

SITE-SPECIFIC FLOOD RISK ASSESSMENT

STRATEGIC HOUSING DEVELOPMENT AT DUCKSPOOL, DUNGARVAN

R497-OCSC-XX-XX-RP-0003-S3-P03

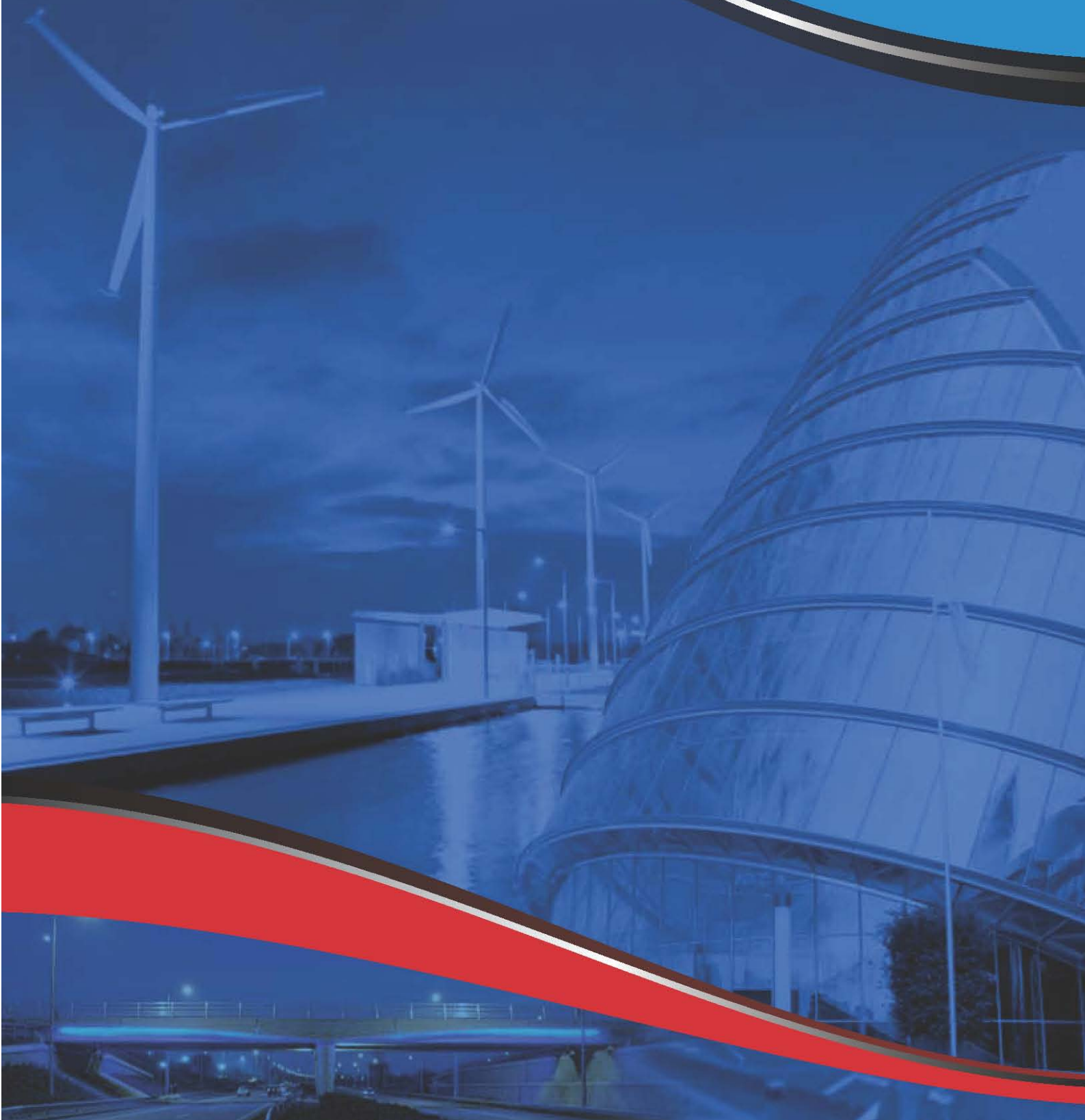
31st MAY 2021



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers



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PROJECT NO. R497

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1. INTRODUCTION

- 1.1 O'Connor Sutton Cronin (OCSC) was appointed to carry out a site-specific flood risk assessment for a proposed Strategic Housing Development at Duckspool, Dungarvan, Co. Waterford – see **Figure 1**.

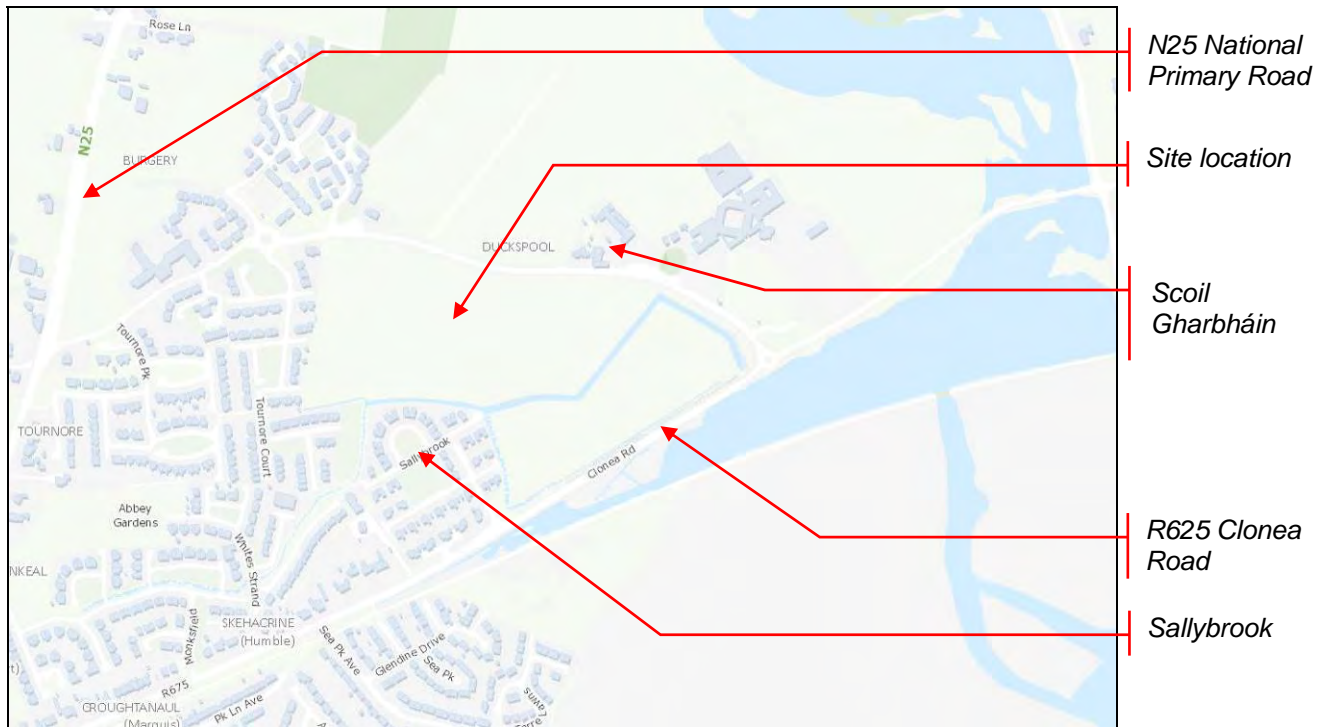


Figure 1: Site Location

- 1.2 The subject site comprises 8.6288 ha located at Duckspool, Dungarvan, which is bound as follows: to the north by the L3168 road (which links the R675 to the east with the N25 as it enters Dungarvan to the west), across which are the Cluain Garbhán housing estate, Scoil Gharbháin (primary level Gaelscoil) and St. Augustine's College (secondary level school); to the east and south-east by an undeveloped field; and to the south and west by existing residential areas (Sallybrook and Tournoire housing estates).
- 1.3 The proposed development layout is shown in **Figure 2** overleaf.



Figure 2: Proposed Site Layout

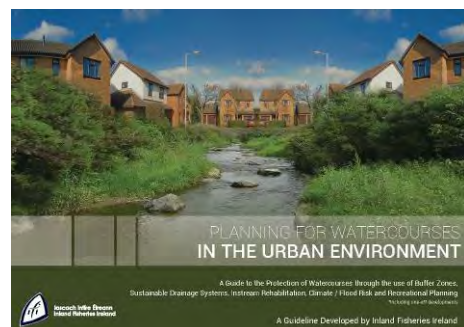
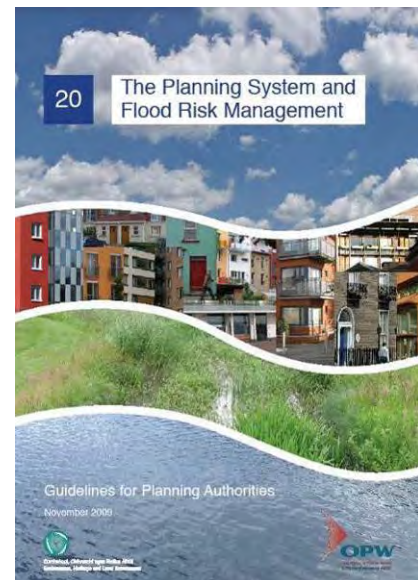
1.4 The development will consist of:

- 218 no. residential units (8 no. 1-bed, 36 no. 2-bed, 161 no. 3-bed and 13 no. 4-bed) ranging in height from 2 no. to 4 no. storeys, comprising 42 no. duplex units (8 no. 1-bed, 32 no. 2-bed and 2 no. 3-bed) and 176 no. terraced, semi-detached and detached houses (4 no. 2-bed, 159 no. 3-bed and 13 no. 4-bed (with the option for up to 121 no. of the 3-bed houses to have attics converted, thereby creating 4-bed houses)), with private open space as rear gardens, balconies and terraces;
- crèche (342.34 sq. m GFA);
- 466 no. car parking spaces at surface level (430 no. within the residential area for residents and visitors and 36 no. in the crèche and community car park), which include 24 no. mobility impaired spaces;
- 48 no. cycle parking spaces at surface level in 3 no. locations;
- bin stores (73 no. for houses and duplexes and 1 no. for the crèche);
- open space areas (28,570 sq. m total), which include footpaths and cycle paths, children's play areas, planting and the incorporation of existing hedgerows and open space;

- new entrances along the northern frontage, including (1) main multi-modal entrance and junction works to the residential area, (2) one-way multi-modal entrance system (separate access and egress) and junction works to the crèche and community car park and (3) 2 no. pedestrian and cycle entrances;
- pedestrian and cycle connection to be facilitated via bridge to the south-west into Tournore Court; and
- all ancillary site services and works to facilitate the development, including adjustments to site levels, boundary treatments, water services and public lighting.

