



## PROPOSED RESIDENTIAL DEVELOPMENT AT HOLYWELL, CO. DUBLIN



Initial Site Specific Flood Risk Assessment | September 2023



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### Initial Site Specific Flood Risk Assessment

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## Proposed Residential Development at Holywell Co. Dublin

### Initial Site-Specific Flood Risk Assessment

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# 1. INTRODUCTION

Roughan & O'Donovan Consulting Engineers has carried out a Flood Risk Assessment for a greenfield site development at Holywell Co. Dublin for a proposed residential development. This report has been prepared to assess the flood risk to the subject sites and adjacent lands as a result of the proposed development.

## 1.1 Description of Proposed Development and Study Area

The site is located at Holywell, Swords, Co. Dublin. and is bounded by the Holywell Distributor Road to the north and west, existing residential development to the east and a residential landscaped area to the south. There is an existing ditch that runs along the southern boundary of the site. The site location is outlined in Figure 1.1 below. The site is situated within the catchment of the River Gaybrook which generally flows in a west-east direction and outfalls into the Malahide bay approximately 1 km west of the Malahide Marina.

The proposed development involves the construction of 57 no. apartments (21 no. one bedroom; 28 no. two bedroom; and 8 no. three bedroom) in 3 no. apartment blocks incorporating 33 car parking spaces, 166 no. long-stay bicycle parking and 57 no. short-stay bicycle parking.

Proposed access is located at the north-east corner of the site on Holywell Distribution Road. The proposed finished floor levels are set at 26.4 mOD. The proposed development will incorporate 150m<sup>3</sup> of compensatory flood storage. The development includes landscaping of the surrounding area within the development site and associated utilities & drainage work.

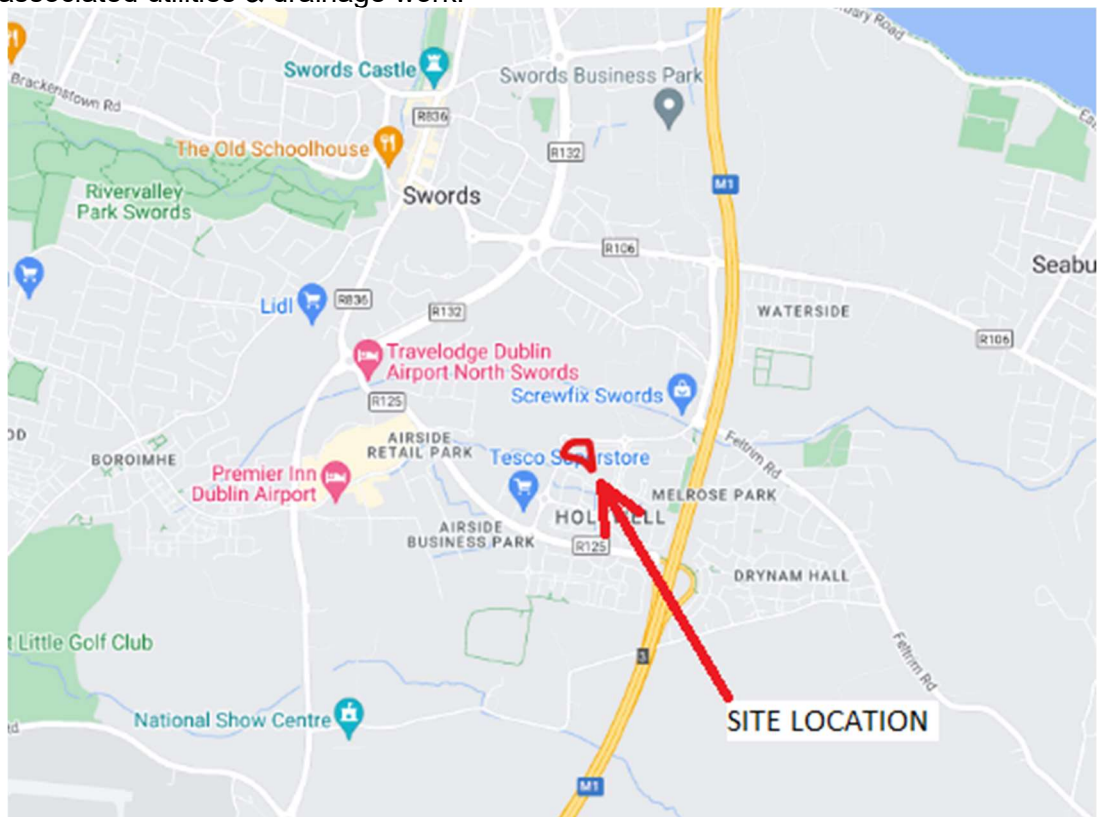


Figure 1.1 Site Location (map underlay source: Google Maps)

## 2. FLOOD RISK

### 2.1 Introduction

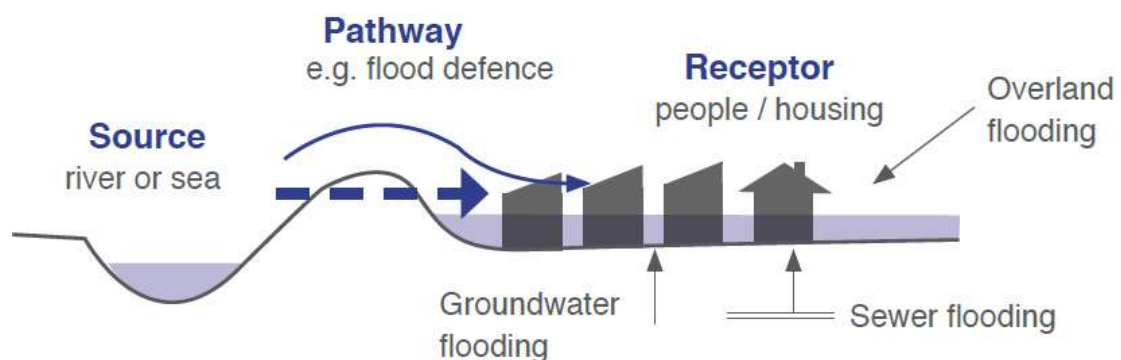
This report has been prepared in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' herein referred to as 'The Guidelines' as published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoEHLG) in 2009.

### 2.2 Identification of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

To fully assess flood risk an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors) is required. Figure 2.1 below shows a source-pathway-receptor model reproduced from 'The Guidelines' (DEHLG-OPW, 2009).



**Figure 2.1 Sources, Pathways and Receptors of Flooding**

The principal sources of flooding generally are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors can include people, their property and the environment. All three elements as well as the vulnerability and exposure of receptors must be examined to determine the potential consequences.

The Guidelines set out a staged approach to the assessment of flood risk with each stage carried out only as needed. The stages are listed below:

- ***Stage I Flood Risk Identification*** – to identify whether there may be any flooding or surface water management issues.
- ***Stage II Initial Flood Risk Assessment*** – to confirm sources of flooding that may affect an area or proposed development, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps.
- ***Stage III Detailed Flood Risk Assessment*** – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

## 2.3 Likelihood of Flooding

The Guidelines define the likelihood of flooding as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or annual exceedance probability (AEP). A 1% AEP flood indicates a flood event that will be equalled or exceeded on average once every hundred years and has a return period of 1 in 100 years. Annual Exceedance probability is the inverse of return period as shown Table 2.1 below.

**Table 2.1 Correlation Between Return Period and AEP**

Return Period (years)	Annual Exceedance Probability (%)
1	100
10	10
50	2
100	1
200	0.5
1000	0.1

## 2.4 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. These are split into three categories in The Guidelines:

### Flood Zone A

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/tidal flooding);

### Flood Zone B

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 or 0.5% or 1 in 200 for coastal/tidal flooding);

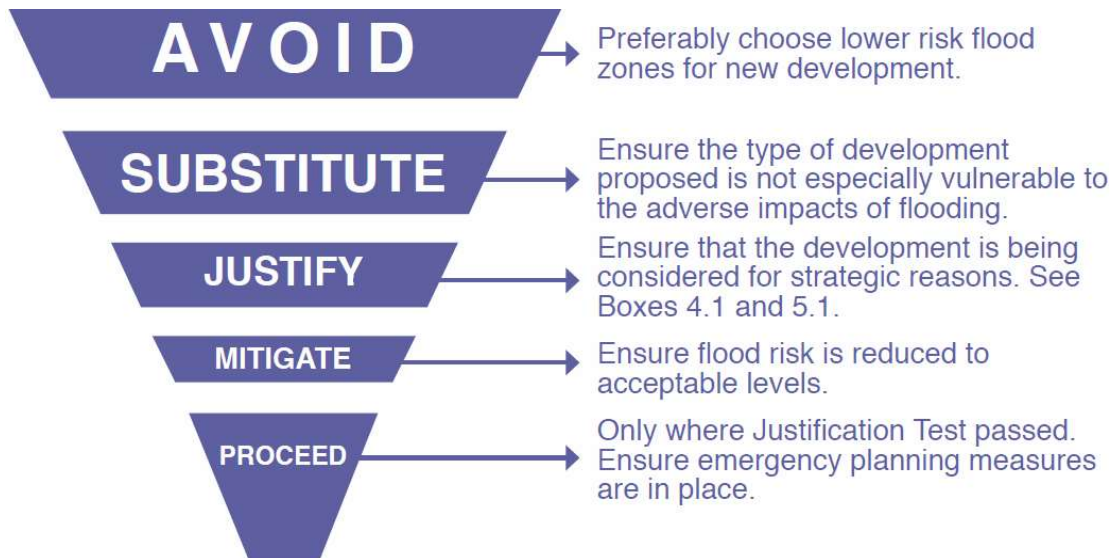
### Flood Zone C

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/tidal flooding. Flood Zone C covers all plan areas which are not in zones A or B.

