

Project

Santa Sabina SHD- Proposed Alterations to Reg. Ref.: F17A/0615

Report Title

Site Specific Flood Risk Assessment (SSFRA)

Client

Parsis Limited

INFRASTRUCTURE



DBFL CONSULTING ENGINEERS

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1. INTRODUCTION

1.1 Background

DBFL Consulting Engineers were commissioned by the applicant, Parsis Limited, to prepare a Site-Specific Flood Risk Assessment (SSFRA) for the proposed strategic housing development on the lands formerly owned by Santa Sabina Dominican College.

A planning permission for a residential development on this site was granted by Fingal County Council (FCC) under planning application Reg. Ref.: F17A/0615. This application was accompanied by an SSFRA which confirmed that the development is appropriate for this flood zone. Furthermore, these lands were zoned for residential development in the Fingal Development Plan 2017-2023 (see extract, Figure 1.2, below) for which an extensive flood risk assessment would have been undertaken.

Works are currently being undertaken, or have been undertaken, on this site under permitted development Reg. Ref.: F17A/0615. These works include provision of a new access road to the Santa Sabina Dominican College and partial construction of a new access road for the residential development along with the watermain connection, surface water attenuation tank and surface water outfall connection to the public network.

Parsis Ltd are now applying for planning permission through the Strategic Housing Development process for alterations to the permitted residential development. The proposed alterations relate to a c. 0.76 hectare portion of the permitted development site. The remainder of the development is being constructed in accordance with the permitted development.

The application site for this amended SHD planning permission is limited to the green boundary as marked on Figure 1.1 below (please see drawings submitted alongside the application for alteration for a precise boundary line). All the proposed amendments, which relate to 102 no. residential units, are on the lands zoned RS- Residential. No changes are proposed to Block B2-B3 (24 no. units) and C2 (17 no. units), which contain a total of 41 no. permitted apartments and a creche. The car parking provision will be reduced to 168 no. spaces. No changes are proposed to the open spaces to the south of the permitted blocks. The finished ground floor level of the units remains set at a minimum of 4.20.

Given that the changes proposed for the SHD application are related to additional storeys and changes in unit distribution (as detailed below), the SHD amendments will not change the footprint of the main apartment block or significantly alter the surrounding landscape from that permitted under Reg. Ref.: F17A/0615. It can therefore be assumed there will be no increase in flood risk from these amendments. Notwithstanding, the flood risk associated with the overall site is analysed in this report.

During development under the permitted Reg. Ref.: F17A/0615 grant DBFL and the client have engaged with FCC and other relevant stakeholders to determine and discuss the flood risk for the site and the issues raised at pre-app stage. Within this flood risk assessment DBFL outline the mid-range and high-end future flood risk scenarios and proposed evacuation routes.

The drainage outfall for the proposed development, including the petrol interceptor, attenuation tank, hydrobrake and non-return valve are currently being constructed under planning Reg. Ref.: F17A/0615. The drainage network for the proposed altered development will connect into this drainage outfall system. Furthermore, the development will not be taken in charge, therefore the maintenance of the permeable paving will be under the control of a management company.



Figure 1.1 – Site location and approximate works boundary. Santa Sabina Dominican College, Greenfield Road, Sutton, Dublin 13.

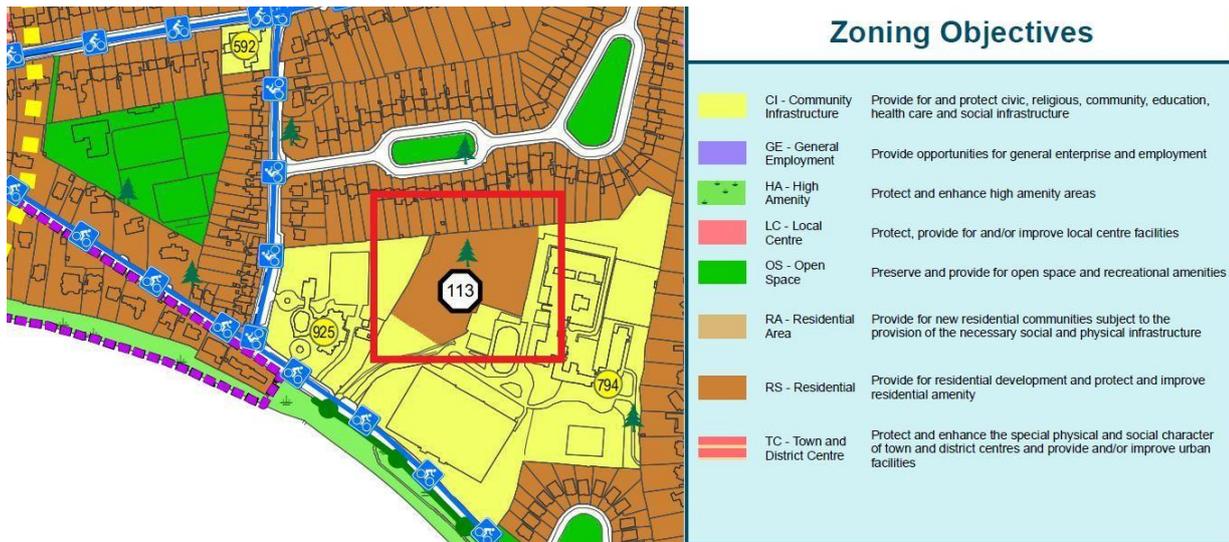


Figure 1.2 – Extract from Fingal Development Plan 2017-2023 (Baldoyle/Howth) showing lands zoned for residential development.

Under the proposed alterations to the permitted development as part of this application a provision for 47 no. additional residential units will be made, i.e. increasing the number of residential units on the site from 96, as permitted under Reg. Ref.: F17A/0615, to 143. This application constitutes a change in layout, unit type/mix and minor amendments to the road and engineering services layout compared to what is currently approved in this area of the site under the above planning permission.

The development comprises alterations to the development permitted under Reg. Ref.: F17A/0615 (currently under construction) consisting of the following:

- Provision of 2 additional storeys to Block A-B1 and alterations / redesign to the 3 permitted storeys below to provide a five storey building containing 42 no. apartments (consisting of 9 no. 1 beds, 29 no. 2 beds and 4 no. 3 beds), and including associated alterations to the courtyard communal amenity space.
- Provision of 2 additional storeys to Block C1 and alterations to the 3 permitted storeys below to provide a five storey building containing 28 no. apartments (consisting of 28 no. 2 beds).
- Replacement of Block D, comprising 10 no. two and three storey semi-detached houses, with 3 no. three storey apartment buildings (Block D1, D2 and D3) containing 32 no. apartments (consisting of 6 no. 1 beds, 21 no. 2 beds and 5 no. 3 beds), and including provision of communal amenity space to the north.
- The alterations to Block A-B1 and C1 include associated alterations to the basement under these blocks primarily relating to the omission of a core and associated alterations to plant, waste storage, car and cycle parking provision.
- The proposed alterations include the provision of balconies / terraces to the external elevations of Block A-B1, C1, D1, D2, and D3.

- An ESB substation and switchroom building and bin collection point are proposed in place of three permitted car parking spaces adjoining the western boundary of the site.
- The proposal includes alterations to the permitted car and cycle parking at basement and ground level, resulting in the provision of a total of 168 no. car parking and 270 no. bicycle spaces.
- The proposed alterations include all associated ancillary site development works.

This SSFRA was prepared for the proposed development to comply with current planning legislation, particularly the recommendations of “The Planning System & Flood Risk Management - Guidelines for Planning Authorities”.

1.2 Objectives

The objective of this report is to inform the planning authority regarding flood risk for the development on the subject site. The report assesses the site and development proposals in accordance with the requirements of “The Planning System and Flood Risk Management Guidelines for Planning Authorities”.

The report clarifies the site’s flood zone category and presents information which would facilitate an informed decision of the planning application in the context of flood risk. The report also outlines appropriate flood risk mitigation and management measures for any residual flood risk.

1.3 Existing Site

The application site relates to the westernmost part of the school grounds as detailed previously in Figure 1.1 and outlined below in Figure 1.3. The site is bordered to the north by the Glencarraig Estate and to the east by the Santa Sabina Dominican College. To the south Greenfield Road fronts the proposed development, further south to this is Dublin Bay and to the west lies St Fintan’s Parish Church.



Figure 1.3 - Aerial view of site showing site works in progress under planning permission Reg. Ref.: F17A/0615 and approximate outline of area submitted for revised permission.

The site is relatively flat and slopes gently at an approximate gradient of 1 in 280 from the West to the East and is graded slightly steeper from the South to North side of the site with a gradient of approximately 1 in 130. There are overhead lines on the eastern side of the site where works have been undertaken under the previous planning permission. The proposed residential area of the site has no overhead lines present.

The proposed residential area was a greenfield site and is now under construction under permitted development Reg. Ref.: F17A/0615. The infrastructure works to provide access to the Santa Sabina Dominican College have been undertaken and completed on the site as per planning Reg. Ref.: F17A/0615. Also under this permitted development Reg. Ref.: F17A/0615, the infrastructure works to the south of the proposed residential blocks are currently being constructed. These works include the construction of the proposed surface water attenuation tank, part of the surface water pipe network, surface water outfall, a portion of the development access road, watermain connection and any associated root protection for these services.

