

Residential Lands at Coolagad, Greystones, Co. Wicklow

Flood Risk Assessment

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1. Introduction

1.1 Background

AECOM have been appointed by Cairn Homes Properties Limited to undertake a Flood Risk Assessment (FRA) for the proposed residential development in Coolagad, Greystones, Wicklow.

The FRA has been carried out in support of a planning application for the proposed development that will be submitted to An Bord Pleanála and in full compliance with the requirements of “The Planning System & Flood Risk Management Guidelines for Planning Authorities” published by the Department of the Environment in November 2009, and in particular the requirements of a sit-specific Flood Risk Assessment as outlined in Appendix A of the Technical Appendices to those guidelines.

The following documents have been reviewed in order to prepare this report:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities;
- Wicklow County Council Development Plan 2016-2022, Volume 3, Appendix 11 Strategic Flood Risk Assessment;
- Greystones – Delgany and Kilcoole Local Area Plan (2013-2019) – Strategic Flood Risk Assessment.

1.2 Existing Site

The site is located to the west of the R761 Rathdown Road, north of the Gate Lodge; north and west of Coolagad House, Temple Carrig School, Gaelscoil na gCloch Liath and Greystones Educate Together National School. The lands are bounded by Waverly Avenue and Seagreen Park residential areas to the east. Templecarrig Lower is located to the north of the lands and Kindlestown Upper to the west.



Figure 1 - Site Location (extract from Google Earth)

1.3 Site Topography

The site is quite hilly with the terrain falling from 90mOD at the western boundary to 39mOD at the R761 Rathdown Road on the eastern side. Towards the south-western extremity of the site, it reaches a highest point of 95mOD. Most of the land slopes moderately at gradients in the range of 1:12 and 1:15 but there are steeper parts of the site with slopes of up to 1:6 which are located toward the higher side of the southern portion of the site.

1.4 Proposed Development

The proposed development will consist of:

- 586 residential units including:
 - 351 two storey houses (207 no. 3 bed, 140 no. 4 bed, 4 no. 5 bed) comprising detached, semi-detached and terraced units
 - 203 no. apartments (65 no. 1 bed, 123 no. 2 bed, 15 no. 3 bed) provided within 6 no. blocks ranging from three to four-storey (over basement) with residential amenity facilities.
 - 32 no. duplex units within 2 no. three-storey blocks (16 no. 2 bed and 16 no. 3 bed units)
- c. 5,192 sqm of communal open space is provided to serve the proposed apartment/duplex units.
- Community building (single storey) of 392 sq.m. with 29 car parking spaces, including changing rooms and a multipurpose room.
- Creche building of 734 sq.m. with 21 car parking spaces
- A new vehicular entrance, with signalised junction and pedestrian crossings, will be provided off the R761 (Rathdown Road). The new junction will be linked to the existing signalised junction at Blacklion Manor Road / Redford Park which has a planned upgrade by Wicklow County Council. Cycle lanes will be provided along this section of the R761 on both sides. A footpath will also be provided on its western side. Car parking will be provided to the east of the R761, in the front of Redford Cemetery.
- The new access will provide a distributor road as part of the long-term objective to provide a northern access route from Greystones to the N11.
- Car and bicycle parking spaces are provided as follows:
 - 702 on curtilage car parking spaces for the houses; 206 car parking spaces at basement level and 5 at surface level for the apartments; and 32 spaces for the duplex units and 10 visitor spaces at surface level.
 - 22 motorbike parking spaces.
 - 436 resident and 118 visitor bicycle parking spaces are proposed in a mix of basement and surface levels for the apartment blocks and duplex units; 12 bicycle spaces are proposed for the creche, 12 for the community centre and 10 at the sport field.
- The development also includes site development infrastructure, a hierarchy of internal streets including bridges, cycle paths & footpaths; new watermain connection and foul and surface water drainage; the development also provides for the construction of a new public foul sewer along the R761/R762 from the site entrance as far as the R762 in front of St. Kevin's National School, Rathdown Road, Greystones.
- c.10.43ha open space to include a sport field, a MUGA, private, communal and public open spaces incorporating an existing stream, formal and informal play areas, and new boundary treatments.
- ESB substations/switchrooms, lighting, site drainage works, and all ancillary site development works above and below ground.

2. The Planning System and Flood Risk Management Guidelines

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

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

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

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

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

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

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



Figure 2 - Indicative Flood Zone Map (Extract from the 2009 Guidelines, Figure 2.3)

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

The Guidelines set out a stage approach to assessment. The stages of assessment are:

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

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

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

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

The potential risk to the proposed development associated with each of the following sources of flooding is investigated in this report are as follows:

- Coastal
- Fluvial
- Pluvial
- Groundwater

3. Wicklow County Council Development Plan 2016-2022, Volume3, Appendix 11 – Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA), which was prepared to accompany the Wicklow County Council (WCC) Development Plan 2016-2022, assesses all the types of flood risk within the WCC County jurisdiction area, identifying principal rivers and sources of flooding, producing flood maps, assessing potential impacts of climate change, and identifying the location of any flood risk management infrastructure.

As part of the SFRA, a Flood Zone Map has been prepared for the Greystones Area and is provided in Appendix A. The figure below is an extract from the Flood Map.

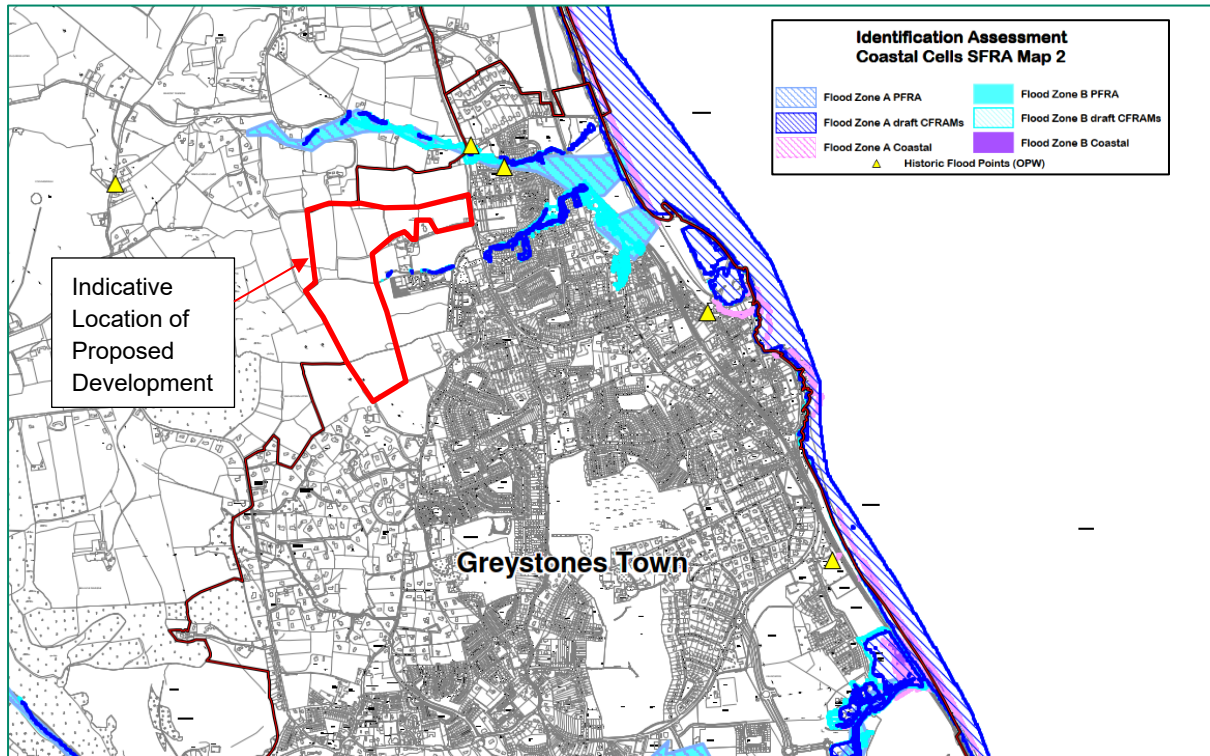


Figure 3 – Extract of the Flood Map prepared for the Greystones Area, included in the SFRA 2016-2022

As shown in Figure 3 – Extract of the Flood Map prepared for the Greystones Area, the location of the proposed development is outside the identified flood risk area in the SFRA. Please refer to Appendix A for full map.

