Waterman Moylan
Engineering Consultants

Additional Flood Risk Assessment (Accompanying Oldtown Phase 5 Planning Package)

Stormwater Storage Tank on Foul Water Network at Balheary Road, Swords, Co. Dublin

March 2022

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This document has been prepared and checked in accordance with
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Comments

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1. Introduction

This additional flood risk assessment report (AFRA) has been prepared by Waterman Moylan as part of the planning documentation for Oldtown Phase 5, in support of the proposed Stormwater Storage Tank required on the Irish Water foul water network, draining to the Swords Wastewater Treatment Plant and serving the Oldtown / Mooretown and Holybanks catchment in Swords, Co. Dublin. The proposed tank will alleviate constraints within the Irish Water foul water system (including the subject application site, Oldtown Phase 5), that occur during times of heavy or prolonged rainfall, resulting from surface water and foul water infiltration.

1.1 Flood Risk Assessment: Statement of Design Consistency

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors. This report provides an assessment of the subject site for flood risk purposes only.

1.2 Site Description

The proposed site for the Stormwater storage tank is located on the junction of the Glen Ellan Road and the Balheary Road, Swords, Co. Dublin, as indicated in *Figure 1* below. The site is 1.4km north of Swords, 1.1km west of the M1 motorway and 300m south of the Broadmeadow River. The site is owned by Gannon Properties and is locally referred to as the Celestica/Motorola site.