1.5 The Flood Risk Assessment was conducted with reference to:

- *The Planning System and Flood Risk Management Guidelines for Planning Authorities* (Department of Environment, Heritage and Local Government and the Office of Public Works). Hereinafter, these guidelines are referred to as the 2009 Planning Guidelines;
- Circular PL 2/2014 dated 13th August 2014 from the Department of the Environment, Community and Local Government;
- *C624 Development and Flood Risk* (Construction Industry Research and Information Association, CIRIA, October 2004);
- *Planning for Watercourses in an Urban Environment* (Inland Fisheries Ireland, November 2020). Hereinafter, these guidelines are referred to as the IFI Guidelines;
- The *Greater Dublin Strategic Drainage Study* (published by Local Authorities in the Greater Dublin Region).



Hereinafter, these guidelines are referred to as the GSDS;

- *Dungarvan Town Development Plan 2012-2018*, as varied and extended and;
- *Waterford County Development Plan 2011-2017*, as varied and extended.

1.6 The Flood Risk Assessment was based on the following information:

- Architectural drawings of the development proposals;
- OPW Floodmaps.ie;
- OPW Floodinfo.ie;
- OPW Irish Coastal Protection Strategy Study;
- Geological Survey of Ireland (GSI) Maps;
- Dungarvan Stormwater Drainage – Duckspool Drainage Review (November 2018) by Mott MacDonald on behalf of Waterford City and County Council.
- Topographical Survey of the Subject Site.

1.7 OCSC carried out an inspection of the site in December 2019 to identify potential pathways for floodwater to enter the site. The inspections consisted of a walkover and visual inspection outside the site and in the general area. A selection of site photographs is provided in **Appendix A**.

2. SITE CONTEXT

2.1 The subject site is located approximately 120m from Dungarvan Bay at Clonea Road. The Colligan River, which is located 1km to the west, has a catchment area of 108km² and the Glendine River, which is located 0.5km to the east, has a catchment area of 1.7km² – see **Figure 3**.



Figure 3: Site Context

2.2 The site is bounded to the south and east by a local watercourse, which is identified in the OPW's South Eastern CFRAM Study (Document Reference Number IBE0601Rp0018) as the Duckspool watercourse – see **Figure 4** overleaf. The Duckspool discharges to the tidal waters of Dungarvan Bay via a culvert beneath the R675 Clonea Road. The outfall from this culvert is fitted with a non-return valve.



Figure 4: Site Context (local)

2.3 The site is currently in greenfield condition. The site is accessed from the local road on the northern boundary. A topographical survey of the subject site and adjacent areas was undertaken – see survey drawing in **Appendix B**. The road and footpath level along the site boundary vary from 2.3mAOD at the eastern end and 2.4mAOD at the western end to a high of 2.9mAOD at the midpoint of the boundary. The ground levels within the site vary from 0.5mAOD at the eastern boundary to 1.0mAOD at the western boundary rising to a high point in the middle of the site at 3.0mAOD.

2.4 The Office of Public Works (OPW) collates available reports on flooding from all sources (e.g. fluvial, pluvial, coastal, infrastructure) on a nationwide basis. The OPW's floodmaps.ie website was consulted to obtain reports of historical flooding within the vicinity of the subject site. The Map Report in **Appendix C** lists reports of historical flooding within 2.5km of the subject site. Recurring flooding is recorded at Clonea Road and at Sallybrook, with high tides recorded to be a contributory factor.

2.5 In the Dungarvan Development Plan, the subject site is partly zoned 'R1' for residential development (medium density), 'R2' for residential development (low density), 'R3' residential development (for future development phase) and 'OS' for open space and amenity areas – see **Figure 5**.

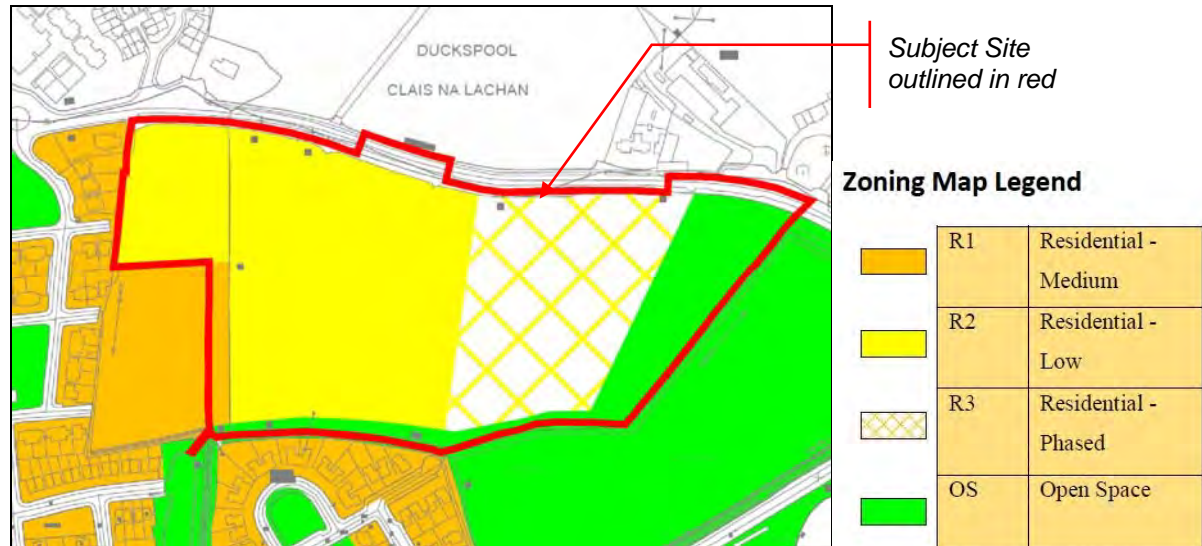


Figure 5: Extract from Dungarvan Development Plan Land Use Zoning map

2.6 The L3168 local road on the northern boundary of the subject site forms the boundary of the Dungarvan Development Plan. In the Dungarvan Environs land use zoning map (part of the Waterford County Development Plan), the lands to the immediate north of the road are zoned for residential development and for institutional, educational and community development – see **Figure 6**.

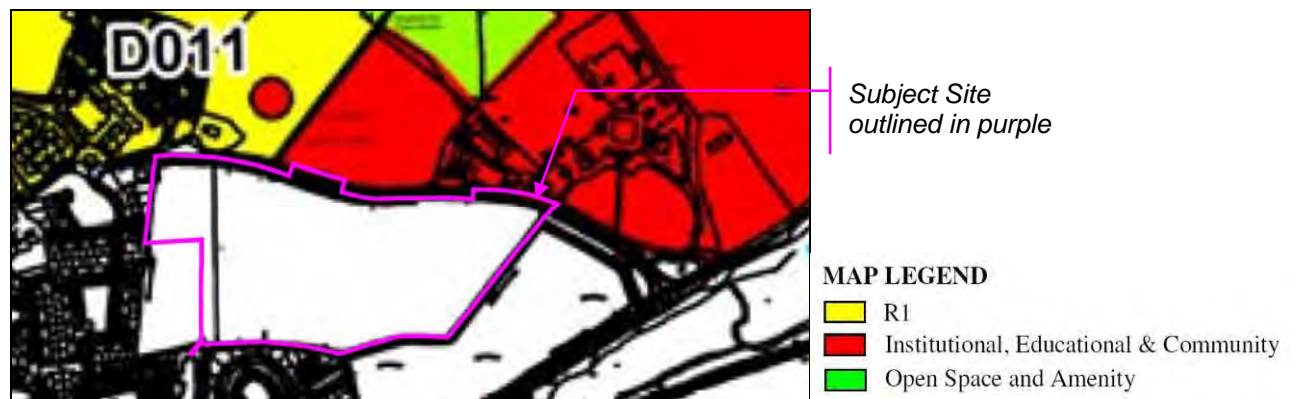


Figure 6: Extract from Dungarvan Environs Land Use Zoning map

2.7 The Dungarvan Town Development Plan includes a Flood Risk map – see **Figure 7**. The Strategic Environmental Assessment accompanying the Development Plan includes a Strategic Flood Risk Assessment (Appendix 3 of the SEA) that describes the areas identified in the Flood Risk map as “areas vulnerable to Flood Risk”. It is noted that all the identified areas are under-developed sites zoned for development. The OPW Map Report (see **Appendix C**) records multiple locations of recurring flooding in parts of Dungarvan that are not identified in the Development Plan Flood Risk map. The Development Plan does not equate these areas with Flood Zoning as identified in the 2009 Planning Guidelines. The Strategic Flood Risk Assessment, which was prepared prior to publication of the OPW’s South East CFRAM Study, notes that “as more up to date information and spatial data becomes available”, flood zones may be identified and applied.

