

Appendix 8-2 – Flood Risk Assessment



Bord na Móna

Drehid Landfill

Flood Risk Assessment



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1.0 INTRODUCTION

TOBIN Consulting Engineers were commissioned by Bord Na Móna to carry out a Flood Risk Assessment (FRA) at the Drehid Waste Management Facility (WMF), for a proposed expansion of the existing facility to increase waste capacity at the Drehid WMF. The subject site is located in Killinagh Upper, Carbury, Co. Kildare (see

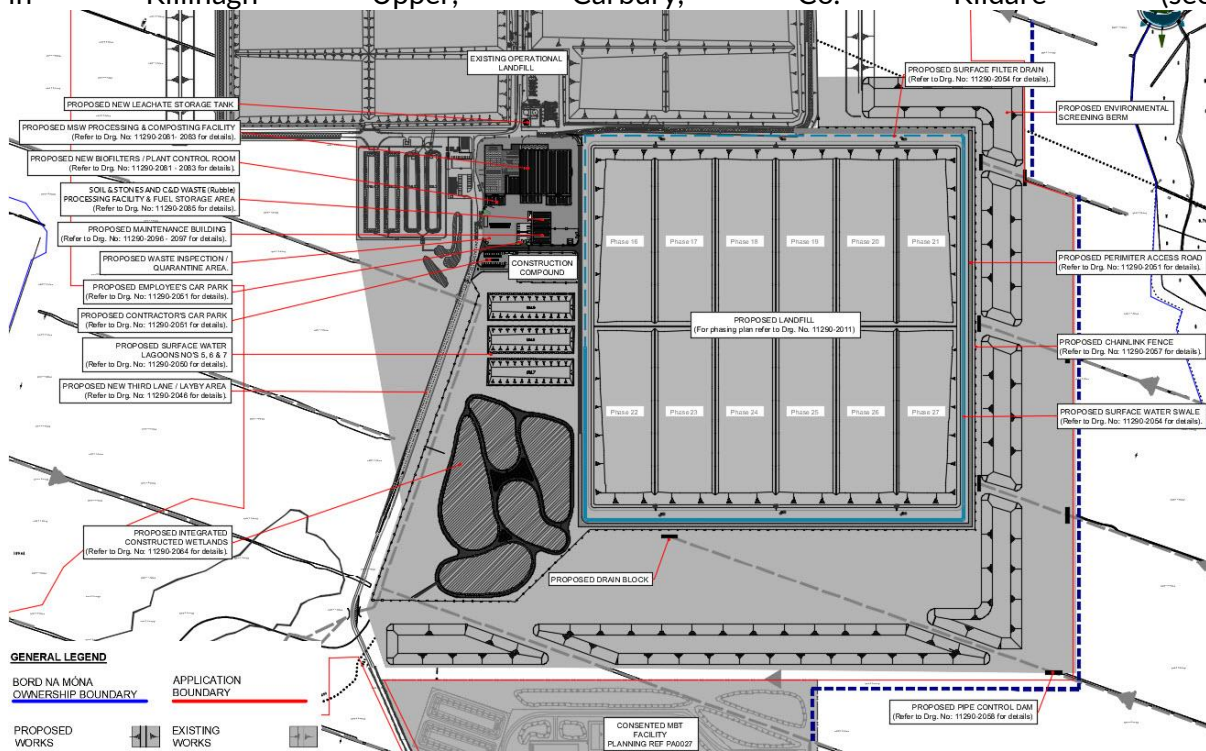


Figure 1–2).

The purpose of this report is to identify, quantify, and communicate the risks of flooding, if any, to the proposed project.