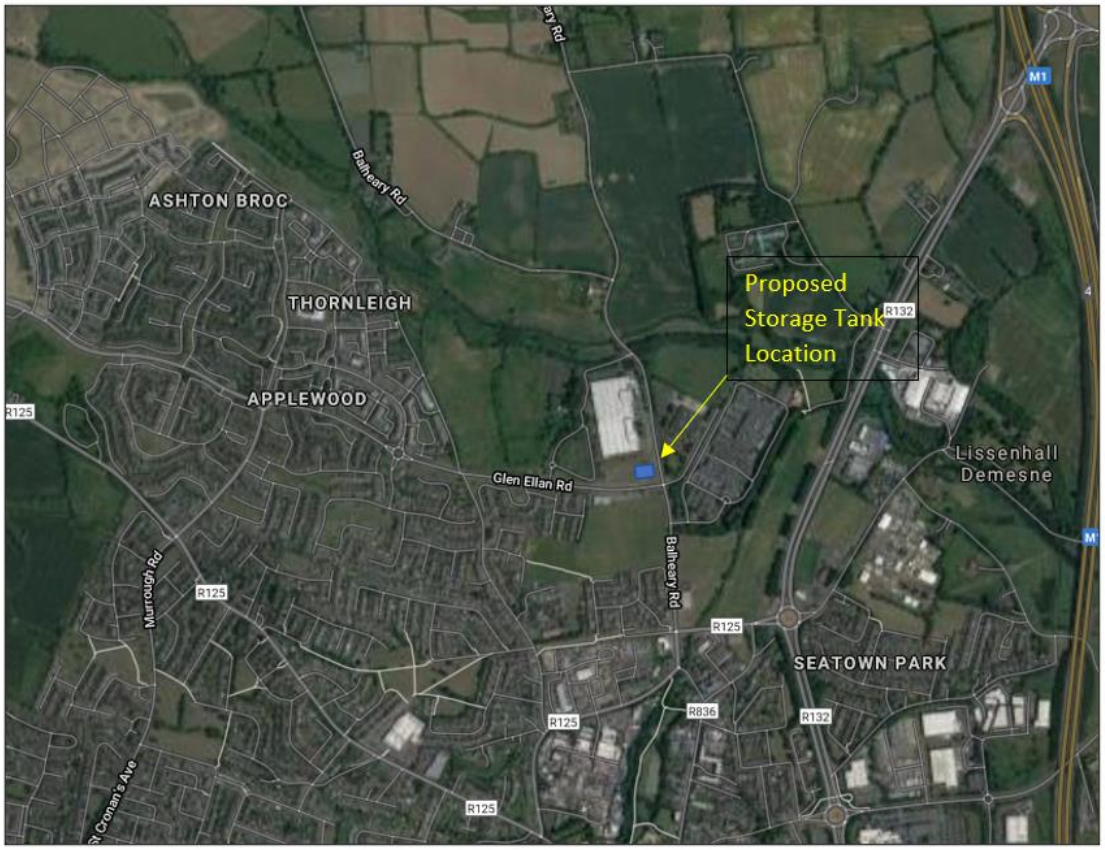


Figure 1 | *Site Location (Source: Google Earth)*

The existing ground topography of the proposed storage tank location ranges from 6.30m-6.90m, with gentle gradients falling from west to east and from north to south.

1.3 Proposed Development

It is proposed to supply a Stormwater storage tank and outfall utilising lands on the Celestica site to alleviate known constraints in the foul water network that services the Oldtown / Mooretown / Holybanks lands catchments. Irish Water have undertaken a model review of the constraints within the network and determined that a tank of 2,250m3 volume is required. It is proposed to also provide a new outfall sewer along the Balheary Road to the Broadmeadow River, for overflow of the excess stormwater within the foul network during the more extreme rainfall events.

Following a review of three different locations in the area, Irish Water have suggested that the most suitable location for the tank would be at the junction of the Balheary Road and Glen Ellen Road (refer *Figure 1*) This area is the lowest point along the network that can be accessed by an adjacent road and facilitates an overflow to the Broadmeadow River via gravity. Gannon Homes own the Motorola / Celestica site at this junction and have agreed with Irish Water to apply for and construct the storage tank at this location.

The proposed storage tank will provide sufficient capacity to serve the catchment of Oldtown / Mooretown / Holybanks, facilitating continued future development in the catchment. The existing constraints within the foul network are currently inhibiting development.

These constraints in this foul water network have been noted in all Oldtown and Mooretown planning permissions since the commencement of this development. Until now Fingal County Council and more recently Irish Water have allowed construction to continue in this catchment whilst they have been preparing their hydraulic model of this catchment in its current and future scenario.

In December 2020, Irish Water confirmed that following recent modelling of the foul water network, that they will not be issuing further Connection Agreements in this area, until such time that the capacity constraints are either fixed or have an agreed solution and programme in place. These critical wastewater infrastructure works will be developer led, utilising the data and modelling input received from Irish Water to form the basis of the planning documentation.

The storage tank has been designed in conjunction with Irish Water input on volumetric storage capacity and was lodged as a planning application to Fingal County Council by the subject applicant. The application was registered under planning Reg. Ref. F21A/0476 and is currently a live application at Additional Information stage which is due for decision in mid-April 2022 (current status at the time of writing this report). Thus, it was deemed appropriate to propose the tank and the associated works as part of this SHD application.

This AFRA should be read in conjunction with Waterman Moylan's Storage Tank Engineering Assessment (AEAR) and Preliminary Construction Environmental Management Plan (APCEWMP).

This report should also be ready with the following reports/packages:

- Screening Report for AA and NIS, as well as the Ecological Impact Assessment, all prepared by Openfield,
- Stormwater Overflow & Receiving Stream (Broadmeadow) Assimilation Simulation Evaluation Reports, prepared by AWN Consulting and Hydro-G.
- Assessment of Likely Arboricultural Impacts, prepared by The Tree File Ltd.
- CGI Verified View of Outfall prepared by Digital Dimensions

- Landscape Plan prepared by Doyle O'Troithigh

1.4 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Groundwater – flooding from springs / raised groundwater
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring and the possible consequences.