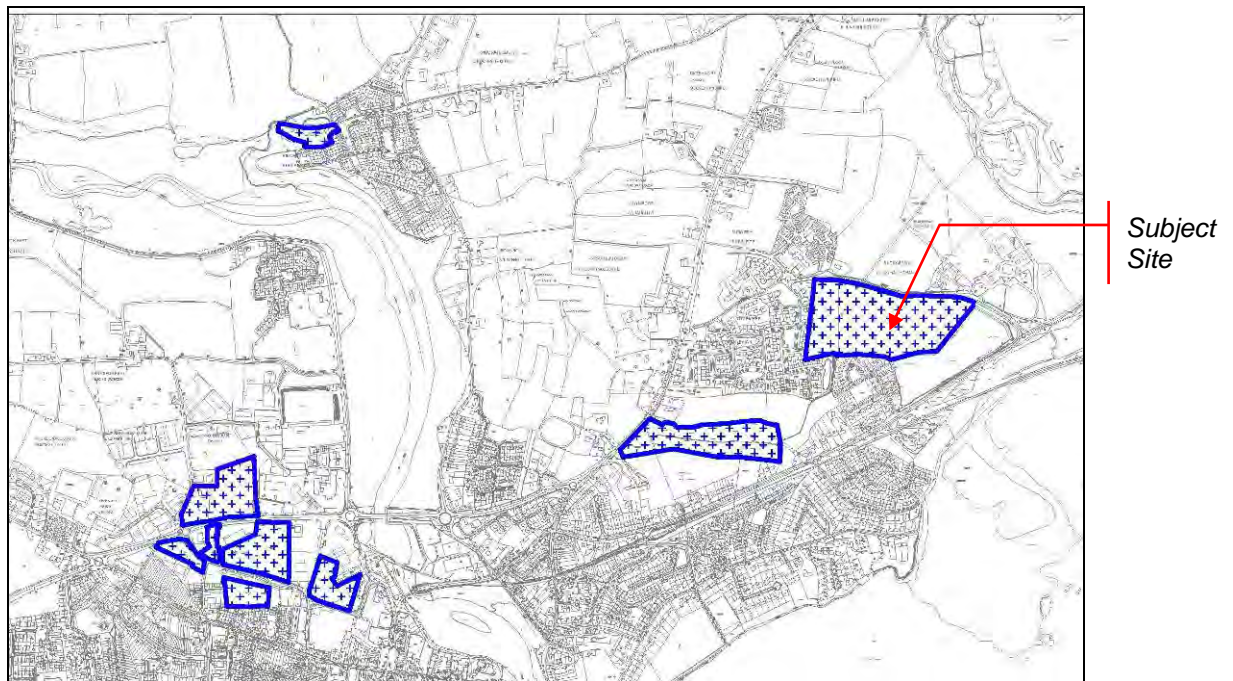


Figure 7: Extract from Dungarvan Development Plan Flood Risk map

3. LEVEL OF SERVICE

3.1 The risk of a flood event is a function of the probability of occurrence in any given year. Traditionally, this has been expressed as a return period (e.g. 1-in-100-year return period). However, this has led to misconceptions about the likelihood of repeat occurrences. A less ambiguous expression of probability is the Annual Exceedance Probability (AEP), which may be defined as the probability of a flood event being exceeded in any given year. A 1-in-100-year return period flood event is therefore expressed as a 1% AEP flood event. Likewise, a 1-in-1-year return period flood event is expressed as a 100% AEP flood event.

3.2 The GSDSDS and the 2009 Planning Guidelines set out the best practice standards for flood risk in Ireland; these are summarised in **Table 1**.

Table 1: Summary of Level of Service

Flooding Source	Drainage	Fluvial (River)	Tidal (Coastal)
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible	–	>1% AEP	>0.5% AEP

3.3 In addition, the GSDSDS requires that ground floor levels of houses be provided with a 500mm freeboard over the 1% AEP fluvial flood level.

3.4 The GSDSDS and the 2009 Planning Guidelines require that account be taken of the effects of climate change over the design life of a development, normally 100 years. Design parameters to take account of climate change were established in the GSDSDS. These parameters are set out in **Table 2** over.

Table 2: Climate Change - Impact on Design Parameters

Design Category	Impact of Climate Change
Drainage	10% increase in rainfall
Fluvial (River)	20% increase in flood flow

3.5 The 2009 Planning Guidelines adopt a sequential approach to managing flood risk by reducing exposure to flooding through land-use planning. The approach adopted by the 2009 Planning Guidelines (in paragraph 2.23) establishes three zones on a sliding scale of flood risk – see **Table 3**.

Table 3: Flood Risk Zones

Zone A	High Probability of Flooding Where the annual probability of flooding is: greater than 1% for fluvial flooding or greater than 0.5% for coastal flooding
Zone B	Moderate Probability of Flooding Where the annual probability of flooding is: between 0.1% and 1% for fluvial flooding or between 0.1% and 0.5% for coastal flooding
Zone C	Low Probability of Flooding Where the annual probability of flooding is: less than 0.1% for fluvial flooding and less than 0.1% for coastal flooding

3.6 Flood risk zones are determined on the basis of the probability of river and coastal flooding only (2009 Planning Guidelines paragraph 2.24). Other sources of flooding (such as groundwater, infrastructure and pluvial) do not affect the delineation of flood risk zones. These other sources of flooding should be considered and mitigated in design. Flood risk zones are determined on the basis of the current flood risk, i.e. without the inclusion of climate change factors (2009 Planning Guidelines paragraph 2.24).

3.7 The 2009 Planning Guidelines classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in Table 3.1 of the 2009 Planning Guidelines, which is reproduced in **Table 4**.

Table 4: Development Vulnerability Class

Vulnerability Class	Land uses and types of development which include:
<p>Highly vulnerable development (including essential infrastructure)</p>	<p>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.</p>
<p>Less vulnerable development</p>	<p>Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.</p>

Water-compatible development	<p>Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).</p>
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3.8 The 2009 Planning Guidelines direct new development primarily towards areas at low risk of flooding. The 2009 Planning Guidelines recognise that flood risks should not be the only deciding factor in zoning for development; the 2009 Planning Guidelines recognise that circumstances will exist where development of a site in a floodplain is desirable in order to achieve compact and sustainable development of the core of urban settlements. To allow consideration of such development, the 2009 Planning Guidelines provide a Justification Test, which establishes the criteria under which desirable development of a site in a floodplain may be warranted. The decision-making process for undertaking a Justification Test is set out in paragraph 3.2, page 23 of the 2009 Planning Guidelines and is reproduced in **Figure 8**.

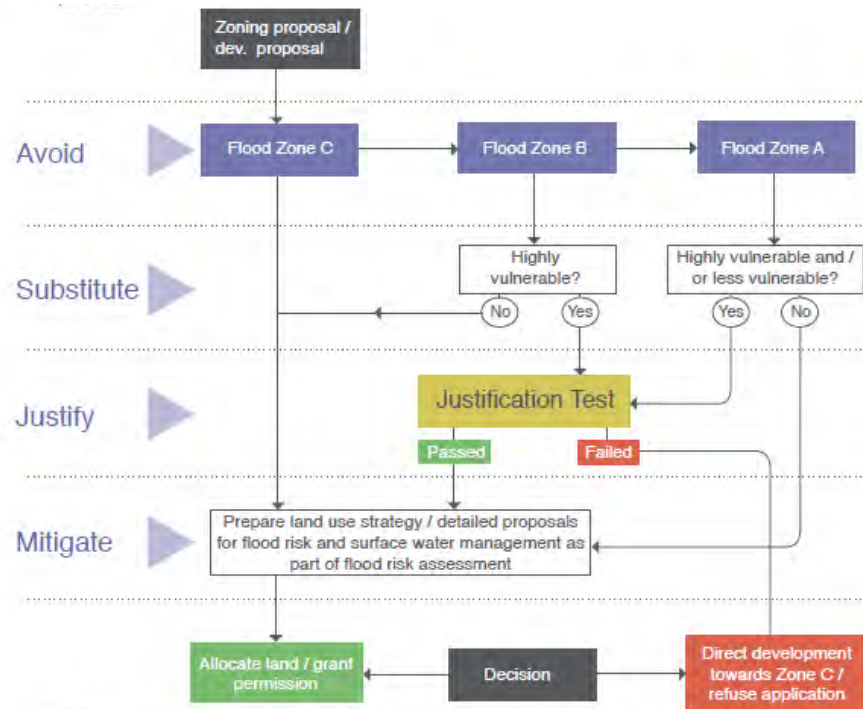


Figure 8: Sequential Approach and Justification Test

3.9 Planning permission is currently being sought for residential development on lands zoned R1/R2/R3 and open space amenity development on lands zoned 'OS'. The R1/R2/R3 residential development and the creche are classified as "highly vulnerable development" and the 'OS' open space amenity development is classified as "water compatible development" in accordance with Table 3.1 of the 2009 Planning Guidelines.

4. FLOOD RISKS & MITIGATION MEASURES

4.1 Tidal Flooding

4.1.1 The subject site is located approximately 120m from the nearest tidal source, Dungarvan Bay at Clonea Road. The OPW's *Irish Coastal Protection Strategy Study* (ICPSS) used oceanographic modelling to provide predictions of extreme sea levels along the Irish coastline. ICPSS drawing number S/RA/EXT/20 (see **Appendix D**) shows the predicted sea levels extended across the adjacent land, without consideration of obstructions to potential floodwater pathways – see **Figure 9**. The drawing shows that much of the subject site and the surrounding area are within the potential tidal/coastal floodplain.

