Clifton Scannell Emerson
Associates

Site Specific Flood Risk Assessment
Proposed K2 Data Centre Development

Client: K2 Strategic Infrastructure Ireland Ltd.

Date: 23rd May 2022

Job Number: 22_043

K2 DATA CENTRES

CONSULTING ENGINEERS

Civil Engineering | Structural Engineering | Transport Engineering | Environmental Engineering | Project Management | Health and Safety

Clifton Scannell Emerson Associates

Clifton Scannell Emerson Associates Limited,

Consulting Engineers, Mentec House, Bakers Point, Dun Laoghaire, Co. Dublin, Ireland A96 K6P3

T. +353 1 2885006 F. +353 1 2833466 E. info@csea.ie W. www.csea.ie

Document Control Sheet

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Report Title:	Site Specific Flood Risk Assessment
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Issue No.	Issue Status	Date	Prepared by	Checked by
P01	DRAFT	23/05/2022	KB	CD
P02	PLANNING	14/07/2022	CD	CD

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1 Introduction

1.1 Background

CSEA was requested to undertake a Site Specific Flood Risk Assessment (SSFRA) to support the submission of a planning application by K2 Strategic Infrastructure Ireland Ltd for the proposed K2 data centre development at the junction of Kingswood Drive and Kingswood Road within Citywest Business Campus, Naas Road, Dublin 24.

The proposed development of a brownfield site of approximately 1.9 Hectares. The subject site is located at the junction of Kingswood Drive and Kingswood Road, within Citywest Business Campus, Naas Road, Dublin 24 which lies approximately 11km southwest of Dublin's city centre and is accessed from the N7, Old Naas Road and Kingswood Drive.

1.2 Development Description

The proposed development permitted under Reg. Ref.: SD18A/0301 comprises of the development of a two storey data centre with two storey administration spaces and associated plant spaces with a total permitted floor area of 11,548.5m^2, all associated site development works, landscaping, car parking and two vehicular entrances of Kingswood Drive and Kingswood Road.

The proposed development comprises amendments to the development permitted under Reg. Ref.: SD18A/0301. The proposed amendments comprise the following:

- Alterations to the permitted two storey data centre building including internal reconfiguration, alterations to finished floor levels, alterations to the building footprint to provide for the relocation of an internal staircore to the south of the building, and the replacement of the enclosed first floor level with an open screened roof mounted plant space (resulting in a reduction of 4,091 sq.m in the gross floor area (GFA) of the building).

- Associated alterations to the façade of the data centre building, including alterations to fenestration, cladding, step-out in the southern façade to accommodate a staircore, and a reduction in the eastern building parapet height of c. 2 metres.

- The provision of a canopy over the loading docks on the east facade.

- Alterations to the permitted generator compound, generators, and flues, including a reduction in the number of generators (5 no. now proposed), and provision of MV rooms within the generator compound.

- Provision of an ESB substation compound in the northeastern portion of the site, comprising a single storey substation building (with a GFA of c. 125 sq.m), 2 no. transformers, client control building (with a GFA of c. 47 sq.m), and associated access arrangements within a 2.6 metre high security fence. The ESB substation compound will be accessed from Kingswood Drive.

- Omission of the permitted sprinkler tank, pump room and 10kV Substation, reconfiguration of the permitted car parking, and revisions to permitted boundary treatments.

- Associated alterations to landscaping, access and internal road arrangements, services, lighting, and layout, and all associated and ancillary works.