4. Greystones-Delgany and Kilcoole Local Area Plan 2013-2019 – Strategic Flood Risk Assessment (SFRA)

A SFRA has been produced to accompany the Greystones-Delgany and Kilcoole Local Area Plan 2013-2019. The objective of the SFRA is to identify flood risk in the Greystones area, with the aim to facilitate the consideration of the flood risks at all levels.

The SFRA shows the classification of different types of development (Figure 4) and the Matrix of vulnerability versus flood zones to illustrate appropriate development and the requirement to meet the justification test (Figure 5).

Table 1.2: Classification of vulnerability of different types of development

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children’s homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.

Figure 4 – Description of Highly Vulnerable Development Types (Source: Greystones-Delgany and Kilcoole LAP 2013-2019)

Table 1.1: Matrix of vulnerability versus flood zones to illustrate appropriate development and that required to meet the justification test

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

Source: Table 3.2 of the Guidelines on Planning System and Flood Risk Management

Figure 5 – Development Types Versus Flood Zones Matrix (Source: Greystones-Delgany and Kilcoole LAP 2013-2019)

The LAP objectives relating to Flooding are listed below:

- **TS4:** To implement flood management objectives as set out in the Wicklow County Development Plan 2010-2016 and to implement the ‘Guidelines on the Planning System and Flood Risk Management’ (DoEHLG/OPW, 2009).

- **TS5:** To restrict the types of development permitted in Flood Zone A and Flood Zone B to the that are 'appropriate' to each flood zone, as set out in Table 3.2 of the guidelines for Flood Risk Management (DoEHLG/OPW, 2009). Developments that are an 'inappropriate' use for a flood zone area, as set out in Table 3.2 of the guidelines, will not be permitted, except where a proposal complies with the Justification Test for Development Management, as set out in Box 5.1 of the Guidelines. Flood Risk Assessments shall be in accordance with the requirements set out in the Guidelines.
- **TS6:** Notwithstanding the identification of an area as being at low or no risk of flooding, where the planning authority is of the opinion that flood risk may arise or new information has come to light that may alter the flood designation of the land, an appropriate flood risk assessment may be required to be submitted by an applicant for planning permission.

It is confirmed that these objectives have been considered and addressed in this report.

The SFRA also includes an indicative flood zone map, as illustrated in Figure 6.

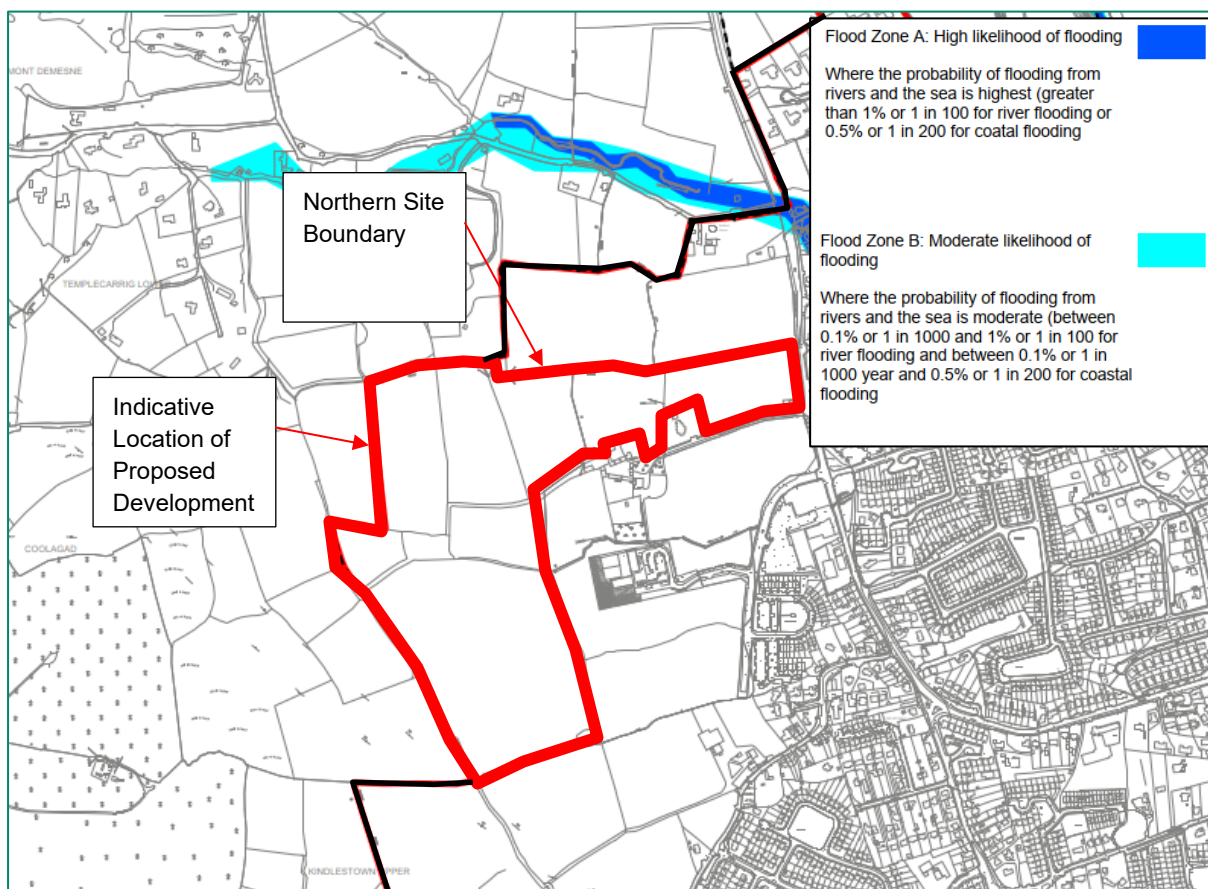


Figure 6 – LAP SFRA Indicative Flood Zone Extent (Source: Greystones-Delgany and Kilcoole LAP 2013-2019)

As shown in Figure 6 above, the site is outside the flood zoning areas A and B identified and lies entirely within flood zone C where the probability of flooding is low. Please refer to Appendix B for full map.

The LAP objectives listed in above have been addressed in the following sections.

5. Flood Risk Identification

The proposed development is located approximately 700m west of the Irish Sea near Greystones, Co. Wicklow. The Templecarrig stream flows in an easterly direction and is located approximately 270 north of the proposed site entrance. An unnamed stream also originated within the subject site and flows in an easterly direction towards the Greystones National school where the flows are culverted further east through Redford Park.

5.1 History of Flood

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

- Historic Flood Records (OPW and OSi)
- Wicklow Development Plan
- Geological Ground Conditions (GSI)
- Eastern CFRAM Study
- All relevant available information on existing soil conditions and topography.

5.1.1 OPW Past Flood Events

The Office of Public Works (OPW) collates available reports of flooding from all sources (e.g. fluvial, pluvial, coastal, etc.) on a nationwide basis. The OPW's website (www.floodinfo.ie) was consulted to obtain reports of recorded flooding within and surrounding the site. Figure 7 below is an extract from the mapping available on the OPW database website, which indicate there are 2 No. historic events in proximity of the site, 200-307m away from the proposed development.

The full OPW Past Flood Event Local Area Summary Report is included in Appendix C of this report.

