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Flood Risk Assessment

P1956

Proposed Unmanned Service Station Development, Liffey Valley, Fonthill Road, Clondalkin, Dublin 22.

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1.0 Introduction

McArdle Doyle Ltd. have been instructed by the Client Certas Energy Ireland, to prepare a Site-Specific Flood Risk Assessment (SSFRA) to accompany a Planning Application to South Dublin County Council (SDCC) for a proposed unmanned service station development at Fonthill Road, Clondalkin Dublin 22, on lands south east of the existing Liffey Valley Shopping Centre.

2.0 Existing Site

The proposed development, shown in Figure 1 below, is to be located on an existing circa 2680 sq.m. (0.66 acres) brownfield site which is bound to the east by the M50 Motorway embankment and to the north & west by Fonthill Road as well as to the south by an existing access road to B&Q retail premises.
The application area is part of a larger brownfield site and it is noted that the remaining area of the brownfield site is earmarked for future development for an alternative usage which can be served by an existing exit located off the existing southern access road serving the B&Q facility.
A topographical survey of the existing site and adjacent roads is illustrated on McArdle Doyle Engineering Existing Layout drawing P1956.C02 Appendix D of this report.

Figure 01- Site Location (Source Google Maps)

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3.0 Proposed Development

The site is currently classified as brownfield and the land topography slopes generally from north to south east. The site levels vary approx. 1.1 metres across the site from 62.637m-61.500m

It is noted that the site is labelled as 'Objective MRC' in the South Dublin County council land use development maps which states the lands future usage is 'to protect improve & provide for the future development of a major retail centre'

In term of this planning permission proposal the development description consists of the construction of new petrol filling station forecourt with multiple dispensers and underground fuel storage tanks with an associated canopy structure. It also encompassed the creation of a new egress location onto the Fonthill Road along the northern boundary and includes car wash facilities (automatic brush and jet car washes), electric charging bays with associated substation and air & water services.

4.0 The Planning System & Flood Risk Guidelines

In September 2008 "The Planning System and Flood Risk Management Guidelines for Planning Authorities" (Guidelines) were published by the Department of Environment, Heritage and Local Government in Draft format. In November 2009, the adopted version of the document was published.

The Guidelines provide guidance on flood risk and development. A precautionary approach is recommended when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding.

The objective of a site-specific Flood Risk Assessment (FRA) is to assess all types of flood risk to a development. The assessment should investigate potential sources of flood risk and include for the effects of climate change. The assessment is required to examine the impact of the development and the effectiveness of flood mitigation and management procedures proposed. It should also present the residual risks that remain after those measures are put in place.

This approach is based on the identification of flood zones for river and coastal flooding. "Flood Zones" are geographical areas used to identify areas at various levels of flood risk. It should be noted that these do not consider the presence of flood defenses, as the risks remain of overtopping and breach of the defenses. There are three flood zones defined (refer to Figure 2):

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Flood Zone A (high probability of flooding) is for lands where the probability of flooding is greatest (greater than 1% or 1 in 100 for river flooding and 0.5% or 1 in 200 for coastal flooding).

Flood Zone B (moderate probability of flooding) refers to lands where the probability of flooding is moderate (between 0.1% or 1 in 1,000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding).

Flood Zone C (low probability of flooding) refers to lands where the probability of flooding is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

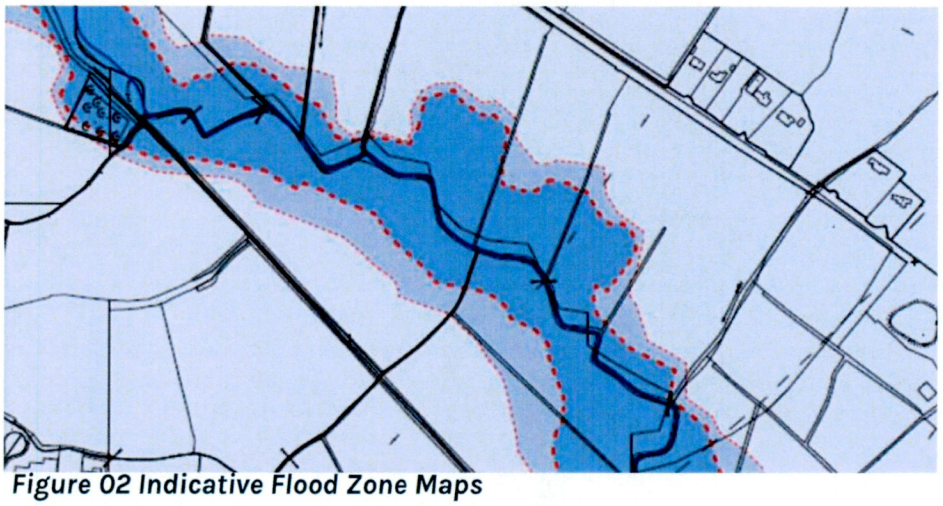

Figure 02 Indicative Flood Zone Maps

Once a flood zone has been identified, the guidelines set out the different types of development appropriate to each zone. Exceptions to the restriction of development due to potential flood risks are provided for through the use of the **Justification Test**, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centers that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.
Flood Risk management is summarized through various levels of the planning system in Figure 03 below.

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Policy Documents / Instruments	Flood Risk Assessment Technique	Decision-making Tools	Key Chapters
National Spatial Strategy, National Planning Guidelines	Flood Risk Management Guidelines	n/a	1 2
Regional planning guidelines	Regional Flood Risk Appraisal, Catchment Flood Risk Management Plans	Sequential approach, Strategic Environmental Assessment	3 4
City / county development plan	Strategic Flood Risk Assessment, Catchment Flood Risk Management Plans	Sequential approach, dev. plan Justification Test, SEA	3 4
Local area plan	Strategic Flood Risk Assessment	Sequential approach, dev. plan Justification Test, SEA	3 4
Master plan, non-statutory plan, site brief	Site-specific Flood Risk Assessment	Sequential approach, dev. plan Justification Test, SEA / Env. Impact Assessment	3 5
Planning application	Site-specific Flood Risk Assessment	Sequential approach, dev. management Justification Test, EIA	3 5

Figure 03 Flood Risk Management & the Planning System

Using sequential approach as described in Chapter 03 of the aforementioned guideline document (and referenced in Figure 06 of this report) including confirmation that the site is classified as 'Less vulnerable' and therefore classified as appropriate and in conjunction with assessing available flood data i.e OPW PFRA & CFRAMS mapping etc, it has been determined that the site has been categorized as falling into Zone C. It is proposed to apply the **Source Pathway Receptor model** in providing the necessary mitigating measures.