The extent of the site layout is highlighted in Figure 1 below:-

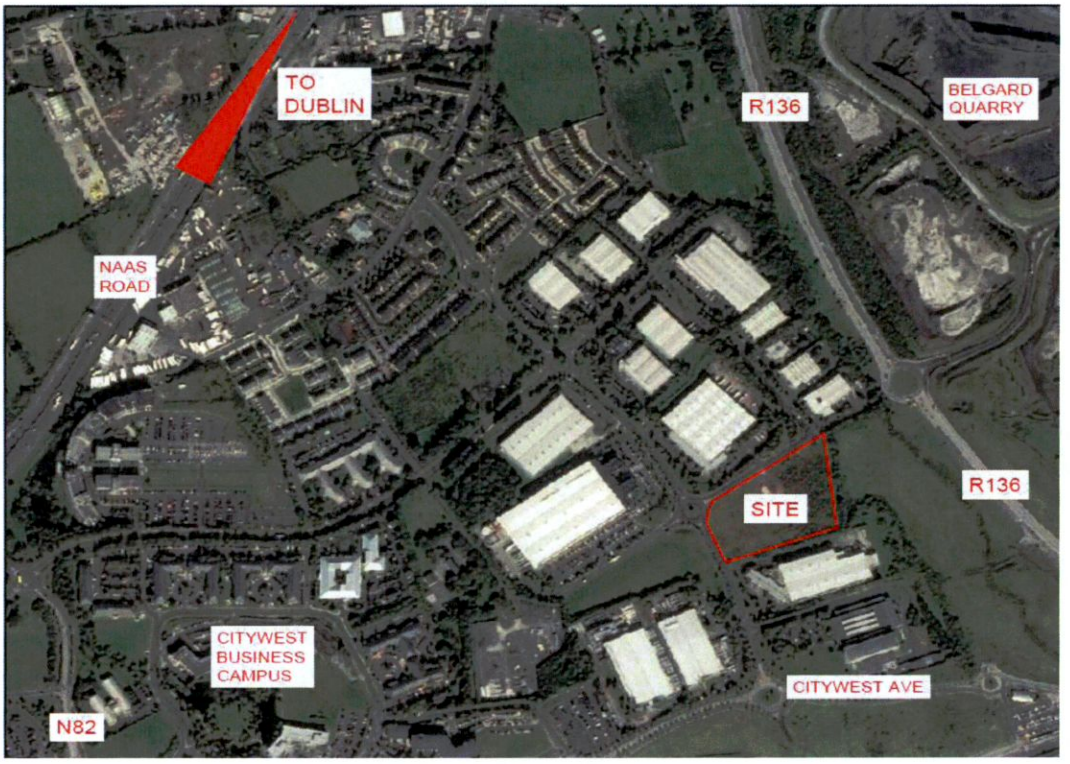


Figure 1 – Proposed Site Location Plan

1.3 Background Information

1.3.1 Catchment-based Flood Risk Assessment and Management

Catchment-based Flood Risk Assessment and Management (CFRAM) program has been implemented by the Office of Public Works (OPW) as a competent authority in Ireland for the EU floods directive. Over 29 Flood Risk Management Plans (FRMPs) have been prepared in coordination with the implementation of the Water Framework Directive (WFD). The FRMPs involved undertaking detailed engineering assessment and producing flood protection measures. The assessment addressed the potential impact of the proposed measures on waterbodies hydromorphology and quality status.

1.3.2 OPW Flood Guidelines for Planning Authorities

The purpose of The Planning System and Flood Risk Management Guidelines for Planning Authorities published by the OPW in 2009 (OPW Guidelines) is to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

1.3.3 Objectives of OPW Guidelines

Floods can have broad range of impact on people, property, infrastructure and the environment. Flood can cause damage to the infrastructure including electricity and other utilities with significant detrimental impacts on local and regional economies. This may also cause long-term closure of businesses leading to economic loss other than the damage caused during the event. The core objectives of the OPW Guidelines include:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

1.3.4 Flood Risk Assessment FRA Key Concepts

For carrying out a Site-specific Flood Risk Assessment (SSFRA), the OPW Guidelines recommend using Source-Path-Receptor concept model to identify where the flood originates from, what is the floodwaters path and the areas in which assets and people might be affected by such flooding (section 2.18 of the OPW Guidelines, 2009). Figure 2 show a schematic representation of S-P-R model.

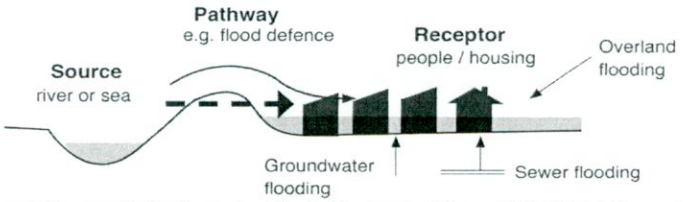


Figure 2 Source-Path-Receptor Model (extracted from OPW Guidelines, 2009)

The other key concept in flood management is the "Flood Risk". it is "the combination of the likelihood of flooding and the potential consequences arising". Consideration of flood risk must be addressed in terms of:

- The likelihood of flooding. Expressed as percentage probability or exceedance each year; and;
- The consequences of flooding as the associated hazard e.g. flood depth and velocity.

Flood risk is then expressed with the relationship:

Flood Risk = Likelihood of flooding x Consequences of flooding.

1.3.5 Flood Zones

Flood Zone is the spatial inundation area that fall within a range of likelihood of flooding. The OPW Guidelines specified three levels of flood zones:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding or 0.5% AEP 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% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP 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% AEP 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.

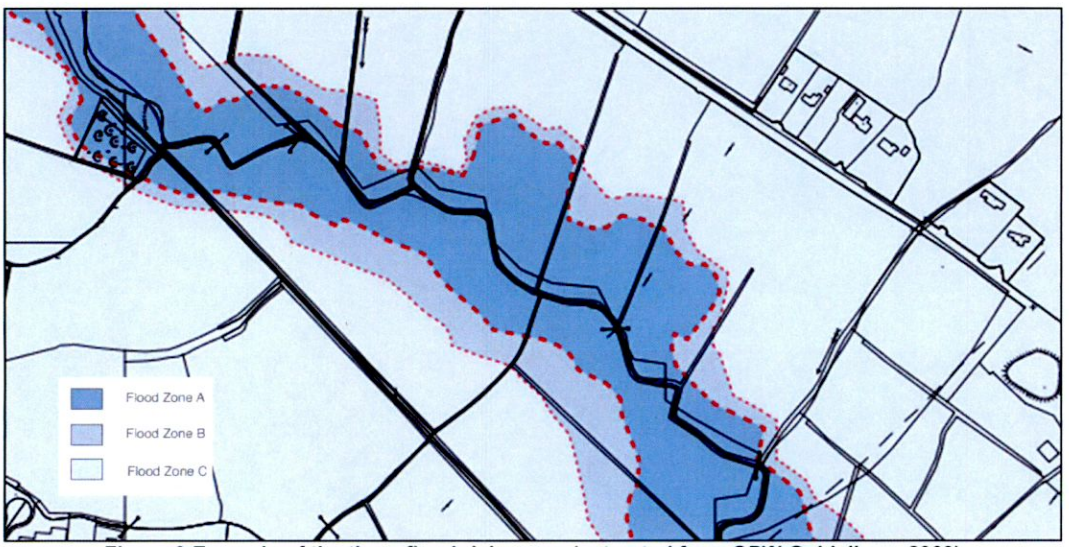


Figure 3 Example of the three flood risk zones (extracted from OPW Guidelines, 2009)

According to the OPW Guidelines, the planning implication of each of the zones mentioned above are:
Zone A - High probability of flooding. Most types of development would be considered inappropriate in this zone.
Zone B - Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone
Zone C - Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

1.3.6 Sequential Approach

Sequential approach is an important tool used in the planning process which gives preference to locate a new development in the Low Flood Risk Zone and ensures that it does not have an adverse impact of flooding.