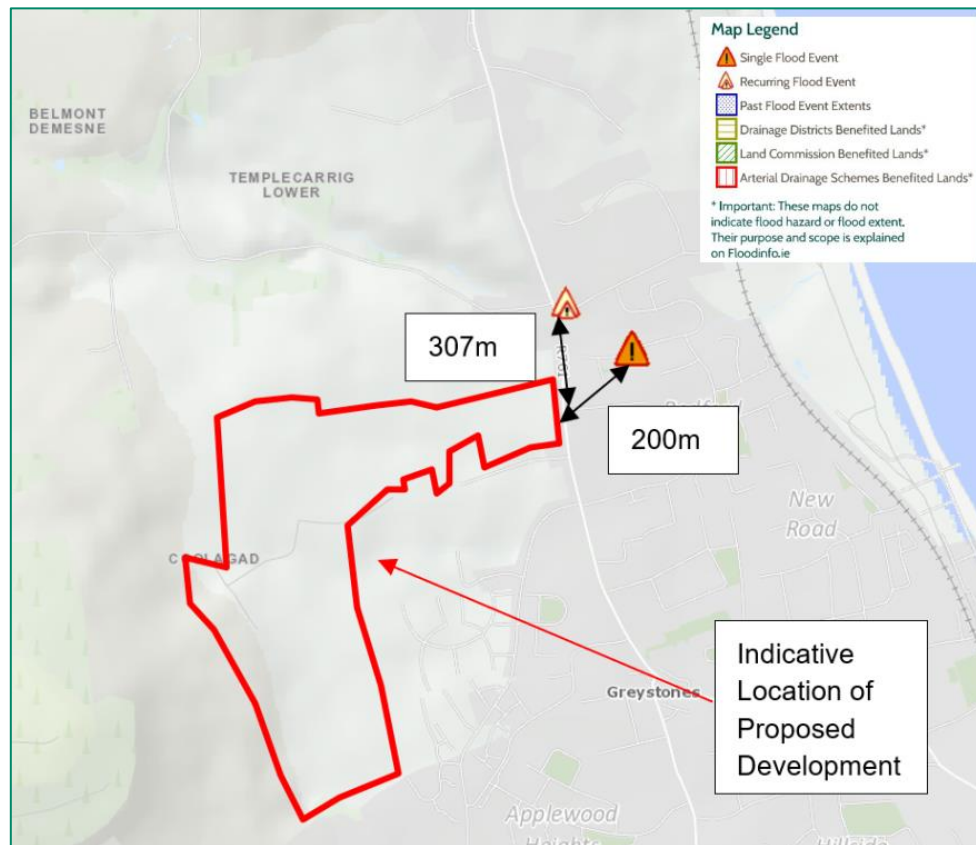


Figure 7 – Recorded Historical Flood Events in Proximity of Subject Site (Source: OPW Flood Maps)

5.2 Eastern CFRAM Predictive Flood Risk Mapping

The Eastern Catchment Flood Risk Assessment and Management (CFRAM) study commenced in the eastern district in June 2011 through to the end of 2016. The study is focusing in the areas known to have experienced flooding in the past and areas that may be subject to flooding in the future, either due to development pressures or climate change.

5.2.1 Coastal Flood Risk

Coastal flooding results from sea levels which are higher than normal and result in sea water overflowing onto the land. Coastal flooding is influenced by the following three factors which often work in combination: high tide level, storm surges and wave action. It is noted that the development is currently 700m away from the Irish Sea, to the east of the subject site.

AECOM have reviewed the CFRAM Flood Maps available and noted that no maps were developed for the Coastal Flood Risk that would comprise the subject site. It is also noted that as part of the CFRAM Map Study, 2 No. predicted future scenarios are available: the Mid-Range Future Scenario (comprising a 20% Climate Change) and the High-End Future Scenario (which comprises the 30% Climate Change).

High level maps were retrieved for both scenarios and shown in the Figure 8 below.

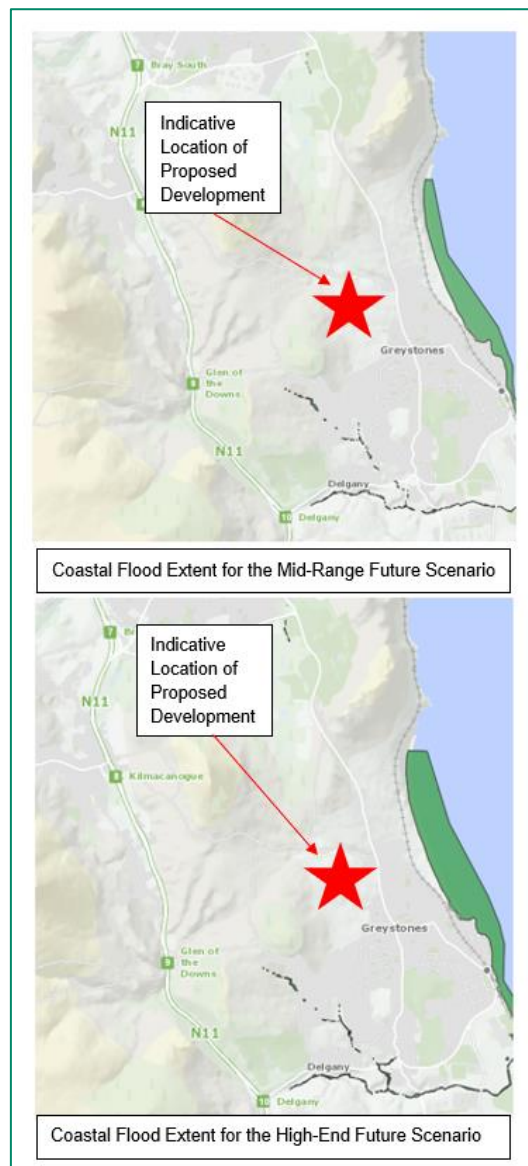


Figure 8 – Extent of Coastal Flood Risk for the Estimated Future Scenarios

Based on the Mid-Range Future Scenario and the High-End Future Scenario, there is no significant risk of coastal flooding to the site of the proposed development.

5.2.2 Fluvial Flood Risk

Fluvial flooding is the result of a river exceeding its capacity and excess of water spilling out onto the adjacent floodplain.

The CFRAM Fluvial Map which the subject site is located within is E10GRE_EXFCD_F2_07.

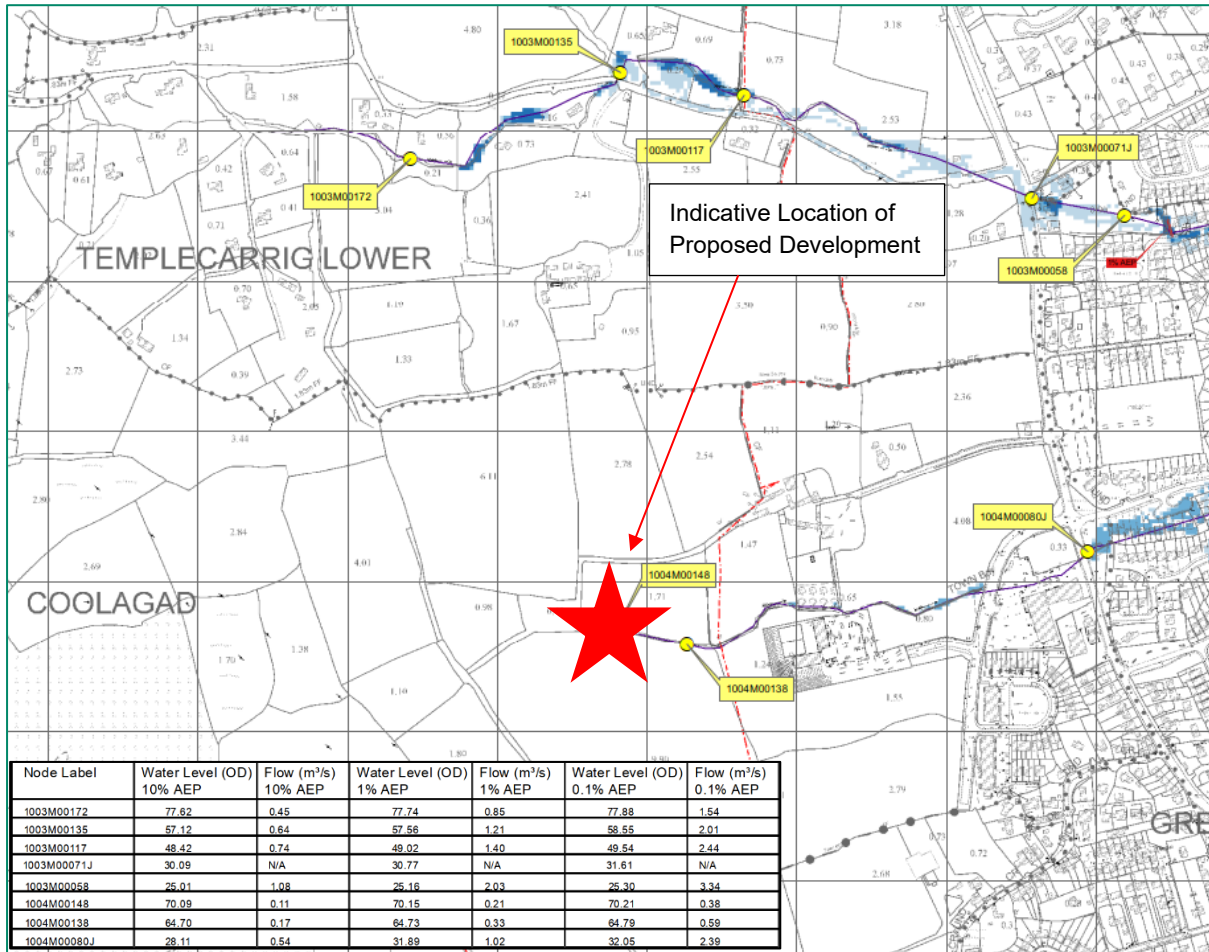


Figure 9 – Extract of CFRAM Fluvial Map for the Subject Area

Figure 9 is an extract of the CFRAM Fluvial Map, noting that there is a stream originating within the subject site that flows eastwards. The identified nodes that show the Water Level (OD) for the 0.1% Annual Exceedance Probability (AEP) are indicated in the table below.

