FLOOD RISK
CONSULTING

SITE SPECIFIC

FLOOD RISK ASSESSMENT

PROPOSED ONE BEDROOM, TWO STOREY SEMI DETACHED HOUSE AT 20 WOODFORD PARK, DUBLIN 22

DECEMBER 2021

CHARTERED CIVIL ENGINEERS

LISBURN OFFICE: 93 Hillsborough Road, Lisburn, Co Antrim, BT28 1JN | Tel: +44 (0)28 9267 8891
Email: phil@floodriskconsulting.com | Web: www.floodriskconsulting.com

DUBLIN OFFICE: Clifton House, Fitzwilliam Street Lower, Dublin 2 | Tel +353 (0)83 983 1782
Email: [illegible] | Web: www.floodriskconsulting.ie

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1.7 It should be noted that there are no circumstances in which the risk of flooding can be removed entirely. This report should not be considered a guarantee against future flooding events but instead aiming to evaluate the risk of flooding at the site and then propose mitigation measures that may reduce the impact of such flooding.

1.0 INTRODUCTION

1.1 This report has been prepared by Flood Risk Consulting (FRC). The brief for the study was to carry out a Site Specific Flood Risk Assessment (SSFRA), in regulation with The Planning System and Flood Risk Management: Guidelines for Planning Authorities (OPW, 2009) and the South Dublin Country Development Plan 2016-2022 for the proposed one bedroom, two storey semi-detached house at 20 Woodford Park, Dublin 22.

1.2 The planners have confirmed that proposed development is located in an area that is at risk of 1 in 100 to 1 in 1000 flooding. The applicant is therefore requested to submit a report to show the flood risk of the proposed development and also show what mitigation measures are proposed for the development. The applicant is also requested to confirm, or provide alternative plans, showing finished floor levels of at least 500mm above the highest known flood level on the site.

1.3 Therefore, this SSFRA will seek to address the Flood Zones at the proposed development. This study included a topographical survey of the site.

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2.0 DESCRIPTION OF SITE

2.1 Plate 2.1 presents mapping of the proposed site (identified as by the red marker on Google Maps) relative to Dublin.

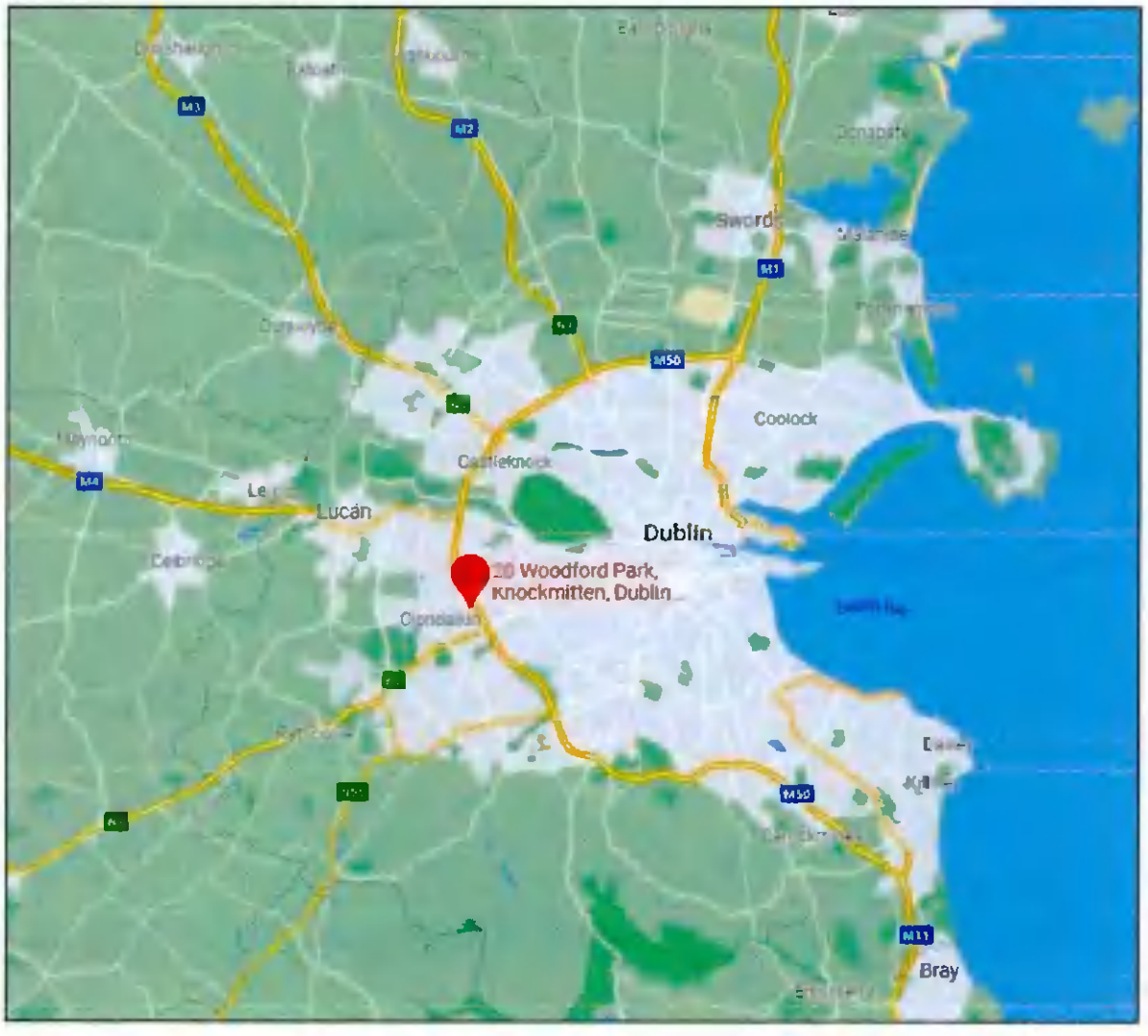


Plate 2.1: Google mapping showing the location of the proposed site

2.2 Plate 2.2 presents lower scale mapping of the site relative to Ballymount, where the site can be seen to be located in an urban area between Woodford Walk and the M50.

Plate 2.2: Google mapping of the location of the proposed site relative to Ballymount

2.3 Plate 2.3 presents a site location map, with the proposed site identified by the red line and additional land owned by the applicant identified by the blue line. The proposed site is located immediately north west of 20 Woodford Park.