According to the sequential approach, If the development lies within a Flood Zone, it is required to consider measures for mitigating flood impact to an acceptable level. It is also required to provide justifications and strategic reasons for locating a proposed development on a higher risk flood zone (see Figure 4 and 5 below).

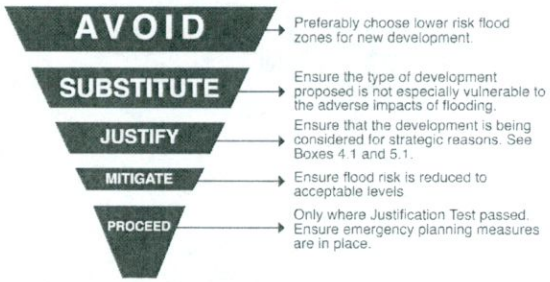


Figure 4 FRA Sequential Approach (extracted from OPW Guidelines, 2009)

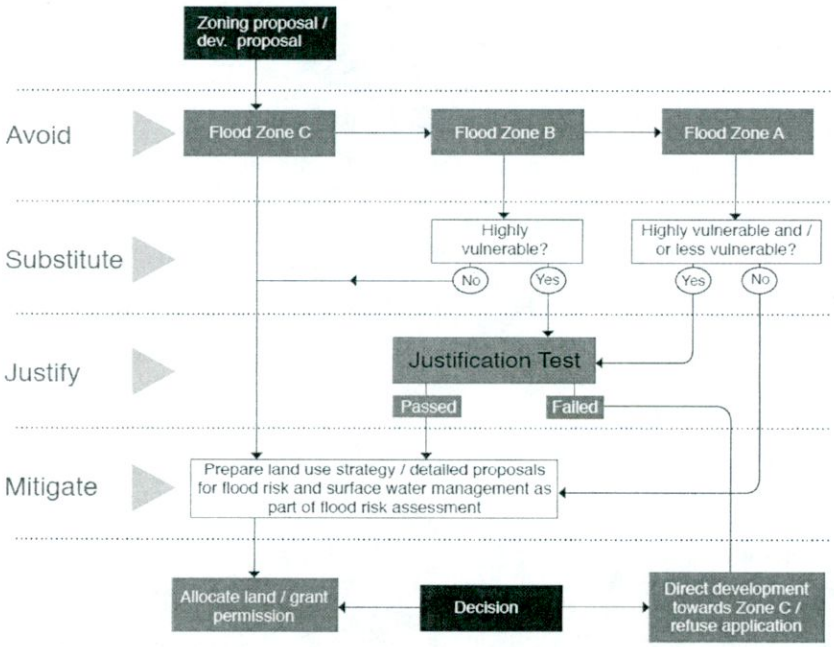


Figure 5 Sequential approach mechanism in the planning process (extracted from OPW Guidelines, 2009)

1.3.7 Development Classification

The OPW Guidelines provided three vulnerability categories based on the type of development which are:

- **Highly vulnerable:** This includes essential infrastructure, such as primary transport and utilities distribution, electricity generating power stations and sub-stations

- **Less vulnerable:** This category includes Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;
- **Water compatible:** Includes water-based flood control and recreational developments and other amenity open space, outdoor sports and recreation and essential facilities such as changing rooms.

The OPW Guidelines, as described in Section 2.2.4 of this report, sets out a sequential approach which makes use of flood risk assessment and classifies vulnerability of flooding of different types of development.

Table 3.2 of the OPW Guidelines illustrates those types of development that would be appropriate to each flood zone (reproduced in Table 1 below) and those that would be required to meet a Justification Test in accordance to Box. 5.1 in the Guidelines.

	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

Table 1 Matrix of vulnerability versus flood zone (extracted from OPW Guidelines, 2009.

2 Stage 1 - Flood Risk Identification

2.1 General

In this stage of the FRA, we use the existing information to identify any flooding issues related to the site that may require any further investigation.

2.2 Source of Information

Information source reviewed for flood risk identification are listed in table 2 below:

	Information Source	Remarks
1	Information on watercourse and streams in the study area such as those available from OS Maps, EPA and GeoHive	An extract from EPA map viewer https://gis.epa.ie/PAMaps/; with active *stream* and *flow direction* layers in Figure 6 shows the Kingswood Stream running to the north east of the proposed site.
2	Irish Water Mapping	An extract from Irish Water mapping indicates the Kingswood Stream is culverted in an 1800mmø pipe to the east of the site which discharges to the ditch flowing north (See Figure 6A for details).
2	Predictive fluvial, coastal, pluvial and groundwater flood maps available on CFRAMS mapping obtained for the site from https://www.floodinfo.ie/map/floodmaps/	The proposed development is located outside the extents of the 1 in 1000 year (0.1% AEP). Refer to CFRAMS mapping in Appendix B.
3	Previous SDD Site Investigation Report (Information only)	Groundwater seepages identified in the Gravel Strata at depths ranging from 2.7m to 3.3m, locally 0.8m.