2. PLANNING SYSTEM & FLOOD RISK MANAGEMENT GUIDELINES

2.1 General

“The Planning System and Flood Risk Management Guidelines for Planning Authorities”, November 2009 and its technical appendices outline the requirements for a site specific flood risk assessment.

The proposed development is classified as “highly vulnerable development” according to Table

3.1 of the Guidelines. Table 3.2 of the Guidelines indicates that this type of development is appropriate and compatible with flood zone C i.e. outside the current 1000 year (0.1% AEP) flood extents.

Highly vulnerable developments may also be compatible with Flood Zone Category B depending on its performance in a site justification test. Therefore, as part of the sequential approach mechanism of the Guidelines, a justification test is only required if ‘highly vulnerable development’ is proposed in Flood Zone B.

2.2 Flood Risk Assessment Stages

This site-specific flood risk assessment will initially use existing flood risk information to determine the flood zone category of the site and to check if the Guidelines Sequential Approach has been applied or if a justification test is required; - refer to Figure 2.1 below for details. Flood risk is normally assessed by a flood risk identification stage followed by an initial flood risk assessment. A more detailed flood risk assessment stage may then follow which includes an assessment of surface water management, flood risk and mitigation measures to be applied.

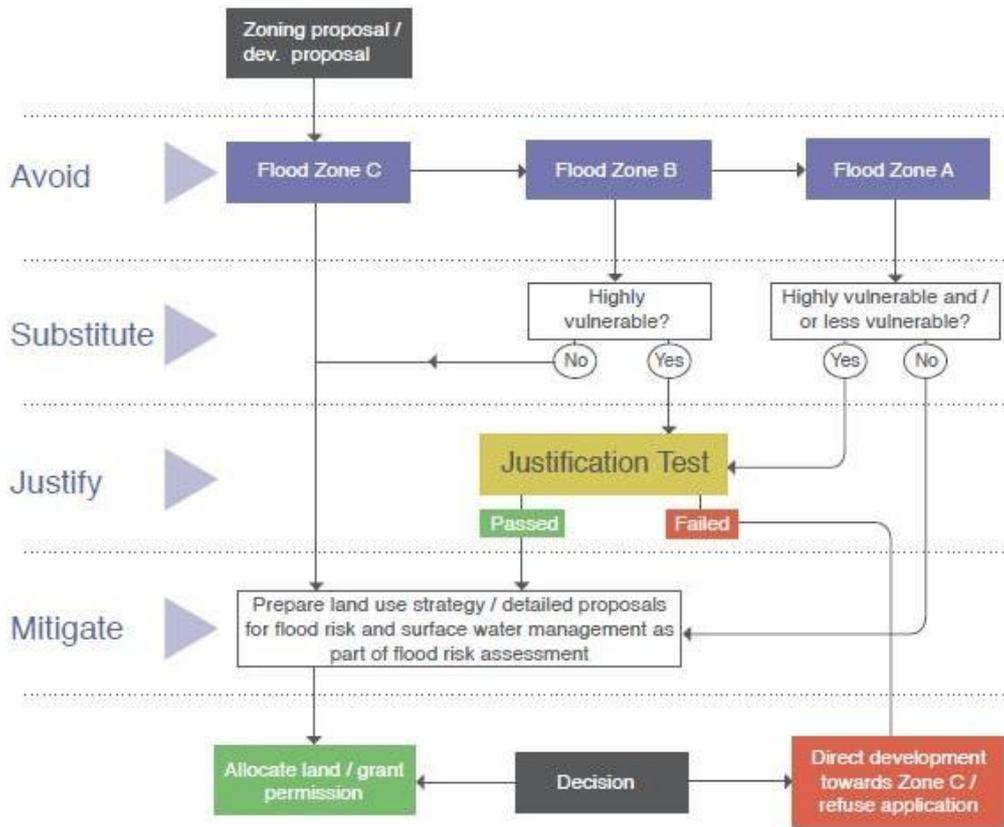


Figure 2.1 – Sequential Approach mechanism in the Planning Process

3. FLOOD RISK IDENTIFICATION STAGE

3.1 General

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the lands in question that warrant further investigation.

3.2 Information Sources Consulted

Information	Source	Assessment
Predictive and historic flood maps, and benefiting lands maps, such as those available on http://www.floods.ie	OPW www.floodmaps.ie website consulted	There were no OPW land commission schemes or benefitting land zones within the subject site's boundary. There is one flood event (1982) recorded on the map as occurring within the subject site however it references Carrickbrack Road which is not within the site and records indicate defence assets were introduced. A second flood event occurred nearby, in February 2002 but did not encroach on the site. See Figure 3.1 and accompanying text below
Predictive fluvial, coastal, pluvial and groundwater flood maps.	ECFRAMS, ICPSS https://www.floodinfo.ie/map/floodmaps/ myplan.ie	ECFRAMS mapping extracted from floodinfo.ie shows that the subject site is in Flood Zone C – based on present-day modelling. This ECFRAMS mapping extract is included within Appendix B, alongside the ICPSS modelling. The floodinfo.ie maps (based off the ICPSS model) indicate that the site is situated in the flood extents of all high-end future scenarios (high, medium and low probability) and two of the mid-range scenarios (medium and low probability). Refer to section 3.2.4 below and Appendix C for map extracts. Note the basis for flood zoning is based on the current scenario, as opposed to any predictive future scenarios.
Previous Flood Risk Assessments;	ECFRAMS	Flood extents mapping extracted from the OPW site shows that the subject site is in Flood Zone C. This mapping is included within Appendix B.

Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;	OSI Maps consulted, site topographic survey undertaken and analysed.	No evidence found of flooding. The site is built up to a level of 4.00m above sea level at the entrance to the proposed site to prevent tidal waters entering the site.
Information on existing public sewerage condition and performance;	GSDSDS performance maps for existing sewerage in the vicinity of the subject site examined.	GSDSDS flood mapping for the site shows that the Foul/Combined Sewer surcharges for 1- or two-year return period events and one section floods for the 30 year return period or less.
Alluvial deposit maps of the Geological Survey of Ireland. These maps, while not providing full coverage, can indicate areas that have flooded in the past.	GSI maps consulted.	No karst features are in this area. The site consists of massive unbedded lime-mudstone. Groundwater vulnerability data is not available from GSI mapping however site investigations indicate a high-water table which varies with the tide. Aquifer Data is not available.
National, regional & local spatial plans, such as the National Spatial Strategy, regional planning guidelines, development plans & local area plans provide key information on existing and potential future receptors.	Fingal Development Plan 2017 - 2023 – Strategic Flood Risk Assessment for the draft Fingal development plan 2017 - 2023	The site is not located close to an area benefiting from formal flood defences. The site is not subject to fluvial flooding as per map 22 of 24 attached to the 2017-2023 development plan and appended to this report.
Site investigation	Private company (IGSL) undertook site investigation at the behest of the client. Survey Drawings, trench reports and trial pit reports produced	The reports produced by IGSL indicate a ground make up of topsoil on sandy subsoil with the water table apparent at approximately 1.8m deep
Information on flood defence condition and performance; <i>Visual inspection</i>		Flood defences are present to the south of Greenfield Road which fronts the proposed development and faces onto Dublin Bay. Directly to the south of the site is the promenade which ensures that wave overtopping does not immediately deluge Greenfield Road. To the south east of the proposed site is a build-up of riprap which protects the promenade area from erosion. Although not specifically a flood defence the existing boundary wall will offer some protection against flooding events.

Table 3.1 - Information Sources Consulted

3.2.1 OPW Predictive, Historic & Benefiting Lands Maps & Flood Hazard Information

The OPW website www.floods.ie indicates that there were no OPW land commission schemes or benefitting land zones within the boundary of the subject site. The website does indicate two flood events in the vicinity of the site. The event highlighted as being within the site on the floodmaps.ie report is in fact outside the site area on Carrickbrack Road according to the report about this event, see appendix A nonetheless it is noted that measures have been put in place to alleviate this flooding.

Close to the site was the 2002 flood event which caused flooding in the Sutton area as mapped below in Figure 3.1, however the subject site was not noted as having flooded. Since this flooding, works to upgrade the outfall of the surface water drain, which discharges almost immediately opposite the site entrance, have been carried out. The aim of this work was to reduce the frequency and volume of siltation at the outfall, and therefore increase the time that discharging can occur.