The current South Dublin County Development Plan, 2022– 2028 has been recently adopted and encompasses the publication of flood risk assessment guidelines in a document titled '***Strategic Flood Risk Assessment South Dublin County Development Plan'*** produced by Roughan & Donovan Engineers. The Guidelines set out a stage approach to assessment in keeping with the 'Planning System & Flood Risk Management Guidelines' document.

The stages of assessment are:

Flood Risk Identification (Stage 1) – Identification of any issues relating to the site that will require further investigation through a Flood Risk Assessment.

Initial Flood Risk Assessment (Stage 2) – Involves establishment of the sources of flooding, the extent of the flood risk, potential impacts of the development and possible mitigation measures.

Detailed Flood Risk Assessment (Stage 3) – Assess flood risk issues in sufficient detail to provide quantitative appraisal of potential flood risk to the development, impacts on flooding elsewhere and the effectiveness of any proposed mitigation measures.

This report addresses the requirements of a Stage 1 and 2 Site Specific Flood Risk Assessment.

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5.0 Flood Risk Identification

There are no open watercourses which flow through the site however as per '***Strategic Flood Risk Assessment South Dublin County Development Plan***' produced by Roughan & Donovan Engineers, the site is located within the catchment of the River Liffey. Therefore, the potential flood risk to the proposed development site has been assessed.

5.1 History of Flooding

As part of the overall exercise to establish the potential flood risk to the subject site, McArdle Doyle Ltd. carried out a review of available and recorded information on flooding in the area.
The following sources were consulted as part of the review:

- OPW Flood Records,
- SDCC Records,
- Historic Flood Records.

5.2 OPW Flood Hazard Mapping

The Office of Public Works (OPW) collates available reports of flooding from all sources (e.g. fluvial, pluvial, coastal, etc.) on a nationwide basis. The OPW's website (www.floodmaps.ie) was consulted to obtain reports of recorded flooding within and surrounding the site. The information available on this website indicates there is a history of flooding in the area.
Figure 4 is an extract from the mapping available on the OPW database and illustrates the location of recorded flood events, this full document is attached as part of **Appendix A** of this report. This information notes that no areas within the proximity of the subject site has been previously prone to flood events and therefore no previous flooding on the site has occurred.

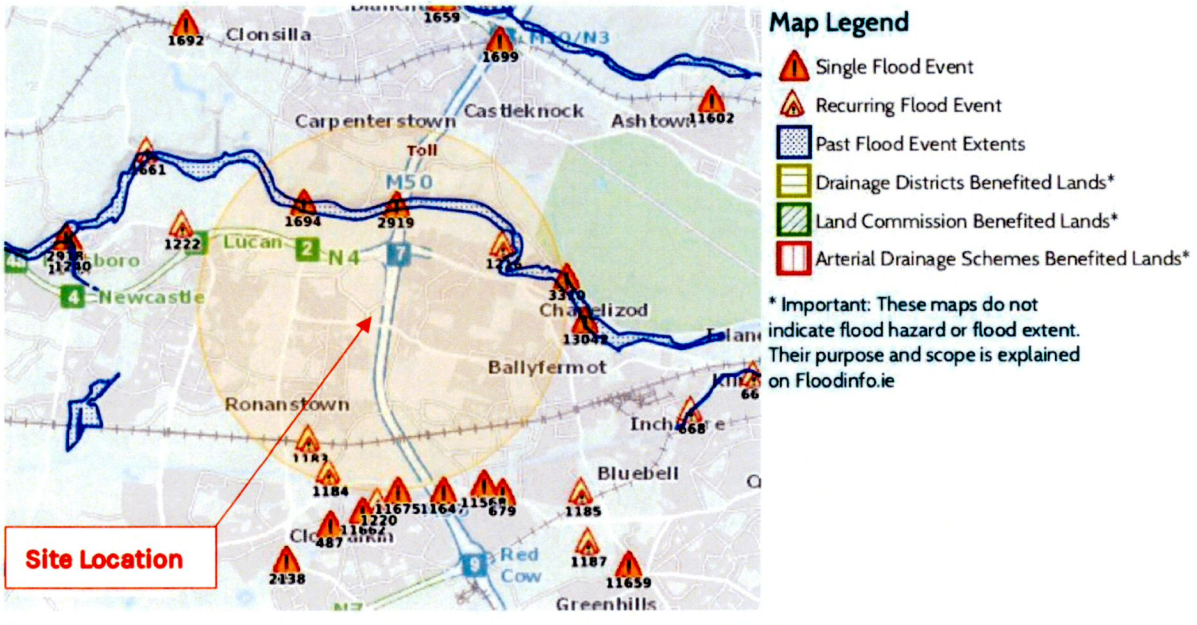

Figure 04- Past Flood Event Local Area Summary Report (OPW)

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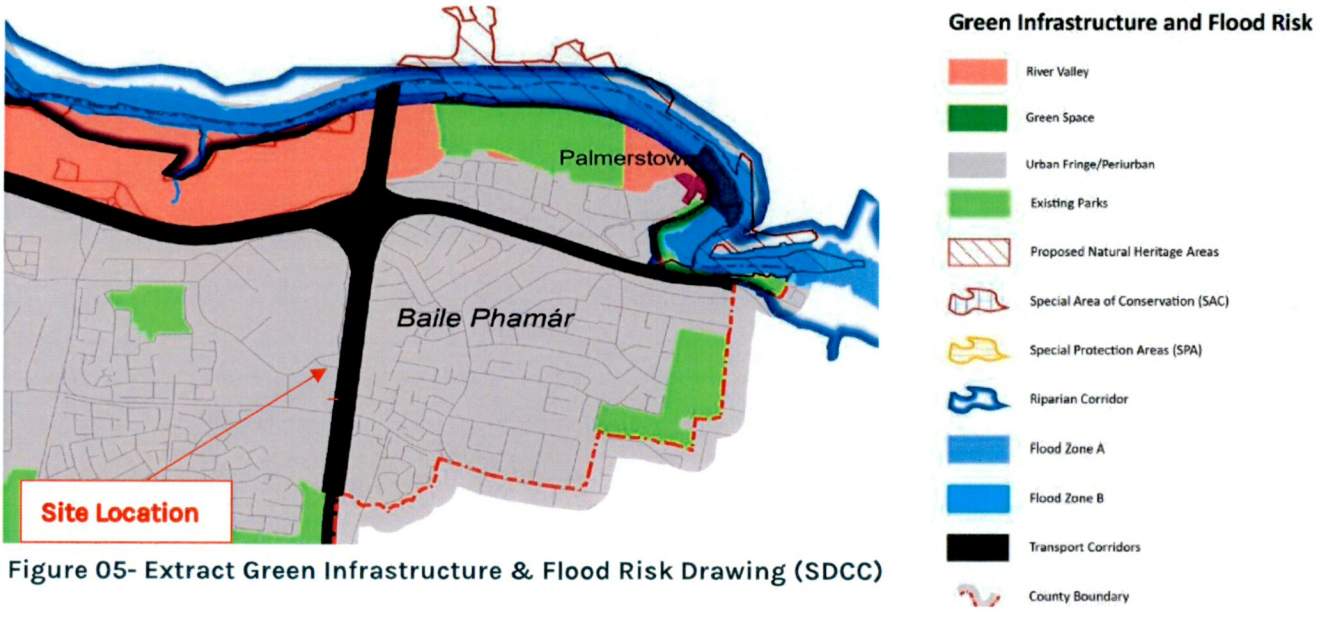

Figure 05- Extract Green Infrastructure & Flood Risk Drawing (SDCC)

5.3 South Dublin County Council Flood Records

Figure 05 above shows records of extent of Flood Zone A and Flood Zone B on Green Infrastructure & Flood Risk Drawing as part of suite of drawings incorporated in the South Dublin County Council 2022-2028 Development Plan. This full drawing document is attached for reference in **Appendix C** of this report.