It is important to note that when determining flood zones the presence of flood protection structures should be ignored. This is because areas protected by flood defences still carry a residual risk from overtopping or breach of defences and the fact that there is no guarantee that the defences will be maintained in perpetuity.

## 2.5 Sequential Approach & Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 2.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.



**Figure 2.2 Sequential Approach (Source: The Planning System and Flood Risk Management)**

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

**Table 2.2 Matrix of Vulnerability Versus Flood Zone to Illustrate Appropriate Development that is Required to Meet the Justification Test (Source: The Planning System and Flood Risk Management)**

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

### 3. STAGE 1: FLOOD RISK IDENTIFICATION

#### 3.1 General

This Stage 1 Flood Risk Identification includes a review of the existing information and the identification of any flooding or surface water management issues in the study area that may warrant further investigation.

#### 3.2 Vulnerability

As per the OPW Guidelines, the proposed development is classified as “highly vulnerable” development as it comprises residential uses. The guidelines stipulate that typically highly vulnerable developments are only appropriate within Flood Zone C (low risk areas).

#### 3.3 Information Sources Consulted

The following information sources were consulted as part of the Stage 1 Flood Risk Identification:

**Table 3.1 Information Sources Consulted**

Source	Data Gathered
<b>Primary Sources of Baseline Data</b>	
Catchment Flood Risk Assessment and Management Study (CFRAM): <a href="http://www.floodinfo.ie">www.floodinfo.ie</a>	Fluvial, Pluvial, Coastal flooding examined
National Indicative Fluvial Maps: <a href="http://www.floodinfo.ie">www.floodinfo.ie</a>	National Indicative Fluvial Maps examined
OPW Past Flood Events Mapping: <a href="http://www.floodinfo.ie">www.floodinfo.ie</a>	OPW Records of Fluvial, Pluvial, Coastal flooding examined
Fingal East Meath Flood Risk Assessment and Management Study <a href="http://www.floodinfo.ie">www.floodinfo.ie</a>	FEM FRAM Fluvial Maps consulted
<b>Secondary Sources of Baseline Data</b>	
Strategic Flood Risk Assessment (SFRA) of the Fingal County Development Plan 2023-2029	Fluvial, Coastal and Pluvial flooding examined
Stage 2 Site Specific Flood Risk Assessment Holywell, Swords, Co. Dublin – February 2022 (McCloy Consulting)	Flood Risk assessment examined
Geological Survey of Ireland (GSI) Maps	GSI Teagasc subsoils map consulted to identify if alluvial sediments are shown to be present at development site that may indicate historic flooding.
Historical Maps	OSI 25” mapping assessed
News Reports	News reports published in newspapers or digital news websites.

#### 3.4 Primary Sources of Baseline Data

##### (i) Fingal East Meath Flood Risk Assessment and Management Study

The FEM FRAM was undertaken as a pilot study for the OPW’s Catchment Flood Risk Assessment and Management (CFRAM) programme. The site and



surrounding area are included in the FEM FRAM Swords (south) Fluvial Extent Map. The mapping indicates flooding on site in the 1 in 1000 year event. The mapping also indicates flooding emanating from surface water sources in the upstream catchment.

An overview of the OPW FEM FRAM Swords (south) Fluvial Extent Mapping is reproduced in appendix B.

**(ii) National Indicative Fluvial Maps (NIFM)**

The indicative fluvial flood maps were finalised in December 2020. The mapping presents flood extents for river reaches that were not previously modelled as part of the CFRAMS and have catchments larger than 5 km<sup>2</sup>. As per the OPW the use of these maps is to “provide an indication of areas that may be prone to flooding. They are not necessarily locally accurate and should not be used as the sole basis for defining the Flood Zones nor for making decisions on planning applications.” As the site was considered as part of the CFRAMS study the NIFM maps are not applicable.

**(iii) OPW past flood Events (Floodinfo.ie)**

The OPW National Flood Hazard Mapping was examined to identify any recorded flood events within the vicinity of the site. No flood events have been recorded on the site, however, a number of flood events have been recorded within 1 km from the site.

An overview of the OPW National Flood Hazard Mapping is reproduced in appendix B.

### **3.5 Secondary Sources of Baseline data**

The following sources were also examined to identify areas that may be liable to flooding:

**(i) Strategic Flood Risk Assessment (SFRA) of the Fingal County Development Plan 2023-2029**

The site area is covered as part of the Fingal County Development Plan 2023-2029. There are indicators of flooding on site in the 1 in 1000 year event in the current climate scenario maps, maps for medium range scenario Flood Extents and High-End future scenario Flood Extents also indicate that there is a probability of flooding on the site.

An overview of the Strategic Flood Risk Assessment Flood Extents Mapping is reproduced in appendix B.

**(ii) Stage 2 Site Specific Flood Risk Assessment Holywell, Swords, Co. Dublin – February 2022**

A Stage 2 Site Specific Flood Risk Assessment was undertaken for a residential development and associated access roads, car parking and open amenity space in February 2022.

The study concluded that the site is within Flood Zone C, as defined in the OPW Guidelines. However, the site has been shown to be affected by climate change fluvial flooding and pluvial / surface water flooding.

The study indicates that the southern extent of the site is at risk of fluvial flooding in a climate change scenario, and further detailed assessment is required.

**(iii) Geological Survey of Ireland Maps**

According to the Geological Survey Ireland (GSI), the underlying subsoil is Till derived from limestones, and there are no known karst features (swallow holes, enclosed depressions, wells or springs) within the footprint of the site.

**(iv) Historical Maps**

Historical Maps were studied. No areas of the site have been identified as liable to flooding.

**(v) News reports**

No News report of flooding have been found in relation to the site.

**3.6 Source – Pathway – Receptor Model**

The following source-pathway-receptor model has been developed using the information examined in the Stage I Flood Risk Identification to categorise the sources of flooding, where it flows to (pathway) and the people and infrastructure affected by it (receptors). The likelihood and consequences of each type of flooding have also been assessed to determine the risk. These are summarised in Table 3.2 (taken from Appendix A of the Guidelines).

**Table 3.2 Source-Pathway-Receptor Model**

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Fluvial flooding	Overbank flow from the Gaybrook Stream	Dwelling houses	<i>Medium</i>	<i>High</i>	<b>Medium</b>
Pluvial / Surface Water flooding	Extreme rainfall events and inadequate surface water drainage	Dwelling houses	<i>Possible</i>	<i>High</i>	<b>Medium</b>
Coastal flooding	Extreme tides, storm surges or wave overtopping	Dwelling houses	<i>Highly Unlikely</i>	<i>High</i>	<b>Low</b>
Ground-water Flooding	Rising groundwater levels	Dwelling houses	<i>Low</i> (No reports or geological indicators)	<i>High</i>	<b>Low</b>

**3.7 Stage 1 Conclusions**

**3.7.1 Fluvial Flooding**

A number of sources of information including previous Site-Specific Flood Risk Assessment and Fingal Strategic Flood Risk Assessment Flood Extents maps indicates that the site is at risk of fluvial flooding. Therefore, the risk of fluvial flooding at the site is classified as medium and a Stage 2 – Initial Fluvial Flood Risk Assessment is required for the development.

**3.7.2 Coastal Flooding**

Coastal flooding was not identified as a source of flooding affecting the site in any of the sources of information consulted including CFRAM maps. The site is more than 20 m above sea level. Therefore, the risk of coastal flooding at the site is classified as low and further assessment is not required.

### **3.7.3 Surface Water / Pluvial Flooding**

The sources consulted indicate that the site may be subject to surface water derived flooding. Flood maps from the SFRA of Fingal County Development Plan, show flood affecting the surrounding developments and road infrastructures on the southern part of the site, this might be related to inadequate drainage capacity of the existing drainage infrastructures and may result in increased runoff volume routed towards the site object of this study. Therefore, the risk of Surface Water flooding at the site is classified as medium and a stage 2 – Initial Surface Water Flood Risk Assessment is required for the development.

### **3.7.4 Groundwater Flooding**

Groundwater flooding was not identified as a source of flooding affecting the site. Therefore, the risk of groundwater flooding is classified as Low and no further assessment is required.

## 4. STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

### 4.1 General

The Stage 2 Initial Flood Risk Assessment will confirm the sources of flooding that may affect the proposed development site.

### 4.2 Sources of Flooding

#### Flooding from Fluvial / Surface Water

The subject site is situated within the catchment of the Gaybrook Stream. The sources consulted as part of this assessment indicate that as portion of the subject site is at risk of flooding in the present day 1 in 1000 year fluvial event, it is therefore within Flood Zone B as defined in the OPW Guidelines. Flooding of the surface water network upstream of the site also appears to create flow paths that converge on the subject site.

The FEM FRAMS flood map includes model nodes along the Gaybrook Stream indicating flood levels for the 1% AEP and the 0.1% AEP present day. The closest node (3Ga3779) is located just upstream of the subject site before the river enters a culvert that conveys the water to another open channel to the east of Holywell. Table 4.1 shows the predictive 1% AEP and 0.1% AEP present day flood levels at the node 3Ga3779.

Climate Scenario	1% AEP Water Level (mOD)	0.1% AEP Water Level (mOD)
Current	24.08	25.57
High End Future Scenario (HEFS)	N/A	25.88

Note: the location of the node 3Ga3779 upstream of the subject lands means it is likely that the estimated flood levels are higher than they are within the subject lands. For the purposes of this assessment they are seen as appropriate but may be subject to revision downward following further assessment.

