


This Report has been cleared for submission to the Board by David Flynn,
Programme Manager

Signed: 

Dated: 10 April 2019



OFFICE OF ENVIRONMENTAL SUSTAINABILITY

INSPECTOR'S REPORT ON AN APPLICATION FOR A CERTIFICATE OF AUTHORISATION FOR A CLOSED LANDFILL

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| TO: | Eimear Cotter, Director |
| FROM: | Magnus Amajirionwu, Inspector, Environmental Licensing Programme |
| DATE: | 29 March 2019 |
| RE: | Application by Wicklow County Council for a Certificate of Authorisation for a closed landfill at Fassaroe 2, Bray, County Wicklow . Certificate of Authorisation Register Number H0475-01 . |

1. Application details

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| Type of facility: | Closed landfill as defined in the Regulations ¹ |
| Original site ownership | Wicklow County Council |
| Current site ownership | Cosgrave Developments (a private development company) |
| Operator of closed landfill | Wicklow County Council |
| Proposed use post remedial works | The site of the landfill is within a larger land bank currently zoned for housing / development. The landfill site will be an open space in the long term, with development adjacent to it. |
| Risk category of closed landfill: | High risk (class A) <ul style="list-style-type: none">• Reason(s): pollutant linkages:<ul style="list-style-type: none">○ Leachate migration to surface water and protected areas,○ Potential for lateral landfill gas migration to human receptors. |
| Section 22 register number: | S22-02639 |

¹ Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008).

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| Grid Reference | 723707 E and 718455 N |
| Application received: | 03/01/2019 |
| AA screening determination: | 08/03/2019 |
| Regulation 7(4) notice: | 11/03/2019 |
| Additional information received: | 15/03/2019 |
| Name of Qualified Person: | Michael Boland (BSc, MSc, P. Geo) Credentials provided by Institute of Geologists of Ireland |
| EPA site inspection: | 27/11/2018 |

2. Information on the closed landfill

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| Location of facility | <p>The Fassaroe 2 landfill is one of five landfill sites collectively known as the Fassaroe Historic Landfills. The four other landfill sites are Fassaroe 1, 3A, 3B and 3C. As their names indicate, they lie within the area of Fassaroe, Bray, Co. Wicklow (see Figure 1).</p> <p>However, Fassaroe 1 landfill site was privately owned and operated. Therefore, it does not qualify as a historic landfill site, as defined in the Regulations.</p> <p>The Fassaroe 2 landfill site general location is shown on Figure 2.</p> |
| Period of landfilling | 1979 to 1991 |
| Surrounding area | <p>The Powerscourt Demesne is located approximately 2km to the southwest of the site. Dun Laoghaire Golf Club is located on elevated lands to the north west of the site, accessed from Ballyman Road. Mostly, the lands at Fassaroe are in general, currently in agricultural use.</p> <p>There are a number of other notable activities within the general Fassaroe area. Roadstone operate a soil recovery facility at a former sand and gravel quarry located to the southeast of the area of the landfill. This soil recovery facility operates under licence from the EPA (Waste Licence Ref. W026901) for the purpose of backfilling the quarry. There is also the Greenstar Recycling centre located to the northeast of the landfill location. This is a materials recovery and transfer facility (MRF) operated by Starrus Eco Holdings Limited who are the named licensee on Waste Licence Register No. W005303.</p> <p>There are also a number of residential clusters within a 5 km radius of the landfill; at Thornhill Road, adjacent to Greenstar in the northeast; along Kilbride Lane in the southeast; and along Berryfield Lane which runs east to west through the Fassaroe area 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 site.</p> |

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| Area of the closed landfill | Fassaroe 2 landfill covers an area of 4.72 Ha (Figure 3). |
| Quantity of waste at the facility | Approximately 340,000 tonnes. It is the largest of all the Fassaroe landfill sites. |
| Characterisation of waste deposited | The Tier 2 site investigation report dated 2016 show that the waste predominantly comprised of municipal waste including; plastic bags, bottles, concrete, fabric, timber, wavin piping, wood, newspaper, metal, glass, brick, concrete blocks, textiles, rubble, tins. |