5.4 Historic Mapping- OSI

Historical mapping available on OSi.ie was reviewed to identified historic flood plains and areas liable to flooding. There are no records of historic flooding within or surrounding the subject site available on this website.

5.5 Indicative Flood Risk Mapping

Predictive flood risk mapping published by the OPW was reviewed to establish the potential flood risk to the subject site.

5.4.1 OPW PFRA Mapping

The CFRAM (Catchment Flood Risk Assessment and Management) programme is a national programme which produced a series of Preliminary Flood Risk Assessment (PFRA) which cover the entire country. This assessment was carried out based on available and readily derivable information to identify areas where there may be a significant risk of flooding. The objective of the PFRA is to identify areas where the risks associated with flooding might be significant.
The PFRA was undertaken by:

- Reviewing records of flood that have happened in the past;
- Undertaking analysis to determine which areas might flood in the future, and what the impacts might be; and
- Consulting with Authorities and other Government department and agencies.

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There are no records of any risks associated with flooding as part of the OPW PFRS Mapping.

5.4.2 CFRAM Mapping

The CFRAMS (Catchment Flood Risk Assessment and Management) mapping is further explored in **Section 7** of this report which details the **Source Pathway Receptor Model** outlining Tidal, Fluvial, Pluvial, Ground Water & Human/Mechanical Error as flood risk components to be identified for the subject site.

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6.0 Initial Flood Risk Assessment

6.1 Sequential Approach and Justification Tests

The sequential approach and Justification tests procedures are outlined in 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' 2009 and is summarised and adopted below.

6.2 Flood Zones

A sequential approach is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding. The philosophy used in this approach is:

1. Avoid – preferably choose lower risk flood zones for new development
2. Substitute – Ensure the type of development proposed is not especially vulnerable to the adverse impact of flooding
3. Justify – Ensure that the development is being considered for strategic reasons
4. Mitigate – Ensure flood risk is reduced to minimal levels
5. Proceed – Only where Justification Test passed and emergency measures are in Place

Figure 6 sets out the mechanism for the use of the sequential approach to development in flood areas from the planning perspective.

The sequential approach makes use of flood risk assessment and of prior identification of flood zones for river and coastal flooding and classification of the vulnerability to flooding of different types of development as outlined in the sections below

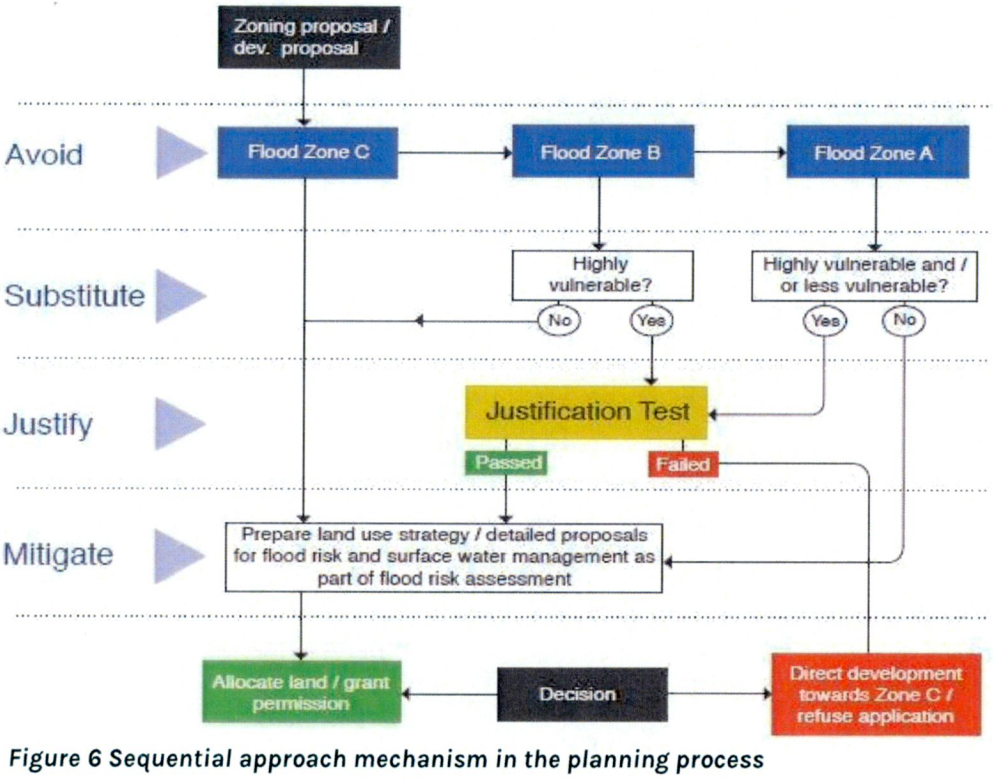

Figure 6 Sequential approach mechanism in the planning process

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Flood zones are geographical areas within which the probability of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.
There are three types or levels of flood zones defined for the purposes of the guidelines:
Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1 or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding);
Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

6.3 Vulnerability Classes

Table 3.1 of The Planning System and Flood Risk Management Guidelines for Planning Authorities provides a classification of vulnerability of different types of development. **Figure 7** is taken from the Guidelines (Table 3.1) and sets out the Vulnerability Classifications of different types of land uses. **Figure 8** (Table 3.2 of the Guidelines) describes the vulnerability of developments relative to the identified Flood Zone and when the requirements of the Justification Test must be satisfied.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

*Uses not listed here should be considered on their own merits

Figure 7 Classification of Vulnerability of different types of development

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 8 Vulnerability of Development vs. Flood Zone

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Figure 8 illustrates those types of development which would be appropriate to each flood zone and those which would be required to meet the Justification test.