Table 1 – Water Level for the Nodes within Subject Site

Node Label ID	Water Level (OD) 0.1% AEP
1004M00148	70.21m
1004M00138	64.79m

The highest predicted 1 in 1000 year (0.1% AEP) return period water level is 70.21m for Node 1004M00148; the lowest proposed level on site in this location is 71.96m, which is 1.75m higher than the predicted water level. Further east within the subject site, the highest predicted 1 in 1000 year (0.1% AEP) return period water level is 64.79m for Node 1004M00138; the lowest proposed level on site in this location is 66.89m, which is 2.10m higher than the predicted water level.

Based on the CFRAM Fluvial Flood Maps, there is no significant risk of fluvial flooding to the site of the proposed development. Please refer to Appendix D for the full map.

5.2.3 Pluvial Flood Risk

Pluvial Flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high intensity rainfall and typically occurs in the summer months.

The CFRAM maps did not develop a study for the subject area, showing only the Dublin City area (refer to Figure 10 below). However, in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities, the drainage network has been designed in order to carefully manage the surface water runoff from significant rainfall events.

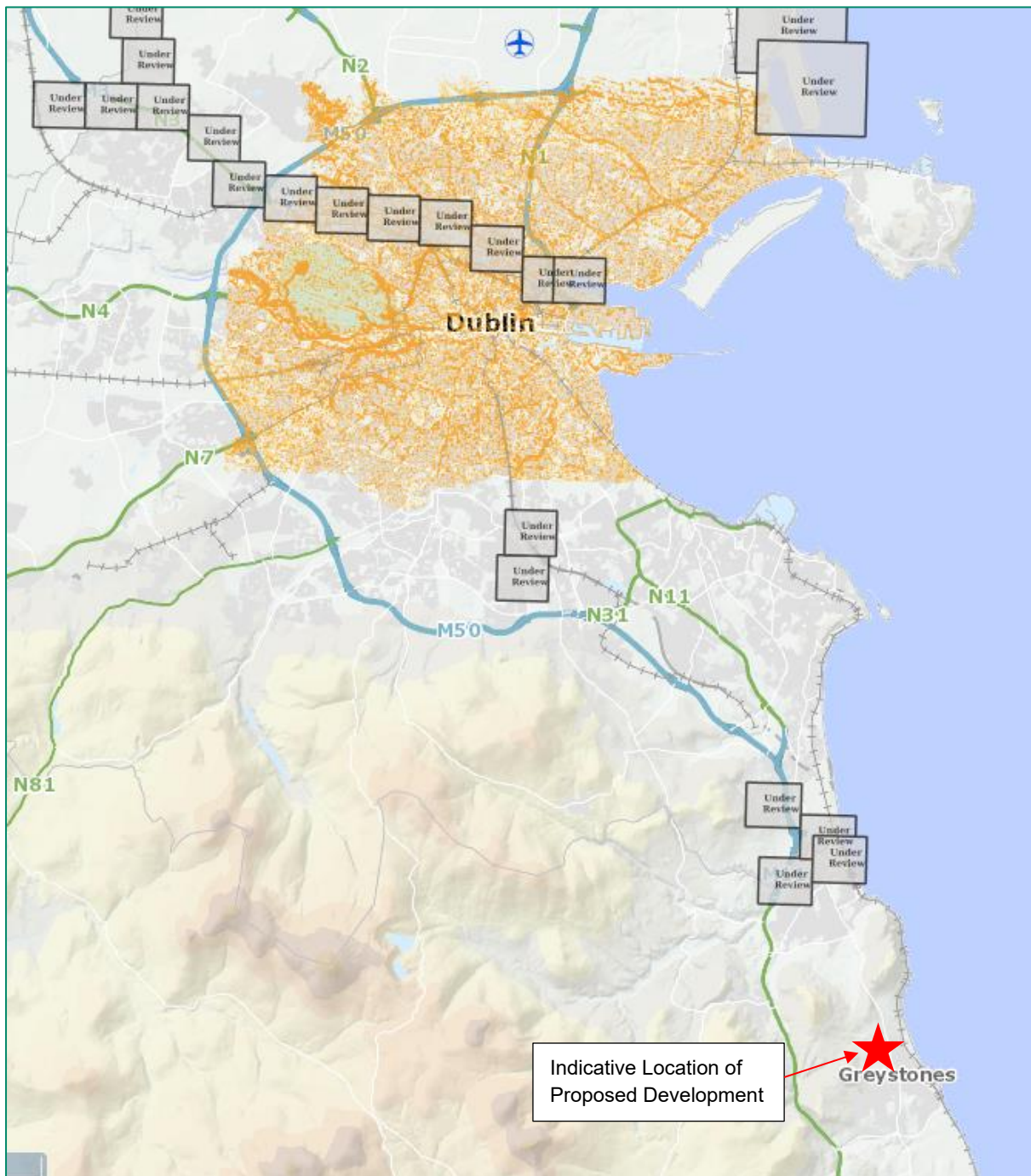


Figure 10 – CFRAM Pluvial Risk Map (extract from floodinfo.ie)

The proposed surface water drainage network has been designed to cater for storm water runoff from impermeable areas, within the proposed development, in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) and will provide attenuation for the 1 in 100 year event plus 20% climate change allowance. A series of SuDS systems (i.e. dry swales, filter drains, permeable paving) will provide a “Management Train” (Interception and Treatment) on site.

It is also noted that the development is located at the lower end of the Kindlestown Hill, which is characterised by steep gradients and it is estimated that during heavy rainfall events, the surface water runoff flows in an easterly direction towards the proposed development.

AECOM have carried out an overland catchment study to establish the existing surface water runoff from the eastern lands that might affect the site. Due to the topography of the site and the steep fall from land that is higher to the west, a series of swales along the western boundary is proposed to intercept any over land flows that may be generated from higher up the slope and which could potentially constitute a flood risk to the development. The proposed swales are of various trench depths ranging from 0.925m to 1.6 m with a 1:100 base slope and are provided with 1 in 4 side slopes which could potentially have the top of bank planted with a hedge to provide an additional amenity / biodiversity component, whilst also serving as an additional flow barrier / transpiration source. The swales have been proposed to flow along the topographical lines to connect into the existing watercourse, which would serve to replicate the existing flow paths.

The proposal will replicate the current scenario and it will not increase the flows directed to the existing stream.

5.2.4 Groundwater Vulnerability

The Groundwater Vulnerability map ([Groundwater Data Viewer](#)) shows land areas where groundwater can be easily contaminated. It also shows areas where it is very well protected by the natural subsoil layers.

