser anser</i>) [A043] Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046] Wigeon (<i>Anas penelope</i>) [A050] | 12.2km south-east- Remote and tenuous connectivity via the Irish Sea. |

| Designated Area | Designation and Site Code | Qualifying Interests | Approximate Distance from Boundary of the Closest Landfill Site and SW and GW Connectivity |
|-----------------|---------------------------|--|--|
| | | Teal (<i>Anas crecca</i>) [A052] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Herring Gull (<i>Larus argentatus</i>) [A184] Little Tern (<i>Sterna albifrons</i>) [A195] Wetland and Waterbirds [A999] | |

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Figure 2.4: European Sites within 15km of Proposed Works



2.4.1 Ballyman Glen SAC (000713)

Ballyman Glen SAC is situated adjacent to and slightly overlapping with the site of the subject landfill remediation works, approximately 3km north of Enniskerry, where it straddles the Wicklow and Dun Laoghaire Rathdown county boundary. The Glen is characterised by pastoral ground sloping up from a small stream (the County Brook) that winds its way along the Glen floor. The site has been designated as an SAC due to the presence of petrifying springs with tufa formation (*Cratoneurion*) [7220], a priority Annex I habitat and Alkaline fens [7230]. The fen vegetation at this site is well developed, with an unusually large number of sedge species present. The presence of alkaline fen and of petrifying spring/seepage areas is also particularly notable, as these habitats are listed, the latter with priority status, on Annex I of the E.U. Habitats Directive. Fens are rare in Wicklow and Dublin, and this is one of only two sites in Wicklow for the Narrow-leaved Marsh orchid.

2.4.2 Knocksink Wood SAC (000725)

Located in a steeply-sided valley, just north-west of Enniskerry in Co. Wicklow, the fast flowing Glencullen River winds its way over granite boulders along the valley floor. Much of the terrain is covered with calcareous drift and supports extensive areas of woodland as well as other ecological features. The SAC has been designated specifically due to the presence of two priority Annex I habitats, namely: Petrifying springs with tufa formation (*Cratoneurion*) [7220] and Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]. The site has national importance as having one of the most diverse woodland invertebrate faunas in the country, some of which are considered to be under threat at an international level. A large proportion of the site has also been designated as a Statutory Nature Reserve.

2.4.3 Bray Head SAC (000714)

This coastal site is situated in the north-east of Co. Wicklow between the towns of Bray and Greystones. The SAC has been designated specifically for the presence of two Annex I habitats, namely Vegetated Sea Cliffs [1230] and Dry Heath [4030]. Dry heath is the principal habitat over much of Bray Head, while Calcareous dry grassland, typically species-rich, occurs on deposits of glacial till. Rocky sea cliffs form most of the seaward boundary at this site and extend for approximately 2 km. Steep clay cliffs extend southwards for a further 1 km, with a small area of clay cliff also at the northernmost part of site. The lower cliffs are fairly steep in places but above the track they are less steep, and often support heath or dry grassland vegetation. A stand of mostly native woodland occurs in the northern part of the site. Other habitats which are found at this site include bedrock shore, a sandy/shingle beach and an area of shallow marine water. Bray Head is of high conservation importance as it has good examples of two habitats (sea cliffs and dry heath) listed on Annex I of the E.U. Habitats Directive. It also supports a number of rare plant species and has ornithological importance.

2.4.4 Glen of the Downs SAC (000719)

Glen of the Downs is a semi-natural oak wood situated within a glacial overflow channel. It is located on the Dublin-Wexford road, about 7 km south of Bray, Co. Wicklow. The site is selected as an SAC for the presence of the Annex I habitat Old Oak Woodlands [91A0]. Much of the site comprises Sessile Oak (*Quercus petraea*) woodland referable to the *Blechno-Quercetum petraeae* association. Sessile Oak is especially dominant on the mid to upper slopes. Glen of the Downs is notable for some rare invertebrates, including *Mycetobia obscura* (Order Diptera) which is found in only one other

locality in Britain and Ireland. Although exploited heavily in the past, this woodland is well developed, rich in species and is of high conservation significance.

2.4.5 Glenasmole Valley SAC (001209)

Glenasmole Valley in south Co. Dublin lies on the edge of the Wicklow uplands, approximately 5 km from Tallaght. The River Dodder flows through the valley and has been impounded here to form two reservoirs which supply water to south Dublin. The site has been designated as an SAC specifically due to the presence of two Annex I priority habitats, namely Orchid-rich Calcareous Grassland [6210] and Petrifying Springs [7220]; and also Molinia Meadows [6410], an Annex I habitat. At this site, examples of calcareous fen and flush occur between the two reservoirs. Tufa depositing springs are long-known from the site, along the valley sides, and some have substantial tufa mounds and banks. Tufa formation is also known from small streams within the woodland at the site. Orchid-rich grassland occurs in the drier parts of this site, grading into Molinia meadow in seepage and flushed areas. The site also supports four Red Data Book plant species and populations of several mammal and bird species of conservation interest.

2.4.6 The Murrough Wetlands SAC (002249)

The Murrough is a coastal wetland complex which stretches for 15 km from Ballygannon to north of Wicklow town, and in parts, extends inland for up to 1 km. The site is designated for the presence of Annex I habitats Annual Vegetation of Drift Lines [1210], Perennial Vegetation of Stony Banks [1220], Atlantic Salt Meadows [1330], Mediterranean Salt Meadows [1410], Alkaline Fens [7230]; and also Cladium Fens [7210], a priority Annex I habitat. Drift line vegetation has developed on the seaward side of the shingle bank which runs along the Murrough Wetlands SAC site. Low sand hills occur at Kilcoole and in other areas and further inland a rich grassy sward, which is most extensive at the south of the site, has developed. Saltmarsh is present within the site in two distinct areas. At the southern end of the site is found Broad Lough. This is a brackish, partly tidal lake, and has a well-developed saltmarsh community. Saltmarsh is also present in the northern end of the site in the vicinity of The Breaches. Fen vegetation is well developed in the Murrough wetlands, with both alkaline and calcareous fen. A wide range of freshwater and brackish marsh habitats also occur within the site. This site is of importance as it is the largest coastal wetland complex on the east coast of Ireland. It is an important site for both wintering and breeding birds and supports a variety of species listed on Annex I of the E.U. Birds Directive.

2.4.7 Carriggower Bog SAC (000716)

Carriggower Bog is situated on Calary plateau at the eastern edge of the Wicklow Mountains. The site is an area of wet bog and poor fen, flanked by the Vartry River on the south-western side. The site has been designated as an SAC due to the presence of Transition Mires [7140]. Very wet areas of transition mire occur on the south-western side of the site. The whole area is quaking and is characterised by a mosaic of sedges, grasses and rushes. This site is of conservation importance because it shows a good transition between fen and bog vegetation (with the fen being colonised by characteristic bog species). The area holds a rich and varied flora, and it provides a habitat for some rare invertebrates. Carriggower Bog is the last remaining site in Wicklow from which some of these invertebrates are recorded. It also has ornithological interest, being an important site for Jack Snipe.

2.4.8 Wicklow Mountains SAC (002122)

This site comprises a complex of upland areas in Counties Wicklow and Dublin, flanked by the Blessington reservoir to the west and Vartry reservoir in the east, Cruagh Mountain in the north and Lybagh Mountain in the south. Most of the site occurs at elevations over 300m, the highest point being Lugnuquilla at 925m. Within its boundaries there is considerable topographical and geomorphological diversity as well as ecological richness. There is for much of its extent overlap with the Wicklow Mountains SPA. The qualifying features for the site include eleven Annex I Habitats, namely; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* [3130]; Natural dystrophic lakes and ponds [3160]; Northern Atlantic wet heaths with *Erica tetralix* [4010]; European dry heaths [4030]; Alpine and Boreal heaths [4060]; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) [8110]; Calcareous rocky slopes with chasmophytic vegetation [8210]; Siliceous rocky slopes with chasmophytic vegetation [8220]; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] as well as 2 priority Habitats: Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) [6230] and Blanket bogs (* if active bog) [7130] along with a single Annex II species: *Ultra ultra* (Otter) [1355].

2.4.9 South Dublin Bay SAC (000210)

Extending from the South Wall to the west pier at Dún Laoghaire, this intertidal site is characterised by extensive areas of sand and mudflats. Its landward perimeters are largely bounded by coastal constructions – seawalls, etc. However, a number of small sandy beaches occur at Poolbeg, Irishtown and Merrion/Boosterstown. There is evidence of incipient dune formation in areas, notably on the seaward side of Boosterstown marsh, which is of recent origin. The site is designated for a single Qualifying Interest, namely: Mudflats and sandflats not covered by seawater at low tide [1140]. South Dublin Bay is also part of a more extensive SPA (South Dublin Bay & River Tolka Estuary SPA 004024) supporting a number of internationally important birds.

2.4.10 Rockabill to Dalkey Islands SAC (003000)

This is a long linear site within the Irish Sea, approximately 7km wide and 40km long runs from Rockabill southwards towards Frazer Bank. It encompasses inshore and coastal waters and includes the seabed, reefs, sandbanks and a small number of islands (Dalkey, Muglins and Rockabill Islands). Its Qualifying Interests are: Reefs [1170] and Harbour Porpoise (*Phocoena phocoena*) [1351]. The NPWS note that Reefs are an uncommon feature along the Eastern seaboard. Conversely, the SAC is a key habitat for the Porpoise within the Irish Sea. As part of the wider Dublin Bay complex, the area is an important national and international resource for birds. In relation to terrestrial element of the SAC, Dalkey Island supports large number of terns (Arctic, Common and Roseate while other seabirds commonly seen include Kittiwake, Razorbill, Guillemot, Puffin, Fulmar, Shag, Cormorant, Manx Shearwater, Gannet and Gulls.

2.4.11 Wicklow Mountains SPA (004024)

This is an extensive upland site, which largely overlaps with Wicklow Mountains SAC. The SPA comprises a substantial part of the Wicklow Mountains within County Wicklow but extends into Co. Dublin. Given its extent, it is considered a site of high ornithological importance owing in part to the range of habitats and the bird species that have been recorded there, in particular Merlin (*Falco*

columbarius) [A098] and Peregrine (*Falco peregrinus*) [A103], both of which are the qualifying species for the SPA

2.4.12 South Dublin Bay and River Tolka Estuary SPA (004024)

South Dublin Bay and River Tolka Estuary SPA comprises a substantial part of Dublin Bay. It far exceeds the boundaries of the preceding SAC. It includes the intertidal area between the River Liffey and Dún Laoghaire, and the estuary of the River Tolka to the north of the River Liffey, as well as Booterstown Marsh. A portion of the shallow marine waters of the bay is also included. The site is an important site for wintering waterfowl, being an integral part of the wider Dublin Bay complex. The Special Conservation Interests for the site include 13 Annex I Bird Species and 1 Habitat, namely; Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]; Oystercatcher (*Haematopus ostralegus*) [A130]; Ringed Plover (*Charadrius hiaticula*) [A137]; Grey Plover (*Pluvialis squatarola*) [A141]; Knot (*Calidris canutus*) [A143]; Sanderling (*Calidris alba*) [A144]; Dunlin (*Calidris alpina*) [A149]; Bar-tailed Godwit (*Limosa lapponica*) [A157]; Redshank (*Tringa totanus*) [A162]; Black-headed Gull (*Chroicocephalus ridibundus*) [A179]; Roseate Tern (*Sterna dougallii*) [A192]; Common Tern (*Sterna hirundo*) [A193]; Arctic Tern (*Sterna paradisaea*) [A194] & Wetland and Waterbirds [A999].

2.4.13 Dalkey Islands SPA (004172)

The SPA comprises a string of three small islands, namely Dalkey Island, Lamb Island and Maiden Rock, as well as the intervening rocks and reefs, and the surrounding sea to a distance of 200 m. As the largest island, Dalkey Island lies approximately 400 m off Sorrento Point on the mainland from which it is separated by a deep channel. This site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest due to the presence of the following Annex 1 bird species- Roseate Tern (*Sterna dougallii*) [A192]; Common Tern (*Sterna hirundo*) [A193] and Arctic Tern (*Sterna paradisaea*) [A194].

South Dublin Bay and River Tolka Estuary SPA comprises a substantial part of Dublin Bay. It includes the intertidal area between the River Liffey and Dún Laoghaire, and the estuary of the River Tolka to the north of the River Liffey, as well as Booterstown Marsh. A portion of the shallow marine waters of the bay is also included. The site is an important site for wintering waterfowl, being an integral part of the wider Dublin Bay complex. The Special Conservation Interests for the site include 13 Annex I Bird Species and 1 Habitat, namely; Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]; Oystercatcher (*Haematopus ostralegus*) [A130]; Ringed Plover (*Charadrius hiaticula*) [A137]; Grey Plover (*Pluvialis squatarola*) [A141]; Knot (*Calidris canutus*) [A143]; Sanderling (*Calidris alba*) [A144]; Dunlin (*Calidris alpina*) [A149]; Bar-tailed Godwit (*Limosa lapponica*) [A157]; Redshank (*Tringa totanus*) [A162]; Black-headed Gull (*Chroicocephalus ridibundus*) [A179]; Roseate Tern (*Sterna dougallii*) [A192]; Common Tern (*Sterna hirundo*) [A193]; Arctic Tern (*Sterna paradisaea*) [A194] & Wetland and Waterbirds [A999].

2.4.14 The Murrough SPA (004186)

The Murrough SPA comprises a coastal wetland complex that stretches for 13 km from Kilcoole Station, east of Kilcoole village in the north to Wicklow town in the south, and extends inland for up to 1 km in places. The site includes an area of marine water to a distance of 200m from the low water mark. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following protected species Red-throated Diver (*Gavia stellata*) [A001], Greylag Goose (*Anser anser*) [A043], Light-bellied Brent Goose (*Branta bernicla hrota*) [A046],

Wigeon (*Anas penelope*) [A050], Teal (*Anas crecca*) [A052], Black-headed Gull (*Chroicocephalus ridibundus*) [A179], Herring Gull (*Larus argentatus*) [A184], Little Tern (*Sterna albifrons*) [A195] and Wetland and Waterbirds [A999].

The E.U. Birds Directive pays particular attention to wetlands, and as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds. The shingle ridge at Kilcoole is a traditional nesting area for Little Tern, and the site now supports one of the largest colonies in the country. The Murrrough SPA is an important site for wintering waterbirds, being internationally important for Brent Goose and nationally important for Red-throated Diver, Greylag Goose, Wigeon, Teal, Black-headed Gull and Herring Gull. It is probably the most important site in the country for nesting Little Tern. The site also supports a typical diversity of birds associated with reed swamp, including Reed Warbler, a very localised species in Ireland.

2.5 SCREENING ASSESSMENT OF SIGNIFICANCE

2.5.1 Elements of the Project Likely to Give Rise to Impacts on European Sites

Landfill sites 1, 2, 3A and 3C lie immediately adjacent to (and slightly overlap with, in the cases of sites 1, 3A and 3C) Ballyman Glen SAC, which is designated specifically for the presence of petrifying springs with tufa formation (*Cratoneurion*) [7220], a priority Annex I habitat, and Alkaline fens [7230]. Both of these habitats are dependent on groundwater regime and quality. The remediation proposals encompass works on these four historical landfill sites, as well as a fifth set back from the SAC to the south of Site 3A (and to the south of Berryfield Lane). There is potential for direct impacts on the Ballyman Glen SAC in the form of landtake and fragmentation of habitat due to the capping and possible slope stabilisation works at sites 2, 3A and 3C where they slightly overlap with the SAC. There is also potential for indirect impact on the SAC by reason of sediment runoff during the construction phase of the remediation works.

A Tier 1 Risk Assessment of these areas of landfill¹ found that groundwater flow direction from all the historic landfill sites is ultimately towards the County Brook (Fassaroe Stream) and Ballyman Glen to the north and northeast. The Risk Assessment identified an existing risk of vertical and horizontal flow of leachates into this European Site. The proposed remediation solution includes proposals to cap the areas of landfill. As such, there is potential also for these remediation works to affect the water table and flow to the springs and alkaline fen. There is therefore potential for direct impacts to the qualifying interests of Ballyman Glen SAC by reason of impact on the local hydrological regime as a result of the proposed remediation works. There is also potential for these remediation works to alter surface and groundwater quality, which may result in an impact to the qualifying interests of Ballyman Glen SAC. Knocksink Woods SAC is situated approximately 550m to the south-west of the proposed development. This European Site has been designated for the presence of the Annex I habitats petrifying springs with tufa formation (*Cratoneurion*) [7220] and Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]. No surface water connectivity between the study area and Knocksink Woods has been identified. The study area is within the Dargle Lower River sub-basin (Water Framework Directive (WFD) Code: IE_EA_10_1275), while Knocksink Woods is within Glencullen River sub-basin (WFD Code: IE_EA_10_1277). Landfill area 3B (which is the closest to Knocksink Woods) is located approximately 550m to the north-east of Knocksink Woods, however the Risk Assessment identified that groundwater flow from this landfill area is in a north-easterly direction, away from Knocksink Woods SAC. The land between the subject remediation sites and Knocksink Woods SAC comprises

¹ RPS (2015) Fassaroe Historic Landfill, Phase 1 Report. RPS.

agricultural fields bound by hedgerows. In consideration of the lack of robust hydrological connectivity and the significant buffer of vegetated land between the remediation sites and Knocksink Woods SAC, no impacts to the qualifying interests this SAC are anticipated.