The proposed land use for this development is predominantly commercial and can be classified as local infrastructure which falls within the 'Less Vulnerable Development' classification, as shown in **Figure 7**. Based on the review carried out of the predicted flood water extents and the topographical survey, the proposed development has been located outside Flood Zones A and B and within Flood Zone C (Low probability of flooding). It can be seen from **Figure 8** that Flood Zone C is a suitable land use for 'Less Vulnerable Developments' and that a Justification Test is not required.

7.0 Source Pathway Receptor Model

The 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 as referenced earlier in this report.

The components to be considered in the identification and the assessment of flood risk are as per the above document guidelines;

- Tidal
- Fluvial
- Pluvial
- Ground Water
- Human/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.

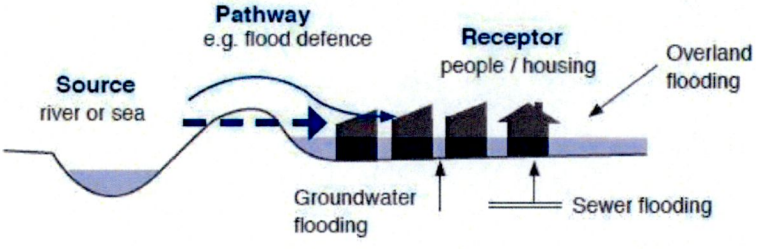

Figure 9 Source Pathway Receptor Model

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Likelihood	Low	Moderate	High
Tidal	Where probability < 0.1% chance of occurring in a year	0.5% chance of occurring in a year > probability > 0.1% chance of occurring in a year.	Where probability > 0.5% chance of occurring in a year
Fluvial	Where probability < 0.1% chance of occurring in a year	0.5% chance of occurring in a year > probability > 0.1% chance of occurring in a year.	Where probability > 0.5% chance of occurring in a year
Pluvial	Where probability < 0.1% chance of occurring in a year	0.5% chance of occurring in a year > probability > 0.1% chance of occurring in a year.	Where probability > 0.5% chance of occurring in a year

Figure 10- Table A1 Guidelines on Planning Process and Flood Management

For ground water and human mechanical error, the limits of probability are not defined and therefore professional judgement is used. However, the likelihood of flooding is still categorized a low, moderate and high for these components.
From consideration of the likelihoods and the possible consequences of risk is evaluated. Should such a risk exist, mitigation measures and the residual risks will be assessed.

7.1 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of flooding events. Therefore, in order to determine a value for the consequences of a flooding event the elements likely to 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. From consideration of the likelihoods and possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored and the residual risks assessed.

7.2 Assessing Risk

Based on the determined likelihood and consequences values of a flood event the following risk matrix will then be referenced to determine the overall risk of a flood event.

		CONSEQUENCES		
LIKELIHOOD		**Low**	**Moderate**	**High**
	Low	Extremely Low Risk	Low Risk	Moderate Risk
	Moderate	Low Risk	Moderate Risk	High Risk
	High	Moderate Risk	High Risk	Extremely High Risk

Figure 11- 3x3 Risk Matrix

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7.3 Tidal Flooding

The subject site is located approximately 12.81Km from the Irish sea. The proposed development will be constructed with road levels of approximately 62.300m- 61.600m.