3. Site investigations

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| Current condition and appearance of closed landfill: | <p>The landfill site profile is stated to be relatively flat in the western portion with a maximum height of 85mOD. From the centre of the site however, the slope increases in an eastward direction. The eastern portion of the site, which is densely vegetated with mature trees and bushes, extends down a very steep section of the valley for approximately 50m at a slope, dropping from 63mOD to 43mOD. At two locations on this section of the valley, slope failure has occurred, which has exposed waste material.</p> <p>The landfill site has been capped with topsoil and returned to agricultural use. Vegetative die back was notable during the site visit. Visible evidence of waste was noted in the northern margins of the site where erosion has taken place on the slopes leading to the valley of County River Brook. The ground was soft underfoot, with clear signs of ochre staining and hydrocarbon sheening at surface.</p> |
| Site investigations | <p>Geophysical surveys conducted in 2015 and 2016, indicated that the lateral extent of the waste material is approximately 4.3 Ha. Approximately, there is 18.5m depth of waste with high organic and metallic content. The landfill waste was also reported to extend towards the lower ground to the north east.</p> <p>During the geophysical survey session on the 3rd December 2015 extremely high rainfall was reported with surface water streams running off the landfill. Erosion of the embankment to the north east resulted in a minor landslide washing soil into the stream. The soil slope was found to be very unstable in localised areas where the effect of the surface water runoff was most.</p> <p>Intrusive site investigation was conducted in 1998, 2015 and 2016 and it included a site walk-over, trial pits, and installation of boreholes. Specifically, at Fassaroe 2 landfill site there were:</p> <ul style="list-style-type: none"> • 11 No. trial pits (8 No. onsite and 3 No. offsite) of depth from 2.70mbgl to 4.80mbgl; within an approximately 75m grid to characterise the waste, ascertain base of waste and identify natural ground • 5 No. offsite combined groundwater and leachate monitoring wells (located up gradient and down gradient of groundwater flow direction), • 10 No. onsite combined landfill gas and leachate monitoring wells, and • 12 No. offsite landfill gas monitoring wells |

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| | <p>In addition, one spring location was used for collecting surface water samples down gradient of Fassaroe 2.</p> <p>Samples of soil, leachate, groundwater and surface water were dispatched for analysis.</p> |
| Monitoring and analysis of samples (water, gas, waste): | <p>For the risk assessment, monitoring was carried out in 2016, 2017 and 2018 as follows:</p> <ul style="list-style-type: none"> • 18 rounds of gas sampling were done at 27 locations (i.e. at all monitoring wells). • 3 rounds of leachate sampling were done at 5 locations. • 3 rounds of groundwater sampling were done at 3 locations. • Eluate testing was carried out on 11 waste samples. • 3 rounds of surface water sampling done at 10 locations (upstream and another downstream of the offsite springs). • Soil was sampled in 4 locations. <p>An ecological survey and assessment as part of the Tier 3 risk assessment, in accordance with EPA Code of Practice, was also conducted. A stand of Japanese knotweed was observed adjacent to the northeastern boundary of Fassaroe 2. Condition 3 of the recommended certificate of authorisation requires remedial actions to eradicate invasive species growing at the site.</p> |
| Hydrology | <p>The northern site boundary is bordered along the County Brook River. County Brook River flows eastwards into the Dargle River and flows into St. Georges Channel and into the Irish Sea. The Dargle River is a registered salmonid river under the Salmonid Regulations (S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988).</p> <p>The Dargle River catchment forms part of the Eastern River Basin District. Outside of the river valley, the Fassaroe site is underlain by thick permeable subsoil and as a result the surface water drainage density is low, with very few field drains in the area and no ponds or tributaries to the County Brook River. As such there is no formal drainage system connecting the land around the historical landfill sites in Fassaroe and the County Brook River or its associated drainage system within the valley. Groundwater fed springs and seepages are evident in the riparian zone along the County Brook River. These springs feed the alkaline fen and tufa deposits. The spring flows are relatively small and coalesce downstream to form a more defined channel.</p> |
| Hydrogeology | <p>The Enniskerry groundwater body (IE_EA_G_038) is designated a locally important gravel aquifer (Lg). The bedrock beneath the gravel aquifer, the Maulin Formation, is classified by the GSI as a locally important, moderately productive bedrock aquifer in local zones (LI).</p> <p>The aquifer vulnerability at the Fassaroe site is classified as High due to the presence of greater than 3m thick unsaturated zone overlying a gravel aquifer. Groundwater flow within the granular aquifer is expected to be towards the local river, where groundwater discharges emerge as springs and seeps along the lowest boundary of the groundwater body and regionally towards the Irish Sea. Previous GSI reports have shown the local groundwater regime at the site is dominated by the County Brook River valley to the north, and the valley of the River Dargle to the east.</p> <p>The Water Framework Directive (WFD) status for the Enniskerry Gravel water body has been assigned as 'Good' between 2007 and 2012. The Ballyman Glen SAC which runs along the County Brook River adjacent to the Fassaroe 2 landfill site, comprises riparian wet woodland and contains a</p> |