There is a remote indirect connectivity from the remediation sites to Bray Head SAC via the County Brook (Fassaroe Stream), which confluences with the River Dargle approximately 1.1km downstream of the Site 2, before flowing out into the Irish Sea approximately 1.8km downstream again, and approximately 1.6km along the coast from Bray Head SAC. Rockabill to Dalkey SAC and South Dublin Bay SAC both have a tenuous indirect connectivity to the remediation proposals, being approximately 4.5km and 16.5km north along the coast from the point the Dargle discharges into the Irish Sea. These European Sites are designated for coastal habitats and species associated with routine estuarine and or tidal inundations and fluctuations. To this end, habitats and species associated with these European Sites are accustomed to high levels of water turbidity, fluctuations in sediment accretion, deposition and erosion. As a result these habitats are not as sensitive (when compared to freshwater / terrestrial habitats and species) to potential impacts associated with the remediation proposals (in particular sporadic increases in sediment load during construction / capping activities). Therefore, these sites would not be significantly affected by low level or sporadic release in sediment or particulate matter that may be associated with the capping works. Furthermore, the potential release of other deleterious substances such as hydrocarbons, particulate matter etc. can be readily retained to within the footprint of the proposed works area through standardised best practice measures.

There is no surface water or groundwater connectivity to the Glen of the Downs, Glenasmole Valley, Wicklow Mountains, Carriggower Bog and The Murrough Wetlands. Further, the sites are situated a significant distance from the proposed works (between 5.2 and 13.3km distance) and will not be impacted either directly or indirectly. Therefore, potential impacts to these sites are no longer considered as part of this assessment.

There is no desktop evidence to suggest that the qualifying species of Wicklow Mountains SPA, South Dublin Bay & River Tolka Estuary SPA, Dalkey Islands SPA and The Murrough SPA are using lands in the vicinity of the proposed works. Bird species identified during the site walkover surveys at the landfill sites and surrounding area undertaken in 2016 reflect the habitat assemblages present in the majority of the study area; i.e. improved pasture and arable fields fringed by hedgerow and treeline habitats. The wider study area of Fassaroe also includes private residential dwellings, gardens and farm holdings, which also influence species composition and abundance. No Annex I or Red list species were recorded during the site visits. Further, the coastal SPAs are separated from the development by the busy M11 road. It is not anticipated that the proposed works would result in a significant increase in the level of background noise disturbance in the local areas. Any disturbance to bird species within nearby European Sites as a result of the proposed works is considered extremely unlikely. Furthermore, potential disturbances will be temporary and confined to the construction element of the site remediation only.

Therefore, it is not anticipated that the proposed remediation works will impact the Wicklow Mountains SPA, South Dublin Bay & River Tolka Estuary SPA, Dalkey Islands SPA and The Murrough SPA with regards to noise disturbance of bird species.

Table 2.2: Potential Significant Impacts on European Sites from the Proposed Remediation Works

| Site Name | Direct Impacts | Indirect/ Secondary | Resource Requirements (Drinking Water Abstraction, etc.) | Emissions (Disposal to Land, Water or Air) | Excavation Requirements | Transportation Requirements | Duration of Construction, Operation, Decommissioning |
|----------------------|--|---|---|--|---|--|--|
| South Dublin Bay SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Ballyman Glen SAC | Potential loss or degradation of alkaline fen and petrifying spring Annex I habitats due to overlap of works areas with SAC. | Potential impacts on surface water quality via run-off which may affect petrifying spring Annex I habitat. Potential impacts to groundwater quality which may affect alkaline fen and petrifying spring Annex I habitats. Potential impacts to the hydrological and hydro-geological regime which may affect alkaline fen and petrifying spring Annex I habitats. | No impact on qualifying interest | Construction activities within the remediation areas will involve the transport of materials to and from construction areas leading to air emissions and potential spillages and runoff of polluting substances to the County Brook (Fassaroe Stream) and receiving European sites | Potential impacts to qualifying interests from excavation and construction works for slope stabilisation and capping works. | Limited access will be required within the Ballyman Glen SAC during the remediation works at Sites 1, 2 3A and 3C. | Potential impacts on hydrological regime and groundwater quality during construction and post remediation which may affect fen and petrifying spring Annex I habitats. |
| Bray Head SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Carriggower Bog SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |

| Site Name | Direct Impacts | Indirect/ Secondary | Resource Requirements (Drinking Water Abstraction, etc.) | Emissions (Disposal to Land, Water or Air) | Excavation Requirements | Transportation Requirements | Duration of Construction, Operation, Decommissioning |
|--|----------------------------------|----------------------------------|---|--|----------------------------------|----------------------------------|---|
| Glen Of The Downs SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Wicklow Mountains SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Knocksink Wood SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| The Murrough SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Glenasmole Valley SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Rockabill to Dalkey Island SAC | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| South Dublin Bay and River Tolka Estuary SPA | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| The Murrough SPA | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Dalkey Islands SPA | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |
| Wicklow Mountains SPA | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest | No impact on qualifying interest |

2.5.2 Likely Changes to the European Site(s)

The likely changes that will arise from the proposed remediation works have been examined in the context of a number of factors that could potentially result in a significant effect on the identified European Sites (**Table 2.3**).

Table 2.3: Likely Effect on European Sites

| Site Name | Reduction of Habitat Area | Disturbance to Key Species | Habitat or Species Fragmentation | Reduction in Species Density | Changes in Key Indicators of Conservation Value (Water Quality Etc.) | Climate Change |
|-----------------------|--|----------------------------|--|------------------------------|--|----------------|
| South Dublin Bay SAC | None | None | None | None | None | None |
| Ballyman Glen SAC | Potential negative impact to petrifying springs and alkaline fen during construction and operation | None | Potential fragmentation of habitats due to remediation works at edge of SAC. | None | Potential negative impact during construction to surface and groundwater quality; Potential negative impact due to changes in hydrological regime during construction and post remediation; Potential long-term positive impact from improvement to groundwater quality post remediation | None |
| Bray Head SAC | None | None | None | None | None | None |
| Carriggower Bog SAC | None | None | None | None | None | None |
| Glen Of The Downs SAC | None | None | None | None | None | None |
| Wicklow Mountains SAC | None | None | None | None | None | None |
| Knocksink Wood SAC | None | None | None | None | None | None |
| The Murrough SAC | None | None | None | None | None | None |
| Glenasmole Valley SAC | None | None | None | None | None | None |

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| Site Name | Reduction of Habitat Area | Disturbance to Key Species | Habitat or Species Fragmentation | Reduction in Species Density | Changes in Key Indicators of Conservation Value (Water Quality Etc.) | Climate Change |
|--|---------------------------|----------------------------|----------------------------------|------------------------------|--|----------------|
| Rockabill to Dalkey Island SAC | None | None | None | None | None | None |
| South Dublin Bay and River Tolka Estuary SPA | None | None | None | None | None | None |
| The Murrrough SPA | None | None | None | None | None | None |
| Dalkey Islands SPA | None | None | None | None | None | None |
| Wicklow Mountains SPA | None | None | None | None | None | None |

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3 SCREENING CONCLUSIONS

The likely impacts that will arise from the proposed remediation works have been examined in the context of a number of factors that could potentially have a significant effect on the Natura 2000 network (**Tables 2.2** and **2.3**). With regards to the European sites which do not support connectivity, either direct or indirect, to the proposed remediation works, or where it has been established that there are no impacts, it can be objectively concluded that there is no likelihood of any significant negative effects on these European sites and therefore no further assessment is required.

On the basis of the findings of this Appropriate Assessment Screening, it is concluded that the proposed Fassaroe historic landfill remediation works:-

- i. are not directly connected with or necessary to the management of a European Site;
- ii. may have significant effects on petrifying springs with tufa formation (*Cratoneurion*) [7220], a priority Annex I habitat, and Alkaline fens [7230] an Annex I habitat for which Ballyman Glen SAC is designated; and
- iii. may result in positive impacts to current water quality conditions.

Therefore, applying the Precautionary Principle which requires that the conservation objectives of the European site should prevail where there is uncertainty and in accordance with Article 6(3) of the Habitats Directive, likely changes to the Ballyman Glen SAC may arise from the proposed remediation works if robust and effective mitigation measures are not implemented.

It is evident that there may be significant impacts from the proposed Fassaroe historic landfill remediation works, therefore, due to this uncertainty, a Stage 2 'Appropriate Assessment' is considered necessary.

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4 STAGE 2: APPROPRIATE ASSESSMENT – NATURA IMPACT STATEMENT

4.1 INTRODUCTION

In this section, Annexed habitats for which Ballyman Glen SAC is designated are described and all potential impacts resulting from the proposed works are discussed in relation to the conservation objectives of these Annexed habitats.

4.2 DESCRIPTION OF PROJECT

The proposed landfill remediation works are described in **Section 2.2** above.

4.3 ECOLOGICAL DESCRIPTION OF STUDY AREA

A number of ecological surveys have been conducted at the landfill sites and surrounding lands. The following provides an overview of the habitats identified in the survey area, and **Figure 4.1** illustrates the distribution of these habitats.

Improved Grassland

A large field of agriculturally improved grassland (GA1) is situated adjacent to Ballyman Glen SAC which roughly equates to the area of landfill Site No. 2 and adjacent areas. There are a further three fields of improved grassland to the west of the study area towards Monastery. The sward in these areas is species poor and dominated by Perennial Rye-grass (*Lolium perenne*).

There are two fields of abandoned improved grassland to the south of Sites Nos. 1 and 2 (and to the south of Berryfield Lane) In addition to Perennial Rye-grass, the sward in these fields also contains the grasses Yorkshire Fog (*Holcus lanatus*), Rough Meadow-grass (*Poa trivialis*), Cock's-foot (*Dactylis glomerata*) and False Oat-grass (*Arrhenatherum elatius*). Herbs present here include Creeping Buttercup (*Ranunculus repens*), White Clover (*Trifolium repens*), Red Clover (*T. pratense*), Dandelion (*Taraxacum agg.*) and Ribwort Plantain (*Plantago lanceolata*); and several noxious weeds including Broad-leaved Dock (*Rumex obtusifolius*), Creeping Thistle (*Cirsium arvense*) Ragwort (*Senecio jacobea*) and Hogweed (*Heracleum sphondylium*).

Amenity Grassland

Amenity grassland (GA2) is located in two areas adjacent to Berryfield Lane. The sward is of low botanical interest and is dominated by Perennial Rye-grass.

Dry Meadows and Grassy Verges

Site Nos. 3A and 3C are species poor dry meadows. Species in the sward include Cock's-foot, Perennial Rye-grass and Hard Rush (*Juncus inflexus*). Forbs are limited to Common Sorrel (*Rumex acetosa*), Meadow Vetchling (*Lathyrus pratensis*), Creeping Cinquefoil (*Potentilla reptans*), Ribwort Plantain, Curled Dock (*Rumex crispus*), Dandelion, Celandine (*Ranunculus ficaria*), Silverweed (*Potentilla anserina*) and Willowherb (*Epilobium* spp).

Arable

The predominant habitat across the study area is arable (BC1). This habitat is located adjacent to Ballyman Glen SAC on the fields adjacent to site Nos. 1 and 3C. A field located between site Nos. 3A and 3C had been tilled prior to the survey undertaken in May 2018, but is thought to also be arable.

Hedgerows

Fields across the study area are generally bound by good quality hedgerows (WL1) comprised of native species including Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*), Willow (*Salix spp.*), Hawthorn (*Crataegus monogyna*), Elder (*Sambucus nigra*), Crab Apple (*Malus sylvestris*), Blackthorn (*Prunus spinosa*) and Holly (*Ilex aquifolium*).

Treelines

Berryfield Lane which runs east west through the Fassaroe area (to the south of sites 1, 2, 3A and 3C and to the north of Site 3B) is lined with tree and shrub species (WL2) including Ash, Sycamore, Hawthorn and Blackthorn. There is also a treeline separating an arable field and the Countybrook Lawns housing development to the west of the wider study area.

Scrub

Areas of mixed scrub (WS1) adjoin parts of the southern edge of the woodland in Ballyman Glen SAC; extend south from Ballyman Glen in the area around and including Site No. 1; in a steep sloping area to the north of site 3A; and also in an area to the east of Site 2 (to the west of Greenstar Recycling Centre). Scrub also surrounds the ESB substation south of Berryfield Lane. Species present in these areas included Gorse (*Ulex europaeus*), Elder, Blackthorn, Hawthorn, Bramble (*Rubus fruticosus* agg) and Butterfly Bush (*Buddleia davidii*).

Woodland

To the north-west of the general study area within Ballyman Glen SAC (immediately to the north of landfill site nos. 1, 3A and 3C), the river valley supports a wet woodland habitat (WN4/ WN6). Plant species composition here included abundant canopy species such as Ash and Alder (*Alnus glutinosa*) with a shrub layer of Grey Willow (*Salix cinerea*) and occasional Hazel (*Corylus avellana*) and rare Holly. Further west, closer to site 3A, Downy Birch (*Betula pubescens*) occurs locally within wet woodland areas.

The ground layer of this woodland area is flushed, wet underfoot and slightly waterlogged in parts. Plant species composition is diverse and included Remote Sedge (*Carex remota*), Great Willowherb (*Epilobium hirsutum*), Creeping Buttercup, Water Mint (*Mentha aquatica*), Cleavers (*Galium aparine*), Wavy Bitter-cress (*Cardamine flexuosa*), Nettle (*Urtica dioica*), Herb Robert (*Geranium robertianum*), Meadowsweet (*Filipendula ulmaria*), Bugle (*Ajuga reptans*), Primrose (*Primula vulgaris*), Sanicle (*Sanicula europaea*), Yellow Pimpernell (*Lysimachia nemorum*), Marsh Hawk's-beard (*Crepis paludosa*) Violet (*Viola spp.*), Great Horsetail (*Equisetum telmateia*), Broad Buckler fern (*Dryopteris dilatata*), Male Fern (*Dryopteris filix-mas*) and Lady Fern (*Athyrium filix-femina*). Bryophytes present in these areas include *Mnium hornum*, *Thuidium tamarascinum* and *Thamnobryum alopecurum*. Yellow Iris (*Iris pseudacrous*), and Reed Canary-grass (*Phalaris arundinacea*) are found in localised areas of marsh located near the river main channel. The species recorded within the woodland and ground layer does not support the list of positive indicator

species and criteria for classification as Annex I Habitat '91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (6410), in accordance with the National Survey of Native Woodland (NSNW) (2003-2008).

Parts of the woodlands fringe; i.e. the southern bounds of Ballyman Glen SAC are drier and correspond to habitats WD1 and WN2. WD1 areas comprise Sycamore (*Acer pseudoplatanus*) and Ash (*Fraxinus excelsior*). Drier areas corresponding to WN2 include abundant Ash with Hazel frequent in the understorey. Plant species composition within understorey of drier woodland areas notes the replacement of Great Horsetail with Bramble. Species recorded here include Germander Speedwell (*Veronica chamaedrys*), Herb Robert, Sanicle, Ivy, Lords and Ladies (*Arum maculatum*), Hart's-tongue fern (*Asplenium scolopendrium*), Wood Sedge (*Carex sylvatica*) and Spindle (*Euonymus europaeus*).

There is also a small area of mixed conifer woodland (WD3) adjacent to a dwelling located to the south of site 3C.

Calcareous Spring/ Poor fen flush

These areas are dominated by Great Horsetail, with other species present including Yorkshire Fog (*Holcus lanatus*), Marsh Foxtail (*Alopecurus geniculatus*), Hairy Sedge (*Carex hirta*), Common Spike-rush (*Eleocharis palustris*), Lesser Stitchwort (*Stellaria graminea*), Creeping Buttercup, Meadowsweet, Common Sorrel (*Rumex acetosa*), Water Mint and Silverweed (*Potentilla anserina*). Tufa deposits have been observed towards the bottom of the valley in two of the springs in Ballyman Glen SAC in areas to the north east of Site 3C and to the northeast of Site 3A (see **Figure 4.2** and **Section 4.7**).

4.3.1 Invasive Species

Non-native invasive species may have a significant impact on native habitats and species, causing significant decline or loss and may jeopardise the conservation objectives of European sites

There are four records of Japanese Knotweed (*Fallopia japonica*) from the O21 grid square, including a record from 2013 from the Crookstown River approximately 0.5km to the south of the site. Giant Hogweed (*Heracleum mantegazzianum*) has been recorded between 1978 and 1987 by the River Dargle at Bray, which is approximately 0.6km to the east of Site No. 2. Cherry Laurel (*Prunus laurocerasus*) was recorded in 2007 from the Dargle Glen, approximately 1km to the south of the area of the landfills, and also in 2005 at Knocksink Woods, approximately 1.6km to the west of the closest landfill site. Rhododendron (*Rhododendron ponticum*) has been recorded in 2005 in Tithewer, approximately 2.5km south of the general study area.