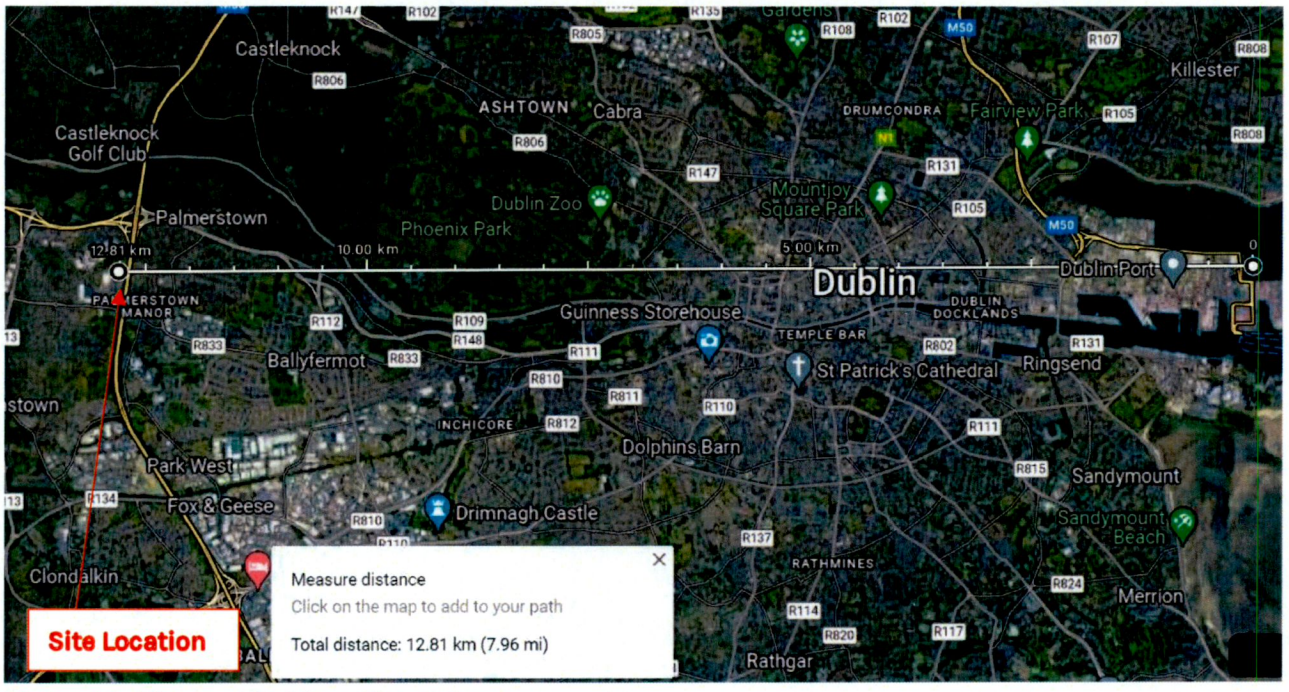

Figure 12- Distance Subject Site to Sea

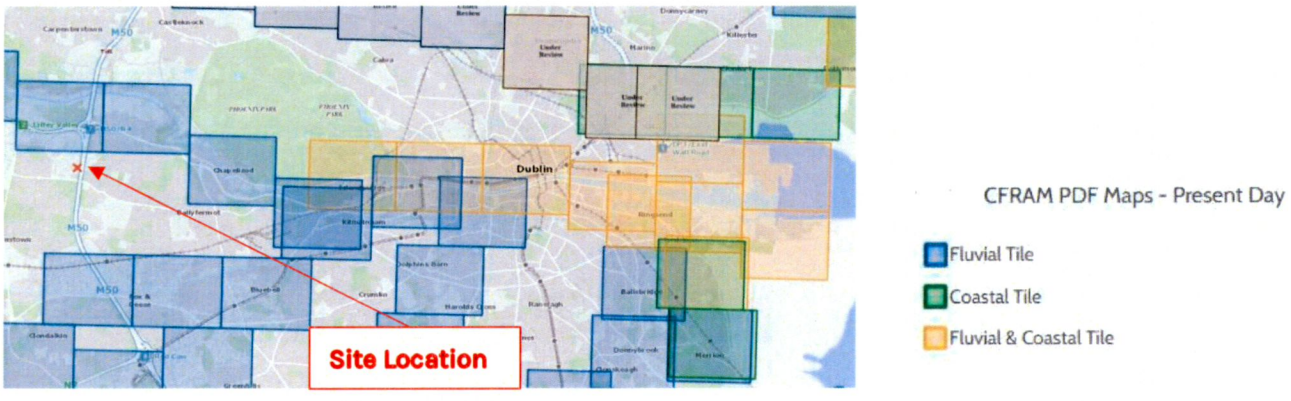

Figure 13- CFRAM Fluvial & Coastal Map

The Dublin Coastal protection project indicated that the 2002 high tide event reached 2.95m OD Malin Head. Therefore, the road levels are approximately 59m above the highest tide recorded in the Dublin area.
Given that the site is located 12.81 km inland from the Irish Sea and there is circa 60m level difference between the site and sea level it is evident that a path does not exist between the source and the receptor.
A risk from tidal flooding is low and no flood mitigations measures need to be implemented.

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7.4 Fluvial Flooding

Fluvial flooding is defined as flooding from a river or other watercourse.
The site is located directly south of the River Liffey basin. As per below google maps image extract the northern boundary of the subject site is located approx. 1.2km from this watercourse.

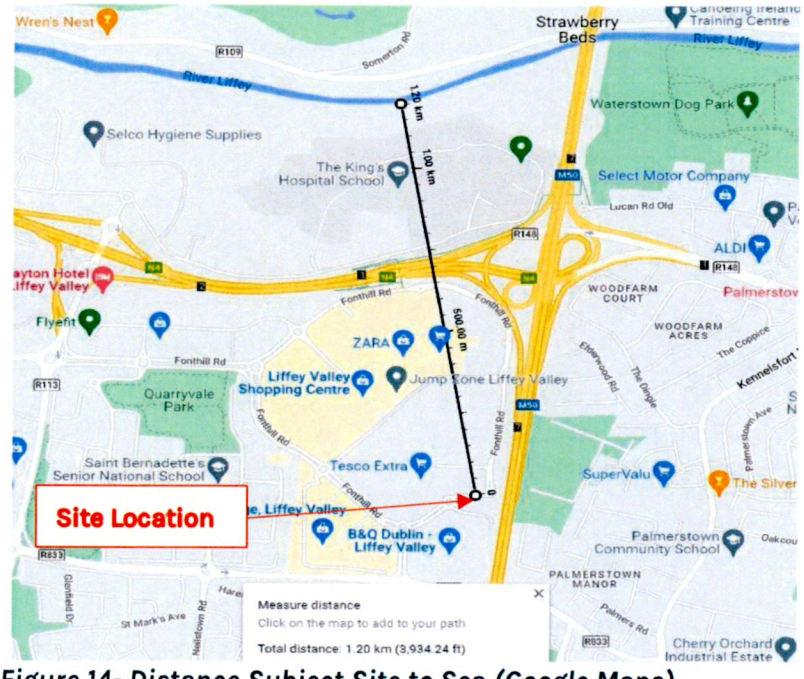

Figure 14- Distance Subject Site to Sea (Google Maps)

The pathway is explored by the SFRA maps in relation to the fluvial flooding risks.
The closest extents of Flood Zones A & B from the River Liffey are greater than 1 km away from the subject site i.e the receptor.

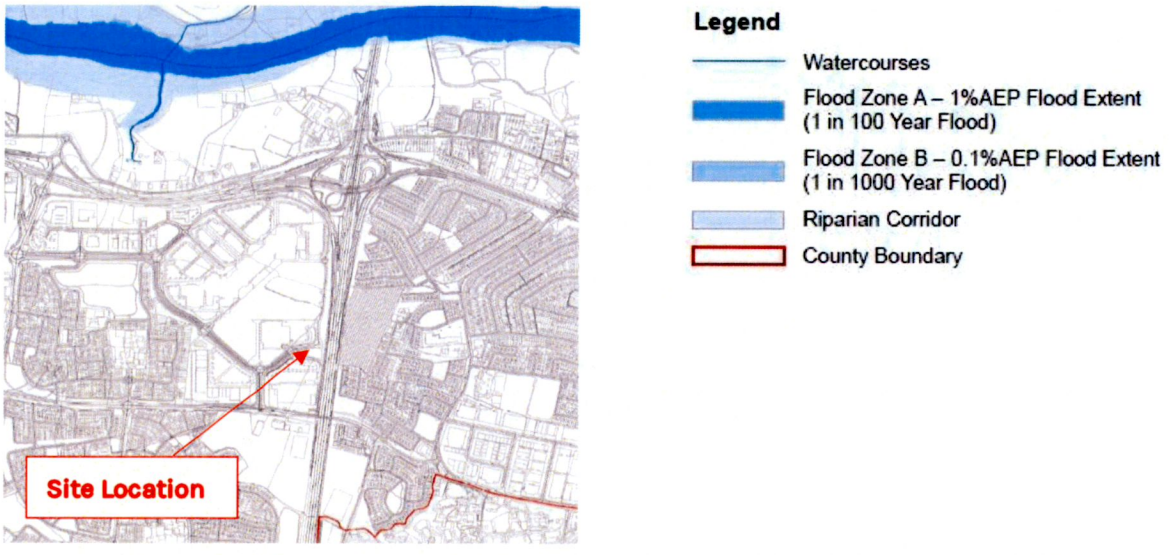

Figure 15 SFRA Mapping (extract sheet 3 of 26 (ROD drawing SDSFRA-ROD-EWE-SW_AE-DR-ENV-003

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The receptor is this case being the roads and services and service plant buildings on the subject site. A risk from fluvial flooding is low and no flood mitigations measures need to be implemented.

7.5 Pluvial Flooding

The source of pluvial flooding is heavy rainfall. This type of flooding is applicable to all sites and is caused by summer thunderstorms or high intensity rainfall during longer duration events. During the 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 Service Station
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes.	Proposed Service Station
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding.	Downstream properties & roads
4	Overland flooding from the surrounding areas flowing onto subject site	Proposed Service Station
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

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

7.5.1 Surcharging of the proposed on-site drainage system

The proposed on-site surface water drainage system has been designed to accommodate flows from a 5-year return event which indicates that on average the internal system may surcharge during rainfall events with a return period in excess of 5 years. Therefore, the likelihood of the surcharging of the proposed on-site drainage system is moderate.