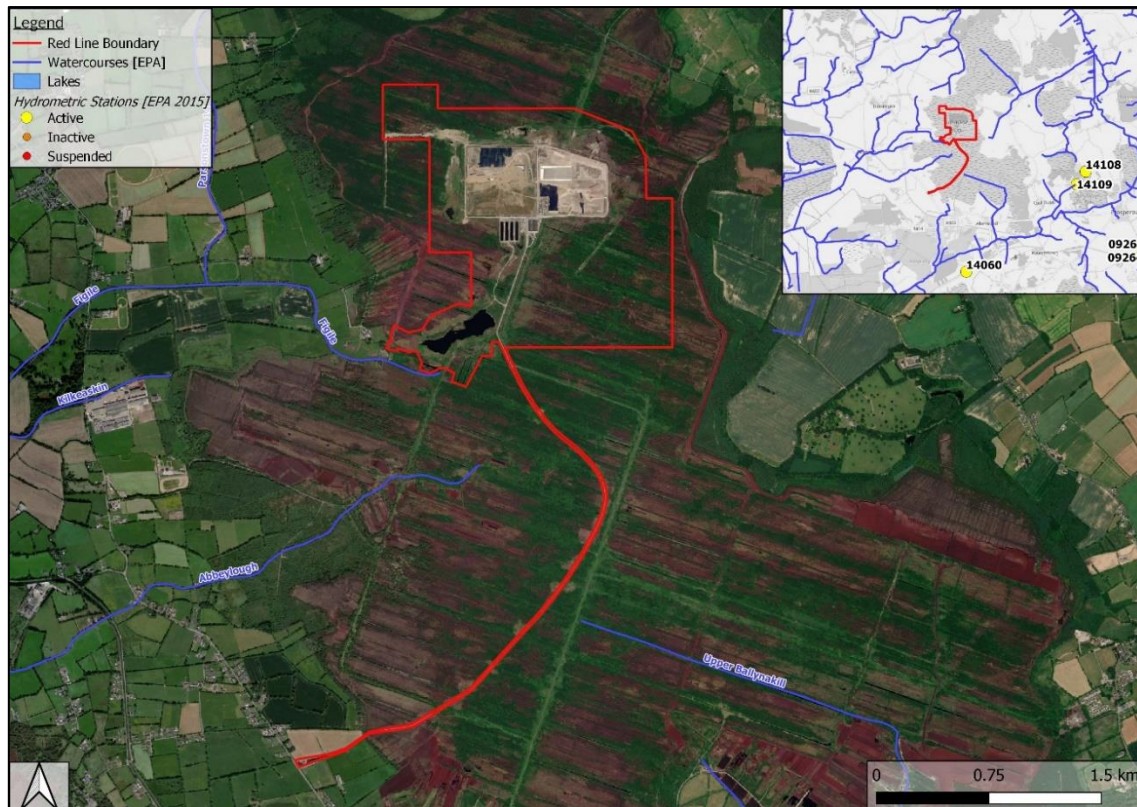


Figure 1–1 Site Location

1.1 Existing Site

The proposed development site occurs within Drehid Bog which is owned by BnM. The site is located to the south of the current Drehid landfill off the R403. The closest settlement is Timahoe located 1.3km east of the site.

The application area (the area within which the application for development is being made) is confined to an area of 264 hectares (ha), outlined in red on Figure 1–1. This development, hereafter referred to as the proposed development, is situated in the townlands of Timahoe West, Coolcarrigan, Killinagh Upper, Killinagh Lower, Drummond, Kilkeaskin, Loughnacush, and Parsonstown.

The topography of the existing application area slopes east to west. The existing ground levels within the application area range from approximately 87.937mOD at the south-eastern area of the site boundary, to approximately 82.128mOD at the south-western area of the site boundary.

The Figile River (also known as the Cushaling River) rises at the south western boundary of the subject site and flows west to Ticknevin. From Ticknevin, the Figile River flows in south west to Clonbulloge and then south to Monasterevin. The Figile river drains to the River Barrow at a confluence in Monasterevin.

A number of smaller watercourses originate in the vicinity of Timahoe Bog. The nearest of these watercourses is the Abbeylough River, a tributary of the Figile River, which originates approx. 1,000m south of the proposed development.

1.2 Proposed Development

The proposed development will comprise an expansion of the existing and operational integrated waste management facility at Drehid. The proposed landfill infrastructure and additional composting capacity will utilise the existing infrastructure in place at the facility and, accordingly, the proposed development application boundary incorporates the entirety of the existing facility including access road and entrance.

The existing waste management infrastructure comprises a non-hazardous waste landfill and a biowaste composting facility. In addition to the main waste infrastructure, the existing facility comprises a private site entrance, high-quality 4.8km long access road from the R403, weighbridge, access control kiosk, administration building, car parking, maintenance building, domestic wastewater treatment system and surface water drainage network.

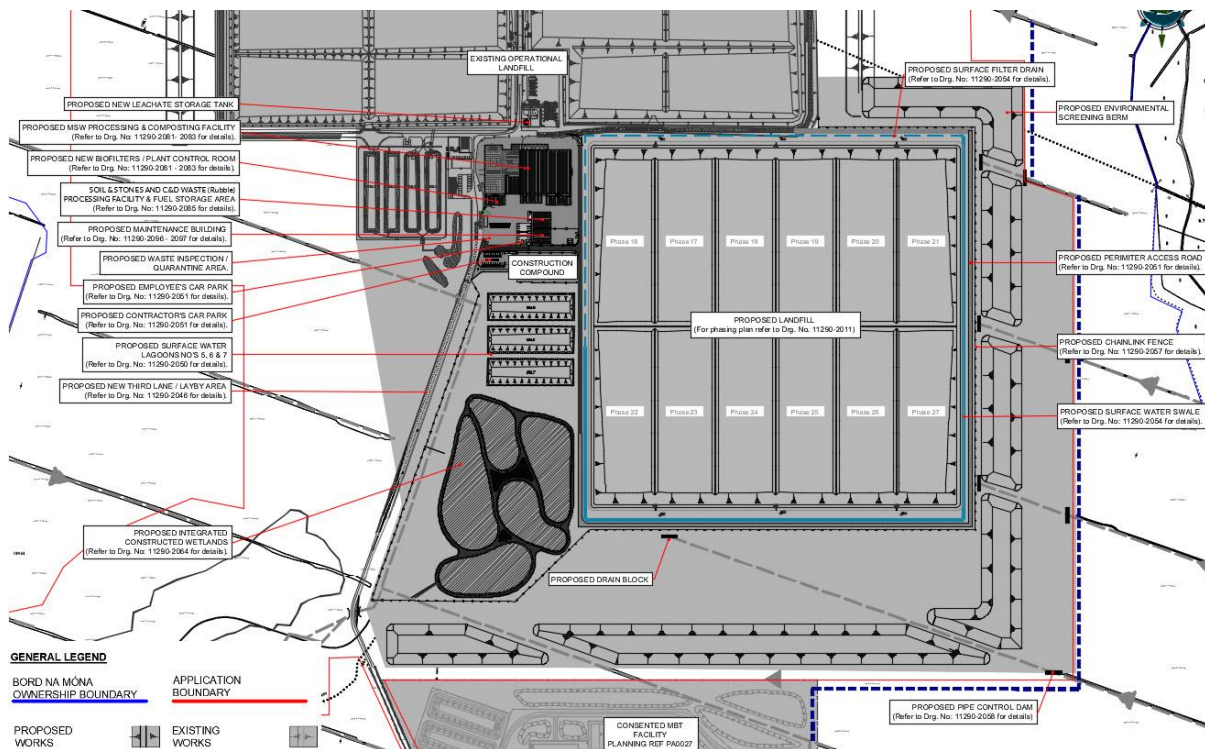


Figure 1–2 Proposed Site Layout

Drehid has been historically used for the production of sod peat for energy generation. As a result, a network of existing, manmade land drains are present at the existing subject site, constructed to lower the water table in the bog. As part of the proposed development, existing land drains will be diverted around the proposed development (See Figure 1–3).