Table 2 Information Source Consulted

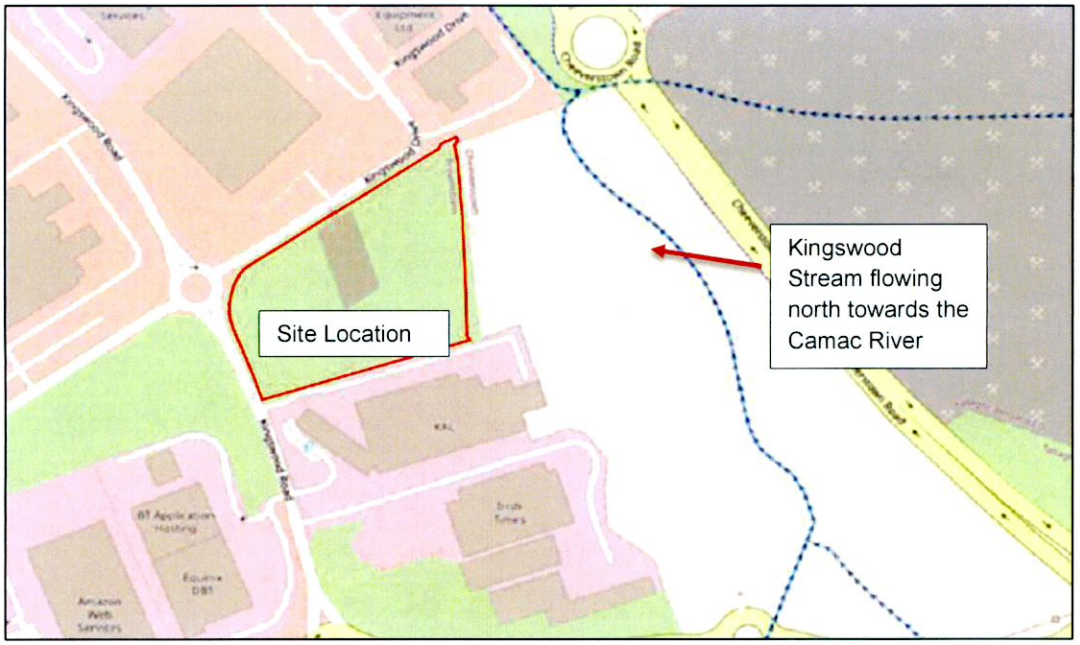


Figure 6 – Extract from EPA Mapping indicating location of Drainage Network adjacent to site

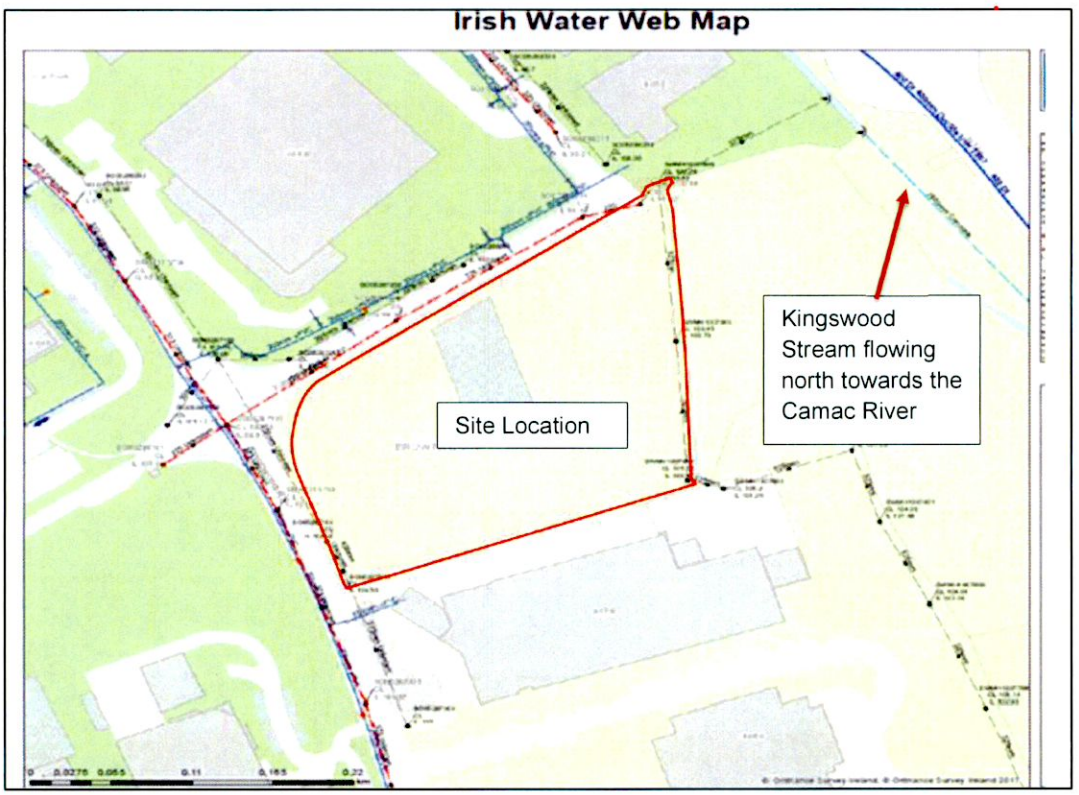


Figure 6A – Extract from Irish Water Mapping indicating location of Drainage Network adjacent to site

2.3 Source-Path Receptor

A Source-Pathway-Receptor model has been produced to assess the possible sources of floodwater and their likelihood, the pathways by which flood water reaches receptors and the receptors that could be affected by potential flooding, as summarized in Table 2 below.