Four stands of Japanese Knotweed were noted during the field surveys undertaken by ecologists between 2016 and 2018. These stands are located primarily within the scrub area of Site No. 1 adjacent to the SAC; there is also a stand to the adjacent to the north-eastern boundary of Site No. 2 (**Figure 4.1**). Butterfly Bush (*Buddleja davidii*) is present scattered throughout the southern edge of woodland in Ballyman Glen, and is also present in the same area as the Japanese Knotweed at Site No. 1. No invasive species were recorded in the vicinity of site Nos. 3A- 3C.

Figure 4.1: Habitat Map of Area Surrounding Landfill Sites

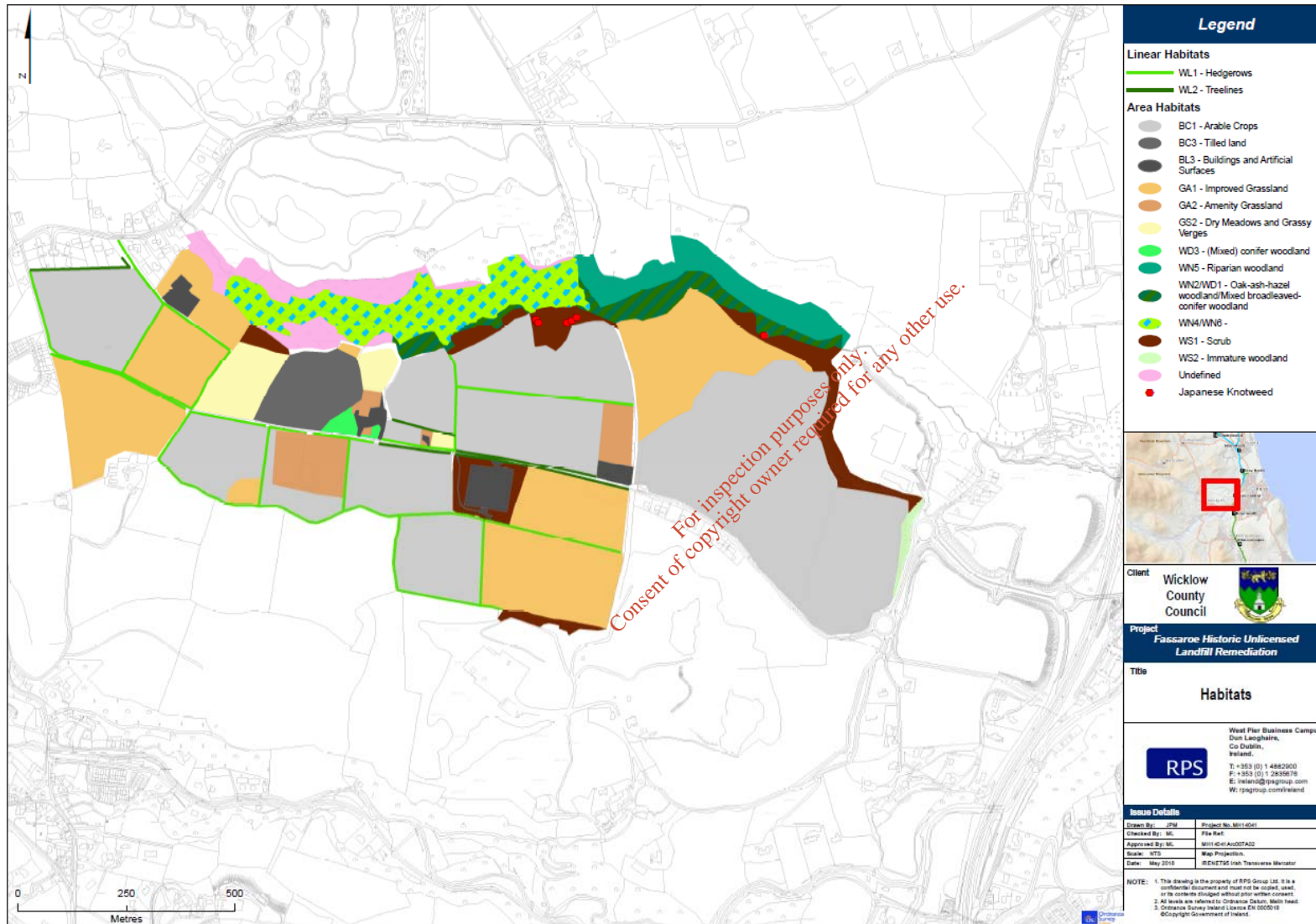
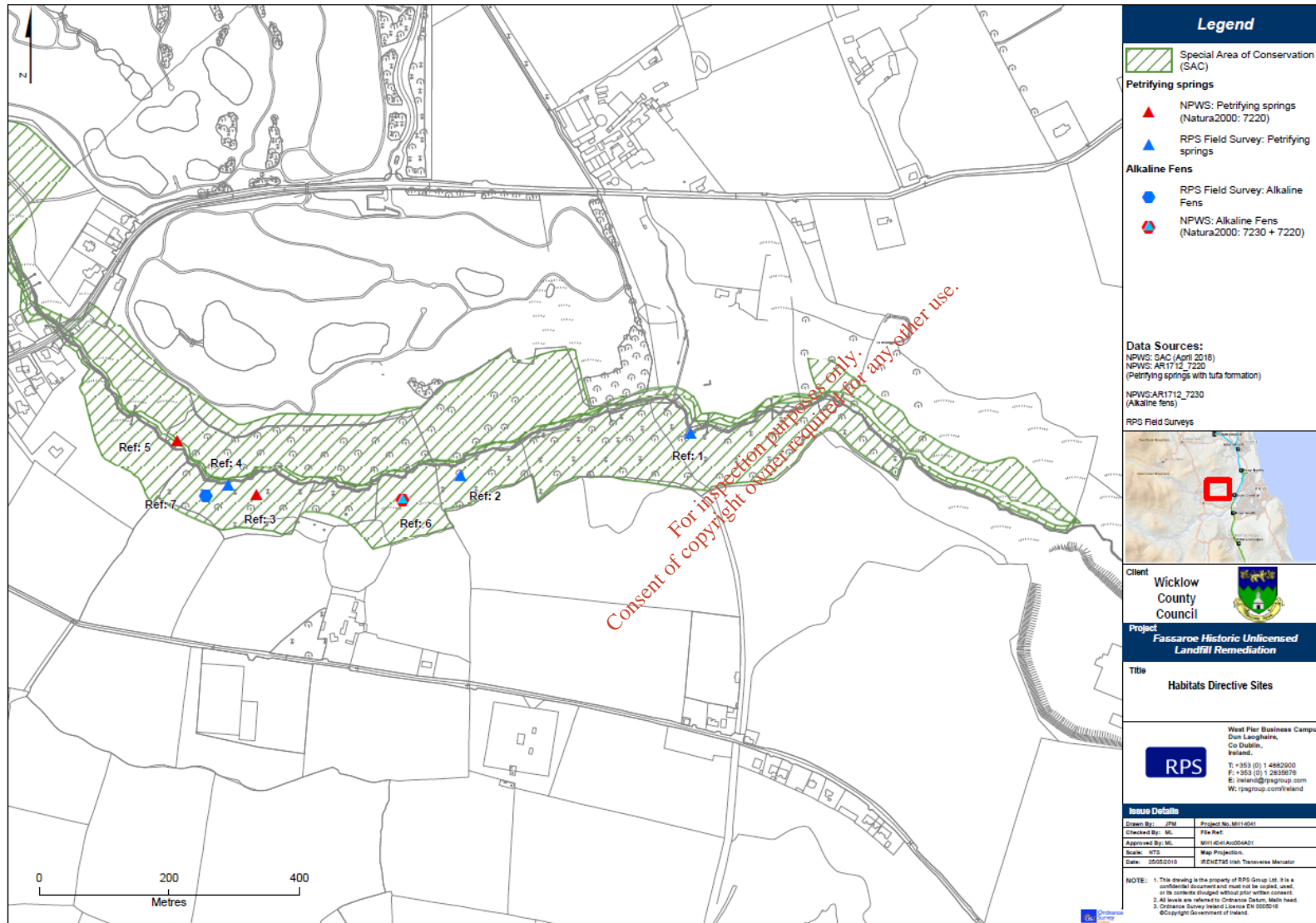


Figure 4.2: Petrifying Spring and Alkaline Fen Habitat Recorded at Ballyman Glen



4.4 GEOLOGY AND HYDROGEOLOGY

The subsoils (Quaternary Geology units above the rock) at the site consist of glaciofluvial sands and gravels. According to the Geological Survey of Ireland (GSI), these sand and gravel deposits derived predominantly from Limestones make up the Fassaroe Delta. The site forms part of the Enniskerry delta, listed as an Irish Geological Heritage Site (WW020).

The sands and gravels are a glacial outwash delta comprising glaciofluvial and glaciolacustrine sediments also known as the Fassaroe Delta. The sediments are arranged in the typical delta sequence: topset gravels composed of up to 2m depth of horizontally bedded gravels on top; foreset gravels which are steeply dipping and well bedded deposited at the front of the delta; and bottomset, finer sediments of sands and silts, usually underlying the foresets and representing sediment that was originally deposited beyond the steep delta front on the sea floor. The thickness of the sand and gravel unit has not been established as it extends below the maximum reach of the drilling rig used in site investigations to date (35m below ground level). However, bedrock outcrop was noted in the river bed to the north of the site, the County Brook.

The unconsolidated sands and gravels are comprised largely of limestone from the Irish Midlands, and form part of the Enniskerry gravel aquifer body, classed as locally important gravel aquifer of "Good" WFD status. Groundwater discharges emerge as springs and seeps along the lowest boundary of the groundwater body in the river valley and feed a small strip of alkaline fen and tufa deposits within the Ballyman Glen. The aquifer vulnerability at the site is classified as High, due to the proximity of the gravel aquifer to ground level.

The underlying bedrock consists of Ordovician Metasediments of the Maulin Bedrock Formation characteristic of dark blue-grey slate, phyllite and schist. The Maulin Formation is classified by the GSI as a locally important, moderately productive bedrock aquifer in local zones (LI). The Maulin Bedrock Formation forms part of Wicklow Groundwater Body which is a very large but characteristic of a poorly productive aquifer flow regime.

As the bedrock at Fassaroe is characteristic of significantly lower transmissivity than the overlying sand and gravel deposits, it is assumed that the contact with the underlying bedrock constitutes the hydraulic base to the overlying granular sand/gravel aquifer system. The groundwater flow regime at Fassaroe is that of a shallow, unconfined, largely granular aquifer system with groundwater flow directions generally reflecting the surface topography.

A groundwater contour map for the local system is presented in **Figure 4.3**, based on water levels measured on 29th March, 2016. This figure confirms that a water-table is present within the sand and gravel deposits, and groundwater flow direction at all sites is ultimately towards the County Brook (Fassaroe Stream) to the north and northeast.

4.5 QUALIFYING INTERESTS OF THE EUROPEAN SITE

The importance of a site designated under the Habitats Directive is defined by its qualifying features or interests. Qualifying interests for any European Site are listed on a pro forma, called the Natura 2000 standard data form, which forms the basis of the rationale behind designation, and informs the Conservation Management Plan for targeted management and monitoring of key species and habitats.

Qualifying interests for the Ballyman Glen SAC are given in **Table 4.1**, along with the conservation status and specific sensitivities and main threats relevant to each feature. Information on conservation status for each habitat within the SAC was extracted from the Natura 2000 Standard Data Form (which was last updated in September 2014) on the NPWS website <http://www.npws.ie/protectedsites/>. This information provides specific details on the conservation status of each habitat within the SAC. The environmental sensitivities have been derived from *The Status of EU Protected Habitats and Species in Ireland*².

Table 4.1: Conservation Status and Main Threats to the Qualifying Interests of Ballyman Glen

| Annex I Habitat | Conservation Status at Ballyman Glen SAC | Environmental Sensitivity/ Main Threats (Ranked High to Medium) |
|---|---|--|
| [7220] Petrifying springs with tufa formation (<i>Cratoneurion</i>) | C= Average or reduced conservation status. Short-term trend direction: Stable. | <ul style="list-style-type: none"> ▪ Landfill, land reclamation, and drying out, general; ▪ Abandonment of pastoral systems, lack of grazing; ▪ Diffuse pollution to surface waters due to agricultural and forestry activities; ▪ Trampling, overuse; ▪ Roads, motorways; ▪ Intensive grazing; and ▪ Water abstractions from groundwater. |
| [7230] Alkaline fens | A= Excellent conservation status. Short-term trend direction: Stable. | <ul style="list-style-type: none"> ▪ Water abstractions from groundwater; ▪ Reclamation of land from sea, estuary or marsh; ▪ Diffuse pollution to ground waters due to agricultural and forestry activities; ▪ Abandonment of pastoral systems, lack of grazing; ▪ Water abstractions from surface waters; ▪ Infilling of ditches, dykes, ponds, pools, marshes or pits; ▪ Invasive non-native species; ▪ Diffuse pollution to surface waters due to agricultural and forestry activities; ▪ Peat extraction; ▪ Artificial planting on open ground (non-native trees); and ▪ Agricultural intensification. |

² NPWS (2013): The Status of EU Protected Species and Habitats in Ireland. Habitats Assessment Volume 2. Version 1.1. Department of Arts, Heritage and Gaeltacht.

4.6 CONSERVATION OBJECTIVES

Article 6.3 of the Habitats Directive requires that the impact of the project (either alone or in combination with other projects or plans) on the integrity of the European Site is considered with respect to the conservation objectives of the site and to its structure and function. The EC guidance on Natura 2000 (MN2000) states that:-

The integrity of a site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives (MN2000, para 4.6(3)).

The maintenance of favourable condition of qualifying interests at the site level will contribute to the overall maintenance of favourable conservation status of those habitats and species at national level:-

- **Favourable conservation status of a habitat** can be described as being achieved when: “its natural range, and the area it covers within that range, is stable or increasing, and the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable”.
- **Favourable conservation status of a species** can be described as being achieved when: “population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, sufficiently large habitat to maintain its populations on a long term basis”.

Where conservation objectives have not yet been set, a set of generic conservation objectives has been produced by NPWS.

Generic Conservation Objectives for SACs are as follows:-

- To maintain Annex I habitats and Annex II species for which the SAC has been selected at favourable conservation condition.

Generic Conservation Objectives for SPAs are as follows:-

- To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the SPA.

4.6.1 Ballyman Glen SAC

Conservation Objectives were downloaded from the NPWS website (www.npws.ie). The date of issue for the Ballyman Glen Conservation Objectives is 21/02/2018 (Generic Version 6.0).

The Conservation Objective for Ballyman Glen is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:-

- [7220] Petrifying springs with tufa formation (*Cratoneurion*)* (* denotes a priority habitat);
- [7230] Alkaline fens.

Site specific conservation objectives are not available for Ballyman Glen SAC. To enable the full ecological implications of the proposed development for the conservation objective and integrity of Ballyman Glen, the attributes that are used to define site-specific conservation objectives for the same qualifying interests in other sites have been referred to. For Petrifying Springs [7220] the conservation objectives for the Carrowmore Point to Spanish Point and Islands SAC (Site Code: 001021) have been referred to. These conservation objectives are defined by a list of attributes and targets as follows (please note that any site specific requirements for Carrowmore Point to Spanish Point and Islands SAC have been excluded):-

- Habitat area: area stable or increasing, subject to natural processes;
- Habitat distribution: no decline;
- Hydrological regime: maintain appropriate hydrological regimes. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources;
- Water quality: maintain oligotrophic and calcareous conditions. Characteristically, petrifying spring water has high values for pH, alkalinity and dissolved calcium and is oligotrophic (Lyons and Kelly, 2013); and
- Vegetation composition: maintain typical species. The bryophytes *Palustriella commutata* (*Cratoneurion commutatum*), *Cratoneurion filicinum* and *Eucladium verticillatum* are diagnostic of this habitat (EC, 2007).

The conservation objectives for the Connemara Bog Complex SAC (Site Code: 002034) have been referred to with regards to Alkaline Fen [7230]. These conservation objectives are defined by a list of attributes and targets as follows:-

- Habitat area: area stable or increasing, subject to natural processes;
- Habitat distribution: no decline from current distribution, subject to natural processes;
- Ecosystem function: soil nutrients: maintain soil nutrient status within natural range;
- Community diversity: maintain variety of vegetation communities, subject to natural processes;
- Vegetation composition- number of positive indicator species: number of brown moss species present at each monitoring stop is at least one;
- Vegetation composition- cover of positive indicator species: number of positive vascular plant indicator species at least two for small sedge flushes and at least three for black bog-rush flush and bottle sedge fen;
- Vegetation composition- negative indicator species: total cover of negative indicator species less than 1%;
- Vegetation composition- non-native species: cover of non-native species less than 1%;
- Vegetation composition- native trees and scrub: cover of scattered native trees and shrubs less than 10%;
- Vegetation composition- soft rush and common reed: total cover of soft rush and common reed less than 10%;

- Vegetation structure- height: proportion of live leaves and/or flowering shoots of vascular plants that are more than 5cm above the ground surface should be at least 50%;
- Physical structure- disturbed bare ground: cover of disturbed bare ground less than 10%;
- Physical structure- drainage: area showing signs of drainage from heavy trampling, tracking or ditches less than 10%;
- Physical structure- tufa formations: disturbed proportion of vegetation cover is less than 1%;
- Indicators of local distinctiveness: no decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat.