1.4.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	***Moderate***	***High***
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

Table 1 | *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.4.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.4.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

		Consequences		
		Low	***Moderate***	***High***
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 2 | *3x3 Risk Matrix*

2. Tidal

2.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

2.2 Pathway

The site is approximately 1.5km west of the nearest coastline at the Malahide Estuary, as shown in *Figure 2*. This figure is extracted from the OPW's flood information portal, shows that the site is not at risk of coastal flooding for even the 1-in-1,000-year flood event. The Dublin Coastal Protection Project indicates that the 2002 high tide event reached 2.95m OD Malin. The lowest existing ground level on site is approx. 6.85m, almost 3m above the historic high tide event.

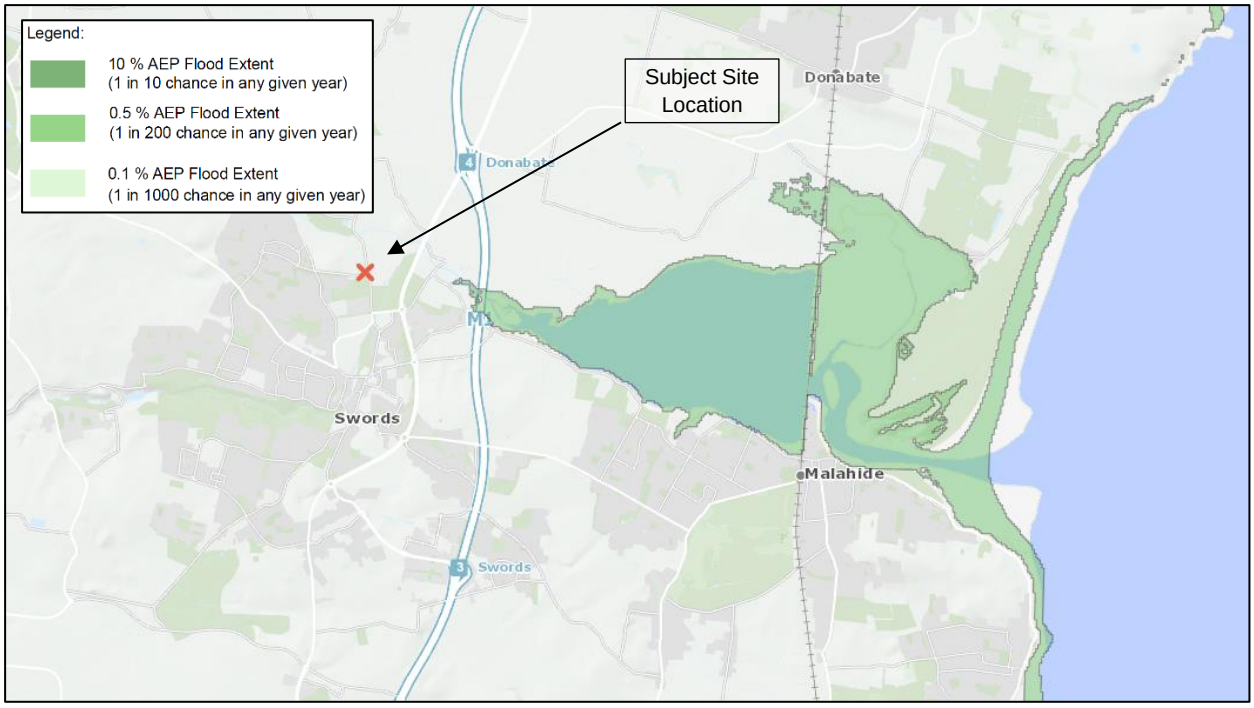


Figure 2 | *Extract from the FEM FRAMS Tidal Flood Extents Map*

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200-year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000-year storm). The map indicates that the subject development is not at risk of flooding for the 1-in-1,000-year event.

Given that the site is located 1.5 kilometres inland from the Irish Sea, that there is almost 3m level difference between the proposed buildings and the high tide and given that the site is outside of the 1-in-1,000-year flood plain, it is evident that a pathway does not exist between the source and the receptor. The risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented in this regard.

