


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

Signed: 

Dated: 24/04/2019



OFFICE OF ENVIRONMENTAL SUSTAINABILITY

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

TO:	Eimear Cotter, Director	
FROM:	Magnus Amajirionwu & Caitríona Collins, Inspectors,	Environmental Licensing Programme
DATE:	24 April 2019	
RE:	Application by Louth County Council for a Certificate of Authorisation for a closed landfill at Carlingford, County Louth . Certificate of Authorisation Register Number H0306-01 .	

1. Application details

Type of facility:	Closed landfill as defined in the Regulations ¹
Original site ownership	Louth County Council
Current site ownership	Louth County Council
Operator of closed landfill	Louth County Council
Proposed use post remedial works	The Carlingford waste water treatment plant (WWTP) owned by Irish Water, is currently located at the site and is not expected to change.
Risk category of closed landfill:	Medium risk (class B) <ul style="list-style-type: none">Reason(s): pollutant linkages:<ul style="list-style-type: none">Leachate migration to groundwater, surface water and protected areas,On-site and off-site human receptors from landfill gas migration.

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

Section 22 register number:	S22-02452
Application received:	23/12/2013
AA screening determination:	31/08/2018
Regulation 7(4) notice:	31/08/2018
Additional information received:	12/02/2019
Name of Qualified Person:	Sean Moran (MSc, Eur. Geol., P. Geol.) of O'Callaghan Moran & Associates Credentials provided by Institute of Geologists of Ireland
EPA site inspection:	None required

2. Information on the closed landfill

Location of facility	<p>The former Carlingford Town Landfill is located at the south-eastern edge of Carlingford town on the LS7062 road (Figure 1). Most of the site is situated in a low-lying area (approximately 1.2 - 4.0m OD) with the ground rising to the east and south-east up to approximately 8m OD and in the west to a maximum of approximately 14.5m OD.</p> <p>A stream flows along the western site boundary. There is a public water well located approximately 50m from the southwestern site boundary.</p> <p>Carlingford sewerage treatment plant surrounded by a security fence enclosing an area of 0.7 Ha is located in the southern portion of the site. Much of the northern portion of the site outside the security fence is covered by gorse.</p> <p>For the purposes of the risk assessment, it has been envisaged by the Qualified Person that the sewage treatment plant for Carlingford, which is located in the southern section of the site, will continue operating at the location post remediation. No mixed use has been envisaged by the Qualified Person.</p>
Period of landfilling	It is not known when the landfill opened but it ceased to operate as a landfill in 1984 when the engineered Whiteriver landfill was opened.
Surrounding area	<p>The general area surrounding the site is a mix of residential and agricultural land use. There is a housing estate constructed 50m to the west of the site and agricultural lands to the south and east of the site. To the west there is a Bed & Breakfast and further west there is a retirement/nursing home. The area is secured with a chain link fence and gate around the site.</p> <p>Carlingford Lough is located within 500m of the site.</p>
Area of the closed landfill	Carlingford landfill covers an area of 1.44 Ha. Prior to the development of the wastewater treatment plant, geophysical survey data indicates a waste footprint of approximately 1.15 Ha. Waste was removed from the southern section of the site for the development of the wastewater treatment plant. This resulted in a reduction of the waste footprint to approximately 0.92Ha.

Quantity of waste at the facility	<p>The Tier 2 site investigations identified the presence of a waste body comprising approximately 0.92Ha with an average thickness of 2.5m – 3m. This equates to approximately 29,400m³ of waste intermingled with sand and clay. The waste density is estimated to be 0.4 which equates to approximately 11,760 tonnes of waste.</p> <p>This northern portion of the site includes a mound approximately 4-6m high. Waste (domestic and construction and demolition) was reportedly found to be exposed in places on the slopes of this mound during the geophysical survey of the site.</p>
Characterisation of waste deposited	<p>Tier 2 site investigation show that the waste comprised of plastic, brick, concrete, blacktop, glass bottles, timber, soil and stone, domestic waste such as clothes and burnt waste.</p> <p>The waste was incorporated in a sandy gravelly clay matrix. No layers or pockets of significantly contaminated material was encountered during the intrusive investigation. There was no evidence of staining or odours consistent with the presence of such material identified during field screening activities.</p> <p>The Tier 2 report further stated that the Waste Acceptance classification testing carried out on the waste body indicated that the waste is inert. However, the report also stated that localised hydrocarbon odours were noted in the fill material in two trial pits, and another trial pit was described as having an oily odour. These were recorded as isolated occurrences.</p> <p>A review of the trial pit site investigation and the geophysical site investigation indicates that waste is not present across the entire site footprint of 1.4Ha. The geophysical survey data indicates a waste footprint of approximately 1.15 Ha. As stated earlier, waste was removed from the southern section of the site for the development of the wastewater treatment plant. This resulted in a reduction of the waste footprint to approximately 0.92Ha.</p>