4.7 ASSESSMENT OF QUALIFYING HABITATS AND SPECIES

4.7.1 Petrifying Springs

Petrifying springs with tufa formation (*Cratoneurion*) [7220] are a priority habitat in Annex I of the Habitats Directive. The term 'petrifying' means to replace with stone, and in the context of the springs it refers to the habitats close association with the hydrochemical process of calcium carbonate precipitation³. The calcium carbonate deposits are commonly known as 'travertine' or 'tufa' and form where lime-rich spring water deposits tufa on the ground surface. Tufa depositing waters are characterised by having a high pH, high levels of dissolved calcium and bicarbonate ions and by being oligotrophic (low in nitrogen and phosphorus). The Conservation Status Assessment for Petrifying Springs⁴ found that the petrifying spring habitat as it occurs in Ireland falls within the definition of the Habitats Directive, and describes three physiognomic categories of petrifying spring:-

- I. Clearly defined spring heads with consolidated tufa;
- II. Spring heads with associated tufaceous flushes; and
- III. Tufa-forming seepage areas on level ground.

Petrifying springs contain *Cratoneuron* vegetation, typically dominated by bryophytes and characterised by the presence of *Palustriella commutata* along with *Pellia endiviifolia*, *Cratoneuron filicinum*, *Eucladium verticillatum*, *Bryum pseudotriquetum*, *Pallustriella falcata* and *Didymodon tophaceus*. Frequently occurring vascular plants are *Festuca rubra*, *Carex lepidocarpa*, *C. panicea* and *Equisetum telmateia*. The three main subtypes of petrifying springs are woodland springs, inland non-wooded springs and coastal springs.

4.7.1.1 Alkaline Fen

Alkaline fens [7230] are wetlands that are mostly or largely occupied by peat or tufa producing small sedge and brown moss communities that have developed on permanently waterlogged soils, with a soligenous or topogenous base rich, often calcareous water supply; and with the water table at, or slightly above or below the substratum. Peat formation, when it occurs, is infra-aquatic⁵. Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the *Caricion davallianae*, characterised by an usually prominent brown moss carpet, a grass like growth of Black Bog-rush (*Schoenus nigricans*) and *Carex* spp and a rich herb flora (please refer to the

³ Graham, J. & Farr, G. (2014) Petrifying Springs in Wales. Field Bryology No 112/14

⁴ Lyons, M. & Kelly, D. (2013) Conservation Status Assessment for Petrifying Springs. Unpublished report to NPWS.

⁵ EC (2007) Interpretation Manual of European Union Habitats. European Commission.

Interpretation Manual of European Union Habitats for a full species list). Under the Heritage Council classification scheme⁶ alkaline fen is classified as 'Rich Fen and Flush' (PF1). The vegetation of rich fen and flush is described in the Fossitt classification scheme as typically dominated by Black Bog-rush (*Schoenus nigricans*) and or small to medium sedges such as *Carex viridula*, *C. nigra*, *C. dioica*, and *C. panacea*. Other prominent components of the vegetation include rushes, particularly Blunt-flowered rush (*Juncus subnodulosus*), Purple Moor-grass (*Molinia caerulea*), Marsh Pennywort (*Hydrocotyle vulgaris*), Lesser Spearwort (*Ranunculus flammula*), Water Mint (*Mentha aquatica*), Common Marsh Bedstraw (*Galium palustre*), Grass of Parnassus (*Parnassia palustris*), Common Butterwort (*Pinguicula vulgaris*) and Devil's-bit Scabious (*Succisa pratensis*). Rich fen and flush can be important for orchids such as *Epipactis palustris* and *Dactylorhiza* spp.

4.7.1.2 Petrifying Spring Habitat Recorded at Ballyman Glen

The area in which the landfill sites are located drains to the north-east into the southernmost valley of Ballyman Glen and the County Brook (Fassaroe Stream). Three areas of petrifying spring habitat were identified in the southern valley of Ballyman Glen SAC by RPS during field surveys. These are identified as Petrifying Spring Locations Nos. 1, 2 and 4 in **Figure 4.2**. Spring location No. 1 is to the northeast of landfill site No. 1; Spring location No. 2 is to the northeast of landfill site no. 3C; and spring location No. 4 is to the northeast of landfill site no. 3A. The springs were located on flushed slopes within Alder woodland, were dominated by Giant Horsetail and supported a build-up of tufa deposits.

Three petrifying springs were previously recorded in Ballyman Glen by Lyons & Kelly (2013) during survey work completed for the *Conservation Status Assessment for Petrifying Springs* on behalf of the NPWS. These are identified as Petrifying Springs Nos. 3, 5 and 6 and referenced as NPWS records on **Figure 4.2**. Spring No. 3 is to the northeast of landfill site no. 3A, Spring No. 5 is the north west of landfill site no. 3A and spring no. 6 is to the northeast of landfill site no. 3C.

It is also noted that two springs were identified during field work undertaken by RPS with visual evidence of ochre staining (spring SPR1 and spring SPR4). Results of 3 rounds of water quality monitoring undertaken by RPS for the ERA showed that the pH measurements for tufa forming (calcite) springs were consistently elevated relative to those showing ochre staining (with an average pH of between 7.5 and 8.1 relative to a pH of 7.2 to 7.3). When considered with water quality for key leachate marker parameters (i.e., ammoniacal nitrogen) it was therefore concluded that the existing landfill waste at certain sites (i.e., Site 2 and Site 3A) may have had a localised effect on tufa formation on some of the springs. These effects were not seen at all springs and/or seepages, which is consistent with output of the DQRA, which suggests that despite high source concentrations, significant attenuation is generally observed, principally as a result of mixing at the water table. As detailed in **Table 4.1**, landfill has been identified by the NPWS⁷ as one of the main threats to petrifying spring habitat.

4.7.1.3 Alkaline Fen Habitat Recorded at Ballyman Glen

An area of rich fen and flush was identified to the north east of landfill site Nos. 3A and 3C, during the ecological survey conducted in June 2016 by RPS. The area of fen and flush occurred near the southern boundary of Ballyman Glen, within a woodland opening (see **Figure 4.2**). This area supported an extensive cover of Great Horsetail but also had a relatively diverse assemblage of fen

⁶ Fossitt, J. (2000) A Guide to Habitats in Ireland. The Heritage Council.

⁷ *Ibid* 2.

species or species indicative of flowing water. Great Horsetail cover became more and more abundant toward western margins of this area, becoming almost mono-specific in places. Purple Moor-grass was more abundant in some areas, with Sharp-flowered Rush (*Juncus acutiflorus*) and Horsetail species (*Equisetum* spp.) also present.

Plant species identified within this general area included Long-stalked yellow Sedge (*Carex lepidocarpa*), Small-fruited Yellow Sedge (*Carex viridula* subsp. *viridula*), Carnation Sedge (*Carex panicea*), Jointed Rush (*Juncus articulatus*), Broad-leaved Cottongrass (*Eriophorum latifolium*), Purple Moor-grass, Marsh Arrowgrass (*Triglochin palustris*), Bogbean (*Menyanthes trifoliata*), Devil's-bit Scabious (*Succisa pratensis*), Hemp-agrimony (*Eupatorium cannabinum*), Greater Bird's-foot-trefoil (*Lotus pedunculatus*), Marsh Hawk's-beard (*Crepis paludosa*), Angelica (*Angelica sylvestris*), Slender St John's-wort (*Hypericum pulchrum*), *Dactylorhiza* spp., and the mosses *Calliergonella cuspidata*, *Scleropodium purum* and *Rhytidiadelphus loreus*.

4.8 DESCRIBE HOW THE PROJECT WILL EFFECT KEY SPECIES AND KEY HABITATS

The following sections assess the potential impacts, in the absence of mitigation, of the proposed remediation works on the conservation objectives of Ballyman Glen SAC.

4.8.1 Potential Significant Impacts during the Construction Phase

This section comprises an evaluation of the potential significance of impacts of the construction phase of the remediation works on the conservation objectives of the European Site, Ballyman Glen SAC that has been selected for Appropriate Assessment. Desktop studies and field survey have been undertaken in order to inform a complete impact assessment of the proposal on the qualifying interests of the European Site. Potential impacts include:-

- Loss of habitat area/ distribution and degradation of habitats;
- Alteration of water quality;
- Alteration of hydrological regime; and
- Introduction or spread of invasive species during construction.

4.8.1.1 Loss of Habitat Area/ Distribution and Degradation of Habitats

As noted in **Section 2.2.3**, there are a number of areas in which works are required within Ballyman Glen SAC. These include the following:-

- Localised structural stabilisation works at northern boundaries of Landfill site Nos. 2, 3A and 3C, and potentially site No. 1 adjacent to and within Ballyman Glen SAC;
- Landfill remediation of Site No. 3C which overlaps with SAC
- Edge of landfill remediation at Sites 1, 2 and 3A adjacent to and overlapping slightly with the SAC.

The location of these proposed works in relation to the Qualifying Interests of Ballyman Glen SAC are illustrated in **Appendix A**. The potential impacts of these proposed works on the Qualifying Interests of Ballyman Glen SAC are detailed below.

Petrifying Springs

The proposed landfill remediation measures and associated slope stabilisation works within Ballyman Glen SAC are located within scrub, mixed broadleaf woodland and wet woodland habitats. No works or associated vegetation clearance is proposed within, or adjacent to, the location of any springs identified as petrifying springs with tufa formation, therefore no direct loss to this habitat is anticipated to arise from the proposed remediation works. The location of the proposed works in relation to the Qualifying Interests of Ballyman Glen is illustrated in **Appendix A**. However, the remediation construction works detailed above, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the petrifying spring habitat as a result of pollution of surface waters.

There is potential for a reduction in habitat or loss of habitat as a result of alteration in hydrological regime, as detailed in **Section 4.8.1.3**.

Alkaline Fen

As noted in **Section 4.7.1.3** and illustrated in **Appendix A**, the areas of alkaline fen within Ballyman Glen SAC are located north-east of Site 3A and 3C. No remediation works are proposed within, or adjacent to, the location of any alkaline fen, therefore no direct loss to this habitat is anticipated to arise from the proposed construction works. However, the remediation construction works detailed above, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the petrifying spring habitat as a result of pollution of surface waters.

There is potential for a reduction in habitat area as a result of alteration in hydrological regime, as detailed in **Section 4.8.1.3**.

4.8.1.2 Alteration of Water Quality

Construction

Small amounts of waste may need to be removed to accommodate likely future infrastructure in the area. In the event that this occurs, waste material will be removed from site by a licensed waste haulier and taken to a licensed landfill, or where possible, recovered for recycling. The localised disturbance of waste could potentially mobilise landfill leachate resulting in further contamination of the groundwater aquifer. This could occur by the breaching of a confining layer allowing downward vertical migration or lateral movement along utility trenches.

Landfill Capping

The results of the Environmental Risk Assessment (ERA) at Fassaroe showed that there were elevated levels of ammonia and heavy metals in up-gradient and down-gradient boreholes, indicating that groundwater quality within the zone of influence of the landfill sites has been impacted by the historic landfilling of waste (for location of historic landfill sites see **Figure 2.4**). The

vertical pathway for leachate generation is driven by direct rainfall percolating through the waste body. The recharged water travels northeast through higher permeability sections of the waste. The leachate then pools within the base of the waste and from there percolates into the underlying unsaturated sand and gravel deposits. Upon reaching the water-table, the sand and gravel aquifer provides both lateral and vertical migration pathways for leachate mixed with groundwater. The groundwater flow within the sandy gravel deposits is orientated in a northeast direction towards Ballyman Glen SAC.

As noted in **Section 4.7.1.2**, survey work conducted by RPS found that two springs in Ballyman Glen showed visual evidence of ochre staining, indicating contamination from leachate. As detailed in the ERA, there is a difference in chemistry between the two sets of springs (i.e. those identified as petrifying springs and those with ochre deposits), although the results were highly variable over the monitoring rounds. In general, springs characterised by ochre staining also had the highest concentrations of ammoniacal nitrogen (albeit not elevated in all rounds) and lower (average) pH although the variability is high. A lower pH is generally consistent with a reduced calcium carbonate saturation of groundwater and hence the potential for tufa forming at the springs. The tufa springs had lower ammonia and higher pH which allows a higher calcium carbonate saturation level which then promotes the precipitation of tufa. The results also showed that the water quality at the three petrifying springs is compromised with some elevated BOD and metals concentrations.

The proposed landfill capping will:

- Minimise infiltration of water and maximise run off from the landfill areas;
- Promote surface drainage and maximise run off from the landfill areas;
- Control landfill gas migration; and
- Provide a physical separation between waste and plant and animal life.

Leachate generation as a result of rainfall infiltration will be significantly reduced by the installation of the capping system.

One of the targets defining the Conservation Objectives for Petrifying Springs is:

Water quality: maintain oligotrophic and calcareous conditions. Characteristically, petrifying spring water has high values for pH, alkalinity and dissolved calcium and is oligotrophic.

As noted above, there is potential for the construction works for the remedial works to have negative impacts on groundwater quality. However, the water quality at the springs will improve following the capping of the landfill due to the reduced recharge through the waste and reduced leachate generation. This is expected to result in a rise in the pH level, a reduction in contaminants and an increase in the calcium carbonate saturation and the precipitation of tufa. The water quality at the three petrifying springs is currently compromised with some elevated BOD and metals concentrations. Therefore, it would be reasonable to expect an improvement in the amount of tufa being deposited, from the current conditions, following the capping of the landfills. The remediation works therefore have the potential to provide a positive impact on the groundwater quality and potential for the improvement of spring water quality and petrifying conditions at the springs.

Overall, it is anticipated that the landfill remediation measures proposed as part of the development will have a positive impact on the current situation with regards to water quality.

The areas of alkaline fen within Ballyman Glen (Nos. 6 and 7 in **Figure 4.2**) are located to the northeast of landfill site nos. 3C and 3A respectively. The direction of groundwater flow from these two landfill sites is toward the area of alkaline fen. As noted above, the capping of the landfill is expected to result in a reduction in contaminants and a rise in the pH level within the groundwater. Consequently, no adverse impacts on the qualifying habitat alkaline fen are anticipated to arise from an alteration of groundwater quality, however, there is potential for a positive impact as a result of potential improvement in water quality.

4.8.1.3 Alteration of Hydrological Regime

Landfill Capping

As noted in **Section 4.8.1.2**, the objective of the landfill capping system is to minimise the infiltration of water into the waste, control gas migration and provide a physical separation between the waste and plant, animal life and human contact.

In terms of groundwater impact, a landfill capping system has the effect of reducing the amount of effective rainfall or recharge percolating to groundwater and increasing surface water run-off from the area. The runoff from the capping will be diverted to a surface water management system and discharged directly to surface water and therefore represents a loss to the groundwater recharge.

The resulting reduction in ground recharge in the catchment may result in the lowering of the water-table. A significant reduction in the water-table elevation at the Fassaroe site will reduce the head driving the flow to the alkaline fen and springs which could result in a reduction in flow to alkaline fen and a reduction or cessation of spring flow along the banks of the river which could have a direct impact on the petrifying springs.

Groundwater Recharge and Levels

The scale of the potential impact of the landfill capping is examined by estimating the total groundwater recharge for the catchment to the springs and then determining the reduction in recharge which is anticipated due to capping of the landfills.

Pre-Remediation Recharge

The total groundwater recharge supporting the river baseflow and spring discharges in Ballyman Glen is a product of the catchment area and the recharge rate. As part of the ERA, a groundwater catchment for the area of the landfill sites and Ballyman Glen was delineated using groundwater elevation contours developed by RPS and detailed topographic data. The resulting catchment is shown in **Figure 4.3** and represents the assumed area of 0.658 square kilometres. There is some uncertainty in relation to location of the up-gradient catchment boundary as the groundwater contours are based on monitoring boreholes located around the perimeter of the landfill cells. In lieu of groundwater monitoring locations in that area the topographic contours have been used to guide the groundwater catchment delineation.

The Geological Survey of Ireland (GSI) provides estimates for groundwater recharge on a regional scale. The groundwater recharge for the Fassaroe site is estimated at 575mm/year. This yields a total recharge for the catchment to the springs of approximately 378,350m³/year.

Post-Remediation Recharge

For the post-remediation scenario, a reduced infiltration rate of 67mm/year for each of the capped landfill areas is used. This estimated infiltration rate is equal to the average effective rainfall through a 0.6m compacted layer with hydraulic conductivity of 1×10^{-9} m/s.

The recharge rate is estimated using the reduced rate for the landfill cells and paved areas. The resulting recharge rate for the catchment as a whole is 512mm/year which yields approximately $336,694 \text{ m}^3/\text{year}$. The catchment and landfill areas, recharge rates and total recharge results are summarised in **Table 4.2**.