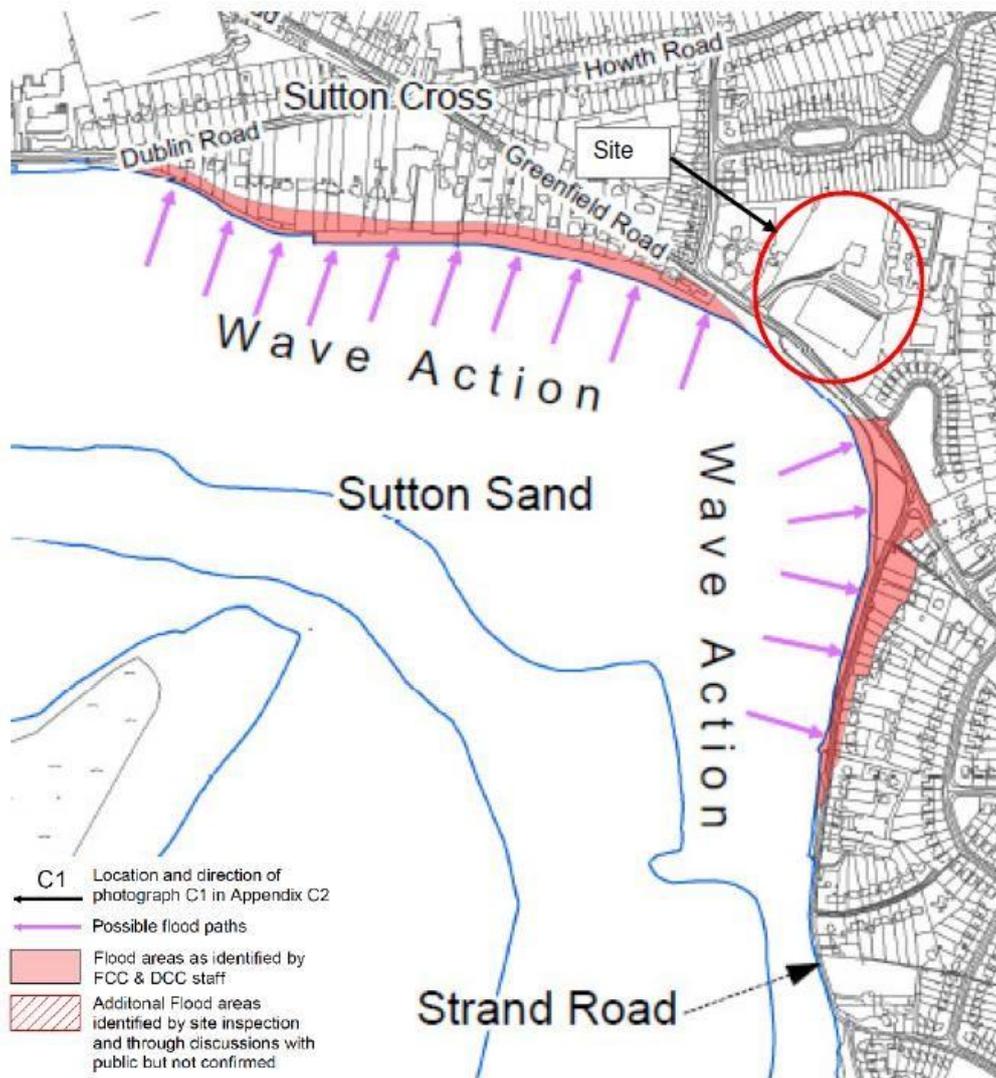


Figure 3.1 – extract from C1.3 (Dublin Coastal Flooding Protection Project)

Multiple other flooding events have occurred in the search radius of 2.5km around the site but are

not within influencing distance.

3.2.2 Previous Flood Risk Assessments & Predictive Flood Maps

ECFRAMS mapping extracted from the OPW site shows that the subject site is in Flood Zone C.

3.2.3 Fluvial Flood Predictive Maps

The site is not susceptible to fluvial flooding as per predictive fluvial flood maps. On GDSDS mapping a 'Santa Sabina Stream' is noted, however this has not been encountered on site in any form or noted in any other mapping and is presumed to be dry or have been culverted in storm sewers.

3.2.4 Coastal Flood Maps

The residential part of the site is located approximately 100m from the coast. Tidal flood maps from the ECFRAM Study indicate that the site is not at risk from any of the modelled tidal floods. "Present Day" coastal flood extent maps indicate that the site is not at risk from coastal flood events as shown in Appendix B. Note the basis for flood zoning is based on the current scenario, as opposed to any predictive future scenarios.

The future flood scenarios were also reviewed for the site as requested by FCC, refer to Appendix C. The site is situated in the flood extents of all the high-end future scenarios as shown on the extracts from the floodinfo.ie flood mapping. The high-end future scenarios model the flood extents taking into consideration a climate change driven 30% increase in rainfall and a sea level rise of 1m. These maps also show a large portion of Sutton and Kilbarrack under flood waters.

The site is also situated in two of the flood extents for mid-range future scenarios - medium and low probability extents. Mid-range scenario flood extents take into consideration a climate change increase of 20% additional rainfall and a 0.5m increase in sea levels. Again these maps also show a low lying portion of the Sutton adjacent the site under flood waters also.

3.2.5 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the site, these included:

- Topographical surveys of the area – topographical surveys undertaken of the site indicate that the boundary area between Greenfield Road and the proposed site has been raised to 4.00m to reduce the risk of tidal flooding.
- Flood defence information – flood defences were inspected visually and found to be in good

condition. The wall fronting the site is currently in poor condition but is being rebuilt as part of the works proposed under planning application Reg. Ref.: F17A/0615. Ground level of 4.00m will be maintained at the boundary with Greenfield Road.

- Existing Local Authority Drainage Records - There is an existing 450mm diameter concrete foul water sewer which traverses the site east to west, an existing surface water sewer serving the college which runs north to south along the eastern edge of the site and an existing surface water sewer located within the Church grounds to the west of the site. As part of the works currently being undertaken new surface water drainage will be installed to cater for any additional runoff generated and the discharge controlled. A diversion of the existing foul sewer traversing the site has been agreed with Irish Water and FCC under the permitted development Reg. Ref.: F17A/0615.

GSDSDS flood mapping for the site shows that the Foul/Combined Sewer surcharges for 1- or two-year return period events and one section floods for the 30 year return period or less. At no point in the pre-connection enquiry stage or in the connection agreement was any issue raised by Irish Water with regards to their asset. Furthermore, the flow into the pipe will be reduced as a stormwater connection from the neighbouring school site has been diverted into the surface water network.

It is noted on maps available on myplan.ie that an area close to the site is susceptible to flooding, however this flood map only provides indicative areas that may be prone to flooding and is not locally precise or accurate. In fact, the website states that it should not be used as the basis for defining Flood Zones nor for making decisions on planning applications (see Figure 3.2 below). Additionally, the floodmaps.ie site does not record any historical flooding in this location and this flooding was not referenced by FCC in the permitted development Reg. Ref.: F17A/0615 and the alterations to the development do not vary the strategy.

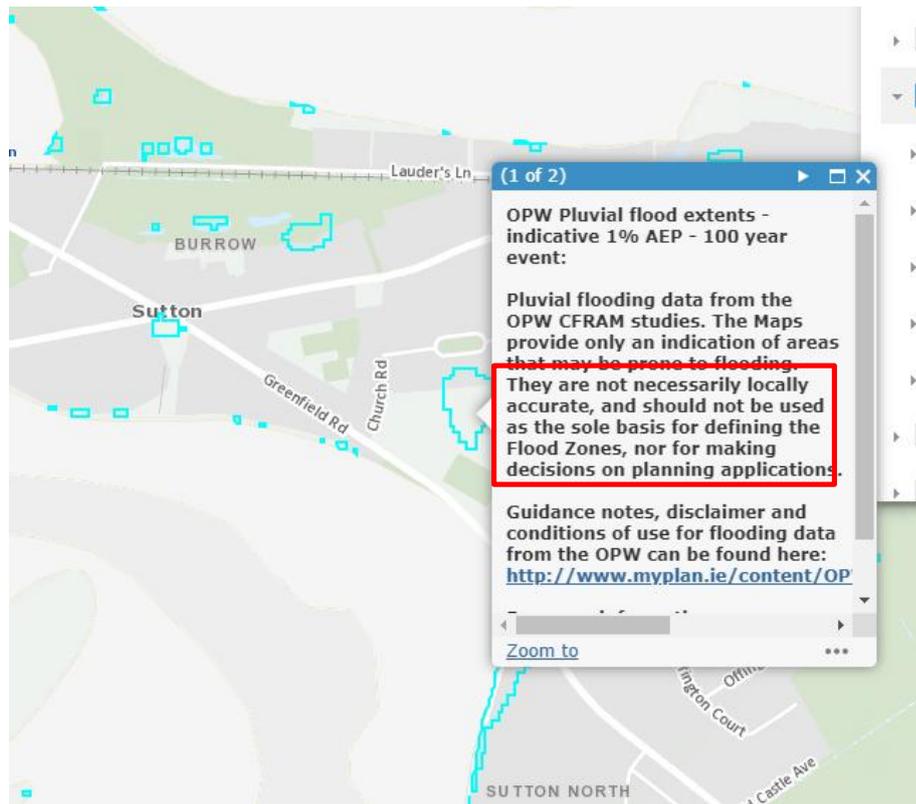


Figure 3.2 - Pluvial flooding extract disclaimer – myplan.ie

- The Fingal County Development Plan 2017-2023 – Strategic Flood Risk Assessment indicated that the development site is not at risk from flooding and benefits from informal flood defences. The development plan has zoned these lands as appropriate for residential development and the site has twice before been afforded planning permission.
- Santa Sabina College - Board of Management. According to the Board of Management, the school site has been subject to previous flooding which is directly related to the “impediment of surface water outfall” from the school site during high tidal levels/high groundwater. This results in surface water entering the property from existing surface water infrastructure, or as suggested in the observation submitted by the School under PAF15A/0303; that water rises through the floor of ‘low lying’ areas of the 1980s extension.
- DBFL agree that existing deficiencies with school infrastructure and restrictions on the surface water outfall are likely to be the primary source of the localised flooding problems encountered on school grounds and until such time as the necessary improvement works are undertaken, the school site will continue to experience future flooding. It should be noted that the surface water system for the school access road upgrade was discussed and agreed with FCC and is a separate system to that which is permitted for development to serve the residential site under Reg. Ref.: F17A/0615. The localised flooding on the school site does not impact or extend to the proposed residential development.