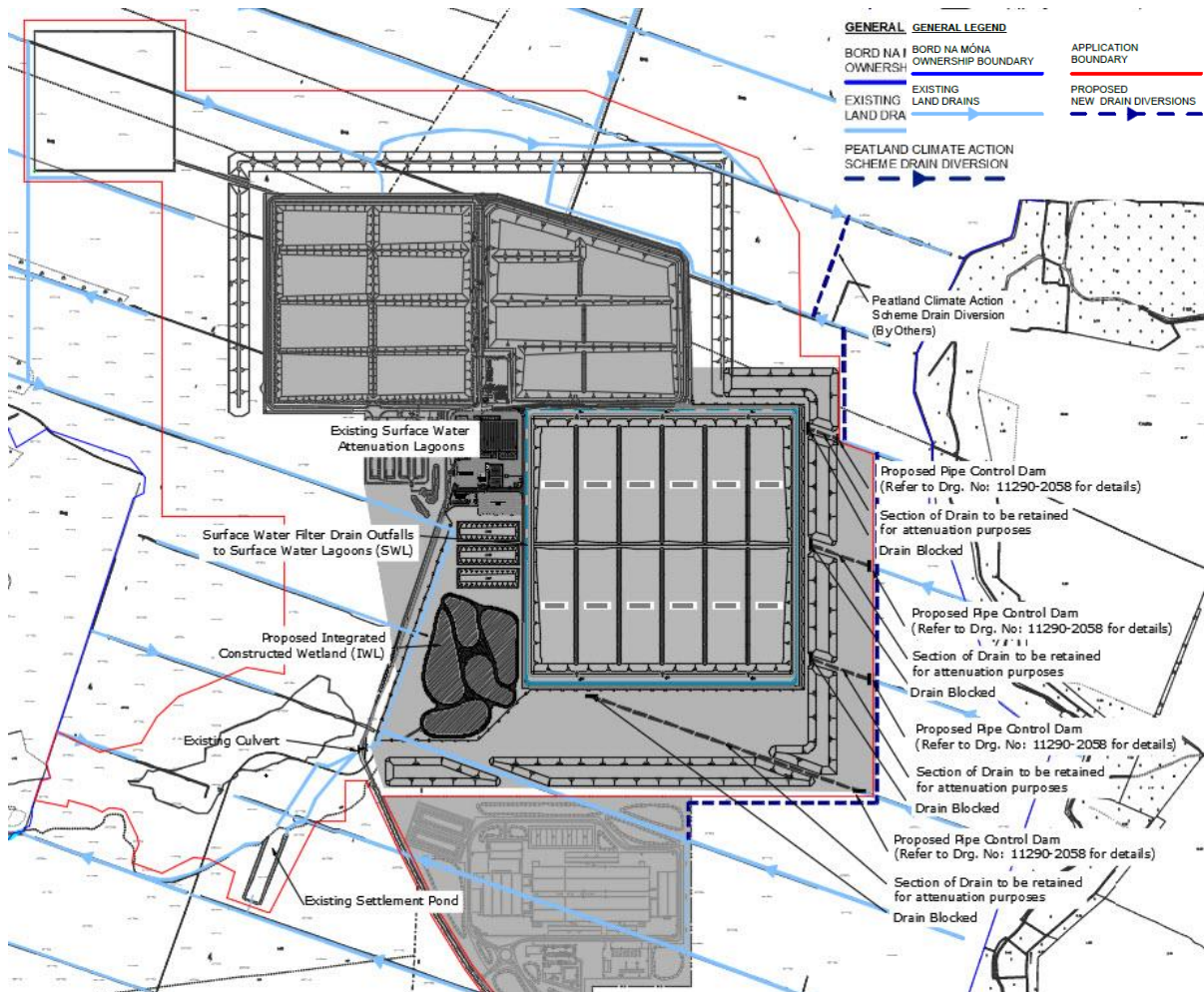


Figure 1–3 Proposed Drainage Layout

2.0 FLOOD RISK MANAGEMENT GUIDANCE

This Strategic Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Kildare County Development Plans 2017-2023
- Draft Kildare County Development Plan 2023-2029

2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of flood zones A, B, and C, which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The PSFRM Guidelines also categorise different types of development into three vulnerability classes based on their sensitivity to flooding. Waste Treatment facilities (such as the works proposed as part of the proposed Landfill expansion) are considered “highly vulnerable” in terms of their sensitivity to flood risk.

Table 2-1 shows a decision matrix that indicates which types of development are appropriate in each flood zone and when the Justification Test (see Section 2.1.2) must be satisfied. The annual exceedance probabilities used to define each flood zone are also provided.

Table 2-1 Decision Matrix for Determining the Appropriateness of a Development

Flood Zone (Probability)	Annual Exceedance Probability (AEP)	Development Appropriateness		
		Highly Vulnerable	Less Vulnerable	Water Compatible
A (High)	<u>Fluvial & Pluvial Flooding</u> More frequent than 1% AEP	Justification Test	Justification Test	Appropriate
	<u>Coastal Flooding</u> More frequent than 0.5% AEP			
B (Medium)	<u>Fluvial & Pluvial Flooding</u> 0.1% to 1% AEP	Justification Test	Appropriate	Appropriate
	<u>Coastal Flooding</u> 0.1% to 0.5% AEP			
C (Low)	<u>Fluvial, Pluvial & Coastal Flooding</u> Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate

2.1.2 The Justification Test

Any proposed development being considered in an inappropriate flood zone (as determined by Table 2-1) must satisfy the criteria of the Justification Test outlined in Figure 2–1 (taken from the PSFRM Guidelines).