Table 4.2: Recharge Calculation for the Fassaroe Site and Landfills

| Phase | Site | Area (Ha) | Recharge Rate (mm/yr) | Recharge (m^3/yr) |
|---|------------------------|-----------|-----------------------|--|
| Pre-Remediation | Total Catchment | 65.8 | 575 | 378,350 |
| Post-Remediation | Site 1 | 0.5 | 67 | 335 |
| | Site 2 | 4.5 | 67 | 3,015 |
| | Site 3B | 0.4 | 67 | 268 |
| | Site 3A | 1.9 | 67 | 1,273 |
| | Site 3C | 0.9 | 67 | 603 |
| | Greenfield (unchanged) | 57.6 | 575 | 33,1200 |
| | Total Catchment | 65.8 | 533 | 336,694 (equivalent to 512 mm/year) |
| Post-Remediation Reduction in Recharge Across Total Catchment Area | | | | 11% |

The post-remediation recharge represents a potential reduction of 11% in the recharge rate to the entire groundwater catchment area. This is based on a reduction from 575mm/year to 512mm/year, which is a reduction of 63mm/yr. The reduction in the average groundwater levels as a result of the decrease in recharge rate of 63mm/year can be estimated based on the storage parameters for the gravel aquifer. A typical effective porosity for a gravel deposit of 20% is adopted for the basis of the assessment. To estimate the drop in levels resulting from a decrease in recharge rate the reduction in question (63mm/year or 0.063m/year) is divided by the porosity (20% or 0.2) which yields a water level fluctuation of 0.32m.

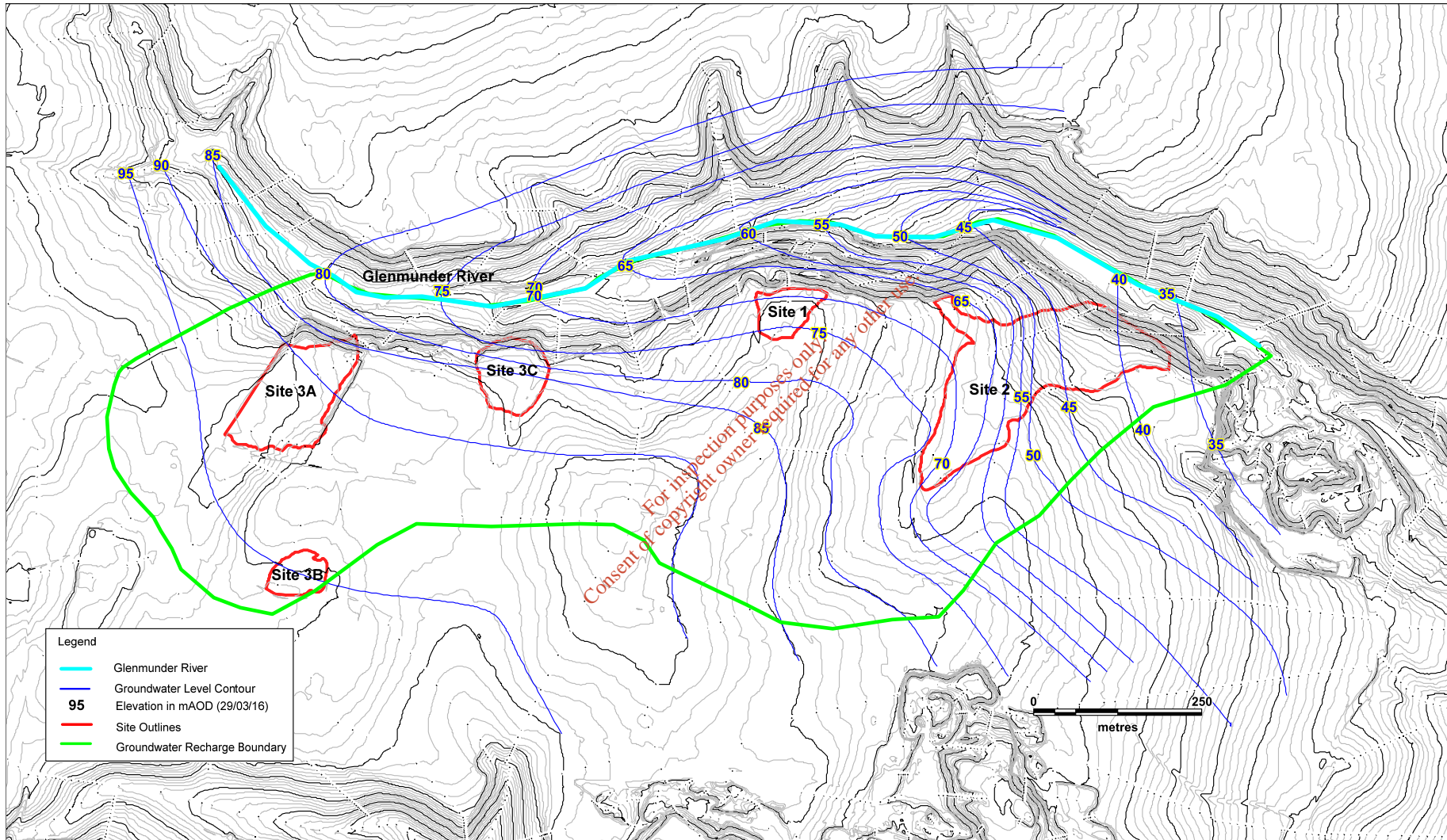
Similarly it is estimated that a consistent reduction in recharge percolating to groundwater across the larger landfill cells (landfill site 2) from 575 to 67mm could result in a potential ground water level decrease directly beneath the landfill of up to 2.5m. The observed reduction in groundwater level will be less as the potential drop in groundwater levels directly beneath the landfill will promote groundwater flow in from the surrounding areas, which will equilibrate the levels with the effect of marginal drawdown being observed from the wider area.

The springs and seepages which feed the tufa deposits emanate at the seepage face where groundwater emerges from the river valley. The extent of the seepage face above the river elevation is related to the groundwater elevation in the gravels, which in turn is related to the recharge.

The reduced recharge rate in the aquifer could lead to a comparable reduction in the seepage face elevation. Therefore, potentially there may be a drop of 0.32m from the top of the seepage face and the reduction in flow at the springs could reduce by 11%. This is illustrated in a diagram included in **Appendix B**, which illustrates the pre and post development water table and artesian levels through a typical valley section. This illustrates that the predicted reduction of 0.32m is a small change when compared to the total saturated thickness of the gravel. The tufa springs are mapped lower down in the river valley, rather than at the top of the seepage face and therefore it is unlikely that this minor amount of drawdown would lead to a significant loss of any of the petrifying springs. The reduced recharge rate (by 11% in comparison to pre-development conditions) could lead to a comparable reduction in flow from the springs (11%), however it is expected the springs would continue to flow and the tufa would continue to be deposited. Likewise, the potential drop of 0.32m is above the level of elevation of the alkaline fen; therefore, negative impacts on the alkaline fen within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be not significant.

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Figure 4.3: Groundwater Catchment Area for the Fassaroe Landfill Remediation Area



4.8.1.4 Introduction or Spread of Invasive Species

There are four stands of Japanese Knotweed present at Landfill Site No. 1 in an area of scrub and there is also a stand just outside the north-eastern boundary of Site No. 2 (**Figure 4.1**). There is potential for the proposed development to spread Japanese Knotweed into Ballyman Glen SAC.

4.8.2 Potential Significant Impacts Post-Remediation

4.8.2.1 Loss of Habitat Area/ Distribution and Degradation of Habitats

There is potential for indirect effects through degradation in habitat or loss of habitat as a result of alteration in hydrological regime, as assessed in **Section 4.8.1.3** and **4.8.2.3**.

4.8.2.2 Alteration of Water Quality

As described in **Section 4.8.1.2**, there is an existing migration of leachate from the landfills into the groundwater body feeding the petrifying springs and alkaline fen that are a qualifying interest of Ballyman Glen SAC. It is anticipated that the landfill capping system to be installed during the construction phase of remediation works will continue to reduce leachate generation as a result of rainfall infiltration post-remediation. This is likely to have a positive impact on the water quality of the groundwater system feeding the petrifying springs and alkaline fen within Ballyman Glen.

4.8.2.3 Alteration of Hydrological Regime

As described in **Section 4.8.1.3**, it is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 11% over the life of the development. However, the potential drop of 0.32m is above the level of elevation of the petrifying springs and alkaline fen, therefore negative impacts on the petrifying springs and alkaline fen within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be not significant.

4.8.2.4 Introduction or Spread of Invasive Species

No further risk of introduction or spread of invasive species is identified post-remediation.

4.8.3 Summary of Impacts on the Qualifying Interests of Ballyman Glen SAC

A summary of potential impacts on the habitats of conservation value and qualifying interests of Ballyman Glen SAC is provided in **Table 4.3**.

Table 4.3: Summary of Impacts on the Qualifying Interests of Ballyman Glen SAC

| Qualifying Interest/ Habitat of Conservation Value | Potential Impacts | Brief Explanation | Mitigation Required |
|---|-----------------------------------|--|---------------------|
| Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220] | Alteration of Water Quality | There is potential for the localised construction works for the remediation works to have negative impacts on groundwater quality. However installation of the landfill capping system will result in a reduction of leachate generation in the groundwater feeding the petrifying spring habitat. | Yes |
| | Alteration of Hydrological Regime | It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 11%. However, the consequent potential drop of 0.32m at the top of the seepage face is located above the level of elevation of the petrifying springs; therefore negative impacts on the petrifying springs within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be not significant. | No |
| | Degradation of Habitat | The remediation construction works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the petrifying spring habitat as a result of pollution of surface waters. | Yes |
| Alkaline Fen [7230] | Alteration of Water Quality | There is potential for the localised construction works for the remediation works to have negative impacts on groundwater quality. However, installation of the landfill capping system will potentially result in a reduction of leachate generation in the groundwater feeding the alkaline fen habitat. | Yes |
| | Alteration of Hydrological Regime | It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 11%. However, the potential drop of 0.32m is located above the level of elevation of the alkaline fen, therefore negative impacts on the alkaline fen within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be not significant. | No |
| | Degradation of Habitat | The remediation construction works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the alkaline fen habitat as a result of pollution of surface waters. | Yes |

4.8.4 Cumulative and In-Combination Impacts

It is a requirement of Appropriate Assessment that the in-combination (the cumulative development with any other plans or projects) effects be assessed. The following section considers plans and projects that may contribute to in-combination impacts.

4.8.4.1 Methodology

In accordance with EC Article 6 Guidance Document (EC2000), in order to ensure all impacts upon the site are identified, including those direct and indirect impacts that are a result of cumulative impacts, the following steps were completed:-

1. Identify all projects/ plans which might act in combination: identify all possible sources of effects from the project or plan under consideration, together with all other sources in the existing environment and any other effects likely to arise from other proposed projects or plans.
2. Impacts identification: identify the types of impacts that are likely to affect aspects of the structure and functions of the site vulnerable to change.
3. Define the boundaries for assessment: define boundaries for examination of cumulative effects; these will be different for different types of impact and may include remote locations.
4. Pathway identification: identify potential cumulative pathways (e.g., via water, air, etc.; accumulations of effects in time or space).
5. Prediction: prediction of magnitude/ extent of identified likely cumulative effects.
6. Assessment: comment on whether or not the potential cumulative impacts are likely to be significant.

4.8.4.2 In-combination- Other Plans and Projects

A search of Wicklow County Council planning enquiry system (<http://www.wicklow.ie/online-enquiries>) and Dún Laoghaire-Rathdown County Council planning enquiry system (<http://planning.dlrccoco.ie>) was conducted for developments permitted since 2011 that may have in-combination effects on European Sites with the proposed development. Plans relevant to the Fassaroe area were searched in order to identify any elements of the plans that may act cumulatively or in-combination with the proposed development.

Table 4.4 lists those projects and Plans which may potentially contribute to Cumulative or In-Combination Impacts with the proposed development.

Table 4.4: List of Potential Plans and Projects which may Contribute to Cumulative Impacts

| Name of Plan or Project | Key Issues Directly Linked to Relevant European Sites | Potential Cumulative or In-Combination Impacts on Relevant European Sites |
|--|--|--|
| <p>Bray Municipal District Local Area Plan –2018 (Draft)</p> | <p>The Draft Plan is due to be adopted in May / June 2018.</p> <p>The Plan identifies the area of Fassaroe as a key future growth area for Bray. The LAP makes provision for residential, employment, education, retail and recreation / leisure development at Fassaroe. Based on the zoning objectives and ‘Concept Plan’ for the future development of Fassaroe contained in the Draft Plan Landfill Site Nos. 1, 2 and 3 are on lands zoned for open space / recreation; with Sites 3A and 3B outside of the zoned land area. It is likely that Site 3B will intersect with a roads objective to link to Ballyman Road.</p> <p>The Draft LAP also includes an objective for the provision of a north-south link road from Fassaroe across Ballyman Glen to the area of Old Conna on the northern side of the Glen.</p> | <p>Largescale development at Fassaroe, including the associated infrastructural works have potential for direct impacts on Ballyman Glen, by reason of positioning of infrastructure as well as indirect impacts due to construction activities and due to alterations to the hydrological regime of the area on foot of the introduction of new development on greenfield areas.</p> <p>The detail of any such potential future development however is not yet known and accordingly an informed cumulative impact assessment of the potential future development of Fassaroe cannot be undertaken at this time. It is noted however that SUDs drainage techniques can be adopted for future development which would ensure groundwater recharge levels post development would remain at pre-developments levels. Various construction management techniques can also be employed to minimise risk to the SAC during construction.</p> <p>It is also noted that the Wicklow County Development Plan 2016 - 2022 includes objective NH2 on the protection of Natura 2000 sites, as detailed below. Should the Fassaroe area be the subject of future development proposals (including infrastructure crossing Ballyman Glen), a full assessment of the potential ecological impacts associated with the proposals will be required at that time, to include the appropriate research and survey work necessary in order to inform a robust assessment of the potential impacts associated with the proposed works.</p> |
| <p>Wicklow County Development Plan –2016 - 2022</p> | <p>The Vision of the Wicklow County Development Plan 2016 -2022 is for the county “to be a cohesive community of people enjoying distinct but interrelated urban and rural environments; where natural surroundings and important resources are protected, where opportunities abound to live and work in a safe atmosphere, allowing people to enjoy the benefits of well paid jobs, a variety of housing choices, excellent public services,, ample cultural and leisure opportunities, and a healthy environment.”</p> | <p>Policies and objectives of the Wicklow County Development Plan 2016 - 2022 ensure that local planning applications will comply with proper planning and sustainability of the area and with the requirements of relevant EU Directives and environmental considerations. There is therefore no potential for adverse in-combination effects on European Sites.</p> |

| Name of Plan or Project | Key Issues Directly Linked to Relevant European Sites | Potential Cumulative or In-Combination Impacts on Relevant European Sites |
|---|---|---|
| | <p>One of the key strategic goals underpinning this Vision relates to heritage and states as follows:</p> <p><i>“To protect and enhance the diversity of the county’s natural and built heritage, including the protection of the integrity of the Natura 2000 network, the protection of ecological corridors under Article 10 of the Habitats Directive and the protection of protected species. “</i></p> <p>Objective NH2:</p> <p><i>No projects giving rise to significant cumulative, direct, indirect, or secondary impacts on Natura 2000 sites arising from their size or scale, land-take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this plan (either individually or in-combination with other plans or projects).</i></p> | |
| <p>Dún Laoghaire Rathdown CDP 2016-2022</p> | <p>It is a policy of the Council to prepare a Local Area Plan for Old Conna once existing infrastructural constraints in the water supply have been overcome. Any developments with potential impacts to Ballyman Glen SAC will be bound by the following policies set out in the County Development Plan:-</p> <p>Policy LHB17: Protection of Natural Heritage and the Environment is an overall policy for the protection of the natural heritage:-</p> <ul style="list-style-type: none"> ▪ <i>“It is Council policy to protect and conserve the environment including, in particular, the natural heritage of the County and to conserve and</i> | <p>Associated developments included within the Old Conna LAP area could potentially pose impacts on Ballyman Glen SAC. However, any developments with potential impacts to Ballyman Glen will be bound by the overarching Policy LHB17 and Policy E14, LHB22 and E123. SUDs drainage design approaches and construction management techniques can serve to minimise or protect against impacts on the SAC. With the inclusion of these protective policies within the Dún Laoghaire Rathdown CDP 2016-2022, no adverse cumulative impacts with the proposed Fassaroe Historic Landfill Remediation on European Sites are anticipated.</p> |

| Name of Plan or Project | Key Issues Directly Linked to Relevant European Sites | Potential Cumulative or In-Combination Impacts on Relevant European Sites |
|-------------------------|--|---|
| | <p><i>manage Nationally and Internationally important and EU designated sites - such as Special Protection Areas, candidate Special Areas of Conservation, proposed Natural Heritage Areas and Ramsar sites - as well as non-designated areas of high nature conservation value which serve as ‘Stepping Stones’ for the purposes of Article 10 of the Habitats Directive”.</i></p> <ul style="list-style-type: none"> ▪ Policy E14 - Groundwater Protection & Appropriate Assessment which states that: ‘It is Council policy to ensure the protection of the groundwater resources in and around the County and associated habitats and species in accordance with the Groundwater Directive 2006/118/EC and the European Communities Environmental Objectives (groundwater) Regulations, 2010’; and ▪ Policy LHB22 - Rivers and Waterways which states ‘It is Council policy to maintain and protect the natural character and ecological value of the river and stream corridors in the County and where possible to enhance existing channels and to encourage diversity of habitat. It is also policy (subject to the sensitivity of the riverside habitat) to provide public access to riparian corridors to promote improved passive recreational activities’. <p>Policy EI23 is also noted:</p> <ul style="list-style-type: none"> ▪ Rathmichael Ground and Surface Water Protection stated – “It is Council policy to refuse planning permission for any new developments | |