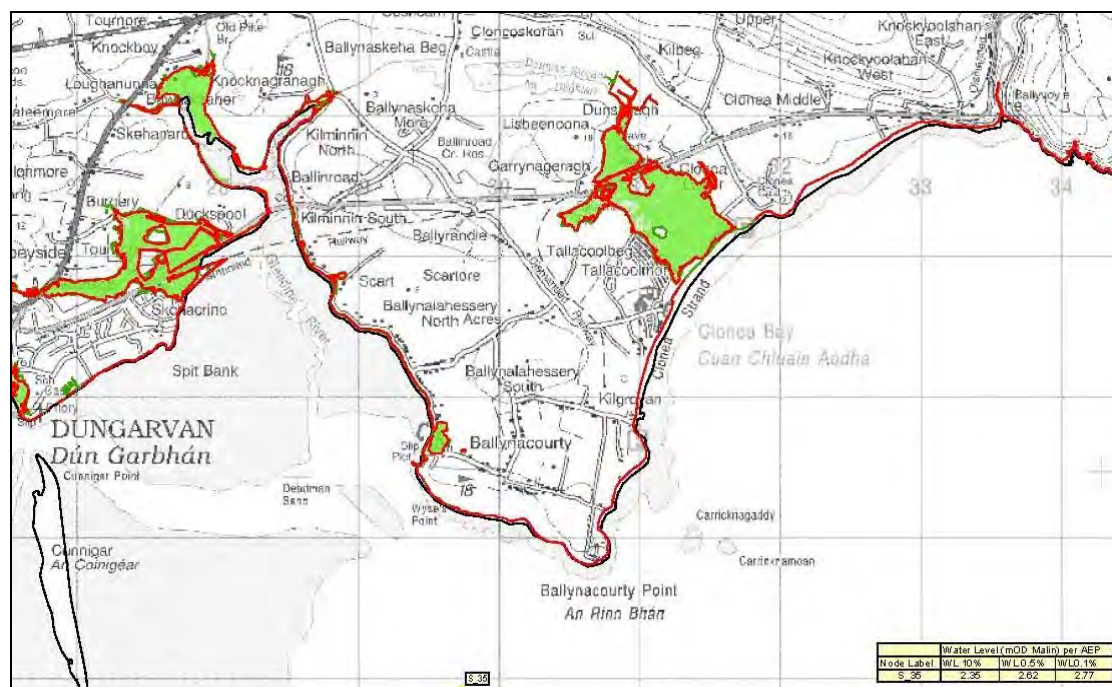


Figure 9: Extracts of ICPSS tidal flood extent map

4.1.2 The ICPSS drawing indicates that the predicted sea levels at the mouth of Dungarvan Bay are 2.62mAOD for the 0.5% AEP event and 2.77mAOD for the 0.1% AEP event. The existing ground levels on the site vary between 0.5mAOD and 3.0m AOD. Using a

ground model generated from topographical survey data, OCSC projected the ICPSS flood levels across the subject site; this was used to determine the extents of Flood Zones A, B and C. The findings are shown on **Drawing R497-OCSC-XX-XX-DR-C-2803** and an extract is presented in **Figure 10**. The subject site is shown to lie within Flood Zones A, B and C for tidal flooding (see **Section 4.2** later for fluvial flooding).

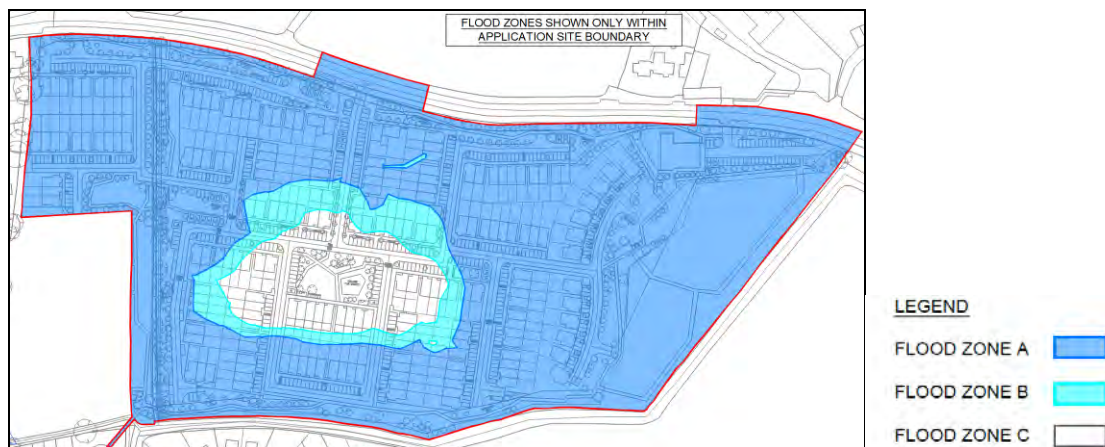


Figure 10: Flood Zones on the subject site

4.1.3 As described in **Section 3** earlier, planning permission is currently being sought for residential development on lands zoned R1/R2/R3 and open space amenity development on lands zoned 'OS'. The R1/R2/R3 residential development and the creche are classified as "highly vulnerable development" and the 'OS' open space amenity development is classified as "water compatible development" in accordance with Table 3.1 of the 2009 Planning Guidelines. Therefore, a Justification Test is provided – see **Section 5** later.

4.1.4 The site is located immediately adjacent to a local watercourse identified as the Duckspool watercourse in the OPW's South Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study. The CFRAM fluvial flood extent map (drawing number o17dgn_exfcd_f0_09) is included in **Appendix E** and extracts are shown in **Figure 11** overleaf.

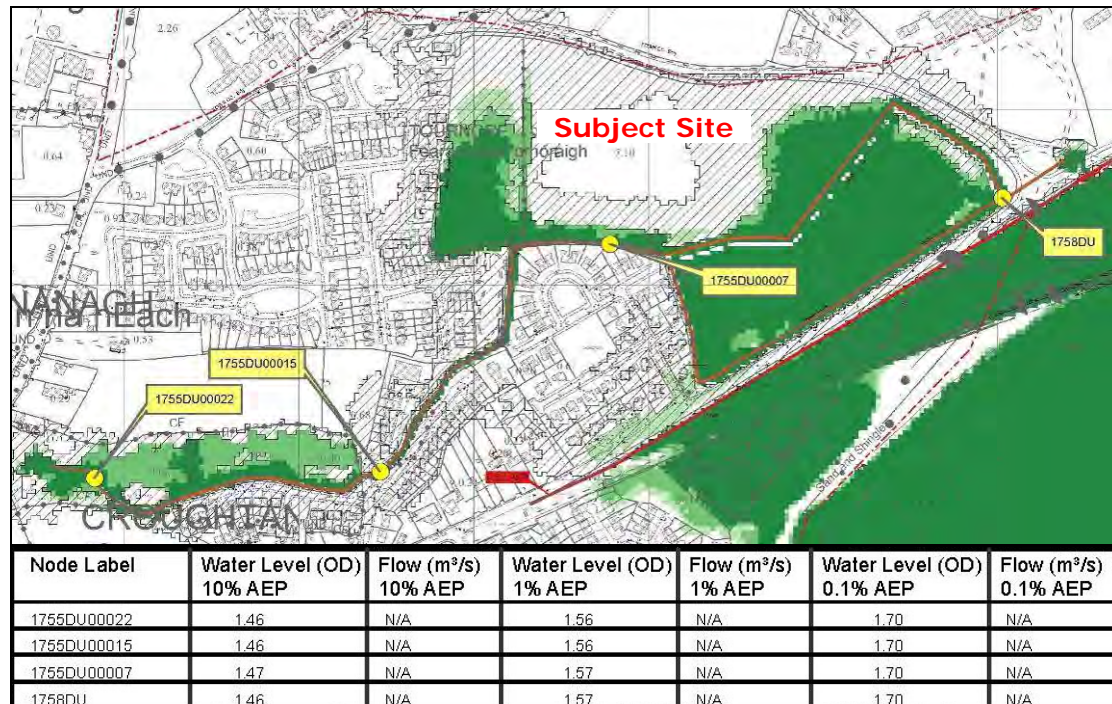


Figure 11: Extracts of CFRAM Study tidal flood extent map

4.1.5 The CFRAM mapping indicates that there is a flood defence wall located adjacent to the R675 Clonea Road which provides a 0.5%AEP standard of protection. The CFRAM mapping shows that much of the subject site is located in a defended area. As the ICPSS did not take flood defences into account, the extent of the defended area shown on the CFRAM mapping is consistent with the potential tidal flood extent shown on the ICPSS mapping.

4.1.6 The Duckspool discharges to the tidal waters of Dungarvan Bay via a culvert beneath local road and beneath the R675 Clonea Road. The outfall to the Bay is fitted with a non-return valve. The watercourse is tidally locked, meaning it only discharges when water levels in Dungarvan Bay are low enough to permit. The CFRAM mapping indicates predicted flood levels on the Duckspool watercourse that are significantly lower than the sea levels indicated in the ICPSS mapping. This is consistent with flooding arising from a tidally locked watercourse during tidal flood events.

4.1.7 The CFRAM tidal flood extent map indicates that the flood water levels adjacent to the site are 1.57m AOD for the 0.5% AEP event and 1.70m AOD for the 0.1% AEP event. The existing ground levels on the site vary between 0.5m AOD and 3.0m AOD. The CFRAMS map shows that the subject site is partially within the active floodplain of the 0.5% AEP event, partially within the active floodplain of the 0.1% AEP event, partially outside the active floodplain of the 0.1% AEP event.

4.1.8 As part of the South Eastern CFRAM Study, the potential effects of climate change were considered. The impact of the Mid-Range Future Scenario on tidal flood extents is reproduced in **Figure 12**. As can be seen, the study predicts a substantial change to the tidal flood extents.



Figure 12: Tidal Flood Extent Mid-Range Future Scenario Climate

4.1.9 As noted earlier in paragraph 4.1.5, there is an existing flood defence wall located adjacent to the R675 Clonea Road which provides a 0.5%AEP standard of protection. It is considered that the value of the defended area will justify continued maintenance of the flood defences for the design life of the proposed development. It is therefore reasonable to expect that the future tidal flood risk to the site will be largely mitigated by the flood defences.