3. Site investigations

Current condition and appearance of closed landfill:	<p>The Carlingford sewage treatment plant is located in the southern section of the site. Prior to the development of the site, waste from beneath the development area was excavated and re-deposited within the landfill further to the north.</p> <p>No waste is visible on the surface of the site as the majority of the site has been capped with soil. The cap layer of topsoil ranged in thickness from 0.2m to 2.2m across the site. The area around the wastewater treatment plant has been landscaped.</p>
Site investigations	<p>Geophysical survey conducted in 2009, indicated about 0.3 to 2.2m soft/loose topsoil and/or capping material overlying up to 4.3m soft to firm or loose to medium dense landfill waste material. The interpreted base of the landfill waste lies at 1 - 2.5m OD (ordnance datum) generally. Moderately low resistivity material (33-90 Ohm) underlying the waste was interpreted as possible leachate. The report suggested that there is relatively little metal dispersed throughout the body of the landfill. The survey also showed that there was no waste present beneath the wastewater treatment plant footprint.</p> <p>Intrusive site investigations, 2009 and 2011:</p>

	<ul style="list-style-type: none"> • 33 trial pits to depth 0.5 - 4.3 metres below ground; • 1 borehole later used as groundwater monitoring well; • 5 landfill gas monitoring wells <p>In addition, two locations were used for surface water samples. Samples of soil, leachate 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 2009, 2011, and 2018 as follows:</p> <ul style="list-style-type: none"> • 7 rounds of gas sampling were done at 5 locations. • 1 round of internal landfill gas monitoring at onsite property. • Leachate samples were taken at 3 locations. • 1 solid waste and 3 eluate testing was carried out on 4 waste samples. • Surface water was sampled in 2 locations (upstream and another downstream of the site). • Groundwater was sampled in 1 location onsite. • 3 rounds of sampling were done at the up-gradient Carlingford Water Supply well • 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.</p>
Hydrology	<p>There is a stream on the western site boundary. The stream is culverted upstream of the site. It is reported that on the 1860's six inch map the stream is depicted as rising approximately 50m to the south of the site. The stream discharges from a culvert pipe into an open channel at the southern boundary of the site. The stream flows to the north and discharges to Carlingford Lough, approximately 500m from the site.</p> <p>The landfill is hydraulically up-gradient of the Carlingford Shore SAC and Carlingford Lough SPA. The surface water drainage from the site enters a stream along the western boundary and which flows to the Carlingford Lough. The Carlingford Shore SAC and SPA is located 500m to the northeast of the site respectively. Stage 1 Screening exercise identified that the project was likely to have a significant impact on a Natura 2000 site because of the Leachate to Surface Water Pathway. This pathway was stated in the screening report to have the potential to link the site to ecologically sensitive sites downstream.</p>
Hydrogeology	<p>According to GSI source protection report of the Carlingford Groundwater Supply Boreholes, the site is underlain by a locally important gravel aquifer (Lg). This aquifer is the water source for the Carlingford borehole. The source protection zone extends into the landfill area. While the semi-analytical equations used to establish the lateral extent of the boundary indicate that the boreholes would draw water from up to 50m distance down gradient of the source which would not extend into the landfill area. However, in carrying out the risk assessment, a conservative approach was taken in determining the extent of the source protection area. This approach means that a precautionary arbitrary distance of 100m is used to allow for errors and variability in the aquifer parameters.</p> <p>The GSI classification system for aquifers characterises the bedrock aquifer beneath the site as a locally important aquifer which is moderately productive (Lm).</p>