If geologists find features in the landscape like sinkholes or sinking streams ('karst' features), these are specially outlined as being extremely vulnerable. Where the water table is close to the surface in sand and gravel aquifers, groundwater vulnerability is also extremely vulnerable. Four groundwater vulnerability categories are defined by the DELG/EPA/GSI (1999):

- Extreme (E)
- High (H)
- Moderate (M)
- Low (L)

The vulnerability follows the Vulnerability Mapping Criteria:

Depth to rock	Hydrogeological Requirements for Vulnerability Categories				
	Diffuse recharge			Point Recharge	Unsaturated Zone
	high permeability (sand/gravel)	Moderate permeability (sandy subsoil)	low permeability (clayey subsoil, clay, peat)	(swallow holes, losing streams)	(sand & gravel aquifers only)
0–3 m	Extreme	Extreme	Extreme	Extreme (30 m radius)	Extreme
3–5 m	High	High	High	N/A	High
5–10 m	High	High	Moderate	N/A	High
>10 m	High	Moderate	Low	N/A	High

i N/A = not applicable.
ii Release point of contaminants is assumed to be 1–2 m below ground surface.
iii Permeability classifications relate to the engineering behaviour as described by BS5930.
iv Outcrop and shallow subsoil (i.e. generally <1.0 m) areas are shown as a sub-category of extreme vulnerability.
 (amended from Deakin and Daly (1999) and DELG/EPA/GSI (1999))

Figure 11 - Vulnerability Mapping Criteria (DELG/EPA/GSI 1999)

In relation to the subject site (shown in Figure 12), it is deemed that the site is classified as class 'M' and, therefore the risk of groundwater vulnerability is considered moderate.

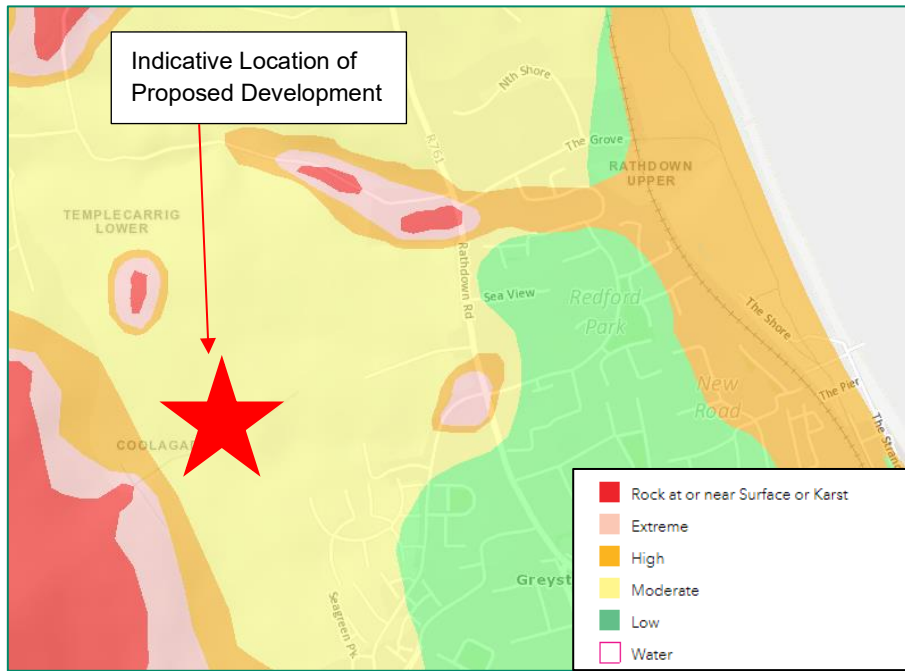


Figure 12 – Groundwater Vulnerability within the Vicinity of the Site (GSI Online Mapping).

AECOM have also reviewed the mapping for the subsoil permeability within the site and Figure 13 is an extract from the GSI mapping for the proposed development.



Figure 13 – Subsoil Permeability within the Vicinity of the Site (GSI Online Mapping)

The subject site presents a Low subsoil permeability property.

In July 2021, Site Investigations Limited carried out ground investigations on site (Report No. 5868) and previous investigations were also carried out in 2018 by Ground Investigations Ireland (Report. No. 6994-08-17).

Groundwater was encountered at depths of less than 5m below ground during the site investigations. As noted in the Site Investigation Report *“there is always considerable uncertainty as to the likely rates of water ingress into excavations in cohesive soil due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volume of water”*.

Based on the results from the exploratory hole locations, it is considered that any shallow ingress (less than 2m) in excavation of the clay will be slow to medium, with the possibility of higher rate if granular soils are encountered in shallow excavations. This is in line with the findings from the GSI Online Mapping, that shows the site within an area of Low subsoil permeability.

For further details on groundwater vulnerability, please refer to the Hydrogeology Assessment Report by Enviroguide Consulting.

6. Flood Risk Assessment

6.1 Potential Sources of Flooding

Based on the review of the historical data and existing flood studies, the potential sources of flooding at the proposed development site are the following:

- Coastal Flood Risk
- Fluvial Flood Risk
- Pluvial Flood Risk
- Groundwater Flood Risk

6.2 Coastal Flood Risk

Coastal flooding is the result of sea levels which are higher than normal and result in sea water overflowing onto the land. Despite the location of the proposed development to the Irish Sea (700m), the general ground levels for the site are higher than the expected coastal flood levels. It is concluded there is no significant risk associated with coastal flooding for this site (see section 5.2.1)

6.3 Fluvial Flooding Risk

Fluvial flooding is the result of a river exceeding its capacity and excess of water spilling out onto the adjacent floodplain. The CFRAM maps show no flood event within the subject site. Nodes have been identified as part of the CFRAM maps and flood levels for the 0.1% AEP have been reviewed against with the proposed levels on site. The proposed levels on site are higher than the estimated flood levels for the 0.1% AEP (1.75m and 2.10m) and therefore there is no significant risk associated with fluvial flooding for this site (see section 5.2.2)

6.4 Pluvial Flood Risk

Pluvial flooding is the result of rainfall generated overland flows which arise before runoff can enter any watercourse or sewer. The CFRAM maps suggest that there has been no study conducted for pluvial flooding for the subject site; however, the pluvial flood risk will be mitigated through an effective surface water and SuDS strategy (see section 5.2.3).

The development is located at the lowermost of the Kindlestown Hill, which is characterised by steep gradients and it is estimated that during heavy rainfall events, the surface water runoff flows in an easterly direction, therefore towards the proposed development. It is proposed to intercept any over land flows that may be generated from higher up with a series of swales.

The proposed swales are of various trench depths ranging from 0.925m to 1.6 m with a 1:100 base slope and are provided with 1 in 4 side slopes which could potentially have the top of bank planted with a hedge to provide an additional amenity / biodiversity component, whilst also serving as an additional flow barrier / transpiration source. The swales have been proposed to flow along the topographical lines to connect into the existing watercourse, which would serve to replicate the existing flow paths.

The proposed weir will limit the flow to the next swale system to 25l/s and an additional layer of stones will be provided at the transition between the swales, in order to decrease water velocity and minimise the risk of erosion.

6.5 Groundwater Flood Risk

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. If the groundwater level rises above surface level, it can pond at local points and cause periods of flooding.

The Groundwater Data Viewer (GSI) online maps were reviewed and noted the following:

- The subject site lies within an area where the subsoil permeability is considered low, in line with the Site Investigations carried out on site;
- The subject site lies within an area where the groundwater vulnerability is considered moderate.

Groundwater was also monitored during the site investigations carried out, noting that the groundwater has been encountered at depths less than 5m (see section 5.2.4). However, as noted in the Hydrogeology Assessment Report by Enviroguide Consulting, the site investigations undertaken to date have “coincided with a predominantly dry period with occasional rainfall events. It is therefore recommended that groundwater level monitoring during wetter weather including longer-term continuous monitoring to record temporal fluctuations and groundwater level response to recharge (rainfall) events is recommended to establish worst case groundwater levels”. It is noted that groundwater level monitoring will be carried out during the detailed design.

For further details on groundwater vulnerability, please refer to the Hydrogeology Assessment Report by Enviroguide Consulting.

6.6 Flood Zone

With reference to Section 2 above, it is concluded that the subject site is located in Flood Zone C. Flood Zone C is defined in the Planning System and Flood Risk Management where the probability of flooding is low and is deemed appropriate for this type of development.

6.7 Vulnerability

As discussed in Section 4, Table 3.1 of the Planning System and Flood Risk Management for Planning Authorities gives a detailed classification of vulnerability of different types of development. Buildings with a residential element are classed as highly vulnerable developments and these are considered a suitable land use for Flood Zone C; all residential elements are located within Flood Zone C, thereby negating the requirement for a Justification Test.

7. Conclusions

This flood risk assessment was prepared for the purposes of assessing the flood risk to the proposed residential development in Coolagad, Greystones.

AECOM have reviewed the CFRAM Flood Maps available and noted that no maps were developed for the Coastal Flood Risk. The lowest proposed level on site is circa 39mOD over the Irish Sea level. It is also noted that as part of the CFRAM Map Study, 2 No. predicted future scenarios are available for the Greystones area, showing that the proposed development is not subject to risk of coastal flooding.