3.3 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model was produced to summarize the possible sources of floodwater, the people and assets (receptors) that could be affected by potential flooding (with specific reference to the proposals) and the pathways by which flood water from an event exceeding 1%AEP (Annual Exceedance Probability) would follow (see Table 3.2). It provides the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors in the context of the residential development proposal. These sources, pathways and receptors will be assessed further in the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	Tidal flooding from coast 100m away. This was the main issue in relation to flood risk, as identified in previous planning applications	Residents (people) development, visitors and the buildings themselves and other property such as vehicles located in car park areas.	Possible	High	Moderate
Fluvial	Flooding from nearby water courses (none nearby)	Residents (people) development, visitors, the buildings themselves and other property such as vehicles located in car park areas.	Remote	High	Very Low
Surface Water - Pluvial	Flooding from surcharging of the development's drainage systems	Residents (people) development, visitors and the buildings themselves and other property such as vehicles located in car park areas.	Possible	High	Moderate
Surface Water - Pluvial	Flooding from internal sources – overland flows	Residents (people) development, visitors and the buildings themselves and other property such as vehicles located in car park areas.	Possible	High	Moderate
Surface Water -	Flooding from external sources – overland	Residents (people) development,	Possible	High	Moderate

Source	Pathway	Receptor	Likelihood	Impact	Risk
Pluvial	flows	visitors and the buildings themselves and other property such as vehicles located in car park areas.			
Groundwater flooding	Rising GWL on the site	Residents (people) development, visitors and the buildings themselves and other property such as vehicles located in car park areas.	Possible	High	Moderate
Human or Mechanical Error (Pluvial)	Petrol interceptor and hydrobrake	Areas of development draining to the surface water network; Residents (people) development, visitors and the buildings themselves and other property such as vehicles located in car park areas.	Possible	High	Moderate

Table 3.2 - Source-Pathway-Receptor Analysis

It is clear from the above flooding analysis that the proposed site is at moderate risk from tidal, pluvial or groundwater flooding. Tidal modelling in the ECFRAM study indicates that the site is in flood zone C and as such it is not expected to flood for a 1-100 to 1-1000 year event this has also been reiterated by the zoning of the lands for residential development.

The boundary of the site, along Greenfield Road, is set to 4m above sea level which offers further protection against coastal inundation. It is recommended that the minimum FFL for residential buildings should be set to the 0.5% AEP flood level (see table below), with an increase of 0.5m, as per The OPW guidance with regards to climate change, plus a 0.5m freeboard. The use of these principals sets the FFLs to a minimum of 4.11mOD. The proposed finished ground floor levels have been set at a minimum level of 4.20m further mitigating the risk of groundwater flooding.

ECFRAMS Model results	10% AEP (mOD Malin)	0.5% AEP (mOD Malin)	0.1% AEP (mOD Malin)
Existing Water Level	2.67	3.11	3.34
Climate Change Water Level	3.17	3.61	3.84

The proposed development includes a basement carpark with minimum levels of 1.2m OD. Flooding to the basement is mitigated by ensuring it is sealed, fully waterproofed to exclude any ingress of groundwater, and that there are no vents or other ingress routes into the basement structure below the access ramp at 3.40m OD above 0.1% AEP. Please see schematic below, Figure 3.3.

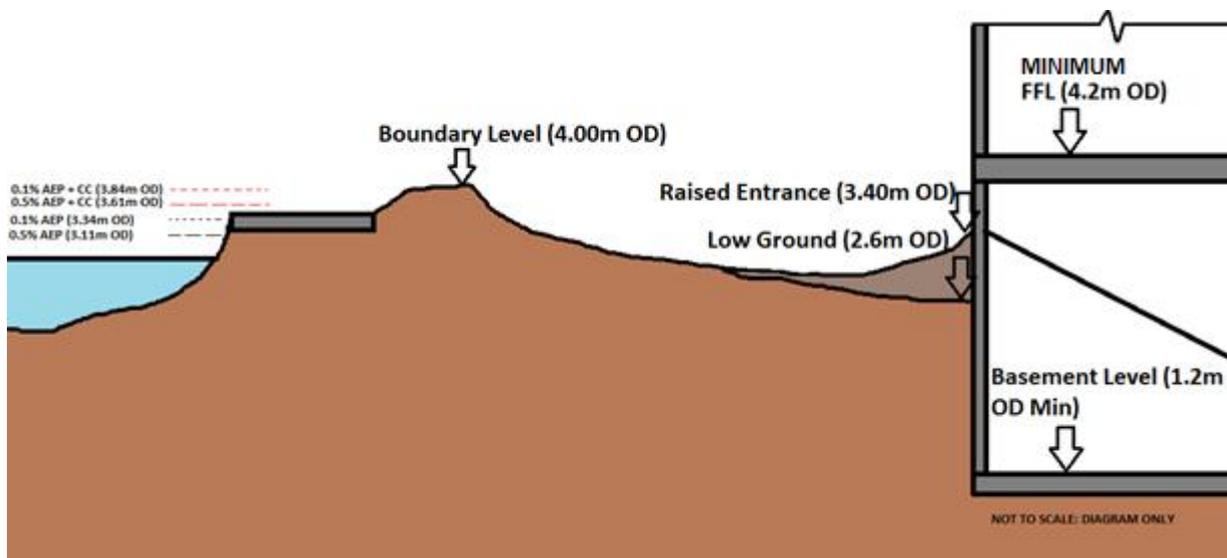


Figure 3.3 – Diagram of site levels and proposed structure levels compared to predictive flood levels

There is a moderate risk of pluvial flooding of the site due to the potential surcharging and blockage of both the new and existing drainage network. Given the topography of the site any flooding from the existing sewer would be located in the north western corner of the site and in the adjacent low-lying lands. Also given the proposed finished floor levels for the residential units any flooding is unlikely to affect the properties.

The risk of fluvial flooding is remote as there are no nearby watercourses encountered.

Consequently, an initial flood risk assessment will follow to provide further detail on the causes, effects and possible mitigation measures for the types of flooding identified above.

The new entrance constructed under Reg. Ref.: F17A/0615 for the school for vehicles and pedestrians involved the deconstruction of the existing boundary wall. The road raised the ground level to 4.0m OD to act as a barrier which replaces the high level previously held by the boundary wall.