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| | <p>small strip of fen. The fen is very alkaline and is associated with petrifying springs and seepage areas, which have given rise to thick deposits of marl. The earth of the banks around the landfill is unstable, and as a result, silt is being released into the County Brook River.</p> <p>The GSI well database lists a number of springs and old boreholes (from 1965) in the surrounding areas of Enniskerry and Bray, of which only a small number have been assigned as domestic use. The nearest spring, St Kevin's Well (GSI code 3224SWW137) is located immediately north of the site. There are no recorded abstractions from the Enniskerry groundwater body.</p> |
| <p>Leachate and water quality:</p> | <p>It is stated in the geophysical report (2016) that a discrete leachate body has been identified in the waste mass and geophysical survey results suggest that the leachate plume has reached as far as 40 metres below the depth of waste, particularly to the north-east of the site. Leachate results compared against published minimum and maximum observed ranges (EPA Landfill Manual) show that the leachate parameters including ammoniacal nitrogen, orthophosphate, heavy metals and petroleum hydrocarbons were above the published ranges. The average leachate quality has been screened against the typical values for methanogenic leachate from large landfills as presented in the EPA Landfill Manual. The data screening is generally consistent with methanogenic conditions in landfill sites.</p> <p>Groundwater samples taken from the site showed groundwater concentrations more than the relevant GTV or IGV for the parameters ammoniacal nitrogen, calcium and metals including aluminium, arsenic, iron, lead, nickel, zinc and cadmium. Concentrations of heavy metals in up-gradient borehole are generally slightly lower than those measured in down-gradient. Furthermore, down-gradient borehole shows exceedances above GTV for parameters of lead and ammonia which are not observed in up-gradient borehole.</p> <p>Surface water quality samples showed exceedances above EQS for the parameters BOD, ammoniacal nitrogen, orthophosphate and metals including copper, chromium, lead, nickel, and vanadium. Water quality parameters for the spring sampling locations along the County Brook River showed exceedances above EQS for the parameters BOD, ammoniacal nitrogen, metals including arsenic, cadmium, chromium, copper, lead, nickel and zinc.</p> <p>The Tier 2 report stated that there are no instances of leachate emergences at the foot of the waste body that directly link via overland drainage to the down-gradient stream, although there is possible seepage from exposed waste at a collapsed river bank. A number of spring flows emerging as diffuse seepages were observed showing ochre staining. Spring monitoring has confirmed visual evidence of contamination at several points of groundwater emergence with the Ballyman Glen SAC principally in the form of orange / red ochre deposition and/or sheening.</p> |
| <p>Landfill gas:</p> | <p>The ongoing generation of landfill gas at the landfill means there is risk posed by the presence of methane from the site. The gas monitoring data collected from onsite monitoring locations over the monitoring period recorded methane concentrations ranging from no detections to 73.7% v/v and carbon dioxide concentrations ranging from no detection to 36.6% v/v. Methane concentrations are consistently elevated with peak readings in excess of 60% v/v and flow rates are extremely variable ranging from -6.2 to +7.6 l/hr.</p> |