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
 - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
 - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
 - (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
 - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 2–1 Criteria of the Justification Test

2.2 The Flood Risk Management Climate Change Adaptation Plan

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW's approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2-2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

For the purpose of this flood risk assessment, we have assessed the proposed development against the Mid-Range Future Scenario as it represents a likely future scenario.

2.3 Kildare County Development Plan 2017-2023

The current Kildare County Development Plan provides a strategic framework for land use planning for 2017 to 2023.

Chapter 7 Infrastructure section 7.2 outlines the Kildare County approach to Surface Water and Flooding, incorporating the PSFRM Guidelines.

2.4 Draft Kildare County Development Plan 2023-2029

The current Kildare County Development Plan provides a strategic framework for land use planning for 2023 to 2029.

Chapter 6 the Infrastructure and Environmental Services chapter has a section 6.7 which outlines the Kildare County approach to Flood Risk Management, incorporating the PSFRM Guidelines. The Draft Development Plan sets out one policy and seven key Flood Management Objectives:

IN P5	Ensure the continued incorporation of Flood Risk Management and National Flood Risk Policy (2018) into the spatial planning of Kildare, to meet the requirements of the EU Floods Directive and the EU Water Framework Directive and to promote a climate resilient County.
IN O29	Support and co-operate with the Office of Public Works (OPW) in delivering the Flood Relief/Alleviation schemes and measures contained in the Flood Risk Management Plans adopted by the Council in July 2018, and in other flood management works and schemes, as may arise, through the OPW Non-Coastal Minor Works Programme.
IN O30	Support the implementation of the EU Flood Risk Directive (2007/60/EC) on the assessment and management of flood risks and the Flood Risk Regulations (SI No 122 of 2010).
IN O31	Manage flood risk in the county in accordance with the sequential approach and requirements of the Planning System and Flood Risk Management Guidelines for Planning Authorities, DECLG and OPW (2009) and circular PL02/2014 (August 2014), when preparing plans, programmes, and assessing development proposals. To require, for lands identified in the Strategic Flood Risk Assessment, a site-specific Flood Risk Assessment to an appropriate level of detail, addressing all potential sources of flood risk, demonstrating compliance with the Guidelines or any updated version of these guidelines, paying particular attention to avoidance of known flood risk, residual flood risks and any proposed site-specific flood management measures.
IN O32	Recognise the important role of natural boglands and other wetland areas in flooding patterns. Development in these areas shall therefore be subject to a Flood Risk Assessment in accordance with the relevant guidelines.
IN O33	Require development proposals which may affect canals and their associated infrastructure to prepare a Flood Risk Assessment in accordance with the relevant guidance.

IN O34	Require that development along urban watercourses comply with the Inland Fisheries Ireland Guidance: Planning for Watercourses in the Urban Environment (2020), including the maintenance of a minimum riparian zone of 35 metres for river channels greater than 10 meters in width, and 20 meters for river channels less than 10 metres in width. Development within this zone will only be considered for water compatible developments as defined in the OPW Planning System and Flood Risk Management Guidelines for Planning Authorities (2009).
IN O35	Protect any implemented/constructed flood relief schemes from inappropriate development or otherwise.

3.0 EXISTING FLOOD RISK INFORMATION

3.1 Past Flood Events

The OPW's National Flood Information Portal¹ provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data. Based on the flood map shown in Figure 3–1, a recurring flood event has been recorded near the site entrance of the subject site.