3. Fluvial

3.1 Source

Fluvial flooding occurs when a river / water course's flow exceeds its capacity, typically following excessive rainfall, though it can also result from other causes such as heavy snow melt and ice jams.

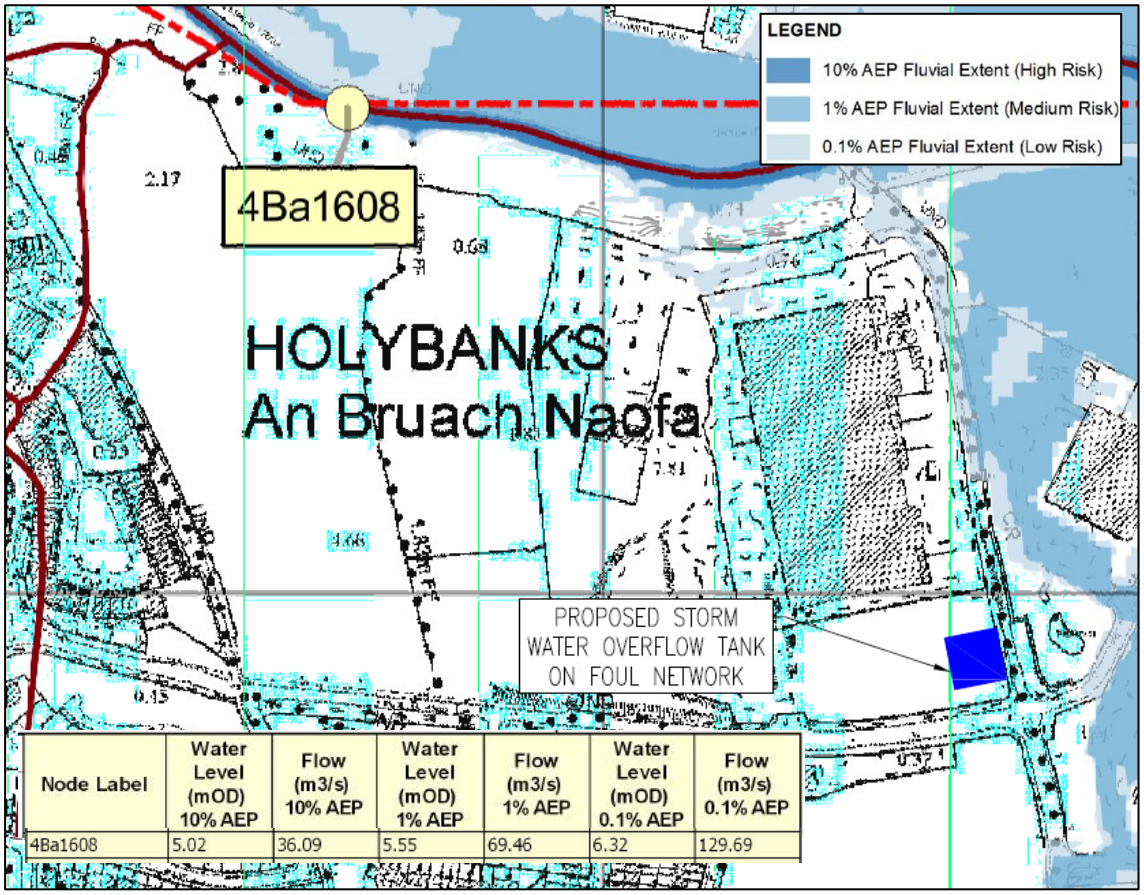
3.2 Pathway

The subject site is located within the Broadmeadow River catchment.

The Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS) maps, available on the OPW's National Flood Information Portal and extracted below, shows that none of the subject site falls within the 0.1% AEP (1-in-1,000 year) flood plain, as shown in *Figure 3.*

The nearest node point, reference number: 4Ba1608, located circa 400m to the north-west, will have a 1-in-1,000-year flood event water height of 6.32m, half a metre below the lowest height of 6.85m on the subject lands.