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| | <p>The gas monitoring data collected for offsite monitoring locations generally recorded no detections or very low methane concentrations in the majority of monitoring locations. The notable exceptions are where methane concentrations range from no detection up to 55.7 % v/v.</p> <p>Offsite carbon dioxide concentrations are extremely variable ranging from 0 to 16.5 % v/v, but are elevated on occasions at most offsite monitoring locations. Sustained elevated concentrations were recorded at locations between the existing 33" water main and the site. Flow rates were correspondingly variable, ranging between -16 l/hr to +19.8 l/hr.</p> <p>The Department of the Environment (DOE) publication on the 'Protection of New Buildings and Occupants from Landfill Gas' (1994) guidelines stipulate that, where carbon dioxide or methane are present in a landfill at 0.5% v/v and 1% v/v respectively, then housing should not be erected within 50m of the landfill and private gardens should not be allowed within 10m.</p> <p>A housing estate is planned to be developed around the landfill site with the landfill as an open space. Landfill gases were detected in landfill gas monitoring wells located on and offsite of the landfill. This would indicate that lateral migration of gas is occurring.</p> <p>Landfill gas generation and migration is the focus of the risk assessment and proposed remedial actions submitted by Wicklow County Council. The remedial measures proposed include passive venting by means of a Virtual Gas Curtain (VGC) around the site.</p> <p>Consequently, Condition 3 of the recommended certificate of authorisation requires Wicklow County Council to install and maintain appropriate landfill gas management infrastructure.</p> |
| <p>Conceptual site model:</p> | <p>The original conceptual site model developed in 2015 was provided with the original application. It was reviewed in 2018 and identified the following pollutant linkages:</p> <ul style="list-style-type: none"> • Human contact with waste mass and dust in areas with minimal capping • human health exposure and emission into buildings due to off-site migration of landfill gas; • migration of leachate into the adjoining surface water body; and the SAC via surface water migration; • migration of leachate into the underlying aquifer and discharge to the adjoining surface water body. <p>The SPR linkages of primary concern relate to the potential for leachate to impact surface water bodies and the SAC through surface water migration, and the potential risk of lateral migration of landfill gas to human presence:</p> <ul style="list-style-type: none"> • leachate migration to surface water (SPR 8) • leachate migration to protected area via surface water (SPR 9) • human health exposure pathway of off-site migration of landfill gas and emission into on-site building (SPR 10). <p>The conceptual site model is shown in Figure 4. The source, pathways and receptors can be described as follows:</p> <p>Source:</p> <ul style="list-style-type: none"> – Waste mass exposed in parts of site with minimal capping – Rainfall on the landfill will preferentially percolate through the cap and into the waste. – Leachate is generated in the waste. |

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| | <ul style="list-style-type: none"> - Gas is generated at the landfill. <p>Pathway:</p> <ul style="list-style-type: none"> - dermal contact, soil ingestion and inhalation of dust - Leachate migration from the site through the unsaturated sand and gravel deposits. - Leachate can migrate through the base of the landfill into underlying aquifer beneath and discharge to the adjoining surface water body. - Gas migration can occur through the permeable cap and into the unsaturated sand and gravels; and through fractured bedrock beneath the waste. - Gas migration beyond the site boundary. <p>Receptors:</p> <ul style="list-style-type: none"> - the County Brook River; - the Ballyman Glen SAC; - the underlying sand and gravel aquifer; - current and future site users; and - existing and proposed offsite buildings and structures <p>No private or public groundwater supply sources are present down-hydraulic gradient from Site.</p> |
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4. SPR linkages and remedial actions