	<p>The GSI Vulnerability Map indicates that the vulnerability across the site is High (H). Vulnerability is defined by the GSI as the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. Vulnerability categories range from Extreme (E) to High (H) to Moderate (M) to Low (L) and are dependent on the nature and thickness of subsoils above the water table.</p> <p>The local groundwater flow direction is considered to follow the local topography, moving to the north towards Carlingford Lough.</p> <p>There is an on-site groundwater monitoring well in the western section of the site. The water supply for Carlingford town is derived from an abstraction well located approximately 55m to the south west of the site. The well is situated up-hydraulic gradient of the site.</p>
<p>Leachate and water quality:</p>	<p>Leachate results compared against published minimum and maximum observed ranges show that the key leachate parameters BOD, COD, ammonia and MRP (molybdate reactive phosphorous) and metals were either below or within the published ranges. An aged, weak, leachate was detected in the waste body and this has the potential to enter the surface water system downstream of the landfill. However, no such linkage was observed in 2018.</p> <p>Based on the chemical analysis carried out on the surface water and sediment samples obtained from the stream which flows along the eastern site boundary, the site is not significantly impacting on the stream. According to Tier 3 report updated in 2018, this may be due to the dilution in the watercourse and, or the presence of an aged and weak leachate beneath the site. It is noted that the stream has been dry in 2018.</p> <p>Elevated levels of iron, manganese and coliforms were observed in the on-site groundwater monitoring well. These could be attributed to the weak leachate from the landfill. The impact on groundwater water quality is therefore expected to be remarkably low. However, no impact was detected in the off-site Carlingford groundwater water supply borehole located approximately 55m to the south west and up hydraulic gradient of the site. The well is pumping up to 1,200m³/day of groundwater. This pumping rate could result in groundwater flowing beneath the site in the sand and gravels being pulled toward the abstraction well. The landfill is located within the source protection zone for the well. There is therefore potential for migration of leachate from the landfill to the well. Groundwater monitoring in the well has however not detected any water quality impacts. This may indicate that the estuarine clays beneath the waste body are an effective barrier to vertical leachate migration and that leachate migration is generally toward the surface water system because of the presence of estuarine clay above the gravel.</p> <p>Because the leachate is very weak, the potential impacts on water quality are expected to be very low. Accordingly, any potential impacts on the receiving environment associated with leachate are considered not significant, and are expected to continue to decline over time.</p>
<p>Landfill gas:</p>	<p>The ongoing generation of landfill gas at the landfill and the close proximity of buildings and any underground structures serving the nearby housing, estate means there are conduits for gas to migrate and accumulate in a manner that potentially poses a risk to property and people.</p> <p>There is risk posed by the presence of methane from the site. Recorded concentration of methane of 15.4% and 22.6% v/v above the upper</p>

	<p>explosive limit of 5% v/v were recorded at two out of five onsite locations in 2018. In 2011 methane was also detected at levels of 53.8% v/v, 27.5% v/v, and 38.8% v/v in three out of five on site landfill gas monitoring wells.</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>There is a housing estate within 50m of the western site boundary. The presence of the stream on the western site boundary may be acting as a natural cut off inhibiting lateral migration of gas to the west towards the houses. Landfill gases were not detected in landfill gas monitoring wells located on the north western and south western site boundary. This would indicate that lateral migration of gas is not occurring in these directions.</p> <p>There is also an existing on-site building owned by Irish Water as part of the wastewater treatment plant located on the landfill site. It is stated (in the 2018 Tier 3 report) that the on-site building has been fitted with gas proof membranes. Prior to construction, waste beneath and immediately surrounding the building were excavated and placed on the northern part of the site. Granular fill was placed to establish formation level around the building. It is likely that any landfill gas migration toward the building is venting to atmosphere in the granular fill surrounding the building. While a potential pathway from the landfill to the on-site building exists, this has for the most part, been mitigated with the landfill gas proof membranes incorporated in the construction process.</p> <p>The results of the internal landfill gas surveys in the onsite Irish Water building showed no gas migration into the building. It is also confirmed by the quantitative risk assessment that there is no immediate risk to the onsite property. There was absence of landfill gas in the wells at the boundary of the landfill, which would suggest that lateral movement of landfill gas to the west and towards surrounding houses is not taking place.</p> <p>Landfill gas generation and migration is the focus of the risk assessment and proposed remedial actions submitted by Louth County Council. The remedial measures proposed include the installation of a landfill gas ventilation trenches in the northern portion of the site where elevated readings have been detected.</p> <p>Consequently, Condition 3 of the recommended Certificate of Authorisation requires Louth 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 2009 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 health exposure and emission into buildings due to off-site migration of landfill gas; • migration of leachate into the adjoining surface water body; and • migration of leachate into the underlying aquifer and discharge to the adjoining surface water body. <p>Of the three, only the risk posed by gas was taken forward for further consideration. The pollution risk to the groundwater and surface water was not borne out from sampling and analysis and assessment or results.</p>