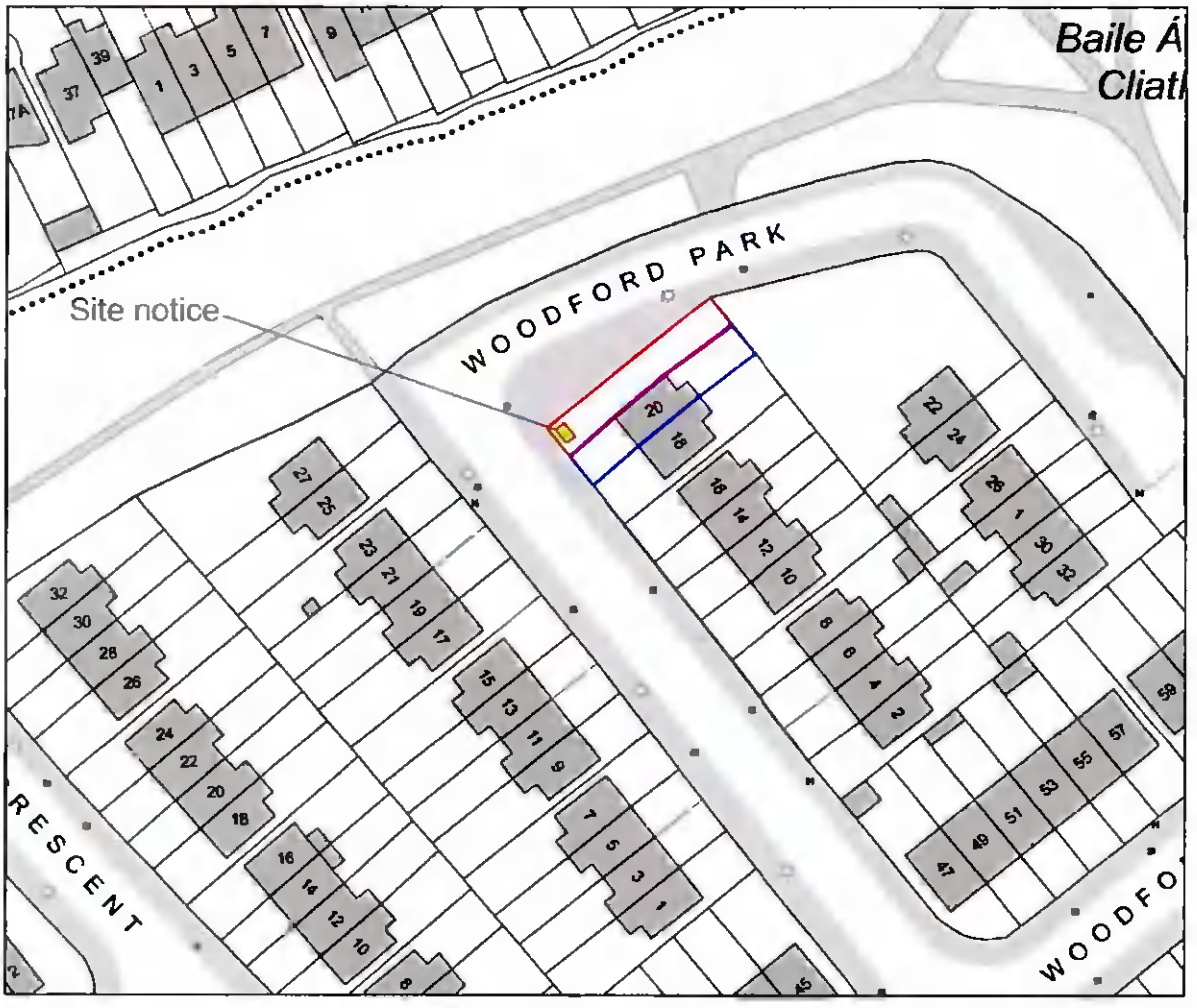


Plate 2.3: Site location map

2.4 Plate 2.4 presents OSI mapping of the area, with the proposed site location approximately indicated by the red triangle. An open watercourse is visible north of the site.

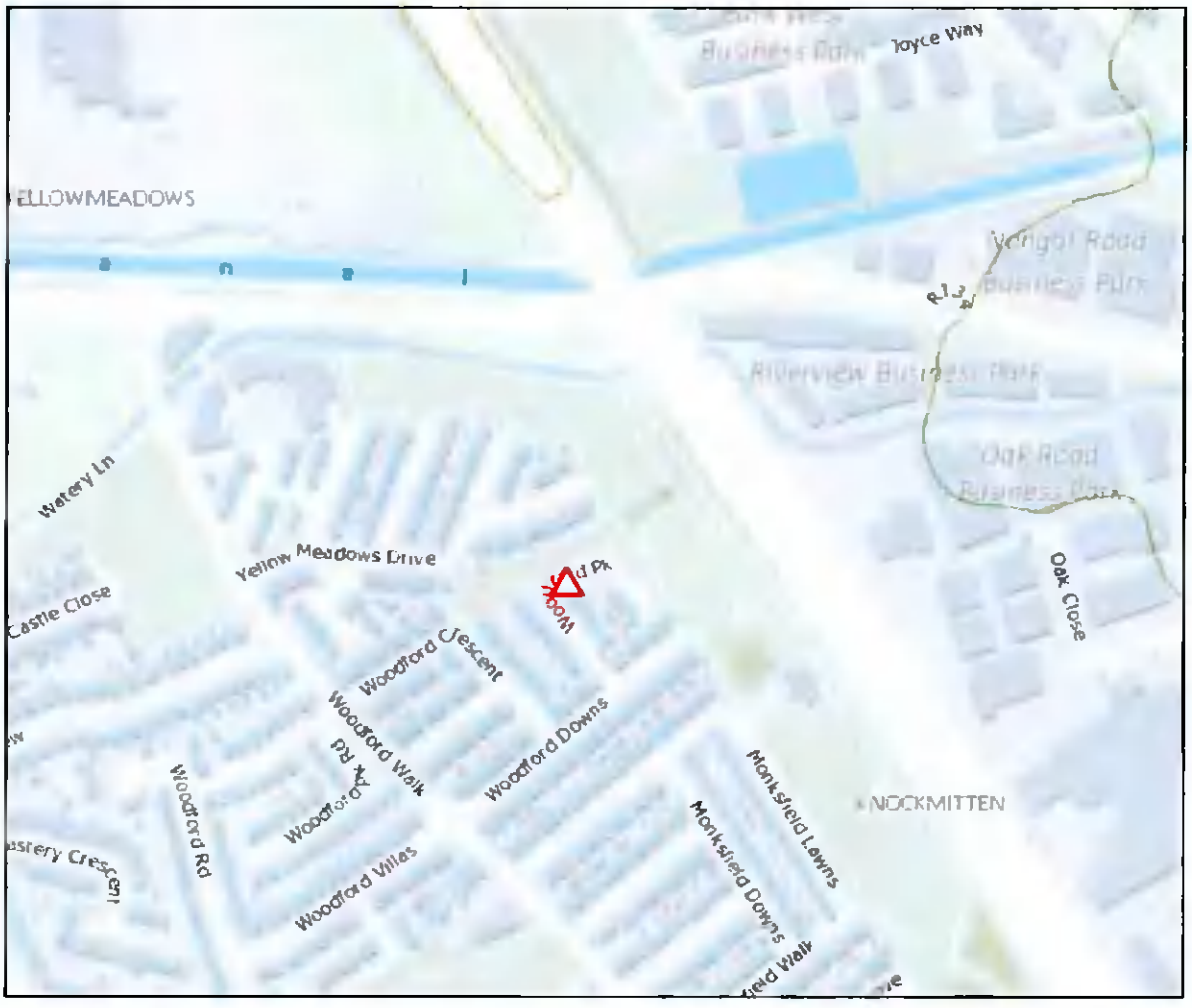


Plate 2.4: OSI mapping of the proposed site

2.5 Plate 2.5 confirms that the watercourse north of the site flows from west to east as an open watercourse before flowing under the M50.

Plate 2.5: Watercourse flow direction

2.6 An extract of Google Streetview at Woodford Park is presented on Plate 2.6. The proposed dwelling is to be located immediately left of the existing dwelling on the plate.

Plate 2.6: Google Streetview extract of site's frontage

2.7 Plate 2.7 presents a Google Streetview image of the open watercourse north of the site.

Plate 2.7: Google Streetview image of open watercourse north of the site.

2.8 Plate 2.8 presents aerial photography of the proposed site. This image confirms that the proposed site is located within an urban area.

Plate 2.8: OSI aerial photography of the proposed site

3.0 FLOOD INFORMATION COLLECTED FOR THE PROPOSED SITE

3.1 Plate 3.1 presents the CFRAM predicted fluvial flood extents mapping for the area of the proposed site (site location approximately identified by the red triangle). The dark, medium and light blue shading represents the predicted Q10, Q100 and Q1000 floodplains within the vicinity of the site. The plate shows that the proposed site is fully located outside both the 10 year and 100 year floodplains, but flooding is predicted at the site during the 1000 year flood event.