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| <p>SPR linkage scenarios (applicable ones only):</p> | <p>Leachate migration through surface water pathway</p> <p>SPR 8, Receptor = Surface Water</p> <p>SPR 9, Receptor = Surface Water Body Protected Area (SWDTE - Surface Water Dependent Ecosystem)</p> <p>Landfill gas migration through lateral and vertical pathway</p> <p>SPR 10, Receptor = Human</p> <p>Summary:</p> <p>Upon the review of the updated monitoring data, surface water assessment and the ecological assessment;</p> <ul style="list-style-type: none"> - Remedial action is warranted to address the risk of leachate migrating from the site to the receiving water and aquatic habitats within the SAC adjoining the site. - remedial action is warranted to address the risk of offsite migration of landfill gas. |
| <p>Proposed remedial actions:</p> | <p>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 addresses both environmental risk associated with the landfills and potential risk to human health. This is to ensure appropriate safety standards for potential future development at the lands. Therefore, it is anticipated that no buildings would be located within the landfill areas and these would be developed instead as open space / amenity.</p> <p>The overall remediation strategy includes the proposed installation of landfill gas ventilation curtain around the site. The VGC is expected to</p> |

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| | <p>reduce the risk posed by the presence of landfill gas to receptors by intercepting the preferential lateral pathway for gas migration out of the landfill site and thus breaking the source-pathway-receptor linkage. The VGC forms a low pressure or low gas concentration area relative to the surrounding gassing ground to encourage gas to flow towards the VGC barrier, and allow subsequent venting to atmosphere.</p> <p>Leachate management will include capping with a low permeability barrier, surface water collection layers and a minimum of 1m of cover soils. Slope failures and potentially unstable slopes have been recorded along the northern boundary of landfill site. In order to accommodate both the construction of the landfill capping system and any subsequent development, Condition 3 of the recommended certificate of authorisation requires slope stabilisation measures to be undertaken at the affected areas where landslips have occurred.</p> <p>The proposed remedial actions are intended to break the SPR linkages by preventing potential migration of leachate and landfill gas to offsite locations and to vent the gas in a controlled manner to the atmosphere.</p> <p>The draft Certificate of Authorisation allows for the importation and use of soil and stone to complete the works.</p> <p>Condition 3.15 of the recommended certificate of authorisation provides for a communications programme directed at the occupiers of buildings adjacent to deposited waste (the site). The communications programme will inform these people of what they should be doing to protect their property health and well-being, and members of the public from the risk of an incident involving landfill gas.</p> |
| Proposed aftercare monitoring and assessment: | <p>Monitoring as specified in Condition 3.5 of the recommended certificate of authorisation.</p> <p>Validation report to be submitted within 30 months.</p> |
| Adequacy of risk assessment: | <p>Regulation 7(7) of the Regulations states that the EPA must be satisfied with the risk assessment before proposing to grant a certificate of authorisation. The risk assessment is adequate for the following reasons:</p> <ul style="list-style-type: none"> • It has identified, assessed and adequately addressed the associated risks inherent with the landfill site. • An Appropriate Assessment screening was also completed to evaluate the potential risk to the European sites associated with the adjoining receiving waters • Report of Tier 2 intrusive investigation show that municipal waste deposited in the landfill was relatively low in biodegradable waste. Therefore, the waste deposits in the "closed landfill" will present relatively low risks of ongoing leachate and gas generation. |

5. Appropriate assessment

A screening for Appropriate Assessment was undertaken to assess, in view of best scientific knowledge and the conservation objectives of the site, if the proposed activity, individually or in combination with other plans or projects is likely to have a significant effect on any European Site. In this context, particular attention was paid to the European Sites at Ballyman Glen SAC [Site Code: 000713].

The activity is not directly connected with or necessary to the management of any European Site and the Agency considered, for the reasons set out below, that it cannot be excluded, on the basis of

objective information, that the activity, individually or in combination with other plans or projects, will have a significant effect on any European Site and accordingly determined that an Appropriate Assessment of the activity was required.