	<p>The conceptual site model developed in 2009 and refined by the Qualified Person in 2018, identified the only remaining pollutant linkage that warrants remedial action as:</p> <ul style="list-style-type: none"> • human health exposure pathway of off-site migration of landfill gas and emission into on-site building (SPR10). <p>The conceptual site model is shown in Figure 3. The source, pathways and receptors can be described as follows:</p> <p>Source:</p> <ul style="list-style-type: none"> – Rainfall on the landfill will preferentially percolate through the cap and into the waste. – Leachate is generated in the waste albeit at low strength. – Gas is generated at the landfill. <p>Pathway:</p> <ul style="list-style-type: none"> – Leachate migration from the site through glaciofluvial sands and gravels. – 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 glaciofluvial sands, gravels and fractured bedrock beneath the waste. – Gas migration beyond the site boundary. <p>Receptors:</p> <ul style="list-style-type: none"> – Existing on site Irish Water house, and off-site buildings and users in close proximity of the site. – The bedrock aquifer beneath the waste body. – Leachate discharges directly to adjoining water body and groundwater.
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

4. SPR linkages and remedial actions

SPR linkage scenarios (applicable ones only):	<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 offsite migration of landfill gas from the site across the northern portion of the boundary and from beneath the on-site building.
Proposed remedial actions:	<p>The risk assessment and remedial actions are based on the current use at the closed landfill – i.e. partly developed as a wastewater treatment plant site. The landfill site is zoned as public utility use - mixed (general water / wastewater) uses. This zoning will remain for the site.</p> <p>Further capping is proposed in the application and risk assessment, though there is varying thickness of 0.3 – 2.2m capping across the landfill.</p> <p>The overall remediation strategy includes the proposed installation of landfill gas ventilation trenches in the northern portion of the site where elevated readings have been detected. The trenches would comprise</p>

	<p>vertical ventilation pipes installed in trenches backfilled with granular fill. Where possible, vertical ventilation pipe work would extend to the full depth of the waste. The trenches would be about 1m wide and at least 2m deep and will be located to ensure maximum ventilation of landfill gas in the northern portion of the site. The vertical ventilation pipes will extend above ground and will be fitted with a cowl to prevent the pipes from being blocked by debris.</p> <p>It is intended to break the SPR linkages by preventing potential migration of 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 3.13 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 Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078].

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:

- surface water drainage from the landfill site flows into the stream along the western boundary, which then flows to the Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078].

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 Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078], 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:

- Though there is a stream that flows from the site into Carlingford Lough, surface water monitoring data show there is not a significant deterioration in the surface water quality between the upstream and downstream monitoring points on the stream.
- 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 Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078].
- 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 Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078].
- 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 Sites: Carlingford Lough SPA [004078] and Carlingford Shore SAC [004078].

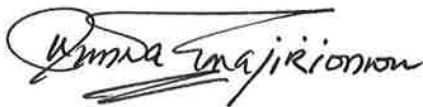
6. Consultation

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

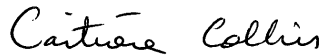
7. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed



Magnus Amajirionwu



Caitríona Collins

Date 24 April 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 Carlingford Historical Landfill