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| Name of Plan or Project | Key Issues Directly Linked to Relevant European Sites | Potential Cumulative or In-Combination Impacts on Relevant European Sites |
|--|---|---|
| | <p>which include an on-site wastewater treatment facility within the Rathmichael area until the groundwater issues in the area are resolved or ameliorated”</p> | |
| <p>River Basin District Management Plan 2018-2021</p> | <p>The plan establishes the following priorities:</p> <ul style="list-style-type: none"> ▪ Ensure full compliance with relevant EU legislation; ▪ Prevent deterioration; ▪ Meet the objectives for designated protected areas; ▪ Protect high-status waters; and <p>Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objective and (2) addressing more complex issues that will build knowledge for the third cycle.</p> | <p>Implementation of the environmental objectives of the RBDMP and compliance with the EU Water Framework Directive 2000 (2000/60/EC) and any associated Programmes of Measures, ensure that projects shall only be permitted where it can be clearly demonstrated that the proposal would not have an unacceptable impact on the water environment, including surface waters, groundwater quality and quantity, river corridors and associated wetlands, estuarine waters and coastal waters. Compliance with result in net positive in-combination effects to European sites.</p> |
| <p>NPWS Conservation Management Plans/ Conservation Objectives</p> | <p>There is no Conservation Management Plan available for Ballyman Glen SAC, however Generic Conservation Objectives have been prepared as detailed in Section 4.6 of this report.</p> | <p>The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. Generic and site-specific conservation objectives aim to define favourable conservation condition for a particular habitat or species at that site to ensure the ecological integrity of these sites is maintained or restored. The resultant effects of conservation objectives are a net positive and there is no potential for adverse in-combination effects on European Sites.</p> |
| <p>Old Connaught Woodbrook Water Supply Scheme (WSS)</p> | <p>The Old Connaught-Woodbrook WSS is a major scheme being undertaken by Irish Water to provide storage and distribution capacity for the area (including Woodbrook, Old Conna, Ballyman, Rathmichael and Fassaroe (County Wicklow)). The WSS will consist of new watermains and associated supporting infrastructure such as reservoirs and</p> | <p>The detailed design for the Old Connaught Woodbrook WSS is not currently known, consequently there has been no Appropriate Assessment or Ecological Impact Assessment of the proposal to date. Therefore an informed cumulative impact assessment of the provision of the Old Connaught Woodbrook WSS cannot be undertaken at this time. It is noted that the Wicklow County Development Plan 2016 -2022 includes objective NH2 on the protection of Natura 2000 sites, as detailed above. Further, as also noted above, any developments within the Old</p> |

| Name of Plan or Project | Key Issues Directly Linked to Relevant European Sites | Potential Cumulative or In-Combination Impacts on Relevant European Sites |
|----------------------------|--|---|
| | <p>pumping stations. The WSS project is at design and as such no specific detail is publically available. However, due to the area to be served by the WSS, infrastructure is likely to be located in lands to the northern side of the County Brook River valley and Ballyman Glen.</p> | <p>Conna LAP will be bound by the overarching Policy LHB17 and Policy E14, LHB22 and E123 of the Dún Laoghaire Rathdown CDP 2016-2022.</p> <p>As the Old Connaught Woodbrook WSS will be progressed, a full assessment of the potential ecological impacts associated with the proposals will be required, to include the appropriate research and survey work necessary in order to inform a robust assessment of the potential impacts associated with the proposed works on European Sites within the Zone of Influence of the works. In consideration of this requirement and with the inclusion of the protective policies included within Wicklow County Development Plan 2016 2022 and Dún Laoghaire Rathdown CDP 2016-2022, no adverse cumulative impacts with the proposed landfill remediation works at Fassaroe on European Sites are anticipated.</p> |
| Other Development projects | None of relevance found on the Wicklow or Dún Laoghaire-Rathdown planning enquiry systems. | N/A |

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No elements of the Plans or development projects detailed in **Table 4.4** are anticipated to act cumulatively or in-combination with the proposed landfill remediation proposals at Fassaroe to have a significant effect upon Ballyman Glen SAC. No other development projects or Plans were identified that may have a significant effect upon Ballyman Glen SAC in combination with the landfill remediation.

4.9 MITIGATION MEASURES

For the purposes of this assessment the term “mitigation measures” are considered to be ‘*those measures which aim to minimise, or even cancel, the negative impacts on a site that are likely to arise as a result of the implementation of a plan or project. These measures are an integral part of the specifications of a plan or project*’ (Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC, January 2007).

The Contractor will be required to establish a Construction Environmental Management Plan (CEMP) prior to commencement of construction. The CEMP will be prepared in accordance with industry best practice and will be effective for the duration of the construction works. The CEMP will be prepared in consultation with a suitably qualified ecologist.

The following documents will form the backbone of the CEMP supplemented by specific additional measures proposed below:-

- DOMNR (1998). Fishery guidelines for Local Authority works. Department of the Marine and Natural Resources, Dublin;
- Environment Agency (2013) *The Knotweed Code of Practice. Managing Japanese knotweed on development sites* (Version 3);
- NRA (2010) Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads. National Roads Authority, Dublin;
- H. Masters-Williams et al (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532). CIRIA;
- IFI (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland, Dublin;
- Irish Water (2016). *Information and Guidance Document on Japanese knotweed Asset Strategy and Sustainability*;
- Murnane *et al* (2002) Control of Water Pollution from Construction Sites- Guide to Good Practice. SP156; and
- Murphy, D. (2004) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*. Eastern Regional Fisheries Board, Dublin.

4.9.1 General Sediment and Erosion Management Measures

This section describes a number of general mitigation measures which will be implemented by the Contractor to minimise the effects of sediment and erosion during the remediation construction activities. Construction of the proposed remediation works will be restricted to the minimum area necessary, and construction activities will be minimised, and monitored in the vicinity of Ballyman Glen SAC. Mitigation measures will be included in the Design and Construction to ensure that there will be no negative impact on the integrity of Ballyman Glen SAC. The following mitigation measures,

as a minimum, will be implemented Wicklow County Council and the Contractor, where appropriate, to reduce the risk of pollution of water bodies during the construction works:-

- Stockpiling of construction materials will not occur within 50m of the nearest watercourse.
- Appropriate management of excess material stockpiles to prevent siltation of watercourses
- Temporary construction compounds will not be located close to road cuttings, watercourses or Ballyman Glen SAC or where it is likely that groundwater will be encountered.
- All oils, solvents and paints will be stored within suitably designed bunded areas with a bund volume of 110% of the capacity of the largest tank/container.
- Refuelling will take place in designated areas of hardstanding. A supply of spill kits and hydrocarbon adsorbent packs will be stored along the construction areas. Personnel will be trained in the use of this equipment. Waste oils and hydraulic fluids will be collected in suitable leak-proof containers and transported from the site and off-site areas for disposal or recycling.
- Machinery used on site will be regularly inspected to ensure there is no leakage from them and to ensure the machinery will not cause contamination of watercourses.
- Where required, fuel will be transported in a mobile, double skinned tank and a spill tray will be used when refuelling (if taking place outside a compound area).
- Concrete, including, but not limited to, waste and wash-down water, will be contained and managed appropriately to prevent pollution of watercourses. Concrete pouring will be prevented during periods of heavy rainfall. Use of quick setting mixes will be used.
- Protection measures will be put in place by Wicklow County Council / the Contractor to ensure that all hydrocarbons used during the Construction are appropriately handled, stored and disposed of in accordance with recognised standards as detailed by the Environmental Protection Agency and/or Wicklow County Council e.g. approved waste contractor, off-site treatment/ recycling/disposal etc.

Eroded sediments will be retained on site with erosion and sediment control structures such as sediment traps, silt fences, sediment control ponds. Cut off ditches to divert surface water run-off from entering excavations will be utilised.

- Guidelines for minimising impacts on water quality and fisheries in relation to construction will be implemented including, but not limited to, CIRIA C532 "Control of water pollution from construction sites - Guidance for consultants and contractors", Inland Fisheries Ireland guidelines and TII guidelines.
- All watercourses that occur in areas of land that are to be used for Site compounds and storage depots will be fenced off at a minimum distance of 50 metres from the watercourse. In addition, appropriate measures will be taken to ensure that silt laden or contaminated surface water runoff from such compounds and depots do not discharge directly to watercourses.
- Run-off velocities and erosive energy will be reduced by increasing the lengths of flow paths for precipitation run-off, through the construction of interceptor ditches and channels with low gradient, and by lining unavoidably steep interceptors or conveyance ditches with filter fabric, rock or polyethylene lining to prevent channel erosion.
- The length and steepness of slopes will be minimised where practicable.
- Riparian vegetation will be left intact where practicable. Protection will be afforded to riparian vegetation by fencing prior to commencement of any works. Where practicable, the fencing will be set a minimum distance of 5 metres from the bank of the watercourse or at the edge of a woody canopy, whichever is the greatest.
- Run-off and wash down water from exposed aggregate surfaces, cast in place concrete and from concrete trucks will be trapped on site to allow sediment to settle out and reach neutral pH. Wicklow County Council will consult and comply with the requirements of the National

Parks and Wildlife Service and the Inland Fisheries of Ireland. Waste products and pollutants associated with the works will not be permitted to enter watercourses or groundwater and all precautions necessary will be taken to prevent the spillage of diesel fuel or other solvents.

4.9.2 Measures for Capping and Localised Slope Stabilisation Works at Northern Boundary of Landfills

Measures to ensure long term stability and avoid impact on the surrounding environment will include:-

- Landfill capping to be placed at the base of the new slope construction to the required thickness wherever land fill is present.
- Slopes (existing or resulting from excavation) steeper than 1(v):5(h) will be benched prior to receive fill.
- Temporary drainage will be installed to prevent surface water runoff from the adjacent land from flowing onto the slopes and cause instability and/or erosion.
- Bunding and silting ponds will be constructed/installed at the toe of the slope to intercept running water with suspended solids and/or concrete spillage (or other chemicals, oil, diesel, etc.) entering the Glen. Water will then be flowing to siltation ponds and discharged when clear of suspended solids. Water found contaminated with cement, oil, petrol or other chemical will be pumped for treatment or safe disposal.
- Minimise runoff velocities and erosive energy by maximising the lengths of flow paths for precipitation runoff, constructing interceptor ditches and channels with low gradients to minimise secondary erosion and transport, and lining unavoidably steep interceptors or conveyance ditches with filter fabric, rock or polyethylene lining to prevent channel erosion.
- Sediment basins and traps should be installed before any site grading takes place. Additional sediment traps and silt fences should be installed as grading takes place to keep sediment contained on site at appropriate locations.
- Runoff-control measures should be located in conjunction with sediment traps to divert water from planned undisturbed areas away from the traps and sediment-laden water into the traps.

4.9.3 Additional Measures for the Protection of Petrifying Springs and Alkaline Fen

The following measures will be implemented for the storage and use of hydrocarbons on site:-

- Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled.
- Refuelling will be carried out from these tanks or from delivery vehicles and will not be left unattended.
- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005).
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling.

- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction site to deal with any accidental spillage.

It is possible that waste will be encountered during the remediation works and leachate could potentially be mobilised (either vertically or horizontally). To minimise or prevent lateral migration of groundwater/leachate along utility trenches, clay plugs will be used.

4.9.3.1 Measures to avoid the Spread of Invasive Species

The presence of invasive species has the potential to lead to an offence under the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). Regulation 49 of the 2011 Regulations prohibits (unless under licence) the breeding, release, or allowing or causing the dispersal from confinement of any animal listed in the Third Schedule of the Regulations; or the planting, allowing or causing dispersal, and spreading of any plant listed in the Third Schedule. Japanese Knotweed is a plant listed in the Third Schedule.

It is an offence to plant or encourage the spread of Japanese Knotweed by moving contaminated soil from one place to another, or incorrectly handling and transporting contaminated material or plant cuttings. Persons must therefore take all reasonable steps and exercise due diligence to avoid committing an offence under the 2011 Regulations:-

- Japanese Knotweed is present within the landfill site locations (Refer to **Figure 4.1** for specific locations). A Japanese Knotweed Management Plan for the proposed development has been prepared and is included in **Appendix C**.
- The contractor and Wicklow County Council must ensure that the source locations for materials which are introduced to the site during the construction phase of the project are free from non-native invasive species.

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4.10 RESIDUAL IMPACTS

Residual impacts and significance of effects on Ballyman Glen SAC arising from the proposal are summarised in **Table 4.5** below.

Table 4.5: Residual Impacts Potentially Affecting European Sites within the Zone of Influence of the Proposed Works

| Site Name and Code | Qualifying Interests | Potential Impacts | Potential Cumulative Impacts | Proposed Mitigation | Residual Impacts |
|---------------------------------------|---|--|--|--|---|
| Ballyman Glen SAC (Site Code: 000713) | Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220] | <p>Alteration of water quality: There is potential for the localised remediation works to have negative impacts on groundwater quality. However construction of the landfill capping system will result in a reduction of leachate generation in the groundwater feeding the petrifying spring habitat.</p> <p>Alteration of hydrological regime: It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 11%. However, the potential drop of 0.32m at the top of the seepage face is located above the level of elevation of the petrifying springs, therefore, negative impacts on the petrifying springs within Ballyman Glen SAC due to reduced</p> | No potential cumulative impacts with other plans or projects have been identified. | <p>Alteration of water quality: as detailed in Section 4.9, rigorous sediment, erosion and pollution control measures will be implemented for the proposed works. Good practice measures for the prevention of pollution of groundwater and surface waters will be employed at all times during the construction and post-remediation period of the development.</p> <p>To minimise or prevent lateral migration of groundwater/leachate along utility trenches, clay plugs will be used.</p> <p>Degradation of Habitat: as detailed in Section 4.9, rigorous sediment, erosion and pollution control measures will be implemented for the proposed works. Good practice measures for the prevention of pollution of groundwater and surface waters will be employed at all times during the construction and post-remediation period.</p> | <p>Alteration of water quality: With the effective implementation of mitigation measures and the reduction of leachate generation in groundwater as a result of the installation of a capping system, the overall residual impact on the quality of the groundwater feeding the petrifying spring habitat is anticipated to be positive.</p> <p>Alteration of hydrological regime: Residual negative impacts on the petrifying springs within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to not be significant.</p> <p>Degradation of Habitat: With the effective implementation of mitigation measures no significant residual impact</p> |

| Site Name and Code | Qualifying Interests | Potential Impacts | Potential Cumulative Impacts | Proposed Mitigation | Residual Impacts |
|--------------------|----------------------|--|---|--|---|
| | | <p>groundwater flow contribution are predicted to not significant.</p> <p>Degradation of habitat: the construction works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the petrifying spring habitat as a result of pollution of surface waters.</p> | | | <p>on petrifying springs as a result of degradation of surface waters at the springs.</p> |
| | Alkaline Fen [7230] | <p>Alteration of water quality: Construction of the landfill capping system will potentially result in a reduction of leachate generation in the groundwater feeding the alkaline fen habitat.</p> <p>Alteration of hydrological regime: It is predicted that the capping of the landfills is likely to reduce the current recharge to groundwater up to 11% over the life of the development. However, the potential drop of 0.32m is</p> | <p>No potential cumulative impacts with other plans or projects have been identified.</p> | <p>Alteration of water quality: as detailed in Section 4.9, rigorous sediment, erosion and pollution control measures will be implemented for the proposed works. Good practice measures for the prevention of pollution of groundwater and surface waters will be employed at all times during the construction and post-remediation period.</p> <p>To minimise or prevent lateral migration of groundwater/leachate along utility trenches, clay plugs will be used.</p> <p>Degradation of Habitat: as detailed in Section 4.9, rigorous sediment, erosion and pollution control</p> | <p>Alteration of water quality: With the effective implementation of mitigation measures and the reduction of leachate generation in groundwater as a result of the installation of a capping system, the overall residual impact on the quality of the groundwater feeding the alkaline fen habitat is anticipated to be positive.</p> <p>Alteration of hydrological regime: No significant residual negative impacts on the alkaline fen within</p> |

| Site Name and Code | Qualifying Interests | Potential Impacts | Potential Cumulative Impacts | Proposed Mitigation | Residual Impacts |
|--------------------|----------------------|--|--|---|--|
| | | <p>located above the level of elevation of the alkaline fen, therefore negative impacts on the alkaline fen within Ballyman Glen SAC due to reduced groundwater flow contribution are predicted to be not significant; no significant changes to the attributes and targets defining the favourable condition of Alkaline Fen are anticipated.</p> <p>Degradation of habitat: The remediation construction works, if unmitigated, could potentially lead to suspended solids runoff. Excavation and ground disturbance will result in soil disturbance extending overflow runoff impacts. There is potential for this runoff to degrade the alkaline fen habitat as a result of pollution of surface waters.</p> | <p style="color: red; transform: rotate(-45deg); opacity: 0.5;">For inspection purposes only. Consent of copyright owner required for any other use.</p> | <p>measures will be implemented for the proposed works. Good practice measures for the prevention of pollution of groundwater and surface waters will be employed at all times during the construction and post-remediation period.</p> | <p>Ballyman Glen SAC due to reduced groundwater are anticipated.</p> <p>Degradation of Habitat: With the effective implementation of mitigation measures no significant residual impact on alkaline fen as a result of degradation of surface waters is anticipated.</p> |

4.10.1 Residual Impacts Conclusion

The result of the recharge assessment has highlighted that the capping of landfills is likely to reduce the current recharge to groundwater by up to 11%. The remediation proposal may therefore have a minor negative impact on the springs and seepages supporting the tufa deposits and the alkaline fen identified within Ballyman Glen SAC due to reduced groundwater flow contribution. The reduced recharge is expected to result in a local drop in groundwater levels of approximately 0.32m. As a result, the potential drop in the top of the seepage face supporting the springs may drop by 0.32m; however the tufa springs are not located at the top of the seepage face. Therefore, while the flow discharging from the springs may reduce by 11%, it is expected that they will continue to flow and the impact is not predicted to be significant.