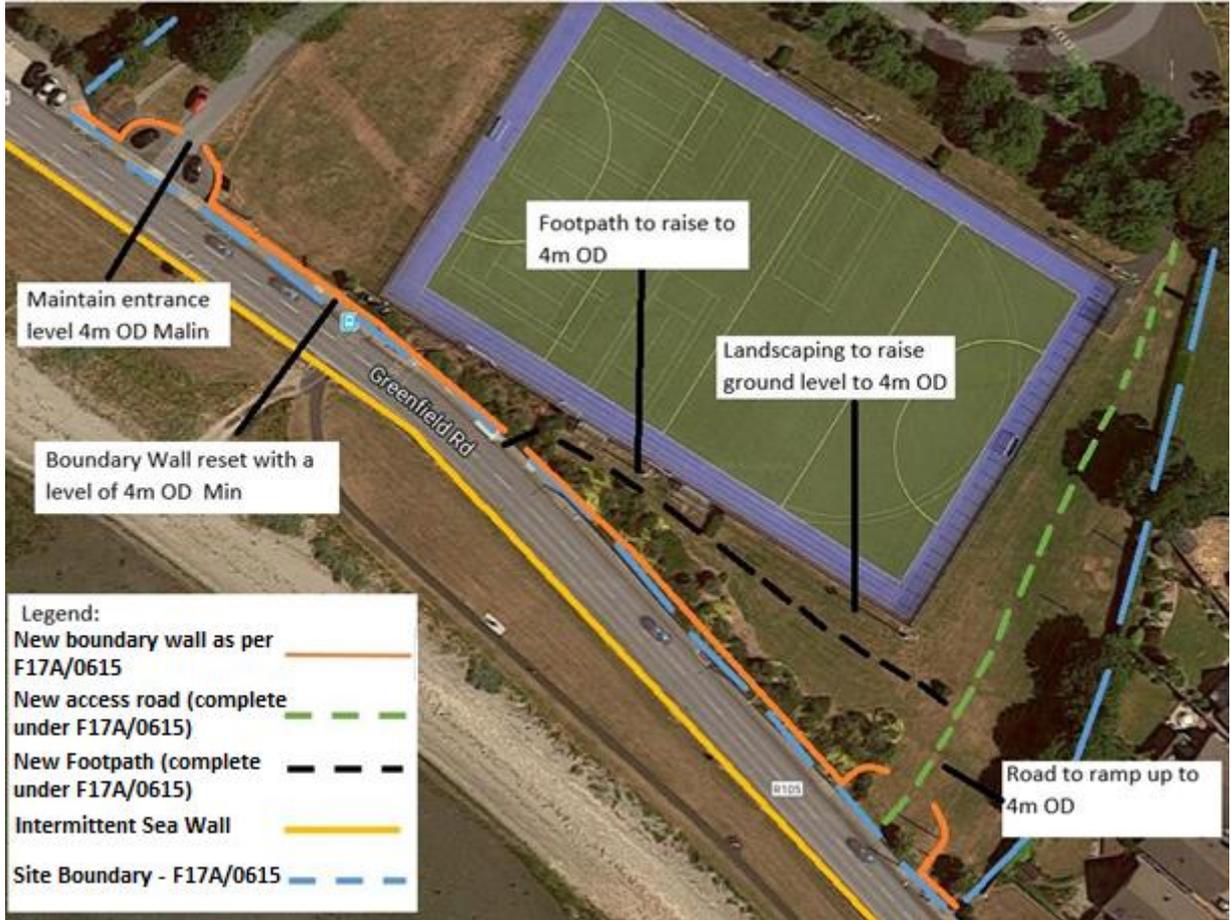


Figure 3.4– Boundary Levels



Figure 3.5 – As constructed under Reg. Ref.: F17A/0615, view of school access road boundaries

4. INITIAL FLOOD RISK ASSESSMENT STAGE

4.1 Initial Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for pluvial/groundwater flood risk due to the high water table and potential for pluvial flood risk within the development site related to blockage or mechanical failure of the surface water drainage network.

The drainage system has 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 exceedance for storms return periods exceeding 1% AEP (Annual Exceedance Probability).

Proper operation and maintenance of the drainage system should be implemented to reduce the risk of human or mechanical error causing pluvial flood risk from blockages etc.

4.2 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 Category C as defined by the Guidelines and as indicated by the current scenario OPW mapping (ECFRAMS mapping)– refer to Appendix B. Therefore, the proposed residential development on the subject site is appropriate for this flood zone category, and a justification test is not required.

It is noted that the ECFRAMS maps have been consulted (<https://www.floodinfo.ie/map/floodmaps/>) and that the lands have been zoned for residential development in the latest development plan for Fingal (2017-2023) as well as twice having been granted planning permission.

5. DETAILED FLOOD RISK ASSESSMENT STAGE

5.1 General

As a justification test is not required, a detailed flood risk assessment must be carried out which considers moderate pluvial flood risk in relation to the following;

- Proposed Surface Water Management measures
- Flood Exceedance
- Impact of proposals on flood risk to adjacent areas
- Effects of climate change
- Access and Egress during Flood Events
- Residual risks
- Effectiveness of any flood mitigation measures

5.2 Proposed Surface Water Management Measures

The following approach and parameters have been used: -

- Drainage design consists of Sustainable Drainage System (SuDS) with roof downpipes, gullies, pipes, manholes, attenuation systems and discharge control at outlets;
- SuDS systems to be provided including green roofs, permeable pavements, and petrol interceptor;
- Attenuation to be a below ground concrete tank system;
- Climate change factor of 10% has been applied;
- Site discharge rate is controlled to Greater Dublin Strategic Drainage Study (GDSDS) standards;
- Overland flow routes have been designed to direct surface flows away from buildings;
- Non-return valves to be used to prevent the system backing up during high-tide.

5.3 Assessment of Flood Risk

5.3.1 Flood Exceedance - Pluvial

Flooding from overland flows: -

Site levels have been designed such that overland flow caused by flooding from the site drainage system, or from surface water that fails to enter the site drainage system in extreme events, will not flood buildings, driveways or footpaths. Surface water is designed to remain within the bounds of roadway reservations.

In addition to this the ground floor levels have been proposed at a minimum of 4.20m to alleviate any further risk.

Pluvial Flood Risks: -

Flooding from surcharging of the development's drainage systems: -

The surface water pipe system has been designed using the Modified Rational Method. It is noted that the overall capacity of the pipes will be greater than the peak flows generated from this intensity, therefore the pipe system would be considered to exceed the requirements of the GDSDS for a 1 in 30-year return period surcharge check.

The attenuation tanks have been sized for a 6-hour duration storm for a 1 in 100-year return period, which exceeds the requirements of the GDSDS and it is designed using the current rainfall depth values available from Met Eireann including 10% increase for the effects of climate change.

Flooding from high water table combined with low-probability rainfall event: -

The high groundwater level is linked to the high tide and so will only ever be of concern during this time. Nonetheless ground floor levels have been proposed at a minimum 4.20m to alleviate any risk.

5.3.2 Human or Mechanical Error - Pluvial

If petrol interceptors and hydrobrake are not adequately cleaned and maintained, there is a risk that they would become a throttle and cause flooding upstream. To overcome this an agency will be contracted to clean and maintain the petrol interceptor and Hydrobrake on a regular basis.

5.4 Access & Egress During Flood Events

During flood events, access and egress would need to be maintained and overland flow routes and extents would need to be carefully planned. All habitable spaces are located more than 500mm above the top water levels for attenuation systems for the 1 in 100 year event and are at no perceivable

risks of flooding.

Access and egress routes for emergency services have been considered. The area between the proposed block A-C and block D has been designed as a permeable pavement, this will alleviate any build-up of potential flood waters. Permeable pavement has significant storage capacity and as such will lessen any flooding of access and egress routes for the proposed development.

Flood routing ensures that any potential flood waters will be directed firstly away from properties towards road channels and the surface water drainage network and secondly, in the event that these are surcharged, to areas of open space away from structures where floodwaters can infiltrate to ground.

In the event that Greenfield Road floods a pedestrian evacuation route is available through an existing public right of way through the Santa Sabina School to the east of the development and through the existing public laneway into the Glencarraig estate to the north where emergency services can be accessed (Figure 5.1).

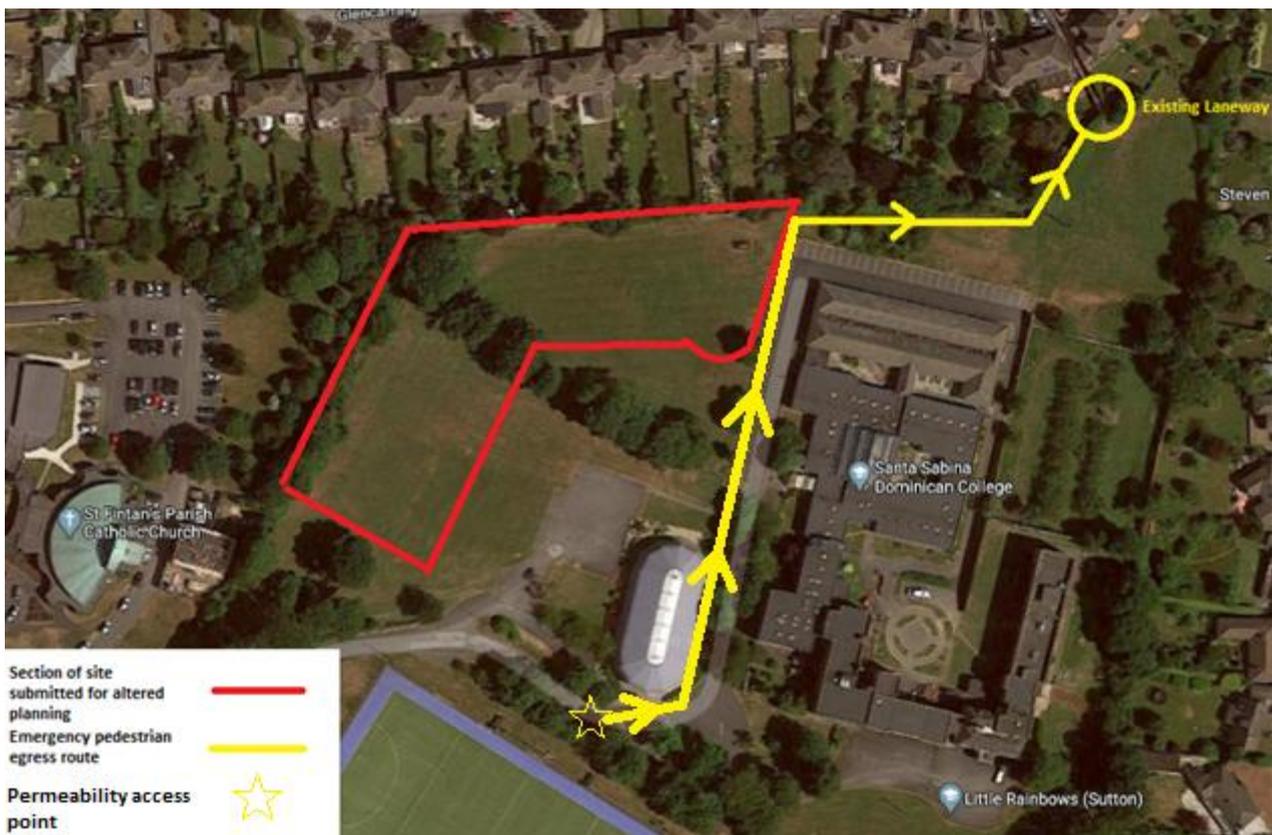


Figure 5.1– Pedestrian Evacuation Route. (Note that google maps extract does not reflect current site conditions)