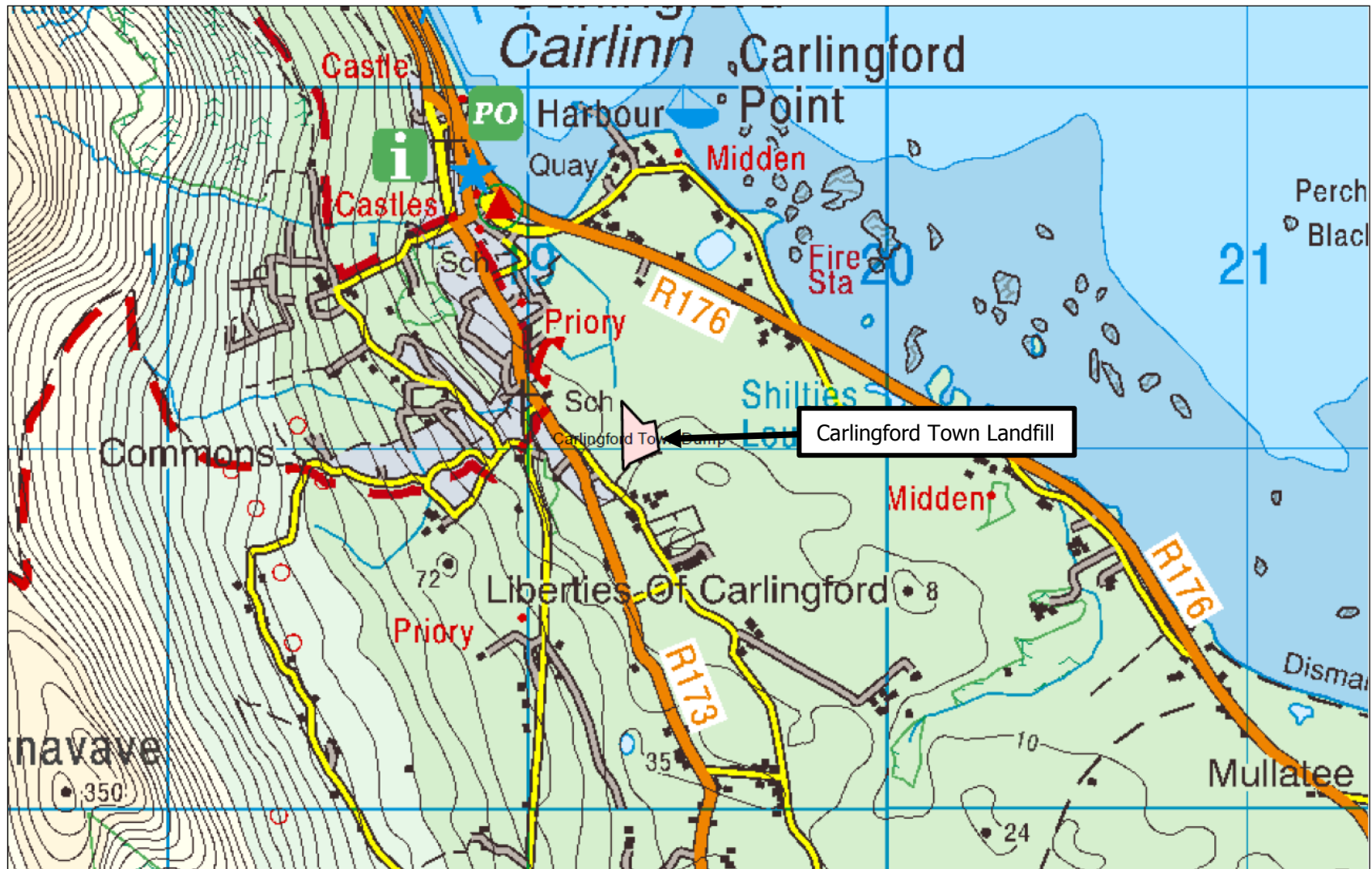
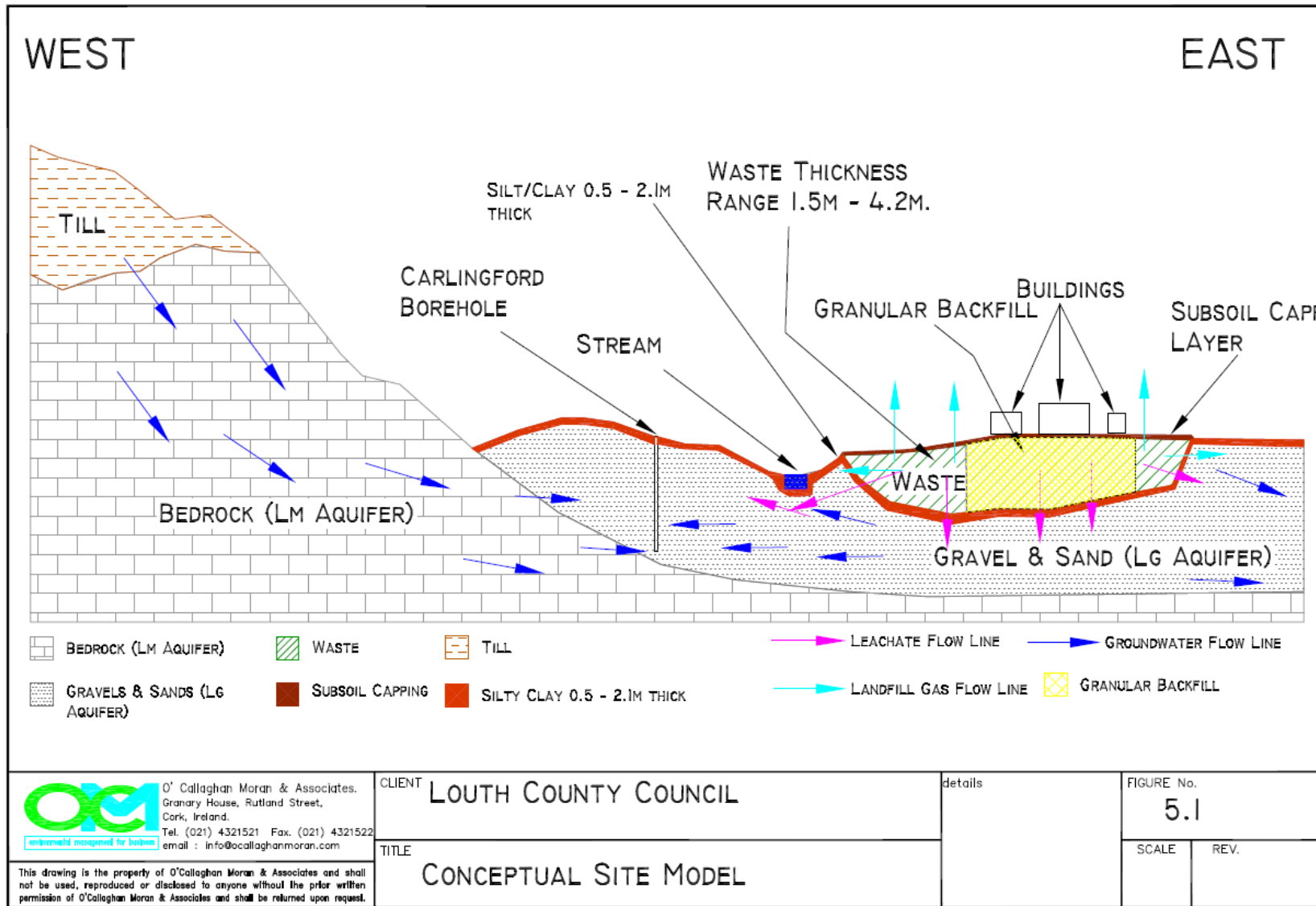