An assessment of the water quality has shown that the capping of the landfills will have a beneficial impact on the groundwater quality and could potentially lead to an increase in tufa deposition rates as the groundwater quality at existing springs improves. While there may be a reduction in flow from the springs, the improvement in water quality could lead to an increase in the tufa deposition rate and also an increase in the number of tufa deposits. The net potential impact on the springs is therefore considered to be a positive impact as a result of the reduced leachate seepage rate. Likewise, the potential drop in groundwater levels of 0.32m is above the elevation of alkaline fen, therefore no loss of alkaline fen area or distribution is anticipated as a result of the proposed remediation. The areas of alkaline fen are located to the northeast of site Nos. 3A and 3C and there is likely to be a net potential impact on the fens as a result of the reduced leachate seepage rate.

Overall, no significant residual impact on alkaline fen is anticipated as part of this proposal.

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5 APPROPRIATE ASSESSMENT CONCLUSION

5.1 INTEGRATION OF APPROPRIATE ASSESSMENT AND THE PROPOSAL

As stated in DoEHLG Guidance Document (2010), the requirement of the AA is not to prove what the impacts and effects will be, but rather to establish beyond reasonable scientific doubt that adverse effects on site integrity will not result.

The current Appropriate Assessment of the proposed historic landfill remediation works at Fassaroe has been incorporated into the engineering remediation design process and has informed the proposal with changes being made as necessary to minimize potential for impact on European Sites. Initial reviews of the proposed remediation works indicated that there was a potential risk of adverse effects on the integrity of Ballyman Glen SAC unless appropriate mitigation was undertaken. Mitigation measures in the form of specific actions designed to protect the environment have been provided to ensure compliance with the Habitats Directive Article 6 requirements by integrating measures for the protection of European Sites into all areas covered by the proposed remediation works. Mitigating policies clearly indicate that where any physical development, water quality alteration or any other form of disturbance has the potential to significantly impact on a European Site, the works will be subject to mitigation measures to ensure full compliance with Article 6(3) and (4) of the Habitats Directive (1992).

5.2 NIS CONCLUSION AND STATEMENT

This Appropriate Assessment has been prepared following the Department of the Environment, Heritage and Local Government guidance 'Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities' (DoEHLG, 2010a). The current assessment for the proposed landfill remediation works at Fassaroe investigates the potential adverse effects on the qualifying interests of the European sites arising from the proposals. The assessment considers whether the remediation works, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European Site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects.

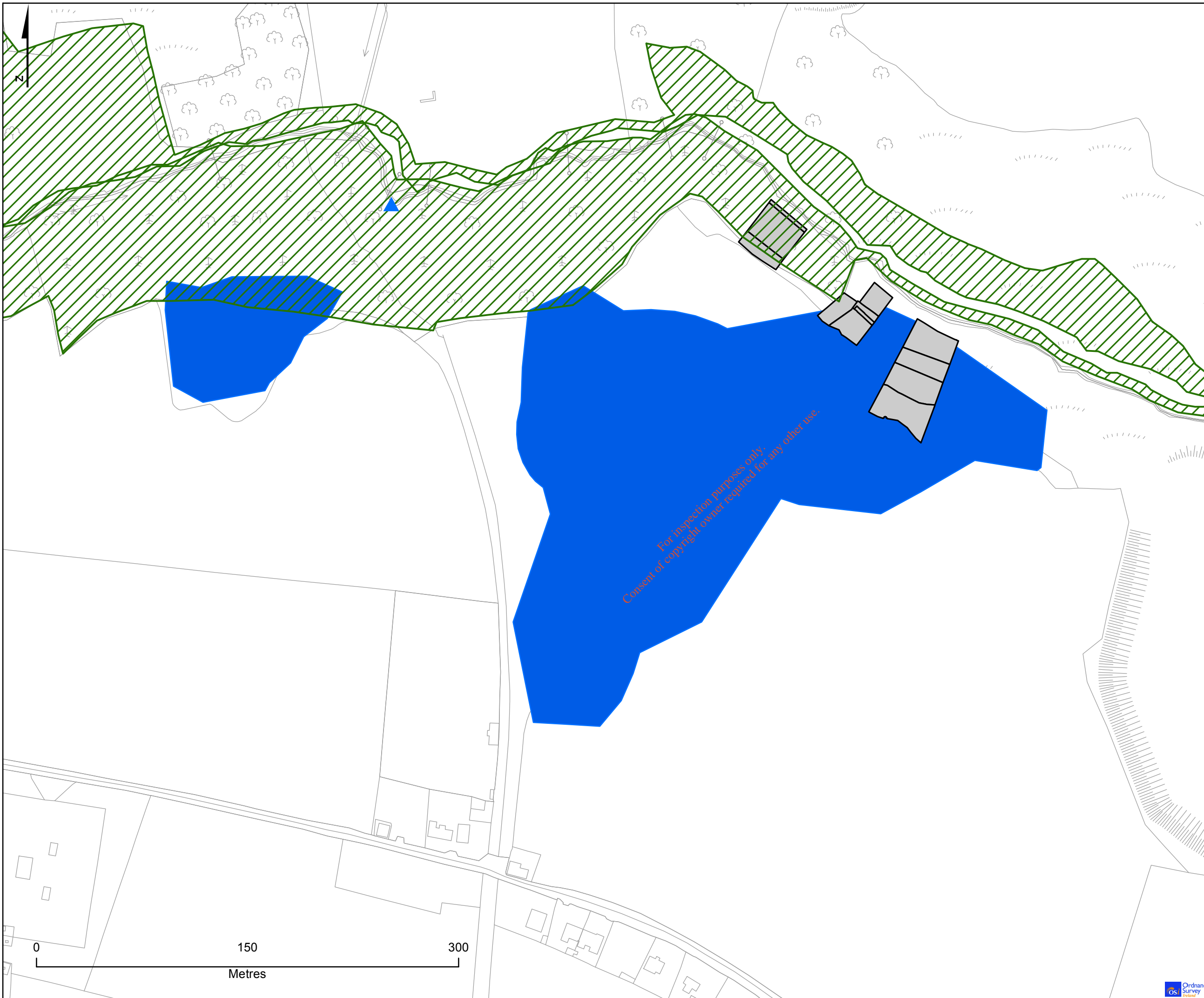
Provided that the above mitigation measures are implemented in full, it is envisaged that there will be no significant adverse effects on the integrity of Ballyman Glen SAC in view of the sites conservation objectives and that the conservation status of the qualifying Annex I habitats will not be compromised by the remediation works either directly, indirectly or cumulatively.

The conclusion of this Natura Impact Statement is that there will be no potential for cumulative impacts arising in combination with any other plans or proposals, with the implementation of best practice and the recommended mitigation measures, it is considered that the proposed historic landfill remediation works at Fassaroe will not adversely affect the integrity of Ballyman Glen SAC.

APPENDIX A

LOCATION OF PROPOSED WORKS WITHIN AND ADJACENT TO BALLYMAN GLEN

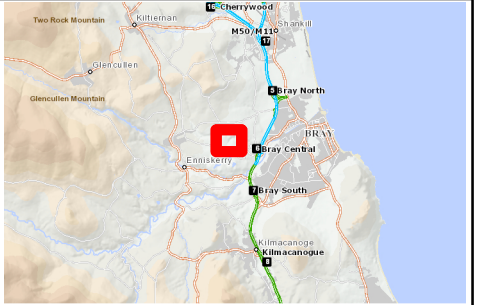
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Legend

- ▣ NPWS: Alkaline Fens (Natura2000: 7230 + 7220)
- ▣ RPS Field Survey: Alkaline Fens
- ▴ NPWS: Petrifying springs (Natura2000: 7220)
- ▴ RPS Field Survey: Petrifying springs
- ▨ Special Area of Conservation (SAC)
- ▭ Geotech Earthworks (Approximate)
- ▭ Capping Extent



Client
Wicklow County Council

Project
Fassaroe Historic Unlicensed Landfill Remediation

Title
Proposed Slope Stability Works

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| Issue Details | |
|-------------------------|------------------------------------|
| Drawn By: JPM | Project No. MH14041 |
| Checked By: ML | File Ref: |
| Approved By: ML | MH14041Arc013A01 |
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| Date: 25/05/2018 | IRENET95 Irish Transverse Mercator |

NOTE:

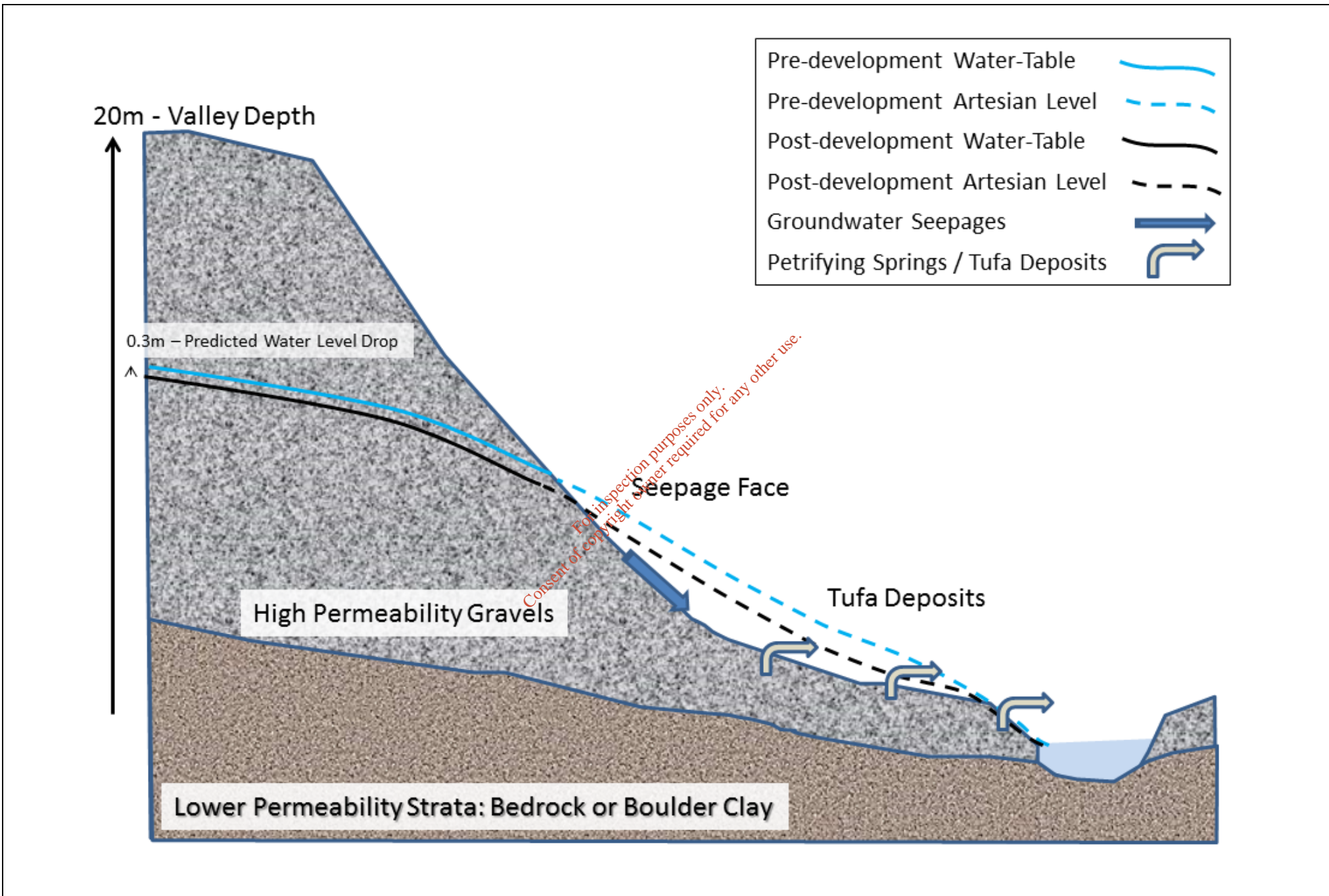
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APPENDIX B

ILLUSTRATION OF SEEPAGE FACE ELEVATION

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APPENDIX C

JAPANESE KNOTWEED MANAGEMENT PLAN

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Fassaroe Historic Unlicensed Landfill Remediation

Japanese Knotweed Management Plan

Document Control Sheet

| | |
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| Client: | Wicklow County Council |
| Project Title: | Fassaroe Historic Unlicensed Landfill Remediation |
| Document Title: | Japanese Knotweed Management Plan |
| Document No: | MH14041RP0019 |

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| | | | | | | | | |
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1 INTRODUCTION

This Japanese Knotweed Management Plan has been prepared to enable the proposed remediation of 5 No. historic unlicensed landfill sites at Fassaroe, Bray, Co. Wicklow. These 5 No. sites are identified as Sites Nos. 1, 2, 3A, 3B and 3C. These sites were historically quarried areas which were subsequently used for landfill purposes by Wicklow County Council. The remediation measures proposed comprise the provision of a gas management system as well as a capping of the landfill sites to standards suitable for accommodating future development on the zoned lands surrounding the landfills, including the provision of open space/recreation on the sites of the landfills themselves.

Field surveys of the historic landfill sites were carried out on 11th and 12th August 2015, 9th June 2016 and 27th June 2016 and 2nd May 2018 by RPS ecologists. Four stands of Japanese Knotweed were recorded primarily within the scrub area of Site No. 1; there is also a stand adjacent to the north-eastern boundary of Site No. 2 (**Figure 1.1**). No Japanese Knotweed was recorded in the vicinity of site Nos. 3A- 3C. Japanese Knotweed is classified as a 'high impact' invasive species¹. No other high impact invasive species were observed in the study area.

1.1 SITE INVASIVE SPECIES MANAGEMENT OBJECTIVES

It is anticipated that remediation works will commence in 2019. The main objective of this Japanese Knotweed Management Plan is to manage the Knotweed present on site in order to enable commencement of remediation works; and to eradicate Knotweed from the site prior to the commencement of works. Appropriate measures will be put in place to prevent the spread of Knotweed both within the site and off site, in accordance with EC (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

1.2 LIMITATIONS AND THREATS TO THE PROPOSED DEVELOPMENT SITE

The presence of Japanese Knotweed has the potential to lead to an offence under the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). Regulation 49 of the 2011 Regulations prohibits (unless under licence) the breeding, release, or allowing or causing the dispersal from confinement of any animal listed in the Third Schedule of the Regulations; or the planting, allowing or causing dispersal, and spreading of any plant listed in the Third Schedule. Japanese Knotweed is a plant listed in the Third Schedule.

It is an offence to plant or encourage the spread of Japanese Knotweed by moving contaminated soil from one place to another, or incorrectly handling and transporting contaminated material or plant cuttings. Persons must therefore take all reasonable steps and exercise due diligence to avoid committing an offence under the 2011 Regulations.

When considering excavation and containment/ disposal methods, regards must be paid to the Waste Management Acts 1996 to 2008. A waste license or waste facility permit may be required for containment/ disposal of excavated material. It is also required that the waste haulier employed to haul waste is authorised by a waste collection permit, or is exempt from such a requirement.