- 4.1.10 ICPSS drawing number S/RA/EXT/MRFS/20 (see **Appendix F**) shows the predicted sea levels in the Mid-Range Future Scenario for climate change. Comparison with ICPSS drawing number S/RA/EXT/20 (see **Appendix D**) indicates a predicted sea level rise of 500mm in both the 0.5% AEP and 0.1% AEP events.
- 4.1.11 Taking cognisance of the findings of the Strategic Flood Risk Assessments for the Dungarvan Town Development Plan and the Waterford County Development Plan, reference was made to the Strategic Flood Risk Assessment of the Dublin City Development Plan 2016-2022, which recommends that, to mitigate tidal flood risk, finished floor levels should be the 0.5%AEP tidal flood level with a suitable allowance for climate change and a freeboard of at least 300mm. It is therefore recommended that the proposed development provide **a minimum finished floor level of 3.42mAOD (2.62mAOD (0.5%AEP Tidal) +500m Climate Change Sea Rise +300m Freeboard)** to mitigate risk from tidal flooding.
- 4.1.12 To achieve design objectives for density and urban design, it is proposed to rationalise the flood extent area to create a contiguous and coherent developable area. In general, raising ground levels in areas affected by tidal flooding only (i.e. no fluvial flooding) does not impact flood risk elsewhere; however, in the vicinity of the subject site, tidal flooding arises from a tidally locked watercourse and therefore floodplain storage is critical to the standard of protection afforded by the floodplain. However, it is noted that raising ground levels within the defended area that is not part of the active floodplain does not result in a loss of active floodplain storage.
- 4.1.13 Rationalisation of the flood extent area can be achieved by raising ground levels in areas of the existing active floodplain and lowering ground levels in areas outside the existing active floodplain to

provide compensatory storage. Compensatory storage is permitted as a mitigation measure in the 2009 Planning Guidelines where it is described in Appendix Section 3.3 – see extract in **Figure 13**. The proposed “level-for-level” direct compensatory storage is to be provided in accordance with the recommendations of CIRIA C624 – details are shown on **Drawing R497-OCSC-XX-XX-DR-C-2802**.

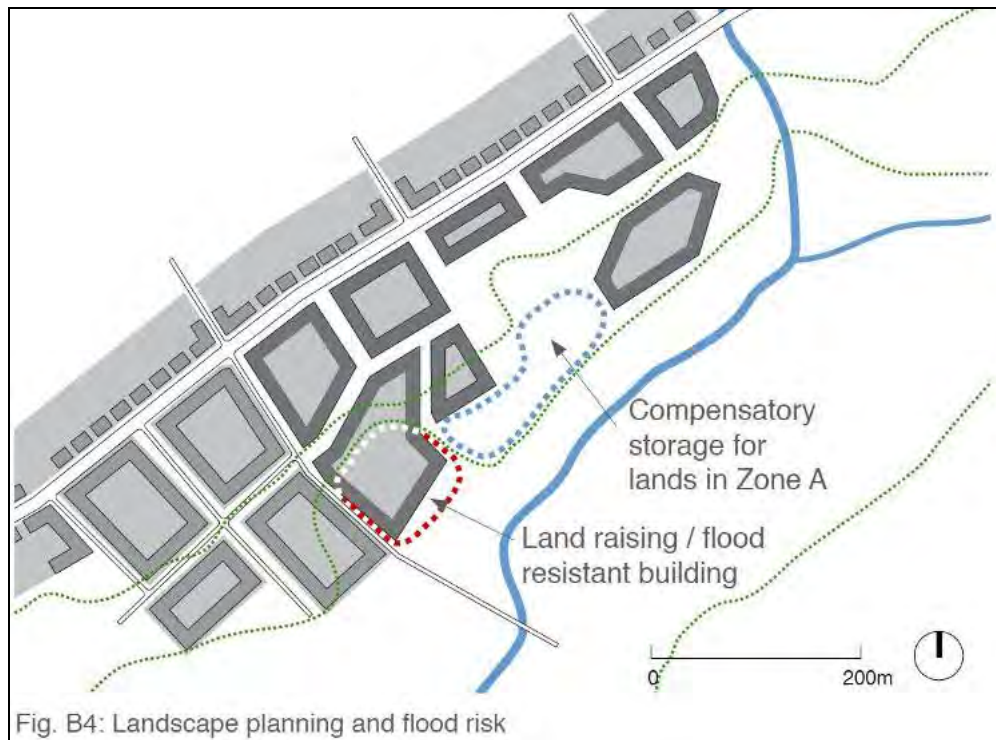


Figure 13: Extract from 2009 Planning Guidelines

4.1.14 It is concluded that the site of the proposed development is partially within Flood Zones A&B for tidal flooding and partially within Flood Zone C, in accordance with the 2009 Planning Guidelines. A Justification Test is required, pursuant to the 2009 Planning Guidelines – see **Section 5** later. Mitigation measures in the form of (a) direct “level-for-level” compensatory storage and (b) FFLs to be a minimum of 3.42mAOD, are included in the proposed development. Details of the proposed compensatory storage are shown on **Drawing R497-OCSC-XX-XX-DR-C-2802**.

4.2 Fluvial Flooding

4.2.1 The site is located immediately adjacent to a local watercourse identified as the Duckspool watercourse in the OPW's South Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study. The CFRAM fluvial flood extent map (drawing number o17dgn_exfcd_f0_09) is included in **Appendix G** and extracts are shown in **Figure 14**.

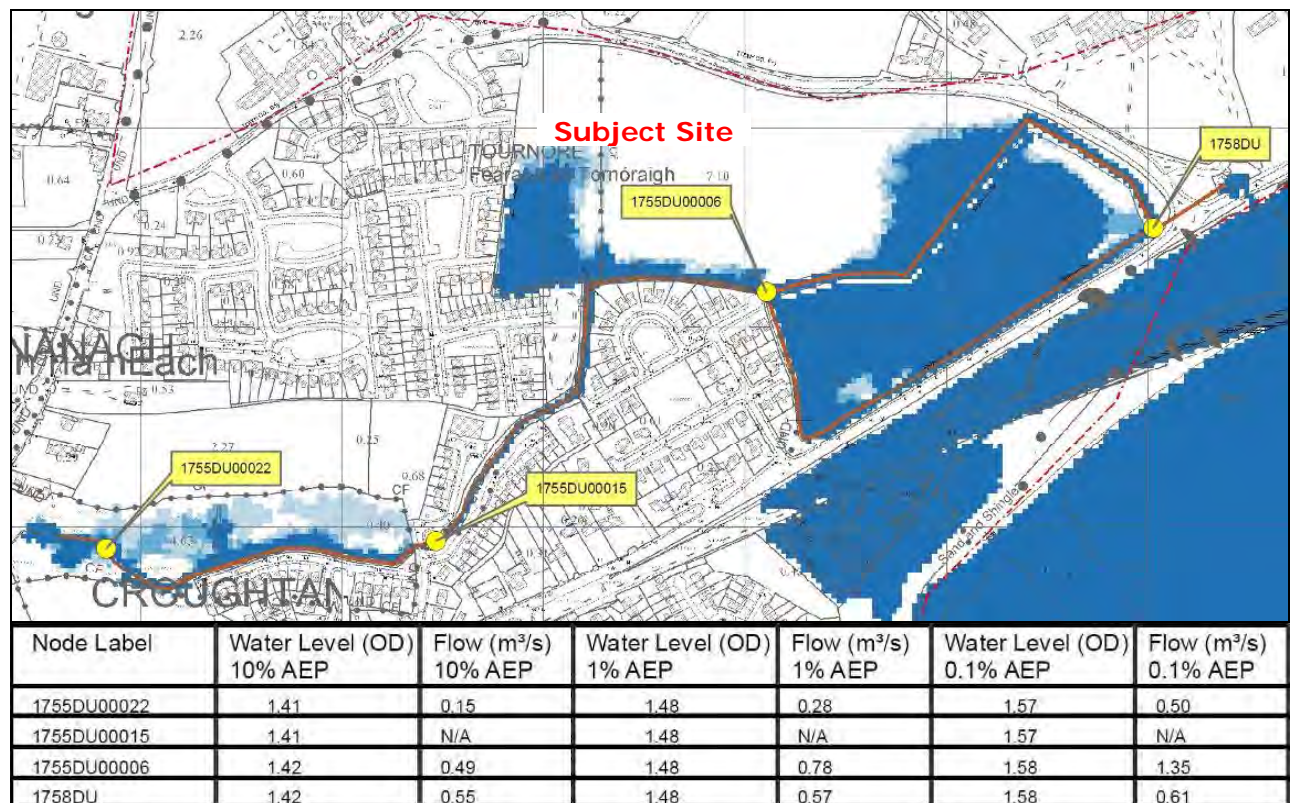


Figure 14: Extracts of CFRAM Study fluvial flood extent map

4.2.2 Comparison of historic Ordnance Survey mapping indicates that the channel of the Duckspool watercourse has been diverted, straightened and widened – see **Figure 15** over.



Figure 15: Duckspool watercourse at the subject site

4.2.3 The Duckspool discharges to the tidal waters of Dungarvan Bay via a culvert beneath local road and beneath the R675 Clonea Road. The OPW's South Eastern CFRAM Study (Document Reference Number IBE0601Rp0018) notes that these culverts "have insufficient capacity, contributing to fluvial flooding... Water is held back by these culverts, delaying its exit to the estuary and causing flooding from the channel, due to the associated low lying banks."

4.2.4 The CFRAM fluvial flood extent map indicates flood water levels at a number of locations along the course of the Duckspool (see **Figure 14** earlier). It is notable that in all three flood events (10%, 1.0% and 0.1% AEP), the flood water level at the downstream end of the watercourse is at least as high as the flood water level at the upstream end. This indicates that there is negligible hydraulic

gradient at the peak of the flood events, which is consistent with a downstream constraint being the cause of flooding. It is concluded that the overriding function of the floodplain is to provide flood storage capacity rather than conveyance capacity.

4.2.5 The Duckspool discharges to the tidal waters of Dungarvan Bay via a culvert beneath local road and beneath the R675 Clonea Road. The outfall to the Bay is fitted with a non-return valve. The watercourse is tidally locked, meaning it only discharges when water levels in Dungarvan Bay are low enough to permit.