Figure 2 Location and boundary map of Carlingford Historical Landfill (outlined in Red).



Figure 3 Conceptual site model



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
002306	Carlingford Shore SAC	Annual vegetation of drift lines [1210] Perennial vegetation of stony banks [1220]	NPWS (2013) Conservation Objectives: Carlingford shore SAC (002306) Conservation objectives supporting document - coastal habitats [Version 1]	<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 was minimal and is expected to continue declining overtime.</p>
004078	Carlingford Lough SPA	Light-bellied Brent Goose (Branta bernicla hrota) [A046] Wetland and Waterbirds [A999]	NPWS (2013) Conservation Objectives: Carlingford Lough SPA (004078) Conservation objectives supporting document [Version 1]	<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 Carlingford Shore and the Carlingford Lough. Accordingly, there is no unacceptable risk to the adjoining receiving waters.</p> <p>Conclusion:</p> <p>Any potential impacts on the receiving environment associated with leachate are, therefore, considered as not significant and no remedial action is warranted.</p> <p>Condition 3.5 requires annual 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 not associated with the site. The Tier 3 risk assessment affirms that there is no immediate risk to any of the offsite properties associated with gas arising from the site. As a precautionary mitigation measure, the installation of gas ventilation trenches is recommended for the site.</p>

Site Code	Site Name	Qualifying Interests (* denotes priority habitat)	Conservation Objectives	Assessment
				<p>Conclusion:</p> <p>Condition 3.1 requires the installation of gas ventilation trenches at 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>