As per the Strategic Flood Risk Assessment for the Fingal Development Plan 2023-2029, the development is to include an appropriate freeboard. As per the Fingal SFRA, freeboard for Highly Vulnerable developments is the greater of:

- 500mm freeboard above current scenario; or
- 250mm above the HEFS (for Highly vulnerable developments).

Levels are given in table below. The minimum design floor level is therefore 26.13mOD.

**Table 4.1 Design Flood Level**

	Current	HEFS
FEM FRAM Flood Maps	25.57	25.88
Freeboard (as per Fingal SFRA)	0.5	0.25
Total	26.07	26.13

As the proposed finished floor level is set at 26.4mOD, the highest water level anticipated from fluvial flooding is 0.27m below the proposed finished floor level.

The layout of the proposed building includes minor areas of structures within the floodplain as derived from the FEMFRAM levels. These structures may displace flood waters within the subject lands in extreme events. A Civils 3D surface model was created to overlay the flood level on the site layout to determine the volume of water displaced by the proposed buildings. Based on this and upon a desktop survey of hydraulic and topographic conditions, the site layout design includes for 150m<sup>3</sup> of compensatory storage. The FEMFRAM levels are seen as appropriately conservative for the site and may be subject to revision downward following further assessment. Further topographic survey and hydraulic analysis at compliance stage will confirm the volumes of compensatory storage required on site to appropriately manage the displaced volumes if required.

*The output from the Civils 3D surface model can be found in Appendix C.*

### **Surface Water Flooding**

Surface water flooding occurs when the local drainage system cannot convey stormwater flows from extreme rainfall events. The rainwater does not drain away through the normal drainage pathways or infiltrate into the ground but instead ponds on or flows over the ground instead. Surface water flooding is unpredictable as it depends on a number of factors including ground levels, rainfall and the local drainage network. The drainage network for any development on the site will incorporate Sustainable Drainage Systems (SuDS) for the purpose for managing surface water in terms of both flow and quality.

## **5. JUSTIFICATION TEST**

The flood risk assessment carried out for the purposes of the proposed residential development determined that the subject site is potentially within lands at risk of flooding. In this context, the proposed development satisfies the Justification Test as outlined below:

5.1 The subject lands have been zoned or otherwise designated for the use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.

The subject site is zoned "Residential". As per the Fingal Council Development Plan 2023-2029 Residential Zoning Objective states "Provide for residential development and protect and improve residential amenity". The proposed development is suitable for the zonings as it is a residential development. Therefore, the proposed development is suitable for the subject site zoning.

5.2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:

5.2.1. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;

Fluvial flooding effects the proposed development in the 0.1%AEP event and above. The proposed development will not alter flow paths or existing flood defences. The proposed development will displace a minor amount of flood waters in extreme events though these volumes are to be compensated for on site.

5.2.2 The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;

The residential unit's minimum finished floor level will be in excess of the 0.1%AEP event level plus an appropriate freeboard. The proposed finished floor level was derived from FEMFRAM Study which included an allowance for climate change as per OPW Guidance. The proposed development will incorporate 150m<sup>3</sup> of compensatory storage in combination with flood resistant design features that will manage risk associated with increased risk as a result of future climate change.

5.2.3 The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access;

The proposed development has been designed with regard to flood resilient construction measures and materials. The proposed development will be subject to a maintenance plan, the maintenance of the proposed development will be undertaken by the relevant competent specialists.

5.2.4 The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The proposed residential development will facilitate compact and sustainable urban growth. The proposed development is in keeping with the surrounding areas visuals and uses within Swords.

## **5.1 Justification Test Conclusions**

The proposed development has been determined to have satisfied all requirements of the justification test.

## **6. CONCLUSION OF STAGE 2 SFRA**

The available sources consulted above indicate that a portion of the proposed development site is liable to flood in the 1 in 1000 year current climate scenario from fluvial sources.

Flood risk management measures incorporated within the design will protect the development up to the design flood event (1 in 1000 year + 20% climate change factor) with an appropriate freeboard and shall ensure flood risk is not increased upstream or downstream of the site. Details of the proposed compensatory storage measures (~150m<sup>3</sup>) shall be provided at compliance stage.

# **APPENDIX A**

## **GLOSSARY OF TERMS**

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**Catchment:** The area that is drained by a river or artificial drainage system.

**Catchment Flood Risk Assessment and Management Studies (CFRAMS):** A catchment-based study involving an assessment of the risk of flooding in a catchment and the development of a strategy for managing that risk in order to reduce adverse effects on people, property and the environment. CFRAMS precede the preparation of Flood Risk Management Plans (see entry for FRMP).

**Climate change:** Long-term variations in global temperature and weather patterns, which occur both naturally and as a result of human activity, primarily through greenhouse gas emissions.

**Core of an urban settlement:** The core area of a city, town or village which acts as a centre for a broad range of employment, retail, community, residential and transport functions.

**Detailed flood risk assessment:** A methodology to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of flood hazard and potential risk to an existing or proposed development, of its potential impact on flood elsewhere and of the effectiveness of any proposed measures.

**Estuarial (or tidal) flooding:** Flooding from an estuary, where water level may be influenced by both river flows and tidal conditions, with the latter usually being dominant.

**Flooding (or inundation):** Flooding is the overflowing of water onto land that is normally dry. It may be caused by overtopping or breach of banks or defences, inadequate or slow drainage of rainfall, underlying groundwater levels or blocked drains and sewers. It presents a risk only when people, human assets and ecosystems are present in the areas that flood.

**Flood Relief Schemes (FRS):** A scheme designed to reduce the risk of flooding at a specific location.

**Flood Defence:** A man-made structure (e.g. embankment, bund, sluice gate, reservoir or barrier) designed to prevent flooding of areas adjacent to the defence.

**Flood Risk Assessment (FRA):** FRA can be undertaken at any scale from the national down to the individual site and comprises 3 stages: Flood risk identification, initial flood risk assessment and detailed flood risk assessment.

**Flood Risk Identification:** A desk-based study to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

**Flood Hazard:** The features of flooding which have harmful impacts on people, property or the environment (such as the depth of water, speed of flow, rate of onset, duration, water quality, etc.).

**Floodplain:** A flood plain is any low-lying area of land next to a river or stream, which is susceptible to partial or complete inundation by water during a flood event.

**Flood Risk:** An expression of the combination of the flood probability, or likelihood and the magnitude of the potential consequences of the flood event.



**Flood Storage:** The temporary storage of excess run-off, or river flow in ponds, basins, reservoirs or on the flood plain.

**Flood Zones:** A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range.

**Fluvial flooding:** Flooding from a river or other watercourse.

**Groundwater flooding:** Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

**Initial flood risk assessment:** A qualitative or semi-quantitative study to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.

**Freeboard:** Factor of safety applied for water surfaces. Defines the distance between normal water level and the top of a structure, such as a dam, that impounds or restrains water.

**Justification Test:** An assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor increase flood risk elsewhere. The justification test should be applied only where development is within flood risk areas that would be defined as inappropriate under the screening test of the sequential risk-based approach adopted by this guidance.

**Likelihood (probability) of flooding:** A general concept relating to the chance of an event occurring. Likelihood is generally expressed as a probability or a frequency of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is based on the average frequency estimated, measured or extrapolated from records over a large number of years and is usually expressed as the chance of a particular flood level being exceeded in any one year. For example, a 1-in-100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.

**Ordnance Datum (or OD) Malin:** is a vertical datum used by an ordnance survey as the basis for deriving altitudes on maps. A spot height may be expressed as AOD for "above ordnance datum". Usually mean sea level (MSL) is used for the datum. In the Republic of Ireland, OD for the Ordnance Survey of Ireland is Malin Ordnance Datum: the MSL at Portmoor Pier, Malin Head, County Donegal, between 1960 and 1969. Prior to 1970, Poolbeg Ordnance Datum was used: the low water of spring tide at Poolbeg lighthouse, Dublin, on 8 April 1837. Poolbeg OD was about 2.7 metres lower than Malin OD.

**Management Train/Treatment Train:** the sequence of drainage components that collect, convey, store and treat runoff as it drains through the site.

**Mitigation:** The term is used to describe an action that helps to lessen the impacts of a process or development on the receiving environment. It is used most often in association with measures that would seek to reduce negative impacts of a process or development.

**Pathways:** These provide the connection between a particular source (e.g. high river or tide level) and the receptor that may be harmed (e.g. property). In flood risk management, pathways are often 'blocked' by barriers, such as flood defence structures, or otherwise modified to reduce the incidence of flooding.

**Pluvial flooding:** Usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems.

**Regional Planning Guidelines (RPG):** These provide the regional context and priorities for applying national planning strategy to each NUTS III region and encourage greater co-ordination of planning policies at the city/county level. RPGs are an important part of the flood policy hierarchy as they can assist in co-ordinating flood risk management policies at the regional level.

**Resilience:** Sometimes known as “wet-proofing”, resilience relates to how a building is constructed in such a way that, although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying and cleaning and subsequent reoccupation are facilitated.

**Receptors:** Things that may be harmed by flooding (e.g. people, houses, buildings or the environment).

**Residual risk:** The risk which remains after all risk avoidance, substitution and mitigation measures have been implemented, on the basis that such measures can only reduce risk, not eliminate it.

**Sequential Approach:** The sequential approach is a risk-based method to guide development away from areas that have been identified through a flood risk assessment as being at risk from flooding. Sequential approaches are already established and working effectively in the plan-making and development management processes.

**Sustainable Drainage System (SuDS):** Drainage systems that are considered to be environmentally beneficial, causing minimal or no long-term detrimental impact.