Source	Path	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coasts 6.5 km away from the site	People and Property (the proposed development).	Remote	High	Very Low
Fluvial	Flooding from the Santry River.	People and Property (the proposed development).	Remote - is not subject to flooding in the 1:1000 year event.	High	Very Low
Fluvial	Flooding from the existing ditches running through the site	People and Property (the proposed development).	Remote	High	Very Low
Pluvial/Surface Water	Flooding from surcharging of the development's proposed surface water network	People and Property (the proposed development).	Possible	High	Moderate
Pluvial/Surface Water	Flooding from rise in water levels in the attenuation basins'	People and Property (the proposed development).	Possible	High	Moderate
Ground Water	Rising GWL on the site	People and Property (the proposed development).	Possible	High	Moderate
Other Source	Flooding due to human or mechanical error in sizing of Petrol interceptor or the hydrobrake/ blockage at any drainage system component.	People and Property (the proposed development).	Possible	High	Moderate

Table 2 Source-Path-Receptor analysis

From the SPR analysis presented above, it is noted that the proposed development site is not subject to tidal (Coastal) or fluvial flooding and therefore very low risk of flooding. However, Moderate risk remains from internal drainage system service to the development.

3 Stage 2: Initial Flood Risk Assessment

3.1 Fluvial Flooding

OPW flood mapping for the site was reviewed – See extract from CFRAMS mapping (Refer to Appendix B) in Fig 7 below.

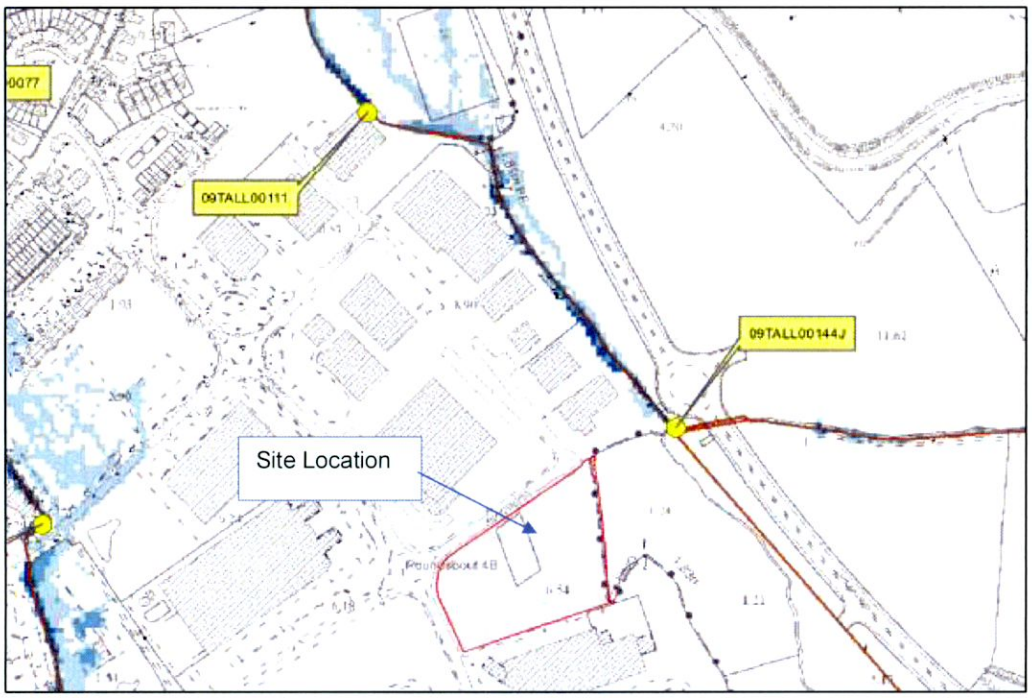


Fig 7 – OPW Flood Mapping CFRAMS

As can be seen above the site is not subject to flood in the 1:1000 year event (0.1% AEP) and falls within Flood Zone C.

There is no history of flood on the site. See extract from The Past Flood Event Local Area Summary Report in Fig 8 below which is included in Appendix C to this report.

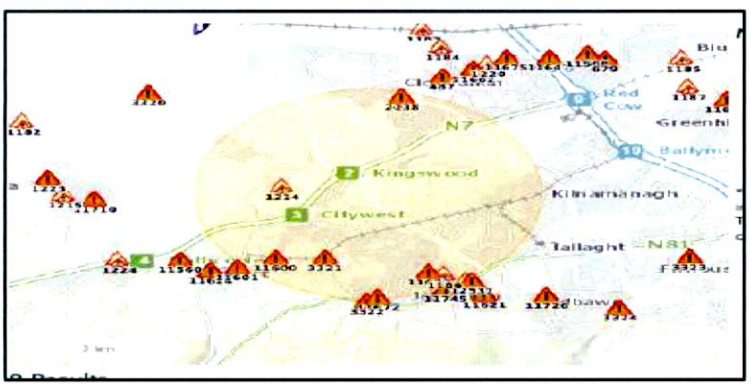


Fig 8 – Past Flood Events

3.2 *Pluvial Flooding from Surface Water Drainage*

The Source-Pathway-Receptor model presented in Stage 1 indicated the likelihood of Fluvial and Pluvial flooding types within the site. The identified risk of flooding in the study area is primarily associated with the future drainage networks service to the proposed development (see Figure 8).