With regard to Fluvial Flooding, the CFRAM maps show the presence of a stream within the site, providing the estimated flood water levels for the 0.1% AEP Flood Event in two locations. Given the predicted water level (for the 0.1% AEP) of 70.21m and 64.79m and the lowest proposed level on site in these locations (71.96m and 66.89m respectively, which is 1.75m and 2.10m higher than the predicted water levels), it is concluded that the subject site is not at risk from fluvial flooding.

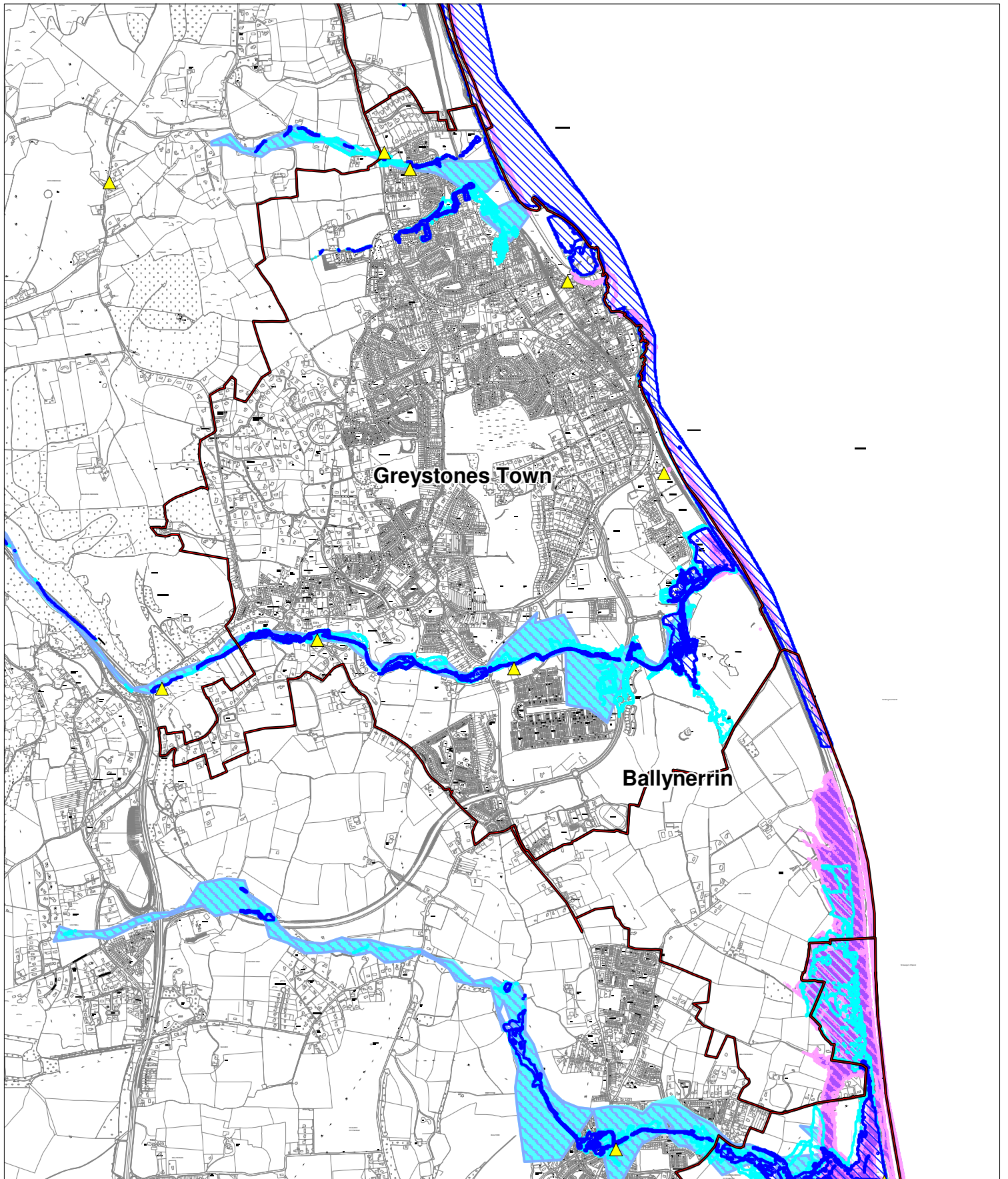
The CFRAM maps did not develop a study for the subject area for pluvial flooding, showing only the Dublin City area. However, the pluvial flood risk will be mitigated through an effective surface water and SuDS strategy. Similarly, a series of swales will intercept and collect the surface water runoff from the Kindlestown Hill and discharge it, at a control rate, into the existing stream within the site. The proposed discharge flow rate will be limited to what is currently being discharged to the stream such that existing flows within the stream are not increased as this could potentially create downstream impacts.

In relation to groundwater vulnerability, the site is classified in class 'M' for moderate, showing a moderate possibility that the site's groundwater can be contaminated. Groundwater was encountered during the ground investigations carried out and further details can be found in the Hydrogeological Assessment by Enviroguide Consultants.

The objectives set out in the LAP 2013-2019 SFRA have been met.

It is concluded that the subject site is entirely within Flood Zone C, negating the requirement of a Justification Test.








Appendix A – WCC Development Plan 2016-2022 – SFRA Flood Map



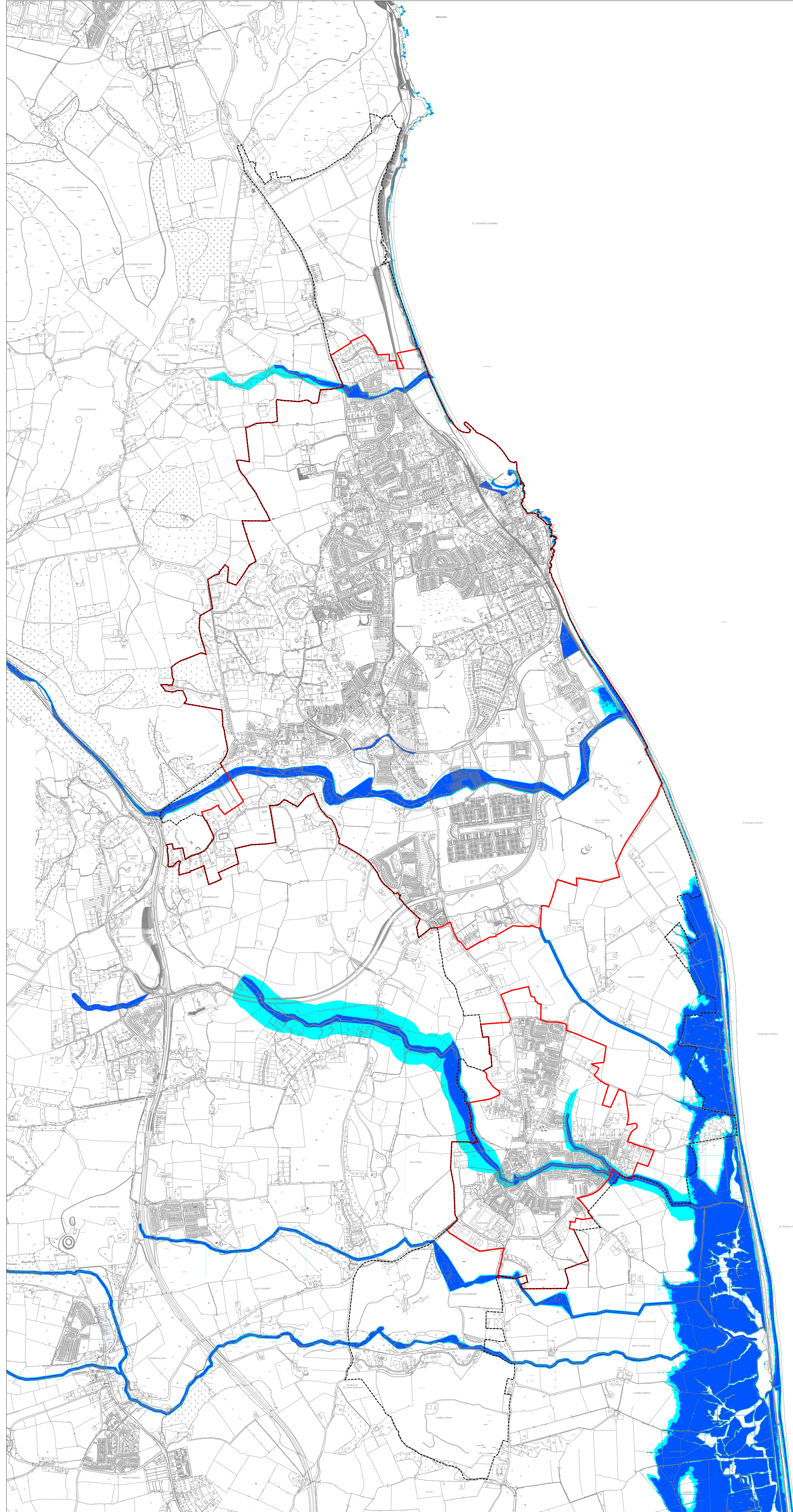
**Stage One Strategic
Flood Risk Assessment**