The reason for this determination is as follows:

- the northern boundary of the landfill site is adjacent to, and within the Ballyman Glen SAC [Site Code: 000713].
- slope failures and potentially unstable slopes have been recorded along the northern boundary of the landfill site adjacent to, and within the Ballyman Glen SAC [Site Code: 000713]

An Inspector's Appropriate Assessment has been completed and has determined, based on best scientific knowledge in the field and in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 as amended, pursuant to Article 6(3) of the Habitats Directive, that the activity, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site, in particular Ballyman Glen SAC [Site Code: 000713], having regard to their conservation objectives and will not affect the preservation of these sites at favourable conservation status if carried out in accordance with the application, risk assessment and recommended certificate of authorisation and the conditions attached hereto for the following reasons:

- Specifically, the remedial works will be undertaken to avoid the potential for water pollution and will ensure that there will be no significant impact on Ballyman Glen SAC [Site Code: 000713], and with a further objective to result in positive impacts to current water quality conditions.
- the project, alone or in-combination with other projects, will not adversely affect the integrity, and conservation status of any of the qualifying interests of the Ballyman Glen SAC [Site Code: 000713].
- Condition 3.5 requires ongoing environmental assessment and monitoring.

In light of the foregoing reasons, no reasonable scientific doubt remains as to the absence of adverse effects on the integrity of those European Site: Ballyman Glen SAC [Site Code: 000713].

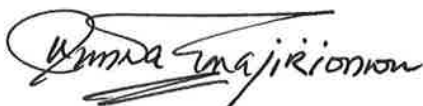
6. Consultation

I consulted with Mr John Gibbons (OEE) on landfill gas assessment and treatment.

7. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed



Magnus Amajirionwu

Date 29/03/2019

Procedural Note

Any representations received by the Agency within 30 days of the draft certificate of registration being made available will be considered by the Agency.

As soon as practicable after the expiry of the 30-day period the Agency will determine the certificate of authorisation, which may vary from the draft certificate, and shall issue an appropriately validated certificate of authorisation in accordance with the Waste Management (Certificate of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008.

Figure 1 Location of Fassaroe Historical Landfill Sites



Figure 3 Location and boundary map of Fassaroe Historical Landfill (outlined in Red and labelled Site 2).