**Site-specific Flood Risk Assessment:** An examination of the risks from all sources of flooding of the risks to and potentially arising from development on a specific site, including an examination of the effectiveness and impacts of any control or mitigation measures to be incorporated in that development.

**Source:** Refers to a source of hazard (e.g. the sea, heavy rainfall).

**Strategic Flood Risk Assessment:** The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).

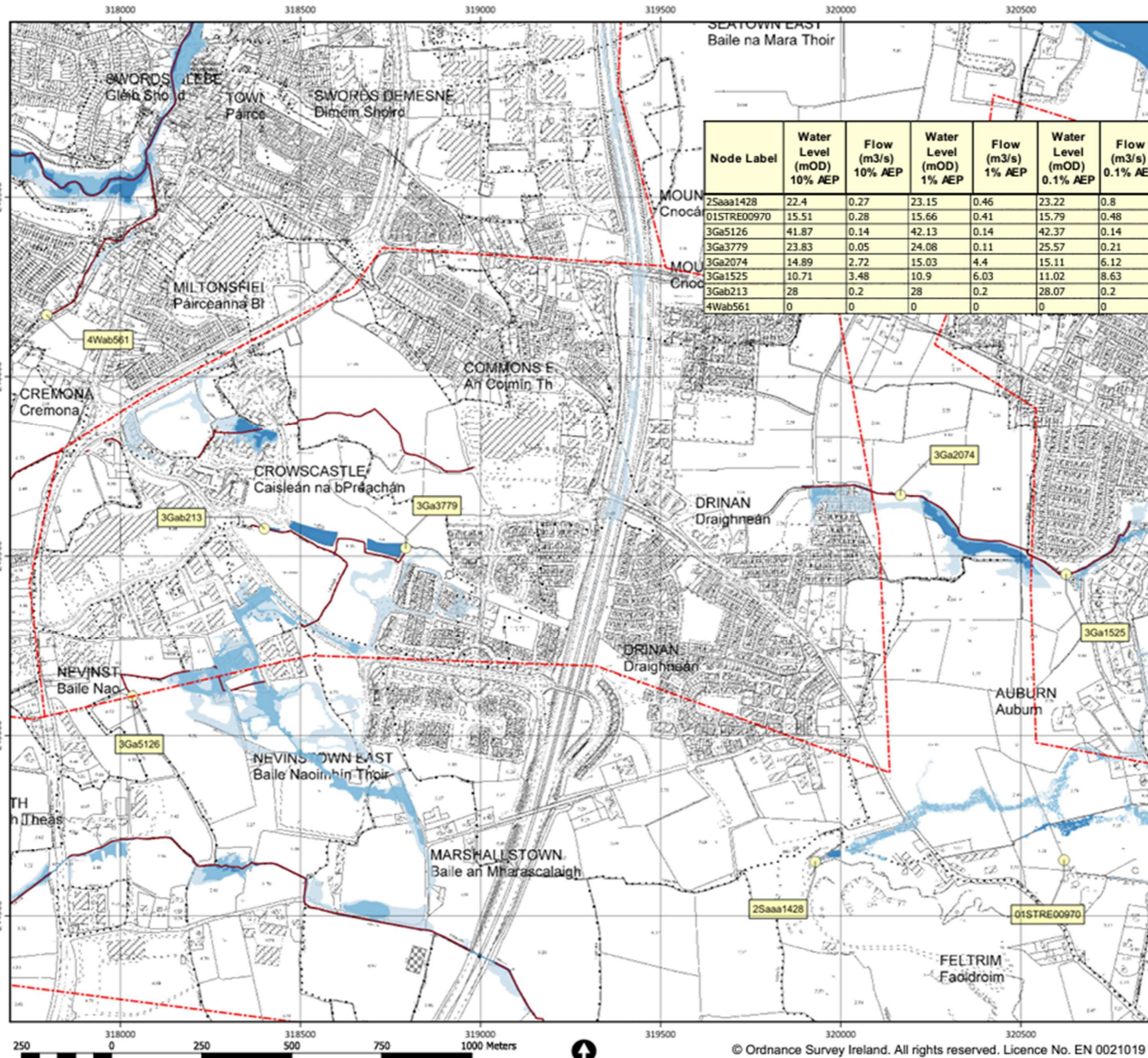
**Vulnerability:** The resilience of a particular group of people or types of property or habitats, ecosystems or species to flood risk, and their ability to respond to a hazardous condition and the damage or degree of impact they are likely to suffer in the event of a flood. For example, elderly people may be more likely to suffer injury, and be less able to evacuate, in the event of a rapid flood than younger people.

**Source:** *The definitions above are sourced from the DoEHLG Guidelines for Planning Authorities on ‘The Planning System and Flood Risk Management, 2009’ and Ciria 753 “the SuDS Manual”.*

## **APPENDIX B**

### **INDICATIVE FLOOD SOURCES**

### FEM FRAM River Flood Extents



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
2Saaa1428	22.4	0.27	23.15	0.46	23.22	0.8
01STRE00970	15.51	0.28	15.66	0.41	15.79	0.48
3Ga5126	41.87	0.14	42.13	0.14	42.37	0.14
3Ga3779	23.83	0.05	24.08	0.11	25.57	0.21
3Ga2074	14.89	2.72	15.03	4.4	15.11	6.12
3Ga1525	10.71	3.48	10.9	6.03	11.02	8.63
3Gab213	28	0.2	28	0.2	28.07	0.2
4Wab561	0	0	0	0	0	0

**Location Plan:**

**LEGEND**

- AFA Boundary
- Defended Area
- Modelled River Centreline
- Node Point
- 10% AEP Fluvial Extent (High Risk)
- 1% AEP Fluvial Extent (Medium Risk)
- 0.1% AEP Fluvial Extent (Low Risk)
- Flood Defence - Embankment
- Flood Defence - Wall
- Gate
- Node Label
- Standard of Protection of Flood Defence

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

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

Project:  
**FINGAL EAST MEATH FRAM STUDY**

Map:  
**SWORDS (SOUTH)  
FLUVIAL EXTENT MAP**

Map Type: EXTENT  
Source: FLUVIAL  
Map Area: HPW  
Scenario: CURRENT

Drawn by: IH Date: Mar - 2019  
Checked by: TC Date: Mar - 2019  
Approved by: GP Date: Mar - 2019

Map No.:  
**E09SWS\_EXFCD\_F1\_34**

Revision: F1  
Map Scale: 1:10000 Plot Scale: 1:1 @ A3

## OPW – PAST FLOOD EVENTS LOCAL AREA SUMMARY REPORT

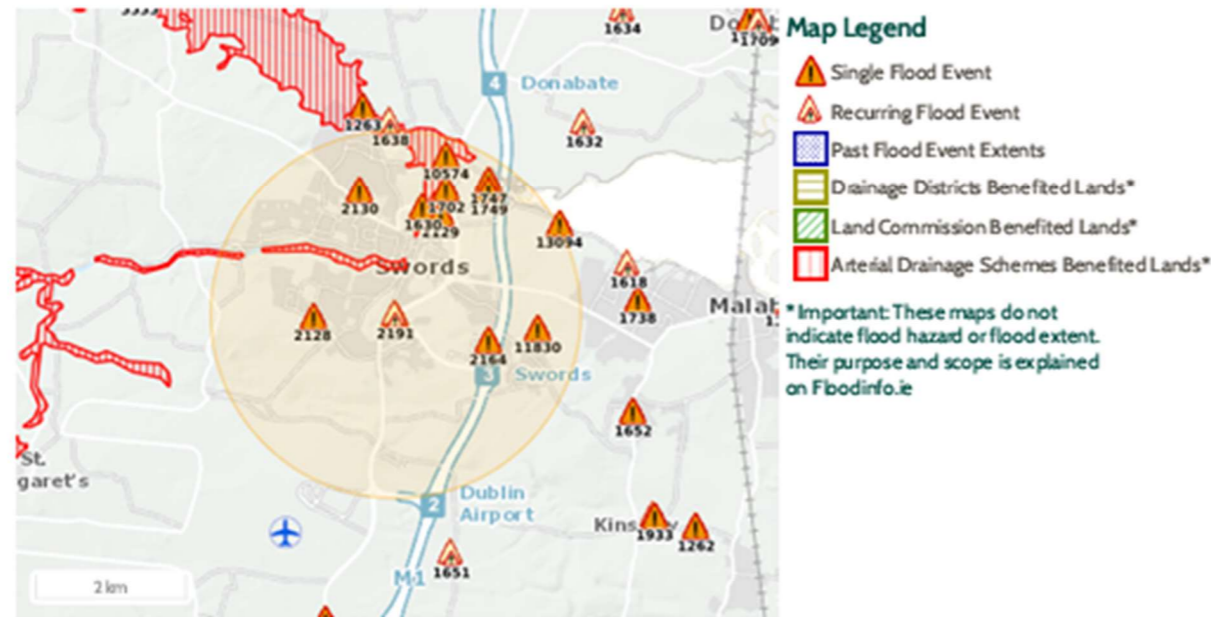
### Past Flood Event Local Area Summary Report



Report Produced: 8/8/2023 15:27

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](http://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.