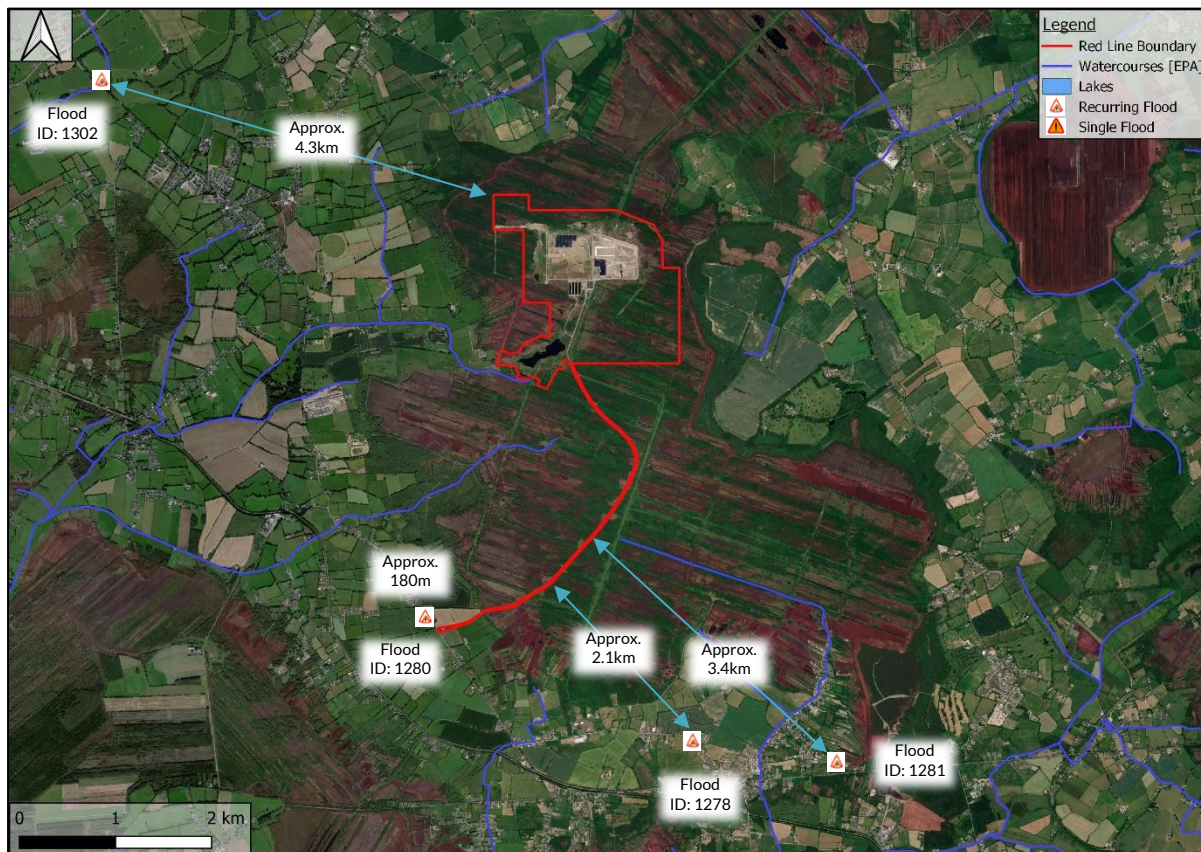


Figure 3–1 OPW Flood Map of Past Flood Events

Meeting minutes from a meeting with the Clane Area Engineer on 3rd June 2005² lists four locations within the vicinity of the proposed site location that is subjected to recurring flooding, as follows:

- Killinagh (Flood ID: 1280) – Area floods after heavy rain every year. The culverts of a stream under the Grand Canal can't take volume of water.

¹ floodinfo.ie

² https://www.floodinfo.ie/map/pf_addinfo_report/5230/

3.2 OPW Preliminary Flood Risk Assessment (PFRA) Study

In 2009, the OPW produced a series of maps to assist in the development of a broad-scale FRA throughout Ireland. These maps were produced from several sources.

The OPW’s National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 noted that *“the flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location”*³.

Limitations on potential sources of error associated with the PFRA maps include:

- Assumed channel capacity (due to absence of channel survey information)
- Absence of flood defences and other drainage improvements and channel structures (bridges, weirs, culverts)
- Local errors in the national Digital Terrain Model (DTM)

Figure 3–2 provides an overview of the fluvial, coastal, pluvial, and groundwater indicative flood extents in the vicinity of the subject site.

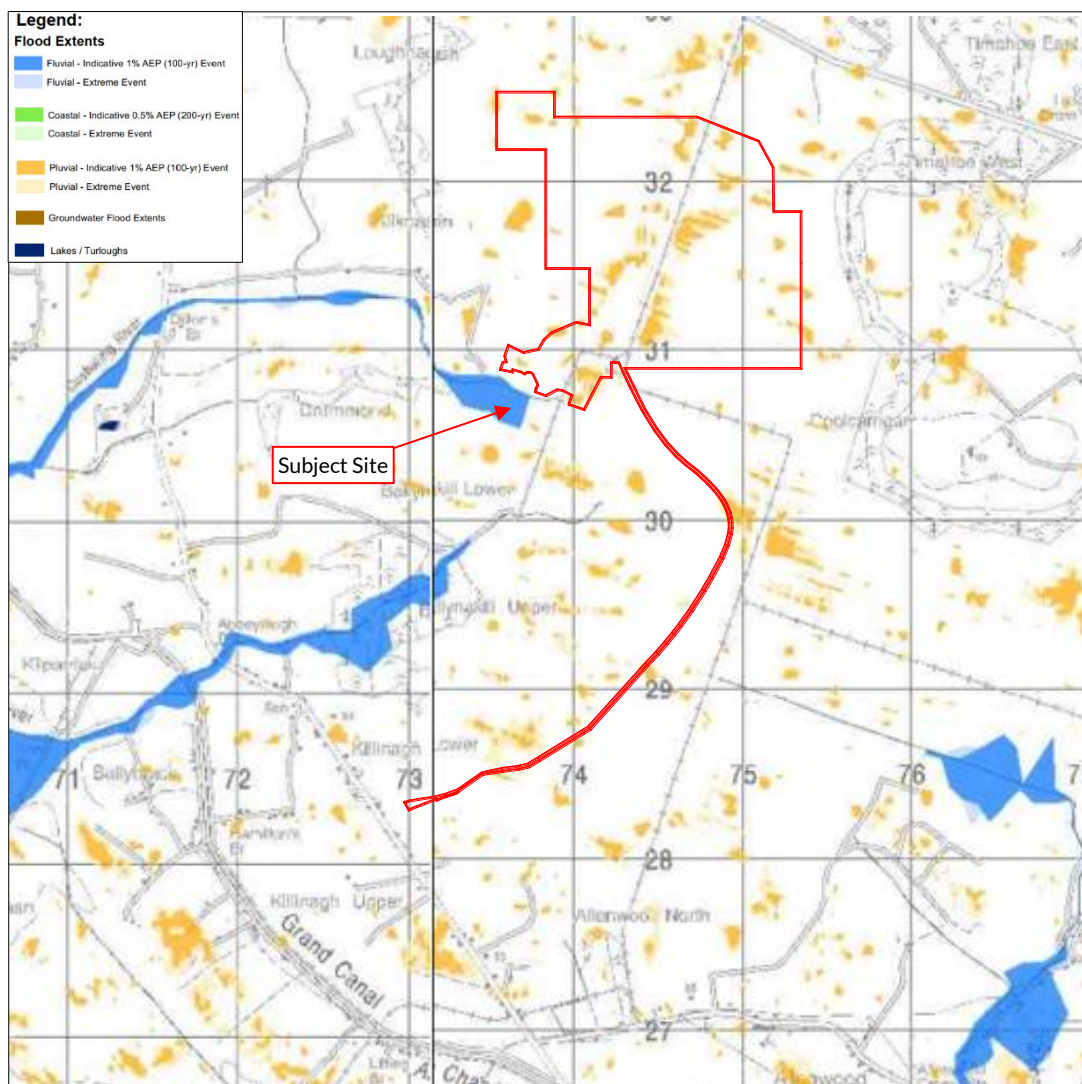


Figure 3–2 Indicative Flood Mapping [extract from PFRA Map 235 & 236]

³ The National Preliminary Flood Risk Assessment (PFRA) Overview Report, OPW (March 2012)

3.2.1 National Indicative Fluvial Mapping (NIFM)

In 2020, the OPW produced the second-generation indicative fluvial flood mapping, improving upon the first generation PFRA and producing higher quality flood maps⁴.