4.2.6 The CFRAM fluvial flood extent map indicates that the flood water levels adjacent to the site are 1.48m AOD for the 1.0% AEP event and 1.58m AOD for the 0.1% AEP event. These fluvial flood levels are significantly lower than the comparable risk flood levels for tidal flooding identified from the ICPSS; therefore, fluvial flooding does not impact on the Flood Zones identified in paragraph 4.1.2 earlier.

4.2.7 The existing ground levels on the site vary between 0.5mAOD and 3.0m AOD. The CFRAMS map shows that the subject site is partially within the active floodplain of the 1.0% AEP event, partially within the active floodplain of the 0.1% AEP event and partially outside the active floodplain of the 0.1% AEP event.

4.2.8 Waterford City and County Council (WCCC) engaged Mott MacDonald (MMD) to conduct assessment of the Duckspool watercourse; the resulting report *Dungarvan Stormwater Drainage – Duckspool Drainage Review* was issued to WCCC in November 2018. The MMD assessment proceeded from and encompasses previous studies by MMD and by EG Pettit (now part of Mott MacDonald).



4.2.9 The 2018 MMD assessment included a number of amendments to the CFRAM model to account for:

- (a) recent, in-progress, and planned development in the area and;
- (b) updated topographical and bathymetrical data on the Duckspool channel;
- (c) provision of new 900mm-diameter culvert beneath local road and the R675 Clonea Road.

4.2.10 The MMD assessment identified the subject landholding (i.e. blue line boundary) as Development Area 1 and allowed for a post-development surface water discharge to the Duckspool watercourse of 60.25 l/s, which equates to 6.5 l/s/ha. As outlined later in **Section 4.5** and detailed in the accompanying Engineering Services Report (**Report R497-OCSC-XX-XX-RP-C-0004**), the proposed development delivers a discharge rate of 4.9l/s/ha, which is approximately 25% lower than that allowed for in the MMD assessment.

4.2.11 The MMD assessment identified a number of constraints on the channel at Monksfield and Tournore, upstream of the subject site. While these constraints resulted in water levels higher than predicted in the CFRAM Study upstream of these constraints, there was no negative impact on water levels downstream of these constraints, for example at the subject site.

4.2.12 As noted earlier in paragraph 4.2.3, the original culvert beneath local road and beneath the R675 Clonea Road had "insufficient capacity, contributing to fluvial flooding". WCCC developed proposals to replace the original culvert with a new 900mm-diameter culvert and applied for foreshore licence for the work in February 2016. Works progressed on site in 2019 and have been completed. The MMD assessment takes account of this new 900mm-diameter culvert.

4.2.13 The MMD assessment considered a Baseline (current) scenario, three scenarios of cumulative development in the catchment and a 'Mitigation Scenario'. The Mitigation Scenario was used to assess potential measures to reduce current and future flood risk to existing residential development. The predicted flood water levels for each scenario at key locations on the watercourse are presented in the MMD report and extracts are reproduced in **Figure 16**.

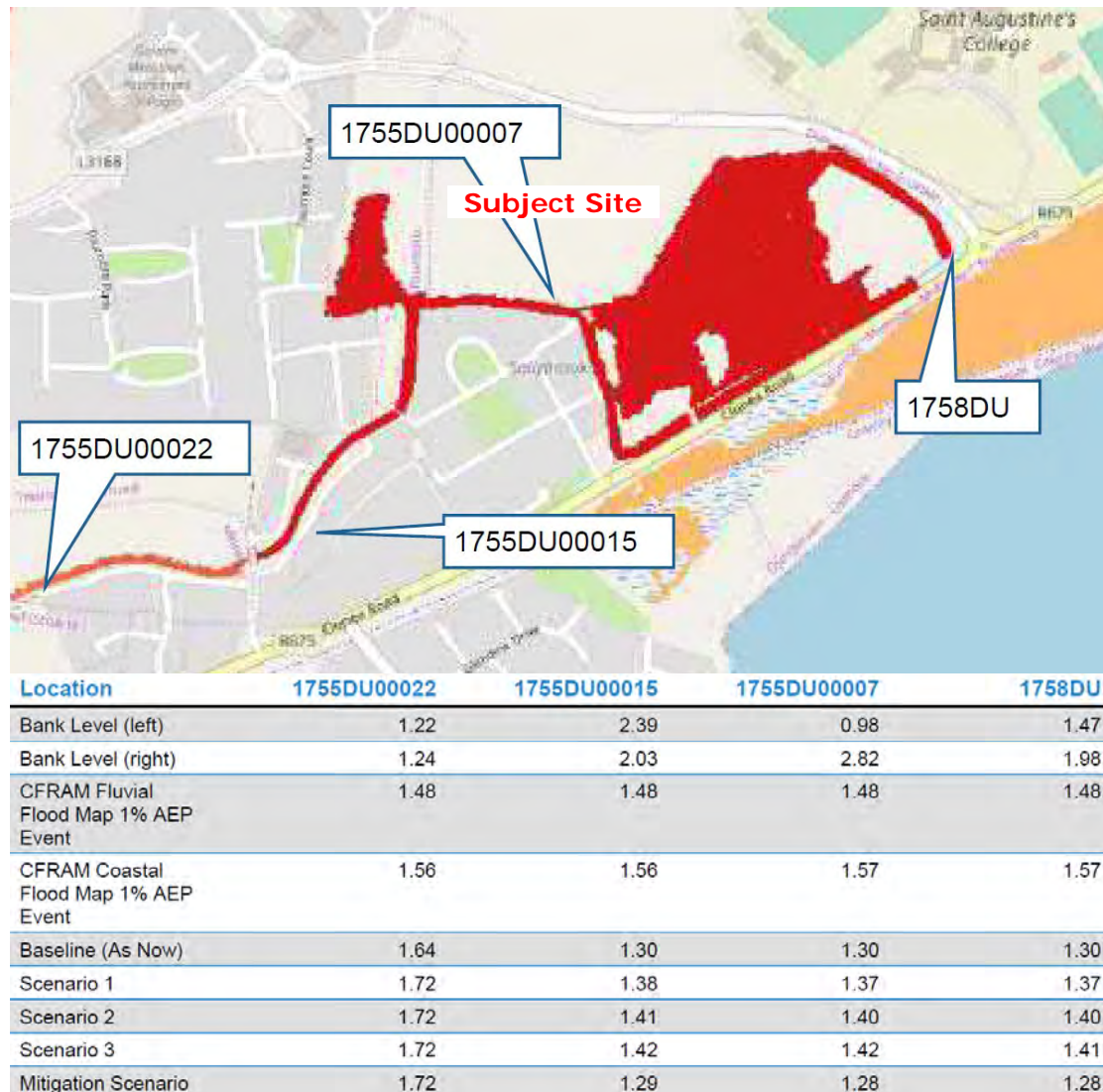


Figure 16: Extracts from Duckspool Drainage Review (MMD report)

4.2.14 The data presented in **Figure 16** shows a comparison of the flood water levels at key locations on the watercourse for each scenario in the MMD assessment and the corresponding flood water level predicted in the CFRAM Study. The comparison shows that,

at the subject site, the MMD assessment predicts flood water levels lower than those predicted by the CFRAM Study. It is therefore concluded that the CFRAM Study represents a more conservative representation of the flood risk to the site and the surrounding area.

4.2.15 As part of the South Eastern CFRAM Study, the potential effects of climate change were considered. The impact of the Mid-Range Future Scenario on fluvial flood extents is reproduced in **Figure 17** overleaf. As can be seen, the study predicts a substantial change to the tidal flood extents.

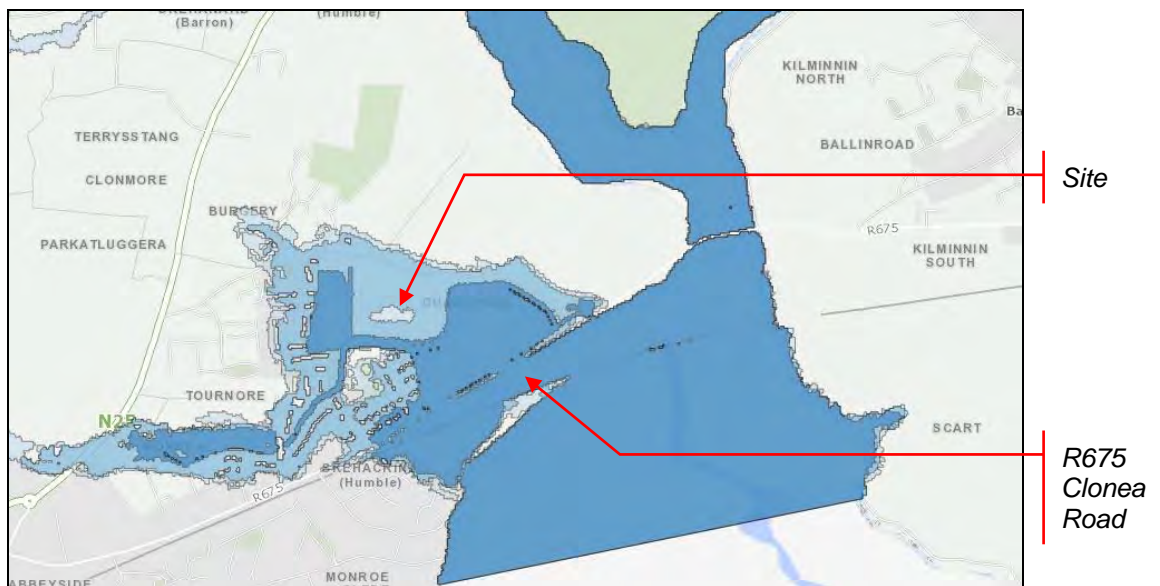


Figure 17: Fluvial Flood Extent Mid-Range Future Scenario Climate

4.2.16 Taking cognisance of the findings of the Strategic Flood Risk Assessments for the Dungarvan Town Development Plan and the Waterford County Development Plan, reference was made to the Strategic Flood Risk Assessment of the Dublin City Development Plan 2016-2022, which recommends that finished floor levels should be the 1.0%AEP fluvial flood level, with a suitable allowance for climate change and a freeboard of at least 300mm. The Duckspool watercourse is tidally locked and comparison of **Figure 12** and **Figure 17** shows that the future tidal flood extent and level is marginally more onerous than the future fluvial flood extent and level. It is therefore recommended that the proposed

development provide a **minimum finished floor level of 3.42mAOD** to mitigate risk from tidal and fluvial flooding.