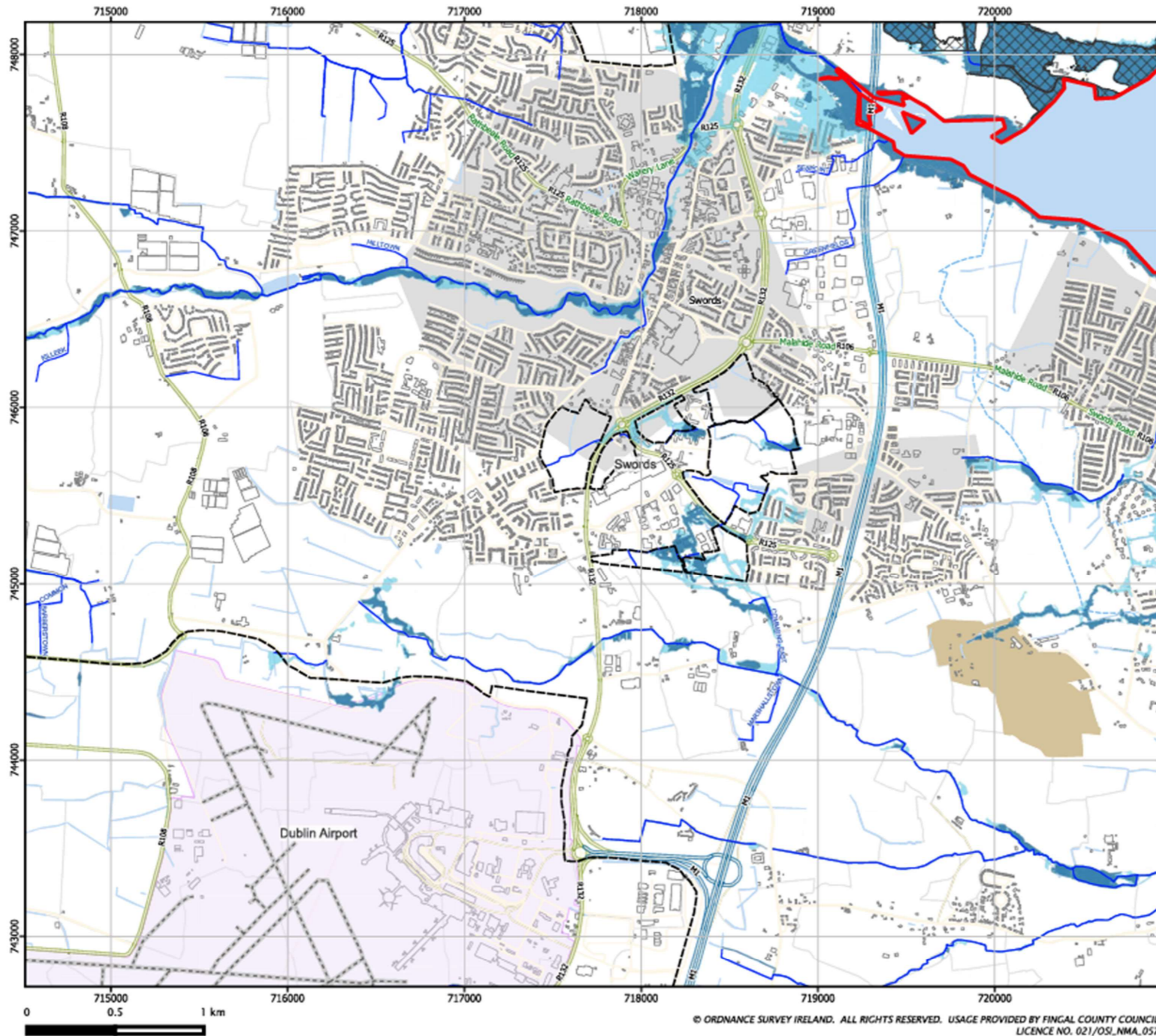


13 Results

Name (Flood_ID)	Start Date	Event Location
1.  Ward North Street Swords Nov 2002 (ID-1630) Additional Information: <a href="#">Reports (4)</a> <a href="#">Press Archive (3)</a>	13/11/2002	Exact Point
2.  N1 at Roundabout at Fingallions Nov 2002 (ID-1702) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	13/11/2002	Exact Point
3.  Estuary Road Swords Feb 2002 (ID-1747) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	01/02/2002	Approximate Point
4.  Gartan Court Swords Feb 2002 (ID-1749) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	01/02/2002	Exact Point
5.  Rathingle Swords Nov 1982 (ID-2128) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	05/11/1982	Exact Point
6.  Seatown Villas Swords Nov 1982 (ID-2129) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	05/11/1982	Exact Point

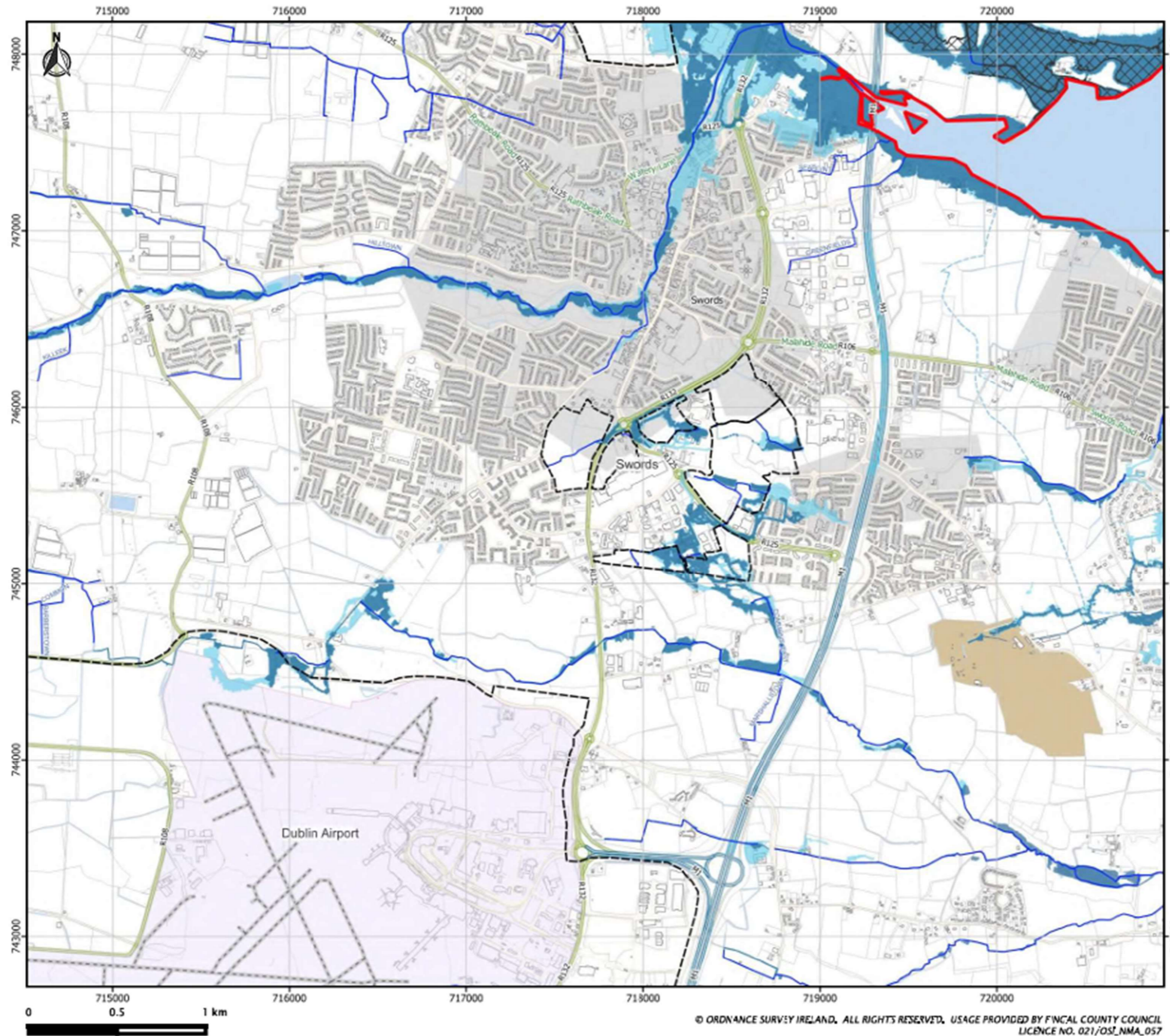
Name (Flood_ID)	Start Date	Event Location
7.  Pine Grove Park Swords Nov 1982 (ID-2130) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	05/11/1982	Exact Point
8.  Melrose Park Oct 2002 (ID-2164) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	19/10/2002	Exact Point
9.  Pinnock Hill Nov 2002 (ID-2191) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	14/11/2002	Exact Point
10.  Pinnock Hill October 2002 (ID-1468) Additional Information: <a href="#">Reports (4)</a> <a href="#">Press Archive (0)</a>	19/10/2002	Exact Point
11.  Pinnock Hill Swords Recurring (ID-1459) Additional Information: <a href="#">Reports (7)</a> <a href="#">Press Archive (0)</a>	n/a	Exact Point
12.  Ward Swords Co.Dublin August 2008 (ID-10574) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	08/08/2008	Approximate Point
13.  Flooding at Kinsealy Court, Swords, Co. Dublin (ID-11830) Additional Information: <a href="#">Reports (1)</a> <a href="#">Press Archive (0)</a>	24/11/2011	Approximate Point