7.5.2 Surcharging of the existing surrounding drainage system

The existing drainage system of the northern Fonthill Road has capacity to accommodate development on this subject site, an existing 1050mm diameter surface water sewer exists on the northern boundary of the subject site, therefore the likelihood of flooding is low.

7.5.3 Surface Water discharge from the subject site to existing drainage network

The development as designed will increase the impermeable area on the site. As a result, the volume of run-off from the site will increase. However, in order to mitigate against this surface water discharge from the development to the existing surface water network

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on the northern boundary of the proposed development will be limited by a hydrobrake with a peak discharge of 1.51 l/s (2 year return period) to match the existing greenfield rate. (Refer to McArdle Doyle Engineering Report Appendix 01). This will greatly reduce the effects of potential flooding from the proposed development on roads and properties downstream of the site. The likelihood of proposed pluvial flooding downstream of the site is therefore considered moderate.

7.5.4 Overland flooding from Surrounding Areas

The office of public works (OPW) records for predictive and historic flood maps and benefit land maps have been consulted with regard to recorded flood events in the vicinity of the subject site. A map showing all flood events within 2.5 km was downloaded from the OPW website and is provided in **figure 16** below.

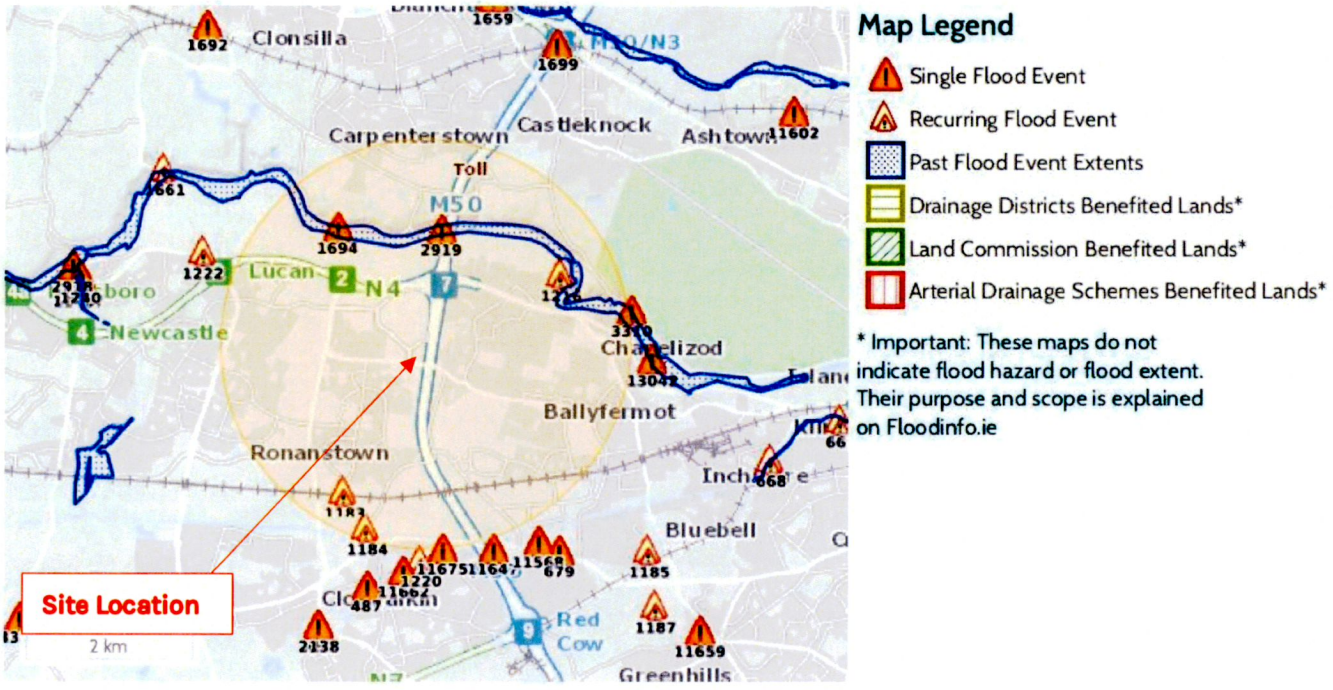

***Figure 16*- Past Flood Event Local Area Summary Report (OPW)**

As noted in full Appendix A document, The closet event recorded to the north was noted as Liffey Strawberry Beds June 1993 with Identification no 2919 and November 2002 identification no.1694 which are both approx. 2.3km away from the subject site.
The closest event recorded to the south of the site was Beech Row Ronanstown along an existing Irish rail line with Identification no 1183 approx 2.2km from the subject site. The likelihood of overland flooding from surrounding area is therefore considered low.

7.5.5 Overland flooding from the subject site

There is an increase in hardstanding area of the subject site as a result of the proposed development. This is coupled with the fact that an area of approx. 800m2 approximately 1/3 of the site is shaded as a Pluvial- 1% AEP Flood Extent (1 in 100 year Flood) as outlined in **Figure 17**.

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This extract is taken from Roughan O'Donovan consulting engineers drawing 'Indicative Pluvial Flooding mapping sheet 1 of 4' from document '***Strategic Flood Risk Assessment South Dublin County Development Plan***' which is attached as part of Appendix B of this report.
It is noted that this area of pluvial flooding identified should be considered open for SDCC review as it does not correspond to site the topography and existing falls/levels within the site boundary and the immediate area which the McArdle Doyle Existing Layout drawing P1956.C02 in **Appendix D** highlights. In this case the likelihood of overland pluvial flooding from the subject site is considered moderate.