The drainage system has a potential to cause local flooding unless it is designed in accordance with the regulations e.g. Greater Dublin Strategic Drainage Study (GDSDS) and to take account of flood 100-year storm return periods plus 20% allowance for climate change.

Proper operation and maintenance of the drainage system should be implemented to reduce the pluvial flood risk due to human/ mechanical error. Appendix A presents a proposed Operation and Maintenance O&M Plan for the drainage system in the development.

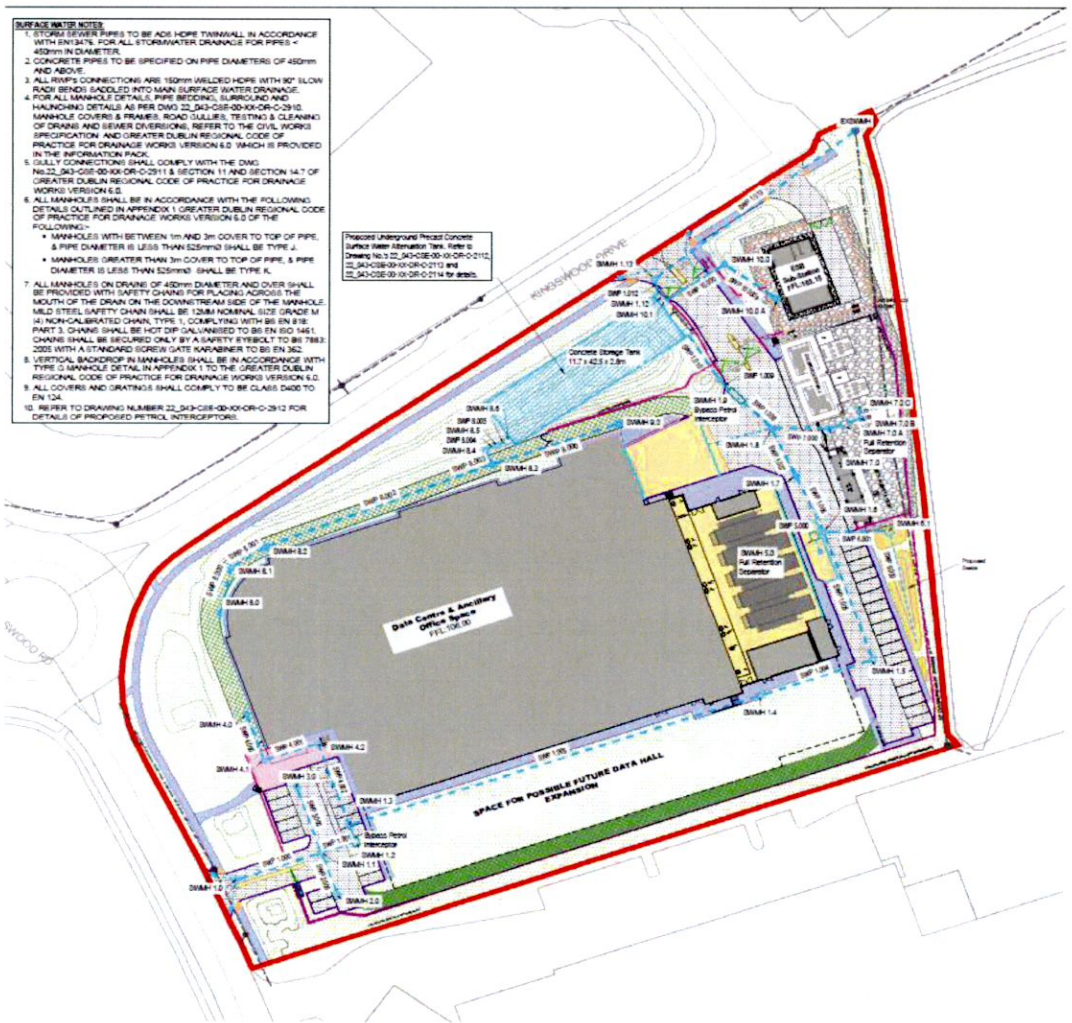


Fig 9 – Proposed Site Drainage Network

3.3 Ground Water Flooding

Based on historical preliminary geotechnical investigation on the site, ground water seepages identified in the Gravel Strata at depths ranging from 2.7m to 3.3m, locally at 0.8m. It should be noted that the FFL of Building is 106.00m, circa 1m above existing ground level at the eastern part of the building. During the site walkover survey, no marshy ground was observed. No groundwater wells or marsh areas are located within the site (based on review of information available on EPA and OSI websites). Therefore, the risk of groundwater flooding occurring at the site is considered negligible.

3.4 Flood Zone Category

Following the assessment of the flood risks to the site and the available information it is considered that the proposed site is located within Flood Zone C as per the OWP Guidelines and as indicated by the CFRAMS maps – refer to Appendix B. Therefore, the proposed development on the subject site is appropriate for this flood zone category, and a justification test is not required.

4 Conclusion

This Flood Risk Assessment for the proposed development was undertaken to the requirements of the OPW Guidelines, 2009, "Planning System and Flood Risk Management Guidelines for Planning Authorities". Following the flood risk assessment stages, it was determined that the site is within Flood Zone C as defined by the Guidelines and based on the CFRAMS mapping. Therefore, the development on the subject site is appropriate for the site's flood zone category and a justification test as outlined in the Guidelines is not required. The Guidelines sequential approach is met with the 'Justify' & 'Mitigate' principals being achieved. A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm occur.