### FINGAL SFRA – FLOOD ZONE MAP



<b>MAP SERIES</b>		15 OF 26
<b>KEY PLAN</b>		
<b>LEGEND</b>		
	Fingal County Administrative Boundary	
	Watercourses	
	LAP & Masterplan Boundaries	
	Flood Zone A	
	Flood Zone B	
	Defended Areas	
REV: 05	NOTE: FOR INFORMATION	05/04/2023
<b>Comhairle Contae Fhine Gall</b> Fingal County Council		
<small>Unit: 12, The Bear Centre, Stephenstown Industrial Estate, Balbriggan, Co. Dublin</small>		
<small>T: +353 (0)1 5138963 E: info@mcclroyconsulting.ie W: www.mcclroyconsulting.ie</small>		
<b>MAP: FLOOD ZONE MAP</b>		
<b>FLOOD PROBABILITY:</b>		
FLUVIAL: 1% / 0.1%      COASTAL: 0.5% / 0.1%		
<b>SOURCE CRS:</b>		ITM EPSG:2157
<b>DRAWN BY:</b>	DL	DATE: 05/04/2023
<b>CHECKED BY:</b>	PS	DATE: 05/04/2023
<b>APPROVED BY:</b>	DKS	DATE: 05/04/2023
<b>DRAWING NUMBER:</b>		
M02127-06_FIG_FL115		
<b>DRAWING SCALE:</b>	1:20000 @ A3	

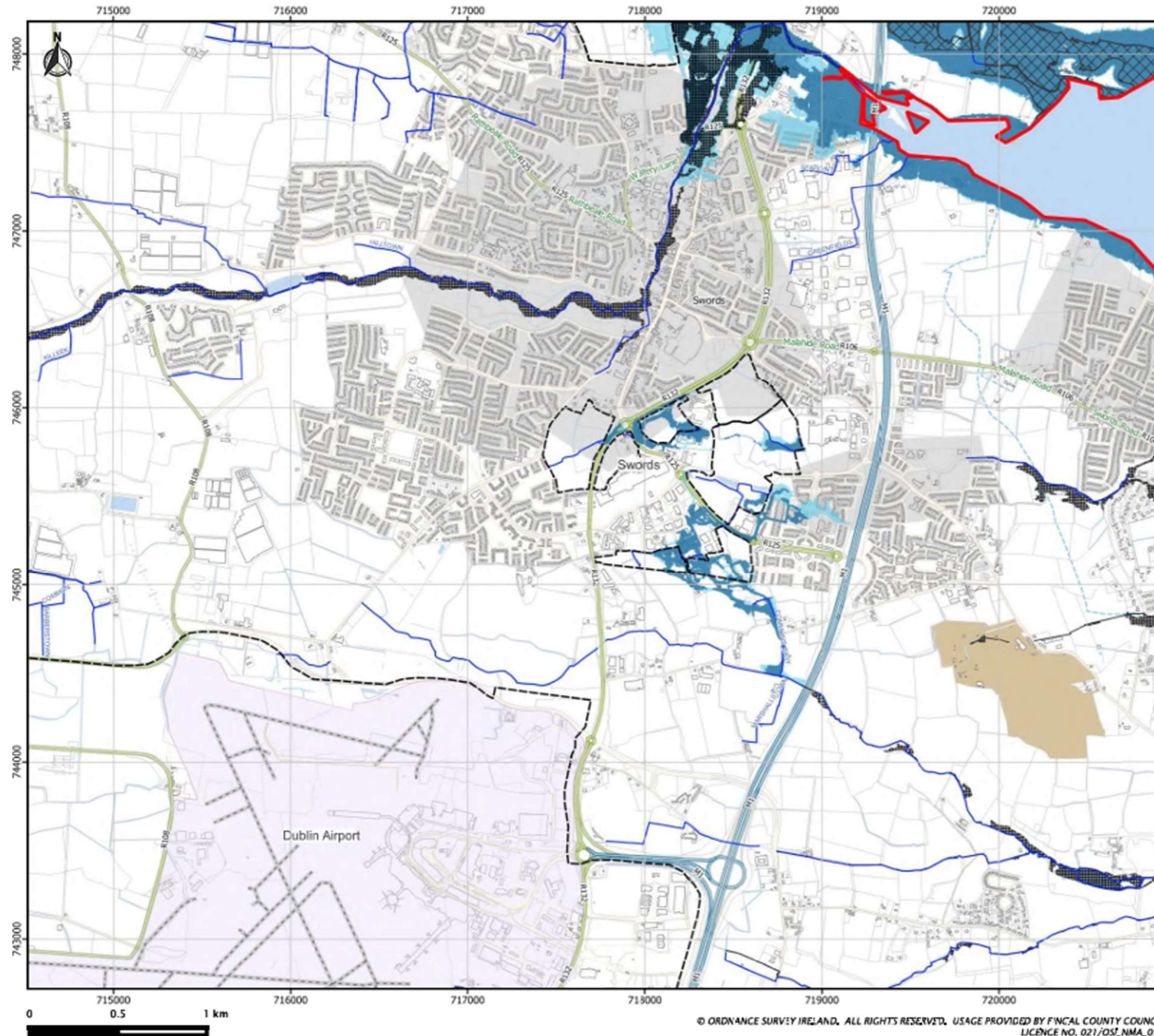
### FINGAL SFRA – MID RANGE FUTURE SCENARIO FLOOD EXTENTS



<b>MAP SERIES</b>		15 OF 26
<b>KEY PLAN</b>		
<b>LEGEND</b>		
<ul style="list-style-type: none"> <li><span style="border: 2px solid red; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> Fingal County Administrative Boundary</li> <li><span style="border-bottom: 2px solid blue; display: inline-block; width: 20px; margin-right: 5px;"></span> Watercourses</li> <li><span style="border: 1px dashed black; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> LAP &amp; Masterplan Boundaries</li> <li><span style="background-color: #0056b3; width: 15px; height: 10px; margin-right: 5px;"></span> 1% / 0.5% AEP MRFS Flood Extent</li> <li><span style="background-color: #add8e6; width: 15px; height: 10px; margin-right: 5px;"></span> 0.1% AEP MRFS Flood Extent</li> <li><span style="background-color: #cccccc; width: 15px; height: 10px; margin-right: 5px;"></span> No Climate Change Data Available; Present Day Flood Data Only, CC Flood Risk Subject to Site Specific Assessment</li> </ul>		
<b>REV:</b> 05	<b>NOTE:</b> FOR INFORMATION	<b>DATE:</b> 05/04/2023
<b>Comhairle Contae Fhine Gall</b> Fingal County Council		
Unit 12, The Beat Centre, Steelesstown Industrial Estate, Balbriggan, Co. Dublin		
T: +353 (0)1 518963 E: info@mcclloyconsulting.ie W: www.mcclloyconsulting.ie		
<b>M.A.P:</b> MID RANGE FUTURE SCENARIO FLOOD EXTENT		
<b>FLOOD PROBABILITY:</b>		
FLUVIAL: 1% / 0.1%		COASTAL: 0.5% / 0.1%
<b>SOURCE CRS:</b>		ITM EPSG:2157
<b>DRAWN BY:</b>	DL	DATE: 05/04/2023
<b>CHECKED BY:</b>	PS	DATE: 05/04/2023
<b>APPROVED BY:</b>	DKS	DATE: 05/04/2023
<b>DRAWING NUMBER:</b>		
M02127-06_FIG_FL215		
<b>DRAWING SCALE:</b>		1:20000 @ A3

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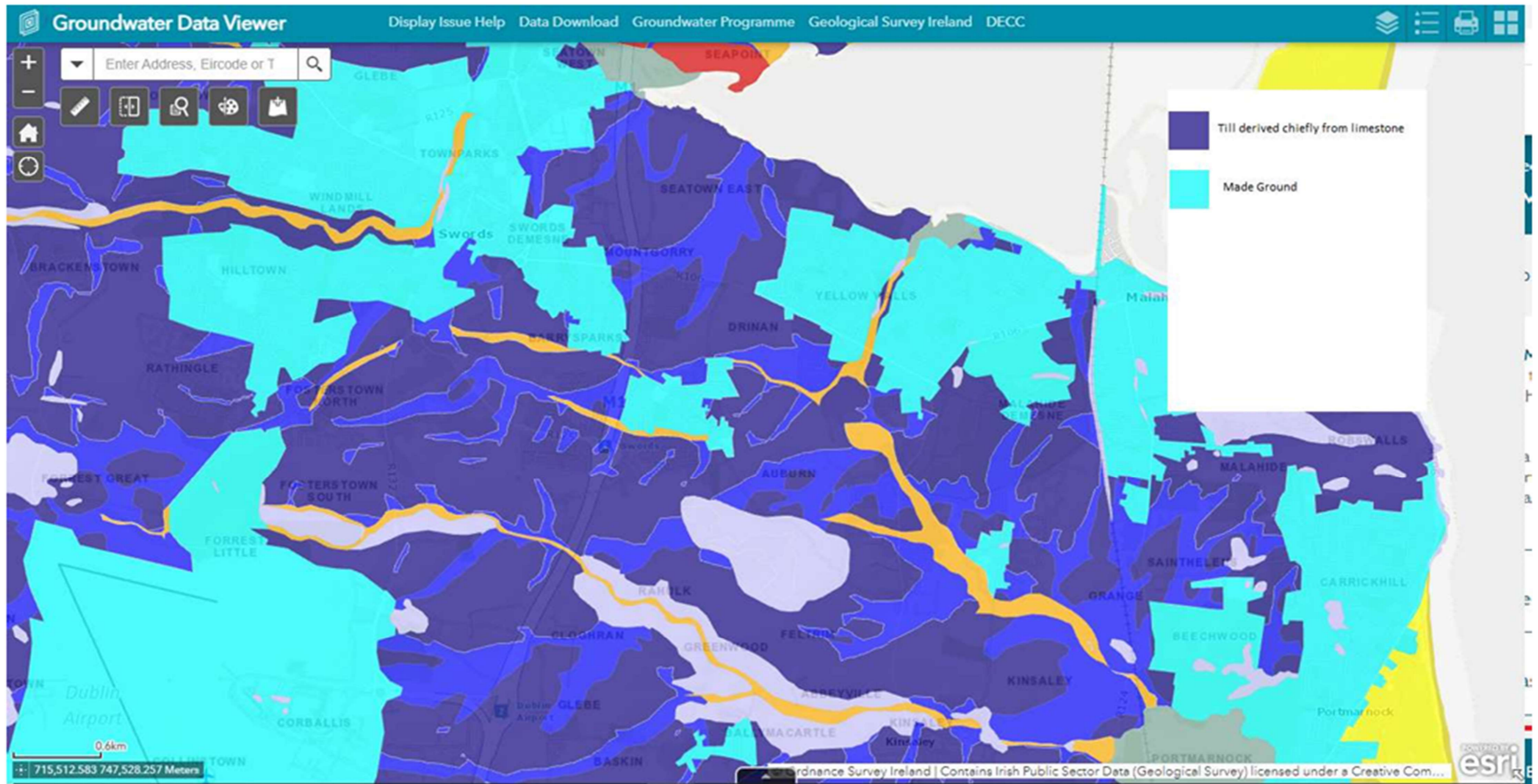
### FINGAL SFRA – HIGH END FUTURE SCENARIO FLOOD EXTENTS