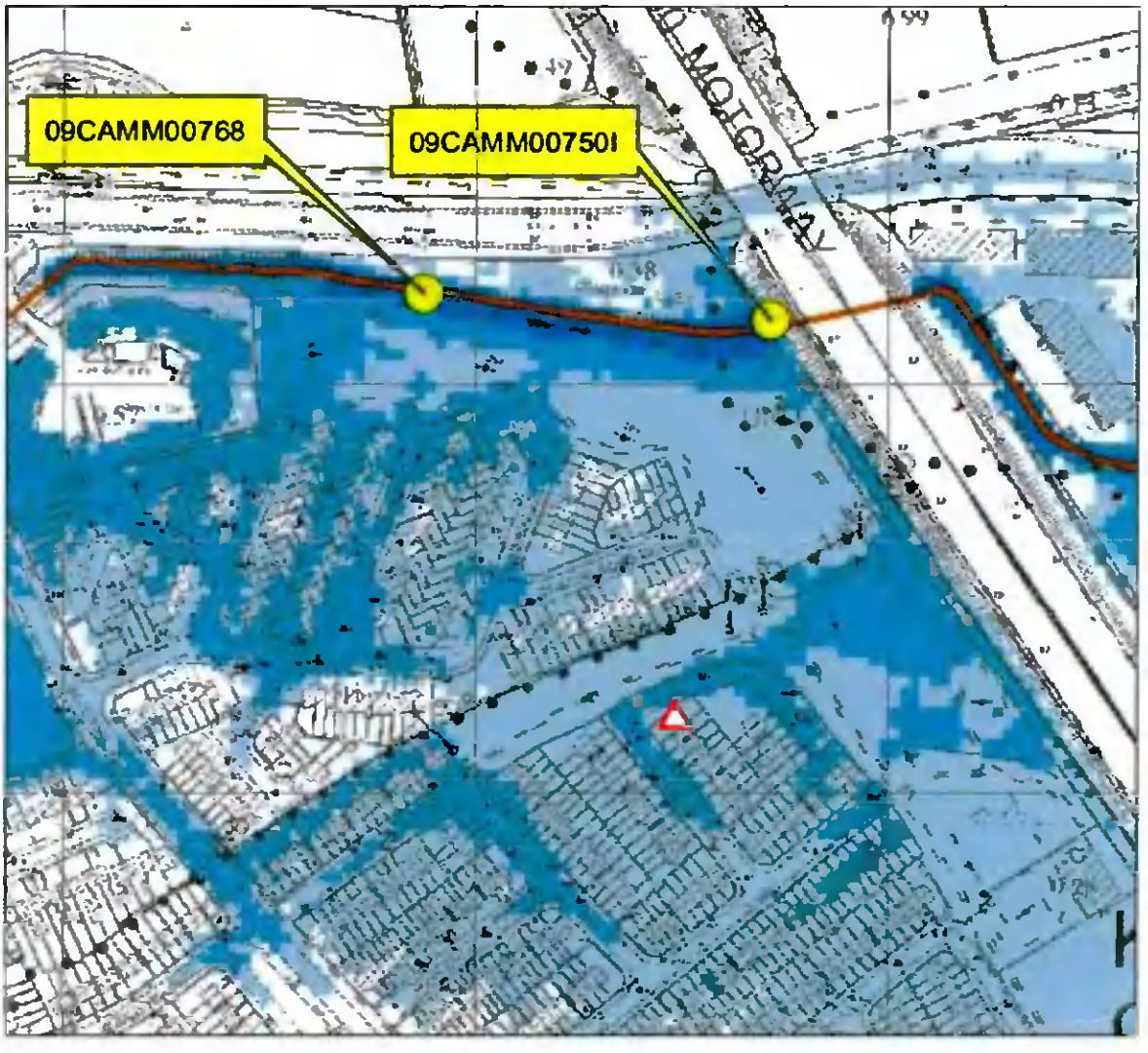


Plate 3.1: CFRAM fluvial flood extents at the proposed site

3.2 Table 3.1 presents the predicted flood levels along the centreline of the watercourse north of the site for the two nodes within the vicinity of the site.

Node	10 year	100 year	1000 year
09CAMM00768	49.91m OD	50.62m OD	51.29m OD
09CAMM007501	49.56m OD	50.37m OD	51.08m OD

Table 3.1: Predicted flood levels along the centreline of the northern watercourse.

3.3 It should be noted that the predicted flood level along the centreline of the river does not necessarily represent the predicted flood level beyond the watercourse. This is because once a river bursts its banks and flows across the out of bank area, the flood level may decrease if there is not sufficient out of bank flooding volume to maintain the flood level with distance from the watercourse.

3.4 Further work will therefore be presented later in this report to propose predicted flood levels at the proposed site.

3.5 Plate 3.2 presents CFRAM's predicted Q100 fluvial flood depth mapping at the proposed site, where the site is identified by the red triangle. This plate shows that flooding in this instance is not predicted to reach the proposed site. Instead, Q100 flooding is mainly restricted to the road network surrounding the site, with the majority of the floodplain along the roads producing predicted flooded of up to 250mm (light blue hatching), with some isolated areas predicting flooding of up to 500mm (dark blue hatching).

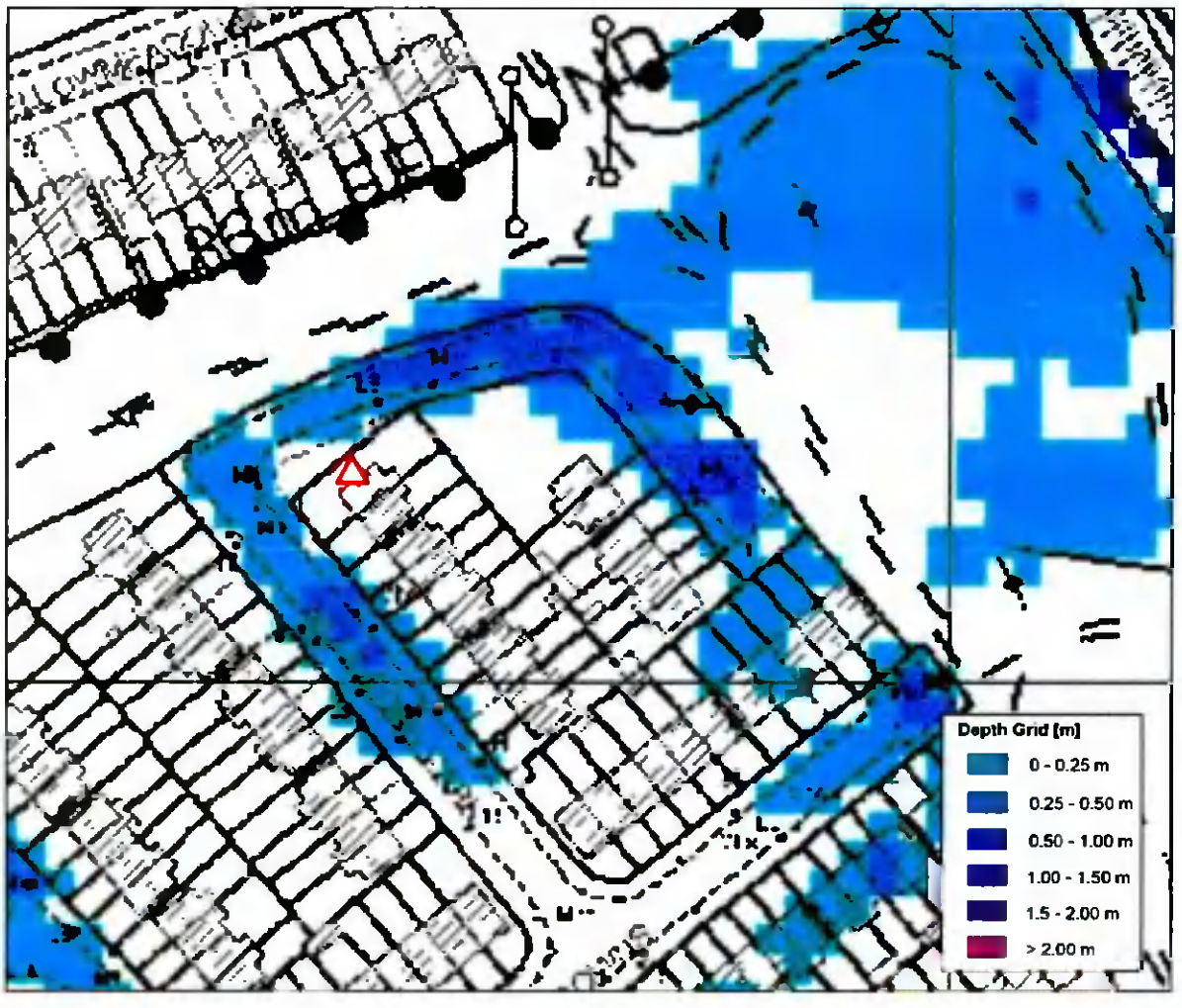


Plate 3.2: CFRAM predicted depth of 100 year fluvial flooding

3.6 Plate 3.3 presents CFRAM's predicted Q1000 fluvial flood depth mapping at the proposed site (site indicated by the red triangle). This plate shows that the proposed site is predicted to flood by between 1.00m and 1.50m during a 1000 year fluvial flood event.