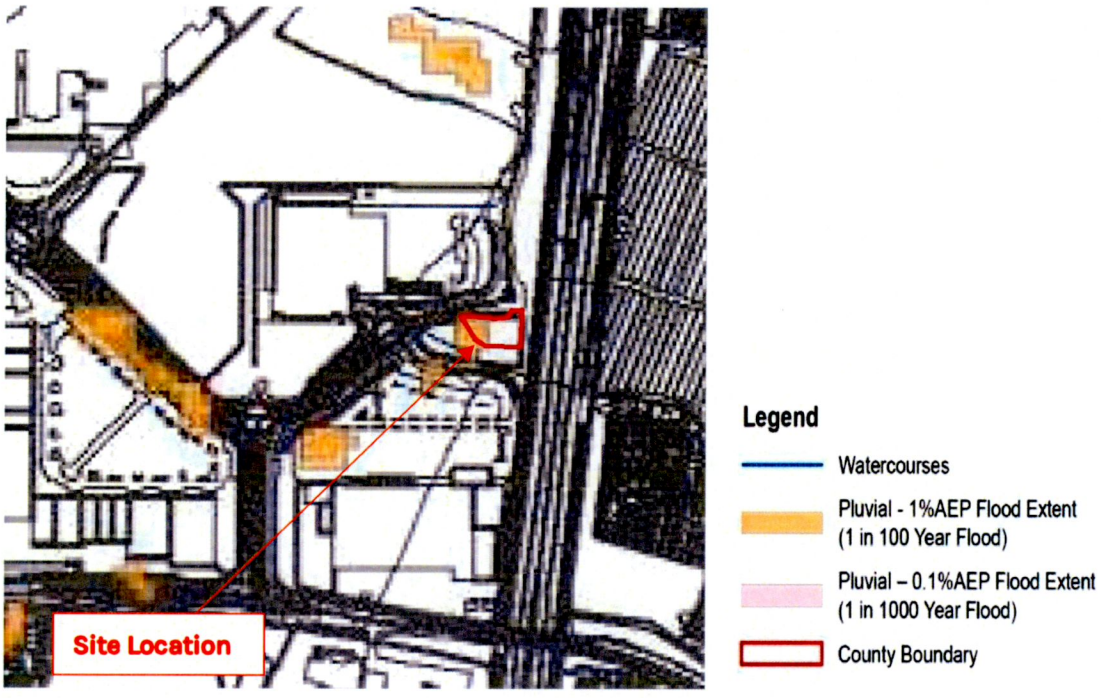

Figure 17- Extract ROD drawing Pluvial Flood Mapping (Sheet 1 of 4) (Appendix B)

7.5.6 Pluvial Flooding Consequences

The consequences of surface water flooding arises from the 5 pathway types and would result in moderate damage to roads and properties. It is noted that there are no retail properties and no amenities buildings open to the public proposed in this unmanned service station development.

7.5.7 Pluvial Flooding Residual Risks

As a result of the design measures detailed on the proposed site there is an overall low residual risk of flooding from each of the surface water risks outlined above. The flood risk measures highlighted previously in this report including appropriate drainage design to relevant guidance, overland flood routing, correct setting of floor levels, appropriate water attenuation storage and proposed hydrobrake control mechanism to limit the outflow to peak discharge of 1.51 l/s (2 year return period) to match the existing greenfield rate will minimize this risk.

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7.6 Groundwater Flooding

7.6.1 Source

During periods with prolonged rainfall the groundwater can seep to above ground level. As per below historic groundwater map of Ireland **Figure 18** this is not a common occurrence in the Dublin region and the subject site is considered low risk from groundwater flooding.

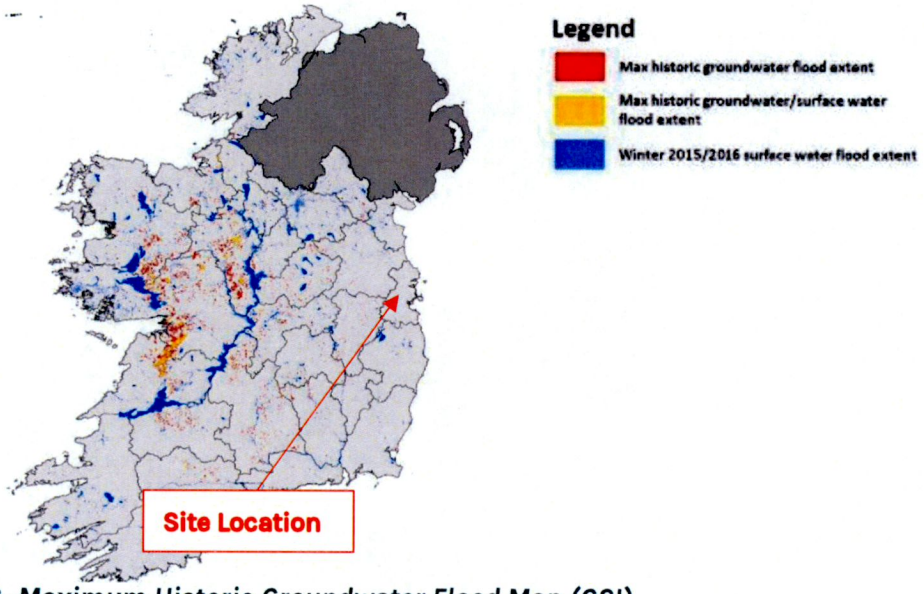

Figure 18- Maximum Historic Groundwater Flood Map (GSI)

7.6.2 Pathway

During periods with prolonged rainfall there is possibility that the groundwater level would rise. This could result in ground water seeping to the ground surface

7.6.3 Receptor

The receptors would be the buildings and roads of the proposed development.

7.6.4 Likelihood

There is no known history of groundwater/springs seeping through the ground in this area of the Dublin region. However, it is possible for ground water to rise and cause potential flooding on the site during prolonged wet periods. The proposed roads and buildings are constructed above the existing ground level with no significant cut proposed on the subject site.

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7.6.5 Consequences

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed building and landscaped areas

7.6.6 Risk

There is a low risk of ground water flooding and the consequence is considered low.

7.6.7 Flood Risk Management

The finished floor levels of the substation and plant building are generally 300mm higher that road levels to ensure any seepage of water does not flood the proposed buildings. In the event of ground water flooding on site this water can escape from the site via the internal storm water drainage system.

7.6.8 Residual Risk

There is extremely low residual risk of flooding from groundwater in this instance.

7.7 Human Mechanical Errors

7.7.1 Source

The subject lands will be drained by an internal storm water drainage system which discharges to the existing local public water sewer on the northern boundary via a proposed flow control installed in the downstream manhole of the proposed attenuation tank within the site. The internal surface water network is the source of possible flooding from the system if it was to block.

7.7.2 Pathway

If the proposed drainage system is blocked this could lead to possible flooding within the development area.

7.7.3 Receptor

The receptor are the proposed buildings and roads.

7.7.4 Likelihood

There is a moderate likelihood of flooding in the subject site if the surface water network was to block.

7.7.5 Consequences

There is a moderate consequence if the surface water system was to block.

7.7.6 Risk

The surface water network would surcharge and overflow through gullies and manholes.

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7.7.7 Flood Risk Management

As described in previous sections the levels on the site have been designed such that in the event of the surface water surcharging, water can still escape the site from overland flooding without entering service buildings. The surface water network within the site needs to be regularly maintained.

7.7.8 Residual Risk

As a result of above there is a moderate residual risk of overland flooding from human/mechanical error.

8.0 Flood Risk Management & Impact on Downstream Network

Flood risk management under the EU Floods Directive aims to minimise the risks arising from flooding to people, property and the environment. Minimising risk can be achieved through structural measures that block or restrict the pathways of floodwaters, such as river defenses or non-structural measures that are often aimed at reducing the vulnerability of people and communities such as flood warning, effective flood emergency response, or resilience measures for communities or individual properties. The flood risk management objective in this instance is to have minimal impact on the existing downstream network.