The NIFM Flood Mapping Technical Data notes that “Cross sectional surveys have not been used to define the dimensions of river channels and structures within the 2D model. Channels have been represented in the 2D model by assuming their channel capacity is equivalent to the estimation of [the index flood flow]”⁵. The 2D model uses a Digital Terrain Model with a grid scale of 5m.

Figure 3–3 provides an overview of the 1% and 0.1% AEP indicative fluvial flood mapping of some of the watercourses surrounding the site.



Figure 3–3 National Indicative Fluvial Mapping 2020- Existing Scenario

The NIFM current flood extents do not extend to the subject site. It is assumed that these channels are too small to have been assessed as part of the study.

⁴ National Indicative Fluvial Mapping; Applying and Updating FSU Data to Support Revised Flood Risk Mapping for Ireland, Brown et al., Irish National Hydrology Conference 2019

⁵ https://www.floodinfo.ie/map/nifm_user_guidance_notes/

The NIFM update also included an assessment of the likely impact of climate change on flood risk in the area. The flood extents for a Mid-Range Future Scenario are shown in Figure .



Figure 3—4 National Indicative Fluvial Mapping 2020- Mid-Range Future Scenario

The NIFM MRFS flood extents do not extend to the subject site. It is assumed that these channels are too small to have been assessed as part of the study.

3.3 OPW Arterial Drainage

The Boyne Arterial Drainage Scheme was initiated in 1969, and completed in 1986, comprising of 119,000 acres of benefitting land, river channels and embankments, within the counties Meath, Westmeath, Louis, Cavan, Kildare and Offaly.⁶

As shown in Figure 3–5, the Arterial Drainage Scheme includes channel works at the adjacent watercourses.

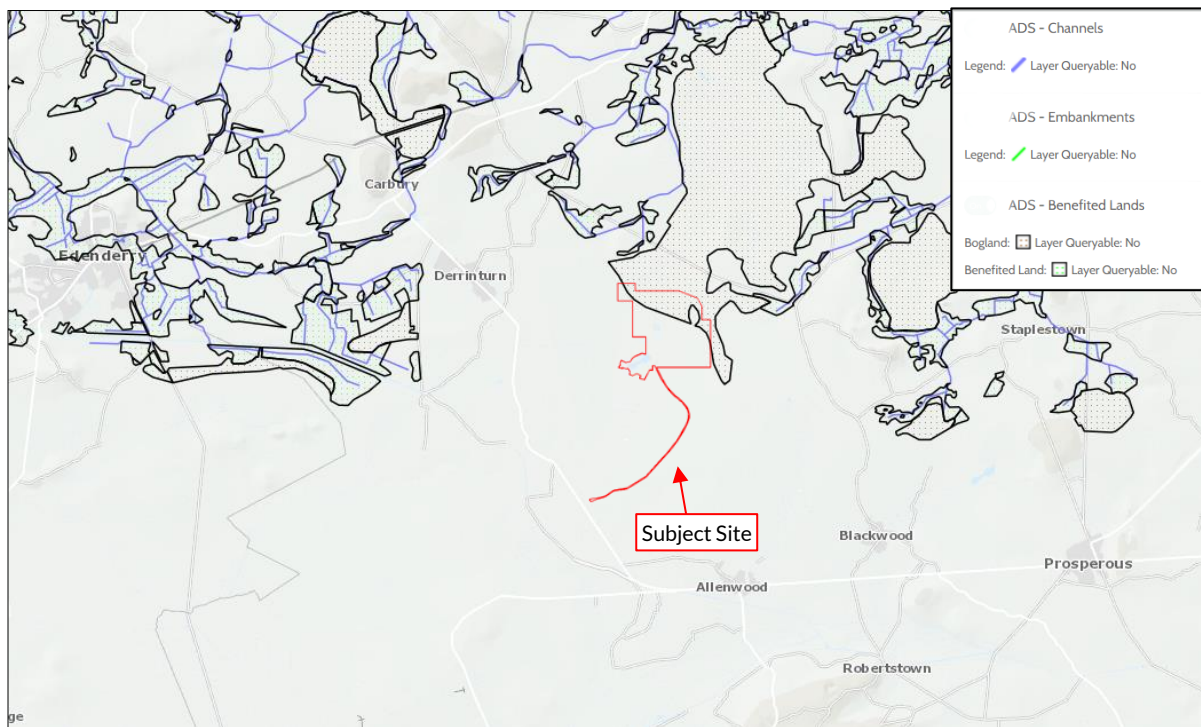


Figure 3–5 OPW Arterial Drainage Flood Relief Scheme

⁶ www.floodinfo.ie

3.4 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping⁷ with data related to Ireland’s subsurface. Based on the map shown in Figure 3–6, the nearest karst features to the subject site are, a spring approximately 8.6km north-east, the Toberhale (Spring) approximately 12.6km north-west, and the Clonbulloge (Spring) approximately 12.9km southwest of the subject site. There are no karst features (caves, springs, turloughs, etc.) in the immediate vicinity of the proposed development.