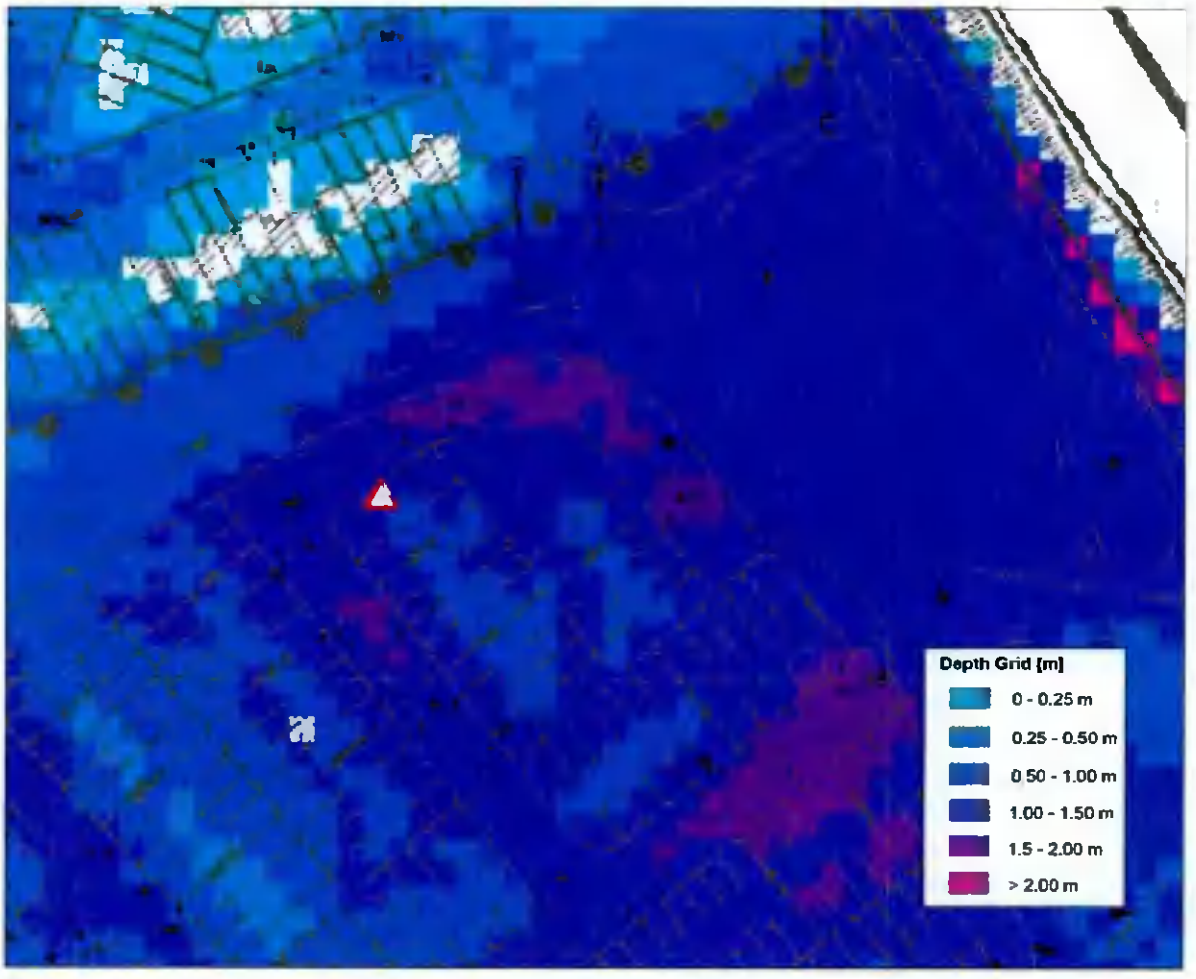


Plate 3.3: CFRAM predicted depth of 1000 year fluvial flooding

3.7 Plate 3.4 presents an extract of OPW's fluvial flood mapping for the 10 year, 100 year and 1000 year mid-range future scenarios, which accounts for a 20% increase in fluvial flows and 500mm sea level rise for climate change (site location identified by the red triangle). This mapping shows that the mid-range climate change allowance is predicted to cause slightly increased flooding within the vicinity of the proposed site.

Plate 3.4: OPW mapping of fluvial extents with a mid-range future climate change allowance

3.8 Plate 3.5 presents an extract of the OPW's fluvial flood mapping for the 10 year, 100 year and 1000 year high-range future scenarios, which accounts for a 30% increase in fluvial flows and 1000mm sea level rise for climate change (site location identified by the red triangle). The high-range climate change allowance is predicted to cause a further slight increase in flooding within the vicinity of the proposed site.

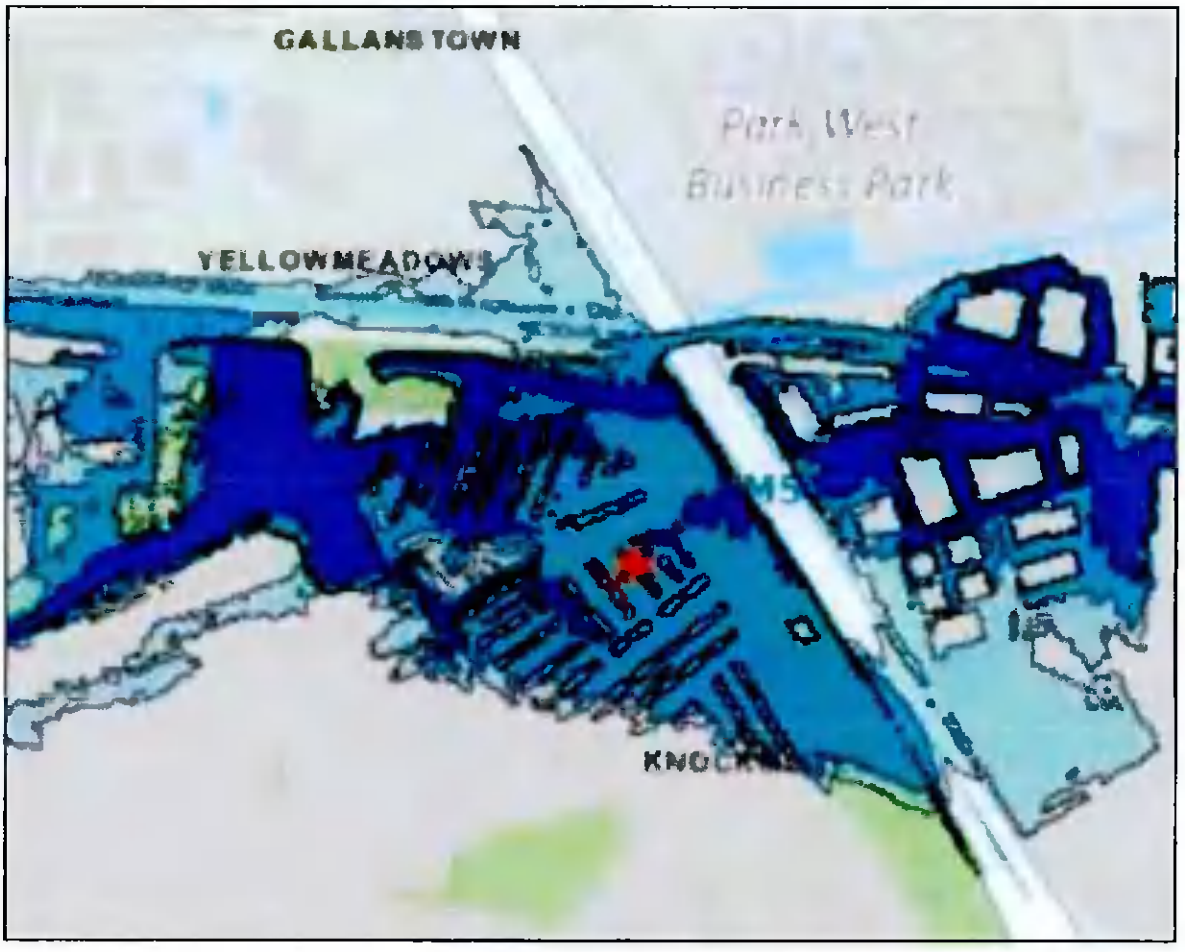


Plate 3.5: OPW mapping of fluvial extents with a high-range future climate change allowance

3.9 Plate 3.6 presents OPW mapping of locations of recorded historical flooding (warning triangles) within the vicinity of the proposed site (identified by the red cross). This plate shows that historic flooding has been recorded along the route of the watercourse north of the site, but no flooding has been recorded within the vicinity of the proposed site.