5.5 Mitigation Measures

Proposed mitigation measures to address residual flood risks are summarized below and are as permitted under Reg. Ref.: F17A/0615;

- Mitigating Measure M1: The drainage system including the concrete tank attenuation to be maintained on a regular basis to reduce the risk of a blockage. A maintenance contract for the petrol interceptor, hydrobrake and attenuation system should be entered into with a specialist maintenance company.
- Mitigating Measure M2: The drainage network is designed in accordance with the recommendations of the GSDSDS and provides attenuated outlets and associated storage up to the 100 year event. The drainage network for the site has been designed to ensure that it can accommodate, below ground, the 6hr, 1 in 100 year rainfall event in surcharged conditions.
- Mitigating Measure M3: Overland flow routes for pluvial events should not be built on or become blocked off. Overland flow routes are designed to direct to water compatible development areas (permeable paving) and to other open space areas away from dwellings.
- Mitigating Measure M4: At detailed design stage, the location of all dropped kerbs and side inlet gullies to be fully reviewed to ensure all overland flow paths are not impeded.
- Mitigating Measure M5: The proposed development is deemed compatible with flood zone category 'C'. Therefore, the guidelines sequential approach is met and a justification test is not required.
- Mitigating Measure M6: Sustainable Urban Infrastructure: the development will include SUDS features e.g. green roofs, permeable paving and storage.
- Mitigating Measure M7: The ground level on the approach to the site is to be raised to 4.00m to provide a barrier to any tidal event that is above that modelled.
- Mitigating Measure M9: All finished floor levels are set at a minimum of 4.20m which is above the GSDSDS requirement of a minimum of 500m above the 1 in 100 year top water level in the attenuation tank.
- Mitigating Measure M10: A pedestrian evacuation route is provided through the neighbouring school and north to the Glencarraig estate.

6. RESIDUAL RISKS

Remaining residual flood risks, following the detailed assessment and mitigation measures include the following;

- Pluvial flooding from the development's drainage system for storms in excess of the 100 year design capacity.
- Tidal flooding from events in excess of the 1-1000 year modelled

7. CONCLUSIONS

This Site Specific Flood Risk Assessment for the permitted development and the proposed alterations to same were undertaken in accordance with the requirements of the Planning System and Flood Risk Management Guidelines for Planning Authorities”, November 2009. Following the flood risk assessment stages, it was determined that the site is within Flood Zone C as defined by the Guidelines, based on the current scenario mapping. This corresponds with the results of the SSFRA undertaken for the approved planning permission Reg. Ref.: F17A/0615. Therefore, the strategic housing development alteration application 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. A flood risk assessment and justification test would have been undertaken prior to the zoning of these lands by Fingal in the 2017-2023 development plan. The Guidelines sequential approach is met with the ‘Justify’ & ‘Mitigate’ principals being achieved.

The proposed flood mitigation measure(s) outlined in Section 5 should be implemented. It is considered that the flood risk mitigation measures once fully implemented are sufficient to provide a suitable level of protection to the proposed development and will not cause an increased risk of flooding to external properties or to the downstream waterbody.

To further mitigate against flood risk to the buildings all finished floor levels are set to a minimum of 4.20m which is above the GDSDS requirement of a minimum of 500m above the 1 in 100 year top water level in the attenuation tank. Also, along the boundary with Greenfield Road the ground level has been set to 4m to prevent inundation by any potential coastal flooding and a pedestrian flood evacuation route is provided through the school site and north to the Glencarraig estate.

A regularly maintained drainage system would ensure that the network remains effective and in good working order should a large pluvial storm occur. In the event of extreme pluvial flooding then overland flood routes would direct water towards the open space areas.

Similarly, should extreme pluvial flooding occur in excess of the development’s drainage capacity i.e. exceeding 1%AEP, then overland flood routes direct towards the on-site open spaces and underground storage.

A pedestrian evacuation route is also provided through the neighbouring school and north to the Glencarraig estate.

While the development falls into a ‘highly vulnerable’ category as per *The Planning System and Flood Risk Management* guidelines, it is appropriate for this flood zone and the scheme will be designed to so that the risk of flooding is reduced as far as practicable. The development does not increase the risk of flooding to adjacent area and roads once mitigation measures are implemented.

APPENDIX A – Flood Info Report

Summary Local Area Report

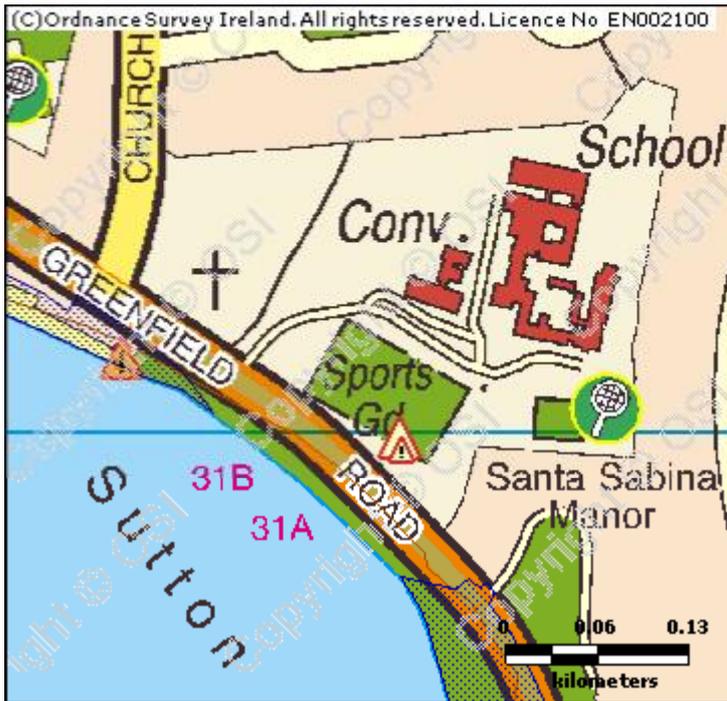
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 263 390

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:5,229

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained in the Glossary.

12 Results

	1. Flooding at Brookstone Road, Baldoyle, Dublin 13 on 24th Oct 2011 County: Dublin	Start Date: 24/Oct/2011 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	2. Dublin City Tidal Feb 2002 County: Dublin	Start Date: 01/Feb/2002 Flood Quality Code:1
Additional Information: Photos (32) Reports (10) Press Archive (27) More Mapped Information		
	3. Grange Stream Baldoyle Dec 1954 County: Dublin	Start Date: 08/Dec/1954 Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information		
	4. Dublin Road Sutton Feb 2002 County: Dublin	Start Date: 01/Feb/2002 Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information		
	5. Strand Rd Sutton Feb 2002 County:	Start Date: 01/Feb/2002 Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information



6. Greenfield Road Sutton Feb 2002

Start Date: 01/Feb/2002

County:

Flood Quality Code:3

Additional Information: Reports (4) More Mapped Information



7. Bloody Stream Howth Area Nov 2002

Start Date: 14/Nov/2002

County: Dublin

Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information



8. Bloody Stream Howth Near Dart Station Oct 2002

Start Date: 21/Oct/2002

County: Dublin

Flood Quality Code:3

Additional Information: Reports (3) More Mapped Information



9. The Grange Road Baldoyle Oct 2002

Start Date: 20/Oct/2002

County: Dublin

Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information



10. Sutton Greenfields Road Recurring

Start Date:

County: Dublin

Flood Quality Code:3

Additional Information: Reports (4) More Mapped Information



11. Bloody Stream Howth Near Dart Station Recurring

Start Date:

County: Dublin

Flood Quality Code:3

Additional Information: Reports (5) More Mapped Information



12. Carrickbrack Road Sutton recurring

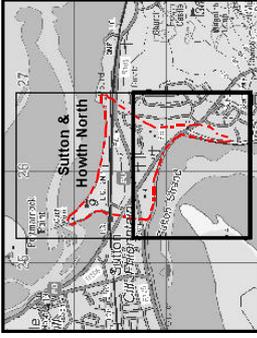
Start Date:

County: Dublin

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

APPENDIX B – ECFRAMS Mapping Extract



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% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - AFA Extents
 - Node Point
 - Node Label

FINAL

REV: NOTE: DATE:



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Map: Sutton & Howth North Tidal Flood Extents