The subject application tank will have an outfall overflow pipe that will drain to the Broadmeadow River, as explained in the accompanying Engineering Assessment Report. As such, a fluvial pathway from the Broadmeadow River to the subject site will exist via this overflow outfall pipe, however this is mitigated against via a non-return valve as explained in section 3.6, overleaf.



Node Label	Water Level (mOD) 10% AEP	Flow (m3/s) 10% AEP	Water Level (mOD) 1% AEP	Flow (m3/s) 1% AEP	Water Level (mOD) 0.1% AEP	Flow (m3/s) 0.1% AEP
4Ba1608	5.02	36.09	5.55	69.46	6.32	129.69

Figure 3 *| Extract from the FEM FRAMS Fluvial Flood Extents Map "BRO/HPW/EXT/CURS/009"*

3.3 Likelihood

The site is outside of the 1-in-1,000-year flood plain, however, given that a pathway exists between the tank via the proposed overflow outfall line to the Broadmeadow River the likelihood of fluvial flooding is high.

3.4 Consequence

The consequence of fluvial flooding would be that the proposed overflow tank would fill via the outfall pipe during storm events, rendering it's intended purpose obsolete. There would also be some minor inundation at ground level. Therefore, the consequences of fluvial flooding occurring at the proposed development is considered high.

3.5 Risk

There is an extremely high risk of fluvial flooding as the likelihood is high and the consequence is high.

3.6 Flood Risk Management

The proposed tank site has been designed to be above the adjacent road network through which overland flood routing drains to the Broadmeadow River.

The proposed development has designed finished levels generally over 200mm above the local road network to minimise the risk of flooding from overland flows. The result of this is a significant reduction in the risk of flooding for the subject site.

To mitigate against the risk of fluvial flooding of the proposed tank via the outfall pipe, a one-way non-return flap is proposed at the outfall, ensuring that the overflow tank and overflow outfall remains functional during extreme fluvial events.

3.7 Residual Risk

As a result of the above proposed flood risk management measures, the residual risk of fluvial flooding is considered low.

4. Pluvial

4.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	**Receptor**
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 3 | *Pathways and Receptors*

4.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

4.3.1 Surcharging of the proposed on-site drainage systems:

The proposed on-site tank has been designed to accommodate in excess of 5-year return event, up to a capacity of 2,250m3, which indicates that on average the internal system may surcharge during rainfall events with a return period in excess of five years. The proposed installation of an overflow outfall pipe to the Broadmeadow for events in excess 2,250m3 ensures that the likelihood surcharging of the on-site drainage system is considered low.

4.3.2 Surcharging from the existing surrounding drainage system:

The OPW's on-line portal was again consulted to ascertain the details of any local historic flood events. *Figure 4* overleaf, shows that there is no record of a previous flood event at the subject site, with the nearest historic flood event occurring approx. 400m away to the east. Information on this flood event shows that it occurred in August 2008. The report notes that a significant heavy and prolonged rainfall in the Dublin region caused flooding not only in this location but also in the greater Dublin region.