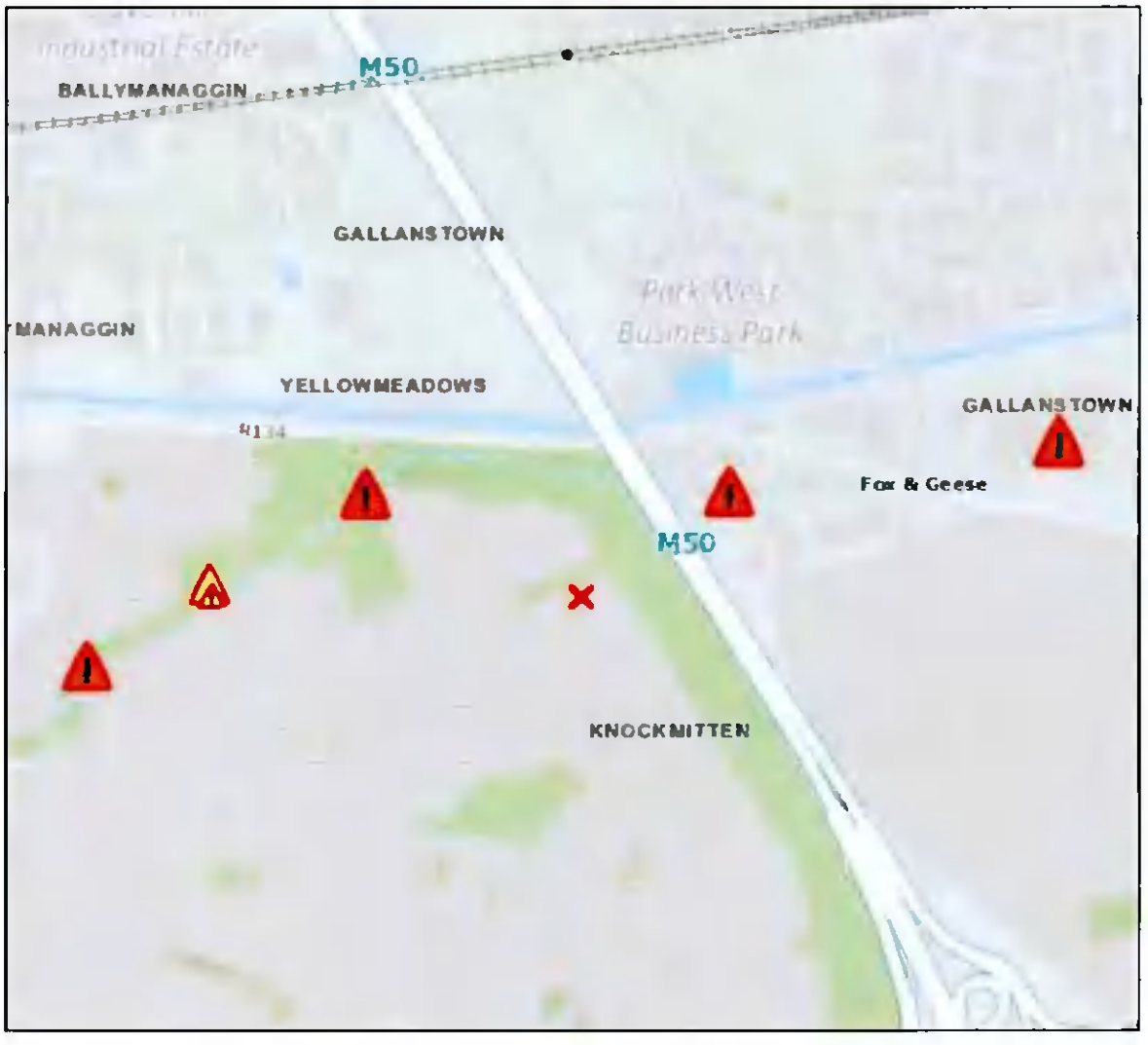


Plate 3.6: OPW mapping of recorded historical flooding within the vicinity of the site

4.0 TOPOGRAPHICAL INFORMATION AND PREDICTED FLOOD LEVELS AT THE SITE

4.1 A topographical survey of the proposed site and its surrounding area was commissioned and provided to FRC in order to allow FRC to propose predicted flood levels at the site.

4.2 Drawing C201 presents a comparison between the CFRAM fluvial extents map and the topographical survey, while Drawings C202 and C203 present the CFRAM Q100 and Q1000 flood depth maps relative to the recorded topographical survey.

4.3 Based upon the above three drawings, FRC have determined that the Q100 and Q1000 flood levels within the vicinity of the site are approximately **50.02m OD** and **51.29m OD** respectively.

4.4 The above levels are in good agreement with both the fluvial extents map and the flood depth maps and confirm that the proposed site, with an average ground level of approximately 50.25m OD, is located above the predicted 100 year fluvial floodplain but would be flooded by over 1m during the predicted 1000 year fluvial flood event.

GENERAL DRAWING NOTES:

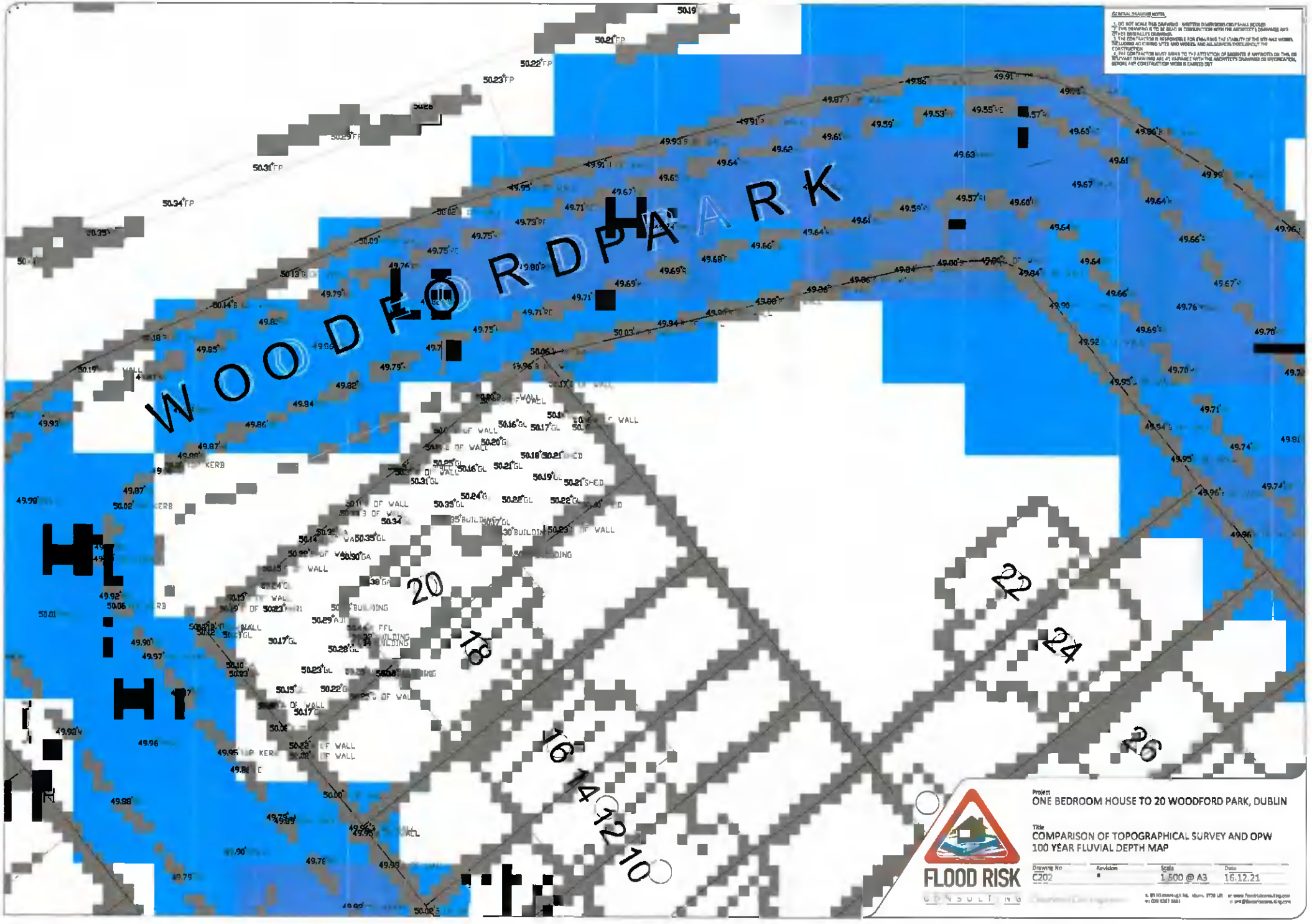
1. DO NOT SCALE THIS DRAWING - WRITTEN DIMENSIONS ONLY SHALL BE USED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ARCHITECT'S DRAWINGS AND OTHER ENGINEERS' DRAWINGS.
3. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THE STABILITY OF THE SITE AND WORKS DURING ADJOINING SITES AND WORKS, AND ALL SERVICES THROUGHOUT THE CONSTRUCTION.
4. THE CONTRACTOR MUST BRING TO THE ATTENTION OF ENGINEER ANY NOTE ON THIS, OR RELEVANT DRAWINGS AND AT VARIANCE WITH THE ARCHITECT'S DRAWINGS OR SPECIFICATION, BEFORE ANY CONSTRUCTION WORK IS CARRIED OUT.

FLOOD RISK CONSULTING

Project
ONE BEDROOM HOUSE TO 20 WOODFORD PARK, DUBLIN

Title
COMPARISON OF TOPOGRAPHICAL SURVEY AND OPW FLUVIAL EXTENTS MAP

Drawing No.	Revision	Scale	Date
C201	*	1:500 @ A3	16.12.21



Project
ONE BEDROOM HOUSE TO 20 WOODFORD PARK, DUBLIN

Title
COMPARISON OF TOPOGRAPHICAL SURVEY AND OPW 100 YEAR FLUVIAL DEPTH MAP

Drawing No	Revision	Scale	Date
C202	-	1:500 @ A3	16.12.21

GENERAL DRAWING NOTES:

1. DO NOT SCALE THIS DRAWING. ONLY FIGURED DIMENSIONS ONLY SHALL BE USED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ARCHITECT'S DRAWINGS AND OTHER ENGINEER'S DRAWINGS.
3. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ENSURING THE STABILITY OF THE SITE AND WORKS, INCLUDING EXCAVATIONS, AND WORKS, AND FOR ALL SHEETING DURING CONSTRUCTION.
4. THE CONTRACTOR MUST BRING TO THE ATTENTION OF ENGINEER ANY NOTES ON THIS, OR ANY OTHER DRAWINGS, THAT ARE NOT IN BALANCE WITH THE ARCHITECT'S DRAWINGS OR SPECIFICATION, BEFORE ANY CONSTRUCTION WORK IS CARRIED OUT.