- 4.2.17 The GSDS recommends that, to mitigate the risk of fluvial flooding, Finished Floor Levels (FFLs) of all proposed buildings should be at least 500mm above the 1.0% AEP fluvial flood level. The recommended minimum finished floor level of 3.42mAOD is 1620mm above the 1.0% AEP fluvial flood level.
- 4.2.18 To achieve design objectives for density and urban design, it is proposed to rationalise the flood extent area to create a contiguous and coherent developable area. This is achieved by raising ground levels in areas of the active floodplain and lowering ground levels in areas outside the active floodplain to provide compensation. This compensation storage is provided on a direct "level-for-level" basis, in accordance with CIRIA C624 and the 2009 Planning Guidelines.
- 4.2.19 As discussed earlier in **Section 4.1**, compensatory storage is permitted as a mitigation measure in the 2009 Planning Guidelines where it is described in Appendix Section 3.3. The proposed "level-for-level" direct compensatory storage is to be provided in accordance with the recommendations of CIRIA C624 – details are shown on **Drawing R497-OCSC-XX-XX-DR-C-2802**.
- 4.2.20 It is concluded that the site of the proposed development is partially within Flood Zones A&B and partially within Flood Zone C, in accordance with the 2009 Planning Guidelines. A Justification Test is required, pursuant to the 2009 Planning Guidelines – see **Section 5** later. Mitigation measures in the form of (a) direct "level-for-level" compensatory storage and (b) FFLs to be a minimum of 3.42mAOD, are included in the proposed development. Details of the proposed compensatory storage are shown on **Drawing R497-OCSC-XX-XX-DR-C-2802**.

4.3 Pluvial Flooding

- 4.3.1 The OPW's National Pluvial Screening Project for Ireland defines pluvial flooding as "flooding which results from rainfall-generated overland flow and/or ponding, which may occur during or immediately after intense rainfall events, before the runoff enters any watercourse or sewer."
- 4.3.2 The topographical survey and a walkover of the site and surrounding area were used to assess the potential risk to the site from pluvial flooding. The existing topography provides ground levels that are higher on the northern boundary and in the middle of the site, with existing overland flow routes leading to the existing watercourses on the eastern, southern and western boundaries.
- 4.3.3 The local road to the north of the site falls away from the site to the east and west. Any pluvial flooding on this road would flow overland along the road away from the site.
- 4.3.4 The existing topography of the site will be changed as part of the development to normalise gradients and accommodate the construction of residential units and infrastructure. In the design of the proposed roads, it is recommended that low points be avoided within the site and gradients channel overland flow away from dwellings to open spaces and boundary watercourses. Finished Floor Levels (FFLs) should be provided above adjacent footpath and road levels. The direction of overland flow will generally remain unchanged; overland flow will be directed along the proposed road network towards the existing boundary watercourses.
- 4.3.5 With implementation of the above mitigation measures, the remaining flood risk associated with pluvial flooding and overland flow are minimal and therefore no further mitigations measures are required.

4.4 Existing Sewerage and Watermains

- 4.4.1 There is an existing wastewater sewer located in the local road to the north of the subject site – see existing services records in **Appendix H**. This sewer flows eastwards to an existing wastewater pumping station (Barnawee WWPS) located at the entrance to St. Augustine's College. Any flooding that might arise from this sewer and pumping station would flow overland along the road away from the subject site.
- 4.4.2 The records show existing wastewater pumping stations serving the Tournore housing estate to the east of the site. Any flooding that might arise from these pumping stations and sewers serving adjacent existing housing estates would flow overland along existing roadways away from the subject site.
- 4.4.3 The existing services records (see **Appendix H**) show small-diameter watermains in the local road to the north of the subject site and in the existing housing estates to the south and west of the site. If these watermains were to burst, the overland flow would flow along existing roadways, away from the subject site.
- 4.4.4 The flood risk from existing drainage and watermains is therefore considered negligible and no further mitigation is required.

4.5 Proposed Drainage Infrastructure

4.5.1 The assessment of the potential flood risk arising from the proposed drainage infrastructure is based on interrogation of the accompanying Engineering Services Report (**Report R497-OCSC-XX-XX-RP-C-0004**) and associated drawings, which provide full details of the proposed drainage infrastructure.

4.5.2 To manage the flood risk arising from rainfall runoff within the site, the design of the proposed drainage will adhere to the hydraulic performance criteria set out in the *Greater Dublin Strategic Drainage Study* and in the *Building Regulations Part H*, to achieve self-cleansing velocity, minimising the potential for blockages leading to flooding.

4.5.3 The drainage system will incorporate Sustainable Drainage Systems (SuDS) that will control the discharge rate and reduce the volumetric runoff from the site. The proposed drainage will be designed to attenuate all surface water runoff from the site to the requirements of Waterford City and County Council. The existing site is a greenfield site and the proposed drainage infrastructure will be designed so as to limit the outflow from the site to that of the existing greenfield scenario.

4.5.4 Waterford City and County Council (WCCC) engaged Mott MacDonald (MMD) to conduct assessment of the Duckspool watercourse; the resulting report *Dungarvan Stormwater Drainage – Duckspool Drainage Review* was issued to WCCC in November 2018. The MMD assessment proceeded from and encompasses previous studies by MMD and by EG Pettit (now part of Mott MacDonald).



4.5.5 The MMD assessment identified the subject landholding (i.e. blue line boundary) as Development Area 1 and allowed for a post-development surface water discharge to the Duckspool watercourse of 60.25 l/s, which equates to 6.5 l/s/ha. As detailed in the accompanying Engineering Services Report (**Report R497-OCSC-XX-XX-RP-C-0004**), the proposed development delivers a discharge rate of 4.9l/s/ha, which is approximately 25% lower than that allowed for in the MMD assessment.

4.5.6 Provided that the proposed drainage system is constructed as designed (in accordance with the relevant standards and regulations), the flood risks arising from the proposed drainage infrastructure will be negligible and no further mitigation is required.

4.6 Groundwater Flooding

4.6.1 According to data obtained from the *Geological Survey of Ireland* (<http://www.gsi.ie>), the subsoil at the subject site comprises till derived from Devonian sandstones and alluvium over a bedrock of Waulsortian Limestones. The site is located on a regionally important aquifer and the groundwater vulnerability is medium (see **Appendix I**).

4.6.2 There is no record of groundwater flooding for the subject site.

4.6.3 The probability of groundwater rising above ground levels is considered extremely low. In any such event, water would follow overland flow routes (see **Section 4.3**) and not collect at or near proposed buildings.

4.6.4 It is concluded therefore that the flood risk represented by ground water is negligible and no further mitigation is required.

5. JUSTIFICATION TEST

5.1 Overview

5.1.1 As described in **Section 4.1** earlier, OCSC projected the ICPSS flood levels across the subject site using a ground model generated from topographical survey data; this was used to determine the extents of Flood Zones A, B and C. The findings are shown on **Drawing R497-OCSC-XX-XX-DR-C-2803** and an extract is presented in **Figure 18**. The subject site is shown to lie within Flood Zones A, B and C.

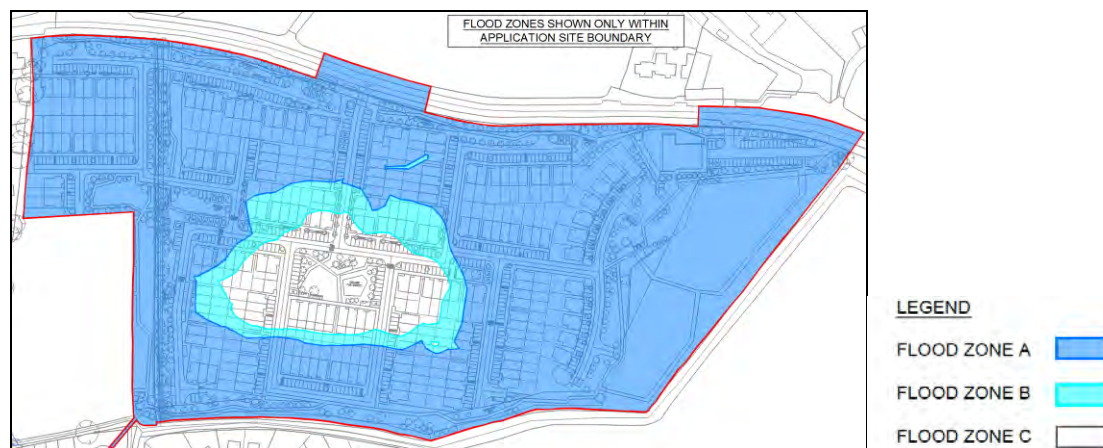


Figure 18: Flood Zones on the subject site

5.1.2 As described in **Section 3** earlier, planning permission is currently being sought for residential development on lands zoned R1/R2/R3 and open space amenity development on lands zoned 'OS'. The R1/R2/R3 residential development and the creche are classified as "highly vulnerable development" and the 'OS' open space amenity development is classified as "water compatible development" in accordance with Table 3.1 of the 2009 Planning Guidelines. Therefore, a Justification Test is required for the proposed development.

5.1.3 There are two parts to the Justification Test: (1) Development Plans Justification Test and; (2) Development Management

Justification Test. It is the Justification Test for Development Management which is required in respect of the proposed development. However, both are conducted below.