**WICKLOW COUNTY
DEVELOPMENT PLAN
2016 - 2022**

**Identification Assessment
Coastal Cells SFRA Map 2**

- | | | | |
|---|---------------------------|---|---------------------------|
|  | Flood Zone A PFRA |  | Flood Zone B PFRA |
|  | Flood Zone A draft CFRAMs |  | Flood Zone B draft CFRAMs |
|  | Flood Zone A Coastal |  | Flood Zone B Coastal |
|  Historic Flood Points (OPW) | | | |

Appendix B – Greystones-Delgany and Kilcoole LAP 2013-2019 – SFRA Flood Zone Map



Flood Zone A: High likelihood of flooding ■

Where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding)

Flood Zone B: Moderate likelihood of flooding ■

Where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding)

Disclaimer

These Indicative Flood Zones are based on currently available information. All information may be substantially altered in light of future data and analysis. In particular, the assessment and mapping of areas of flood risk awaits the publication of the CFRAMS. Full Disclaimer is included in Section 3 of SFRA.

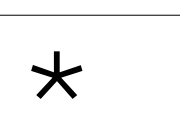
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Strategic Flood Risk Assessment: Indicative Flood Zones

Map 1

DRAFT GREYSTONES - DELGANY AND KILCOOLE LOCAL AREA PLAN (LAP) 2013-2019



Drawn by: AM
Checked by: AM
Scale: NTS

Appendix C – OPW Past Flood Events Local Area Summary Report

MINUTES OF MEETING

Reference: P4D403A – F310 – 036 – 004 - 2441 Page 1 of 2

Project No.: P4D403A

Project Title: OPW Flood Hazard Mapping Programme

Purpose of Meeting: Data Collection Meeting No 2
– Wicklow County Council

Participating: Executive Engineer (Environment) Wicklow CC
Search Manager ESBI

Venue: Wicklow County Buildings, Wicklow.

Date of Meeting: 20/10/2005

Copies to: File

Compiled by: Search Manager

Status: Final

Approved for ESBI: Search Manager

Approved for Wicklow County Council Engineer

Date: 24/10/2005



Details of flood locations in the county area were identified as follows:-

9. The Breaches (Kilcoole)

The culvert at the Breaches is the only outlet for land behind the Railway Embankment. Shingle washes into outlet causing blockage and flooding of marshlands. Severe flooding in January 2005. [Flood ID 3621]

10. Three Trouts Stream.

On 14/15 November 2003 ground floors of Burnabee Court Estate flooded. Also Greystones Treatment Plant flooded and damage caused to machinery. Remedial works in river carried out subsequently. [Flood ID 3622]

11. Sea Road, Newcastle

Heavy rain causes river to flood road regularly. Impassable sometimes. [Flood ID 3623]

12. Barry's Bridge (Glen of the Downs)

Junction of N11/R762 in natural hollow floods regularly. Road impassable. [Flood ID 3624]

13. Redford Bridge

Natural hollow. Heavy rain caused flooding of R761 in Winter 2003 and 2004. Remedial works have been carried out. [Flood ID 3625]

14. Templecarrig

Road floods near Glen of the Downs GC. [Flood ID 3626]

15. Briarswood Estate, Bray

In November 2003 driveways and houses flooded Putland Road opposite school. [Flood ID 3627]

Flooding at Redford Stream Greystones on 16th August 2008

The information contained in this report has been extracted from a Flood Data Collection Form submitted to The Office Of Public Works (OPW) by Dublin City Council.

- **Location and date of flood event:**

Location: Greystones to Bray Road at the intersection of the Grove.
National Grid Reference:
NGR – O 284 134

This flooding event started on, 16th August 2008 at 2.30pm and ended on the same day at 4.10pm. The peak flood occurred at approximately 3.20pm on 16th August 2008.

- **Source and cause:**

So much rain fell that small streams on the Little Sugarloaf side burst their banks and flowed onto the main Greystones to Bray Road.

This in turn flowed into the Grove and a pond formed and when the necessary height arrived the concrete block wall fell allowing the water to access the Redford Stream.

The stream already running high received a huge amount of water and this in turn burst the banks and flooded the houses.

Remedial works have been carried out both at the Grove and a new 750mm thick 1.8m high wall erected at the house nearest the stream. This will assist any further flooding to use the road and reduce and or avoid these houses being flooded from the same occurrence in the future.

- **Flood data:**

The following flood information was provided:

Flood Parameter	Max Value	Typical Value	Comments
Flood Level (metres OD Malin)			
Flood Depth (metres)	2.7	2	Guesstimate in stream
Flood Flow (m ³ /s)	25	15	
Flood Velocity (m/s)	2	1.5	100-200 on road

Flooding has occurred at this location before – yes, but never as sever, just local overtopping of stream

• **Impacts of flooding event:**

It was recorded that this flooding event had the following impacts.

Impacts to property:

Residential - *4 residential properties were affected by the flooding event, impacting approximately 12 people.*

Impacts to transport infrastructure:

Road – 200m of Main Street was flooded, this is a National Secondary road.

Rail –

Impacts to communications infrastructure: Cable TV flood waters blew up amplifiers

Series of photographs of flood event during and after the event (last ~~4~~ images).