FLOOD RISK CONSULTING

Project
ONE BEDROOM HOUSE TO 20 WOODFORD PARK, DUBLIN

Title
COMPARISON OF TOPOGRAPHICAL SURVEY AND OPW 1000 YEAR FLUVIAL DEPTH MAP

Drawing No.	Revision	Scale	Date
C203	-	1:500 @ A3	16.12.21

5.0 PROPOSED DEVELOPMENT

5.1 Plate 5.1 presents an extract from the proposed site plan, where the proposed development consists of a new double storey dwelling with frontal parking

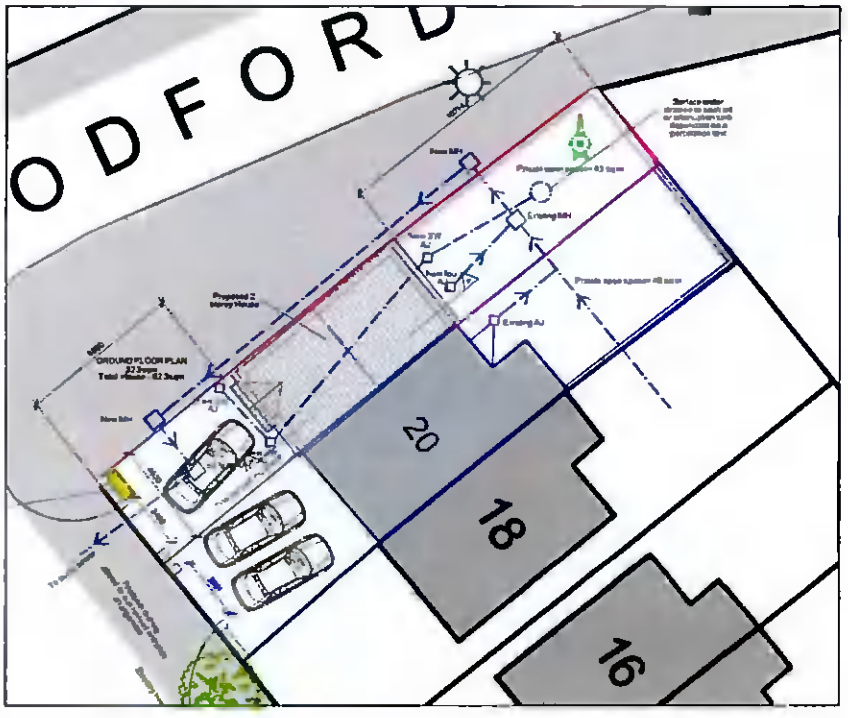


Plate 5.1: Extract of proposed ground floor layout

5.2 Plate 5.2 presents a front elevation of the proposed dwelling relative to the existing dwellings immediately south east of the site. The plate demonstrates that the proposed dwelling will match the neighbouring dwelling height and as such it is reasonable to assume that the FFL of the proposed dwelling will match the FFL of the adjacent dwellings.

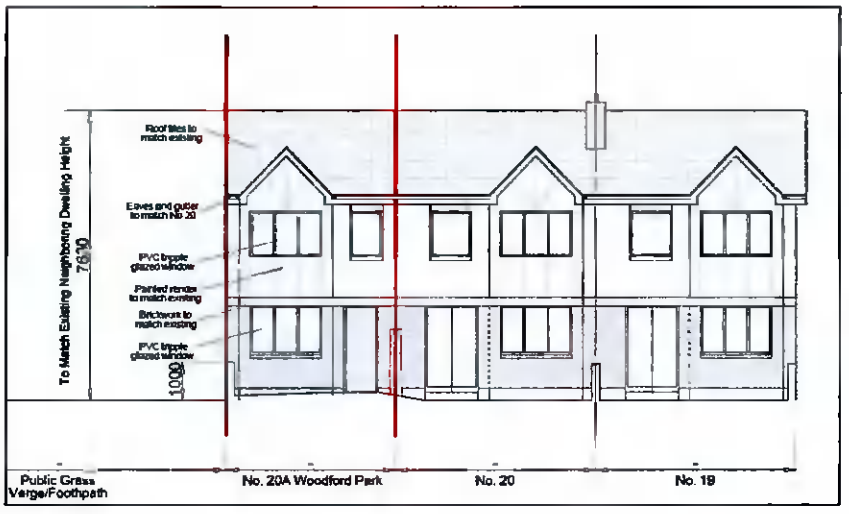


Plate 5.2: Extract of proposed elevation

5.3 The topographical survey provided to FRC recorded the FFL of the adjacent dwelling (20 Woodford Park) as being 50.44m OD and so it has been assumed that the FFL of the proposed dwelling will similarly be **50.44m OD.**

5.4 As such, the FFL of the proposed dwelling would be 420mm above FRC's proposed Q100 flood level in the area and 850mm below FRC's proposed Q1000 flood level.

6.0 GUIDELINES ASSESSMENT OF THE PROPOSED DEVELOPMENT

6.1 *General*

6.1.1 This section will assess whether the proposed development satisfies the document 'The Planning System and Flood Risk Management; Guidelines for Planning Authorities (OPW, 2009)'. The above document shall be referred to within this report as the 'Guidelines'. In addition, consideration will be given to the guidance contained in the Dublin City Development Plan 2016-2022 Strategic Flood Risk Assessment, which will be referred to below as the 'Dublin SFRA'. This assessment has been undertaken by qualified professional civil engineers with experience in hydraulic engineering as required by the above document.

6.1.2 Some of the core objectives of these Guidelines are to avoid inappropriate development in areas at risk of flooding, to avoid new developments increasing flood risk elsewhere (including that which may arise from surface water runoff) and avoiding the unnecessary restriction of national, regional or local economic and social growth.

6.1.3 In achieving the aims and objectives of the Guidelines, the key principles that should be adopted should be to:

- Avoid the risk, where possible,
- Substitute less vulnerable areas, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.

6.1.4 With reference to the last bullet point, Paragraph 1.11 of the Guidelines states that "proper planning and sustainable development may at the same time require in exceptional circumstances **some development in areas of flood risk, provided that the issue of flood risk is managed properly**.

6.1.5 Flood risk is a combination of the likelihood of flooding and the potential consequences arising. The Guidelines therefore recommend a staged approach to flood risk assessment that covers both the likelihood of flooding and the potential consequences.

6.1.6 The likelihood of flooding is normally defined as the percentage probability of a flood of a given magnitude or severity occurring. The consequences of flooding depend on the hazards associated with the flooding (e.g. depth of water, speed of flow, rate of onset) and the vulnerability of people, property and the environment potentially affected by a flood (e.g. the age profile of the population, the type of development, presence and reliability of mitigation measures etc).

6.1.7 A staged approach is therefore recommended within the Guidelines, carrying out only such appraisal and or assessment as is needed for the purposes of decision-making at the site-specific level. The stages of appraisal and assessment are:

- Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to the proposed site
- Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a proposed development site, 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. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped; and
- Stage 3 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, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

6.1.8 At regional level the focus will be on Stage 1 (identification of flood risk), where, in general, the need for more detailed flood risk assessments is flagged for city/country and local area plans. In order to allow this Stage 1 identification to occur, flood zones must be considered. Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of levels of flood zones:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1,000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1,000 year and 0.5% or 1 in 200 for coastal flooding);
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1,000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

6.1.9 In addition to identifying the above zones, there is a great deal of uncertainty in relation to the potential effects of climate change, and therefore a precautionary approach should be adopted. An example of a precautionary approach is to ensure that floor levels are sufficient to cope with the effects of climate change over the lifetime of the development.

6.2 *Flood Zones*

6.2.1 Flood Zone A

6.2.1.1 Most types of development would be considered inappropriate in Flood Zone A. However, water-compatible development, amenity open space, outdoor sports and recreation and essential facilities such as changing rooms would be considered appropriate in this zone.

6.1.8 At regional level the focus will be on Stage 1 (identification of flood risk), where, in general, the need for more detailed flood risk assessments is flagged for city/country and local area plans. In order to allow this Stage 1 identification to occur, flood zones must be considered. Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of levels of flood zones:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1,000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1,000 year and 0.5% or 1 in 200 for coastal flooding);
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1,000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

6.1.9 In addition to identifying the above zones, there is a great deal of uncertainty in relation to the potential effects of climate change, and therefore a precautionary approach should be adopted. An example of a precautionary approach is to ensure that floor levels are sufficient to cope with the effects of climate change over the lifetime of the development.

6.2 *Flood Zones*

6.2.1 Flood Zone A

6.2.1.1 Most types of development would be considered inappropriate in Flood Zone A. However, water-compatible development, amenity open space, outdoor sports and recreation and essential facilities such as changing rooms would be considered appropriate in this zone.

6.2.1.2 Apart from the above types of development, the Guidelines state that development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied.

6.2.2 Flood Zone B

6.2.2.1 The Guidelines state that highly vulnerable development, such as hospitals, schools, residential care homes, caravan and mobile home parks, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in Flood Zone B, unless the Justification Test can be met.