Map Type: EXTENT

Source: TIDAL

Map Area: COASTAL

Scenario: CURRENT

Drawn By: C.McG. **Date:** 14 November 2017

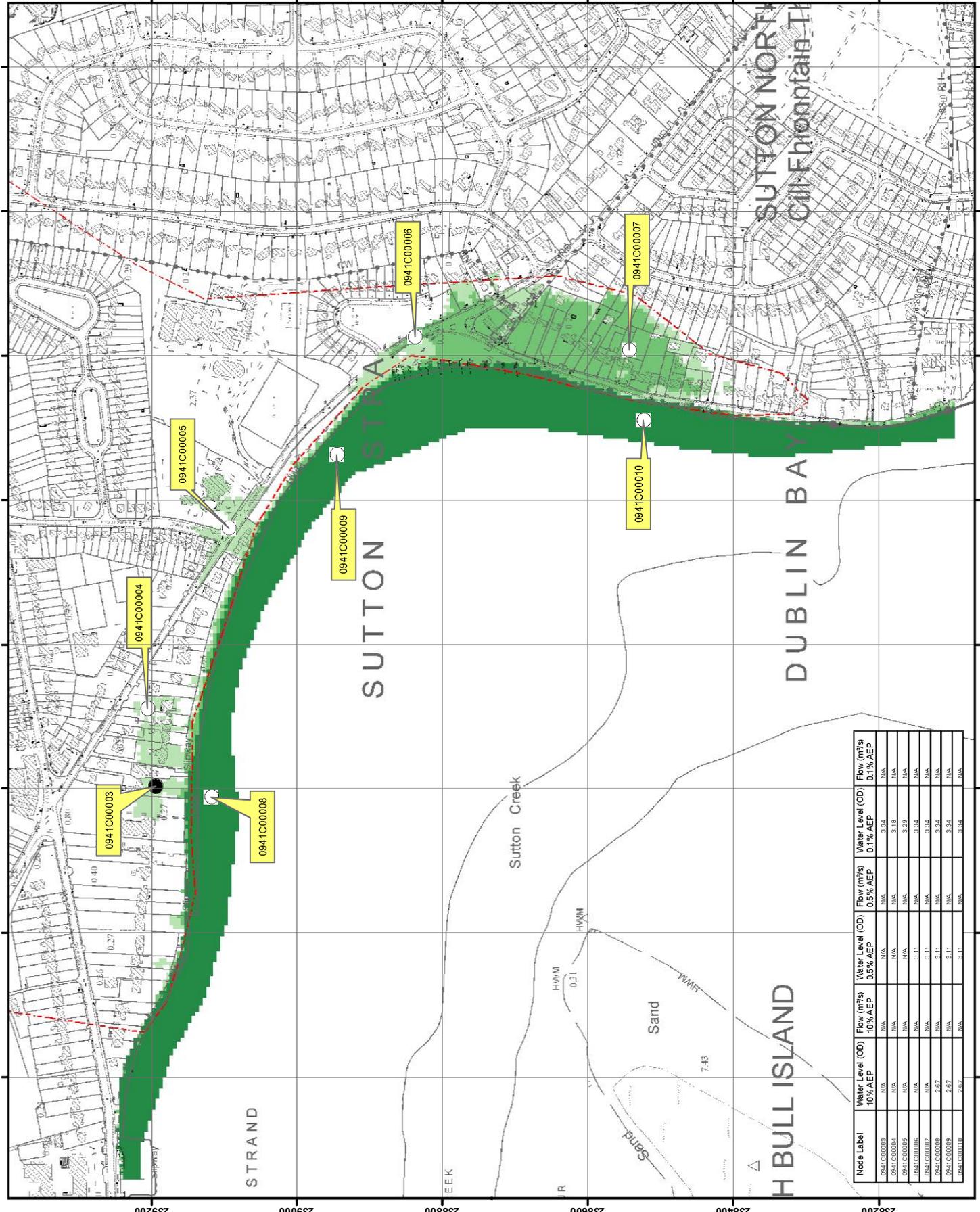
Checked By: A.S. **Date:** 14 November 2017

Approved By: S.P. **Date:** 14 November 2017

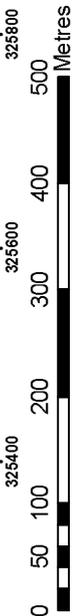
Drawing No.: E09SUH_EXCCD_F1_02

Map Series: Page 2 of 2

Drawing Scale: 1:5,000 @A3

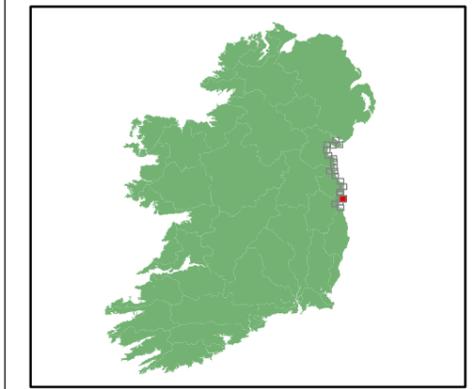


Node Label	Water Level (OD) 10% AEP	Flow (m ³ /s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m ³ /s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m ³ /s) 0.1% AEP
0941C00003	N/A	N/A	N/A	N/A	3.34	N/A
0941C00004	N/A	N/A	N/A	N/A	3.18	N/A
0941C00005	N/A	N/A	N/A	N/A	3.29	N/A
0941C00006	N/A	N/A	N/A	N/A	3.34	N/A
0941C00007	N/A	N/A	N/A	N/A	3.34	N/A
0941C00008	2.67	N/A	3.11	N/A	3.34	N/A
0941C00009	2.67	N/A	3.11	N/A	3.34	N/A
0941C00010	2.67	N/A	3.11	N/A	3.34	N/A



NOTE: MORE DETAILED MAPS SHOWING COMBINED TIDAL AND FLUVIAL FLOOD HAZARD FOR THIS AREA HAVE BEEN PREPARED UNDER THE FINGAL EAST MEATH FRAM STUDY. PLEASE REFER TO WWW.FINGALEASTMEATHFRAMS.IE FOR MORE INFORMATION

Location Plan :



EXTENT MAP

Legend:

- 0.5% AEP FLOOD EXTENT (1 in 200 chance in any given year)
- 0.1% AEP FLOOD EXTENT (1 in 1000 chance in any given year)
- Very High Confidence (0.1% AEP)
- High Confidence (0.1% AEP)
- Medium Confidence (0.1% AEP)
- Low Confidence (0.1% AEP)
- Very Low Confidence (0.1% AEP)
- Very High Confidence (0.5% AEP)
- High Confidence (0.5% AEP)
- Medium Confidence (0.5% AEP)
- Low Confidence (0.5% AEP)
- Very Low Confidence (0.5% AEP)
- High Water Mark (HWM)
- Node Point
- Point 34 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.



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Office of Public Works
17-19 Lower Hatch Street
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Project :
IRISH COASTAL PROTECTION STRATEGY
STUDY - PHASE III