It is noted that the site will be sustainably managed in accordance with the relevant guidelines and specifications with discharge from the catchment area being limited to pre-development rates through the use of measures outlined below.

- Suds measurements have been incorporated in the form of surface water on line modular attenuation tank by Wavin Aquacell or similar with provided a 1 in 100 year storage of 62m3 as outlined on McArdle Doyle Drainage drawing P1956.C04

- A Hydrobrake mechanism is proposed to be installed to restrict the outflow into the existing network accordingly at 1.51 l/s as outlined on McArdle Doyle Drainage drawing P1956.C04 and accompanying stormwater microdrainage software design as outlined in Appendix 01 of the corresponding McArdle Doyle Engineering Report for this proposed development.

- Water quality is maintained as the outflow from the contaminated storm network passes through the proposed class 01 10,000 litre separator and the outflow from the car park the internal road network area passes through a Klargester NSBP003 unit or similar proposed as called up on McArdle Doyle P1956.C04 Proposed Drainage Layout.

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The above methods will ensure that all surface water on site will be sustainability managed and discharged off site via approved run-off rates into the local authority sewer network.

9.0 Conclusions

The subject lands have been analysed for risks from flooding in accordance with the Department of Housing, Local Government & Heritage/ OPW The Planning System and Flood Risk Management Guidelines for Planning Authorities and associated Technical Appendices, published in 2009 from the following components: -

- Tidal
- Fluvial
- Pluvial
- Ground Water
- Human/ Mechanical Error

Design measures have been adopted as part of the proposed development to mitigate risks against flooding from the above components.
The proposed development is located within Flood Zone C where the probability of flooding from rivers is less than 0.1% (1 in 1000 years). The following Table, **Figure 19**, is a summary of the Flood Risks from the various components assessed.

In conclusion the proposed development of the site will be carried out in wholly sustainable manner, as described and will not pose any flooding issues. This holds true for the development site itself and for lands and properties downstream of the proposed development. The site will be positively drained and surface water will be contained within the overall site drainage network and managed in a sustainable manner in accordance with all relevant guidelines and specifications.

Further to the above based on the indicative flood mapping the development site is located within Flood Zone C 'low probability'. additionally, as mentioned the site is classified as 'less vulnerable' and therefore the development is classified as appropriate.

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Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigated Measure	Residual Risk
Tidal	None	Proposed Development	Negligible	None	Negligible	None	**Negligible**
Fluvial	None	Proposed Development	Low	Minor	Low	Appropriate design of overland flood routing	**Very Low**
Pluvial	Private & public drainage network	Proposed Development	Moderate	Moderate, Flooding of the proposed buildings and roads	Moderate risk of damages to properties	Appropriate drainage design, overland flood routing and setting of floor levels	**Moderate**
Ground Water	Ground	Proposed Development	Low	Low saturation of the surrounding grounds during long rainfall periods	Low risk of minor saturation of area around the development	Appropriate drainage design, overland flood routing and setting of floor levels	**Negligible**
Human/ Mech. Error	Drainage Network	Proposed Development	Moderate	Moderate, surcharging of surface water network resulting in flooding of the properties	Moderate risk of minor damage to properties	Appropriate drainage design, overland flood routing and setting of floor levels	**Moderate**

Figure 19- Summary of the Flood Risk from the Various Components

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Appendix A- OPW Past Flood Event Summary

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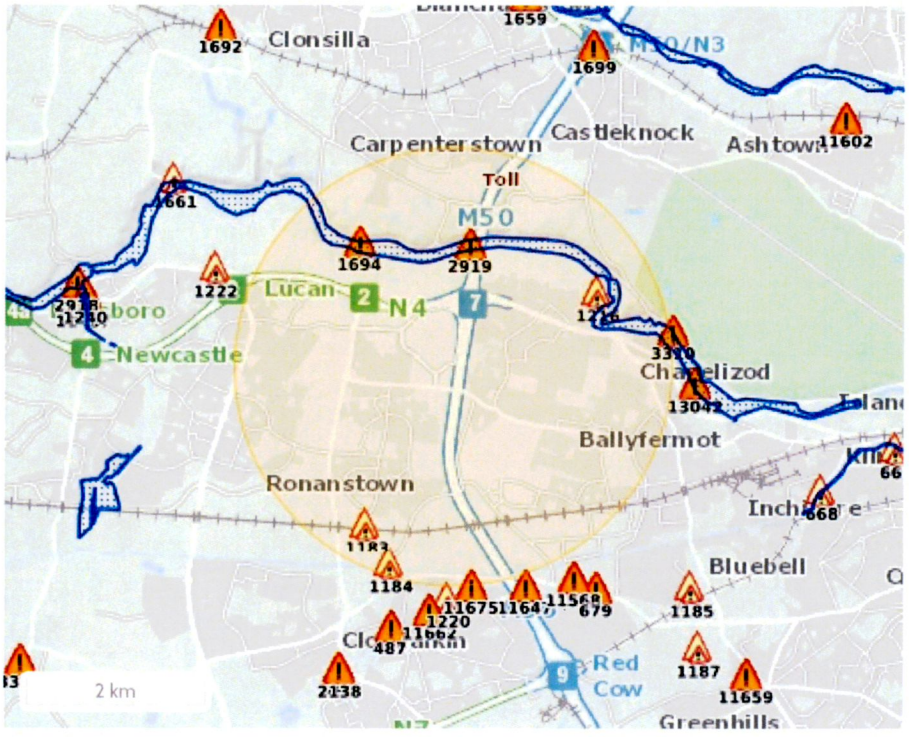
Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: **12/9/2022 11:15**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

8 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Liffey R109 at the Strawberry Beds Nov 2002 (ID-1694)	13/11/2002	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
2.	Liffey Sommerton Rd Luttrellstown Golf C Oct 2004 (ID-2190)	25/10/2004	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Liffey Lower - Dec 1954 (ID-241)	08/12/1954	Area
	Additional Information: Reports (5) Press Archive (2)		
4.	Liffey Strawberry Beds June 1993 (ID-2919)	09/06/1993	Approximate Point
	Additional Information: Reports (2) Press Archive (1)		
5.	Beech Row Ronanstown Recurring (ID-1183)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
6.	Cappaghmore Ronanstown Recurring (ID-1184)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Palmerston Mill Lane Recurring (ID-1216)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
8.	Flooding at Yellow Meadow Apartments, Off Nangor/Yellow Meadows Road, Dublin 22 on 24th Oct 2011 (ID-11675)	23/10/2011	Exact Point
	Additional Information: Reports (1) Press Archive (0)		

Appendix B- Roghan O'Donovan SFRA Maps

SFRA Mapping Overview Map

SFRA Flood Zone Mapping (Sheet 3 of 26)

Pluvial Flood Mapping Overview Map

Pluvial Flood Mapping (Sheet 1 of 4)

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