6.2.2.2 Less vulnerable development, such as retail, leisure, warehousing, commercial, industrial and non-residential institutions, land and buildings used for holiday or short-let caravans and camping, land and buildings used for agriculture and forestry, waste treatment and secondary strategic transport and utilities infrastructure would be considered appropriate for this zone.

6.2.3 Flood Zone C

6.2.3.1 Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

6.3 *Sequential approach*

6.3.1 A risk-based sequential approach is therefore required to manage flood risk. The sequential approach includes the following:

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	Appropriate
Water-compatible development, open space and recreation	Appropriate	Appropriate	Appropriate

Table 6.1: Types of development that are appropriate for each flood zone

6.3.5 The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk. The test is comprised of two processes; the Plan-making Justification Test and the Development Management Justification Test. The Development Management Justification Test is the process that is relevant to this FRA report, as it 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.

6.3.6 Section 5.0 of the Guidelines states that where flood risk may be an issue for any proposed development, a site-specific FRA should quantify the risks and the effects of any necessary mitigation, together with the measures needed or proposed to manage residual risks. This site-specific FRA will therefore seek to consider mitigation measures and to manage residual risk at the proposed development.

6.3.7 The Justification Test as outlined in Box 5.1 of the Guidelines is presented on Plate 6.2. Therefore, in order for a proposed development to pass the Justification Test, the site-specific FRA must:

1. Ensure that the proposed development will not increase flood risk elsewhere,
2. Include measures, proportional to the nature of the development and associated flood risk, to minimise flood risk to people, property, the economy and the environment as far as reasonably possible.

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
   - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
   - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
   - (iii) 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; and
   - (iv) 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 acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Plate 6.2: Box 5.1 of the Guidelines

6.4 *Application of the Justification Test to the proposed development*

6.4.1 Should the justification test be applied to the proposed development?

6.4.1.1 CFRAM mapping shows that the proposed site is not located within the predicted 100 year fluvial floodplain but is located within the predicted 1000 year fluvial floodplain. Drawing C203 presents the proposed development layout relative to the CFRAM 1000 year undefended fluvial flood depth map.

6.4.1.2 Based on a comparison of CFRAM's flood depth mapping for a 1000 year fluvial flood event with a provided topographical survey of the area, FRC has proposed a 1000 year fluvial flood level of **51.29m OD** at the proposed site.

6.4.1.3 Based on the site being above the predicted 100 year fluvial floodplain but within the 1000 year fluvial flooding, the proposed site should be considered to be located in **Flood Zone B**. As the proposed dwelling is considered to be 'highly vulnerable' development, a justification test is therefore required for proposed development within the site.

6.4.1.4 The Guidelines acknowledge that small scale infill housing may be suitable in urban areas. Therefore the acceptability of a proposed dwelling being located within Flood Zone B is requested, with the decision being a matter for the planning authority.

6.4.1.5 Subject to the planning authority granting permission for a small scale infill house being suitable within the urban area, this report will consider flood risk from and to the proposed development, recommending appropriate flood risk and resistance measures to reduce the impact of any future flooding. The above is in accordance with *IE3 Objective 3* of the *Dublin SFRA*, which states;

> For lands identified as being at risk of flooding in (but not limited to) the Strategic Flood Risk Assessment, a site-specific Flood Risk Assessment to an appropriate level of detail, addressing all potential sources of flood risk, is required, demonstrating compliance with the aforementioned Guidelines or any updated version of these Guidelines, paying particular attention to residential flood risks and any proposed site specific flood management measures

6.4.2 *Ensuring the proposed development will not increase flood risk elsewhere*

6.4.2.1 Risk to coastal and fluvial flooding elsewhere

6.4.2.1.1 Drawings C201 and C203 and Plate 3.3 shows that the 1000 year floodplain is very large in the area relative to the footprint of the proposed development. Therefore any loss of floodplain caused by the proposed dwelling will be negligible relative to the overall floodplain volume.

6.4.2.1.2 Paragraph 5.28 of the Guidelines address minor development such as extensions to houses are unlikely to raise significant flooding issues. FRC believe the same applies for the current proposal, where the footprint of the proposed dwelling is very small in relation to the overall floodplain area and storage volume.

6.4.2.1.3 Therefore the proposed development is not considered to cause an increase in fluvial or coastal flood risk beyond the site. The acceptability of the above statement is a matter for the planning authority.

6.4.2.2 Risk to pluvial flooding elsewhere

6.4.2.2.1 Based on the existing hardstanding area within the site, the proposed development will cause either no increase or only a negligible increase in the hardstanding area.

6.3.2.2.2 Proposals for surface-water management should be applied to the development according to sustainable drainage principles to ensure that surface water runoff from the proposed development does not increase beyond that which presently discharged from the existing site.

6.3.2.2.3 Measures such as the use of on-site storm water storage, with appropriate approved storm discharge, are recommended to ensure that the proposed development will not have a negative impact on pluvial flooding elsewhere.

6.3.2.2.4 The proposed development site plan (Plate 5.1) indicates surface water drainage is proposed to address the above risk and includes for the provision of a soak pit or attenuation tank in the rear garden of the property subject to a soakaway test.

6.4.3 *Measures to minimise flood risk to people, property, the economy and the environment*

6.4.3.1 Coastal and fluvial flooding at the proposed development

6.4.3.1.1 Regarding highly vulnerable development adjacent to Flood Zone B, a freeboard is required for development relative to local predicted flood levels. It is FRC's understanding that the county council planning authority requires that a 500mm freeboard is provided above the Q1000 flood level.

6.4.3.1.2 Therefore the recommended minimum FFL for the proposed dwelling is **51.79m OD**. However it has been demonstrated in Section 5.0 that the FFL of the proposed dwelling will be within the vicinity of **50.44m OD** and so cannot achieve FRC's recommended minimum FFL.

6.4.3.1.3 Therefore a precautionary approach should be taken to potential flooding of the proposed dwelling. Section 4.0 of Technical Appendix B of the Guidelines presents measures that should be implemented at detailed design stage for the proposed extension. The following paragraphs also present details of general and site specific flood resistance and resilience measures.

6.4.3.1.4 **General flood resistance and resilience measures** like flood-resistant construction could be incorporated that prevents water from entering the proposed dwelling and also mitigates the damage that floodwater could cause to the building.

6.4.3.1.5 The main entry points for floodwater into buildings are doors and windows (including gaps in sealant around frames), vents, air bricks and gaps around conduit or pipes passing through external building fabric. Floodwater may also arise through sanitary appliances as a result of backflow through the drainage system.

6.4.3.1.6 There are a range of proprietary flood protection devices available on the market that are designed specifically to resist the passage of floodwater. These include removable barriers designed to fit openings, vent covers and stoppers designed to fit WC pans. However, these measures should not be relied upon to mitigate flood risk and should be limited to infill development within existing urban areas that are at risk of flooding.

6.4.3.1.7 Design for flood resilient construction should also be considered, where it is accepted that floodwater will enter buildings and provides for this in the design and specification of internal building services and finishes. These measures limit damage caused by floodwater and allow relatively quick recovery.

6.4.3.1.8 This can be achieved by using wall and floor materials such as ceramic tiling that can be cleaned and dried relatively easily, provided that the substrate materials (e.g. blockwork) are also resilient. Electrics, appliances and kitchen fittings may also be raised above floor level, and one-way valves may be incorporated into drainage pipes.

6.4.3.1.9 FRC also recommend that the following **site specific flood resistance and resilience measures** be implemented at the proposed development.

- **External and Internal Walls:** The design team should consider site specific measures that provide flood resilience to the foundations and external walls of the dwelling. In

addition, Buffalo Anti-Flood Air Bricks should be used instead of airbricks within the proposed dwelling.

- **Surface Water Outfall:** all new surface water outfall manholes/pipes to be fitted with Harmer Backflow Valve to avoid back flow to the ground floor wc, whb's etc.
- **Flood Protection at Doors:** a floodgate entrance door should be fitted for flood protection for the proposed front and rear entrances
- **Internal Floor:** the design team should consider using easy clean and sheet vinyl flooring on concrete screed for the ground floor of the proposed dwelling
- **Electrical Works:** all electrical services including wiring, sockets, switches and associated trunking should be located at least 450mm above FFL.

6.4.3.1.10 The following details are presented in Appendix A:

- Floodgate Entrance door details
- Harmer Backflow Valve
- A Buffalo Anti-Flood Air Brick

6.4.3.1.11 In addition to considering physical design issues, planning and assessing new development must take account of the need for effective emergency response planning for flood events in areas of new development. This is normally the responsibility of the developer.

6.4.3.1.12 Key elements are:

- Provision of flood warnings, evacuation plans and ensuring public awareness of flood risks to people where they live and work
- Awareness of risks and evacuation procedures and the need for family flood plans.