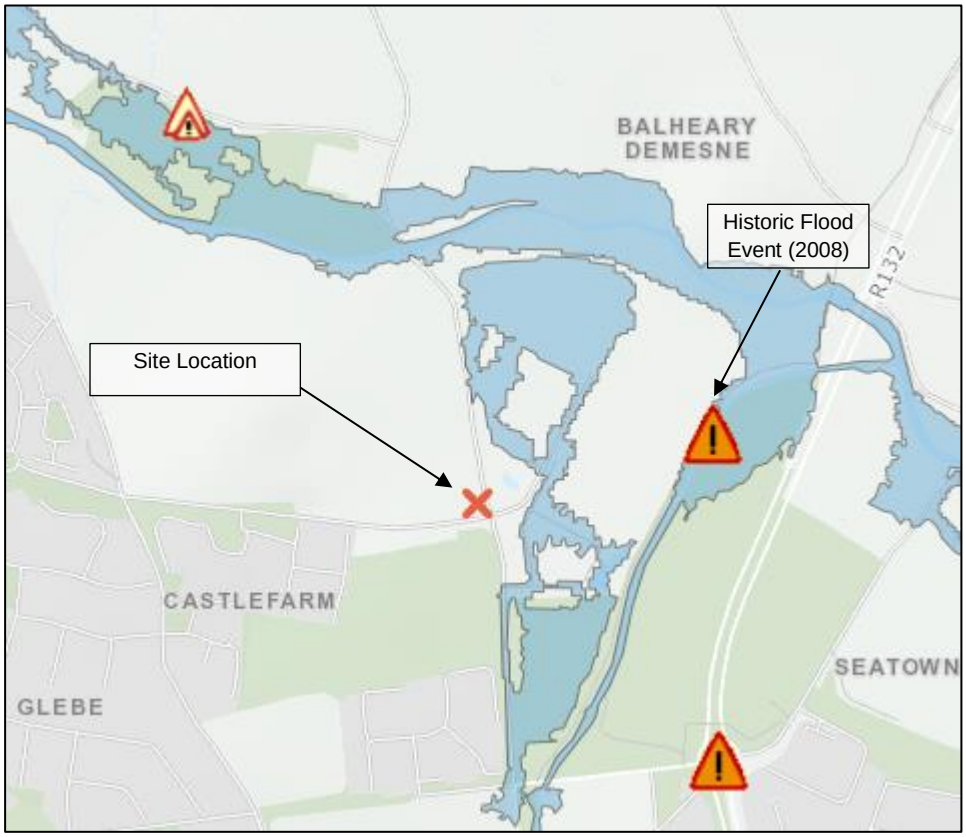


Figure 4 | *Local Flood Event History Extracted from OPW's National Flood Hazard Maps*

With no history of flooding in the area due to surcharging, the likelihood of such flooding occurring is considered low.

4.3.3 Surface water discharge from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of surface water discharge from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.3.4 Overland flooding from surrounding areas:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records referred to above, it is considered that there is a low likelihood of flooding from surrounding areas.

4.3.5 Overland flooding from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered moderate.

4.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas of the site. The consequences of pluvial flooding are considered moderate.

4.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

4.5.1 Surcharging of the proposed on-site drainage systems:

With a low likelihood and moderate consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is low.

4.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate consequence of flooding the site from the existing surface water network, the resultant risk is low.

4.5.3 Surface water discharge from the subject site:

With a moderate likelihood and moderate consequence of surface water discharge from the subject site, the resultant risk is moderate.

4.5.4 Overland flooding from surrounding areas:

With a low likelihood and moderate consequence of overland flooding from the surrounding areas, the resultant risk is low.

4.5.5 Overland flooding from the subject site:

With a moderate likelihood and moderate consequence of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

The following are flood risk management strategies proposed to minimise the risk of pluvial flooding for each risk:

4.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site tank and the associated overflow outfall line to the Broadmeadow River. Open grassed areas and permeable finish to the maintenance access road in accordance with Irish Water CoP requirements will ensure that these areas act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site.

These proposed source and site controls will intercept and slow down the rate of runoff from the site to the on-site drainage system, reducing the risk of surcharging.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

4.6.2 Surcharging from the existing surrounding drainage system:

The risk of flooding due to surcharging of the existing surface water network is minimised with overland flood routing through the adjacent road network.

4.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1 above,

4.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low.

4.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing permeable features to intercept and slow down the rate of runoff from the site to the existing surface water sewer system, as described in Section 4.6.1 above.