5.2 Development Plans Justification Test

JUSTIFICATION TEST FOR DEVELOPMENT PLANS

1. Urban settlement is targeted for growth.

Yes: The subject site is located within the settlement of Dungarvan, Co. Waterford and is targeted for future population growth by relevant plans at all levels: *National Planning Framework: Ireland 2040 Our Plan* (NPF), *Regional Spatial and Economic Strategy for the Southern Region* (RSES), *Waterford County Development Plan 2011–17* (WCDP) and *Dungarvan Town Development Plan 2012–2018* (DTDP). The NPF provides the structure and overarching planning and development principles for Ireland. National Policy Objective 3c of the **NPF** is to:

“Deliver at least 30% of all new homes that are targeted in settlements other than the five Cities and their suburbs, within their existing built-up footprints.”

The subject site is within the development boundary of Dungarvan (as defined by the Dungarvan Town Development Plan, or ‘DTDP’). High-quality residential development will act as an extension to the town, connecting with the schools located to the north-east outside the town. As the guiding regional planning document, the **RSES** is intended to transpose the high-level principles of planning and development in the NPF to appropriate local levels. The RSES reiterates the NPF’s policy objective to drive population growth into existing urban centres.

Regional Policy 11 states:

*“Local Authorities are supported in **targeting growth of more than 30% for each Key Town** subject to capacity analysis and sustainable criteria under Section 3.3 A Tailored Approach, RPO 2 Local Authority Core Strategies and the sustainable requirements*

under the following sub sections of RPO 9 Key Towns. The appropriate level of growth is to be determined by the Core Strategy of Development Plans." [emphasis added]

Regional Policy 35(c) states:

*"Development Plans shall set out a transitional minimum requirement to deliver **at least 30% of all new homes** that are targeted in settlements other than the cities and suburbs, **within their existing built-up footprints** in accordance with NPF National Policy Objective 3c. This will be evidence based on availability and deliverability of lands within the existing built up footprints." [emphasis added]*

The proposed development will actively support the attainment of these policy objectives. The **WCDP** and **DTDP** outline population growth targets for Dungarvan, albeit sourced from now dated population projections set out in the former *National Spatial Strategy* and *Regional Planning Guidelines*. Dungarvan was intended to have reached a target population of 11,600 by 2016, with 13,400 the target for 2022. However, Census data for 2016 reveals that the population reached only 9,227 that year (20.5% less than the target). Consequently, it will struggle to reach its 2022 target (a 45.2% increase on 2016's recorded population). Therefore, further development of housing and employment opportunities is essential to both drive and support sustainable population growth. As the WCDP and DTDP are set for review, the future population allocation and projections for Dungarvan are not yet known. However, given the settlement's existing population size, economic base, location, amenities and opportunities, it is expected that planned growth will be substantial. The proposed development will play an important role in realising this growth.

2. The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in

particular:

i. Essential to facilitate regeneration and / or expansion of the centre of the urban settlement.

Yes: The site is located in Dungarvan, Co. Waterford – designated as a County Town – and is zoned a mixture of R1 Residential-Medium, R2 Residential-Low, R3 Residential-Phased and OS Open Space. The proposed development provides residential development with land-uses consistent with the policies and objectives detailed in the WCDP and DTDP.

ii. Comprises significant previously developed and / or underutilised lands.

Yes: The existing land-use on the subject site comprises agricultural use. Therefore, the existing use represents an under-utilisation of the site, which is at a key location in Dungarvan, proximate to: the town centre, the N25 National Primary Road, Waterford Greenway and several educational institutions. The proposed development provides an appropriate use of the site in the context of the NPF, RSES, WCDP and DTDP.

iii. Is within or adjoining the core of an established or designated urban settlement.

Yes: The subject site is zoned for development and is within the settlement boundary of the town as defined by the DTDP. The site immediately abuts existing residential areas (Tourmore and Sallybrook) and its development for residential uses will provide for the contiguous expansion of the town in a sustainable manner.

iv. Will be essential in achieving compact and sustainable urban growth.

Yes: Dungarvan is the administrative centre for the County (Waterford City aside) and is the second largest urban settlement in the County. The proposed development will provide much needed development in the town, acting as a natural extension to the existing settlement and residential areas on lands zoned for residential uses. It intends to deliver a

high-quality and efficiently designed scheme to support sustainable land-use and living. The high-density proposition will contribute to sustainable travel patterns, such as walking and cycling, and will also improve the viability of providing public transport. The site is immediately adjacent to both Scoil Gharbháin (Gaelscoil) and St. Augustine's College (secondary school). It is also within reasonable walking distance of other local services: several convenience retail outlets, take away, childcare and healthcare centre. Furthermore, it is within walking distance of the highly successful recreation and amenity facility of the Waterford Greenway. Beneficially, the surrounding area is serviced by existing utilities and water services infrastructure, therefore minimal intervention and a minimum of new infrastructure will be required.

v. There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.

Yes: The subject site is zoned residential and is essential for development given the current housing shortage in the Country and in the Region. There are a limited number of sites zoned for development and even fewer that are capable of accommodating large developments. Those that are zoned specifically for residential development are noted as being small, at risk of flooding and/or lacking required infrastructure (e.g. significant road upgrades).

3. A flood risk assessment to an appropriate level of detail has been carried out.

Yes: The current report comprises a detailed site-specific flood risk assessment for the subject site that identifies and recommends mitigation measures.

Conclusion: The subject site passes the Justification Test for Development Plans.

5.3 Development Management Justification Test

JUSTIFICATION TEST FOR DEVELOPMENT MANAGEMENT

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.

Yes: The subject site is currently zoned as follows in the Dungarvan Town Development Plan 2012 – 2018 (DTDP): - R1 Residential–Medium, R2 Residential–Low, R3 Residential-Phased and OS Open Space.

'Generally permissible' uses on the R2 and R3 lands include dwellings and park/playground. 'Open for consideration' uses include: bed and breakfast, guesthouse, café, coach parking, community facility, crèche, cultural building, education, garden centre, halting site, healthcare centre, tourist accommodation, nursing home, office, park and ride, place of worship, public waste water treatment and convenience retail.

No land-uses are noted as being 'generally permissible' on the OS lands. However, 'open for consideration' uses include coach parking, community facility, golf course, major playing fields, park and ride and park/playground.

The R2 zoning allows for residential development during the life of the current plan, while the R3 zoning is intended for the same development type in the next "*Plan period, 2018-2024.*" Recognising that the life of the plan was intended to run until 2018, the continuing demand for housing and the expected delays in the preparation of the new Waterford City and County Development Plan (and a likely replacement for the DTDP), it is asserted that it is appropriate for residential development to come forward at this time.

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;

Yes: The preceding sections of this report demonstrate that the majority

of the subject site is in a defended area. The active floodplain will be rationalised, and compensatory storage will be provided in accordance with the 2009 Planning Guidelines.

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

Yes: The preceding sections of this report identify flood risks and recommend appropriate mitigation measures. The active floodplain will be rationalised, and compensatory storage will be provided in accordance with the 2009 Planning Guidelines. Runoff from the proposed development will be collected in a Sustainable Drainage System providing attenuation storage and discharge off site will be limited to greenfield runoff rates.

(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

Yes: The preceding sections of this report describe mitigation measures to minimise flood risk. While the majority of the subject site is within a defended area, there is a residual risk of defence failure or overtopping. The development will be built to a minimum finished floor level of 3.42mAOD which mitigates the residual risk.

(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.

Yes: The proposed development of high-quality urban design and aims to provide quality housing and spaces which contribute to the growth of Duckspool and Dungarvan. The scheme caters for quality shared spaces

and amenities as well as enhancing the site's unique qualities by opening the scheme towards bay views and maximising connectivity and permeability.

The mitigation measures proposed have been carefully designed into the scheme and have no impact on the character of the proposed development. Hard and soft landscaping as well as a number of large open spaces have been incorporated throughout the scheme which help to further incorporate the mitigation measures proposed.

The recommended mitigation measures are contained within the development site and do not impact on the flood risk to existing adjacent residential developments.

Please refer to both the Landscape Design Strategy and Architectural Design Statement included as part of this application for more details.

Conclusion: The subject site passes the Justification Test for Development Management.

6. CONCLUSIONS AND RECOMMENDATIONS

- 6.1.1 This report identifies the flood risks at the proposed development site at Duckspool, Dungarvan. Planning permission is currently being sought for residential development, a creche and open space amenity development. The residential development and the creche are classified as “highly vulnerable development” and the open space development on lands zoned ‘OS’ is classified as “water compatible development” in accordance with Table 3.1 of the 2009 Planning Guidelines.
- 6.1.2 The tidal and fluvial flood risk has been assessed and it is concluded that the site is within Flood Zones A, B and C in accordance with Table 3.1 of the 2009 Planning Guidelines. Therefore, a Justification Test has been provided.
- 6.1.3 To achieve design objectives for density and urban design, it is proposed to rationalise the flood extent area to create a contiguous and coherent developable area. This is achieved by raising ground levels in areas of the existing floodplain and lowering ground levels in areas outside the existing floodplain to provide compensation. This compensation storage will be provided on a direct “level-for-level” basis, in accordance with CIRIA C624 and the 2009 Planning Guidelines.
- 6.1.4 All proposed buildings will be provided with a minimum FFL of 3.42mAOD, which ensures adequate freeboard to future scenario tidal and fluvial flood levels.
- 6.1.5 Pluvial flooding risk has been assessed and it is considered that off-site pluvial flooding is not a significant risk. The design of internal road and FFLs should ensure that pluvial flooding is directed away from buildings and towards the existing boundary watercourses.

6.1.6 It is recommended that the proposed drainage systems are designed in accordance with current best practices and Building Regulations. Attenuation of surface water runoff should be provided, and discharge limited to pre-development greenfield rates. In circumstances where the proposed drainage system is constructed as designed (in accordance with the relevant standards and regulations), the flood risks arising from the proposed drainage infrastructure will be negligible and no further mitigation is required.

6.1.7 The flood risk represented by ground water is negligible and no further mitigation is required.

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Associate

O'Connor Sutton Cronin

Multidisciplinary Consulting Engineers