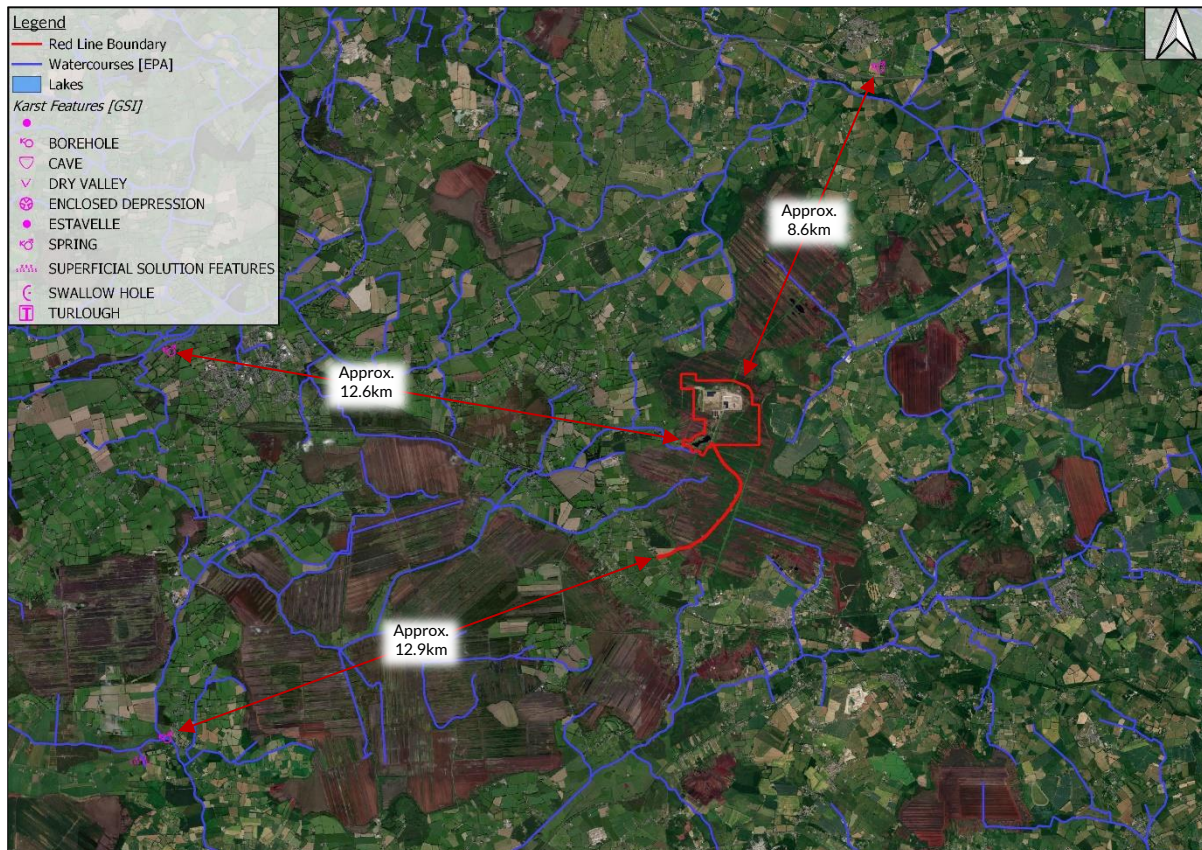


Figure 3–6 GSI Mapping of Karst Features

⁷ <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>

As shown in **Error! Reference source not found.**, as part of their recent GW Flood project, the nearest predicted area of groundwater flooding to the subject site is approx. 32.7km south-east of the subject site.