6.4.3.1.13 In general, flood escape routes should be kept to publicly accessible land, as safeguarding escape routes located within private property may be problematic.

6.4.3.1.14 Further and more detailed guidance and advice can be found at http://www.flooding.ie and in the Building Regulations.

6.4.3.1.15 In addition, "Improving the Flood Performances of New Buildings" published by the Department of Communities and Local Government in the UK is a valuable resource. In addition, a full technical report prepared for the Association of British Insurers and the Building Research Establishment on Flood Resilient Homes can be downloaded from the ABI website (http://www.abi.org). The British Standards Institute (BSI) has introduced a "Kitemark" Certification Scheme for flood resilient products, and CIRIA has published a number of documents detailing flood-protection products for their homes. These can be downloaded from the CIRIA website (http://www.ciria.org).

6.4.3.1.16 Plate 3.1 shows that Woodford Walk a few streets south of the proposed dwelling is located above predicted Flood Zones A and B. Therefore, in the event of future predicted flooding residents of the proposed dwelling should be made aware that the above is a safe muster location beyond the predicted 1000 year floodplain. The developer should therefore consider emergency flood risk planning in their health and safety assessments.

6.4.3.1.17 Key elements of emergency planning regarding flood risk are:

- Provision of flood warnings, evacuation plans and ensuring occupant awareness of flood risks
- Awareness of risks and evacuation procedures and the need for family flood plans.

6.4.3.1.18 The emergency evacuation plan should warn all occupants of the flood risk to the dwelling and direct people to a safe evacuation location in the event of an imminent flood risk.

6.4.3.1.19 As noted above, Woodford Walk at the southern side of the roundabout that connects Woodford Walk to Woodford Downs and Woodford Villas would be a safe muster point.

6.4.3.1.20 Extreme flooding across the Dublin area may be well predicted beforehand and advertised through local radio and television. Nevertheless, the developer should consider the provision of flood warnings and an evacuation plan at detailed design stage. However, even if flooding does occur before the residents have time to reach the safe muster point, the residents could remain within the dwelling but move to the first floor, which will be located within Flood Zone C.

6.4.3.1.21 Design for flood resilient and resilient construction should also be considered to mitigate flood risk at the property, where it is noted that the CFRAM mapping of predicted climate change scenarios indicates slightly increased flooding in the vicinity of the site. Section 4.0 of Technical Appendix B of the Guidelines presents measures that could be implemented at detailed design stage for the proposed dwelling to provide flood resistance and resilience.

6.4.3.1.22 Further and more detailed guidance and advice can be found at http://www.flooding.ie and in the Building Regulations. In addition, "Improving the Flood Performances of New Buildings" published by the Department of Communities and Local Government in the UK is a valuable resource. In addition, a full technical report prepared for the Association of British Insurers and the Building Research Establishment on Flood Resilient Homes can be downloaded from the ABI website (http://www.abi.org). The British Standards Institute (BSI) has introduced a "Kitemark" Certification Scheme for flood resilient products, and CIRIA has published a number of documents detailing flood-protection products for their homes. These can be downloaded from the CIRIA website (http://www.ciria.org).

6.4.3.1.23 The developer should liaise with the insurance industry at an early stage to ensure that affordable flood insurance can be obtained for the development. Should the proposed mitigation measures be implemented, this should positively impact the possibility of securing appropriate insurance for the development.

6.4.3.2 Pluvial flooding at the proposed development

6.4.3.2.1 The Guidelines state that a site-specific FRA should not only consider fluvial risk at the proposed development but also consider other risks of flooding such as surface water and exceedance.

6.4.3.2.2 In order to mitigate against pluvial flooding within the site, the proposed development should be re-profiled as necessary to remove any isolated low-lying areas and/or have appropriate surface water drainage infrastructure installed to remove any standing water. In addition, the FFL of the proposed dwelling should be located at least **150mm** above adjacent ground levels

6.4.3.2.3 Exceedance conditions result in above ground flood flow occurring either when the capacity of the drainage system is exceeded and/or where the rate of runoff exceeds the inlet capacity of the drain. Without good design, flood flow will follow default pathways and this can lead to indiscriminate flooding of property. It is possible to avoid this by identifying and designing above ground flood routes.

6.4.3.2.4 The client should undertake detailed design of the development's storm network to ensure that no flooding of property will occur as a result of a 100 year rainfall storm event.

6.4.3.2.5 The primary risk is that the proposed surface water drainage is exceeded during an extreme storm rainfall event and so surcharge within the site. The design team should therefore ensure that the development's design would not restrict exceedance, and would allow overland exceedance to follow the natural flow regime for the area. This could be achieved with features such as drop kerbs to direct overland flow.

7.0 CONCLUSIONS

7.1 The primary objective of the study was to carry out a Site Specific Flood Risk Assessment (SSFRA) in regulation with The Planning System and Flood Risk Management: Guidelines for Planning Authorities (OPW, 2009) and the South Dublin Country Development Plan 2016-2022 for the proposed one bedroom, two storey semi-detached house at 20 Woodford Park, Dublin 22.

7.2 The report presents the results of a detailed desk top study and topographical site survey. CFRAM mapping shows that the proposed site is not located within the predicted Q10 or Q100 fluvial floodplains but is affected by the Q1000 floodplain. The CFRAM flood maps indicate that the T200 year and T1000 coastal floodplains do not reach the proposed site.

7.3 The planners have confirmed that proposed development is located in an area that is at risk of 1 in 100 to 1 in 1000 flooding. The applicant is therefore requested to submit a report to show the flood risk of the proposed development and also show what mitigation measures are proposed for the development. The applicant is also requested to confirm, or provide alternative plans, showing finished floor levels of at least 500mm above the highest known flood level on the site.

7.4 By comparing CFRAM mapping with a provided topographical survey of the area, Flood Risk Consulting (FRC) proposed Q100 and Q1000 fluvial flood levels of **50.02m OD** and **51.29m OD** at the proposed site. With the proposed site having an average ground level of approximately 50.25m OD, the proposed site is located within **Flood Zone B**.

7.5 As the proposed dwelling is considered to be 'highly vulnerable' development, a justification test is required for proposed development within the site. The Guidelines acknowledge that small scale infill housing may be suitable in urban areas. Therefore the acceptability of a proposed dwelling being located within Flood Zone B is a matter for the planning authority.

7.6 Subject to the planning authority granting permission for a small scale infill house being suitable within the urban area, this report then considered flood risk both from and then to the proposed development, recommending appropriate flood risk and resistance measures to reduce the impact of any future flooding.

7.7 Regarding highly vulnerable development within or adjacent to Flood Zone B, a freeboard is required for development relative to local predicted flood levels. It is FRCs understanding that the county council planning authority requires that a 500mm freeboard is provided above the Q1000 flood level.

7.8 Therefore FRC's recommended minimum FFL for the proposed dwelling is **51.79m OD**. However it has been demonstrated in Section 5.0 that the FFL of the proposed dwelling is tied to that of adjacent dwellings and so will be within the vicinity of **50.44m OD**.

7.9 Therefore a precautionary approach should be taken to potential flooding of the proposed dwelling. Section 4.0 of Technical Appendix B of the Guidelines presents measures that should be implemented at detailed design stage for the proposed extension. The report also presented details of general and site specific flood resistance and resilience measures for the proposed development.

7.10 It was also recommended that the developer should consider emergency flood risk planning in their health and safety assessments. As part of this package, an emergency evacuation plan could be created that warns all occupants of the flood risk to the site and directs people to a safe evacuation location in the event of an imminent flood risk.

7.11 The proposed dwelling is located a few streets away from a section of Woodford Walk that is located in Flood Zone C and therefore provides a straightforward escape route to higher ground in the occurrence of a Q1000 flood event. Alternatively, residents could move to the first floor of the dwelling, which is located above the predicted Q1000 flood level, if there is not sufficient time to vacate the dwelling.

7.12 It is also necessary to ensure that the proposed development will not increase pluvial flood risk elsewhere. Proposals for surface-water management should be applied to the development according to sustainable drainage principles. The design team have taken account of this risk by including the provision of a soak pit or attenuation tank in the rear garden of the property subject to a soakaway test.

7.13 In order to mitigate against pluvial flooding within the site, the proposed development should be re-profiled as necessary to remove any isolated low-lying areas and/or have appropriate surface water drainage infrastructure installed. In addition, the FFLs of proposed buildings should be located at least 150mm above adjacent ground levels. It is recommended that the development's design would allow overland exceedance to follow the natural flow regime for the area.

7.14 Subject to the implementation of the proposed mitigation measures, the above consideration and recommendations are considered to satisfy the requirements of the planning Guidelines.

Dr Philip Hull PhD BEng BTh CEng MICE MIEI
Director for Flood Risk Consulting Limited

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APPENDIX A DETAILS OF PROPOSED FLOOD RESISTANCE AND RESILIENCE MEASURES