¹ <http://invasivespeciesireland.com/wp-content/uploads/2013/03/Risk-analysis-and-prioritization-29032012-FINAL.pdf>

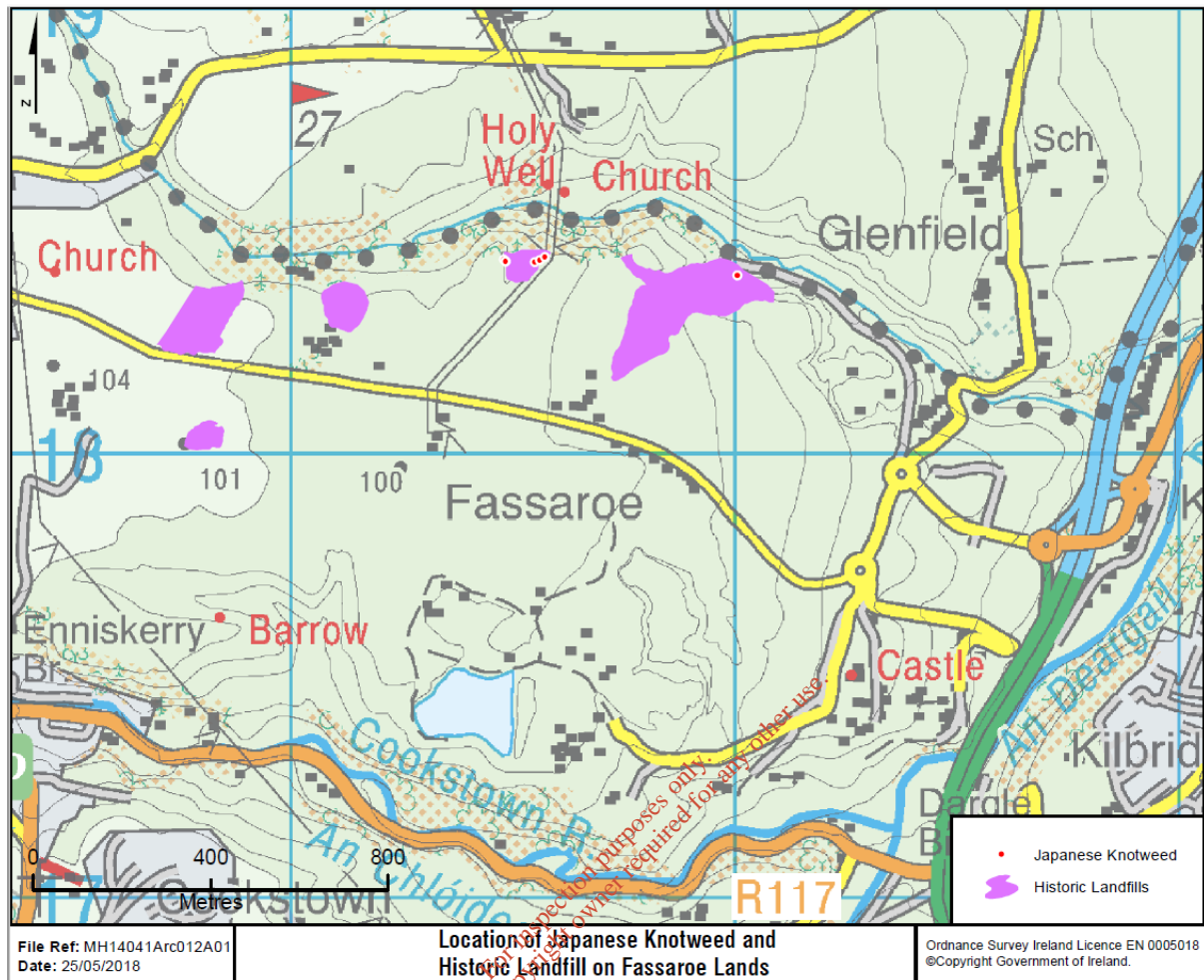
Japanese Knotweed is located within the footprint of the proposed remediation works, therefore, management of the Japanese Knotweed is required prior to the commencement of works.

1.3 LOCATION OF JAPANESE KNOTWEED

Four stands of Japanese Knotweed were recorded primarily within the scrub area of Site No. 1; there is also a stand adjacent to the north-eastern boundary of Site No. 2 (**Figure 1.1**). No Japanese Knotweed was recorded in the vicinity of site Nos. 3A- 3C. The location of the Japanese Knotweed is shown on the map in **Figure 1.1**.

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Figure 1.1: Location of Japanese Knotweed on the Historic Landfill Sites at Fassaroe



2 OVERVIEW OF MANAGEMENT PLAN

2.1 BRIEF DESCRIPTION OF MANAGEMENT PLAN

The person responsible for the management of Japanese Knotweed on the site and the implementation of the Japanese Knotweed Management Plan (JKMP) has yet to be decided. Cosgrave Property Group is the owner of the lands and will be responsible for ensuring that the Japanese Knotweed is treated in an appropriate manner according to the JKMP and that provisions are made for avoiding any further contamination. The Japanese Knotweed Management Plan is a working document; any revisions of the plan should be kept for future site owners.

2.2 GENERAL CONTROL MEASURES

Great care is needed to ensure that plant material (i.e. fragments of stems, leaves and roots) is not spread whilst performing any of the eradication measures; effective site hygiene is essential. Such hygiene measures include, but are not limited to, the following:-

- Fencing-off and signing the infested area (a specimen sign is presented in the Environment Agency 2013 publication – “*The Knotweed Code of Practice, Managing Japanese Knotweed on Development sites V3*”),
- Not using tracked vehicles in the infested area,
- All machinery and vehicles on site will be washed down on geotextile membrane and cleaned immediately prior to leaving the contaminated area, and
- Ensuring adequate site supervision.

Further good hygiene measures for management of the Japanese Knotweed on the Fassaroe historic landfill sites are provided in **Section 3.3.1**.

2.3 CHEMICAL TREATMENT

The use of herbicides is often the most effective option for the control of Japanese Knotweed but there are issues that need to be considered first.

In keeping with A Guide to Landscape Treatments for National Road Schemes in Ireland (NRA 2006), the use of herbicides should be minimized and application should be targeted rather than broad-spread application.

Where there is a need to use herbicides in and around waterbodies, it is imperative that only herbicides specifically approved for such use are used, and that they are used in line with the manufacturers' specifications.

In general, the application of herbicides should not be undertaken:-

1. In windy weather (above Force 2 on the Beaufort Scale) where there is a risk of spray drift occurring;
2. During or preceding rainfall (no rain for 6 hours, preferably 24 hours), which can result in the chemical being washed off; or
3. During periods of particularly cold weather, which can reduce the plants ability to uptake the chemical.

There are health and safety issues and those administering herbicide need to be competent to do so and, consequently, must have sufficient training, experience and knowledge in the area of herbicides/pesticides application. It is important that all staff involved in the application of herbicides have received appropriate training, which may include achieving an appropriate FETAC award in this area.

The application of herbicide must be used in compliance with the product label and in accordance with Good Plant Protection Practice as prescribed in the European Communities (Authorization, Placing on the Market, Use and Control of Plant Protection Products) Regulations, 2003 (S.I. No. 83 of 2003).

Japanese Knotweed can become very tall, which makes it difficult to apply herbicides. The plants should ideally be sprayed in the spring when they are about 1m tall. There are various methods of application including tractor-mounted spraying for large areas; knapsack spraying for small areas; lance sprayer for tall stands or for stands in inaccessible places (such as steep slopes and river banks); controlled droplet application; injection method for small stands and weed wiper or herbicide gloves for direct application onto leaves of specific plants.

Dense stands of Japanese Knotweed can be treated with a glyphosate-based herbicide, such as 'Roundup Pro Biactive'. Glyphosate is a systemic herbicide which acts by blocking a plant's enzyme system. The herbicide is absorbed through growing leaves and stems where it is translocated throughout the plant and root network. It kills virtually all annual and perennial weeds including grasses. Glyphosate is quickly broken down in soil or sediment and is harmless to animal life.

If the Japanese Knotweed is sparsely distributed, use a 2,4-D amine preparation, which is specific to broadleaved plants and will not harm the grasses.

More targeted methods of applying herbicides are being developed for sites where it is important to protect the native flora. This includes using a weed wiper to apply the herbicide directly to the leaves of the plant rather than spraying or injecting herbicide directly into the plant. This ensures that only target plants are treated.

Plant protection products containing glyphosate should be applied in late September or early October. However, it is further advised that the plants be treated early in the growing season (May) to stunt the growth of the plant, consequently reducing the amount of viable above-ground growth.

It may take at least three years before Japanese Knotweed stops growing back.

2.4 PHYSICAL CONTROL

A number of methods have been developed to deal with and control Japanese knotweed on development sites which are all based on mechanical excavation of the rhizome material and its subsequent containment either at depth, within an impermeable membrane, or its disposal off-site.

However, the use of these methods should be avoided where possible. Where feasible, preference should be given to treating Japanese knotweed in its original location (Environmental Agency, 2013). Excavation should only be considered where construction requires it (NRA, 2010).

2.4.1 Excavation and Deep Burial

1. Mapping of underground rhizomes (roots) by digging test pits is required to determine the extent of underground infestation or alternatively it can be assumed that underground infestation extends for 7m in all directions from the nearest stem and to 3m depth (NRA, 2010).
2. The 'receiving pit' will be excavated prior to excavation of the infested area. Excavated material from this pit will be set aside and used for backfilling.
3. The contaminated material must be buried to a depth of 5m, hence the receiving pit must be excavated to a depth sufficient to accommodate the contaminated material plus an additional depth of 5m above for covering/ backfilling.
4. An access way leave between the infested area and the receiving pit will be fenced-off and signed.
5. A designated wash-down area will be established at the entrance to this way leaved area. Waste water from this wash down area must not be discharged to surface water.
6. The infested area as defined above will be excavated to a depth of 3m.
7. Material from the infested area will be transported to the receiving pit and deposited.
8. A root barrier membrane layer will be placed over the contaminated material in the pit (see 'Vertical Root Barrier Membrane' below for specification).
9. Vehicles and machinery used for transportation of the contaminated material between the infested area and the receiving pit will be pressure washed in the designated wash down area (see above). This is to avoid cross-contamination of the backfill material.
10. The pit will be backfilled to a depth of at least 5m above the root barrier membrane.
11. The receiving pit area will be mapped and permanent signage erected around its periphery.
12. Another disposal option includes removal to (licensed) landfill, and
13. On exiting the fenced way leave area vehicles and machinery will be pressure washed in the designated wash down area (see above).

2.4.2 Vertical Root Barrier Membrane

A vertical root barrier membrane involves the placement of vertical root barrier membrane along the exposed edge of the excavation prior to filling / backfilling. This is intended to prevent knotweed from the infested area beyond the works from spreading back into the works area in future years via horizontal rhizome (root stock) growth.

Commercially available 'Japanese Knotweed-proof' membranes should be used. These should be installed under expert supervision, ideally provided by the supplier. Key considerations in the installation of the membrane are:-

- Avoid joins; ideally use a single sheet of the membrane.
- Joins must be sealed securely.
- Damaged membrane will not be used.

2.4.3 Cell Formation

Where burial is the preferred disposal method but it is not possible to bury Japanese Knotweed to 5m, it may be completely encapsulated into a root barrier membrane cell. These cells may be placed where they will not be disturbed. It is important that the deeds to the property show where these cells are located, to avoid damage in the future that could be caused, for example by trenching to lay services. To avoid damage after it has been installed, the upper cell surface must be covered by a capping layer, at least 2m deep.

2.4.4 Excavation and Bund

Where there is not sufficient depth on a site for deep burial, the excavated material may be placed in a structured bund. The bund is a raised area above ground level or a shallow excavation, no more than 0.5m deep, and is lined with a root barrier membrane. The membrane must stay intact for at least 50 years and a manufacturer's guarantee is required. This method of treatment can also be used where the Knotweed material needs to be moved from a location and there is another ideal area of the site available to contain it. Following the provisions of the Waste Management Act 1996, as amended, a license or permit may be required for the burial of excavated material.

The aim of this method is to concentrate the rhizome material into the upper surface of the bund, where it will grow and be controlled by herbicide. If the rhizome is buried deep, it will become dormant when inside the bund and regrow when the apparently clean soil is used for landscaping on the site. The bund location needs to be clearly signed and protected from potential accidental damage.

Reapplication of herbicide may be required for up to five years after the initial application, subject to the site-specific management plan.

2.4.5 Excavation and Removal from Site

Where the above treatment options are not possible (site is too small to contain excavated material, too shallow for burial, or where there is lack of space), removal of excavated material may be the only option. Where there are small amounts of Japanese Knotweed material to be removed it is possible to double bag the material and send to a fully licenced waste facility for disposal (i.e. landfill). Where the amount of material is larger in volume it will be necessary to haul from site to a suitably licenced waste facility.

It should also be noted that in the process of excavating the Japanese Knotweed if it has been treated with a persistent herbicide, the excavated material will need to be classified as hazardous waste and will need to be disposed of to a hazardous waste facility.

This option is generally considered to be the least favourable option because of the high costs involved.

Furthermore, if Japanese knotweed contaminated material is removed off site it will require a licence from the National Parks and Wildlife Service in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).

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3 SPECIFIC METHOD STATEMENT FOR JAPANESE KNOTWEED ON FASSAROE HISTORIC LANDFILL SITES

3.1 METHOD STATEMENT

The four stands of Japanese Knotweed are located in historic landfill Site 1 (see **Figure 1.1**). The stand of Japanese Knotweed to the east is located at the edge of historic landfill Site 2 (see **Figure 1.1**).

As detailed in **Section 2.4**, a number of methods have been developed to deal with and control Japanese Knotweed on development sites. Where feasible, preference should be given to treating Japanese Knotweed in its original location (Environmental Agency, 2013). Excavation should only be considered where construction requires it (NRA, 2010). However, the Fassaroe historic landfill sites will be subject to disturbance during remediation, therefore medium to long-term options such as herbicide applications are unsuitable at this site. There is no space within the site for bund treatment and there is insufficient depth available for burial of the Japanese Knotweed. Therefore, the preferred option for Japanese Knotweed management on the Fassaroe historic landfill sites is excavation and removal off site.

3.1.1 General Control Measures for Japanese Knotweed Management on Fassaroe Historic Landfill Sites

Great care is needed to ensure that plant material (i.e. fragments of stems, leaves and roots) is not spread whilst performing the eradication measures detailed below. Effective site hygiene is essential, particularly during construction. This includes the following measures:-

- Understand the possible extent of the rhizome system underground – up to 7 metres horizontally and 3 meters vertically.
- Fence off or clearly mark infested area including the extent of the rhizome system underground.
- Do not use machinery with tracks within an infested area, if possible.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site; stockpiles cannot be within 50m of any watercourse or within a flood zone.
- Creation of entry and exit points for operators on foot and for small mobile equipment. A delineated access track to be maintained free of Japanese knotweed should be established through the site to minimise the spread of Japanese Knotweed by permitted vehicles accessing the site.
- Installation of a dedicated footwear and vehicular wheel wash down facility into a contained area within the site.
- Vehicles leaving the site should be inspected for any plant material and washed down into a contained area.
- Vehicles used in the transport of contaminated material will need to be visually checked and washed down into a contained area before being used for any other work, either on the same site or at a different site.
- Material gathered in dedicated wash down contained areas will need to be appropriately treated along with other contaminated soil on site.

- For any material entering the site, the supplier must provide an assurance that it is free of Japanese Knotweed.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Japanese knotweed Site Management plan.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material.

3.1.2 Japanese Knotweed Excavation

1. Map underground rhizomes (roots) by digging test pits to determine the extent of underground infestation. Alternatively it can be assumed that underground infestation extends for 7m in all directions from the nearest stem and to 3m depth (NRA, 2010).
2. Clearly mark out haulage routes with tape. Access to these areas shall be limited to vehicles involved in moving Japanese knotweed. Vehicles must be decontaminated before they leave the area.
3. Strict hygiene measures must be adhered to when transporting soil infested with Japanese Knotweed off-site. Failure to do so may lead to Japanese knotweed spreading.
4. Trucks shall be filled up to a maximum of 20cm from the top with excavated Japanese Knotweed and infested soil. The void must be sealed with a well-secured membrane. Sufficient membrane shall be used to let the soil be sealed into a temporary cell for transporting. It is very important that the soil is contained to prevent any material being lost when it is moved.
5. Haul from site to a suitably licenced waste facility under licence from the National Parks and Wildlife Service, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477).
6. If the Japanese Knotweed has been treated with a persistent herbicide, the excavated material will be classified as hazardous waste and will need to be disposed of to a hazardous waste facility.

The Main Contractor will be instructed to prepare a detailed method statement to carry out the works based on the above methodology. This method statement will be reviewed by the RE and ecologist.

3.2 IMPLEMENTATION SCHEDULE

Table 3.1: Japanese Knotweed Management Implementation Schedule Fassaroe Historic Landfill Sites

| Implementation Schedule | Date |
|--|--|
| Year 1, Excavation | |
| Excavate Japanese Knotweed and haul to licenced facility | 2019 ² |
| Monitor re-growth throughout growing season over next 4 years or until no further re-growth appears. | July- Sept 2019- 2023 Every 4-6 weeks |

² Estimated date.

4 REFERENCES

EPA (2000). Landfill Manual: Landfill Site Design. Environmental Protection Agency, Wexford.

Environment Agency (2013). The Knotweed Code of Practice. Managing Japanese Knotweed on Development sites V3. UK Environment Agency.

Irish Water (2016). Irish Water Report: Information and Guidance Document on Japanese knotweed. Uisce Eireann.

NRA (2006). A Guide to Landscape Treatments for National Road Schemes in Ireland. National Roads Authority.

NRA (2008). Guidelines for the Management of Waste from National Road Construction Project. National Roads Authority.

NRA (2010). Guidelines for the Management of Noxious Weeds and Non- Native Invasive Plant Species on National Roads (Revision December 2010). National Roads Authority.

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