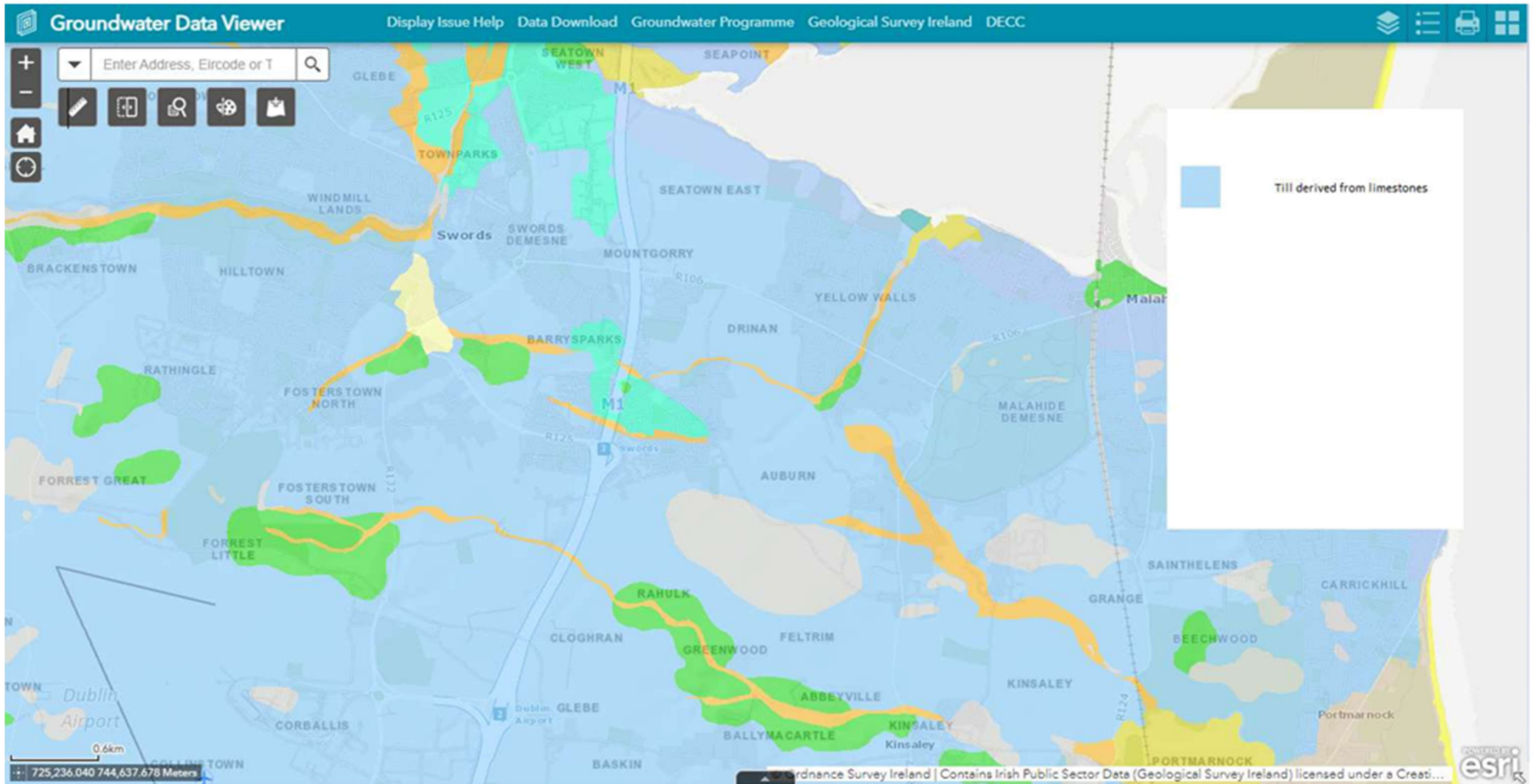
<b>MAP SERIES</b>		15 OF 26
<b>KEY PLAN</b>		
<b>LEGEND</b>		
	Fingal County Administrative Boundary	
	Watercourses	
	LAP & Masterplan Boundaries	
	1% / 0.5% AEP HEFS Flood Extent	
	0.1% AEP HEFS Flood Extent	
	No Climate Change Data Available; Present Day Flood Data Only. CC Flood Risk Subject to Site Specific Assessment	
<b>REV:</b> 05	<b>NOTE:</b> FOR INFORMATION	05/04/2023
<b>Comhairle Contae Fhine Gall Fingal County Council</b>		
Unit 12, The Beat Centre, Stephenstown Industrial Estate, Balbriggan, Co. Dublin		
T: +353 (0)1 5138963 E: info@mcclloyconsulting.ie W: www.mcclloyconsulting.ie		
<b>MAP:</b> HIGH END FUTURE SCENARIO FLOOD EXTENT		
<b>FLOOD PROBABILITY:</b>		
FLUVIAL: 1% / 0.1%		COASTAL: 0.5% / 0.1%
<b>SOURCE CRS:</b>		ITM EPSG:2157
<b>DRAWN BY:</b>	DL	<b>DATE:</b> 05/04/2023
<b>CHECKED BY:</b>	PS	<b>DATE:</b> 05/04/2023
<b>APPROVED BY:</b>	DKS	<b>DATE:</b> 05/04/2023
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M02127-06_FIG_FL315		
<b>DRAWING SCALE:</b>		1:20000 @ A3



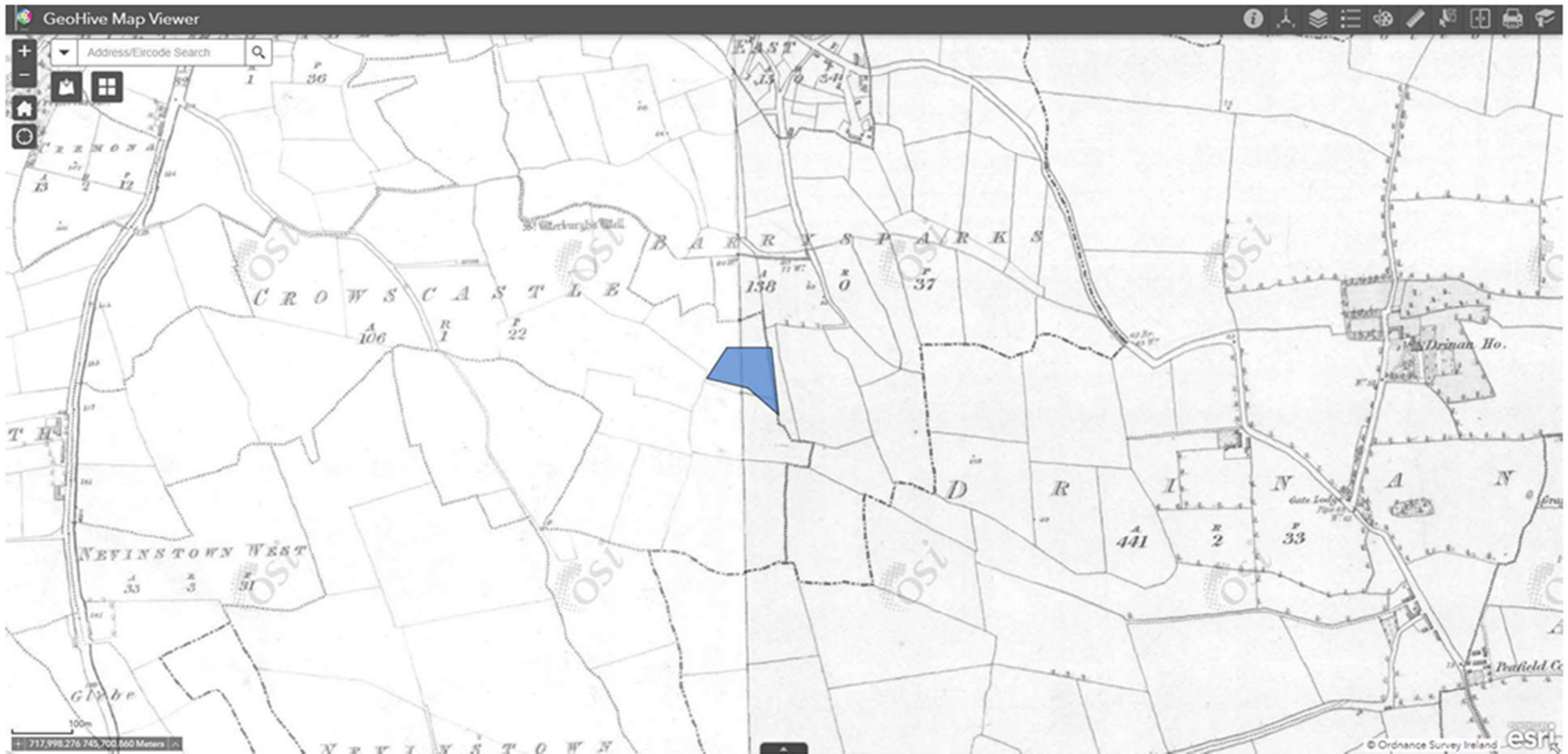
### Geological Survey of Ireland: Teagasc Subsoil Mapping