4.7 Residual Risk

As a result of the design measures detailed above in Section 4.6, there is a low residual risk of flooding from each of the surface water risks.

5. Groundwater

5.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

5.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, underground services and infrastructure could also be affected by high water tables that do not reach the ground surface.

5.3 Receptor

The receptors for ground water flooding would be underground services/infrastructure and roads.

5.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies within an area with low to moderate groundwater vulnerability.

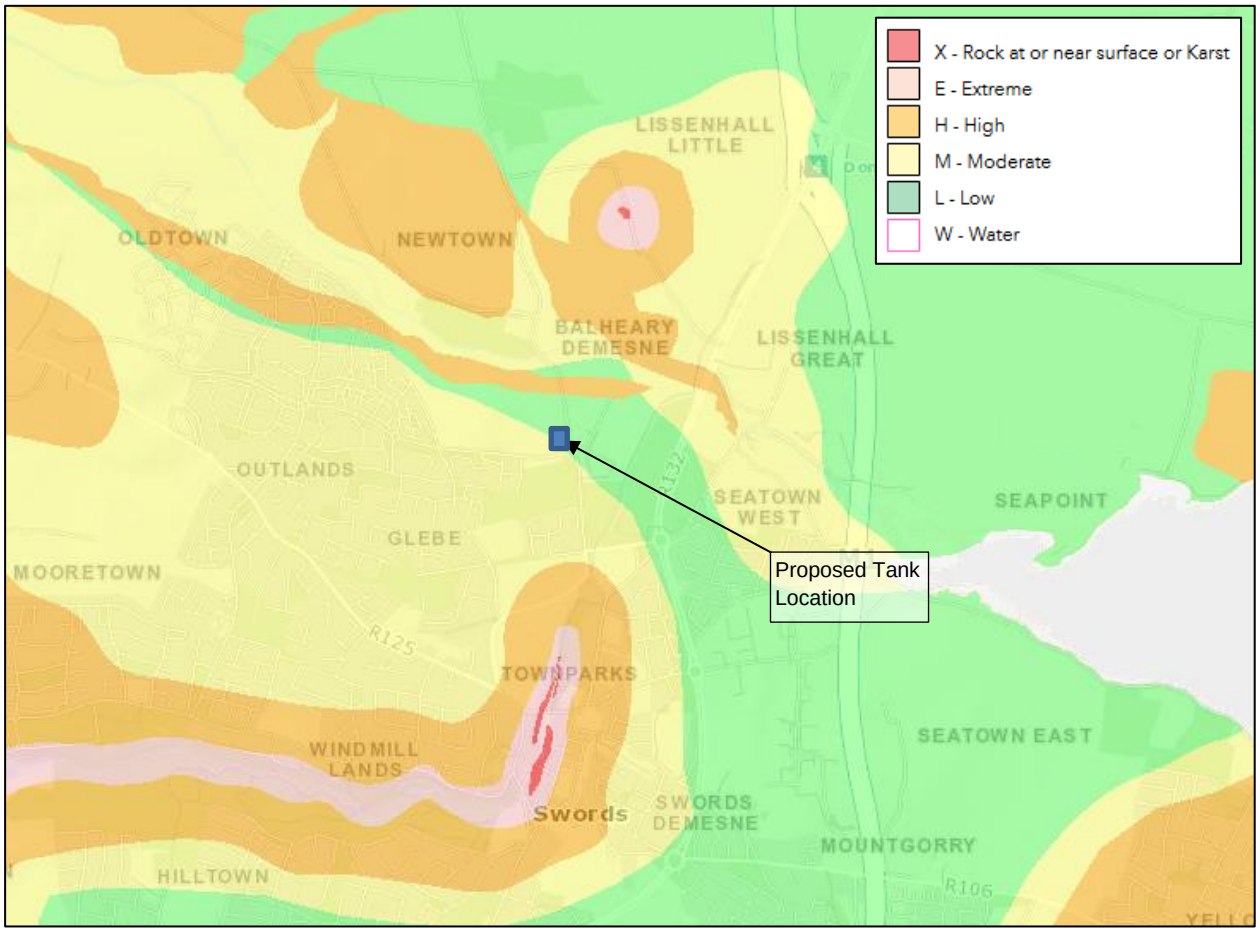


Figure 5 | *Extract of Groundwater Vulnerability Map*

With the site falling within an area with low to moderate groundwater vulnerability, the likelihood of groundwater rising through the ground and causing potential flooding on site during prolonged wet periods is moderate.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground. Underground services and infrastructure could be inundated from high water tables. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

With a moderate likelihood and moderate consequences of flooding due to groundwater, the risk is considered moderate.

5.7 Flood Risk Management

Finished levels of the ground have been set above the adjacent road levels, as described in Section 3.6, to reduce the likelihood of ground water flooding. As a result, In the event of ground water flooding on site, this water can escape from the site via the overland flood routing.

The tank design will incorporate measures to protect water ingress from below ground level.

5.8 Residual Risk

There is a low residual risk of flooding from ground water.

6. Human/Mechanical Errors

6.1 Source

The subject tank will drain via an overflow outfall pipe to the Broadmeadow River, which in turn outfalls to the Malahide Estuary. The above ground maintenance access to the tank will be kerbed and finished in permeable surfacing.

The internal surface water network is a source of possible flooding were it to become blocked.

6.2 Pathway

If the proposed permeable maintenance access becomes inundated or if the outfall overflow system blocks this could lead to possible flooding within the private and public areas.

6.3 Receptor

The receptors for flooding due to human/mechanical error would be the maintenance access road, adjacent roads and footpaths, and the open landscaped areas around the site.

6.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