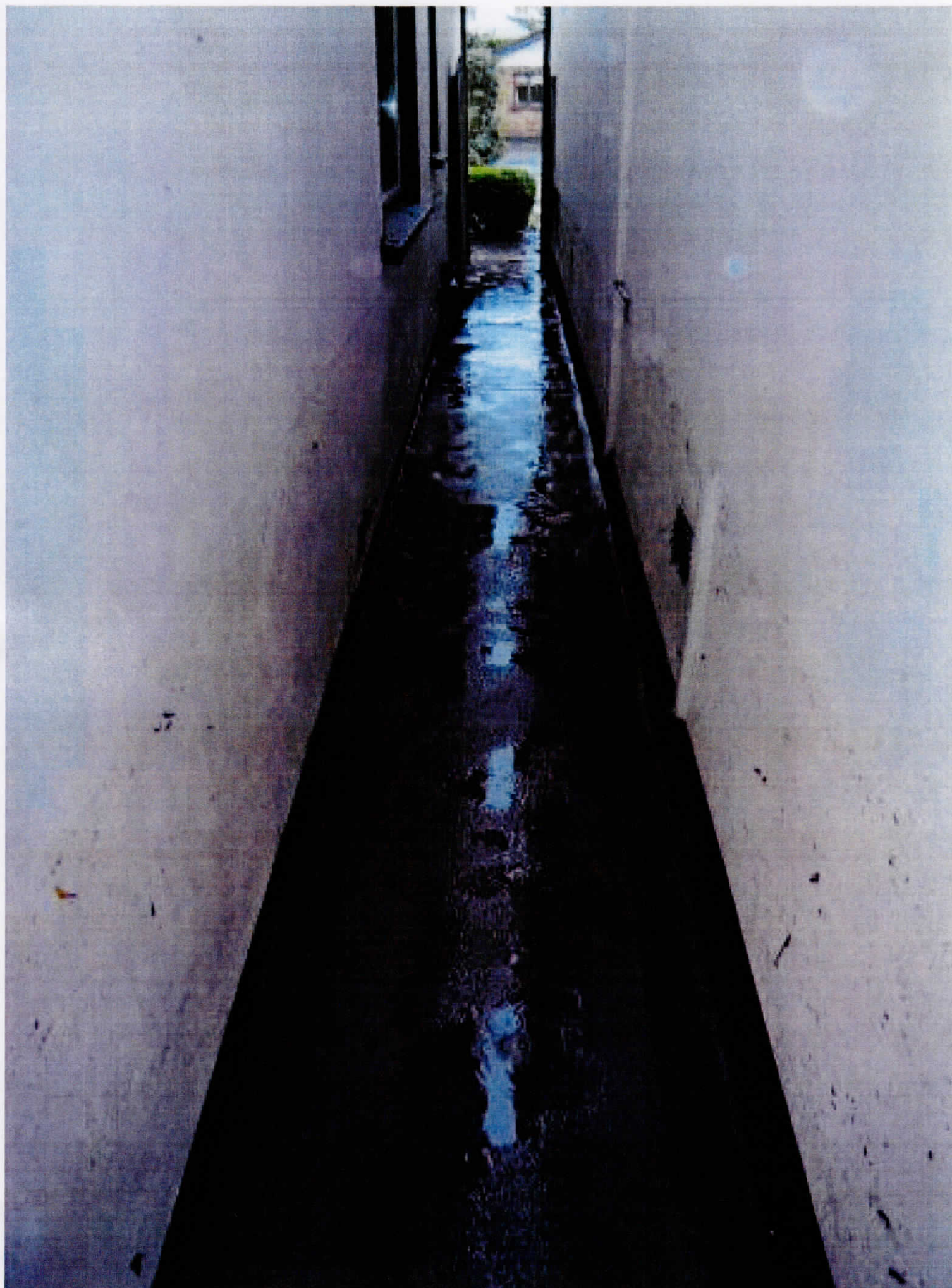








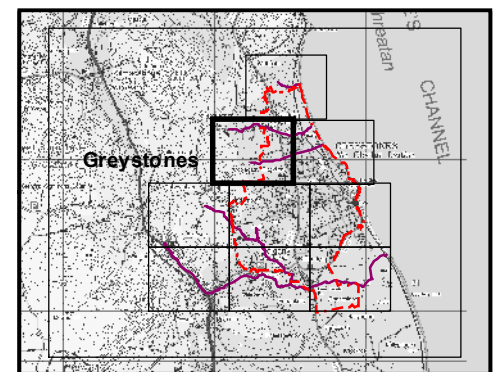
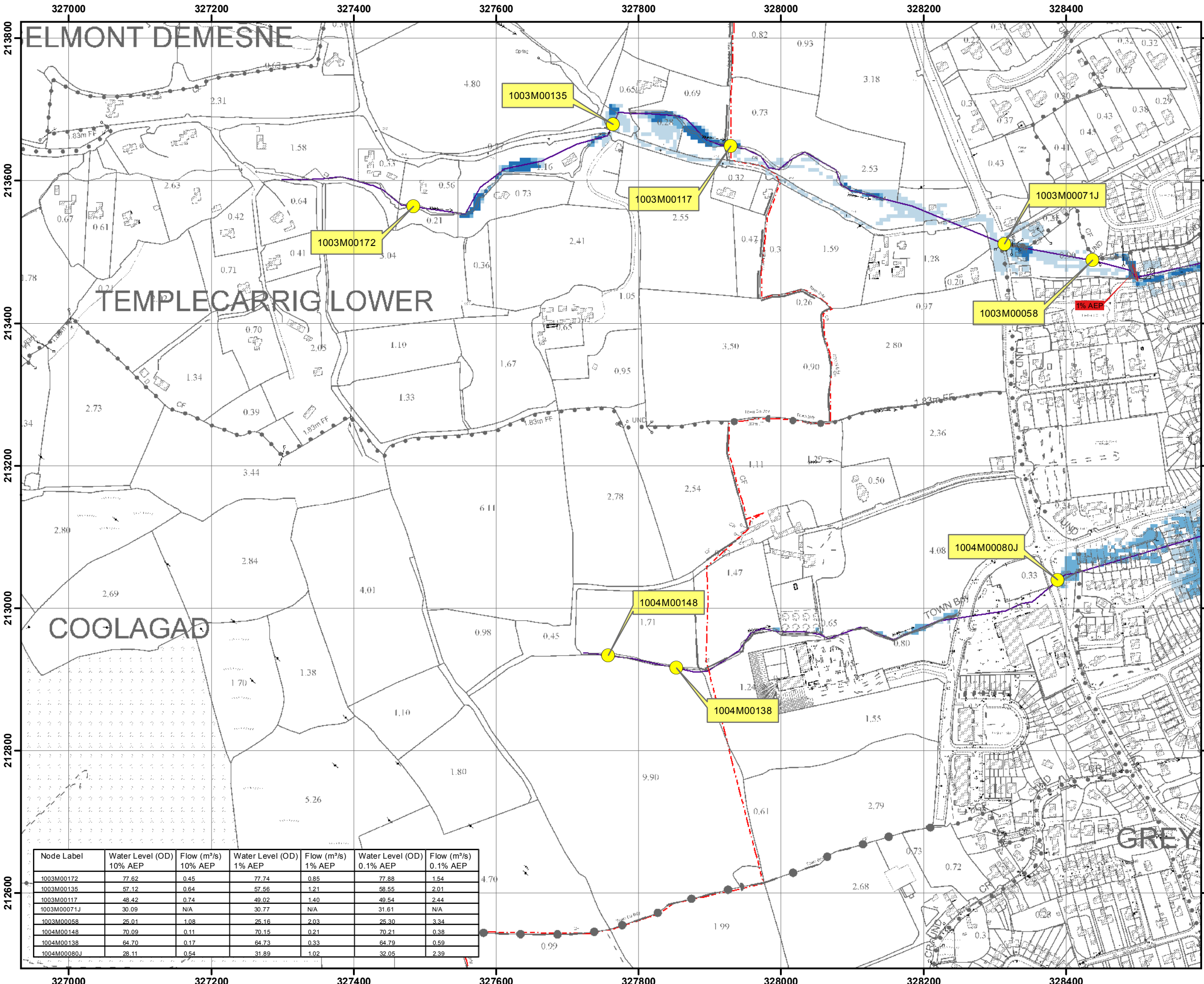








Appendix D – CFRAM Maps



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

- Legend**
- 10% Fluvial AEP Event
 - 1% Fluvial AEP Event
 - 0.1% Fluvial AEP Event
 - Modelled River Centreline
 - AFA Extents
 - Embankment
 - Wall
 - Defended Area
 - 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
 - 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
 - Node Point
 - Node ID

FINAL

REV:	NOTE:	DATE:
------	-------	-------

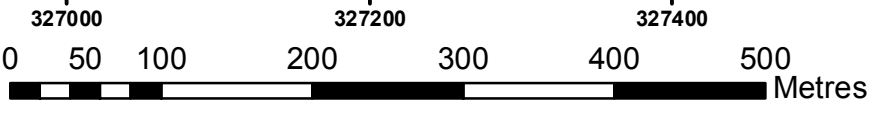


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Node Label	Water Level (OD)		Flow (m³/s)		Water Level (OD)		Flow (m³/s)	
	10% AEP	10% AEP	1% AEP	1% AEP	0.1% AEP	0.1% AEP	0.1% AEP	0.1% AEP
1003M00172	77.62	0.45	77.74	0.85	77.88	1.54		
1003M00135	57.12	0.64	57.56	1.21	58.55	2.01		
1003M00117	48.42	0.74	49.02	1.40	49.54	2.44		
1003M00071J	30.09	N/A	30.77	N/A	31.61	N/A		
1003M00058	25.01	1.08	25.16	2.03	25.30	3.34		
1004M00148	70.09	0.11	70.15	0.21	70.21	0.38		
1004M00138	64.70	0.17	64.73	0.33	64.79	0.59		
1004M00080J	28.11	0.54	31.89	1.02	32.05	2.39		



Map:
 Greystones Fluvial Flood Extents

Map Type: EXTENT

Source: FLUVIAL

Map Area: HPW

Scenario: CURRENT

Drawn By: F.M.C. **Date:** 15 December 2017

Checked By: J.D. **Date:** 15 December 2017

Approved By: S.P. **Date:** 15 December 2017

Drawing No.:
 E10GRE_EXFCD_F2_07

Map Series: Page 7 of 10

Drawing Scale: 1:5,000 @ A3