Map :
NORTH EAST COAST FLOOD EXTENT MAP

Map Type : FLOOD EXTENT

Source : TIDAL FLOODING

Map area : RURAL AREA

Scenario : CURRENT

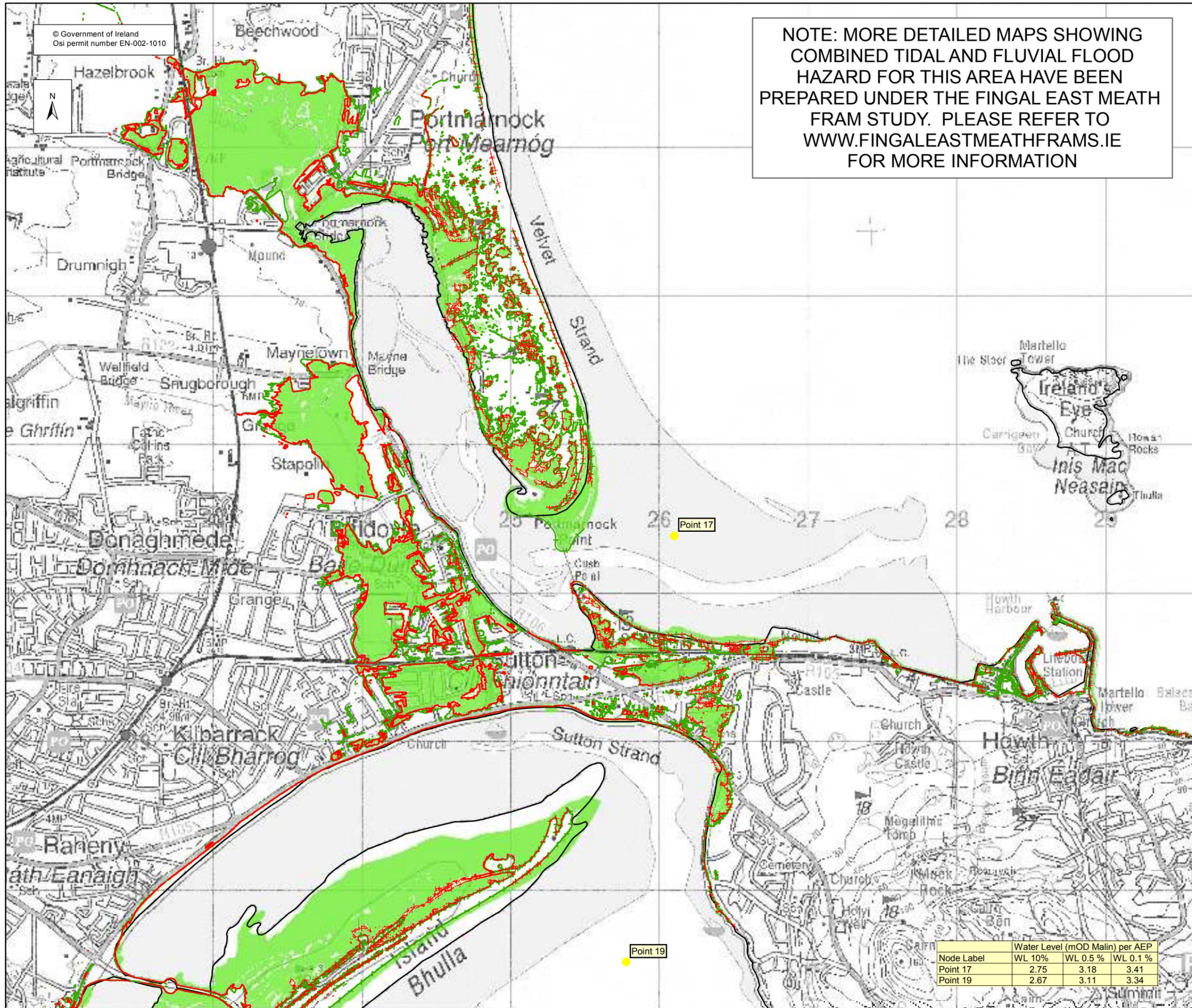
Figure By : PJW Date : Jan 2010

Checked By : JMC Date : Jan 2010

Figure No. : NE / RA / EXT / 17 Revision 1

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3

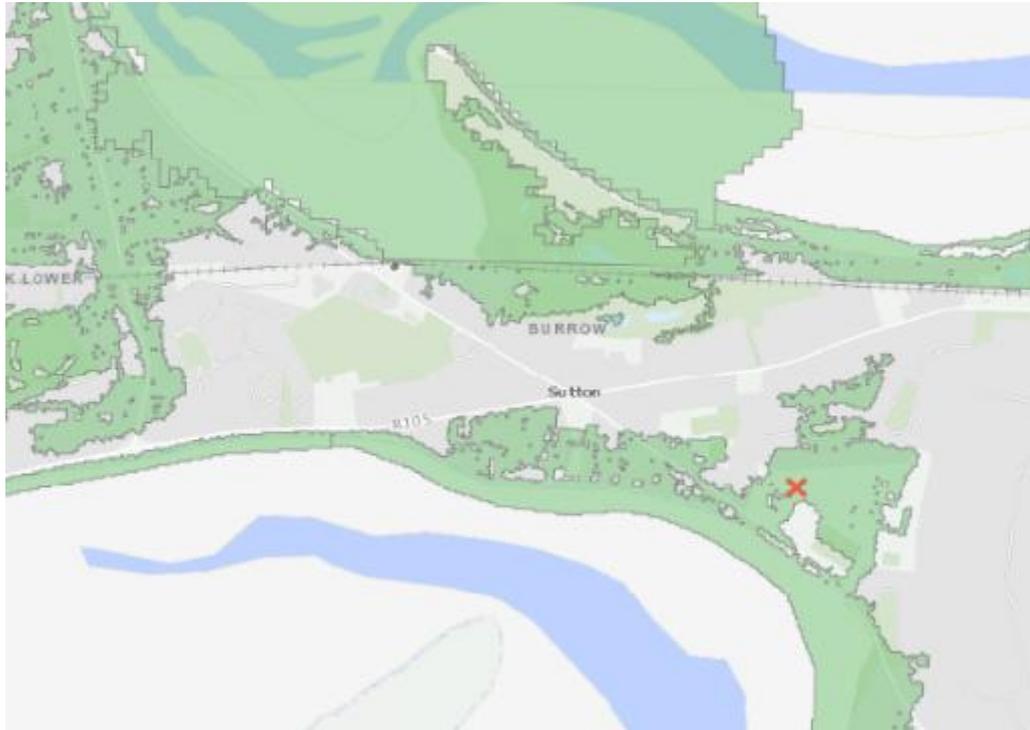
Node Label	Water Level (mOD Malin) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
Point 17	2.75	3.18	3.41
Point 19	2.67	3.11	3.34



APPENDIX C – Floodinfo.ie Mapping Extract



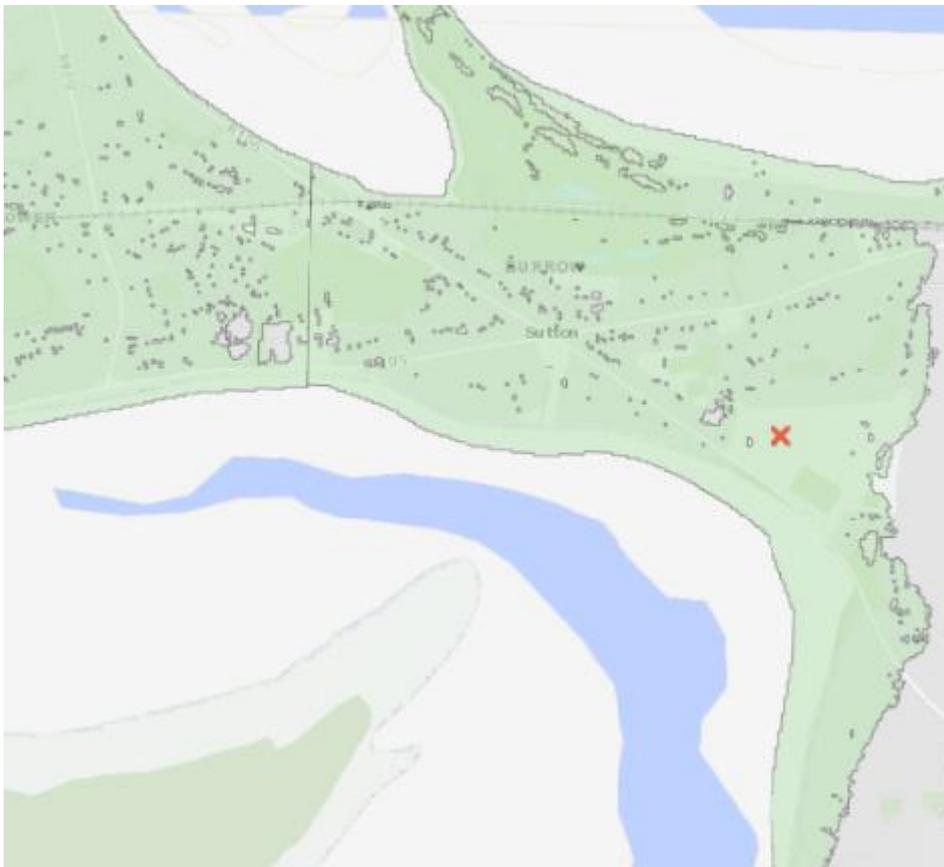
Mid Range Future High Probability



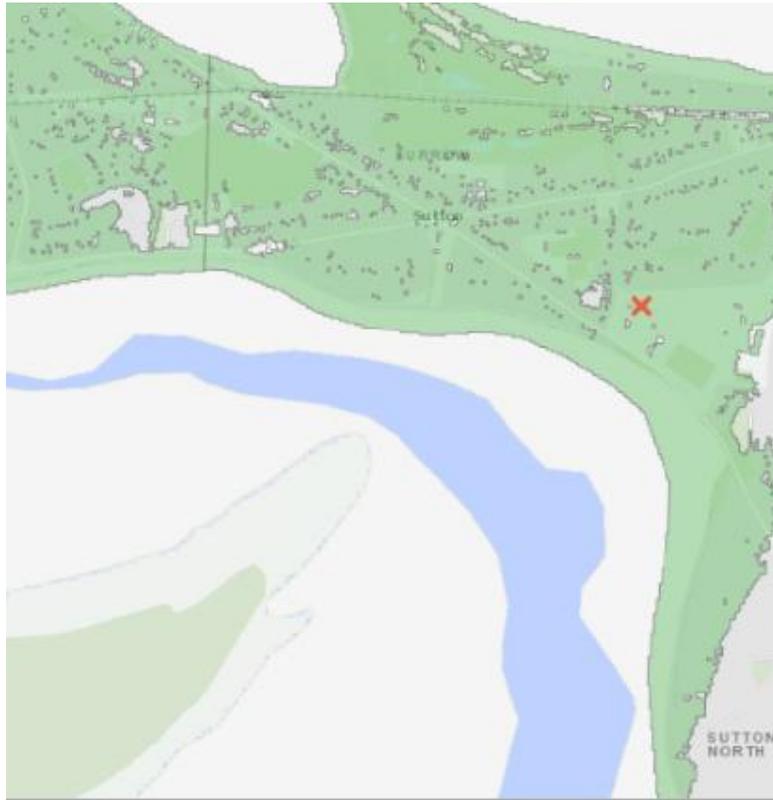
Mid Range Future Medium Probability



Mid Range Future Low Probability



High End Future Low Probability



High End Future Medium Probability



High End Future High Probability