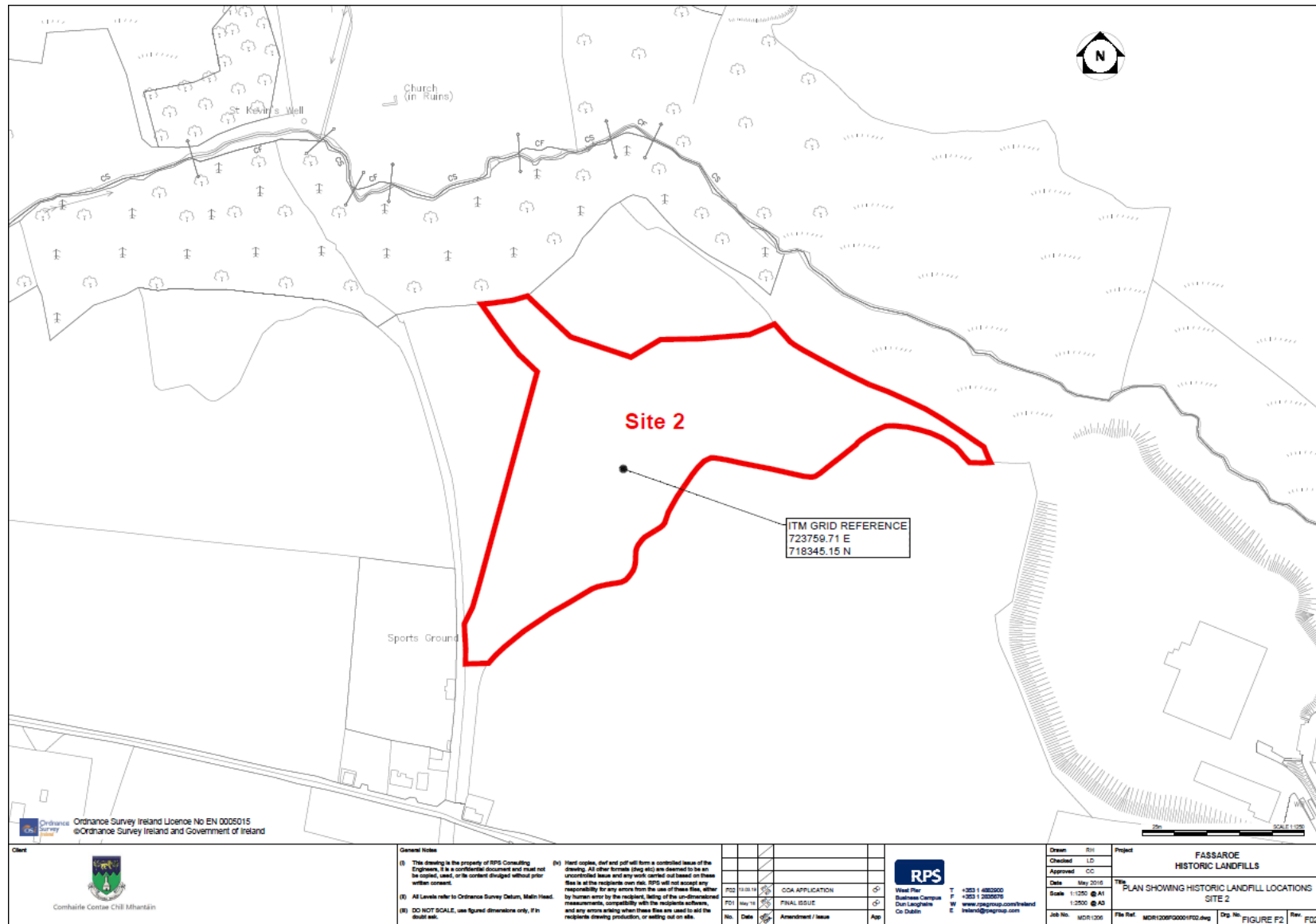
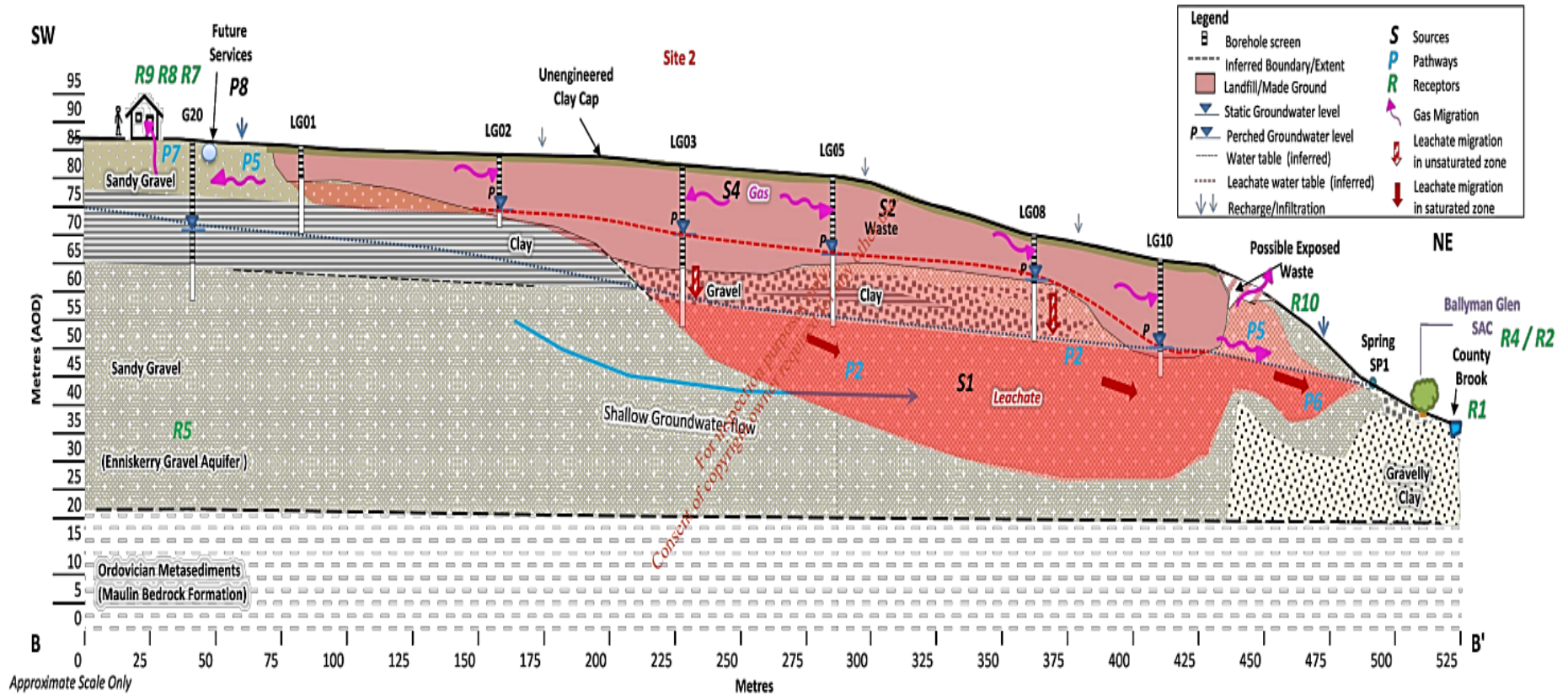