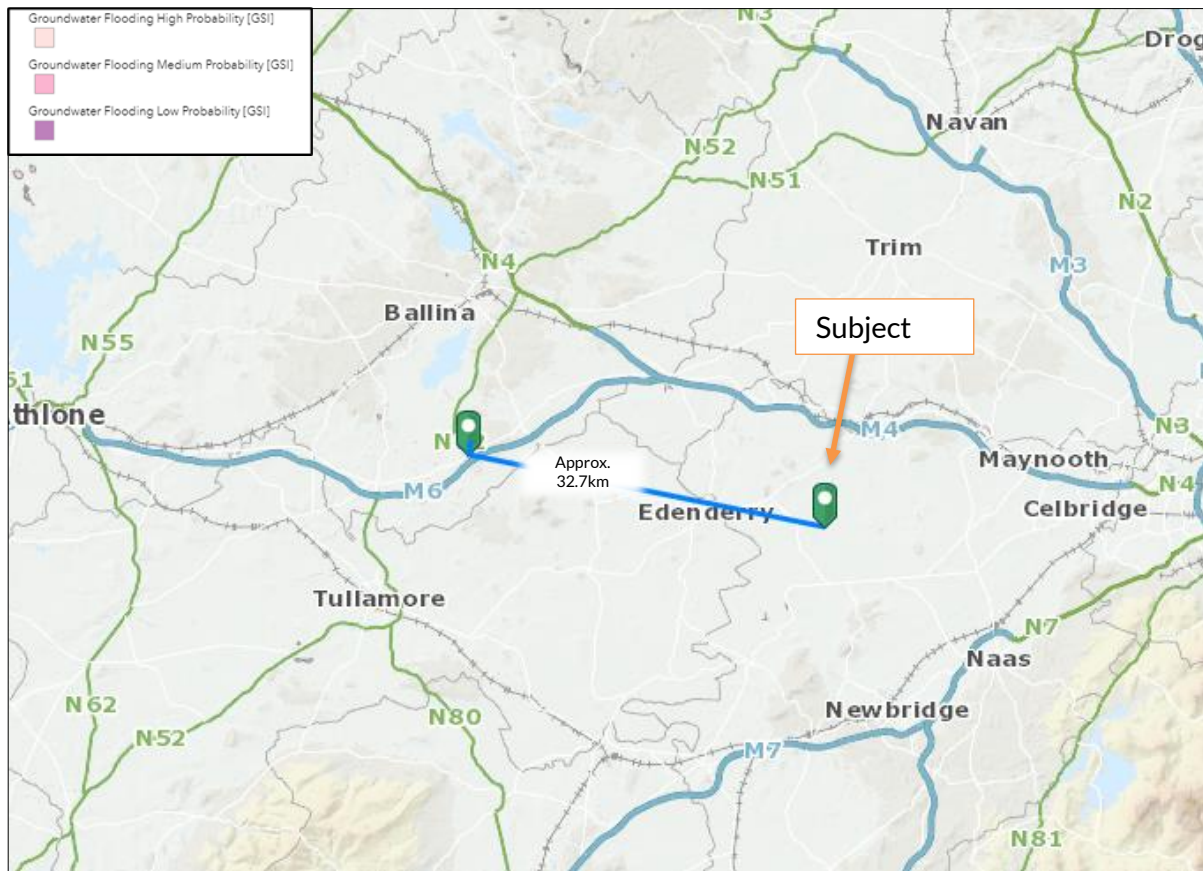


Figure 3–7 GSI Indicative Groundwater Flood Mapping

4.0 DETAILED FLOOD RISK ASSESSMENT

With reference to the PSFRM Guidelines, the proposed Landfill development is classified as “highly vulnerable” in terms of sensitivity to flooding. As such, the proposed Landfill development is only appropriate in Flood Zone C.

4.1 Fluvial Flooding

Several watercourses originate in the vicinity of the proposed site. The Figile River (also known as the Cushaling River) rises at the southwestern boundary of the subject site. The Abbeylough River, a tributary of the Figile River, originates approx. 1,000m south of the proposed development is the nearest watercourse to the proposed development with the exception of the Figile River.

Based on the results of OPW modelling (PFRA, NIFM), the subject site is located outside the predicted 0.1% AEP flood extents (see Figure 3–2, Figure 3–3, Figure 3–4).

As per Section 1.1, a network of existing, manmade land drains are present at the existing subject site. As part of the proposed development, existing land drains will be diverted around the proposed development (See Figure 1–3). The proposed stormwater drainage system and land drain diversions have been designed in accordance with Sustainable Drainage Systems (SuDS) principles.

Based on the available information, it is estimated that risk of fluvial flooding associated with the proposed development is minimal.

4.2 Pluvial Flooding

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that parts of the subject site may be liable to pluvial flooding during an extreme 0.1% AEP pluvial flood event (see Figure 3–2).

Any localized depressions or areas where surface water ponding may indicated by the PFRA mapping will be removed to facilitate the development of the proposed waste management facility expansion.

Surface water arising at the proposed development site will be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

4.3 Groundwater Flooding

There are no karst features located within a 500m radius of the site (see Figure 3–6). The closest karst feature to the site is located 8.6km north-east of the subject site. The nearest predicted groundwater flooding is 32.7km north-west to the site.

Older hydraulic modelling completed by HR Wallingford as part of the PFRA Study (see Figure 3–2) does not indicate groundwater flooding as a potential source of flood risk to the proposed development site.

Therefore, it is estimated that the risk of groundwater flooding to the proposed development is minimal.

4.4 Coastal Flooding

The subject site is located more than 43km inland, with site elevations in the region of approximately 82.128mOD. The nearest predicted 0.1% AEP MRFS coastal flood level at Dublin is estimated by the Irish Coastal Protection Strategy Study (ICPSS) to be approximately 3.25mOD⁸; therefore, it is estimated that the lands are not at risk of coastal flooding.

4.5 The Justification Test

With reference to the PSFRM Guidelines, the proposed Landfill development is classified as “highly vulnerable” in terms of sensitivity to flooding.

Based on the findings of this Flood Risk Assessment, the subject site is located in Flood Zone C, i.e. there is less than a 0.1% Annual Exceedance Probability (AEP) of pluvial/fluvial/coastal/groundwater flooding.

As the Planning System and Flood Risk Management Guidelines consider Waste Treatment developments appropriate in Flood Zone C the Justification Test does not need to be applied.

⁸ Irish Coastal Protection Strategy Study – Phase III Map No: NE/ RA / EXT /20 (Jan 2010) – Node 23

5.0 CONCLUSIONS

TOBIN Consulting Engineers were commissioned by Bord Na Móna to carry out a Flood Risk Assessment (FRA) at the Drehid Waste Management Facility (WMF), for a proposed expansion of the existing facility to increase waste capacity at the Drehid WMF.

The proposed Landfill development is considered “highly vulnerable” in terms of their sensitivity to flooding under the Planning System and Flood Risk Management (PSFRM) Guidelines (OPW/DoEHLG, 2009). The proposed works are therefore only considered appropriate in Flood Zone C.

Fluvial Flooding:

As per Section 4.1, Based on the results of OPW modelling (PFRA, NIFM), the subject site is located outside the predicted 0.1% AEP flood extents (see Figure 3–2, Figure 3–3, Figure 3–4). The proposed stormwater drainage system and land drain diversions as part of the proposed development have been designed in accordance with Sustainable Drainage Systems (SuDS) principles.

Based on the available information, it is estimated that risk of fluvial flooding associated with the proposed development is minimal.

Pluvial Flooding:

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that parts of the subject site may be liable to pluvial flooding during an extreme 0.1% AEP pluvial flood event (see Figure 3–2).

Referring to Section 4.2, localized depressions or areas where surface water ponding may indicated by the PFRA mapping will be removed to facilitate the development of the proposed waste management facility expansion and surface water arising at the proposed development site will be managed by a dedicated stormwater drainage system in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The landscaping and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

Groundwater Flooding:

Referring to Section 4.3, a review of the GSI mapping and PFRA mapping indicates that the risk of groundwater flooding at the subject site is minimal.

Coastal Flooding:

As per Section 4.4, the proposed development site is not at risk of coastal flooding due to its elevation and distance inland.

Based on the results of this Stage 2 Flood Risk Assessment, the subject site is appropriately located in Flood Zone C in accordance with the Planning System and Flood Risk Management Guidelines. It is predicted that the proposed works will not adversely impact flood risk elsewhere in the catchment.

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