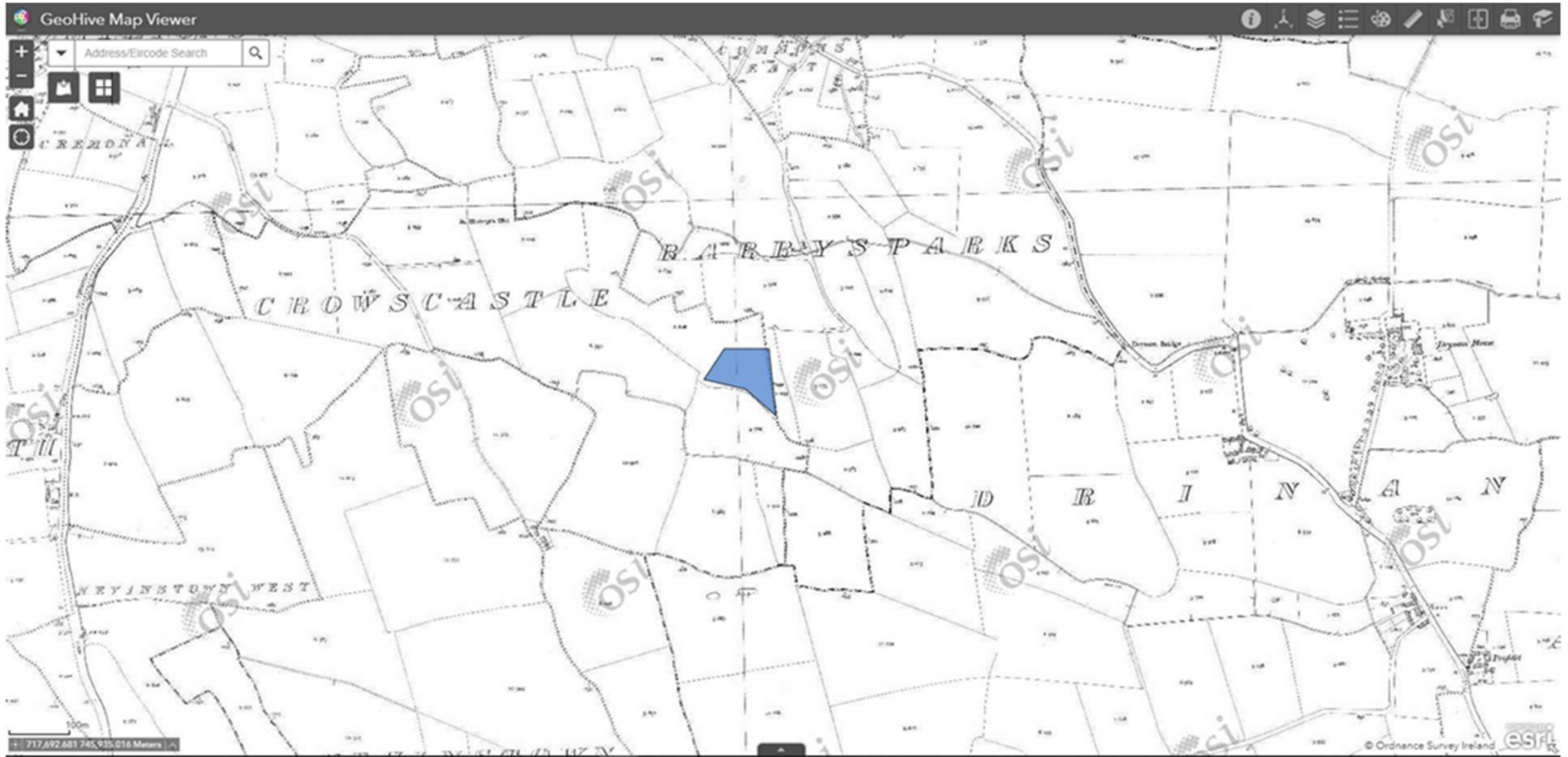
### Geological Survey of Ireland: Subsoil (Quaternary Sediments)



### Historical Maps: 6" Genie

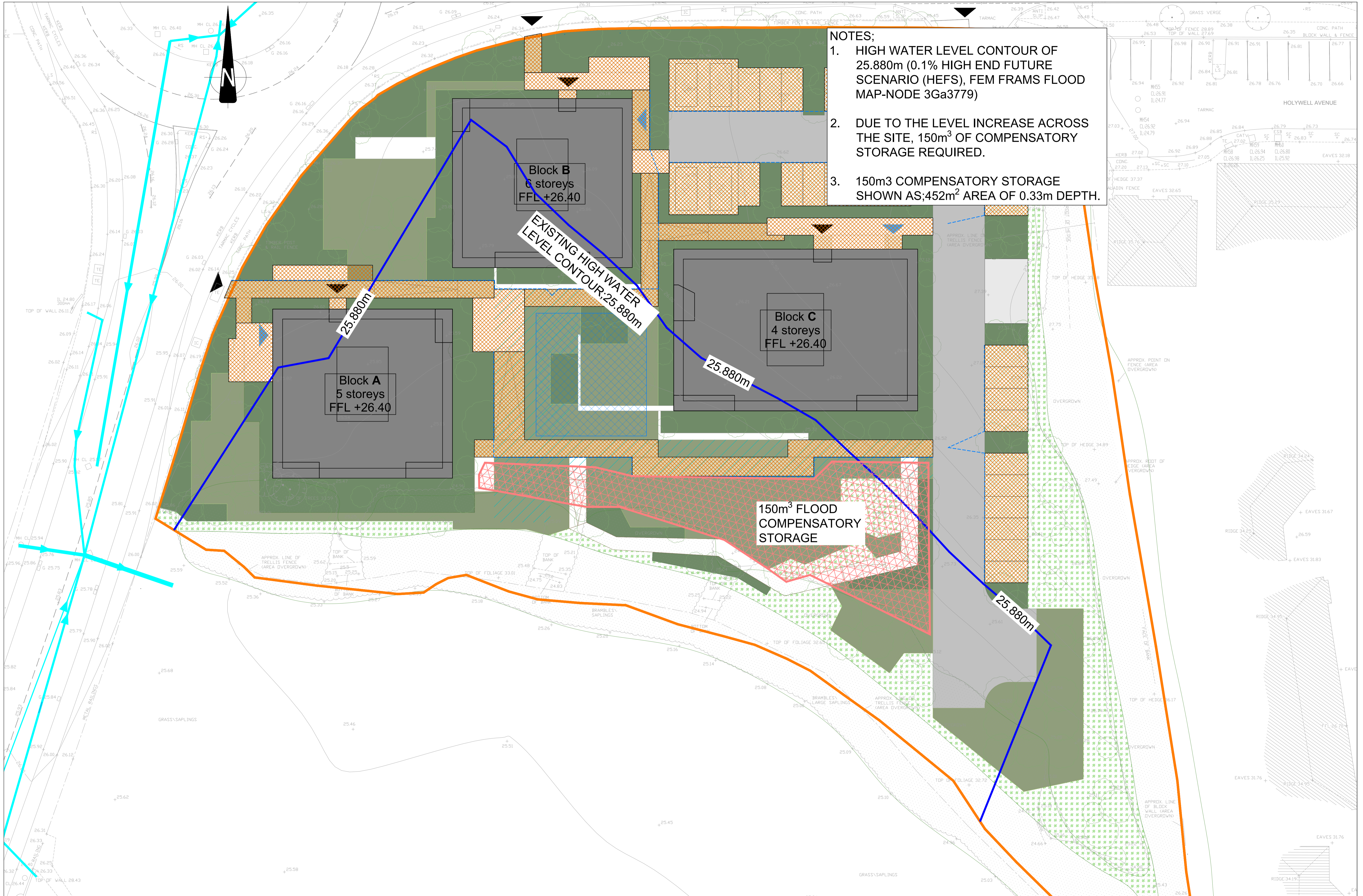


### Historical Maps: 25" Genie



## **APPENDIX C**

### **DISPLACED VOLUME CALCULATION**



- NOTES;**
1. HIGH WATER LEVEL CONTOUR OF 25.880m (0.1% HIGH END FUTURE SCENARIO (HEFS), FEM FRAMS FLOOD MAP-NODE 3Ga3779)
  2. DUE TO THE LEVEL INCREASE ACROSS THE SITE, 150m<sup>3</sup> OF COMPENSATORY STORAGE REQUIRED.
  3. 150m<sup>3</sup> COMPENSATORY STORAGE SHOWN AS; 452m<sup>2</sup> AREA OF 0.33m DEPTH.

Block B  
6 storeys  
FFL +26.40

EXISTING HIGH WATER  
LEVEL CONTOUR; 25.880m

Block C  
4 storeys  
FFL +26.40

25.880m

Block A  
5 storeys  
FFL +26.40

25.880m

150m<sup>3</sup> FLOOD  
COMPENSATORY  
STORAGE

25.880m