Figure 4 Conceptual site model for Fassaroe 2 site



Appendix 1: Assessment of the effects of activity on European sites and proposed mitigation measures.

| Site Code | Site Name | Qualifying Interests (* denotes priority habitat) | Conservation Objectives | Assessment |
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| 000713 | Ballyman Glen SAC | Petrifying springs with tufa formation (Cratoneurion) [7220] Alkaline fens [7230] | NPWS (2018) Conservation objectives for Ballyman Glen SAC [000713]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht. | <p><u>Emission to Water</u></p> <p>Any change in water quality has the potential to impact on water dependant habitats and species.</p> <p>The Tier 3 risk assessment carried out in accordance with the EPA Code of Practice show that the presence of leachate at the site and the potential impact on groundwater is expected to continue declining overtime.</p> <p>Tier 3 risk assessment of the potential impact associated with leachate migrating to the adjoining surface waters indicate that it will not have significant impact on the overall water quality of the Fassaroe stream and the Ballyman Glen SAC.</p> <p>Conclusion:</p> <p>Due to risk of potential impacts on the receiving environment associated with leachate remedial action is warranted. Condition 3 of the certificate of authorisation outlines the remedial actions required at the site.</p> <p>Condition 3.5 requires monitoring, sampling, analysis and characterisation of leachate. It also requires annual sampling of surface water from the adjacent stream; and sampling, analysis and characterisation of groundwater from onsite and off-site boreholes.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of the European sites are protected.</p> <p><u>Emissions to Air</u></p> <p>Landfill gas migration beyond the site boundary is currently associated with the site. The Tier 3 risk assessment affirms that there is immediate risk to any of the offsite properties associated with gas arising from the site. As a mitigation measure, the installation of virtual gas curtains is recommended for the site.</p> <p>Conclusion:</p> |

| Site Code | Site Name | Qualifying Interests (* denotes priority habitat) | Conservation Objectives | Assessment |
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| | | | | <p>Condition 3.1 requires the installation of gas curtains along the perimeter of the closed landfill.</p> <p>The controls in the recommended certificate of authorisation ensure the qualifying interests of the European sites are protected.</p> |