6.5 Consequence

The surface water network would surcharge and overflow to the adjacent road network. It is, therefore, considered that the consequences of such flooding are moderate.

6.6 Risk

With a high likelihood and moderate consequence, there is a high risk of surface water flooding should the surface water network block.

6.7 Flood Risk Management

As described in Section 3.6, finished levels have been designed to be above the adjacent road network, which will reduce the risk of flooding if the surface water network were to block. In the event of the surface water system surcharging, the surface water can still escape from the site by overland flood routing without causing damage to the surrounding network.

The surface water network (tank outfall pipe and maintenance access track) will need to be regularly maintained and where required cleaned out. A suitable maintenance regime of inspection and cleaning should be incorporated into the safety file/maintenance manual for the development.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding from human / mechanical error.

7. Conclusions and Recommendations

The subject lands have been analysed for risks from tidal flooding from the Irish Sea and Broadmeadow River, fluvial flooding from Broadmeadow River, pluvial flooding, ground water and failures of mechanical systems. *Table 4*, below, presents the various residual flood risks involved.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Irish Sea (Malahide Estuary)*	*Proposed tank site*	*Extremely low*	*None*	*Extremely low*	*None*	Extremely low
Fluvial	*The River Broadmeadow*	*Proposed tank site*	*High*	*High*	*Extremely high*	*Setting of finished levels, overland flood routing and non-return flap to Outfall pipe*	Low
Pluvial	*Private & Public Drainage Network*	*Proposed tank site and adjacent roads*	*Ranges from moderate to low*	*Moderate*	*Ranges from moderate to low*	*Appropriate drainage, setting of site levels, permeable surfacing*	Low
Ground Water	*Ground*	*Underground services/ infrastructure*	*Moderate*	*Moderate*	*Moderate*	*Appropriate setting of levels, flood routing, tank impervious to groundwater ingress*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed tank site / adjacent roads and footpaths*	*High*	*Moderate*	*High*	*Setting of site levels, overland flood routing, regular inspection of drainage network*	Low

Table 4 | *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the residual risk of flooding from any source is low.

UK and Ireland Office Locations