Appendix A Surface Water Operation and Maintenance (O&M) Activities

All operation and maintenance activities should be in accordance to the following guidelines:

- Greater Dublin Strategic Drainage Study GDSDS- Volume 3 – Environmental Management
- CIRIA 2015SuDS Manual, Part E - Chapter 32

Considerations for surface water O&M:

Requirement	Assessment/Action
***Maintenance access* – ensuring appropriate and long-term access to all points in the system where future maintenance may be required**	A standard minimum of 600mm diameter opening is provided for all manhole, chambers and treatment system. Removable gullies grate opening with a minimum size of 450mm X 320mm.
Forebays and/or appropriate pre-treatment structures to facilitate the sediment management process.	Service manholes are proposed upstream and downstream of the attenuation system. Road gullies and the petrol interceptor will also facilitate sediment management process.
Bypass systems or appropriate temporary drainage infrastructure for use if required during sediment management or other maintenance activities.	Not required
The availability of disposal areas for organic arisings (green waste) and sediments.	To be included as part of maintenance contract of the development.

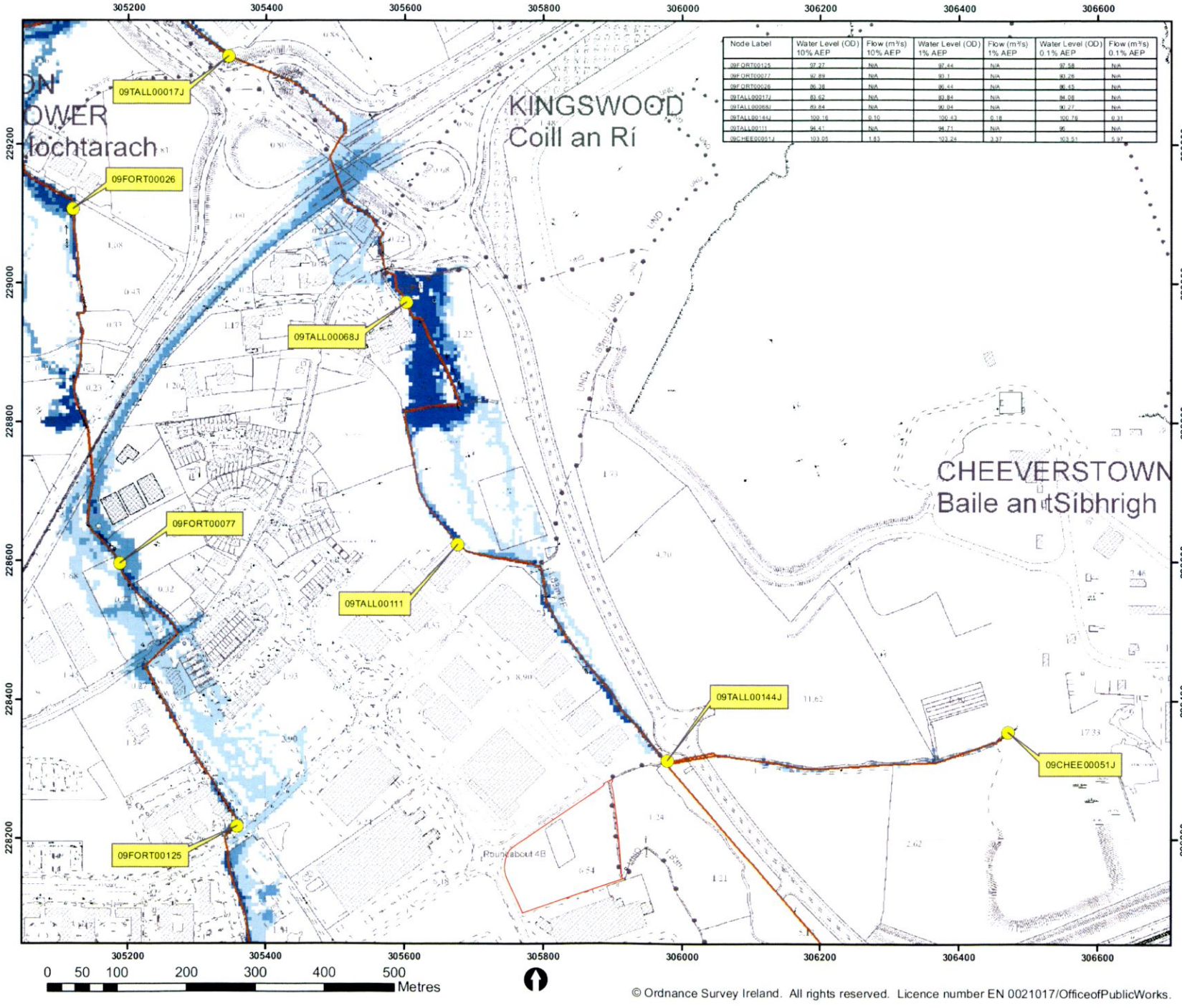
Types of SuDS systems used that require O&M activities:

- **Detention Pond:** 3no. of proposed ponds.
- **Soakaway:** N/A.
- **Pervious Paving:** proposed permeable paving areas proposed within the development area
- **Treatment system:** proposed petrol interceptor as part of road and parking drainage system

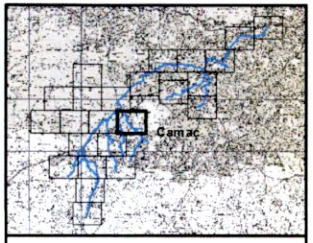
O&M activities required as following:

Operation and maintenance activities	SuDS Component			
O&M Activities	Attenuation Tank	Soakaway	Pervious Paving	Treatment System
Regular maintenance				
Inspection	■	■	■	■
Litter/debris removal	■		■	
Grass cutting			■	
Weed/invasive plant control	■		■	
Shrub management			■	■
Shoreline vegetation management				
Aquatic vegetation management				
Occasional maintenance				
Sediment management	■	■	■	■
Vegetation/plant replacement				
Vacuum sweeping and brushing			■	
Remedial maintenance				
Structure rehabilitation/repair	□	□		□
Infiltration surface reconditioning		□		
■ Will be required				
□ May be required				

Appendix B CFRAMS Mapping



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09FORT00125	97.27	N/A	97.44	N/A	97.58	N/A
09FORT00077	92.89	N/A	93.1	N/A	93.26	N/A
09FORT00026	86.38	N/A	86.44	N/A	86.45	N/A
09TALL00017J	83.62	N/A	83.84	N/A	84.08	N/A
09TALL00068J	89.84	N/A	90.04	N/A	90.27	N/A
09TALL00144J	100.16	0.10	100.43	0.18	100.76	0.31
09TALL00111	96.41	N/A	96.71	N/A	96	N/A
09CHEE00051J	103.05	1.83	103.24	3.37	103.51	5.97



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP / 1% AEP — Standard of Protection of Flood Defence (Walls / Embankments)
- Node Point
- Node ID — Node Label
- Outline of the Site Subject to this application

FINAL

REV:	NOTE	DATE:
01	SOP label updated (Pg 21) Removal of Def. Area (Pg 21)	13/11/2017

EASTERN CFRAM STUDY

OPW
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

RPS
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44(0) 28 90 667914
F +44(0) 28 90 663286
W www.rpsgroup.com
E ireland@rps.group.com

Map:	Camac Fluvial Flood Extents
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.McG. Date : 13 November 2017
Checked By :	A.S. Date : 13 November 2017
Approved By :	S.P. Date : 13 November 2017
Drawing No. :	E09CAM_EXFCD_F1_11
Map Series :	Page 11 of 24
Drawing Scale :	1:5,000 @A3

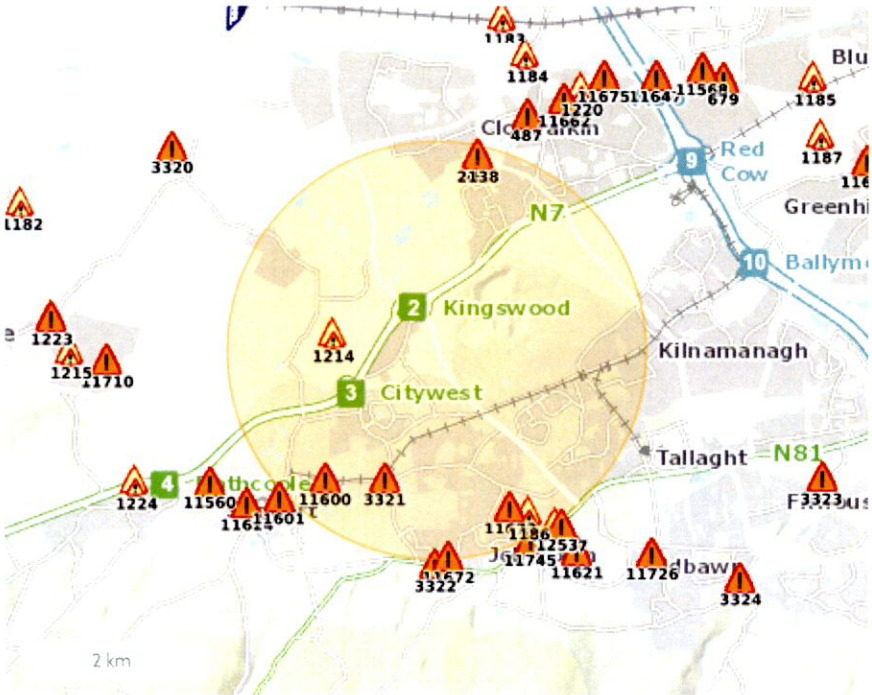
Appendix C Past Flood Event Summary

Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: 13/4/2022 10:20

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



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

9 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Camac Cherrywood Nov 1982 (ID-2138)	05/11/1982	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Camac Cherrywood June 1993 (ID-488)	11/06/1993	Exact Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Killinarden Stream Jobstown recurring (ID-1186)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (1)		
4.	Baldonnell Barneys Lane Recurring (ID-1214)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
5.	Camac Cherrywood Feb 1994 (ID-1271)	04/02/1994	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
6.	Fortunestown Lane Nov 2000 (ID-3321)	06/11/2000	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		

Clifton Scannell Emerson Associates Limited, Civil & Structural Consulting Engineers
Mentec House, Bakers Point, Pottery Road, Dun Laoghaire, Co Dublin, Ireland A96 K6P3
T. +353 1 288 5006 F. +353 1 283 3466 E. info@csea.ie W. www.csea.ie

	Name (Flood_ID)	Start Date	Event Location
7.	Flooding at Fortunestown Lane, Citywest, Co. Dublin on 24th Oct 2011 (ID-11600) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Approximate Point
8.	Flooding at Belfry Drive/De Selby Park, Dublin 24on 24th Oct 2011 (ID-11672) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point
9.	Flooding at Bawnlea Crescent and Avenue, Tallaght, Co. Dublin on 24th Oct 2011 (ID-11673) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point